The Corporation of the Township of Whitewater Region

Tender No. **2021-14**

Background

The Township of Whitewater Region is seeking bids for **the Westmeath Cenotaph Project, located at the intersection of Gore Line (County Rd. 50) and Rapid Rd**. The lowest or any bid will not necessarily be accepted, and the Township reserves the right to award any portion of this tender. This offer shall be irrevocable for a period of sixty (60) calendar days following the date bids are to be received.

Registration and Communications

It is mandatory that you register as a bidder with the Township. Failure to register will result in non-acceptance of your submission.

Please remit Name of Company, Name of Contact Person, Contact Information to Sandra Moss, Purchasing Coordinator at **smoss@whitewaterregion.ca**

Questions related to this tender or the requirements are to be received by ***1:00 p.m. on April 23, 2021.***

Where a bidder finds discrepancies or omissions in the tender requirements or otherwise requires any clarification, the bidder should contact the Township in writing by email as noted above. Where the Township deems that an explanation or interpretation is necessary or desirable, an addendum may be issued.

Scope of Tender

Following the attached specifications, project completion by September 30, 2021.

Specifications

A detailed list of specifications is attached. Potential vendors may provide alternatives in the event an equal or better-proven product or method is available. Evaluation of alternatives is the sole discretion of the Township.

Delivery and Official Closing Time of Proposals

All submissions shall be in a sealed envelope, clearly marked "2021-14 Westmeath Cenotaph Project" and delivered to:

Township of Whitewater Region

44 Main Street
PO Box 40
Cobden, ON K0J 1K0

or

Electronic submission on biddingo.com

Tender submissions must be received not later than **1:00 p.m. on April 28th, 2021**. The time clock in the Council Chambers at the Township Office is the official time for the deadline for submission. The Township is not responsible for submissions which arrive late or are not properly marked. Submissions shall be officially opened after closing time but will not be open to the public due to COVID requirements.

Timeline

The expected timeline for selection is as follows:

March 30, 2021	Tender Issued
April 23, 2021	Deadline for Questions
April 28, 2021	Closing date for Tenders
May 6, 2021	Award by Township
Sept. 30, 2021	Delivery Deadline

Township's Purchasing Policies

The Township's Purchasing Policies form an integral part of this proposal and process. A copy is available upon request.

The Corporation of the Township of Whitewater Region

Tender No. **2021-14**

Bid Form

Company Information

1.	Company Name	
2.	Bidder's Contact Individual	
3.	Address (incl. Postal Code)	
4.	Office Phone #	
5.	Cellular #	
6.	Fax #	
7.	Email address	
8.	HST Account #	

I/We hereby submit the attached documents to satisfy the requirements as issued by the Township of Whitewater Region.

I/We agree that we have reviewed and understand the tender documents and I/We are capable and qualified to perform the requirements of the contract.

I/We agree that this offer shall be irrevocable from the time the quotations are opened and extended for a period of 60 days.

I/We agree that this offer acknowledges all addenda and that the pricing quoted includes the provision set out in such addenda.

Bid Submission

The undersigned affirms that they are duly authorized to execute this bid and that all costs associated with this proposal have been submitted in the fee envelope.

BIDDER'S SIGNATURE AND SEAL:_____

NAME AND POSITION: _____

WITNESS SIGNATURE: _____

NAME AND POSITION: _____

DATED AT:_____

THIS_____DAY OF_____ 202__

Basis of Payment

The Bidder offers to provide the services detailed within the tender package and identified for required specifications and/or all specifications as detailed in the Bidder's submission, to the acceptance of the Township for the following Cost.

Specifications i.

1. Landscaping	
•Clearing and grubbing (incl. tree removal and stump grinding) One tree, identified by the Township will remain. •New trees and planting beds •New cedar hedge (4 ft. high cultivated cedar) •Grass (150 mm topsoil and seeding) 720 m2	Required YES: NO: Cost:_____
2. Monument	
•Relocate existing monument •Construct concrete plinth •Construct unit paver plaza (45 m2)	Required: YES: NO: Cost:_____
3. Trail	
•1.2m wide asphalt trail (incl. 150mm GA) 90 metres squared	Optional: YES: NO: Cost:_____
4. Fencing	
•Chain-link fencing - 5ft high and 34 linear meters long •Wood Panel fencing - 6 ft high (full privacy match existing and 15 linear meters long	Optional: YES: NO: Cost:_____
5. Site Furniture	
•Two concrete pads for benches •Flag Poles (incl. fiber glass pole and concrete footings)	Optional: YES: NO: Cost:_____

Price: **$_____** HST: **$_____** **Total Price:** **$_____** (including HST)	Pricing shall include total costs indicated in specifications i. 1 through 5.

Specifications ii.

1. This contract must meet all Ontario Provincial Standards applicable to industry standards except as otherwise provided in the provisions. Testing may be requested prior to and/or during the delivery at the contractor's expense.
2. All costs of the contractor's equipment, labour, weigh scales, hauling and stockpiling, if applicable, shall be included in the price of this contract.
3. Contractor shall be responsible for obtaining all necessary permits at their cost.
4. The Township will pay the royalties to the pit owners.
5. Material measurement for this contract shall be by belt scale.
6. The Township reserves the right to sample and test material on site.
7. The Township shall be notified five (5) working days prior to commencement of any operations.
8. The Bidder shall indemnify and save harmless The Corporation of the Township of Whitewater Region against all claims, demands, loss, damages, etc. The Bidder shall keep in force, a comprehensive policy of public liability and property damage insurance acceptable to the Township providing insurance coverage in respect of any one accident to the limit of at least $2 million ($2,000,000.00) resulting from, or arising out of any act or omission on the part of the Bidder or any of his employees or agents.
9. The Contractor is required to conform with the *Occupational Health and Safety Act* related to the performance of the contract. In addition, the successful Proponent will be required to supply to the Township valid Clearance Certificate issued by the WSIB to supply to the Township within ten (10) days of award or prior to commencement of work, whichever is earlier a valid Clearance Certificate issued by the WSIB.
10. If the time limit is not sufficient to permit completion by the Contractor working a normal number of hours, the contractor may seek an

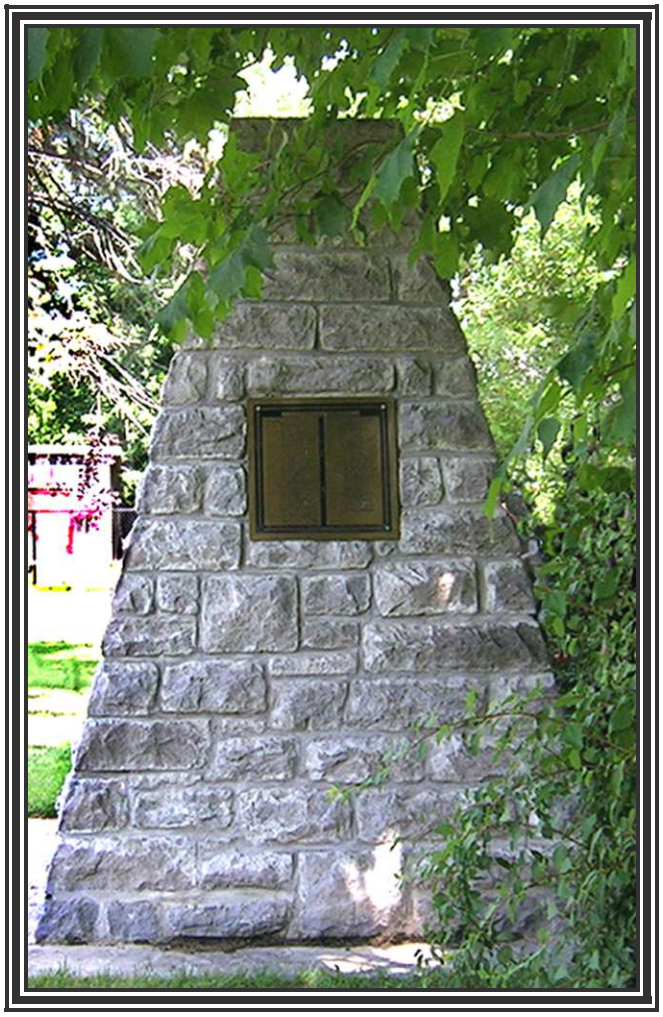
amended date of completion from the Township's representative. If the work is not completed by the above date, or by an amended date allowed by an approved extension, the Contractor agrees to pay the Township a sum of $300.00 per calendar day, for each day delay in the completion of the work, as liquidated damages.

11. Payment at the contract price shall be compensation in full for performing the work specified in the tender and for the supply of all labour, equipment and materials, except as otherwise provided in the tender, necessary to complete the work to the satisfaction of the Township.

12. Maintenance Period shall be added as follows:

    "The contractor shall provide a Maintenance Period of one (1) year after completion of the contract during which the contractor is obligated to repair any defects in workmanship and materials that may become evident."

THE COMMEMORATIVE PARTNERSHIP PROGRAM



CONSERVATION & CONSTRUCTION GUIDELINES

Revised: March, 2018

Canada

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INTRODUCTION TO THE GUIDELINES

In the context of the Commemorative Partnership Program, the community war memorials comprised of cenotaphs or monuments are objects of cultural value that deserve to be protected using a conservation approach. The aim of a 'conservation approach' is to build or to safeguard these memorials with the ultimate goal of extending their physical life for the benefit of future generations.

The primary purpose of the Commemorative Partnership Program - Conservation and Construction Guidelines is to provide sound, practical technical advice appropriate to the construction, conservation or expansion of a community war memorial. These Guidelines are not intended to replace the role of conservation practitioners or professionals, or to provide detailed technical prescriptions appropriate for every situation. They are intended to provide technical guidance and direction to assist in investigating, planning, and implementing the conservation or the new construction of a community war memorial, and to assist in planning and in selecting appropriate materials for durability and compatibility with the existing or proposed new setting.

The secondary purpose of these Guidelines is to assist the custodians of community war memorial who intend to apply for funding support through the Veterans Affairs Canada Commemorative Partnership Program, in determining a scope of work that is both valuable and appropriate. The Guidelines will form the basis for the technical evaluation criteria against which submissions for funding will be assessed.

The Guidelines are divided into six sections. The first section addresses the treatment of the community war memorials as a whole in its site and setting. The second section addresses the role of the site and setting, and presents guidelines for the landscape elements of a site. The remaining sections present guidelines for the use and the treatment of the most common materials used in a community war memorial: masonry, concrete, metal, and wood. Basic background information on these materials, including their characteristics and how they are formed or are fabricated, and a brief discussion on the most common types of deterioration that affect the materials is provided at the beginning of each Guideline section. A glossary of specific terms is also included at the end of the Guidelines.

These Guidelines have been developed, in part, using Parks Canada's *Cultural Resource Management Policy* and the *Standards and Guidelines for the Conservation of Historic Places in Canada*, to ensure that the guidance provided represents best practice in heritage conservation. In addition, these Guidelines follow the internationally accepted conservation principle of 'minimal intervention' - a fundamental principle which allows the safeguarding of the valued objects while balancing the project objectives, the physical changes, the costs, and the impact on the heritage values.

Within the Guidelines, recommendations are presented in order from the lowest level of intervention to the highest.

Conservation is inherently an interdisciplinary process, requiring individuals with different types of expertise to work together towards a common goal of safeguarding the community war memorial. These guidelines should be shared with and referred to by all stakeholders involved in the conservation project: custodians, consultants, and contractors, to help ensure the success of the work.

GUIDELINES FOR OVERALL COMMUNITY WAR MEMORIAL

GENERAL APPROACH

Recommended	Not Recommended
Preserve significant existing features of the memorial.	Removing or radically changing existing features of the memorial.
Document the existing character, the form and the condition of the memorial and its materials prior to beginning project work.	
Evaluate the overall condition of the memorial through investigation, analysis, monitoring and/or testing to determine the appropriate conservation treatments.	Initiating a repair without understanding the cause of the problem(s) being treated. Carrying out a repair that does not address the cause of the problem(s).
Ensure that problems with one component or material of the memorial are not negatively impacting adjacent components or materials.	
Ensure that all proposed conservation treatments represent minimal interventions to solve identified problems.	Proposing excessive or uncalled work on the memorial because funding is available.
Record all conservation treatments undertaken on a memorial with the dates of the interventions. Maintain this record in a safe and accessible place for future custodians and conservators, and references.	

CONSERVATION TREATMENTS

Recommended	Not Recommended
Ensure that conservation treatments would not interfere with water drainage away from the base of the memorial.	Implementing conservation treatments that result in water accumulating at the base of the memorial.

Recommended	Not Recommended
Consideration should be given to evaluating tall or slender memorial to determine their ability to resist forces from wind, seismic activity, and other ground vibrations, movements or settlements. Consideration should also be given to evaluate the load carrying capacity of the foundations of these tall or slender memorial s as well as for heavy memorials. Professional structural and geotechnical Engineers, licensed to practice in the Province in which the memorial is located, must complete such evaluation	Ignoring the potential detrimental effects of ground motion and environmental conditions on tall or slender memorials.
Consider the potential effects from individuals climbing on the memorial on its stability and strength.	
Develop a maintenance plan for the memorial.	Initiating maintenance of the memorial only when a problem is evident.

