Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 04 03 06 – Historic works – Cleaning Masonry

.2 Section 04 03 07 – Historic works – masonry repointing and repair.

.3 Section 04 03 08 – Historic works – Mortaring.

.4 Section 04 03 42 – Historic works – Replacement of Stone

.5 Section 04 05 00 – Common Work Results for Masonry.

.6 Section 04 11 00 – Proprietary Grout Anchors.

1.2 REFERENCES

.1 Reference Standards:

.1 American Society for Testing and Materials (ASTM)

.1 ASTM A276-08a, Standard Specification for Stainless Steel Bars and Shapes.

.2 Canadian Standards Association (CSA):

.1 CSA-A179-04, Mortar and Grout for Unit Masonry.

.3 Health Canada / Workplace Hazardous Materials Information System (WHMIS):

.1 Material Safety Data Sheets (MSDS).

1.3 DEFINITIONS

.1 Repair of Stone: any repair, other than cosmetic, i.e. superficial, and replacement, done to restore original appearance and function of partly deteriorated stones.

.2 Grout: material used as adhesive to fasten broken/fractured stone elements by direct application at fracture interface and/or by application to added reinforcing elements such as dowels.

.3 Repair Mortar: material used to rebuild broken or deteriorated part of stone.

.4 Flat cut stone: cut stone with flat surfaces without moldings (retainments of buttresses, baseboard, window jambs, corner stones, window frames, etc.)

.5 Molded cut stone: cut stone which may have an applied pattern (cornices, window sills, corbels, bands, bartisans, machicolations, bottoms of bartisans, capitals, pediments of passing windows, etc.).

.6 Sculpted stone: cut stone which may not have an applied pattern (bas-relief, coats of arms, bas-reliefs of central pediment of north façade)

1.4 ALTERNATIVES

.1 Change of manufacturer's brands, sources of supply of materials must be approved by Departmental Representative before closure of call for tenders.

1.5 SAMPLES

.1 Submit samples in accordance with Section 01 33 00 "Submittal Procedures".

.2 Submit samples of patching mortar and stone adhesive proposed for use.

.3 Submit three full-size stone units of each type of replacing stone (St-Marc facing stone, St-Marc substrate rubble stone, Château-Richer facing stone) representative of the units proposed for the works.

.4 Submit three full-size stone units of each type of finish of replacing stone (cut stone, bossed stone) representative of the units proposed for the works.

.5 Submit three full-size stone units of each type of replacing moulded stone (ex. cornices, mantels, window sills, capitals etc.) representative of the units proposed for the works.

1.6 SUBMITTALS

.1 For each set of photographs, submit to the Departmental Representative:

.1 A complete set of digital files on CD clearly identified with the project name and the location.

.2 A complete set of hardcopies of the photographs, as follows:

.1 200 mm x 250 mm format

.2 Neatly label each photograph with a number system corresponding to the key drawings prepared for the marking of the stonework.

.3 Bind each set of photographs in a three-ring binder clearly identified with the project name and the location.

.4 Include a copy of the relevant key drawing(s) in each binder.

1.7 QUALITY ASSURANCE

.1 Refer to Section 04 05 00 - Common Work Results for Masonry.

1.8 MOCK-UPS

.1 Construct mock-ups in accordance with Section 01 45 00 - Testing and Quality Control and Section 04 05 00 - Common Work Results for Masonry.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store, and handle materials to protect them from damage, extreme temperature, and moisture in accordance with Section 01 61 00 - Common Product Requirements and Section 04 05 00 - Common Work Results for Masonry.

.2 Deliver and store material in the manufacturer's original, unopened containers with the grade, batch, and production date shown on the container or packaging.

.3 Store materials in a dry enclosed area and supported free of the ground. Maintain a minimum ambient temperature of between 15°C to 25°C in the storage area.

.4 Use materials from the same manufacturer throughout the Project.

1.10 ENVIRONMENTAL REQUIREMENTS

.1 Refer to 04 05 00 - Common Work Results for Masonry.

.2 Maintain temperature between 15°C to 25°C throughout thickness of stone, during stone repairing works and 30 days after completion of these works

.3 Choose epoxy resin compatible with humidity and temperature condition of stone as specified by manufacturer.

