BEST PRACTICE GUIDE

PRESERVATION OF GRAVES AND MEMORIALS

NEW ZEALAND MASTER MONUMENTAL MASONS' ASSOCIATION INC.

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Acknowledgements

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Fine example of full ornate concrete surround, footing and desk with marble panel
Napier Hill Cemetery

1.0 Introduction

1.1 The New Zealand Master Monumental Masons' Association Inc (*NZMMMA*) History

The ***NZMMMA,*** formed in 1945, is a Professional Trade Association. It functions in the same manner as Master Builders, Painters, Plumbers, and Electricians etc, acting in the best interest of the client, its own members and the trade.

The Association Membership is made up from all Registered Master Monumental Masons located within NZ.

The Association was established near the end of World War Two by well meaning monumental masons who were concerned at industry problems such as substandard construction material, poor workmanship, lack of recognition and formal relationships with Local Authorities and Cemetery Management. In addition it offers client protection from inferior installations and memorial quality.

New Zealand is a fairly young country in terms of monumental masonry. There were some memorial installations before 1850, increasing slowly as the country became populated through migration.

Early memorial units were constructed from local and imported limestones, sandstones, slate, cast iron and marble. Later, granite was introduced. There were only two sources of NZ granite, the Coromandel and islands off Bluff. Now too expensive to source.

A wide range of granite and granite colours is now imported from around the world.

Our older cemeteries, many with Historic protection status, display a wide range of marble memorial styles with adornments representing many symbols relating to death. These were generally carved by Italian craftsmen and imported into NZ. Later large granite styles were imported mainly from the UK. As the industry grew, NZ factories achieved the ability to import raw granite block and to manufacture styles ever changing for the NZ client taste.

NZMMMA recommends granite as headstone memorial material due to its proven enhanced performance and durability, over many years now. Before 1945 the traditional full cover grave was installed and from around this date there has been a change from the full cover style to the lawn beam concept.

New Zealand pioneer history is displayed in many forms, not the least, by way of the graves and the many wonderfully crafted headstone memorials of our own ancestors, including those of important people who helped to form the nation and the country we enjoy living in.

Their contribution is recognised by various groups dedicated to the preservation of New Zealand's early history as we all know it.

Our cemetery history must be preserved at all costs. To this end, this Best Practice Document has been developed so we can repair, restore and maintain the memorials presented to us now, some in pristine condition, others in various degrees of decay.

1.2 Description

This guide is intended to assist all those involved in the physical care and conservation of monuments and grave sites in New Zealand. This includes all cemetery memorial features such as crosses, obelisks, headstones, footstones, kerbs and fences. The guide includes a brief introduction to the main monumental materials followed by detailed explanation of a range of repair and conservation works.

New Zealand Standard NZ 4242 1995 *Headstones and Cemetery Monuments* specifies minimum structural design criteria, performance and renovation requirements for cemetery monuments and crematoria memorial gardens. New Zealand doesn't yet have a standard that covers work on monuments of cultural significance (ie of heritage value). NZMMMA acknowledges that such monuments may require approaches and conservation procedures different from those in the Standard. It is in regard to these monuments that this guide has been prepared.

1.3 Cemeteries as a Cultural Heritage Resource

A cemetery is more than a collection of interesting historical data – as precious and revealing as that may be. It is also a place – an open space populated by monuments and vegetation – which forms a very particular and revealing part of our built environment.

There are things to be learned from the overall layout and arrangement of the monuments. We can note the nature and quality of the materials; we can see the skill of the monumental masons and observe the richness of the symbolism. We can wonder at the age of the trees and the choice of species and imagine the look of the surrounding landscape in earlier times.

We can speculate on what prompted this location to be chosen for a cemetery and how the presence of the cemetery has influenced the neighbourhood in which it is located. Each cemetery has its own history of creation, development and growth. Together New Zealand's heritage cemeteries form an irreplaceable part of the country's cultural heritage.

Older cemeteries demonstrate their value as a cultural, heritage resource in different ways.

They have often been called outdoor classrooms. For students of all ages they offer endless possibilities for continuing education involving both natural and historical resources. Some cemeteries promote recreational use of their grounds by maintaining extensive and well-labelled collections of plants and trees, by welcoming hikers, cyclists, photographers and birdwatchers and by organising walking tours and outdoor chamber music concerts.

Cemeteries can supplement community park systems and enhance adjacent public open spaces; larger, park-like cemeteries provide habitats for wildlife.

Older cemeteries are visible, tangible links with people who made history – ordinary individuals as well as famous people. The inscriptions on their headstones tell us not only their names and dates but often where they lived, their occupation and affiliations, the manner of their death, personal traits that survivors held dear, and names of relatives.

These inscriptions instruct us about local, medical and material history, cultural geography, historical archaeology, legends, genealogy and much more.

2.0 Planning and Preserving a Cemetery

The first step in preserving your cemetery is to outline a master plan of actions and goals needed to restore, preserve and/or rejuvenate the cemetery. Each cemetery's master plan must be developed to address the unique needs and issues of that cemetery.

Developing a master plan for a cemetery can range from being a relatively simple matter to a very complex document, depending on the needs of the cemetery. A good plan will integrate issues of rehabilitation or treatment of monuments, headstones, features and landscapes; location and legal description with issues such as priorities and the available budget. It will also address the long-term needs of the cemetery, particularly maintenance. Above all it must address both short term and long-range planning while remaining flexible to adapt to changing needs, priorities and available resources.

When starting a master plan to conserve a cemetery, it is important to consult with concerned and interested parties. The local council or cemetery owners need to initiate this process. This enables them to control and mediate the parties, maintaining order in the process. The New Zealand Master Monumental Masons' Association is a recognised authority in the monumental industry and should firstly be approached for guidance and recommendations on who is certified in the areas of need you require. Most cemeteries now have "friends of the cemetery"; well intentioned individuals or groups that have a passion to improve cemeteries by initiating projects ranging from quick clean-ups to total reconfigurations of original layout.

Caution must be taken with such groups, as unguided activities combined with little knowledge for the materials and environment being worked on can be devastating and accelerate deterioration. However, such groups, given guidance and support with goals to achieve such as recording monuments, areas, markers, state of plots, photographic recording, can quickly become the strength of any cemetery's master plan process.

2.1 First steps to Preserving a Cemetery Basic housekeeping

While these works are described as basic they are among the most important for the long term care of the cemetery. Many grave sites will have no work done to them other than those listed in this section.

All the works in this section can be undertaken by cemetery staff or by unskilled labour. Adequate supervision and prior introductory training essential.

2.2 Survey and collection of the fragments

Each monument and its surrounds should be carefully studied in turn, looking at all the elements and materials of which they are made.

- Are there pieces missing?
- Can they be found elsewhere on the grave site or nearby?
- Do the found fragments belong to this monument or another?

Commonly missing are pieces of cast iron fencing, small tiles from grave floors, and pieces of marble and sandstone from crosses and other parts of monuments.

Most of these can be readily identified as belonging to a particular grave. If in doubt keep them separate in case a better match can be made with another. Store the fragments neatly on top of the grave near the base of the monument.

Look carefully around the base of marble headstones or other monuments for pieces of lead lettering that have fallen out. Make sure they belong to this grave (by matching them to gaps on the monument) and then store them carefully in a small container (e.g. for takeaway food) labelled with the name, date and plot number of the grave.

2.3 Weeding and identifcation of exotic plants

Where weeds are so high that the graves cannot easily be seen (surveyed for missing components such as tiles), the larger weeds should first be removed by hand (cutting may be necessary to avoid damage to the monument). Otherwise, removing weeds is best done by treating with a glyphosate based poison such as Roundup. This should be brushed onto foliage rather than sprayed in order to reduce the risk of chemical coming in contact with stone and other elements of the grave site. In some cases combination of poisoning and careful removal by hand will be necessary, particularly where weeds are growing through joints in stonework.

As graves are weeded (and surveyed for missing elements) look carefully for any exotic plants such as bulbs and roses. Do not poison or remove them as they were deliberately planted: they are part of the

historic fabric of the cemetery and should be cared for like monuments.

2.4 Excavation to expose plinths or kerbs

Monuments and their kerbs often become partially buried as a result of soil building up around them. This can be due to work on adjacent graves and to deposition of soil eroded from higher parts of the cemetery. Settlement of the monument also produces the same result.

Such burial and soil build-up is undesirable for two reasons. One is that the monument no longer appears the way it should – with the top of its plinth showing well clear of the ground surface. Secondly, the built-up soil encourages rising damp by holding moisture against the stone. Damp can be seen to be damaging many old headstones, particlarly those of sandstone and limestone.

Ground levels should be lowered around monuments and kerbs so that 100-150mm of the plinth or kerb projects above the ground surface. This might be impossible in places where adjacent graves have monuments or kerbs at much higher levels. In these cases compromise must be reached in the interests of both sites. Simply digging a shallow trench around a grave site will not suffice as heavy rain will collect in the trench, be held against the stone work, and cause an even greater damp problem. Ground levels around monuments and kerbs need to be graded gently away from site and positively drained so that water will not collect against the stones. Any excavated soil should be passed through a coarse sieve to check for the presence of missing pieces such as tiles and lettering. Great care should be taken not to damage the monuments: use hand trowels and not shovels when working close to the base of the stones.

2.5 Chocking beneath unsupported plinths and kerbs

Erosion poses a greater problem where it undermines monuments and kerbs. Because of the sloping ground (albeit only gently sloping) a number of sites have plinths and kerbs with large gaps beneath them. Subsidence of the grave can also lead to unsupported masonry.

Clean out the unsupported areas and dampen the masonry surfaces with clean water from a spray bottle. Coarse stones, gravel and slate pieces should be carefully but tightly rammed into the gap together with relatively dry stiff mortar of proportions 1 : 3 : 12. That is, one part by volume of portland cement, three parts of lime putty (or similar), and twelve parts of washed sand. Cement should be low-alkali variety; lime should be pre-slaked lime putty or hydrated lime that has been run to a putty with water at least 24 hours prior to mixing the mortar. Washed sand is specified, as unwashed or dry-screened sand often contains impurities which reduce the effective strength of the mortar. Washed concrete sand is well-graded and ideal for this task.

2.6 Filling to counteract erosion

After completing any necessary chocking, the ground surface should be built up around the site to cover the repairs and to return it to something like its original level, while also providing an outward sloping surface to encourage run-off. As before, adjacent graves may force compromises, particularly when a later grave has been set at a lower level due to the erosion in the intervening years.

2.7 Temporary placement of broken monuments

Thin headstones and crosses of marble and sandstone are often found in pieces due to toppling and vandalism. Joining the pieces together requires specialist skills from NZMMMA members.

As a temporary measure, the pieces of broken headstones or crosses should be laid face up in position on the grave on a bed of coarse aggregate arranged to provide a slope to the top surface to encourage water run off. This will allow the stones to be read by visitors and, until such time as the complete repairs can be undertaken, help give the impression that the cemetery is being cared for. It may be necessary to delay the temporary placement until after repairs have been made to the grave floors.

A more permanent version of this approach may be appropriate if the temporary placement is extended for any reason, and particularly where the headstone is so badly damaged (or with pieces missing) that it cannot be readily repaired. In this case the sloping support should be a form of concrete for longer life. No-fines concrete (1 cement to 8-10 parts of coarse aggregate which has been dampened prior to mixing) should be used because it is porous and will allow water to drain away from the underside of the headstone. As before, the cement should be of the low alkali type. Polyethylene damp-coursing should be used beneath the concrete where it is placed over an existing grave floor. Then concrete can be readily removed should it be necessary.

Simple formwork should be made up to aid placement of the concrete. The formwork should have sloping top edges so that the upper surface can be finished evenly. Several sets of forms may be required to allow for different size and shaped headstones. Where possible the headstones should slightly overhang the support (to hide it) but the overhang should not be greater than about 75mm. The pieces of headstone are not stuck onto wet concrete but placed in position without adhesive after the concrete has cured.

3.0 Restoration vs Preservation vs Maintenance

3.1 Which term applies for your cemetery?

Restoration means to return to new or near-new condition of the cemetery, monuments, headstones, fencing, grounds etc. Preservation or Conservation means to prevent further deterioration, usually by treatments that are as non-intrusive as possible, hopefully are reversible and that take careful consideration of the original "fabric" to be preserved.