SITE OF COMMUNITY WAR MEMORIALS

The site is the legal boundary of the memorial that contains landscape elements that contribute to the memorial's value and character. The memorial along with the landscape elements play an important role in the memorial's protection and interpretation. These elements are located around the footprint of the memorial or are part of its larger setting. The footprint is the area covered by the memorial, while the setting corresponds to the visual boundaries (whether natural or man-made) that contribute to the site's distinctive aspect and function.

When planning interventions to a site, such as the construction, conservation or expansion of a memorial, it is important to understand how the different elements of a site relate to the memorial and support its cultural value. These elements, essential to the commemoration of the fallen, could be found in two zones: the protection zone and the interpretation zone.

The protection zone is the area located immediately next to the footprint of the memorial and is often conceptually and physically inseparable from the memorial. It contains the physical landscape elements that represent and contribute directly to the cultural value of the memorial. Placed strategically, groups of trees, shrubs, floral beds, and/or fencing add a distinctive character to the memorial. Also included in this zone are elements of the site that are crucial to its security such as lighting, and fences as well as elements that prevent the memorial against premature deterioration such as the surface drainage, trees, and shrubs. The limit of the protection zone could be a fence, planted vegetation, natural boundaries, or other streetscape elements such as roads and sidewalks. Interventions in the protection zone should be handled with great care to avoid any negative impact on the values of the memorial.

The interpretation zone contains the elements that are essential to make the memorial accessible to visitors such as access ramps and walkways. Other elements such as fences, benches, lighting elements (installed to facilitate interpretation and to secure the area) can also be included in this zone. The limit of the interpretation zone is normally defined by the boundary of the site.

Sometimes elements such as structures and/or buildings, statuary, sculptures, additional pathways, and benches are located within the setting but outside these zones. These elements should be considered part of the larger cultural landscape. However, because they may affect positively or negatively the character of the memorial and the experience at the site, they should be identified and recognized as such and taken into consideration when designing a new site or enhancing an existing site.

Often, the setting of a memorial was part of, or a product of, the original design intent, and could be critical to the overall experience of the site. In most cases, the historical setting of a memorial is worth protecting. Ultimately, when planning the construction, conservation or expansion of a memorial, the design strategy should ensure that the setting and/or landscape elements that support the commemorative character of the site and of the memorial are protected or where appropriate, reinstated.

When planning the construction of a new memorial, the conservation or a major addition to an existing one, the site should provide access to a wide spectrum of user needs, regardless of whether persons are living with temporary or permanent disability. The B651 Standard under the

Canadian Human Rights Act (CHRA) outlines best practices and recommendations for these requirements.

It is very clear that the obligations under this Act are of paramount importance, and that the proposed interventions should conform to the CHRA through the use of the B651-12 (R2017) Standard.

The CHRA is based on the principle that all individuals should have equal opportunity to have their needs accommodated, consistent with their duties and obligations and as functioning members of society, without being hindered in, or prevented from, doing so by discriminatory practices. The CHRA prohibits discrimination in the provision of goods, services, facilities or accommodation customarily available to the general public, and prohibits the adverse differentiation between individuals.

It is important to remember that universal accessibility relates not only to persons with physical challenges/impairments, but also to persons living with visual, aural and cognitive challenges/ impairments.

GUIDELINES FOR THE LANDSCAPE ELEMENTS OF A SITE

GENERAL APPROACH

Recommended	Not Recommended
Document the conditions of the landscape elements of a site prior to beginning project definition.	
Evaluate the role of the landscape elements and how they relate to the cultural value of the memorial before planning appropriate conservation treatments or major additions.	
Preserve and stabilize significant site elements (man-made or natural) of the site that contribute to the setting of the memorial. Consider cyclical maintenance practices such as regular pruning of trees and shrubs.	Remove significant vegetation that contributes to the setting of the memorial without considering appropriate maintenance practices.
Record all interventions that affect the landscape elements around the memorial including any changes to the existing grades. Maintain this record in a safe accessible place for custodians and conservators for future interventions.	
Ensure that changes to landscape elements of a site do not interfere with positive drainage away from the base of the memorial. On grass areas, allow a minimum of 2% slope away from the base of the footprint.	Create new site conditions that accelerate degradation of the materials, or create drainage, safety or access problems, or maintenance issues around the footprint of the memorial.
Develop a maintenance plan for the landscape elements of a site that are essential to the conservation and interpretation of a memorial.	
Design and plan the site to make it accessible to the general public. Refer to the CAN/CSA B651-12 (R2017) as it is the best-practices guide for accessible design.	

CONSTRUCTION AND MAINTENANCE ACTIONS

Recommended	Not Recommended
Before undertaking construction activities ensure that the foundation is designed according to the soil composition and level of compaction to prevent any differential settlements and drainage issues.	
Ensure that new trees installed around the existing memorial are of species that do not have invasive roots system such as willows and silver maple. During drought periods, water the trees and their root zones regularly to prevent any settlement of the ground near the memorial foundation.	
Prevent permanent staining on the memorial by implementing a maintenance plan to ensure that organic material is removed regularly. A maintenance plan should also include regular cleaning of the monument and base (refer to the cleaning procedures applicable to the material within the construction guidelines).	Remove vegetation or other organic material that creates stains on the memorial without considering appropriate maintenance practices.
Protect adjacent vegetation and landscape elements during construction of an addition to the existing memorial.	Damage landscape elements that are essential to the protection and presentation of an existing memorial during site construction activities
Repairs to existing landscape elements that contribute to the cultural value of the memorial such as walkways should be done in kind. The new work should match the old in material, form and detailing.	Make repairs to existing landscape elements that contribute to the cultural value of the memorial using material, form and detailing that do not match the existing.
Design new walkways and access ramps in a way that limits their impact on significant vegetation. Damage to the root systems of existing vegetation should be avoided when changing the grades for a ramp.	Damage or destroy significant vegetation when complying with accessibility requirements.
Design new walkways and access ramps to allow wheelchair movement as per CAN/CSA B651-12 (R2017) Standard.	

Recommended	Not Recommended
In a park-like setting, consider using a stable surface material such as stone dust for the walkways and access ramps, instead of a paved surface to minimize the visual impact of the new work. Consider appropriate maintenance methods to prevent damage to stonedust surfaces that are used by wheelchairs.	Install paved walkway/ramp surfaces without considering the setting of the memorial.
Design and locate new built landscape features such as signs, walkways and lighting so they are visually compatible with the character of the existing memorial.	Add new built features that are completely out of character with the existing memorial.
Ensure that new vegetation installed around the footprint of the existing memorial can reach maturity without interfering with its base. Allow good air circulation between the vegetation and the memorial.	Install vegetation close to the footprint of the existing memorial to get instant effect without allowing for ultimate mature size.

CONSERVATION AND INTERPRETATION ACTIONS

Recommended	Not Recommended
Consider using bioengineering techniques such as planted slopes with native species to control erosion problems near a memorial.	
Before undertaking the restoration or relocation of a memorial ensure that the soil around the foundation is designed according to the soil composition and level of compaction to prevent any differential settlements and drainage issues.	
If possible, maintain the memorial in its existing original location. If a relocation is unavoidable, document the existing site and relocate the memorial to the new site while respectfully maintaining, re-establishing or illustrating the values associated with the previous arrangement.	Relocate the memorial to a new site without considering the values associated with the arrangement of the landscape of the previous location.
Ensure that species of new trees installed around the memorial does not have invasive roots system such as willows and silver maple. During drought periods water the trees and their root zones regularly to prevent any settlement of the ground near the memorial foundation.	
Prevent permanent staining on memorial by implementing a maintenance plan to ensure that organic material is removed regularly.	Remove vegetation or other organic material that creates stains on the memorial without considering appropriate maintenance practices.

Maintenance plan should also ensure regular cleaning of the monument and base (refer to the cleaning procedures applicable to the material within the construction guidelines).

Protect adjacent vegetation and landscape elements during conservation activities on a memorial.

Damage landscape elements that are essential to the protection and presentation of the memorial during site construction activities

Walkways, Ramps

Repairs to existing landscape elements that have cultural value such as walkways should be done in kind. The new work should match the old in material, form and detailing.

Make repairs to existing landscape elements using material, form and detailing that do not match the existing.

In a park like setting, consider using a stable surface material for the walkways and access ramp that will minimize the visual impact of the new work. If stone dust surfaces are used, consider appropriate maintenance methods to prevent damage to stone dust surfaces that are used by persons with disabilities.

Recommended

Not Recommended

Design new walkways and access ramps in a way that limits their impact on significant vegetation. Damage to the root systems of existing vegetation should be avoided when changing the grades for a ramp.

Damage or destroy significant vegetation when complying with accessibility requirements.

Design new walkways and access ramps to allow wheelchair movement as per CAN/CSA B651-12 (R2017) Standard to maintain an inclusive, barrier-free environment to ensure the full participation of persons with disabilities.

Consult a certified arborist before removing a significant tree or vegetation that may cause damage to the memorial.

Design and locate new built landscape features such as signs, walkways, benches, lighting so they are compatible with the character of the memorial.

Install paved walkway ramp surfaces without considering the specific character of the setting of the memorial.

Add new built features that are completely out of character with the memorial.

Ensure that new vegetation installed around the footprint of a memorial can reach maturity without interfering with its base. Allow good air circulation between the vegetation and the

Install vegetation close to the footprint of a memorial to get instant effect without allowing for ultimate mature size.

memorial.

Design new walkways and access ramps in a way that limits their impact on significant vegetation. Damage to the root systems of existing vegetation should be avoided when changing the grades for a ramp.

MASONRY IN MEMORIALS

Masonry used to construct memorial is most often stone, though brick may also be present. The most common stone type used is granite, though sandstone, limestone and marble are also used. Brick types can include clay, terracotta or occasionally cement. These different types of masonry elements have different physical properties, will perform differently, and will require different techniques for conservation. A good example of variable physical properties is the thermal expansion resistance of materials. Consideration will need to be given to the thermal resistance of one material alone, but also to the use of multiple different materials in one memorial that need to be compatible. Since no stone behaves exactly the same, coefficients of thermal expansion may even vary in the same type of material depending of its properties which can range from brick 0.000005 to marble 0.0000055 to 0.0000141, (in m/(m*K)). Therefore, with temperature changes, distinct elements of one memorial may behave differently causing unexpected movements or damage to adjacent components.

In addition, when choosing a specific masonry element for a memorial, its resistance to stain and to abrasion, its flexural strength, its durability, and its cost need also to be thoroughly considered in relation to the condition of its surrounding environment (acid rains, pollution, freeze and thaw cycles, exposition to sun radiation, use of de-icing salts, etc.). For all types of masonry, cost will depend on the stone's availability, the location of the quarry, the rarity of colour and the amount of labour required to extract the raw material.

Masonry work deterioration can result from: prolonged exposition to sun radiation, moisture and freeze-thaw cycles; crystallization of water-soluble salts causing the surface to crumble; acid rain causing lime or calcium carbonates in the brick to dissolve; masonry ties corroding and failing; mortar failure, resulting in water infiltration which when frozen displaces brick units.

Granite, an igneous rock formed by the crystallization of magma, is relatively impervious to moisture and highly resistant to weathering. In heavily polluted environments, granite can be damaged by run-off from calcareous stones such as limestone. Small natural inclusions, such as pyrite or iron sulphide are frequently present. These can react with precipitation causing local staining and occasionally the breakdown of the stone. Cracks or micro-cracks in the stone can accelerate this deterioration. Granite has a higher initial cost in comparison to other stones, however, it tends to be the most durable stone due to its negligible porosity, its hardness, its resistance to weathering, to de-icing salts, to chemical attacks and to staining, and to the longevity of its coloured and polished surface.

Sandstone is a sedimentary rock composed of grains of sand held together by natural binders. Sandstone will gradually deteriorate when exposed to the elements, because the binders tend to weather more rapidly than the sand grains, resulting in erosion. Sandstone is also susceptible to exfoliation of its surface and swelling of its layers when exposed to moisture and freezing temperatures. If its layers are not properly oriented in a masonry assembly, exfoliation problems can be significant. If limestone or marble is placed above sandstones, the run-off of chemicals from these stones can react with acid rain to cause deterioration of the sandstone. Natural inclusions, such as deposits of minerals or clay, can also weaken the stone and produce staining. A common form of deterioration is contour scaling, in which a relatively impermeable, dense, brittle crust forms on the surface of the stone as a result of chemical reactions with airborne pollutants. Moisture trapped

behind this crust will expand when frozen, forming blisters and causing spalling. The cycle is then repeated on the freshly exposed stone surface, and can lead to significant loss of detail.

Limestone, like sandstone, is sedimentary, relatively permeable, and susceptible to pollution damage which can result in erosion of surface detail. Limestone may possess inclusions that weaken the stone. It can be susceptible to differential weathering of its bedding planes, which can result in fracture or splitting of the stone.

