Part 1 General

1.1 RELATED REQUIREMENTS

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

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

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

.4 Section 04 05 19 – Masonry anchorage and reinforcing.

.5 Section 04 11 00 – Proprietary Grout Anchors.

1.2 QUALITY ASSURANCE AND STANDARDS

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

.2 All new stones to conform to the following standards:

.1 ASTM International

.1 ASTM C568 Standard Specifications for Limestone Dimension Stone – type III (for limestone)

.2 ASTM C97, Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone.

.3 ASTM C99 Test Method for Modulus of Rupture of Dimension Stone

.4 ASTM C170 Standard Test Method for Compressive Strength of Dimension Stone.

.5 ASTM C348-08, Test Method for Flexural Strength of Hydraulic-Cement Mortars

.6 ASTM C-615 Standard Specification for Granite Dimension Stone

.3 The contractor to provide the laboratory test reports and results on the types of stones required by project (Limestone of St-Marc and Limestone of Château-Richer). The tests must have been done in the 12 months prior to granting of contract to contractor. All the tests identified above at 1.2.2 to be performed for each type of stone in the project (see paragraph 2.1) and the results to be submitted to the Departmental Representative for approval. If the results do not match the requirements, the stone will be refused.

1.3 STONE QUALITY CONTROL BY DEPARTMENTAL REPRESENTATIVE

.1 The Departmental Representative shall inspect the stone blocks and stone units at the following stages:

.1 The Departmental Representative shall do a preliminary visit to the quarries (limestone of St-Marc and limestone of Château-Richer) with the contractor to validate les extraction processes, handling and transport of the stones.

.2 At the quarry: The stone blocks shall be selected by the Departmental Representative.

.3 At the Contractor's facility before cutting: The delivered stone blocks shall be approved by the Departmental Representative at the shop before the Contractor proceeds with the cutting.

.4 Prior to Installation: The cut stone units shall be approved by the Departmental Representative before installation in the building.

.5 It may occur that a block shows few defects in appearance. However cutting it, may reveal undesirable defects and/or geological imperfections, such as clay layers of more than 2 mm thickness, fissures or fractures. The stones presenting such defects will be refused by Departmental Representative, even if the block has been accepted at the quarry.

1.4 SUBMITTALS

.1 Make required submittals in accordance with Section 04 05 00 - Common Work Results for Masonry.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store, handle and protect materials in accordance with Section 04 05 10 - Common Work Results for Masonry.

.2 Deliver materials to job site in dry condition and in purpose made containers, packed to avoid chipping, damage or soiling, and protected from frost.

.3 Label each container to clearly indicate contents and location on building.

.4 Mark each stone quarry bed or direction of bedding and location of stone on building referenced to submittals. Use concealed permanent markings.

.5 Handling:

.1 Avoid excessive handling; protect against chipping damage, soiling or staining.

.2 Repairing stone damaged during handling is not permitted.

.3 Do not use Lewis pins to move stones. Lift stones only by straps or chains with edges protected.

.4 Damaged stones (spalls, bursting, fractured, fissured, etc..) by transport and handling must be totally replaced by contractor, free of charge

1.6 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.

1.7 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 MATERIALS

.1 Stone Types: supplied by the Contractor:

- .1 **Type 1** : bossage finish limestone of Château-Richer (facing sections of 1885)
- .2 **Type 2** : bossage finish limestone of St-Marc (facing sections de 1913/1914). Note that a certain quantity of these new stones must be deeper to serve as key-stones. See drawings.
- .3 **Type 3** : limestone St-Marc with cut stone finish, molded and sculpted (facing sections of 1913/1914 and 1885 and foundations of 1885). and sabot and head stone of interior consoles in the multifunctional room).
- .4 **Type 4**: limestone St-Marc with rubble stone finish (substrate sections of 1913/1914 and 1885).
- .5 **Type 5**: Stanstead granite cut finish (new lintels over pedimented windows of multifunctional room including the two square towers).
- .6 **Type 6**: New marble for partial replacement and reparations of the steps and landings of stair no.4 as per the drawings indications. New marble to be Missisquoi from Polycor, mate finish and 44mm thick.