Maintenance covers a wide range, from simply keeping the grass cut, to repairing any newly damaged plots, to security of the cemetery over the long term. A perpetual Care Trust Fund is worth considering for the long term maintenance of the cemetery. There are currently such plans available through New Zealand Master Monumental Masons' Association. Cemetery planning needs to have provisions for long term maintenance of such features as cemetery grounds, lighting, monuments, headstones, access roads, paths, signs, buildings and any other real property that makes up your cemetery and which should be planned for accordingly.

"Do as much as necessary and as little as possible".

Doing nothing can be a very legitimate choice, especially for graves in stable or weathered condition. The other possibility for doing nothing exists because there are no pressing functional reasons for keeping graves well maintained, as there are with buildings, other than to ensure public health and safety standards are met.

Historic Gorge Cemetery – Woodville

3.2 What's the difference between "Restoration" and Preservation"?

You may occasionally find a firm advertising that it will "restore" monuments. What, exactly, does this mean? And what are they likely to do to your headstone?

By definition, "restoration" means making the headstone like new. Such an approach ignores the history and patina of the stone and attempts, using techniques that are often inappropriate and damaging to the long term preservation of the monument, to make it look like it did the day it was placed in the cemetery. Restoration firms will often be happy to take on any project. The only critical consideration in restoration is what can be charged to the client.

Preservation (or conservation), on the other hand, attempts to keep the stone from deteriorating further, stabilizing it, and ensuring that it is there for future generations. No conservators will claim to be able to work on every type of material or every monument. There are also some critical considerations that must be taken into account in competent preservation or conservation work:

- Preservation must ensure careful planning
- Expedient or easy solutions often compound the problem
- Actions should be the least intrusive
- Treatments should respect the original fabric
- Actions should be, where possible, reversible
- All work must be carefully documented in case future work becomes necessary

Perhaps the most important distinction between a restoration firm and a conservator is that the conservator will be a member of the New Zealand Master Monumental Masons' Association, associated with New Zealand Historical Agencies and will subscribe to their code of ethics and standards of practice. The conservator will provide you with a treatment proposal, explaining exactly what will be done and how; afterwards you will get a treatment report that specifies in even greater detail what was done and what materials were used.

I see all sorts of information on the web about how I can glue monuments together myself. What's wrong with that?

You can probably find information on how to remove your child's appendix, but are you willing to try and risk their life? It is no different with a 100 year old headstone that can't be replaced. Are you willing to try, only to make matters worse? Often seen in our cemeteries, is the work of the "Do it yourself handy man". While the best intentions were had, this type of repair is unsightly and damaging to the aesthetic look of the grave. Council and cemetery owners have a responsibility in monitoring who works in their cemeteries and checking that they understand and follow guidelines for this type of work.

4.0 Assessing Graves , Monuments

This section deals with the maintenance and repair of the graves, memorials and headstones in a cemetery environment. The aim of such maintenance and repair is:

- To ensure as far as is reasonably possible the long life of the monuments.
- To maintain the character and fabric of the monuments, and the integrity of the original designs.
- To ensure the survival of the cemetery with its cultural heritage values preserved and enhanced.

To help achieve this end, a rational philosophy for carrying out maintenance and repair is set out, followed by technical notes on cleaning and repair methods for the wide range of materials found in many cemeteries around New Zealand. It is intended that this "Best Practice Document" will help council staff, members of "friends of the cemetery" groups, Government departments and families of those commemorated, to carry out assessment processes in an appropriate manner.

It is not possible in a document such as this to cover all situations, so that where unusual circumstances arise, specialist advice from a New Zealand Master Monumental Masons' Association member should be sought.

4.1 "AGEING WITH GRACE" OR IN NEED OF REPAIR?

The first issue to address when considering whether to repair a grave is whether to do anything at all. One of the significant aesthetic attributes of the many historical cemeteries in New Zealand is the visible evidence of the passing of time, of age, and of patina. A general tidy up of the grave and its surrounds may be all that is needed, and perhaps cleaning of the main elements.

For the purposes of this document, patina is taken to be those visible effects of ageing and weathering that are not seriously detrimental to the long life of the material; these can include fading, bleaching, some surface growths, light surface rusting, loss of shine to polished surfaces, and elements leaning out of plumb. It does not include the detrimental effects of weathering such as decay, rotting, splitting and spalling, or the build up of dirt on surfaces.

Cleaning would be justified where excessive build up of dirt or growth is affecting the integrity of the material, where it is unsightly, or where it is obscuring important parts of the grave. Graffiti is another reason why cleaning of graves may be required.

Repair, when it is carried out, should aim to retain patina of age where this does not conflict with the long life of the grave.

The decision to carry out work at all should be made by a group comprising people with an appreciation of the historic and aesthetic qualities of the place and of the grave itself, and of how the memorial park is used; in the decision making, there should be support from people with technical expertise in risk assessment and repair methods.

Graves will be divided into two categories; those in good condition that do not require repair, and those that are in need of repair

Graves in good condition
These are graves that require no more than general maintenance, including sweeping and cleaning, the trimming of growth etc. These graves are not categorised for attention.

Graves in Need of Repair

Many graves in historical cemeteries fall into the category of being in need of repair, to greater or lesser extent. It includes graves that present a risk to the public because stones, walls or fences are in danger of collapsing and causing injury. It includes elements that might collapse should people climb on them (even though they shouldn't), such as a grave floor that is cracked or broken and has a cavity underneath, also stones and grave kerbs that are partially dislodged and in danger of falling.

Most graves in need of repair are, however, not dangerous. They are in need of repair because elements are cracked, broken, decaying or lost.

The intention is that priorities for repair work can be established by a scoring system that incorporates the heritage values of the grave along with consideration of whether it is dangerous and its general condition.

Before Restoration

After Restoration

Issues to be taken into account in assessing priority for repair include:

Significance

- Historic Importance
- Aesthetic Importance
- Technical Interest
- Rarity

Condition

- Potential to cause injury
- Structural condition of important elements
- General condition of non-structural elements of grave
- Practicality of effecting repair
- Risk of further degradation if left unattended
- Completeness and authenticity of grave

4.2 Significance

It is expected that graves that are exceptional under at least one heading; or that are considerable under at least two headings, or which score 5 out of 10 will be regarded as 'special graves'

Significance					Max
Historic Importance	Exceptional 3	Considerable 2	Some 1	None 0	3
Aesthetic Importance	Exceptional 3	Considerable 2	Some 1	None 0	3
Technical Interest		Considerable 2	Some 1	Little 0	2
Rarity			Rare 1	Common 0	1
Unassigned					1
					10

4.3 Condition

Condition					Max
Potential to Cause Injury	High 15	Medium 10	Low 5	None 0	15
Structural Condition	Very Poor 3	Poor 2	Adequate 1	Good 0	3
General Condition	Very Poor 3	Poor 2	Adequate 1	Good 0	3
Practicality	Straight-Forward 3	Quite possible 2	Difficult 1	Extremely Difficult 0	3
Risk	Severe 3	High 2	Slight 1	None 0	3
Authenticity		High 2	Low 1	None 0	2
Unassigned					1
					30

Each grave under consideration will be scored in both categories of significance and condition, and a score out of 40 will be assigned.

4.4 Priority Score

The higher the score, the higher the priority for repair work to be carried out.

Work on high scoring graves (say above 25) should be regarded as urgent, and work on those scoring between 15 and 24 as desirable in the near or medium term, as resources permit. Work on those scoring 14 or below would be candidates for treatment in the longer term.

	Score of 25 – 40	Score of 15 – 14	Score of 5 – 14	Score of 0 - 4
	Work is urgent	Work is Desirable in the Medium term	Work is Desirable in the Long term	Work is of Low priority
1. Doing Nothing	Not an Option	Possibly	Possibly	Probably
2. General Maintenance	Not sufficient	Desirable	Desirable	Desirable
3. Stabilising	Possibly	If required	If required	If required
4. Repairing	Possibly	If required	If required	If required
5. Restoring	Possibly	If resources permit	Unlikely	Unlikely
6. Reconstructing	Possibly	If required	Unlikely	Unlikely

5.0 Philosophy

Doing nothing – Cleaning, Weeding, General Maintenance – Stabilising – Dowelling - Repairing – Preserving – Restoring – Reconstruction.

5.1 Compliance with New Zealand Standard

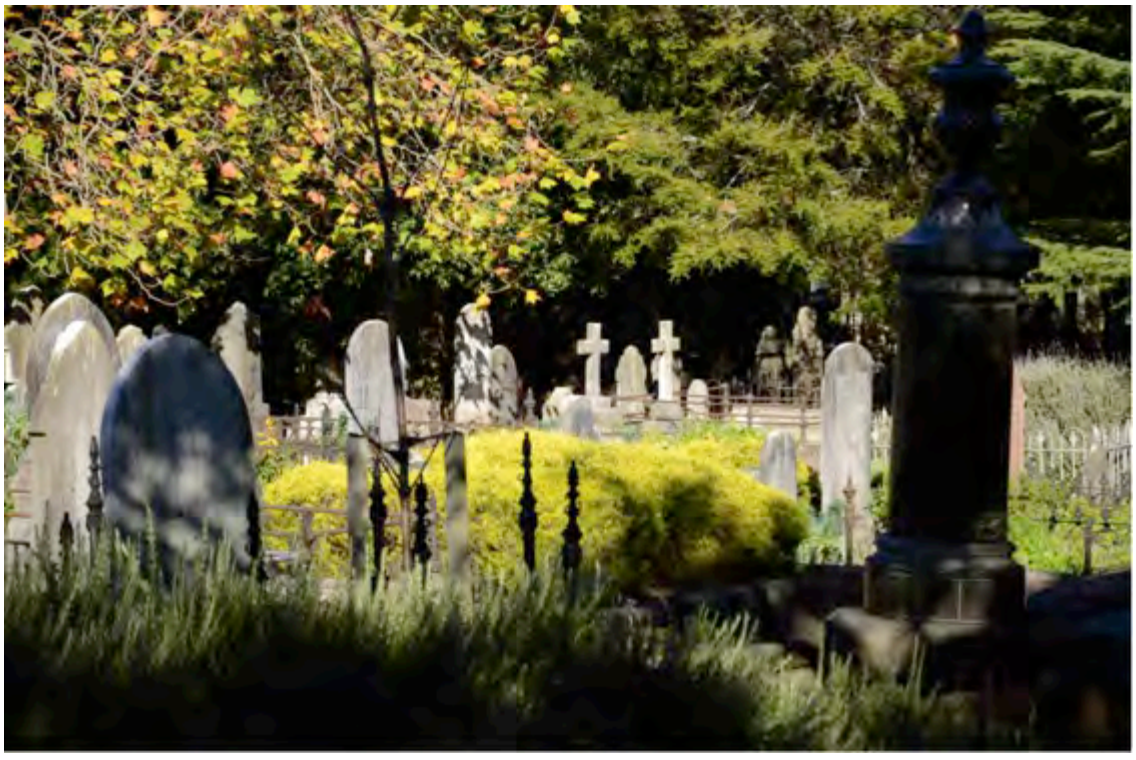
New Zealand Standard NZS 4242:1995 *Headstones and Cemetery Monuments* should be referred to when repairs are carried out. Clause 3.7 Renovation of Monuments states that:

> *Where renovation work is to be performed on a monument, such work shall be carried out in accordance with the Standard, provided that where existing details have performed satisfactorily, such details shall be deemed to be in accordance with the Standard.*

The Standard can be referred to for technical details concerning materials, foundations, reinforcing, dowelling etc.

Copying existing conditions in carrying out repairs should be the first option, but where there has been failure, an improved technical solution may be required. Such solutions will usually be hidden (in the form of reinforcing in concrete, dowelling in joints etc) and will not affect aesthetic qualities, so that they can usually be adopted without significant loss of authenticity.

In addition to compliance with the standard, all councils and cemetery managers should have a permit system in place to assist the governance of qualified masons of the NZMMMA.



5.2 Stabilising

Stabilising is the next step. Graves that are at risk of further deterioration, moving, toppling over or which have already had pieces of the structure break away leaving them at risk of serious decay lying in foliage or posing a danger to public safety, should in the first instance be stabilised, then be re-assessed.

The Kerrigan plot on Napier's Hill Cemetery was identified as an "at Risk" Monument, as the top had been interfered with by a neighbouring Gum tree, unfortunately a storm passed through before the tree could be pruned and the upper part of the monument was dislodged and parts damaged beyond repair.