Marble can include a wide variety of mineral compositions. Most types of marble are soft and can be readily carved. They are soluble in acids and not durable when exposed to moisture. Reactions with sulphuric acids from the atmosphere can cause marble surfaces to be converted to gypsum, which may combine with carbon or soot to form dark crusts which will expand, converting more marble to gypsum, eventually eroding the surface and any carved details or inscriptions. To prevent the event of staining or of adverse chemical reactions, marble's surface can be sealed, but it will then require to properly be maintained. Other types such as the Makrana marble are highly water seepage resistant, very low water absorption, and strong and hard.

Brick and ***terracotta*** are similar in that they are both fired clay products. However, each material has its own characteristics and uses. Brick is a solid or hollow masonry unit, made of clay, with sand and other materials added as binders before being moulded, dried and fired in a kiln. Brick is used for both cladding and structural work. Terracotta is also made of clay mixed with sand, moulded but is fired at a higher temperature making it harder and more compact than brick. It is fabricated with a glazed or an unglazed surface and a thin fire skin is sometimes present on blocks or tiles which were fired at lower temperatures. Terracotta is used for ornamental work, roof and floor tiles, and is not a load-bearing material.

Failure of terracotta can be attributed to: problems with the manufacture of the units; corrosion of abutting metal causing loss of oxides; and water infiltration. Resulting problems include crackling of the glaze surface, accumulation of organic growth causing glaze deterioration, and cracking and shattering of the terracotta units themselves. In addition, glazed and unglazed terracotta surfaces tend to soil in areas with heavy water saturation with a concentration at the edges of the blocks.

The most common masonry assemblies for memorials use one massive stone, or a system of several large stones. Less common are assemblies of smaller stone or brick units. Assemblies using large stones will typically have mortar placed between the stones to evenly distribute their weight sometimes with shims for levelling purposes. Assemblies of smaller stones or brick are built with a lime or cement based mortar to hold the units together and to evenly distribute their weight. The surface pointing for these is almost always mortar. It is possible that some assemblies may be dry laid, with no bedding mortar. A surface pointing of mortar may sometimes be applied to a dry laid masonry assembly. The surface of the joints are also sometimes filled or 'pointed' with putty, caulking, mortar sealant, or lead.

Terrazzo is a man-made stone consisting of natural stone chips, usually marble, set into cement or into an epoxy medium. It has been used to create flooring surfaces since the 15th century. Nowadays, epoxy resin is the preferred medium to set the stone chips in, since it makes the surface also

impermeable, allows for a wider variety of colorations and reduces risks of cracking and chipping. Terrazzo flooring tends to be extremely durable, very visually appealing and unique.

Mortar is a mixture of a binder (lime and/or cement), aggregate (sand) and water, that acts to bind the masonry units together and evenly distribute the forces in the assembly. For exterior conditions, mortar should always be slightly weaker than the masonry units in order to permit the units to expand or contract without damage in response to moisture and temperature variations. Mortar should also generally be more permeable than the stone, so water entering the masonry assembly can evaporate out through the joints. Portland cement based mortars are generally too hard and impermeable for historic masonry assemblies. The profile of a mortar joint is also an important factor in the mortar's performance. The joint should be designed to shed water away from the masonry. For interior conditions, load-bearing performance can be achieved by using mortar that would have similar properties than the units to permit the assembly to carry the loads and distribute the forces.

Additional information on masonry conservation can be found in the following sources:

Weaver, Martin E., 1993. *Conserving Buildings: A Guide to Techniques and Materials.* New York: John Wiley and Sons, Inc.

De Teel, Paterson, and Tiller, 1979. *Preservation Briefs 7: The Preservation of Historic Glazed Architectural Terra Cotta.* U.S. Department of the Interior, National Park Service.

Ashurst, Nicola, 1994. *Cleaning Historic Buildings, Volumes 1 and 2.* London: Donhead Publishing.

Ashurst, John, and Ashurst, Nicola, 1988. *Brick, Terracotta and Earth (Practical Building Conservation, English Heritage Technical Handbook, Vol. 2)* . UK: Gower Technical Press.

GUIDELINES FOR MASONRY ELEMENTS

GENERAL APPROACH

Recommended	Not Recommended
Understand the properties and characteristics of the masonry of the memorial within its environment.	
Documenting the form, materials and condition of the masonry memorial before undertaking an intervention or relocation. For example, identifying the particular characteristics and source of the type of stone or brick used, and the composition of the mortar. Severe deterioration condition or unstable condition may lead to H&S hazard during construction work.	Undertaking an intervention that affects masonry without first documenting its existing character and condition.
	Initiating a repair without understanding the extent and the cause of the problem being treated.
Determine the cause of the distress, damage, or deterioration of the masonry component/assembly requiring repair through investigation, analysis, monitoring, and testing as required.	Carrying out a repair that does not address the cause of the problem.
Monitor the activity of significant cracks, bulges, tilting, or other deformations in masonry assemblies to help determine if repairs are necessary, including checking for: seasonal/cyclical opening and closing of cracks; growth in crack length and size or outward displacement of bulges, over time; the appearance of new cracks or deformations, and increased rate of growth in cracks, bulges or deformation.	Repairing cracks or deformations in masonry assemblies without first determining if active or not, and the cause or significance of the symptom of distress.
Prevent water from collecting within masonry assemblies by maintaining efficient drainage at the base of the masonry, and by re-pointing deteriorated mortar joints.	Applying water-repellent coatings to masonry surfaces that could trap moisture within the assembly.

CONSERVATION TREATMENTS

Cleaning Masonry

Recommended	Not Recommended
General	
Clean using the gentlest methods possible and only when necessary to halt deterioration or remove heavy soiling or graffiti. Remove any vegetation or organic growths that are growing in or on the masonry using the gentlest means possible, such as soaking with low-	Over-cleaning masonry surfaces to create a new appearance, and therefore introducing chemicals or moisture in to the materials.
	Using tools that could damage masonry to remove

pressure water (less than 350 kPa [50 psi]) followed by gentle scrubbing with natural bristle brushes, or scraping with soft plastic or wood spatulas.	vegetative growth, including: steel wire brushes; metal spatulas, knives, or screwdrivers; abrasive pads such as steel wool; rotary grinders or sanders. Using biocides to kill off plants such as lichens, as chemicals in the biocide may adversely react with materials on the memorial, or be hazardous to non-target animals and plant life. Using flame cleaning to burn off plants such as lichens, as the excessive heat may damage the masonry or other materials on the memorial such as wood, lead, synthetic caulks. Cleaning with chemical products that damage masonry or mortar, such as using acid on limestone or marble. Failing to rinse off and thoroughly neutralize appropriate chemicals on masonry surfaces after cleaning.
Remove stains or accumulated dirt on masonry, using low pressure soaking with water (less than 350 kPa [50 psi]) followed by gentle scrubbing with natural bristle brushes.	Cleaning with water when there is any possibility of freezing temperatures. Using detergents or household cleaners with Sodium Hydroxide (NaOH) to remove stains, as they may adversely react with the masonry or be hazardous to animals and plant life. Using abrasive sandblasting techniques that can damage the masonry by eroding its surface, and can damage soft or delicate materials that form nearby parts of the memorial. Using high-pressure water cleaning methods (greater than 2700 kPa [400 psi]) that could damage the masonry, the mortar joints, and other soft or delicate components of the memorial.
Carry out cleaning tests to determine other appropriate cleaning approaches, if cleaning using low-pressure water and brushes or moderate-pressure water does not provide a sufficient degree of removal. Cleaning tests should be observed over a sufficient period of time so that both the immediate and the long-range effects of the cleaning are known. The gentlest method possible should be selected to achieve an appropriate level of cleanliness.	Cleaning masonry surfaces with more aggressive methods, without testing or without sufficient time for the results and accompanying effects of the testing to be evaluated.
Protect adjacent materials during cleaning to avoid	Cleaning masonry without protecting surrounding

damage by abrasion or water infiltration.	materials.
When coatings contain hazardous materials, such as lead, consider moving the specific elements of the memorial in a workshop for cleaning purposes.	Failing to move the elements of the memorial to control the spread of the contaminant in the open air.
Granite	
Clean granite using moderate-pressure water (maximum 2700 kPa [400 psi]) if soaking with water and scrubbing with natural bristle brushes does not provide an acceptable degree of removal. Use a fan type tip on the water pressure machine with minimum 375 mm [15 inch] spread. Do not hold the nozzle closer than 450 mm [18 inch] to the surface being cleaned. Hold the nozzle perpendicular to the surface.	Using moderate-pressure water cleaning techniques on granite that includes lead-filled inscriptions. Using moderate-pressure water cleaning techniques on granite masonry assemblies constructed with soft or poor condition mortars. Using moderate-pressure water cleaning techniques on softer, less durable stones and brick, such as sandstone, marble, or limestone. Adding detergents, acids, or other additives to the water when pressure washing.
Marble	
Clean marble periodically to remove soiling by gently sweeping and washing with clean water and mild soapless cleaner. Clean oil-based stains for marble with a soft liquid cleanser, house hold detergent, ammonia, mineral spirits or acetone. Clean metal stains from marble using a poultice including kaolin, fuller's earth, whiting, diatomaceous earth, powdered chalk, white molding plaster and talc. Clean biological growth from marble using a diluted solution of water and ammonia, bleach or hydrogen peroxide. Clean ink stains from marble using bleach or hydrogen peroxide for light stains and lacquer thinner or acetone for darker stains. Clean hard water from marble by buffing the stone with a dry "0000 steel wool".	Cleaning stains on marble using the wrong technique and acidic and/or abrasive solutions.
Clean paint stains from marble by using a lacquer thinner or by carefully scrapping off the paint with a razor blade. For large stains, clean using a commercial liquid stripper.	Removing paint using acids or flame tools to strip the paint from the marble stone.
Clean efflorescence from marble using a dust mop or	Cleaning efflorescence with water as it only adds

using a vacuum to remove the powder for new installations only.

up to the issue.

Brickwork

Clean brickwork using chemical cleaning. Prefer thixotropic gel or poultice to liquid cleaners, to remove paint and using alkali-based degreasant. Follow it by an agent containing hydrofluoric acid for heavy soiling or using the agent itself for lighter soiling. Thoroughly neutralize the surface.

Cleaning using water or non-ionic soaps as it only removes the loosely adherent dirt.

Using brushes with bristles which are too harsh, too coarse or used too vigorously to clean brickwork.

Cleaning brickwork using abrasive cleaning methods and systems to remove paint or graffiti, even more on historic structures.

Terracotta

Remove superficial or loosely adherent soiling off glazed and unglazed terracotta surfaces using non-ionic detergent in warm water and plastic scourers.

Clean glazed terracotta surfaces using low concentration of alkali degreaser. Clean unglazed terracotta surfaces using low concentration of alkali degreaser and by agitation and/or localized scrubbing using plastic scourers. To avoid streaking, apply cleaning agents with sponges, agitate the surface to prevent runs or use thixotropic agents.

Remove excessive soiling off glazed terracotta surfaces using water, detergent, natural or nylon bristle brushes or plastic scourers.

Cleaning terracotta using abrasive cleaning methods, chemical cleaning such as acid and alkali cleaning methods (including hydrofluoric acid), and mechanical cleaning, including metal brushes.

Terrazzo

First step is to refinishing terrazzo is to remove the wax coating thoroughly with a liquid stripper and abrasive pads.

Clean terrazzo with regular dry and wet mopping or in more commercial environments, with scrubber-drying using a pH balanced cleaner. Apply water or cleaner on the surface, let it stand for 20 minutes and mop.

The floor is then polished with specialized refinishing compounds to restore the terrazzo to its desired lustre. The surface is then sealed to prevent staining and prolong the finish of the surface. Maintenance polishing is required on an annual basis.

Using abrasive cleaners since it may damage the marble stone chips in the terrazzo flooring.

Other Surface Treatments

Recommended	Not Recommended
Inspect painted masonry surfaces to determine whether paint can successfully be removed without damaging the masonry, or if repainting is necessary. Testing in an inconspicuous area would be required.	
Remove damaged or deteriorated paint or other coatings only to the next sound layer using the gentlest method possible, such as hand scraping, prior to recoating.	Removing paint or other coatings that are firmly adhering to, and thus protecting, masonry surfaces. Using methods of removing coatings that are destructive to masonry, such as sandblasting, application of caustic solutions or high-pressure water-blasting. Using tools that could damage the masonry, such as rotary grinders or sanders.
Re-apply paint or coatings, if necessary, that are physically compatible with the previous surface treatments and visually compatible with the surface to which they are applied. Apply compatible paint or stucco following proper surface preparation.	Failing to follow manufacturers' product and application instructions when repainting masonry. Applying paint or stucco to masonry that has been historically unpainted or uncoated. Removing paint from historically painted masonry, unless it is causing damage to the underlying masonry. Removing stucco from masonry that was historically never exposed, or radically changing the type of paint or coating or its colour.
Repaint or re-stucco with colours that are historically appropriate.	Using new paint or stucco colours that are inappropriate to the memorial.
Apply appropriate surface treatments, such as breathable coatings (vapour transmission), to masonry elements as a last resort, only if masonry repairs, alternative design solutions or flashings have failed to stop water penetration, and if a maintenance program is established for the coating.	Treating the stone surface with a topical sealer, which will trap moisture within the stone, and cause delamination and spalling.
Repaint engraved lettering only if there is an evidence of previous painting. Conduct the painting work with the advice of a specialist as the issue may be greater than readily apparent.	Painting engraved lettering without seeking for the advice of a professional. Using a paint that is not compatible with the stone is place.
<u>Terracotta</u> Seal or coat areas of spalled or blistered glazed on terra cotta units, using appropriate paints or sealants	

that are physically and visually compatible with the masonry units.