.2 Select new stones as follows:

- .1 Free of seams, cracks or other imperfections impairing structural integrity or wall performance (ex: clay laminations of more than 3 mm thick)
- .2 Free of excessive mottling or piebald markings, clay spots, coal streaks, iron banding, or foreign substance impairing appearance.
- .3 Of colour and texture appropriate to maintain continuity with existing units to be replaced or to match adjacent units, as applicable.

.3 Anchors, cramps, dowels: to Section 04 05 19 - Masonry Reinforcement and Connectors and Section 04 11 00 - proprietary Grout Anchors.

.4 Fabrication:

- .1 Cut stone to shape and dimensions obtained from measurements and profiles taken from existing stone and/or stock of recuperated stones after the fire.
- .2 Cut stone to lay on its natural quarry bed (horizontal sedimentation bed). Lay arch stones at right angles to thrust.
- .3 Hand tool finish stone to final size and profile. Match appearance and profile of existing stone. Machine split stones are not acceptable.
- .4 Match finish variations to existing stone and to approval of Departmental Representative.
- .5 Cut stone pieces to within tolerances exhibited by similar existing stones.
- .6 All s lateral surfaces of stone which are in contact with mortar in joints must have a bush hammered finish for a better hold of the mortar.
- .7 Preserve all cut stones to replace, to make Dutchmen which will be used to repair existing damaged stones and stones to preserve.
- .8 Dress backs of stone to match original shape and keying into the core of wall.

2.2 GENERAL PHYSICAL PROPERTIES REQUIRED

.1	LIMESTONE PROPERTY STANDARDS		TYPE III
	.1	Density, min. kg/m^3	2560
	.2	Absorption by weight, max. %	3.0
	.3	Compressive strength, min. MPa	28
	.4	Modulus of rupture, min. MPa	6.9
	.5	Abrasion resistance, min. hardness	10
.2	GRANITE PROPERTY STANDARDS		
	.1	Density, min. kg/^{m3}	2560
	.2	Absorption by weight, max. %	0.4
	.3	Compressive strength, min. MPa	131
	.4	Modulus of rupture, min. MPa	10.34
	.5	Abrasion resistance, min. hardness	25
	.6	Flexural strength	8.27

2.3 ANCHORS TIES AND MORTARS

.1 Anchors, cramps, dowels: refer to Section 04 05 19 – Reinforcing, connectors and anchors for masonry.

.2 Mortar: refer to Section 04 03 08 – Historic works - Mortaring.

Part 3 Execution

3.1 PREPARATION

.1 Prevent absorption of ground water and exposure to rain. Stones must be delivered on wood pallets in good condition. Rest stones in their natural bedding.

.2 Handling:

- .1 Move and lift stone units using means to prevent damage. No lifting process using a Lewis-pin system is authorized.
- .2 Submit stone units dropped or impacted to Departmental Representative for inspection and approval.
- .3 Do not make holes or indentations for Lewises or dogs on face or top side of stone.
- .4 Fill holes after moving and lifting.

.3 Indicate bedding planes of stone units. Duplicate bedding marks on usable pieces of cut stone.

.4 Place safety devices and signs near work area, as directed.

.5 Install shoring and supports as required-have the contractor’s structural engineer validate shoring and supports.

3.2 CUTTING AND SIZING OF STONES

.1 Use callipers, squares and levels to measure hole for new stone.

.2 Site trim by cut-sizing new stone with joint widths not more than joint width of existing stone.

.3 Joint between cut and rubble: min 8 mm and max 12 mm.

3.3 MOVING STONES

.1 Use approved methods to move stones horizontally and to lift stones to working level.

.2 Move, handle and set stones without causing damage.

3.4 RESETTING MISALIGNED STONES

.1 Where indicated, re-set misaligned stone. Construct and brace temporary supports for arches to resist loads.

.2 Remove stone units and mortar as necessary.

.3 Re-set stones true to line and install dowels and cramps.

.4 Remove supports.