1.11 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Provide product data for each product proposed for use. Include:

.1 Application/installation instructions.

.2 Laboratory test reports certifying compliance of products with specification requirements.

.3 Manufacturer's material safety data sheets (MSDS) for the safe handling of the specified materials and products, in accordance with WHMIS requirements

1.12 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal and Section 04 05 00 - Common Work Results for Masonry.

1.13 CONSOLIDATION OF STONES BEFORE DISMANTLING

.1 Contractor must compulsorily carry out consolidation repairs of fissured and broken stones BEFORE operations of stone dismantling.

1.14 WORKS SEQUENCE OF REPAIRING STONE IN ZONES OF DISMANTLING

.1 Contractor must carry out all stone repairs (except operations of consolidation repairs of fissured and broken stones) once the stones are dismantled. These repairs must be completed before reassembling works. Contractor must plan in his costs to start over or de retouch a part of these repairs because transport and handling of stones in reassembling operations will cause breakages.

1.15 ACCEPTABLE PRODUCTS AND MATERIALS

.1 Where a particular brand name is stipulated, see Instructions to Bidders for procedure for requesting approval of substitute materials and products

Part 2 Products

2.1 GENERAL

.1 Use materials from same manufacturer throughout project.

.2 Acceptable Materials: Where materials are specified by trade name, refer to the Instructions to Tenderers for procedure to be followed in applying for approval of alternatives.

.3 For approval of alternative materials, thorough lab testing shall be required to establish equivalent performance levels. An independent testing laboratory, acceptable to the Departmental Representative, shall be utilized. The cost of lab testing shall be paid by the Contractor

2.2 MATERIALS

.1 Materials for mortar and grout, see Section 04 03 08, Historic works - Mortaring.

.2 Water: clean and free of deleterious materials such as acid, alkali and organic material in accordance with CSA-A179.

.3 Dowels and threaded rods, 3 to 19 mm diameter to ASTM A276, Stainless Steel Grade 304.

.4 Deformed wire: stainless steel or equivalent non-corrosive metal, 2 mm diameter.

.5 Epoxy Resin Gel.

.6 Epoxy Resin, low viscosity, UV stable, capable of setting and curing in wet conditions.

.7 Acrylic Resin.

.8 Acetone solvent. Industrial grade.

.9 Methyl Ethyl Ketone (MEK) solvent.

.10 Hot glue cartridges with electric gun dispenser.

.11 Modelling clay.

.12 Plumber's adhesive tape.

.13 Burlap, untreated and non-staining.

.14 100% cotton rags.

.15 Hardwood wedges: free of tannins, various lengths and thicknesses.

.16 Backer-rod: Polyethylene rope to accommodate all joint width snugly.

.17 Syringes: 30 ml and 60 ml volumes, with twisted attachment for standard needles.

.18 Catheters: 60 ml volume capacity.

.19 Needles for syringes: size numbers 12,14, 16 and 21.

.20 Plumber's 6 mm and 12 mm clear tubing.

.21 De-ionised water.

.22 Repair mortar for wide stone cracks: Refer to Section 04 03 08 – Historic works - Mortaring.

.23 Dispersed hydraulic lime (DHL) injection grout and shelter coat: Refer to Section 04 03 08 – Historic works - Mortaring.

.24 Microballoons composed of polyester spheres. Colour tan.

.25 Epoxy cement without acrylic latex conceived for re-attachment of stones and for the Dutchmen.

2.3 EQUIPMENT

.1 Supply the following smaller specialized tools and equipment:

.1 Small 18.5 volt cordless drills of good quality.
.2 Small 100 mm grinders.
.3 Tungsten Carbide tipped drill bits of 2 - 6 mm for drilling small holes.
.4 Lightweight, quick-release clamps of various sizes.
.5 Strap clamps.
.6 Plunge-type core drill, capable of core drilling hole of 6 mm.
.7 Metal artist spatulas of various sizes.
.8 Carbide-tipped scriber for marking cut lines on stone.
.9 Neoprene carvers mallet, small size (130 mm diameter).
.10 Small carbide-tipped chisels of sizes 6 mm to 12 mm, dovetail-shaped.
.11 Carborundum rubbing of fine, medium, and coarse grain.
.12 Epoxy injection pump:
.13 Grout injection tanks set up for low pressure injection into joints.
.14 Submersible blender such as supplied in kitchen stores.
.15 Rotary saw Dremil type.
.16 Diamond cutting blades, turbo style, 86 mm.