Terrazzo

Polish repaired terrazzo with an electric floor buffer using a lamb wool pad. Then, apply a clear polyurethane finish to protect terrazzo surfaces.	Using an abrasive pad to polish terrazzo surfaces.

Repairing Masonry Elements and Assemblies

Recommended	Not Recommended
Repair deteriorated masonry elements and assemblies using the most appropriate method available based on a minimal intervention approach, including for : Masonry Assembly - re-pointing; - re-setting loose masonry units; - local replacement of masonry units; or - dismantling and rebuilding. Masonry Unit - mortar and resin repairs; - grouting; - pin and glue repairs; - dutchman repairs; - stone consolidation; Stabilizing deteriorated masonry by structural reinforcement and installing weather protection, or correcting unsafe conditions, as required, until repair work is undertaken. Create a mock-up of each type of masonry repair involved in the conservation project as part of the repair contract in order to refine repair techniques, mortar mixes, replacement materials, and establish the acceptable quality of workmanship for each repair type. It is important to prepare the mock-ups far enough in advance of the repair work to allow them to fully cure before they are evaluated.	Replacing masonry that can be repaired. Removing deteriorated masonry elements that could be stabilized, repaired and conserved.

Terrazzo

When a terrazzo surface becomes chipped, cracked or otherwise damaged, the first step is to clean the surface, then fill the chips, cracks, and holes with matching coloured epoxies or aggregates, or glass or stones chips, as appropriate. Once dried, wet diamond bit grinding removes the scratches, stains, and wear pattern from the surface - the repair should be undistinguishable. The surface is then sealed.

Not matching the filler binding agent and not adding enough replacement chips, or using the wrong size or colour chips, will end up with a repair work that stand out, marring the overall beauty of the surface.

Not having an experienced company to carry out repairs.

Pointing and Re-pointing

Recommended	Not Recommended
Re-point mortar joints where there is evidence of deterioration such as disintegrating mortar, cracks in mortar joints, open mortar joints, or loose masonry units.	
Create new weep or drainage holes at the base of a masonry assembly to assist in the drainage and drying out of the masonry assembly when moisture infiltration into the assembly is an ongoing problem.	Damaging the stone or brick units to create the drainage holes by drilling holes that are wider than the mortar joints.
Remove deteriorated mortar by carefully raking the joints using properly sized hand tools to avoid damaging the masonry unit. The depth of new mortar pointing should equal at least twice the width of the mortar joint being re-pointed.	Using rotary grinders or electric saws to fully remove mortar from joints before repointing. In some instances it may be acceptable to make a single pass with a cutting disk to release tension in the mortar before raking the joint. Extreme caution must be used to prevent accidental damage.
In instances where back pointing is not possible, replace back pointing by the use of an adequate backer rod to avoid the back pointing falling behind the rear face of the masonry elements.	Using backer rods to replace back pointing in any other cases.
Match the aesthetic properties of the re-pointing mortars with the original mortar, including: colour, texture, aggregate, width, and, joint profile.	Using a “scrub” coating technique to repoint instead of traditional repointing methods. Re-pointing mortar joints with a synthetic caulking compound.
Use mortar mixes that ensure the long-term conservation of the masonry assembly. Ensure mortar mix is compatible in strength, porosity, absorption and vapour permeability with the existing masonry assembly and units. Pointing mortars should be weaker than the masonry units; bedding mortars should meet structural requirements; and the joint profile should be visually compatible with the existing masonry in colour, texture and width.	Repointing with mortar of a higher Portland cement content than in the original mortar. This can create a bond stronger than the historic material (brick or stone) resistance in tension and cause damage as a result of the differing thermal expansion coefficients and porosity of the materials. Repointing with a synthetic caulking compound at

	areas of high visibility or of heritage architectural details. Using a 'scrub' coating technique to repoint instead of using traditional repointing methods.
Carry out a comparison of the existing and proposed mortar mixes to determine their mechanical and aesthetic properties for comparison. Carry out the comparison far enough in advance of the repair work to allow sufficient time to identify and source appropriate replacement materials.	
Replace failed or deteriorated joint sealants including caulk, putty and lead, in kind, unless the type of material used is adversely affecting the surrounding materials of the memorial. Replacement sealants should match the original in colour, texture, and finish.	Failing to follow manufacturers' product and application instructions when applying sealants or caulks. Using sealants which can discolour as a result of absorbing soil or dirt particles from atmospheric pollutants. Using sealants or caulk in joints that were originally pointed with mortar.
Where moisture/water and thermal movements may cause negative impact to heritage fabric and values, and cannot be controlled, such as coping stones, projections, terraces and stairs under extreme weather exposure, apply mortar sealant compound. Finish the sealant surface with sand finish visually compatible with the adjacent original historic stone and mortar in terms of colour and texture, as appropriate.	Applying mortar sealant in normal exposure environments. Applying mortar sealant without a sand finish in highly visible locations.
Apply, in only certain cases and where necessary, waterproofing masonry joints using molten lead, lead wool or a proprietary lead capping system, which uses appropriate caulks or sealants.	Failing to follow manufacturers' product and application instructions when applying sealants or caulks. Using sealants which can discolour as a result of absorbing soil or dirt particles from atmospheric pollutants.

Re-setting Loose Masonry Units

Recommended	**Not Recommended**
Reset loose or displaced masonry units by removing all deteriorated mortar around the masonry unit, and resetting the unit fully bedded in new mortar.	

Mortar and Resin Repairs

Recommended	Not Recommended
Use mortar and resin repairs to fill voids and repair damaged stone and to provide protection to decayed stone areas.	Failing to assess how the mortar and resin repairs will aged over time and how the cleaning of the stone masonry will expose different textures and colours than the original masonry.
Clean the original surface and install a key for the repair to adhere. For shallow repairs (less than 10mm), remove a small amount of the original stone, if necessary, to provide sufficient depth and strength to the mortar.	Failing to install a key making the mortar repair weak and short-term lasting.
Use a mortar compatible with the colour and texture of the stone, such as lime putty or natural hydraulic limes with a binder to aggregate ratio of 1:2.5. Use epoxy resin to repair cracks and to pin together a slotted masonry unit. The stone repair are totally invisible once the work is complete.	Using a mortar which is harder than the stone and that is not visually compatible with the existing stone.

Terrazzo

Repair small chips, cracks, divots and other similar damages using a terrazzo repair/patching kit. Inject the visually and physically compatible polymer resin from the kit into the floor with a syringe-like tool. If extensive repairs are necessary, hire a company/professional in conjunction with a conservator.	Removing or concealing character-defining features such as lettering and dates from terrazzo tiles or flooring. Using a terrazzo repair kit with a polymer resin and chips that do not closely matches the color of the terrazzo.

Grouting

Recommended	Not Recommended
Use grouting to fill voids and to re-establish cohesion between delaminated layers to prevent water entry.	
Remove all loose debris from the voids using hand tools and flushing with water either by itself or mixed with solvents, including isopropanol or Industrial Methylated Spirits (IMS).	Using water to remove debris when temperature is below 10^{o}C.
Use a low strength grout with fine aggregates, typically 1:1 ratio of binder to aggregate, or a proprietary grout which is compatible with the existing stone in place.	Using high strength grout, which will transform the stone into a sacrificial component.
Carefully grout the voids in stages to confirm where the grout went and to avoid the build-up of hydraulic pressure. When set, cover the edges with a mortar.	Grout in only one stage and unnecessary pressure on the stone leading to more loss of stone.

Pin and Glue Repairs

Recommended	Not Recommended
Re-attach fragments of stone that have broken off by pinning and gluing where the fractured piece of stone is intact and to be retained. Use adhesives that are compatible with the stones' coefficient of thermal expansion to bond the fragment back onto the stone. Bonding larger fragments may require the addition of reinforcement using non-corroding materials for the pins, such as stainless steel, to mechanically attach the fragment to the stone. Important properties of the adhesive should include the ability to: harden without shrinkage; bond well with the stone; not adversely react chemically with the stone; be reversible or removable; remain stable with age, not becoming brittle with exposure to ultraviolet radiation, for example; and not be wicked out by moisture. Keep the adhesive 6mm [1/4 inch] to 12mm [1/2 inch] back from the visible faces of the stone so that the remaining crack can be filled with a cementitious material.	Replacing a stone, when a re-attaching a broken off fragment is possible. Using hard or rigid adhesives on materials with significant coefficients of expansion such as slate or sandstone. Permitting the adhesive to drip, be smeared or otherwise exposed on the stone surface as they can change the colour of the stone, and can react with ultraviolet radiation, becoming brittle and very dark in color.

Dutchman Repairs

Recommended	Not Recommended
Repair chipped or locally deteriorated parts of larger stone units with dutchman repairs when the fractured piece of stone is lost. Dutchman repairs involve carefully fitting a new piece of stone into a pocket cut into the existing stone and finishing the new piece to match the surrounding existing stone. When using a dutchman repair, carefully match the physical, mechanical, and aesthetic properties of the replacement stone to the existing stone. Use non-corroding materials for pins, such as stainless steel to improve the degree of attachment between the repair stone and the original stone. Use adhesives that are compatible with the stones' coefficient of thermal expansion to bond the repair stone to the original stone. Refer to the guidelines for pinning and gluing stone fragments, for other recommended properties of the adhesive. Keep the adhesive 6mm [1/4"] to 12mm [1/2"] back from the visible faces of the stone so that the joint between the repair stone and original stone can be filled with a	Replacing a stone, when a partial repair using a dutchman is possible.

cementitious material. Match the colour of the cementitious material used to fill the joint between the repair and original stone to the colour of the stone.

Stone Consolidation

Recommended	Not Recommended
Use synthetic or chemical consolidants to return structural integrity to a carving or statue where the naturally occurring binders and cements have been lost and the stone is beginning to disintegrate.	Using untrained personnel to return structural integrity to a carving or statue, thus causing further damage to fragile historic materials.
Determine if consolidating is the most appropriate method of treatment by evaluating this method against other methods of conservation, such as dutchman repair, plastic mortar repair or replacement.	Using untested consolidants, thus causing further damage to fragile historic materials.
Consolidants should be able to deeply penetrate the stone, harden without shrinkage, and bond well with the stone. In addition, they should, be reversible or removable, remain stable with age, neither changing colour nor becoming brittle with exposure to ultraviolet radiation. They should not adversely react chemically with the stone, not be wicked out by moisture, not migrate to the surface of the stone over time, and not alter the surface appearance of the stone.	
Use nano-lime to consolidate a friable stone and to increase its compressive, flexural and surface cohesion strengths. Allow time for maximum penetration, precipitation and carbonation of the nano-lime. It may take days or even weeks for each saturation and may require 5-7 applications. Ensure consolidants diffuses throughout uniformly to achieve optimum gains in compressive strength.	Use consolidants based on carbonation of calcium hydroxide that may not be appropriate for the treatment of pure sandstones because they may introduce calcium salts and cause detrimental effects. Not allowing sufficient time for maximum penetration.
Limewater may be used to consolidate the stone without harming the stone itself, if applied properly. . However, it requires many saturations and up to 150-200 applications: it is therefore recommended to assess if the memorial can sustain the quantity of water in limewater necessary to halt the stone's deterioration.	Using limewater without assessing the risk of introducing large amounts of water within an historic memorial. Using products that are not physically and chemically compatible with the stone requiring consolidation.

Local Replacement of Masonry Units

Recommended	Not Recommended
Replace extensively deteriorated or missing parts of masonry elements, in kind with new stone or brick based on documentary and physical evidence. The new work should match the old in form and detailing.	Replacing an entire masonry element, such as a column, when limited replacement of deteriorated and missing components is appropriate. Using replacement material that does not match the existing masonry element.
Match the physical and mechanical properties of new stone used in repairs and replacements as closely as possible with the existing stone: - stone type; - compressive strength (ASTM C170-90, wet and dry); - modulus of rupture (ASTM C99-87, wet and dry); - absorption (ASTM C97-02); - bulk specific gravity (ASTM C97-02).	
Match the aesthetic properties of the new stone, used in repairs and replacements, with the existing stone, including color, texture, density of grain or bedding planes, number and size of inclusions, and finish.	
Match the physical and mechanical properties of the new brick, used in replacements, as closely as possible with the existing brick, including: - brick material type; - compressive strength; - modulus of rupture; - absorption; - bulk specific gravity. Reference ASTM standard C67-03 for testing procedures.	
Match the aesthetic properties of the new brick, used in replacements, with the existing brick, including size, colour, and texture.	
Carry out testing and comparison of the existing and replacement stones or bricks to determine their physical, mechanical, and aesthetic properties for comparison. Carry out testing far enough in advance of the repair work to allow sufficient time to identify and source appropriate new materials. Carry out comparisons under both wet and dry conditions and under natural light at the memorial.	Tasking the Contractor with the responsibility of sourcing the replacement material.