5.2 Stabilising

Widdop plot: F10-01 Map 8 Bolton Street Memorial Park

The Widdop plot had a high priority due to the delicate nature of the marble. Being softer and more porous than granite the cross was slowly being consumed by the foliage of the surrounding landscape.

Hutchison plot: J07-03 Map 5 Bolton Street Memorial Park

This plot was identified only a couple of years ago as an "at risk" grave as the top pillar and pillar sub mount plinth had moved. Within an 18 month period of being identified the tree behind increased its growing pressure on the pillar, toppling it and the sub mount plinth, breaking the pillar into three pieces and fracturing the sub mount plinth badly.

5.3 Preserving / Restoring

Restoration would be carried out on any grave of historical importance or a grave that has particular aesthetic significance, or a grave that is rare by reason of its design or materials of construction.

Maitland plot: C11-06 Map 7 Bolton Street Memorial Park

This Totara cross dating back to 1876 had previously been poorly repaired. A substantial amount of the cross was embedded in a concrete footing, four inch steel nails had been placed in the centre cross beam and were rusting out, the cross was decaying very quickly in the earth and machinery used to maintain the grass around the cross was also proving to be damaging.

The cross was dismantled, re-assembled using copper components, and re-mounted 4mm above the new concrete plastered footing with a stainless steel mount that was capped in copper.

While the stark NEW look is not the desired result, its location meant that the memorial would weather rapidly and within 12 months had regained balance in the cemetery's aesthetic look.

5.3 Preserving / Restoring

Restoration of monuments is not restricted to cemeteries; all historic monuments need careful reviewing and need to be made part of any community or council plan.

This monument was facing a shortened life when a fracture was noticed around the top. On careful inspection it was discovered that an oak seedling was becoming well established on the top of the main pillar. Attacked by vandals and in need of some tender care, this monument was moved up on the priority list.

Fully restored to its original specifications which were found deep in council archives this central city park feature was well received by the community and much support was given towards its restoration.

Lion Memorial: Cornwall Park Hastings, Hawkes Bay

6.0 Repairs

6.1 Repairing

Repairing implies the further action of putting things back as they were. Not necessarily to "as new" condition, but to a secure, tidy state where all elements are in good condition for their age and composition.

Ballard plot: C11-05 Map 7 Bolton Street Memorial Park

This marble cross had been previously damaged, the repair was badly done and then set in wet concrete below the ground. Due to the fragile nature of this cross it needed to be re-jointed and fitted above the ground free from the earth.

6.1 Repairing

Desecration is the most damaging form of vandalism on historic plots, as seen here when such an act was carried out in the Jewish areas in Bolton Street and Makara cemeteries on 16th July 2004. The fast action of council, combined with advice from an NZMMMA specialist saw the 125 year old monuments gathered, recorded with plot data and map locations of the recovered pieces, all carried out within 24 hours. As the recording of this area was minimal and photographic data was even less, the fast action by council made for a smoother and most successful restoration repair plan which without doubt saved thousands of dollars, but more importantly, saved the historic monuments.

Offer plot: 9001 Jewish Bolton Street Memorial Park

6.2 Repairs to grave floors and ledger slabs, grave covers.

Many early graves with stone or concrete kerbs have a concrete floor set within the kerbs. Sometimes the floor is smooth finished or have a sandy texture, but they are often covered with white quartz river pebbles (crushed or natural), crushed green glass, or various coloured granite aggregate (chips). Younger graves have a ledger slab which lies on top of (and supported by) the kerbs. Ledgers are of plain concrete, or concrete with various finishes including exposed aggregates, or ceramic tiles, or of polished granite.

Concrete floors are often badly cracked or collapsed due to subsidence of the earth filling beneath. Sometimes a new section of floor (a result of an additional burial in the same plot) has cracked away and subsided from the old.

6.3 Concrete and aggregate floors

Fractured and caved-in concrete floors are among the most disfiguring elements in the cemetery.
In cases where the floors are cracked into only two or three pieces they should be levelled up, earth packed beneath, and retained in situ, rather than replaced. This way a minimum of change is made to the components of the cemetery: the retention of as much original fabric as possible is one of the aims of conservation, for it retains the historical truth of the place. Even when levelled up, cracked floors can be disfiguring. Achieving the right balance between retention of original materials and the tidiness of the cemetery is a difficult challenge, but decisions should lean on the side of the original materials.

Some floors covered with coloured aggregates have sagged a little but not broken through. They can be best conserved simply by adding some more aggregate, carefully chosen to match the original in colour, shape and size. The original aggregate should first be removed from the floor and washed in a sieve to remove the dirt and mosses that have accumulated over time.

Badly broken floors will need to be replaced: work should begin with the simpler cases and the more difficult left until some experience has been gained. Carefully record the appearance (or rather what appears to have been the appearance) of the grave before starting any work. Note the height level of the floor

on the kerb stones and on the headstone or its plinth. Has the floor been replaced before and has it been built up higher than it originally was? Ideally, the new floor should not be higher than the original, in order to preserve the original form and appearance of the monument. Later changes may have made this impractical, or inappropriate, but it should be the aim.

Carefully recover any coloured aggregate topping and remove ceramic tiles, storing them in marked containers together with a record of the pattern of the tilework. Seek additional supplies of aggregates and tiles. Accurate matching is important. If the exsisting tiles cannot be readily removed from the concrete floor the whole section should be put aside for a skilled tile worker to deal with, break up and remove the floor taking care not to damage monuments or kerbs. This can be best done by using a portable circular saw with a diamond blade to cut through concrete. Be wary of iron bars that were intended to support the floor: they may extend beneath the kerbs. If so, consider leaving them in place.

Remove and store any elements such as tiles and cast iron fragments that may have fallen into the grave. Fill the grave with spare earth and tap down, a vibrating plate compactor may be useful. Protect monuments and kerbs from damage by covering them with thick padding such as hessian sacking. Limit the use of a compactor near the edges: as well as damaging the kerbs, excessive compaction may force them outwards and disrupt previously sound masonry.

To allow for thermal expansion of the new floor, and to prevent salts from the concrete leeching into adjacent stones, a compressible barrier should be inserted between floor and kerbs. Use ‘zipped expansion joining, the foam used for articulation joints in building construction. 10mm thick, 75mm wide foam with a 10mm tear-off side strip should suffice. Tape it to the kerbs and base of monuments before pouring the concrete so that the tear-off ‘zip’ line will be the finished level of the new floor. 40-50mm of concrete should be sufficient.

After the concrete has cured, the side strip can be peeled off together with the tape holding it to the stonework, leaving the foam level with the top of the concrete. Do not leave masking tape on masonry any longer than absolutely necessary, as it leaves an unsightly sticky residue in a relatively short time. Protect all kerbs and monuments from damage and cement splash with thick hessian sacking and plastic sheeting.

The insertion of expansionary jointing may be impractical in younger monuments where the floor is flush with the top of concrete kerbs. Also, sound concrete kerbing will better resist thermal expansion of the floor than stone kerbs and so the compressible jointing may be unecessary.

If the kerbing has drainholes at the foot of the grave the new floor should be positioned to meet them and have a slope of 1 in 100 from the head to the foot. As an experiment, some graves which have undrained flat floors and aggregate toppings could be covered with a no-fines concrete (1 cement to 8 parts of coarse aggregate which has been dampened prior to mixing). This will allow rainwater to percolate through the floor: an even percolation may be better than letting it all run off the edges and through the kerb stones.
Cement for both types of concrete should be of the low-alkali type. This is to reduce the amount of soluble salts in the concrete which can be a problem for old stonework, increasing rates of decay due to salt attack.

Replace the aggregate toppings, augmented with new material where necessary.

6.4 Tile repairs

Relaying ceramic tiles should probably be left to a specialist. If accurate matching to replace damaged or lost tiles cannot be achieved, it will be best to relay the tiles from the monument end and leave an untiled area at the foot of the grave. To check this, lay out the tiles to dry and ensure that the original pattern is correctly matched and repeated before commencing any relaying with adhesive.
Where the tiles are to be laid on a new concrete floor set within stone or cement rendered kerbs, the tiles may project by a few mm over the expansion jointing at the edges, leaving at least a 7mm gap all round to allow for thermal expansion.

Some tiles may need to be repositioned over cracks in concrete work. These should be laid on a flexible adhesive so as to allow for some movement of the crack or join. The grouting material will also need to be flexible.

6.5 Displaced granite ledgers

Granite ledgers can become displaced from their proper positions. Thermal expansion and contraction of the granite slab can result in the ledger 'walking', often leaving gaps of 50mm or more between the ledger and the plinth or black kerb. Lifting and relaying displaced ledgers is preferable to other means of trying to slide them back into place. Lifting polished granite slabs is best done with the aid of vacuum lifters such as are used for sheet glass. Do not use crowbars or similar tools as levers directly against granite ledgers (or concrete kerbs) as they will almost certainly damage edges. Lead shims should be placed between the ledger and kerbs should be adjusted to evenly support the ledger.
Subsidence of kerbs may lead to ledgers supported on two corners only, which may wobble, even in a breeze. In some cases repair of the subsided kerb may not be warranted, but some additional support should always be provided for the granite slab. This should be in a form of packing such as shims of lead or other insert material. Modern plastic packers are acceptable but should be placed away from strong sunlight. Timber chocks should not be used as they swell and shrink with moisture changes.

6.6 Repointing of joints

Many monuments have joints in the stonework that have lost much of their mortar. Some may have had very little in the first place. Joints need repointing (replacing mortar) in order to weatherproof them, to keep water on the outside. The very narrow joints of most monuments present a considerable challenge, so great care and patience will be required to successfully repoint them. The trade skills of a mason are essential.

Joints that have lichens and algae colonising the adjacent stones first need to be treated with biocide and then left for four weeks.

Using a raking tool remove old mortar from the joints to a depth of 20-25mm.
This applies to narrow joints 3-5mm wide as commonly found between marble blocks. Joints of up to 15-25mm as in rubble stonework need to be raked out to 30-50mm. it is important to clean the stone surfaces right back to the end of the cut out and to finish it with a square end. Use a hand air pump to blow debris out of the joint and then flush it with clean water. After cleaning apply a final spray of biocide prior to repointing.

Mortar for repointing narrow joints should be one part slaked lime putty to two parts fine washed sand, well mixed, beaten and chopped, and relatively dry. For repointing rubble stonework a 1 : 3 mix should be used with sand matching the existing (original) material in colour and grainsize.

The challenge with narrow joints is to get mortar into them rather than across the face of the stones. There are several methods of doing this. Covering the face of the stones either side of the joint with masking tape which is peeled off afterwards is one approach. Another, which requires less accurate taping, is to use a wide tape placed over the joint and then sliced along the joint with a knife. Do not leave masking tape on stone work any longer than absolutely necessary, as it leaves an unsightly sticky residue in a relatively short time.

A third is the mortar sandwich method explained in Ashurst & Ashurst (1988). Thin but strong flexible sheets of mylar form the two slices of bread while a layer of lime mortar in the joint and a narrow jointing tool placed between the mylar sheets holds the sandwich filling. This process is repeated. The advantage of this technique is that mortar can be placed right at the back of the joint and complete tight filling is ensured without spreading mortar over the face of the stonework.

Whichever approach is taken, narrow jointing tools that fit within the joints are a must.
They should be used to tightly compact the mortar into the joint, as simply placing mortar with a trowel is not adequate. Finish joints with a slight (1mm) concave surface. Joints should be filled in stages of 10-15mm each, allowing at least a day for each stage to dry. Prior to filling, dampen the surfaces of the joint with water from a spray bottle to control suction.
Clean up surrounding stonework and remove any mortar spills as work progresses; do not wait until afterwards. Trim surplus mortar with the end of a bent knife blade or similar tool. Do not use a sponge, or mortar will be smeared over the face of the stonework.

6.7 Iron work

Cast iron fences were made up of discrete sections, consisting of posts and infilling panels or rails. The posts are generally set into the stone below with leaded joints: molten lead was poured into oversize holes around the posts and tamped down as it cooled. The lead insulates the iron from damp stone and, because it is soft, permits a certain amount of movement due to the thermal expansion and contraction of the iron without damaging the stone. Joints between sections of ironwork can be seen to be either packed with lead pieces, filled with putty, or both. Sometimes molten sulphur was used as a jointing material in a similar way to molten lead.