3.5 NEW STONE INSTALLATION

.1 Rake carefully peripheral mortar joints by sawing a clearing saw cut. If stone is still solid in the wall, make deconsolidation openings of 150 mm deep with a bit drill in the peripheral joint and at each 50mm without damaging adjacent stones. Id stone is not deconsolidated after borings; proceed with a saw with double parallel blades of type Arbotech. Remove the stone.

.2 Remove all loose fragments and the deteriorated mortar of stone/ brick substrate of wall. Remove all loose masonry elements and restore substrate on a depth of 150mm or 300mm when new stone is a key-stone as identified on drawings.

.3 Departmental Representative must inspect existing conditions of substrate before contractor can continue with the following step. Obtain approval of cleaning of back wall (mortar residues) by Departmental Representative before inserting the stone.

.4 Do back pointing of all stone/brick exposed substrate joints once the restoration is done. Repointing of exposed substrate will be at 100% and up to a depth of 100 mm.

.5 Consolidate and parge the totality (100 %) of exposed substrate with mortar - fill all apparent voids before reinstalling facing stone.

.6 Drill holes and install anchors as prescribed in pertinent sections. Allow prescribed curing period in the pertinent sections before drilling the holes.

.7 Cut stones for connectors and support systems. Set connectors to face stone in appropriate sequence.

.8 Mortar fill deep voids of cores to within 50 mm of back of stone in maximum 50 mm lifts. Build up thicknesses with stone pieces set in mortar to replace original bonding pattern of core to face work.

.9 Reconstruct masonry to ensure full embedding of grouted portion of anchors.

.10 Allow mortar to harden for a period of 24 hours before proceeding to grout injection. Insert grout tubes along the top joint. Inject grout by gravity around the replaced stone or stones.

.11 Clean stone by washing with water and natural fibre brush. Moisten cavity surfaces to fill and apply the bedding mortar.

.12 Set stones plumb, true and level in full bed of mortar and with vertical joints filled full except where otherwise specified. Set stones in same orientation as removed stones with even joint widths. Install stones in the same orientation as the one of the removed stones with joints of uniform width. Install the facing stone in it's original location. Install the masonry unit at exact location with hardwood wedges impregnated with water

.13 Lay heavy stones and projecting stones after mortar in courses below has hardened sufficiently to support weight.

.14 Set large stones on high density plastic wedges to support stone in proper alignment until mortar has set. Remove wedges when dry, do not break off.

.15 Prop and anchor projecting stones until wall above is set.

.16 As work progresses, sponge along joints to free them of mortar and remove mortar droppings from face of stone before mortar is set.

.17 Proceed to surface pointing only when grout has hardened and humidity caused by grout installation has dried. Clean mineral salts and efflorescence which may have formed on stone surface with a nylon brush before doing surface pointing.

3.6 NEW KEY STONE

.1 A certain percentage of new stones are key stones which are deeper than the stones to replace. See drawings for their quantities, locations and depth.

3.7 STONES TO ANCHOR

.1 A certain percentage of existing stones to reinstall and new stones will be to mechanically anchor to the substrate. See drawings for their quantity, locations and depth. See section 04 05 19 REINFORCING, CONNECTORS AND ANCHORS FOR MASONRY pour for types of anchors.

3.8 FINISH POINTING

.1 See section 04 03 07

3.9 CRUSHING EXISTING STONES

.1 Contractor to transport and crush enough existing stones to be replaced in order to generate 2 cu.m. of crushed stones of an average dimension of 25mmx25mmx25mm. The crushed stones below 19mm and above 30mm will be rejected. The contractor to provide sample of crushed stones (0.25cu.m.) to Departemental Representative for approuval.

.2 Crushed stones to be used to build the new decorative bands at the floor level in the Lobby. Crushed stones to be drowned in epoxy in the decorative band. Provide 1lin. m. of sample of the decorative band for the Departemental Representative's approuval.

.3 The existing stones to be crushed are to be selected by the Departemental Representative.

.4 The contractor's cost must cover all required activities and operations to deliver and installed th crushed stones (transportation, manutention, crushing, installation, etc).

END OF SECTION