Dismantling and Rebuilding

Recommended	Not Recommended
Dismantle and rebuild the entire memorial or large parts of it, when the integrity of the assembly of the masonry, or its supporting foundation, is badly deteriorated, putting the security of the memorial at risk. Decide if dismantling and rebuilding is appropriate by evaluating it against other less intrusive methods.	Dismantling a masonry assembly that can be repaired by other less intrusive means.
When dismantling, number and record each stone prior to removal to ensure accurate reconstruction in the original order and stone location. Record the thickness of typical joints at critical locations in the assembly to permit an accurate reconstruction. When rebuilding, replace ferrous dowels or cramps with new dowels or cramps fabricated from non-corroding material such as stainless steel.	

Engraving

Recommended	Not Recommended
If recutting of lettering is necessary, hire a professional letter-cutter.	
Carefully recut heavily damaged letters using the most appropriate technique depending on how it was originally cut (hand cut, using pneumatic or abrasive power tools, etc.).	Recutting originally hand cut lettering using power tools.
Where inscriptions had been painted and the paint has failed, repaint the letters using a suitable/compatible medium. Care should be taken in regard to the surface, the style of lettering and the original paint.	Letting inexperience hands painting the inscriptions, which may lead to the bleeding of the paint on the surrounding stone or to spoiled inscriptions.
Granite Sandblast only heavily damaged letters using stencils identical to the original lettering.	Using stencils which are different from the existing lettering in place.

CONCRETE IN MEMORIALS

Concrete is a human-made material composed primarily of sand, stone aggregate (gravel), Portland cement and water. The ratio of these materials dictates the strength and performance of the concrete. Because concrete lacks significant tensile strength, reinforcement, often in the form of a cage of deformed metal bars or metal wire mesh, is encased within the concrete mass to allow the concrete to carry loadings while spanning across supports. This reinforcement will also allow the concrete mass to undergo thermal expansions and contractions without developing excessive cracking.

Cracking of concrete, corrosion of reinforcement, spalling of the concrete cover, and surface scaling are the four most common and important types of deterioration of reinforced concrete. Deterioration of concrete can result from:

- environmental factors including moisture levels, temperature levels, the presence of chlorides, and carbon dioxide;
- the original materials and workmanship, including aggregate material, level of consolidation of the concrete during placement, amount of reinforcement, presence of cold joints, location and number of crack control joints; and
- improper maintenance such as prolonged exposure to moisture, application of waterproofing coatings that inadvertently trap moisture, saturation with chlorides due to the spreading of road de-icing salts on or nearby the concrete.

Concrete dating from the early part of the 20th century was often built to low construction standards relative to the standards common today. Designers and fabricators from that period often had little knowledge of the properties and characteristics of the concrete. Early instances of concrete construction are thus often in poor condition and can require a significant degree of conservation work.

Virtually all concrete will crack with time. Cracks can be a result of natural shrinkage of the concrete during curing, thermal expansion and contraction, flexure or shear from overloading, and adverse reactions between the alkalis in the cement and some aggregates known as alkali-silica reactivity. Proper design and placement of the reinforcement can provide the necessary tensile strength to counteract the shrinkage, thermal, and overload cracking. Crack control joints can also be introduced at regular intervals, to force the concrete to crack at pre-determined locations to accommodate shrinkage. Shrinkage cracks are dormant and will not change with time. Thermal cracks will tend to widen and narrow with the cycles of the ambient temperature. Structural cracks are active only if the overload condition is continued or if settlement is occurring. Cracking due to alkali-silica reactivity has the appearance of lines on a road map and over time will develop a white crust on the surface.

Concrete is a porous material and absorbs water. To protect the reinforcement metal from corrosion, it is typically buried within the concrete mass and covered by some minimum thickness of concrete. The thickness of the concrete cover provides a physical barrier to moisture to protect the metal, while the high alkalinity of the concrete also provides a degree protection.

Cracking of the concrete can expose the reinforcement resulting in the premature corrosion of the metal. Insufficient concrete cover over the reinforcement also often results in the premature corrosion. Corrosion of the reinforcement metal resulting from contact with moisture will result in a reduction in the strength of the concrete structure, the loss of the concrete cover material, and possible staining of the concrete. Exposure of the concrete to carbon dioxide can also neutralize its alkalinity, thereby eliminating the chemical protection afforded the metal. This is known as carbonation. In the 1970s, the use of steel reinforcement that was coated with an epoxy to increase its resistance to corrosion became relatively common in high exposure situations.

Spalling is the loss of the surface concrete material and is typically a symptom of the corrosion of the underlying metal reinforcement. As the metal corrodes, rust is produced which occupies significantly more space than the original metal and causes expansive forces within the concrete cover which can produce the spalls. Spalls can reduce the strength of the concrete structure due to the loss of concrete, and the loss of bond between the concrete and reinforcing, and can expose the reinforcement to an even greater risk of corrosion.

Surface scaling can result from freeze-thaw actions of moisture trapped within the concrete surface. As the moisture expands when it freezes, it can break off layers of the concrete, resulting in a pitted uneven surface. Scaling can also result from the introduction of high stresses in the concrete produced by thermal expansion forces acting in a concentrated manner on a small area of concrete.

Additional information can be obtained in the United States National Park Service's preservation brief, *Preservation of Historic Concrete Problems and General Approaches*, published by the United States National Park Service, Technical Preservation Services. This document is available online at: http://www.cr.nps.gov/hps/tps/briefs/brief15.htm.

GUIDELINES FOR CONCRETE ELEMENTS

GENERAL APPROACH

Recommended	Not Recommended
Understand the properties and characteristics of the concrete of the memorial.	
Assess condition: Document the form, composition, strength, colour, texture, details and condition of the concrete before undertaking an intervention. For example, identifying the particular characteristics and source of the type of aggregate used.	Undertaking an intervention that affects the long-term conservation of the concrete, without first documenting its existing character and condition.
Determine the cause of the distress, damage, or deterioration of the concrete component requiring repair through investigation, analysis, monitoring, and testing as required.	Initiating a repair without understanding the cause of the problem being treated. Carrying out a repair that does not address the cause of the problem.
Protect and maintain concrete by preventing moisture penetration; maintaining proper drainage; improving water shedding; and by preventing damage due to the overuse of ice-clearing chemicals.	Applying membranes or coatings to act as 'waterproofing' for concrete features as the coatings can inadvertently trap water leading to deterioration of the concrete. Applying either penetrating or film-forming sealers to minimize moisture absorption, as these sealers are often not removable, and both types typically change the appearance of the surface of the concrete by making it more reflective. Applying water-repellent coatings to above-grade concrete to stop moisture penetration, when the problem could be solved by repairing failed flashings or other mechanical defects.

CONSERVATION TREATMENTS

Cleaning Concrete Elements

Recommended	Not Recommended
Clean using the gentlest methods possible and only when necessary to halt deterioration or remove heavy soiling or graffiti.	Over-cleaning concrete surfaces to create a new appearance, thus introducing chemicals or moisture into the concrete.
Clean concrete elements using low-pressure (less	Cleaning concrete elements with water when there

than 350 kPa [50 psi]) soaking with water followed by gentle scrubbing with natural bristle brushes.	is any possibility of freezing temperatures. Using detergents or household cleaners with Sodium Hydroxide (NaOH) to remove stains on the concrete, as they may adversely react with other materials or be hazardous to animals and plant life. Failing to rinse off and neutralize appropriate chemicals on concrete surfaces after cleaning. Blasting concrete elements with abrasives, as this can damage the concrete by eroding its surface, and can damage soft or delicate materials such as wood, lead, sandstone, or marble, adjacent to the concrete of the memorial. Using biocides to kill off plants such as lichens, as chemicals in the biocide may adversely react with other materials on the memorial, or be hazardous to non-target animals and plant life. Using flame cleaning to burn off plants such as lichens, as the excessive heat may damage other materials on the memorial, such as wood, lead, synthetic caulks. Applying coatings or paint over the concrete to present a "clean appearance" as these coatings can inadvertently trap water, leading to premature failure of the coating and the accelerated deterioration of the concrete.
When cleaning using low-pressure soaking and brushes is not sufficient, soaking with low pressure water (less than 350 kPa [50 psi]) followed by spraying with moderate-pressure water jets (maximum 2700 kPa [400 psi]) is generally safe for use <u>on good quality concrete only</u>.	Pressure washing poor quality or low strength concrete. Pressure washing concrete with an exposed aggregate finish. Pressure washing concrete where soft or delicate materials, such as wood, lead, sandstone, marble, lead lettering, or carvings, form nearby parts of the memorial, as the pressure of the water may damage these materials. Adding detergents, acids, or other additives to the water when pressure washing.
Carry out cleaning tests to determine other appropriate cleaning approaches, if cleaning using low or moderate-pressure water and brushes does not provide a sufficient degree of cleanliness. Cleaning tests should be observed over a sufficient period of time so that both the immediate and the long-range	Cleaning concrete surfaces with more aggressive methods, without testing or without sufficient time for the testing results to be known.

effects of the cleaning are known, the gentlest method possible is selected, and an appropriate level of cleanliness achieved.

Protect adjacent materials during the cleaning of concrete elements to avoid damage by abrasion or water infiltration.

Stamped Concrete

Ensure concrete is in good condition prior to start work.

Pressure wash or scrub the surfaces prior to assessing condition may significantly damage the concrete surface.

Sweep and wash the stamped concrete surface. Pressure wash or scrub with a mild detergent for exterior surfaces and use wet mopping or dry dust mopping for interior surfaces.

Other Surface Treatments

Recommended	Not Recommended
For newly built concrete memorial, penetrating sealers or film forming coatings can be used, but they may alter the original colour and appearance, and may mask some fine architectural details.	Using penetrating sealers or film forming coatings on historic concrete. Applying protective coatings is considered as an irreversible action and may trap moisture in the monument and cause detrimental results.
Inspect painted concrete surfaces to determine whether repainting is necessary and repair treatment is required.	
Removing damaged or peeling paint, using the gentlest method possible before repainting.	Removing paint that is firmly adhered to concrete.
Reapply compatible paint or coatings, if necessary, that are physically and chemically compatible with the previous surface treatment, if found appropriate, and visually compatible with the surface to which they are applied.	Removing paint from historically painted concrete unless it is damaging the underlying concrete. Removing stucco or cement parging from concrete that was historically never exposed.
Apply appropriate surface treatments, such as breathable coatings, to concrete as a last resort, only if repairs, alternative design solutions, or flashings have failed to stop water penetration, and if a maintenance program is established for the coating.	Applying coatings to concrete instead of correcting the problem that caused the damage.

Stamped Concrete

Maintain the sealed surface by applying a sacrificial floor wax or polish. If the surface is too deteriorated, recoat with a sealer identic or compatible with the existing, if found appropriate.

Repairing Concrete Elements

Recommended	Not Recommended
Monitor the activity of significant cracks in the concrete before determining if repairs are necessary, including checking for: - seasonal opening and closing of cracks; - growth in crack length over time; and, - the appearance of new cracks.	Repairing cracks in concrete without first determining their causes or significance.
Match the physical and mechanical properties of the repair concrete as closely as possible with the existing, including: - modulus of elasticity (ASTM C469-02); - cement to aggregate ratio; - aggregate gradation (ASTM C136-05); - compressive and shear strength (ASTM C39/C39M-04a); and, - coefficient of thermal expansion. ASTM is the acronym for the American Society for Testing and Materials. ASTM publishes standards for testing procedures and material and construction quality that are referenced by Building Codes in Canada including the National and Provincial building codes.	Using off-the-shelf pre-packaged concrete patching compounds.
Stabilize unsafe deteriorated concrete elements by structural reinforcement and weather protection, or correcting unsafe conditions, as required, until repair work is undertaken.	
Where concrete is exposed and forms an important visual element of the memorial, match the physical appearance of the exposed repair concrete with the existing, including: color; texture; and finish. In some cases, using aggregates from the original sources and reproducing the original construction methods, such as formwork, finishing techniques, should be considered.	Using new coatings or finishes, not historically accurate for the memorial, to cover and hide surface repairs. Re-creating architectural features after forming by sculpting with plastic concrete. Re-creating form finish details such as form lines, wood grain, or knots with grinders or trowels.
Create a mock-up of an exposed concrete repair as part of the repair contract to determine the suitability of the proposed repair materials and techniques in matching the physical appearance of the existing exposed concrete. It is important to prepare the mock-ups far enough in advance of the repair work to allow them to fully cure before they are evaluated (e.g. minimum 28 days), and to prepare them under	

the same conditions as the eventual repairs. For example, if the repair is on a vertical surface, the mock-up should be created in a vertical orientation.

Clean exposed concrete to remove contaminants, dirt, and soil, before initiating repairs, so that the new concrete patches match a cleaned surface.

Carry out testing of the existing concrete to determine its physical and mechanical properties, including its level of air content (percentage of voids), the presence of any impurities or contamination, and evidence of carbonation. Carry out testing far enough in advance of the repair work to allow sufficient time to identify source appropriate replacement materials.

Ensure the freeze-thaw durability of the repair concrete by including an appropriate level of air entrainment as recommended by the Canadian Standard *CSA A23.1 Concrete Materials and Methods of Concrete Construction*.