More recent examples of metal fences have mild steel top rails bolted to lugs on cast iron corner posts. The rails are drilled for uprights which are also mild steel and which often carry cast iron finials in spearhead and fleur-de-lis patterns. Cast iron is very brittle and is easily broken, while mild steel bends rather than fractures.

Repairs to ironwork

Only disassemble iron work where absolutely necessary, taking great care not to further damage it. Use penetratng oil to free up nuts and bolts and apply it some days before work commences on the fence. Many examples of loose cast work can be simply pushed back together, or held in place with short lengths of fencing wire. Use soft galvanised wire and don't over tighten it. Specialist welders can weld cast iron and so repairs can be made to broken sections provided the pieces can be located. Bent steel rails and rods will need to be professionally straightened. Fences should be reset and joined in the traditional ways as explained. Joints should be tightly packed with putty to avoid trapping water and promoting corrosion.

Inhibiting rust and repainting of ironwork

Much of the iron work in New Zealand has a light surface coating of rust but is otherwise not badly corroded. Given the relatively dry climate this is not surprising, particularly in the case of cast iron which is more durable than other varieties. The questions that arise are: should anything be done to protect the metal, and does it need painting?
Although rusted on the surface, the amount of corrosion to cast iron is only slight, and as most of the ironwork dries readily after the rain there is little need for painting which would in turn become a maintenance problem, requiring regular recoating to maintain protection. Instead the ironwork should be brushed down and coated with fish oil.

Use a bristle brush to remove the dirt, flaking paint and loose rust. Wire brushes will produce a cleaner surface but will also leave minute metal filings on the surrounding stonework where they will corrode and discolour the stone. If wire brushes are to be used, dropcloths must be widely spread to catch any metal particles. In any event, dropcloths will be useful for

collecting flaking paint and loose rust. Wire brushes should have bristles of steel and not bronze.

Wash and brush the ironwork down with mineral turps and allow to dry.
Washing is important as it removes any remaining metal particles which would otherwise promote corrosion. The ironwork should then be coated with fish-oil preservative such as is commonly used as a rust inhibitor in cars Wattyl Kilrus Fishoilene diluted with an equal amount of mineral turps and applied with a brush. Work it well into cracks and crevices. Dropcloths should be used to protect the surrounding stones from splash, and if any significant spills occur the cloth should be soaked in water to avoid the risk of self-ignition. The coating dries very slowly (48 hours) and so dry and still weather is desirable to avoid excessive accumulation of dust on the tacky surface. Do not apply to wet or damp surfaces, in wet weather, or when the surface temperature is below 10 degrees.

The fish-oil coating will be dark and glossy initially but will turn matt and gradually degrade and eventually wear off. However, in doing so it will not trap moisture against the metal which is the risk with paints. Thus although the fish-oil will eventually require replacement, any failure to replace in good time will have no deleterious effect.

Some fences have been painted (several times) and the approach to them should depend on the funds available and realistic assessment of the likelihood of regular maintenance. The simplest treatment would be to coat them all over in fish-oil as above. Alternatively, if repainting is desired they should first be carefully inspected by a conservator (or someone with the necessary skills) to determine the sequence of paint colours used through the time, and from this to resolve what should be the finished colour. The sequence of previous colours should be recorded.

The iron should be thoroughly brushed down to remove loose rust, treated with a modern rust converter (such as Slider 2000 RCH) as per manufacturer's instructions and painted with two coats of enamel (alkyd) paint. Again, dropcloths should be used to protect the stonework from splashes.

Rolled steel fences which are less durable than those of cast iron, and of thinner sections of metal, will need the added protection of paint. They should be repainted as described, and to be effective their coatings will need regular maintenance repainting. That these fences are to be repainted when older ones are simply fish-oiled may lead to an unbalanced appearance in the cemetery.
Consequently, a trial area should be treated and the results assessed (after six months of weathering) before more widespread application. One approach may be to apply fish-oil to the rolled steel fences instead of paint, but they will need regular recoating if they are to be maintained in reasonable condition.

7.0 Painting and Protective Coatings

Painting and protective coatings

This section deals only with masonry, i.e. stone, concrete and cement-render work. Repainting of ironwork is covered in section 6.7.

7.1 Early limewashes

Some monuments around New Zealand have been painted – often with several different colours and generally in limewash, distemper or similar materials. Most of these early paint coatings have eroded away and few are now obvious, yet careful inspection shows that many of the sandstone monuments (which are generally the older ones) have been coated several times with a variety of colours, in particular off-white. The coatings can be most readily seen where they are protected from erosion, under prominent overhangs on larger monuments.

It should be clear that these coatings appear to have covered the whole monument in the case of those of sandstone, and the whole plinth and kerbs of others. They are quite distinct from blacks and whites used to pick out lettering, and other colours such as gold that was used to highlight particular features.

The challenge for the ongoing care of the cemetery is, should any of these monuments be repainted, and if so, in what colours and materials?

These questions cannot be answered at this stage: a better understanding of the reasons, tradition, practice and heritage significance associated with the painted monuments is required before options can be weighed up in the context of the ongoing management and care of the cemetery. Available resources and the cemetery community's interest and wishes will be factors that need to be taken into account.

Until these matters are resolved no painting of monuments should be undertaken. Equally, any cleaning works should not remove evidence of old coatings. Look carefully before cleaning any monument, particularly those of sandstone.

7.2 Modern protective coatings

It is tempting to apply clear protective coating, such as silicones, siloxanes, polyurethanes and acrylics, with aim of waterproofing and prolonging the life of old monuments. Don't. Coatings limit the ability of stones to 'breathe' and can trap water within the stone, causing decay and reducing life expectancy rather than increasing it. Many do not last well in sunlight, often discolouring to ugly yellows. The gloss finish that many have is particularly inappropriate for old stonework. Do not apply such coatings in any cemetery.

There is scope for the use of modern synthetics in the conservation of stone and other materials, particularly for the consolidation of weak crumbling stone. However, such treatments are an expensive and specialised activity and should only be undertaken by a qualified and experienced conservator.

8.0

Cleaning Memorials

8.1 Cleaning Historic Memorials

Cleaning historic memorials and monuments is often a debatable issue. The reason for this is that over the years many stones have been cleaned by unqualified people using harsh bleaches and high powered water blasters, damaging and ageing the stone they are trying to clean.

We as an association do endorse cleaning if done correctly, using soft bristle brushes and safe cleaning products that will not stain or damage the stone being cleaned.

All stones types have different attributes and they all should all be treated on a case by case basis. We always recommend when using even endorsed cleaners that a small trial should be conducted on the stone to make sure no discolouring or damage will result from any work done.

Soft stones like Limestone and Marble need to be treated very carefully as they are very susceptible to staining and, depending on environmental factors, can be already damaged by age.

The two main objectives when cleaning a memorial are to remove biological growth and to remove staining.

8.2 Cleaning

One of the most commonly asked questions is, how do I clean this stone? Although the cleaning of a headstone may seem quite simple, this is not always the case. Every time a historic stone is cleaned, some of the stone's surface is removed in the process. Clean it too often, and all the inscription and details may be worn away, especially on softer stones. We recommend using non-ionic detergents and moss inhibitors. Bleach based products are not recommended.

Most of the cemetery monuments are not dirty in the sense that cleaning will improve their appearance or life expectancy. There are exceptions: diesel exhaust fumes dirty some monuments close to the highways or railway lines, and lichens can be disfiguring and mar the legibility of some inscriptions.

Overall the white marble appearance will vary around New Zealand depending on the climate and its exposure to various elements unique to certain parts of the country. It can range from reddish brown to grey. Other colour stains may be a result of impurities in the lead used for the inscriptions.

8.3 Dirt removal:

Cleaning to remove dirt (as distinct from lichens) should only be undertaken where there is a specific need, such as to enable repairs to be done correctly. Before cleaning, carefully inspect the monument for signs of limewashes and other old paint coatings which may remain in protected areas, particularly under overhangs. Record the evidence of these coatings and ensure that they are not lost during cleaning, for they are a valid part of the history of the monument.

Clean by gentle washing with water and a mild colourless detergent at no more that 0.1% concentration (1 part in 10,000 = 1ml in 10 litres of water). This may sound like a very weak solution but is in fact not much weaker than average household dishwashing liquid in a kitchen sink. Suitable detergent should be available from all cemetery offices as this will ensure better control of what is used in the cemetery and provides an extra element of service and guidence for the public. Soft bristle brushes can be used to help shift the dirt. Avoid abrasion on surfaces with lead lettering as the risk of damage is high. Gentle abrasion with the soft side of a well-washed cuttlefish float is suitable for use on polished granite but not on other stones. Rinse down thoroughly with clean water. Don't use harsh abrasive powders or scourers as they may damage the monument. Never mix detergent with the biocide used for lichens – doing so will form a greasy scum that will be difficult to remove.

8.4 Removing Stains

Stains on stone are difficult to remove and cleaning should only be carried out by a qualified Monumental Mason. Stains can be removed with cleaning agents and/or poultice applications.

Safety Precautions

As with any chemical cleaning agents, all health and safety precautions should be taken by the Mason not only to ensure his own safety but the safety of any public in the vicinity while cleaning agents are being applied.

Also great care should be taken with the stone being cleaned as to not damage the surface.

Branding and Identification

Products that are used and endorsed by the New Zealand Master Monumental Masons are:

Reeson Architectural Quad Kleen – This is a product endorsed by New Zealand Historic Places Trust for cleaning stone on historic buildings

Kemsol "Silk" or "Moss kill" – This product is recommended by the New Zealand Historic Cemeteries Trust and by the War Graves Office of the Ministry for Culture and Heritage.

Industrial Methylated Spirits (IMS) in solution - This product is recommended by the War Graves Office of the Ministry for Culture and Heritage.

We do not endorse any use of acids (spirits of salts), bleaches or caustic soda. We also discourage the use of Wire Brushes, Steel Wool, Sandblasting or any other harsh abrasive to clean any monument

8.5 Removing Biological growth

Let us now think in terms of what is best, to promote the life span of the monument, to help preserve it.

The question of whether lichen should be removed from stonework has no straightforward answer. On one hand lichens give pleasing colour and variety and an immediate sense of age to cemetery monuments. Removing all lichens may produce an overall uniformity which would detract from the character and the significance of the place. Also because their stones are dated and the stone types known, cemeteries provide valuable evidence of the rate of growth of lichens and of the habitat of different species. Cemeteries may be the only remaining habitat of rare species, in which case there should be no wholesale removal of lichens.

On the other hand lichens secrete organic acids which attack the stone substrate. While the actual rate of stone decay caused by lichens is relatively slow, their deleterious effects can be seen on the tops of some sandstone monuments. Also, there is a variety of lichen which seems to like growing between lead lettering on marble, presumably feeding on the water film trapped between the two materials. Growth of the lichens appears to be forcing the letters away from the stone making them more susceptible to becoming dislodged. In

addition there are dark lichens which can be very disfiguring – at their densest turning areas of whitish marble to dark grey and black.

The decision is difficult as a visual result cannot always be predicted with confidence. The cautionary approach recommended here is to remove lichens only in the following circumstances:

- From sandstone monuments where lichen damage is apparent;
- From marble monuments which are judged to be strongly disfigured;
- From marble monuments where lead lettering is being damaged;
- From the joints between stones where repointing is required; and
- From the face of monuments where lichens obscure the inscriptions.

This will mean some monuments may be cleaned or part-cleaned of lichens while others won't.
Whether this will leave the cemetery with a pleasing aged appearance or produce a visual jumble will depend a lot on the care taken with cleaning those monuments that are presently disfigured. Excessive cleaning will lead to stones looking too new: the degree of cleaning will have to be carefully judged. For these reasons lichen removal and subsequent clean-up should be carefully monitored. A small trial area should be treated using the above guidelines and the results assessed before more widespread application.

The procedure is to flood the required area with biocide based on a quarternary ammonium compound, Ajax chemicals Turco Thoral (catalogue no. 15200). It should be diluted to a 1% solution in water (10ml in one litre) and painted or sprayed on. Painting is preferred because there is no overspray, but spraying will be required on all areas of lead lettering. This is because the bristles of a brush may become caught in the fine gaps behind loose letters and loosen them further. After four weeks the treated areas should be inspected and re-treated if required.
Dead lichens should be carefully removed by brushing, or scraping with soft plastic or wood scrapers, followed by washing down with clean water, or, in the case of lead lettering, by washing only. A final biocide wash should be applied.