2.4 MORTAR MIXES

.1 Mixes see Section 04 03 08 – Historic works - Mortaring.

.2 Mix restoration repair mortar in small quantities as needed. Mix by hand and small paddle on electric drill (2500 rpm).

2.5 SOURCE QUALITY CONTROL

.1 Retain purchase orders, invoices, suppliers test certificates and documents to prove that materials used in contract meet requirements of specification.

.2 Produce above upon request by Departmental Representative and allow free access to sources where materials were procured.

Part 3 Execution

3.1 EXAMINATION, MARKING AND RECORDING

.1 For each section of stonework, after scaffolding has been erected but prior to starting stonework removal or repair, examine the conditions of the stone works to verify the exact scope of the works and interventions to carry out on the stones.

.2 Designate a set of drawings to be used as key drawings and mark them up to provide a referencing system to identify locations of repair and replacement of stone.

.3 Mark the stone, on the face, using marking product which can be completely erased when required without damaging masonry unit:

.1 Waxless chalk directly on stone with a system of different colour per type of repair.

.4 Mark the stone using a numbering, marking, and positioning system keyed to the prepared key drawings.

.5 Ensure that temporary marking will remain in use, resistant to weather, handling and cleaning until the completion of the work or final marking of stones designated for removal.

.6 When marking is complete obtain the Departmental Representative's acceptance and agreement with respect to the scope of work. Should the agreed upon scope of work be found to vary substantially from that indicated on the drawings, the extra quantities indicated in the unit price table will cover the extra costs.

.7 Ensure that markings and adhesive are removed without damaging units .Brush with a vegetable fibre brush used either dry or with water. Use no solvent, acid or other chemical product.

.8 When stones are removed for repair or replacement, transfer temporary markings to a face which will not be visible in the final assembly using permanent markers.

.9 Make a complete photographic record of the condition of the wall prior to commencement of work.

3.2 PREPARATION

.1 Remove decayed section of stones until sound surface is reached. Obtain Departmental Representative's approval for methodology and tools to be employed before commencing this work.

3.3 PROTECTION

.1 Prevent damage to building, landscaping, pavement, which are to remain. Make good any damage.

.2 Take great care not to damage historic fabric of the works. Make good any damage.

3.4 REMOVAL OF CAULKED SEALANTS

.1 All caulking and sealants are to be removed along the joints between existing flashings and masonry, and at all other locations where caulking has been used to seal mortar joints. Refer to Section 04 03 06 - Historic works- Cleaning Masonry.

3.5 PARTIAL REPLACEMENT OF STONE (DUTCHMEN)

.1 Location and dimension of cutting required to remove deteriorated stone will be marked and agreed upon by the Departmental Representative prior to cutting and preparation works.

.2 Only stones marked on drawings or otherwise marked out by the Departmental Representative shall be cut into for purposes of repair with a Dutchman.

.3 Adjacent masonry units must not be cut into, displaced, or in any way damaged while cutting or removing masonry units and during preparation works for the Dutchmen.

.4 Departmental Representative shall approve methods and tools used for cutting out purposes and preparation works.

.5 Cutting out shall follow precise incised lines (scribed) which are squared and following right angles unless otherwise indicated on drawings.

.6 Cut out deteriorated portion to a minimum of 100 mm behind wall or arris line.

.7 Restore the bottom and side surfaces of the prepared cavity to receive the new stone.

.8 Cut Dutchman stone to dimension to fit prepared cavity snug. A tolerance of 1.0 mm will be allowed between Dutchman insert and host stone joints. This tolerance applies also to backside joint.

.9 Cut, shape and finish surface of Dutchman to match adjacent exterior surface of the cavity.