Use non-corroding reinforcement, such as stainless steel, epoxy coated steel, or glass fibre reinforced polymer [GFRP] rods, in repairs to replace or supplement existing corroded reinforcement.

Match the amount of reinforcement to the existing, unless the repair is treating a case of damage resulting from overloading of the concrete.

Over or under reinforcing the repair location.

Retain sound and repairable concrete elements that contribute to the heritage value of the historic place.

Removing deteriorated concrete that could be stabilized or repaired.

Remove and replace in kind all unsound concrete, based on documentary and physical evidence of satisfactory performance. It may be necessary to limit the size of the chipping equipment used on early concrete features to better control the degree of removal, as the compressive strength of the concrete may be much lower than modern concrete.

Using replacement material that is incompatible with adjacent concrete work.

Replacing entire concrete features, when selective replacement and repair is possible.

Removing an irreparable concrete element and not replacing it, or replacing it with an inappropriate new element.

Remove all corrosion from existing exposed reinforcement that is to remain using wire brushes or sandblasting.

Select an appropriate approach to prevent corrosion and to minimize damage to the concrete, including

Introducing a corrosion protection system for the concrete, without verifying the effectiveness or the

regular inspection and maintenance.

Ensure proper concrete mixing, placement, and curing procedures by following the recommendations of the Canadian Standard *CSA A23.1 Concrete Materials and Methods of Concrete Construction*.

Ensure good chemical and mechanical bonds between the repair material and original concrete by:
- sandblasting the exposed concrete in the patch area;
- air-blasting the patch area to remove any dirt, debris or contaminants;
- pre-wetting the patch area before adding the patch material;
- brushing a slurry made from the repair concrete onto the exposed concrete of the patch area to act as a bonding agent;
- undercutting the edges of patches and cutting the patches square to develop a good mechanical bond;
- introducing supplemental anchors (e.g. stainless steel dowels) to tie the patch to the existing concrete;
- insuring an appropriate minimum thickness of the patch material is applied (i.e. do not feather the edges of the patch); and,
- chipping around all existing rebar a distance at least equal to the size of the largest aggregate used in the repair concrete.

Seal inactive cracks by pointing with a cementitious mortar or injecting consolidants compatible with the mechanical and physical properties of the concrete element to prevent the ingress of moisture into the concrete mass through the crack.

Verify if control joints are present and properly located. Cracks will developed in areas where control joints should have been located.

Control the propagation of thermal expansion/contraction cracks by saw-cutting crack control joints into the concrete at strategic locations to force the concrete to crack at that specific location.

Maintain a record of the date and extent of the conservation treatments to guide future treatment.

level of benefit achieved by the work, or without taking appropriate steps to address the cause of the corrosion.

Sealing active cracks with hard mortars or other hard materials that could damage the masonry units. Repairing cracks without first determining the cause or significance of the crack.

METALS IN MEMORIALS

A variety of metals have been used in the fabrication of memorial including: iron, tin, copper, zinc, aluminium, lead, with the most common being bronze. Typically, metals are featured as decorative elements such as plaques, sculpture, or lettering, but they can also be used for structural purposes. Bronze is an alloy or fusion of the ores, tin and copper. For sculptures, silicon bronze tends to be the material of choice since it is corrosion-resistant, strong, resilient, formable and weldable. Wrought iron, cast iron, and steel tend to be simple to identify, but alloys are more complicated, and their identification may require assistance from a conservator or conservation professional.

Most metals are chemically unstable, reacting with the atmosphere to form oxides over varying periods of time. Some metals, such as aluminum and stainless steel, form a protective oxide coating on their surface that cannot be penetrated by further oxygen molecules, permitting them to retain their shiny appearance with little or no maintenance for years. However, most metals require a coating or anodizing to prevent corrosion.

The long-term performance of metal elements will depend on their physical and chemical properties, the climate to which they are exposed, design details, and their proximity to other metallic and non-metallic elements. In order to correct damage to a metal component, the cause of its deterioration must be understood. If the properties of the metal are not understood, inappropriate treatment may result in an adverse reaction that causes further deterioration. Generally, metal elements tend to be durable, but elements that are not suited for a particular location and function, or not receiving adequate maintenance, may become fragile.

The following describes typical forms of metal deterioration:

Corrosion occurs in most metals in reaction to oxygen, water, and other elements in the environment. As metals corrode, a chemical compound forms on their surfaces creating first a film, and later a crust. The expansion caused by the formation of this crust can break masonry where metal is bolted or embedded. In certain cases where the film of corrosion is stable and uniform, it actually forms a finish called a patina that protects the metal. Bronze statuary will turn a reddish-brown, but in the presence of pollutants, the surfaces may turn green and/or black. The end colour and period of time it takes the change to occur will depend on the atmosphere and the chemical pollutants present. Artificial patinas may be applied to metals for aesthetic reasons to achieve a particular colour.

Selective corrosion takes place when only some of the metals in an alloy begin to corrode. A common example is when the zinc from a brass alloy corrodes, leaving white patches on the surface of the metal.

Galvanic corrosion occurs when dissimilar metals are in contact with each other causing an electrochemical reaction. The metal that is less resistant to corrosion will deteriorate at a faster rate. In the case of a bronze-clad aluminium door, the aluminium elements will break down from corrosion while the bronze will remain intact.

Erosion or abrasion is the physical process whereby metal slowly wears away. This can be caused by natural factors such as water, wind or wind-driven sand, or by repeated human actions such as pushing doors open, or by acts of vandalism.

Plastic deformation or creep often affects lead elements subjected to loads or high temperatures. This condition can occur with heavy statuary that sags under its own weight. Lead lettering, which is the most common use of lead on memorials, will not be affected by this problem.

Casting flaws in ironwork can be mistaken for corrosion. These flaws usually take the form of bubbles, holes, or cinders. Cracks may also form due to uneven cooling or flaws in the molten metal pour. The resulting flaws may become corrosion sites.

Cracks in metal can occur for a number of reasons: expansion of ice trapped between sections of metal; flaws in metal castings or extrusions; metal fatigue; no provision for thermal expansion and contraction of metal; and accidental impact or vandalism. How these cracks are repaired will depend largely on the cause of the damage and the type of metal. Some metals can be welded or brazed, while others, such as cast iron, have limited repair options.

Additional information can be found in the following sources:

Gayle, Margot, Look, David W., and Waite, John G. 1992. *Metals in America's Historic Buildings. Uses and Preservation Treatments.* U.S. Department of the Interior, National Park Service, Cultural Resources, Preservation Assistance. Washington, D.C.

Anson-Cartwright, Tamara. 1997. *Landscapes of Memories: a guide for conserving historic cemeteries, repairing tombstones.* Toronto: Ministry of Citizenship, Culture and Recreation. ISBN 0-7778-6339-1

Weaver, Martin E. 1993. *Conserving Buildings: A Guide to Techniques and Materials.* New York: John Wiley and Sons, Inc. ISBN 0-471-50945-0

Ashurst, John, Ashurst, Nicola, Wallis, Geoff, and Toner, Dennis. 1988. *Metals (Practical Building Conservation, English Heritage Technical Handbook, Vol. 4).* UK: Gower Technical Press. ISBN: 0470211075

GUIDELINES FOR METALS ELEMENTS

GENERAL APPROACH

Recommended	Not Recommended
Understanding the properties and characteristics of metals and their finishes or coatings.	Undertaking repairs to metal elements without knowing the type of metal being treated.
Determine the cause of deterioration of the metal elements requiring repair, through investigation, analysis, monitoring, or testing as required.	Initiating a repair without understanding the cause of the problem being treated. Carrying out a repair that does not address the cause of the problem.
Document the form, materials and existing condition of the memorial before and after conservation begins.	Undertaking project work that will have an impact on metal elements without first undertaking a survey of existing conditions.
Ensure that all proposed conservation treatments for metal elements represent minimal interventions to solve identified problems.	Removing or radically changing significant metal elements and finishes.
Retain as much of the original material as possible by repairing or replacing only the deteriorated portions.	Removing major portions of the metal component and replacing with a replica.

CONSERVATION TREATMENTS

Recommended	Not Recommended
Protect and maintain metals from corrosion by preventing water penetration and maintaining proper drainage, so that water or organic matter does not stand on flat surfaces or accumulate in decorative features.	Failing to identify, evaluate, and treat causes of corrosion.
Ensure that incompatible metals are not in contact with each other by installing an appropriate separator to prevent galvanic corrosion.	Placing incompatible metals together without providing a reliable separation material to prevent galvanic corrosion.

Cleaning Metal Elements

Recommended	Not Recommended
Clean metals, when appropriate, to remove corrosion prior to refinishing.	Failing to recognize when cleaning is inappropriate for the particular metal.

Recommended	Not Recommended
Identify the particular type of metal prior to any cleaning procedure to ensure that the gentlest cleaning method possible and test the cleaning method in an inconspicuous area to ensure the appropriate level of cleanliness is achieved.	Over-cleaning metal elements.
Determine the appropriate level of patina before cleaning, and ensuring that this level is maintained for the entire element.	Using cleaning methods that alter or damage the original patina, colour, texture, and finish of the metal; or cleaning when it is inappropriate for the metal.
Protect adjacent materials when cleaning in-situ so as to avoid damage by abrasion or chemical reaction.	Removing the original character-defining patina of the metal, which may be a protective coating on some metals, such as bronze or copper.
When coatings contain hazardous materials, such as lead, consider moving the specific elements of the memorial in a workshop for cleaning purposes.	Exposing metals intended to be protected from the environment.
Cleaning painted metals using appropriate techniques and products to remove corrosion and layers of paint, if required, before repainting.	Failing to control the spread of the contaminant into the open air.
Use applicable non-adhesive method to clean soft metals, such as lead, tin, copper, aluminum, brass, silver, bronze, terneplate, zinc, with appropriate non-abrasive methods.	Cleaning soft metals such as lead, tin, copper, aluminum, brass, silver, bronze, terneplate and zinc, with grit blasting or other abrasive methods, or using tools such as wire brushing, which will abrade the surface of the metal.
Use the gentlest cleaning methods for hard irons: cast iron, wrought iron, and steel, in order to remove paint build-up and corrosion. If hand-scraping and wire brushing have proven ineffective, low pressure dry grit blasting may be used as long as it does not abrade or damage the metal surface.	Failing to employ gentler methods prior to abrasively cleaning cast iron, wrought iron or steel; or using high pressure grit blasting.
	Failing to mask or otherwise protect adjacent masonry, wood or other metal surfaces during metal cleaning.
Re-apply an appropriate paint or coating system after cleaning in order to decrease the corrosion rate of metals or alloys.	Failing to re-apply protective coating systems to metals or alloys that require them after cleaning so that accelerated corrosion occurs.
After cleaning, leave metal surfaces meant to be exposed without further treatment.	Applying paint, lacquer, or other coatings to metal surfaces meant to be exposed.
Bronze Clean indoor bronze sculptures/statues once a year and outdoor bronze twice a year right before and right after summer. Clean using water and soft soap with no scent by wiping the bronze with a clean and	Using cleaning methods that alter or damage the original patina, colour, texture, and finish of the bronze, such as harsh soaps, oils or automotive waxes.

soft rag. For nooks or bird droppings, a soft toothbrush can be used. Then, rinse out the rag and wipe down the sculpture to remove the excess soap. Allow the sculpture to dry completely. Use a soft brush and apply coat plain, clear, paste wax such as of *Johnson's Clear Paste* or *Renaissance Wax* for darker colored bronze and *Trewax Clear Paste Wax*, *Mohawk Blue Label Paste Wax* or *Renaissance Wax* for lighter colored bronze. Wait for approximately an hour and buff the bronze with soft brush or rag. A second coat is recommended for outdoor bronze.

Lead Letters

Clean using a weak solution of sodium hydroxide with water. Ensure to protect the surrounding elements from cleaning solution. Spray with a soft water jet to remove the succeeding debris from the surrounding stone.

Using cleaning methods that alter or damage the original patina, colour, texture, and finish of lead.

Brass and Copper

Use the help of a professional.

Brush away dry dust and dirt using brushes made hog bristle, such as natural bristle toothbrushes and jewelers watch brushes or for more details, using round artists' oil painting brittle brushes and stencil brushes.

Apply a mixture of equal volumes of methyl hydrate (methanol) and water using cotton swabs or where grease is resistant, with a stencil brush may be used for greasy residues and using a moistened wooden toothpick for polish residues. Few drops of mild detergent may also be added in this case, but tests should be carried out prior to a full cleaning.

Remove dark patches by swabbing the surface with methylated or white spirit to first remove grease and dirt. If tarnish stays, rub gently a silver cloth over the surface. If tarnish still remains, use a mild abrasive cream and rub it gently with a swab over the tarnished area in a circular motion. Then, remove the residues with a swab using white spirit. Lastly, swab lightly with methylated spirit or acetone.

Remove powdery green corrosion by swabbing the surface with methylated or white spirit to first remove grease and dirt. Cut a chisel shape at the end of a kebab bamboo stick and gently use it to push off the corrosion product. Swab lightly with methylated spirit.

Using cleaning products and methods that alter or damage the original patina, colour, texture, and finish of copper or brass, such as ammonia, commercial polishing products, water.