As noted earlier, the extent and degree of cleaning associated with lichen removal will be critical to achieving a satisfactory result and will need to be continually assessed as work progresses.

As the biocide has no residual effect, regrowth of lichens can be expected in the long term. This is unlikely to present problems; the lichens have almost certainly never been removed before, and the present extent of damage suggests that repeat treatments may be required only at intervals of 10-30 years.

8.6 Graffiti removal

Although graffiti is not prolific it is seen from time to time. It would be prudent for the Cemetery to set in place policy, equipment and procedures for dealing with any outbreaks.
The Cemetery should adopt a policy for dealing with graffiti that requires:

- Graffiti to be removed as soon as possible after its discovery;
- The use of only approved techniques and materials;
- The supervision of all work;

- Before and after photographic recording;
- The keeping of a log of materials and techniques used;
- All workers to follow relevant occupational health and safety regulations.

A generally accepted rule for minimising graffiti is to remove any examples as soon as possible so that the perpetrators get no satisfaction from seeing their product, and being discouraged, go elsewhere. Further, there are good practical reasons for prompt removal of painted graffiti. While paints may be touch dry within hours or minutes they continue to release solvent and harden over a long period, often weeks or months. The sooner that the paint can be removed, the easier it will be, with consequently less damage to the monument.

Graffiti removal work could be undertaken by contractors hired as needed, or by cemetery staff trained for the purpose. The latter option is recommended because:

- The heritage value of the cemetery demands an extra degree of care;
- This is compounded by the poor condition of many monuments ;
- It provides greater control of materials and techniques used;
- Response times can be minimised with on-site skills; and
- Because of the nature of the monuments and the likely graffiti, only a limited range of chemicals and materials need be maintained on site.

Graffiti removal undertaken by or on behalf of relatives and friends should be discouraged as the risks of damage by well-intentioned but uninformed people are high. The safe use of toxic chemicals is an additional concern.

Of the various forms of graffiti, cemetery monuments are likely to attract two types

- Felt tip marker pens which use liquid inks and dyes; and
- Aerosol packed spray paints

Both marker pen inks and spray paint can penetrate deeply into the more porous stones, such as sandstone or limestone, and also into cement render work. They can prove to be very difficult, if not impossible, to totally remove from these materials.
Because they are thicker, spray paints tend to sit on the surface of dense stones like marble and granite, whereas the thin inks and dyes of marker pens will easily penetrate the fine pores of weathered marble, and to a lesser extent granite. The stronger colours of many granites will disguise small amounts of inks or dyes left in the fine pores whereas the light grey marble that is so widespread in many cemeteries will often show ghosting even after the most careful removal or treatment.

Removal of both pen markings and spray paints should be by chemical treatment with organic solvents. In the case of paints, the solvent acts to swell the paint coating, softening it so that it can be scraped or washed off. With pen markings the solvent dissolves the ink or dyes thus enabling their removal. The two different chemical actions may need different solvents or different mixtures of solvents for best results. In both cases the solvent should be carried in a thick gel, paste or clay poultice. These enable drip free application, retain the active ingredient on the surface where it's required, and prevent rapid evaporation.
The use of poultices is particularly appropriate for pen markings where there is a risk of the inks and dyes being carried further into the stone by the solvent, and spreading the disfiguring even further as a faint ghosting which cannot be removed. Instead, the high suction of clay poultice will draw the solvent and ink away from the stone.

The solvent is mixed into finely ground, high absorbent clay, such as attapulgite or speiolite, and the poultice applied with a soft spatula to the area to be cleaned, building up to 4-6mm thickness.
Pre-wetting the surface with a small amount of neat solvent may assist in dissolving the graffiti, but care should be taken not to overdo it or the graffiti will be carried further into the stone. The poultice is covered with several layers of cling film and left for some hours to allow solvent to slowly evaporate. Remove the poultice with rubber spatulas, or with wood or soft plastic putty knives, the choice depending on the softness of the stone substrate and the need to minimise further damage.
Clean up the surface by washing with water and detergent as in Dirt Removal (8.3). Soft and very soft bristle brushes should be used to gently scrub the surface. Allow to dry and assess results before deciding on further action. If re-treatment is necessary the surface must be allowed to dry thoroughly before reapplying solvent and poultice.

The approach to paint removal is similar and a clay poultice can be used except that timing the removal of the poultice is critical as the paint must still be swollen and soft. If left for too long the solvent will evaporate and the paint will harden, requiring a further application to remove it. Thick gels and pastes are alternative ways of applying the solvent. The Peel Away system has potential for this work. It consists of a trowelable paste containing the solvent and a backing 'paper' which allows ready removal of both paper and paste. Other paint strippers are often supplied premixed with thickening agents which produce a thick gel which can be easily brushed on. The gel can be agitated with a stiff bristle brush during the dwell time on the surface. This improves contact between solvent and paint and ensures a more effective removal. Remove the poultice, paste or gel with soft spatulas or scrapers as before and wash down thoroughly with detergent and water.

Drop sheets and other barriers should always be used to prevent splash onto other parts of the monument. All poultices, gels and pastes must be carefully disposed of as hazardous waste.

The active component of most current paint strippers is methylene chloride which is often supplemented with a small proportion of other solvents such as methanol. Though the most effective paint stripper known, methlylene chloride (also known as dichloromethane) is a dangerous toxic chemical and a suspected carcinogen which should be handled with great care and only used with adequate ventilation. In the cemetery it would always be used outdoors and in relatively small quantities thus reducing the hazard. However, this should not render a false sense of safety: full safety procedures including the wearing of gloves, masks and respirators should be strictly adhered to.

Particular solvents for either marker pens or spray paints have not been recommended as there are a wide variety on the market and new ones are constantly being introduced.

Decisions on which products to use should be made as part of a trial which might usefully be combined with staff training.

Only pH-neutral organic solvents should be considered for graffiti removal. Never use water blasting, neither high, medium or low pressure. Never use abrasive agents. And never use

chemicals other than solvents and detergents, i.e. don't use caustic soda, similarly alkaline materials, nor acids.
Claims that these materials and techniques will enable the job to be done more cheaply may well be true, but even when carefully handled they will damage old stonework. Their uses carry such great risks that they should not be contemplated.

One particularly difficult aspect of graffiti removal is where the graffiti has been sprayed or marked over painted lettering. The challenge is to remove the graffiti without removing the paint that is part of the monument. Less aggressive solvents or diluted methylene chloride should be used: establishing the right one is complex and may require further advice. The solvent should be applied with a rag and wiped off quickly so that it doesn't have time to penetrate the original paint.
Repeated aplications may be necessary. As a precaution the original paint work should be studied prior to treatment so that at the very least it can be accurately reproduced. Incised lettering should be thoroughly checked before any graffiti removal, looking for small traces of early paint or gilding that may be lost during cleaning.

The graffiti on this Oamaru monument is severe, the oil base paint has been obsorbed by the porous Oamaru stone and required a lengthy process to draw it out.

Never be tempted to grind or scratch at the graffiti.

9.0 Dowelling

The use of dowels is essential in all upright memorials whether installed in private or public cemeteries. We have now seen the results in cemeteries throughout Canterbury post-earthquakes of what can happen to memorials without dowels to keep them upright. The reason for having dowels is simply to stop monuments toppling from any form of movement, whether that be by natural causes (earthquakes) or by other causes, (vandals, accidents etc.) with adequate dowelling a monument may become loose but it should not fall over (excluding extreme natural events such as the February 2011 Christchurch earthquake which added a new scenario, "The Trampoline Effect" -the creation of a vertical explosion upwards as a result of the earthquake).

Many forms of dowels have been used in the past. Most of these do not meet our industry standards or expectations for reasons such as longevity, strength and the negative reactions to the memorials themselves (such as expansion or erosion). It has also been proven that the length of doweling (often too short) is a large contributor to the toppling of many memorials over the years.

9.1 NZ standard 4242 – Minimum Standards

All dowelling, no matter what material, should as a minimum comply with **NZ Standard 4242,** which reads:

2.6.1 Metal Dowels

Metal dowels shall be of an alloy type that exhibits high resistance to atmospheric corrosion. Copper alloy shall be Grade 443 as specified in AS 2738.2 and for stainless steel, Grade 304 in accordance with AS 2837. Stainless steel shall exhibit non-magnetic qualities

Table 3.1 – Dowel sizes

Monument Size	***Dowel Diameter***	***Dowel Length***
Mm *Up to 900x600*	*Mm* *10*	*Mm* *140*
900x600 to 1200x750	*12*	*200*
Larger than 1200x750	*Dowel size to be determined by design engineer calculations*	*Dowel size to be determined by design engineer calculations*

9.2 Other NZMMMA recommended Materials

2.6.2 Other Materials

This standard does not preclude the use of other materials for dowels and cramps other than those specified in this standard, provided that such materials can be proved by appropriate performance testing to be equal or better than metal specified in 2.6.1

Current recommendations are

- **Stainless Steel** – This has been the favoured product of NZMMMA members for many years and is still used. As long as it is high quality (Grade 304) steel corrosion will be slow. Threaded options are recommended, especially for restoration or installation.

- **Fibreglass Rod** – This is another product the NZMMMA recommends, because of its high strength values, ease of handling, cost effectiveness and because it will not corrode. Again post-earthquake we have learnt that there were some issues of the adhesive letting go on the smooth surface of the standard fibre glass dowelling. This has led us to find a new product in the fibre glass range "Manteen-Bar" which is still a fibre glass rod but with a ribbed external thread that ensures extreme adhesion to whatever adhesive bonding method is used.

10.0 Lesson from past repairs “DIY”

10.1 Cement Joints

This repair was accomplished by “glueing” the stone back together with mortar mix or some other Portland cement mixture. Not only is it the worst way to repair a stone, but such repairs are widely seen throughout New Zealand. Sadly, the individual who was ambitious enough to do the work, ruined the face of a beautiful old stone. From an engineering perspective, this repair technique is poor because the stone will fail again when lateral force applied to the stone subjects the mortar to tensile stresses. Concrete is only strong under compression. Steel re-bar is typically used to carry tensile loads. In simple terms, this repair will easily break in the same place as soon as someone pushes on it.

10.2 Epoxy Joints

Epoxy joints are even more common. If epoxy runs it can be damaging to the stone, and exposure to the sun will break down epoxy over time.

An important consideration before using epoxy concerns the quality of the edges of the stone that are being rejoined. The epoxy may become “as hard as a rock”, but is the old headstone “as hard as a rock”? Did it appear that the stone failed because of physical damage from impact, or from a general weakness of “rotting stone”? Consulting an expert is essential.

10.3 Metal Plates Bolted Through the Headstone

A metal plate was bolted to the back of this stone to hold the two pieces together. The left hand photo shows the face of the stone and the right shows the plate attached to the back. Although this particular repair appears to have lasted a number of years, it is not a recommended repair method. Installing the bolts can cause the stone to be broken again. A fundamental problem with the use of bolts is that they create a region of high stress in the stone that can immediately or eventually cause additional damage.

Dimant grave: Jewish area, Bolton Street Memorial Park Wellington.

10.4 Cast concrete slab on back of headstone.

This unfortunately is common as well; the headstone was broken and repaired by casting a concrete slab on the back face. The reinforcing in the slab has corroded, causing the concrete to fracture, eventually falling away, with the medium-term risk of the stone coming apart again.

10.5 DIY repairs:

Often seen in our cemeteries, is the work of the "Do it yourself handy man". While the best intentions were had, this type of repair is unsightly and damaging to the aesthetic look of the grave. Council and cemetery owners have a responsibility to monitor who works in their cemeteries and ensure that they understand and follow guidelines for this type of work.

10.6 Poor Workmanship:

This plot has suffered from poor workmanship. After being reopened for interment it has been poorly resealed. The new marble panel has been engraved but instead of traditional leading methods being observed the mason has simply painted the letters black, a lack of expertise that will cost this family many hundreds of dollars in the future and will become a safety issue for council.

11.0 The Nature of Stone

11.1 Stone Type: Marble

Marble is a rock resulting from metamorphism of sedimentary carbonate rocks, (most commonly limestone or dolomite rock).

The most common marble seen in cemeteries or as public monuments would be Italian Carrara Marble which is white with often grey veining. Marble has been used for many years for headstones and monuments and is a reasonably hard material. Marble in most cases will be dirty in appearance and can have staining from lichens and mosses.