.10 Anchorage and size of Dutchmen:

.1 If Dutchman is 50 mm x50 mm and less, use epoxy cement of type MasonRe Adhesive without mechanical anchors. Moisten the Dutchman and the host stone before distempering the surfaces with epoxy cement. See details in drawings.

.2 If Dutchman is between 50 mm x50 mm and 200mm x200mm, use one to two two rods (12 mm dia.), fixed and submerged in epoxy cement. Use DHL to fill crack between Dutchman and host stone.See details in drawings.

.3 If Dutchman is 200mm x200mm and more, use two to three rods (12 mm dia.), fixed and submerged in epoxy cement. Use DHL to fill crack between Dutchman and host stone. Contractor must work with 5 different colors of DHL and Shelter Coat to match existing stones See details in drawings.

.11 Insert Dutchman flush with original surface- no set back or protruding will be accepted. It must be aligned with a joint of even width of 1 mm maximum surrounding it. Use slurry of hydraulic lime (NHL 12) to fill cavity joint around Dutchman. Thoroughly soak stone surfaces prior to applying the slurry or epoxy cement.

.12 Allow slurry and resin for anchors to set thoroughly. Wipe all slurry spills from surface to avoid lime staining.

.13 Fill remaining joints flush to surface with colour matched layer of DHL shelter coat using a syringe and needle with spatula to press flush. The DHL must cover at least 12mm in depth of the peripheral joint. Contractor must work with 5 different colors of DHL and Shelter Coat in order to match existing stones.

.14 The finish of the Dutchman must be the same as the host stone. Same texture same marking.

.15 All Dutchmen must be cutted and placed ‘on the bed" (horizontal sedimentation bed) and not in ‘’up bed’’ (sedimentation bed vertical)

.16 A stock of original stones salvaged after the fire will be available to the contractor to extract Dutchmen which may be used to repair original stones to preserve. The potential quantity of Dutchmen resulting from these stones will be determined by Departmental Representative.

.17 Contractor must recuperate all existing type 3 cut-stones to replace in order to establish an inventory reserve to withdraw Dutchmen. Departmental Representative will judge of quantities of onsite materials coming from recuperated stones and being allowed to be re-used for the project. Contractor must furnish new stones of type 3 for the rest of Dutchmen and required quantities to complete works of his contract. The coping and facing of low wall at south of south wall of old exercise room are part of the stones to dismantle to feed the inventory reserve of stones for Dutchmen. Clean manually and carefully all residing mortar on recuperated stones.

3.6 STONE PLUGS /ANCHORS TO REMOVE

.1 Core-drill a hole of the smallest size possible to remove existing anchors in the stone, generally 25 mm dia. but large enough to include the removal of all irregular edges to the existing hole.

.2 Insert stone plugs to repair holes left by the removal of existing anchors and anchors required for the current work. Stone plugs will be installed and submerged in epoxy cement with a surface finish of pigmented DHL and a Shelter Coat. Contractor must work with 5 different colors of DHL and Shelter Coat to match existing stones. A tolerance of 1mm is accepted between host stone and cylindrical stone plug. Stone plug to be of the same kind and same color as the host stone.

3.7 FLAKING OF STONE SURFACES

.1 Where surface of stone is exfoliated, flaking or disintegrating, gently rub using hand-held carborundum blocks, and pluck with small hand-held tools. Remove only pieces of loose stone without damaging the surfaces of the unit.

.2 Should the surface display significant thin-plate exfoliation or similar condition, larger hand held tools shall be applied to the surface to remove them. Strict caution must be used to avoid aggressive removal of material from the surface.

3.8 SURFACE FISSURE REPAIRS

.1 For wide fissures (i.e. over 4 mm), face up the crack with modelling clay in order to retain the grout to the injected areas of the fissure. Inject the DHL through ports placed along the length of the fissure a maximum of 75 mm apart. For small fissures (i.e. less than 4 mm), mix grout with de-ionized water to consistency that allows easy flow from a #12 and/or #16 hole size needle attached to a syringe containing the DHL deep injection grout to fill the totality of the fissure on it’s whole depth. . The protection shelter coat as well as the DHL injection grout must be pigmented to match the existing stone colour. Contractor must work with 5 different colors of DHL and Shelter Coat to match existing stones.