Other Surface Treatments

Recommended	Not Recommended
Applying an appropriate protective coating to an unpainted metal element that is subject to frequent use and handling, such as a bronze door or brass hardware, or to corrosion due to environmental factors, such as abrasives in winter. The coating should be regularly reapplied, as required, to ensure ongoing protection.	
Re-apply appropriate paint or coating systems after cleaning to decrease the corrosion rate of painted or coated metals.	
Prior to applying a primer on the surface to be painted, clean the surface properly from rust and any other loose particles.	Applying directly the primer on an unprepared surface even if the manufacturer product description encourages it.
Re-paint metal elements, if warranted, with colours that are appropriate to the memorial.	Using new colours that are inappropriate to the memorial.
Brass and Copper When polishing is necessary, polish using the mildest and least harmful method. In order the methods are the following, from the mildest to the more harmful method: - Lightly rub the surface with a paste of precipitated chalk and water on a soft cloth. - Gently and evenly rub the inner layer of flannel impregnated with jeweller's rouge of a jewellers' cloth over the surface and then remove the residual rouge using the outer layer of flannelette. - Apply a wadding-type polish using a soft cloth on the surface while being careful of not extensively rubbing the metal. Finish by hand buffing the surface with a clean, soft and lint-free cloth.	Using products such as ammonia, which can dissolve copper in certain conditions. Using commercial products, such as Brasso, which were created for automotive and stainless steel cleaning, and may scratch copper alloys due to their very hard particles or leave a film on the metal's surface.
Apply a wax coating when necessary by wiping or brushing evenly on a clean surface and let the solvent evaporate. A suitable wax can be prepared using a mixture of one part of Shellsol or Varsol with a bleached micro-crystalline paste wax. Then, buff the surface with a clean and lint-free cloth.	Applying a wax that contains synthetic components such as polyethylene.
Apply lacquer only if the surface was originally lacquered and if the coating has worn off or has been removed deliberately. Send the object to be lacquered to a company specialized in applying	Applying lacquer when not necessary since it will alter the appearance of the object. Not using specialist for lacquering objects,

lacquer.	which require to be re-lacquered.
Gilding	
Keep gilding dry.	Exposing gilding to a damp environment.
Clean only occasionally by dusting gilding with a feather duster and employ a professional conservator for an extensive cleaning gilding.	Cleaning regularly gilding using any products and or a yellow duster. Cleaning water gilding using water as it will dissolve the finish as it is delicate and can easily be damaged. Cleaning oil or mordant gilding using solvents as it will attack and remove the gold from the surface of the gilded elements.
Employ a professional conservator for any types of repairs to gilding as it is delicate and can easily be damaged.	Painting with gold-coloured paint on top of gilding or using any other finishes, such as wax, spray polish and aerosol paint, on top of gilding. Paint will oxidizes in the following months and destroy the intended effect.

Repairing Metal Elements

Recommended	Not Recommended
Use only personnel experienced in the metal being repaired.	Using untrained personnel for repairs to metal elements, thus causing further damage to fragile elements.
Test all chemicals and consolidants for their interactions with the particular metals with which they will be in contact, as part of planning for the repairs.	Using untested chemicals and consolidants thus causing further damage to fragile metal elements.
Retain sound metal elements, or deteriorated metal elements that can be repaired.	Replacing metal elements that can be repaired.
Stabilize deteriorated metal elements by structural reinforcement, weather protection, or by correcting unsafe conditions as required, until final repairs are undertaken. Repairs should be physically and visually compatible.	Removing deteriorated metal elements that could be stabilized on site, or leaving metal elements in precarious states for long periods of time while waiting for repairs to be implemented.
Follow recognized conservation methods when repairing metal features by welding, soldering, patching, splicing, or otherwise reinforcing the metal.	Using metal repair techniques common to auto body shops or other commercial situations when treating the metal elements of a memorial.
Repairs may include limited replacement, in kind or	Replacing an entire metal element when repair

with a compatible substitute material, for those extensively deteriorated or missing components.	of the metal and limited replacement of deteriorated or missing components are appropriate.
When replacing an entire metal component too deteriorated to repair, use the remaining physical evidence as a model to reproduce the substitute part. If the same kind of material is not technically or economically feasible, then a compatible substitute may be considered.	Removing a metal element that is irreparable and not replacing it.
When replacement of a metal component is required, use a new metal element that conveys the same visual appearance, and is physically and visually compatible with the other parts of the memorial.	Using a substitute material for the replacement part that neither conveys the visual appearance of the surviving parts of the metal feature, or that is physically or chemically incompatible.
Lead Letters Use professional conservator for the restoration of lead letters. Restore existing letter when possible and replace missing or heavily deteriorated lead letter with new lead. Tap the letters in good condition back into their original place. Redrill existing holes or drill new holes ensuring that they are keyed. Chisel around the edges of the carved letters if straightening of the edges is necessary. Drill the letters back onto the carved letters in the stone and ensure that the holes are deep enough.	Restoring the letters without the help of a conservator using techniques such as the use of cast white metal letters attached using silicone sealants or gluing back letters which are unstable or have fallen.

WOOD AS A CONSTRUCTION MATERIAL

Wood is an organic material, and has a wide range of physical properties that can vary significantly from species to species or even within species depending on the conditions under which the wood was grown. Degradation of wood can be grouped into two broad categories: biological degradation from fungal decay or insect attack, and mechanical degradation from weathering, wear, excessive usage.

Biological Degradation

Fungi are classified into three categories depending on the nature of the degradation they cause: molds grow on the surface of wood with little effect and can be easily removed; staining fungi penetrate the cellular structure damaging cell contents and walls, reducing strength and stiffness; and decaying fungi can significantly reduce wood's strength by penetrating its cellular structure, and can destroy its chemical composition by consuming cell contents.

In order to grow and propagate, decaying fungi require adequate supplies of oxygen, food and moisture, and temperatures between 20 and 30 degrees Celsius. Areas prone to fungal decay include situations on which water can collect, such as horizontal surfaces, or checks and splits in the wood. Wood that is in direct contact with the ground, with water, or with concrete or asphalt, is also vulnerable, as are locations where two or more wood members butt tightly together, and where debris, bird or animal droppings accumulate.

Wood affected by some decaying fungi will lose structural strength before the decay is even visibly evident. Active advanced decay can be detected and identified by looking for damage to the wood, including cross cracks, stringy and fibrous appearance, staining, brown cubical deterioration, and change of colour and odour. Symptoms of decay can also include staining on paint coatings, local crushing of the wood, and paint failure. The presence of fungal fruiting bodies on the surface of wood is also a clue.

If the spores from fungal fruiting bodies fall on a moist wood surface and meet other favorable growth conditions, they are capable of developing and producing new fungal plants. Thus, disease can be spread from one piece of wood to another without direct contact between sound and infected material.

A number of insect species (such as beetles, carpenter ants, termites, wood wasps, and carpenter bees) can significantly damage wood and reduce its strength. The typical process is initiated when a female insect lays eggs in or on the surface of the wood. The eggs hatch into larvae which then tunnel through and feed on the wood. Upon maturity, the adults emerge, leaving the wood surface perforated with small, round 'flight holes'. The feeding actions of the insects create voids in the wood and can severely degrade the structural integrity of the wooden element. Detecting infestations of some insects can be difficult as their flight holes are very small, and determining if a flight hole is from an active or past infestation is almost impossible. Frass from the flight holes, which looks like fine sawdust, can indicate activity.

Conditions that are favorable to insect infestation (such as damp or wet wood and accumulations of rotting organic debris) can be eliminated. Preventive measures using insecticide and proper maintenance of the wood elements to deny suitable habitat and access,

are usually the most effective approaches to preventing insect damage. When an infestation is present, the first step is to find the location of the colony, and then to determine why it is there. When it is time to eradicate the colony, use'poisoned' bait that the insects will carry back, pass around, and eventually destroy the colony.

Mechanical Degradation

Mechanical degradation of wood can include weathering, mechanical wear, and structural failure. The degradation process of wood can be influenced by the presence of naturally occurring growth defects within the wood, by problems related to the conversion process from logs to dimension lumber, or by defects introduced into the wood by the seasoning or drying processes used in preparing the wood. The use of wooden members with spiral or diagonal cross grains is undesirable for flagpoles, frames, crosses and plaques because those types of grains generate twisting of the material and reduce strength and stiffness along the long axis of the wooden component.

Weathering is a generic term for degradation from exposure to atmospheric elements including ultraviolet radiation, moisture, temperature, chemical gasses, and windborne grit. Cracking and splitting of wooden elements can result from various processes initiated by extended exposure to ultraviolet radiation, moisture, temperature changes, and temperature extremes. Atmospheric gasses that accelerate natural oxidation can damage protective coatings. Weathering often results from combinations of these factors. The application and maintenance of paint, stain or other protective finishes will prevent weathering.

Mechanical wear results in the loss of material. It can be caused by human traffic, windborne grit, sand or dust, impacts from maintenance equipment, deliberate vandalism, cables and ropes swinging in the wind, and animals or birds chewing or tearing at the wood. Protection against mechanical wear can include the application and maintenance of protective coatings, and the restriction or control of damaging activities.

Structural failure occurs when wood is subjected to stress levels that exceed its strength. The natural strength of wood can be reduced by any of the wood degradation processes discussed above. Indicators of structural failure include: sagging, splitting, or crushing of wooden members; leaning structures; and the appearance of new openings or gaps between different parts of a structure.

Additional information can be found in the following sources:

Canadian Building Digest, published by the National Research Council of Canada. Of particular interest are: CBD-85, Some Basic Characteristics of Wood; and CBD-111, Decay of Wood. These documents are available online at: www.irc.nrc-cnrc.gc.ca/cbd/cbd-e.html

Building Performance Series, published by Canadian Wood Council. These documents are available online at: www.cwc.ca

Wood Durability, published by Forintek Canada Corp. This document is available online at: www.durable-woo

GUIDELINES FOR WOODEN ELEMENTS

GENERAL APPROACH

Recommended	Not Recommended
Identify the wood species. Understand its properties and characteristics, such as its species, grade, strength, finish. Identify the presence and the type of coating such as its chemical make-up.	
Inspect the damaged element to determine the level and extent of damage.	Intervening without properly understanding the properties of the wooden component and identifying if repairs are necessary.
Determine the cause of the damage or deterioration requiring repair through investigation, analysis, monitoring, and testing as required.	Initiating a repair without understanding the cause of the problem being treated. Carrying out a repair that does not address the cause of the problem.
Document the existing location, function, form and type of assembly, dimensions of the wooden element, and type of wood; the type and colour of the coating; and, the condition of the wooden element prior to beginning any conservation activity.	Beginning conservation activity without properly identifying the physical characteristics, functional requirements and condition of the wooden element.
Protecting and maintaining wood by controlling water penetration and retention; by maintaining proper drainage so that water or organic matter does not stand on flat, horizontal surfaces or accumulate in decorative features; and by preventing conditions that contribute to weathering and wear.	Failing to identify, evaluate and treat the causes of wood deterioration.
Creating conditions that are unfavourable to the growth of fungus, such as eliminating entry points for water; opening vents to allow drying out; removing piled earth, wet materials or decayed wood resting against wood and plants that hinder air circulation and/or promote biological degradation and insect infestation; or applying a chemical preservative, using recognized conservation and environmental method, technology and products.	

CONSERVATION TREATMENTS

Cleaning Wooden Elements

Recommended	Not Recommended
Clean using the gentlest methods possible and only when necessary to halt deterioration or remove heavy soiling or graffiti.	Using detergents or household cleaners with Sodium Hydroxide (NaOH) to remove stains, as they may adversely react with other materials or be hazardous to animals and plant life.
Clean using low pressure soaking with water (less than 350 kPa [50 psi]) followed by gentle scrubbing with natural bristle brushes.	Using tools that could damage the wood, including: steel wire brushes; metal tools such as spatulas, knives, or screwdrivers; abrasive pads such as steel wool; and rotary grinders or sanders.
	Using biocides to kill off plants such as lichens, as chemicals in the biocide may adversely react with other materials on the memorial, or be hazardous to non-target animals and plant life.
	Using high-pressure water cleaning methods that could damage the wood.
When coatings contain hazardous materials, such as lead, consider moving the specific elements of the memorial in a workshop for cleaning purposes. Bring a qualified professional (if the paint is a lead-laden paint, use the service of a certified lead-removal expert) to do the work, in a workshop or on-site.	Failing to move the elements of the memorial to control the spread of the contaminants in the open air and use proper H&S protection measures.