Is the stone cleanable?

If the stone shows signs of chipping, scaling, flaking or other forms of deterioration, do not clean. You will do more harm than good.

Marble can be cleaned using biocide, water and non-ionic detergents. Use a plastic scraper to remove biological growth and a soft brush to apply biocide/detergent and rinse well with water. It is recommended to always wet the stone when removing biological growth as this makes it much easier to scrape without damaging the surface of the stone. If there are lead letters inlaid, this will need to be 'hammered' before any cleaning can be undertaken. A registered monumental mason must be consulted as this is a specialized technique. The use of a water blaster is not an option as this will cause premature deteriration of the stone. While for many years bleach and sodium hypochlorite cleaners have been used on marble to "whiten" them we do not recommend this process. These types of cleaners can destroy the surface of the stone and have been known to discolour white marble. Never use wire brushes or other hard cleaning abrasives as you will damage the stone.

Lettering marble is generally lettered 'V' cut or with lead filled letters. This is easy to determine as all lettering that has been lead filled will have key holes drilled in all letters and 'V' cut will have none. With lead filled letters a qualified monumental mason who specializes in this work will need to be consulted, one who can preserve what letters that are left and re-form new ones as replacements or in extreme cases, reface the stone, re-cut letters and inlay new lead.

The ***NZMMMA*** does not recommend filling with epoxy fillers as they do not stand the test of time, and shadowing can occur as with paints. If 'V' cut we do not recommend colouring as marble is porous and paint will be absorbed into the stone leaving staining around the letters. This is virtually impossible to remove and will ruin the look of the memorial with shadowing around the letters. In all cases with marble lettering an experienced Monumental Mason should be consulted when working with the lettering and each stone would need to be assessed as to the best option for that particular memorial.

11.2 Stone Type: Granite

Granite is a plutonic rock formed by cooling magma deep underground.

It has particularly, over recent times, become the most favoured material for memorials and is endorsed by the NZ Master Monumental Masons' Association Inc. Due to its very hard nature, it is often described by monumental masons as the hardest mineral next to diamond. It is this durability that makes granite popular for cutting, shaping and polishing into memorial headstones and is an ideal surface for cutting inscriptions and artwork either by sandblasting or chiselling.

Due to its long lasting nature, granite memorials or monuments of any age can be restored quite easily with a water blast to clean off any lichen. Inscriptions can be repainted or gilded. As with most natural stone, it is not recommended to coat with lacquers or similar but to leave the natural surface and renovate the headstones or monuments on an approximate 12 to 15 year cycle.

11.3 Stone Type: Sandstone

Sandstone is a sedimentary rock composed mainly of sand-sized minerals or rock grains. Most sandstone is composed of quartz and/or feldspar because these are the most common minerals in the Earth's crust. Like sand, sandstone may be any color, but the most common colors are tan, brown, yellow, red, gray and white.

Some sandstone is reasonably resistant to weathering, yet is easy to work. This makes sandstone a common building and paving material. However, some sandstone has been used in the past for memorials and while they do last reasonably well they do delaminate and it is difficult to colour the inscriptions.

Is the stone cleanable?

If the stone shows signs of chipping, scaling, flaking or other forms of deterioration, do not clean. You will do more harm than good.

Sandstone can be cleaned using biocide, water and non-ionic detergents. Use a plastic scraper to remove biological growth and a soft brush to apply biocide/detergent and rinse well with water. It is recommended to always wet the stone when removing biological growth as this makes it much easier to scrape without damaging the surface. The use of a water blaster is not an option as this will cause premature deterioration of the stone's surface. Never use wire brushes or other abrasive cleaning products as you will damage the stone.

Lettering: Most sandstone memorials have 'V' cut lettering and would never have been coloured to highlight the letters. Resist the urge to paint the lettering on sandstone as it is very porous and paint will quickly be absorbed into the stone, leaving staining around the letters. This staining is virtually impossible to remove and will ruin the look of the memorial. Generally cleaning the memorial/monument will make the inscription more legible.

11.4 Rising damp and salt attack: their effect on monuments:

All types of stone and other masonry materials are to some extent porous and permeable, permitting the passage of moisture. The small pores in most stones produce a high capillary suction, and it is this suction which causes rising damp, drawing moisture from the ground against the pull of gravity. The moisture evaporates from the face of the stone, allowing more to be drawn from below. The height to which moisture will rise is determined by the evaporation rate and the pore structure of the stone, 0.5 to 1.5 meters is common in buildings.

On its own, rising damp is not a major problem for cemetery monuments. However, when soluble salts are present in the soil the situation is made much worse, for the rising damp will carry the salts from the soil into the masonry. The salts are left behind where the damp evaporates and can often be seen as a white efflorescence on the stone surface. When these salts grow as crystals within pores they can disrupt even the strongest materials, including granite, leading to fretting and crumbling of the surface. This process is known as salt attack, and when severe can lead to the slow but complete loss of stones and other masonry materials.

Sandstones and limestones are most susceptible to decay from the combined effects of rising damp and salt attack because they have high porosities which permit ready transport of moisture and salt. Slates, marbles and granites have relatively low porosities and are generally, but not always, free of salt attack. Typically, a headstone will decay a short distance above the plinth. This is where the rising damp evaporates leading to the build up of salts. Even though there may be little visible sign, decay just beneath the surface may be already advanced and the stones considerably weakened.

Salty soils are not the only source of destructive salts.

12.0 The Nature of other Materials

12.1 Totara

Totara wood is light in weight and easy to carve. Totara heartwood is useful as railway sleepers and outdoor landscaping timber. Second-growth stands less than 100 years old have a high proportion of sapwood. Although heartwood has superior wood qualities, sapwood can be used for furniture, joinery, and also for exterior woodwork. It wasn't uncommon to see Totora memorial markers around the eighteen hundreds as it was accessible and manageable.

Description

Totara grows throughout the North and South Islands of New Zealand, and is most abundant in the central North Island.

It is usually found in lowland areas up to 600m altitude in the North Island, and 400m altitude in the South Island. A related tree, Hall's Totara (Podocarpus hallii also sometimes called Podocarpus cunninghamii,) grows in the North, South and on Stewart Island.

Totara can grow to 2.5m in diameter, but older, larger logs are often hollow. The trunk has a dark brown, fibrous bark that hangs in papery strips.

The heartwood of Totara is an even reddish brown and the sapwood a pale brown. The growth rings are distinctive and even, and the wood has very straight grain, allowing it to be easily split along the grain. Totara wood has fine, even texture and finishes well.

Although the harvest of Totara is very low, plenty of Totara is regenerating on farmland in NZ, especially in Northland. Most stands range in age from 50-120 years, with average diameters of 11-25 cm and are the result of regeneration since original land clearing.

Common deterioration of Totara monuments is due to ground moisture. Unlike traditional memorials of that era, Totara monuments were commonly placed directly into the ground and often resembled "posts", "crosses" etc. Lettering was often simple and "v" carved.

A good example of modern restoration and preservation of a Totara monument can be seen with the ***MAITLAND plot: C11-06 Map 7 Bolton Street Wellington (sec 5.3 page 26)***

Strength

The timber is not very strong, and the dry heartwood is brittle.

Durability

Totara heartwood is very durable in the ground; a 50 x 50mm stake would last in excess of 25 years, an equivalence to H4 Hazard class.

Finishes

Very difficult to paint, but primers are available to aid in this regard.

Working properties

Totara is easily worked, cuts smoothly across the grain and is very amenable to all machining operations including jointing.

Appearance

The heartwood of Totara is an even reddish brown and the sapwood a pale brown.

12.2 Cast Iron

Iron grave markers and decorations were popular during the Victorian era in the United Kingdom and are seen occasionally in New Zealand, often being produced by specialist foundries or the local blacksmith. Cast iron headstones often only survive in a rusted or eroded state.

Cast iron headstones should be cleaned in the same manner as other forms of headstones using biocides and water; harsh chemicals will only destroy lettering and decoration and promote premature deterioration. Do not try to remove rust or flaking metal as it will harm the inscriptions, symbols and icons on the headstone or monument.

Material: Wrought Iron

Wrought iron (sometimes called puddled or charcoal iron) is the traditional material of the blacksmith. It resists corrosion, is not brittle, and seldom breaks. It is soft, relatively malleable and easily worked. As a result it is often found as fencing around gravesites in both plain and ornate forms.

Cleaning: there is some debate as to how best to look after and preserve wrought iron. The main form of deterioration seen is rust, which in most circumstances would be treated and painted. There are a lot of opinions on whether this should happen in cemeteries or whether to leave the iron rusting in its natural ageing process. If the iron is to be painted it is not recommended to have it abrasive blasted. Instead, after wire brushing the loose scale, treat the iron with rust converter, then follow with a recommended paint.

If there is wrought iron fencing that needs to be reset into stone kerbing or existing concrete, it is recommended that it be reset using molten lead in cases where the foundation is in good condition. This is a specialized form of mounting steel in stone (concrete) using sulphur and molten lead and should only be carried out by a qualified mason or a blacksmith.

Material: Bronze

Bronze is analloy, a mix of Tin and Copper, which began appearing in New Zealand cemeteries in the early 1950's and was very popular for cremation memorialisation, then later as plaques set in moulded concrete headstones for servicemen's cemeteries.

The advantage of bronze as a memorial was that lettering did not need to be recoloured or releaded as in granite and marble. However, the initial shiny appearance wears off rather quickly and the plaque tarnishes with age. Some bronze plaques even develop green stains.

Monumental masons are often asked about brightening up older bronze plaques and there are several methods that can be used other than sending the plaque back to the foundry for rebronzing.

Some masons sandblast the bronze surface back to the metal, paint with bronze liquid and apply several coats of lacquer. Others clean the surface and apply a bronze powder as a paste and then rub to a shine using a wax. Any of these methods have, however, a limited lasting effect and will also tarnish with age, just as new bronze plaques do.

12.3 Concrete

Concrete is by far the most prevalent material in New Zealand cemeteries, used for headstones, bases, grave covers and indeed by councils for berms and pathways.

Concrete Headstones:

The most common use of concrete for headstones is as a desk to hold a granite, marble or bronze plaque.

Because concrete erodes over time, this presents a problem for ongoing maintenance and often the best method for preservation of the headstone is to remove the concrete desk and reset the plaque onto a granite desk. In the case of servicemen's headstones, which for some time were made of preset concrete headstones with a bronze plaque insert, the entire headstone is now replaced with a granite alternative.

There are also a few examples of concrete being used to mould a headstone or monument including an inscription.

Once again the gradual eroding of the concrete presents a problem of future preservation, so the choices here are quite limited.

With meticulous care, the letters can be reformed by a fine plaster mix and finished with a concrete sealer. In most cases, though, replacement is required by replicating the lettering and/or designs onto a new granite plaque or headstone but also retaining the original concrete headstone along side for historic purposes.

Left: cast concrete plate with marble panels fitted

Right top and bottom: concrete moulded plaques set in concrete desks

Concrete Bases:

Concrete has and is still being used extensively as a base or plinth to hold a natural stone memorial or monument. Concrete forms the shape of the base and is usually covered with a fine white or grey plaster finish. But some concrete bases are moulded at the workshop and transported onto the site. This method has been popular in high rainfall areas and where long distance travel to the cemetery is required.

All concrete bases should be reinforced with steel mesh or rods.

Cleaning of the bases can be achieved by either water blasting or more popularly now, a spray-on lichen remover product, combined with a biocide detergent solution. These methods can even be used in combination.

Concrete Grave Covers:

A very high proportion of graves up until the early nineteen sixties were covered in tomb slabs or concrete walls and floor areas. These, like the bases, were usually covered with a plaster finish.

The lawn cemetery concept in the late 1950s and early 1960s discouraged the use of concrete ground covers as many concrete slabs needed to be opened up at a later date for additional burials.

Cleaning of the concrete surrounds is by the same methods as previously mentioned for the bases. Most monumental masons strongly recommend never to paint the concrete surfaces as this presents huge problems for future maintenance and it is a costly exercise to either strip the paint and/or sand blast the surface.

13.0 Density & Hardness of Stone

Stone is a natural solid formation of one or many minerals. Stone is quarried all around the world but most of the stone used in the Monumental industry comes from India, Italy, China, Africa and America

Most of the minerals that form stone can be identified by their colour, hardness, and crystal formation. The wide array of these minerals that formed stone is often difficult to identify. Many stones look very similar to each other; however, they are all very different.