3.9 CONSOLIDATION OF FRACTURED STONES AND DEEP FISSURES

.1 Departmental Representative will mark location for anchor dowels on the stones as well as the number of dowels required.

.2 Contractor must compulsorily carry out consolidation repairs of fissured or fractured stones BEFORE operations of dismantling of stones.

.3 Drill small holes as marked by Departmental Representative to a minimum depth of 75 mm beyond line of crack being stitched.

.1 Hole diameters and depths shall be previously determined by the Departmental Representative.

.4 Clean hole thoroughly, first blowing out with forced air from compressor, followed by flushing with acetone. Allow solvent to evaporate.

.5 Install stainless steel dowels as noted on drawings, and as directed by Departmental Representative.

.6 Inject with epoxy, adjusting viscosity with micro-balloons to prevent unnecessary flow into unwanted voids.

.7 Once epoxy is set, drill out cured epoxy from top 12 mm of hole and fill with a colour matching repair mortar.

.8 Complete repair of crack (following item 3.8 above) using DHL injection grout and DHL shelter coat pigmented in the same color as the stone to repair. Contractor must work with 5 different colors of DHL and Shelter Coat to match existing stones.

.9 Where the crack is wider than 4 mm, then mortar repairs (following item 3.11 below) shall be carried out.

3.10 SPALL REPAIRS

.1 Spall repairs consist of recuperation of a small piece of stone fragmented or fractured and of it's reinstallation at it's original place on the damaged stone. Spalls are frequent during raking joints works. Contractor must preserve all fallen or detached pieces of stone with the aim of reinstalling them.

.2 Clean detached surfaces of dust and dirt by scrubbing with water and brush.

.3 Apply small dab of epoxy cement to dry, middle area surface of detached portion.

.4 Working quickly, squeeze the two surfaces together to secure original fitting together.

.5 Cut any squeeze out of epoxy cement while in the gel stage just prior to hardening. Finish the perimeter of glued piece with a pigmented DHL injection and Shelter Coat as described at paragraph 3.8. Contractor must work with 5 different colors of DHL and Shelter Coat to match existing stones.

3.11 RESTORATION MORTAR REPAIR

.1 A mortar repair will be judged as failed if it is not of an acceptable (hard to detect from a distance of 3 meters) colour or is cracked.

.2 The locations for mortar repairs will be marked out by the Departmental Representative.

.3 Cut out and restore deteriorated surface of the stone to form a cavity, ensuring that the edges of the perimeter of the cavity are slightly sloped in order to form a key which will maintain the restoration mortar repair in place.

.1 Depth of cavity to be 20 mm unless the substrate is not sound, in which case, cut depth to sound substrate depth. If sound substrate is deeper than 25 mm, it will be necessary to make a Dutchman as described in paragraph 3.5.

.4 Use small armatures (1mm stainless steel staples) to secure in place the restoration mortar in the cavity. Armature shall be formed from 1 mm stainless steel wire shaped into a "staple", the two turned ends of which are to be placed into predrilled holes of 10 mm depth and secured with epoxy paste Be certain that the armature is set no closer to the surface than 10 mm.

.5 Clean cavity thoroughly with pressurized air and dampen.

.6 Using small spatula-type tools press the repair mortar into the cavity. The mortar should over-fill the cavity by a slight amount. Contractor must work with 5 different colors of restoration mortar to match existing stones

.7 Protect the repair mortar with moistened burlap for several hours. When it just yields to thumb pressure, the mortar is ready for cutting and/or shaping and texturing.

.1 The time it takes before the cutting can take place will vary and depend on ambient temperature and humidity.

.8 Apply and fix in place moistened burlap over which is placed a fixed and sealed sheet of plastic polyethylene to control rapid evaporation. Maintain in place for 7 days and moisten cotton burlap 3 times a day during 7 days. Replace the peripheral sealing and polyethylene as many times as it takes during humid curing if it is deteriorated or as required by Departmental Representative.

3.12 PROTECTION OF COMPLETED WORK

.1 Protect finished work from impact damage for period of four (4) weeks after completion of works. Take necessary measures to protect finished works against bad weather and damages caused by mechanical impacts.

END OF SECTION