Re-coating Wooden Elements

Recommended	Not Recommended
Inspect coated wooden surfaces to determine whether re-coating or re-painting is necessary, or if cleaning is all that is required; and which method (best tools and methods) to use and how to contain the debris.	Removing paint or other coatings that are firmly adhering to and thus protecting wooden surfaces.
	Re-coating or repainting a wooden feature that is stained, without first determining whether or not the stain is the result of fungal decay.
Retain coatings, such as paint, that help protect the wood from moisture and ultraviolet light. Removal of a coating should be considered only where there is surface deterioration of the coating and where re-coating will occur.	Stripping paint or other coatings to reveal bare wood, thus exposing historically coated surfaces to the effects of accelerated weathering.
	Stripping coated wooden surfaces to bare wood, and then applying clear finishes or stains in order to create a 'natural' look.
Remove damaged or deteriorated coatings to the next	Using destructive removal methods such as

sound layer using the gentlest methods possible, scraping and sanding by hand, then re-coating in kind.	propane or butane torches, sandblasting or water-blasting. These methods can irreversibly damage woodwork or other delicate parts of the memorial, or cause fires.
Use gentlest means possible to remove paint or varnish when it is too deteriorated to recoat, or so thickly applied that it obscures details.	Using thermal devices improperly so that the woodwork is scorched. Failing to have a fire extinguisher nearby when using thermal devices such as heat guns.
To melt away paint, use electric hot-air guns carefully on decorative wooden features at the right temperature. Use electric heat plates on flat wooden surfaces when paint is so deteriorated or so thick that total removal is necessary prior to repainting. This method minimizes dust but fumes maybe present and there are risks of charred wood.	Using temperature too low that would slow the work or too high that would create harmful vapours, char the wood.
Use chemical strippers for fine details, awkward shapes and hitting spots. This method does not generate dust or paint chips but can be messy, smelly and slow.	Using chemical paint strippers containing methylene chloride (DCM) is dangerous. Prolonged exposure to DCM has been linked to severe health conditions and worker may feel dizzy and wheezing. Failing to neutralize the wood thoroughly after using chemical strippers, thereby preventing the new coating from adhering. Allowing detachable wood elements to soak too long in a caustic solution, causing the wood grain to raise and the surface to roughen. Stripping historically coated wood surfaces to bare wood, then applying a clear varnish or stain.
Apply compatible paint coating systems following proper surface preparation, such as washing with trisodium phosphate.	Failing to follow the manufacturer's product and application instructions when re-painting woodwork. Applying paint over deteriorated wood.
Ensure that new coatings are physically and visually compatible with the surface to which they are applied in durability, chemical composition, colour and texture. Re-paint with colours that are historically appropriate.	Using new colours that are historically inappropriate.
Prior to applying a primer on the surface to be painted, clean the surface properly from any loose particles.	Applying directly the primer on an unprepared surface even if the manufacturer product description encourages it.
Apply a chemical preservative treatment that are not exposed to view, if required, using recognized preservation methods.	Using chemical preservatives such as creosote or copper napthanate, because if they have not been used historically, they can change the appearance

	of wood features.
Gilding	
Keep gilding dry.	Exposing gilding to a damp environment.
Clean only occasionally by dusting gilding with a feather duster and employ a professional conservator for an extensive cleaning gilding.	Cleaning regularly gilding using any products and or a yellow duster. Cleaning water gilding using water as it will dissolve the finish as it is delicate and can easily be damaged.
	Cleaning oil or mordant gilding using solvents as it will attack and remove the gold from the surface of the gilded elements.
Employ a professional conservator for any types of repairs to gilding as it is delicate and can easily be damaged.	Painting with gold-coloured paint on top of gilding or using any other finishes, such as wax, spray polish and aerosol paint, on top of gilding. Paint will oxidizes in the following months and destroy the intended effect.

Eliminating Insect Infestations

Recommended	Not Recommended
Treat active infestations of insects by first identifying the type of insect, and then implementing a program of elimination appropriate to that insect. If using pesticides, confirm that the chemical is registered for the intended purpose with Agriculture and Agri-Food Canada, and follow the manufacturer's product and application instructions.	Using pesticides that leave or form harmful residues, injure non-target animals or plant life, or corrode or damage other materials of the memorial and its surroundings.

Treating Deteriorated Elements

Recommended	Not Recommended
Stop and prevent the continued deterioration of wood by isolating it from the source of deterioration. For example, blocking windborne sand and grit with a windbreak, or installing wire mesh over floor joists in a crawlspace to thwart rodents.	Neglecting to treat known conditions that threaten wood, such as abrasion, animal gnawing, fungal decay, or insect infestation.
Retain all sound and repairable wood that contributes to the heritage value of the historic place.	Replacing wood that can be repaired, such as wood elements from old growth timber that is inherently more durable.
Stabilize deteriorated wood by structural reinforcement, weather protection, or correct unsafe conditions, as required, until repair work is undertaken.	Removing deteriorated wood that can be stabilized or repaired.

Repair deteriorated wooden features by the most appropriate minimal interventions available such as: patching, piecing-in, consolidating, structural reinforcement, or otherwise reinforcing the wood.	Removing or replacing an entire wooden element when repair of the wood or limited replacement of deteriorated or missing parts are appropriate. Unnecessarily removing sound wood.
Use a compatible substitute material if matching existing wood strength and characteristics is not technically or economically feasible.	Using a substitute material for the replacement part that neither conveys the same appearance as the surviving parts of the wooden element, nor is physically or chemically compatible.
Repair of deteriorated wood may include consolidation. Consolidants should be compatible and be able to: contract and expand as the wood substrate; deeply penetrate the wood; harden without shrinkage; bond well with the wood; not adversely react physically and chemically with the wood; be reversible or removable; remain stable with age, for example not changing colour or becoming brittle with exposure to ultraviolet radiation; not be wicked out by moisture; and, not alter the surface appearance of the wood.	Using untested consolidants that could cause further damage to fragile historic materials.
Use surviving prototypes upon which to base the design of in kind replacement when repairing extensively deteriorated or missing wooden parts.	Replacing wooden elements with forms lacking any previous association with the memorial.
Replace extensively deteriorated or missing wooden parts with new wooden elements having a similar Moisture Content (MC) than the wooden elements in place. If the replacement wood has a dissimilar moisture content, bring the wooden parts in their new environment until properly cured, or use a controlled drying technique to bring the new wooden parts to an equilibrium MC with their new environment prior to installation.	Replacing wooden elements with new components with dissimilar relative humidity levels.
Replace in kind extensively deteriorated or missing parts of wood elements, based on documentary and physical evidence.	Using a substitute material for the replacement part that neither conveys the same appearance as the wood element, nor is physically or chemically compatible.
Replace in kind the entire panel of an extensively deteriorated or missing modular wood product, such as plywood, on a unit-by-unit basis.	
Create connections between the new and existing wood that will accommodate natural shrinking and expansion; maintain load paths and stress distributions within the original structure; and are	Creating connections between replacement and existing wood that detract from the appearance of the wooden feature. Using metal fasteners that react chemically with

appropriate for the original framing techniques used.	the wood or any preservative treatments applied to the wood.
Design and install a complete wooden component when the existing one is entirely damaged or missing. New design should be compatible with the style and character of the memorial, and should be based on physical and documentary evidence.	Changing the original style and character of the memorial by adding newly designed replacements.
Maintain a record of the date and extent of the conservation treatments to guide future research and treatment.	
<u>Totem poles displayed outside</u>	
Inspect the entire surface of the pole each spring and fall. Keep the information in record. If the base of the poles has been buried in the ground, inspect its base for biological degradation with the help of a non-destructive testing device such as a micro-drill and/or a stress-wave system.	Failing to inspect the totem.
Clean poles by brushing with a soft painter brush. If washing the poles with water is necessary, contact a conservator prior to washing/cleaning.	Cleaning the pole using inappropriate treatments, which would damage the wood.
Prevent any debris from collecting at the base of the poles. Keep the poles free from vegetation/debris/obstructions for 1 m radius around the base of the poles and trim away trees/bushes 2 m away from their base.	Letting debris, vegetation and any other obstructions accumulating at the base of the pole since it may inhibit air circulation and lead to early rotting of the pole.
Pour fungicide against the pole, if planted, just above the gravel and allow to seep down.	Not treating the pole with any treatment or with an inappropriate treatment.
Apply borate fungicide every 5-8 years whether fungus appears or not.	Failing to apply borate fungicide even if fungus does not appear.
If repainting is contemplated, contact the original artists, or designated competent artists, and hire them to carry the work.	
<u>Totem poles displayed inside</u>	
Monitor ambient conditions to avoid large fluctuations in ambient relative humidity and MC in the wood. (NO greater than 10% RH).	Having large fluctuations in relative humidity (greater than 10%) and failing to protect the poles by other means such as an airtight humidity chamber or a tent.
Dust the poles only once a year by using a vacuum cleaner with a soft, long-haired brush attachment.	Dusting the poles on a daily basis since it will polish or abrade the pole.

	Dusting the pole using a cloth or a feather duster, which could potentially pull off some fragments.

Engraving

Recommended	Not Recommended
If recutting of lettering is necessary, hire a professional letter-cutter.	
Carefully recut heavily damaged letters using the most appropriate technique depending on how it was originally cut (hand cut, using pneumatic or abrasive power tools, such as sandblasting, etc.).	Recutting originally hand cut lettering using power tools.
Where inscriptions have been painted and the paint has failed, repaint the letters using a suitable medium. Care should be taken in regard to the surface, the style of lettering and the original paint.	Letting inexperience hands painting the inscriptions, which may lead to the bleeding of the paint on the surrounding stone or to spoiled inscriptions.

GLOSSARY

Air entrainment: Minute bubbles of air are introduced into concrete to improve its durability under freezing conditions: the bubbles provide room for moisture to expand into when it freezes, thereby reducing the stresses generated in the concrete.

Bedding mortar: The mortar in which the stone or brick is set. The bedding mortar may be physically different than the pointing mortar, especially in terms of its colour.

Check: A lengthwise separation of the wood that usually extends across the annual growth rings and commonly results from stresses set up in wood during seasoning.

Cold joint: A joint or discontinuity formed when a concrete surface hardens before the next batch of concrete is placed against it. The cold joint will be a weak point in the concrete casting.

Consolidant: A product that is introduced into a crumbling or deteriorating material to make up for the loss of naturally occurring binding agents.

Crack control joint: A joint created in the concrete casting, often by cutting a groove in the concrete that is intended to encourage cracking due to shrinkage at that specific location.

Cross crack: Cracking in a direction that is across the grain of the wood.

Cultural Landscape: Landscape that has been modified, influenced, or given special cultural meaning by people.

Exfoliation: A process in which the surface material of a stone or brick sheds or sloughs off as a result of an ongoing deterioration in the integrity of the stone or brick.

Exposed aggregate: A special finish for concrete, where an aggregate is deliberately exposed on the surface of the concrete casting. The aggregate is most often a pea-stone or small sized stone.

Footprint zone: The immediately surrounding area of a memorial. In this situation the monument is isolated with no man-made or landscape elements around it. In most cases, the footprint limit corresponds to the solid material and/or grassed area around the monument.

Fruiting body: The visible organ of fungi in which the spores are produced, commonly seen as bracket fungi, which grow like shelves on trees, or molds.

Interpretation zone: Often a larger area that goes beyond the preservation zone. It contains the elements that are essential to make the memorial accessible to visitors (e.g. access ramps and walkways). Other elements such as protective fences or lighting elements (installed to facilitate interpretation and to prevent vandalism) can also be included in this zone and could be covered by funding. The interpretation zone does not include the parking areas.

Joint profile: The shape of the mortar joint. The joint profile can be flush or recessed and can vary depending on the shape of the tool used to finish it. The ability of the mortar joint to shed water away from the masonry (rather than directing it into the masonry) is an important design consideration.

Mock-up: A full size model of a repair or replacement used for testing and reference during work for quality assurance purposes. Mock-ups are prepared at the start of work and can often form part of the finished project.

Oxidation: A reaction of a metal with oxygen, usually resulting in the degradation of the metal. Oxidation can result in the formation of a protective layer, such as a patina or tarnish.

Permeability: A measure of a material's ability to transmit fluids.

Pointing mortar: The mortar that is used to finish the face of the exposed mortar joint. Pointing mortar will often have a different colour and texture than the bedding mortar for aesthetic reasons.

Preservation zone: The area located immediately next to the footprint of the memorial and is often conceptually and physically inseparable from the memorial. It contains the landscape elements that contribute directly to the values of the memorial (such as the flag mast) but also other elements related to the larger setting. Placed strategically, groups of trees, shrubs, floral beds, and/or fencing add a distinctive character to the memorial.

Setting: The setting corresponds to the visual boundaries (whether natural or man-made) that contribute to the distinctive character of the memorial.

Site: The area of the memorial normally contained within the recognized property lines over which the owner has jurisdiction and control.

Slurry: A thin watery mixture of concrete paste applied to a concrete surface to improve bonding between the existing and new concrete.

Schedule B

Part E- Site Design Drawing

LEGEND

- PROPERTY LINE
- NEW CONIFEROUS TREE
- NEW DECIDUOUS TREE
- NEW DECIDUOUS FLOWERING TREE
- NEW SHRUB BED
- GRASS
- ASPHALT PATHWAY
- UNIT PAVERS
- RELOCATED MONUMENT
- BN — NEW BENCH ON CONCRETE PAD
- NEW PARK SIGN
- FP — NEW FLAG POLE
- HP — EXISTING HYDRO POLE
- EXISTING SIGN POST
- NEW PLAQUE

CIVITAS GROUP

WESTMEATH PARKETTE
WHITEWATER REGION TWP
1 RAPID ROAD, WESTMEATH, ON

SCALE: 1:200
DATE: 2020-05-22

GRAPHIC SCALE: 0 2 5 10

CONCEPT

L1