It is important to know the type of stone that is to be maintained. Stone is natural and may have reactions to certain cleaning chemicals and procedures.

The familiar stone types that are used or have been used in cemetery monuments are identified through three categories: ***SEDIMENTARY, METAMORPHIC, IGNEOUS STONE.***

SEDIMENTARY

Stone came from organic elements such as glaciers, rivers, wind, oceans, and plants that have been bonded through millions of years of heat and pressure.

LIMESTONE

Mainly consists of calcite. It does not show much graining or crystalline structure. It has a smooth granular surface. It varies in hardness and will weather more quickly than Igneous and Metamorphic Stones. Some dense limestones can be polished. It is more likely to stain than marble.

SANDSTONE

Is a formation of quartz grains (sand) and is similar to limestone in hardness and durability.

METAMORPHIC

Stone originates from a natural change from one type of stone to another type through the mixture of heat, pressure, and minerals. The change may be a development of a crystalline formation, a texture change, or a colour change.

MARBLE

A recrystallized limestone that formed when the limestone softened from heat and pressure and recrystallized into marble where mineral changes occurred. Marble comes in many colors and is usually heavily veined and shows lots of grains. Hardness rates from 2.5 to 5 on the MOH Scale.

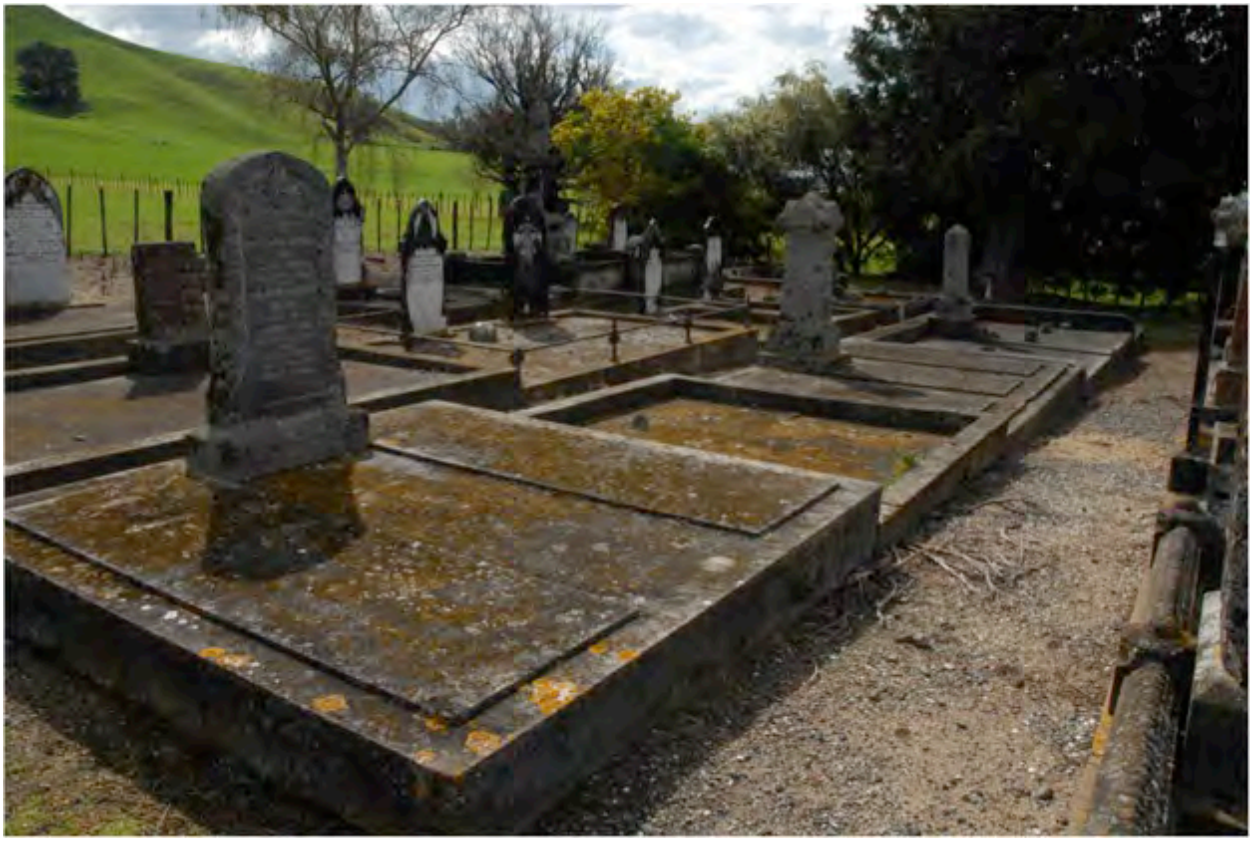
IGNEOUS

Stones are mainly formed through volcanic material such as magma. Mineral gases and liquids penetrated into the stone and created new crystalline formations with various colours.

GRANITE

Primarily made of Quartz (35%), Feldspar (45%) and Potassium. Granites usually has darker colors. It is very hard material and easier to maintain than marble or sandstone. While it is very hard and dense it is still porous and can stain. There are different types of granite depending on the percentage mix of quartz, mica and feldspar. This is by far the best material in regard to hardness and density for use in the monumental industry. The ***NZMMMA*** recommends the use of granite for new memorials

Other local stone used in cemeteries will generally fall into one or other of the above categories and local knowledge of these stones will help able to determine the hardness and density of these.



Beautiful example of sound structured ledgers, four walls, granite, marble and mild steel surounds. – Otane Cemetery

14.0 Finishes and Profiles

Monuments vary from simple but dignified plaques to maximum custom-made designs with a wide range of colors and sizes available to comply with local council bylaws.

Durability is an essential quality in any monumental material and time and experience have proved conclusively the superiority of shaped granite.

14.1 Sawn Finish

To produce a sawn finish the stone is sawn with a frame saw (steel shot or diamond) or wire saw (silicone carbide abrasive) or circular diamond blades.

The surface texture varies depending on the machine used and is hardly ever flat or uniform looking, as grinding is needed to produce a flat uniform finish.

14.2 Fine Axed

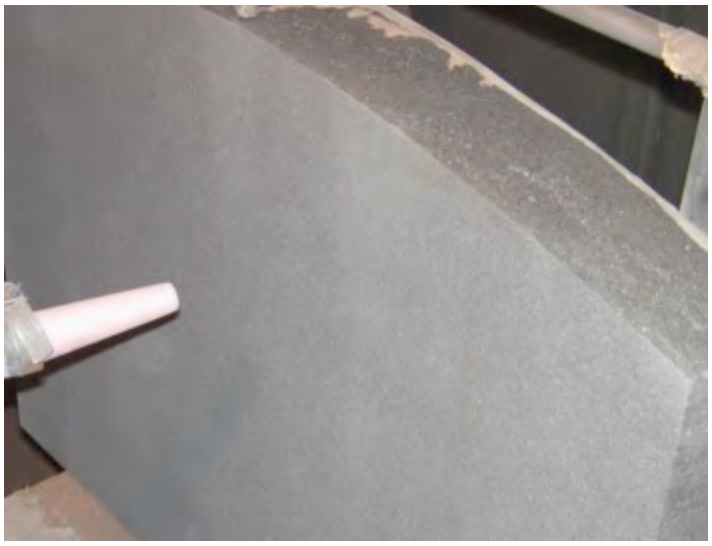
This is where a sawn finish is made smooth and regular by hand-machine tooling over the surface area leaving a rustic finish.

14.3 Honed

Using a polishing machine with diamond abrasive surfacing tools, working through the grades finishing with a fine grade abrasive to give a very smooth matt, non-reflective finish.

14.4 Sand Blasted

Sandblast the surface area to remove the irregular markings of the cut/ground finish to leave a fine textured finish.



14.5 Polished

Using a polishing machine with diamond abrasive surfacing tools, the granite goes through a series of polishing wheels fitted with coarse abrasive pads and also finer polishing pads. These chemically impregnated pads apply pressure to the stone grinding, buffing the stone as it moves through the finishing process until it's smooth like glass and has a highly polished reflective surface.

14.6 Rocked

A natural rock finish is produced by a sharp blow with a pitching tool and is suitable for edges and margins.

14.7 Flamed

A surface treatment applied by intense heat (flaming), this creates a rough textured finish.

15.0 Lettering

Lettering

From our point of view, lettering on monuments can be divided into two broad categories.

- Lead lettering, either set into incised grooves and flush with the surface as on marble, or raised from (generally) granite surfaces as individual castings;
- Incised/embossed lettering, chiseled or sand-blasted and sometimes painted or gilded as seen on granite (20th century monuments)

15.1 Repairing lead lettering

Traditional lead lettering is tapped into v-shaped grooves cut into the marble monument. Small anchoring holes are drilled in the marble through the bottom of the grooves. As the soft lead is tapped into place it flows into the holes forming a series of lugs anchoring each letter. In good quality work the anchoring holes are drilled at different angles, particularly downwards, so as to lock the lead in place. When the lug holes are drilled straight into the marble the locking effect is not present, risking loss of the lead work due to the different thermal expansion co-efficients of the metal and marble and the resulting tendency for the lettering to work loose over a long period of time. Sometimes this may be the only reason for the loss of letters.

The dislodgment of some lettering is enhanced by the growth of lichens. There is a variety of lichen, which seems to be growing between the lettering and the marble, presumably feeding on water films trapped between the two materials.

The aim of repairs should be to retain as much of the original material as possible: re-fixing the existing lettering is preferred to its replacement with new metal. This leads to a conflict between conservation philosophy and good practice. The latter would suggest that new angled lug holes should be drilled to ensure that the lettering remains locked to the marble, but this would use more lead and so require more material. Each case will have to be treated separately; new lead will be required in some, but where the original lead remains every effort should be made to retain and refix it. Prior to re-fixing, both lettering and stone should be treated with a biocide.

The work of re-fixing existing lettering, or replacing lettering with new lead, is the province of a specialist NZMMMA mason or conservator.

15.2 Repainting and re-gilding lettering

Incised lettering which has lost its paint coating or gilding can be repainted or gilded provided the work follows previous practice. That is, gilding should replace gilding, and paint should replace paint, in matching colours. Where there was no previous coating or gilding the lettering should be left plain and not 'improved' by adding to it.

15.3 Adding new lettering to an existing monument

A new inscription may be sought when a burial takes place in a plot with an existing monument.
Provided there is room on the monument, and provided the monument is in sound condition there is no reason why a new inscription should not be added. The new lettering should be of the same type, style and size as the existing.

Adding new lead lettering to an old marble monument is made difficult because of the etched and rough surface of the marble, which is caused by natural weathering and made worse by acidic rainfall. Successful application of lead lettering requires a smooth flat marble surface and means that some rubbing back will be required. This is acceptable provided that it is kept to a minimum consistent with good lettering practice, and provided that the rubbing back is limited to the face on which the lettering is to be applied. No attempt should be made to smooth the rest of the monument so that it matches the new work. The contrast with the new can be softened with a gentle hand wash. The new work will still be obvious for some time and should be allowed to blend in naturally with the old.

There may be some heavily decayed marbles for which rubbing back would result in too much loss of material, or weak stones where incising new letters would risk damaging or breaking the stone. In these and other cases, such as where incised lettering is becoming illegible due to decay of the stone, new inscriptions should be made on a small tablet of similar material, which can be unobtrusively installed near the base of the monument. The new plaque should be dated so that there can be no confusion about its origin. Do not recut eroding lettering for this falsifies the evidence of the monument and destroys the remaining craftwork of the original mason.

The lead is raised above surface due to weathering; preservation and repair must be done by a certified member of NZMMMA.

16.0 Sustainability

Stone has been used as a building material for monuments for thousands of years. It has long been recognized for its great durability and artistic quality. The still standing pyramids in Egypt and temples in Malta were all built from stone over 4000 years ago.

Granite is an igneous non-porous stone formed from the cooling of molten magma. It is highly durable and low maintenance with high thermal mass. It is versatile, available in many colours, and can be used for many other uses besides monuments.

Stone blends well with the natural landscape, and can easily be recycled for other purposes. But is stone a sustainable material?

Stone is a natural resource. However, the way it is quarried, processed, transported and used determines its environmental footprint. The ***NZMMMA*** encourages its members to treat our product's source - the earth-with respect. We are dedicated to developing and maintaining stone processing practices that minimize the impact on the environment.

16.1 Goals

- Lessen the impact of the manufacturing and distribution processes on air, land and - water.
- Recycle more of the water we use.
- Minimize transportation through on-site (quarry) processing.
- Maximize quarry yield and minimize waste.
- Minimize waste by creating stone by-products.

“Green” is a buzzword associated with everything and anything that’s supposedly better for our environment. There is little disagreement that stone is a natural material. It is, after all a natural element of the Earth, even in its final form. However, “green” refers to more than the natural stone material and its many characteristics that enhance its environmental profile (natural material, durable, recyclable, reusable, etc.).

“Green” also encompasses the environmental performance of the companies that produce it - in our case, the stone industry itself. We are judged based on the choices we make to lessen the impact on the environment. Current perceptions of the stone industry include a dirty, unsophisticated operating environment, high-energy consumption, high water consumption and high waste factors. It is our challenge to help our industry address these perceptions with hard data in a proactive way.

The ***NZMMMA*** is committed to providing the research and promotional support necessary to help those of us in the natural stone industry substantiate our claims about natural stone as a “green” product.

Our goal is to support the stone industry’s efforts to increase the preference for and consumption of genuine stone.

17.0 Glossary

Base A support structure for a monument.

Beam A ledge or space of ground alongside a paved road or path used as a foundation for installing memorials.

Canopy A roof-like covering on a monument.

Cemetery An area set aside for interment of remains.

Design Engineer A person who, on the basis of experience or qualifications, is competent to design structure elements of the headstone or monument to safely resist the design loads or effects likely to be imposed.

Desk A backward sloping support inclined either nearly flat or nearly vertical which either supports a headstone or a plaque, or has the inscription engraved directly on it.

Dowel A pin used to align and to prevent movement between adjacent elements of a monumental structure.

Footing A part of a structure in direct contact with and transmitting load to the supporting foundation.

Full grave construction A monument that covers the whole area of the grave.

Grave A place of burial below ground level, which may or may not be lined.

Granite *(refer page 60)*

Headstone An inscribed stone or monument usually set at the head of a grave.

IMS Industrial Methylated Spirits, or Ethanol. Other names for it are WP Alcohol, and De-Natured Alcohol. WP stands for “Without Pyridine” which is the purple coloured additive in the Meths.

Inscription A dedication recorded on a memorial.

Kerbing Grave edging.

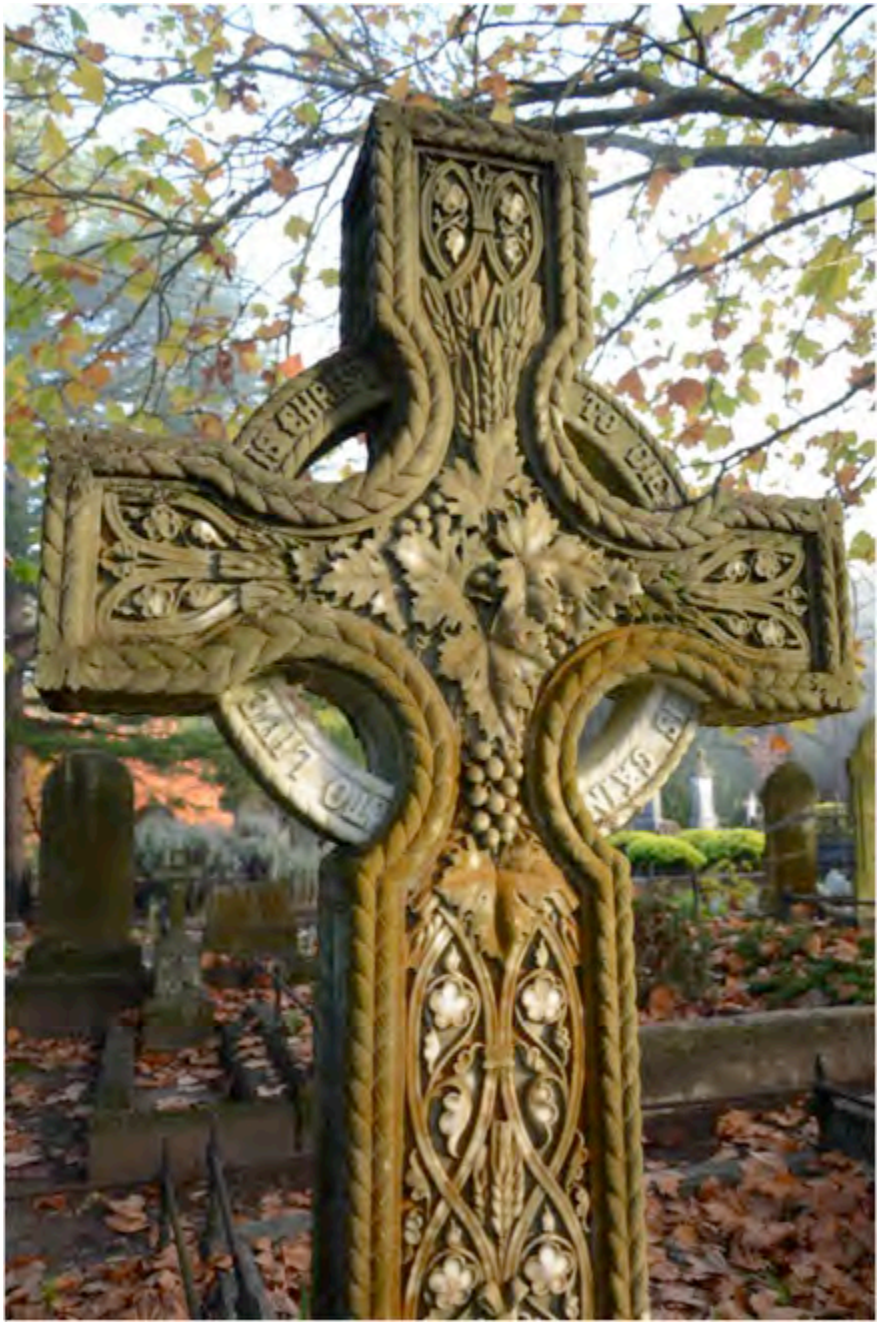
Ledger A slab covering a grave or part thereof.

Limestone *(refer page 59)*

Memorial Something designed to commemorate a person or an event.

Memorial Plaque	A plate bearing an inscription.
Monument work	Construction and renovation of monuments in cemeteries by monumental masons or other appropriately trained personnel.
Natural Stone	A naturally occurring, consolidated aggregation of one or more minerals which constitute the crust of the earth.
No-Fines	No Fines concrete is a specially designed concrete with a specified void content that allows large volumes of water to quickly fill the voids between the aggregate particles. It is formed by eliminating the fine material from the regular concrete mix.
Pier	A vertical element supporting a structure above, which is subjected primarily to both compressive axial loads and seismic forces.
Pillar or column	A vertical structure, slender in proportion to height and used as a support or ornament.
Plate	An upright memorial of the same thickness.
Plot	The land to which is attached the right to inter human remains therein.
Post	A tall four-sided monument with parallel sides.
Sandstone	*(refer page 59)*
Spalling	Is a result of water entering brick, concrete or natural stone and forcing the surface to peel, pop out or flake off. This is because there is salt in water. Salt pushes outward from the inside. Eventually, spalling can cause crumbling and destruction of a structure. **Also Known As**: Flaking, especially in limestone.
Spire	A tall four-sided tapered post monument.

Exquisite example of fine carved sandstone, positioned In a high part of the cemetery and clear from dense tree cover. This memorial shows no sign of rising damp. It receives full sunlight and is well ventilated.



Guide to monument care for relatives and friends

Introduction

Our aim is to maintain the cemetery and its monuments in good condition while still maintaining their character and their evidence of age. Making all the monuments look new would destroy the character of the older ones and the history that the cemetery can tell us.

What can be done?

This leaflet explains some of the straightforward tasks that can be undertaken by relatives and friends who are keen to maintain a grave site in good condition.

Survey and collection of fragments

Carefully study the grave site looking at all the components such as the headstone or monument, its base, the grave top and any surrounding fence.

- Are there pieces missing?
- Can they be found somewhere else on the grave site nearby?
- Do the found fragments belong to this grave or another?

Commonly missing are small tiles from the grave tops, and pieces of marble and sandstone from crosses on the tops of monuments. Look carefully around the base of marble headstones or other monuments for pieces of lead lettering that have fallen out. Make sure they belong to this grave by matching them to gaps on the monument. Handle the letters carefully as these are very soft: don't attempt to staighten them out if buckled. Store them in a small plastic container, place it at the foot of the monument and label it with the name and date on the grave. Talk to the cemetery office about having a specialist put the letters back on the monument or headstone.

Weeding and exotic plants

Weeds growing through joints in stonework should be inspected to see if they can safely be pulled out without damage to the surrounding stones. Otherwise, removing weeds is best done by treating with a poison which should be brushed onto foliage rather than sprayed in order to reduce the risk of the chemical coming in contact with stone and other elements of the grave site. The cemetery office can help with the right materials.

While weeding (and keeping an eye out for missing elements such as lettering) look carefully for any exotic plants such as bulbs or roses. Do not poison or remove them, as they are a part of the cemetery and should be cared for just as much as the monuments.

Broken monuments

Subsidence is a common problem in cemeteries: rows of awkwardly leaning headstones are the result. Sometimes monuments lean over so far that they overbalance and break into pieces. Vandalism makes the problem worse. If you're looking after a monument that is lying in pieces on the ground you may want to have it put back together and stood upright. Such works are strictly for the specialist and can be expensive. The cemetery office can advise.

Meanwhile, it is good idea to collect the pieces and lay them out like a jigsaw puzzle on the grave top. Support the pieces on a bed of coarse gravel (cemetery staff can help) that is sloped towards the foot of the grave to allow rainwater to run off. This will allow the stones to be read by visitors and help give the impression that the grave site is being cared for until the complete repairs can be undertaken.

Removing lichens

Lichens are tiny plant-like organisms that grow on and in stone. Some are pale apple green with leaf-like 'foliage', while others are white, grey or orange dots which are best seen with the aid of a hand lens or magnifying glass. Lichens do damage stone but only very slowly. They can be disfiguring too, when dense colonies of dark lichens turn areas of whitish marble dark-grey and black.

On the other hand lichens add pleasing colour and variety and an immediate impression of age to cemetery monuments. Removing all lichens may produce an overall uniformity which would detract from the character and significance of the place.

Lichen removal should take place

- From sandstone monuments where physical damage is apparent;
- From marble monuments which are judged to be strongly disfigured;
- From marble monuments where lead lettering is being damaged;
- From the joints between stones where repointing is required; and
- From the face of monuments where lichens obscure the inscriptions.

Lichens are removed chemically with a biocide (poison). The correct chemical is available from NZMMMA member offices in convenient spray bottles. Spray on a good flood coat over area to be cleaned. Wear gloves and a mask and avoid overspraying. After four weeks the treated areas should be inspected and re-treated if lichens still show signs of life. Dead lichens should be carefully removed by brushing, or scraping with soft plastic or wood scrapers (not metal), followed by washing down with clean water. A final biocide wash should be applied. Take extra care when scraping away dead lichens near lettering as the latter is easily damaged. Bristle brushes can get caught in the fine gaps between lettering. Lichen treatment should not need repeating for about twenty years.

Removing dirt

Few monuments are dirty, most are slightly discoloured by lichens rather than dirt. Those that need cleaning should be gently washed with a mild detergent in water. Soft bristle brushes can be used to help shift the dirt. Gentle abrasion with the soft side of a well-washed cuttlefish float is suitable for use on polished granite. Rinse down thoroughly with clean water. Don't use harsh abrasive powders or scourers – you may damage the monument. Never mix the detergent and the biocide for lichens.

After cleaning as described, you may feel that you have not achieved much as some dirt and stains remain. Doing as much as possible is an important principle to keep in mind. If you're still not happy with the result talk it over with the cemetery staff.

Other works

Repairs to lettering, stonework, concrete and metals are best undertaken by specialist masons and conservators.

Sealers and weatherproof coatings should not be applied to headstones or monuments as these can be very damaging in the long term.

Remember to seek advice and talk any problems over with the cemetery office before proceeding.

Cemetery
Name……
Address:……
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Contact: ……
Website: ……

We recommend using monumental specialists registered as members of the New Zealand Master Monumental Masons' Association Inc.
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