Part 1 GENERAL

1.1 SUMMARY

1. This Section to conform to Section 01 01 00, General Requirements.
2. Work Included in this Section

.1 Raking out and pointing of joints in existing stone masonry.

.2 Hand grouting voids.

.3 Backpointing of joints.

.4 Pointing of joints in new and repaired stone masonry.

.5 Cutting Out and Replacement of Stone.

.6 Repair of stone.

.7 Preparation of reglets.

.8 Removal of surplus equipment, metal fixings, including pointing of scaffold tie holds.

.9 Miscellaneous repairs.

1.2 RELATED WORK SPECIFIED ELSEWHERE

1. Masonry Procedures: Section 04 03 05 01
2. Masonry Mortaring: Section 04 05 13
3. Mortar Restoration: Section 04 05 20 91
4. Masonry Accessories: Section 04 05 23
5. Masonry Restoration: Section 04 05 20 91
6. Masonry Cleaning: Section 04 01 20 52

1.3 SUBMISSIONS

1. Submit samples, literature and details of tools, machinery and equipment as specified in Section 04 03 05 01, Masonry Procedures.
2. Execute mock-ups as specified in Section 04 03 05 01, Masonry Procedures.
3. Prepare materials for testing, in accordance with requirements of Section 04 03 05 01, Masonry Procedures.

1.4 QUALIFICATIONS

1. Comply with requirements specified in Section 04 03 05 01, Masonry Procedures for all aspects of work specified in this section.

2. All consolidation, pinning, filling, and cleaning shall be carried out by a heritage conservator or under the continuous supervision of a heritage conservator.
3. Provide full career details of training and experience of individuals proposed for the work of this section. Only individuals with relevant training and experience shall carry out this work. Individuals without relevant qualifications shall be rejected.

1.5 SEQUENCE OF WORK

1. Refer to sequence of work specified in Section 04 03 05 01, Masonry Procedures.
2. The Contractor shall develop a sequence of work which shall be agreed with the Consultant.

1.6 MOCK-UP

1. Execute mark-up for each type of conservation procedure including pinning, grouting, crack injection, repair mortars and shelter coating.
2. Where colour of stone dictates, execute as may repair mortar mock-ups necessary to match the variations in stone colour.

Part 2 PRODUCTS

2.1 GENERAL

1. The use of any materials or custom equipment not listed below is not permitted without prior review of the Consultant and Masonry Consultant.
2. Substitutions for any materials or custom equipment is not permitted without prior review of The Consultant and Masonry Consultant.

2.2 PRODUCT DELIVERY, STORAGE AND HANDLING

1. Materials have limited shelf life.
2. Ensure materials are delivered to site in original, unopened containers.
3. Do not allow materials to freeze.

2.3 MATERIALS

1. Dispersed Hydrated Lime-based Materials:
   - .1 Dispersed Hydrant Lime Injection Mortar: Proprietary injection compound composed of dispersed hydrant lime, marble powders, mixing water and dispersing aids of not more that 0.4% by weight.
   - .2 Dispersed Hydrated Lime Putty: Proprietary lime mortar compound composed of dispersed hydrated lime, mixing water and dispersing aids of not more than 2% by weight.
   - .3 Dispersed Hydrated Lime Putty: Proprietary lime mortar compound composed of dispersed hydrated lime, mixing water and dispersing aids

of not more than 2% by weight.

.4 Dispersed Hydrated Lime Shelter Coats:

Proprietary lime mortar compound composed of dispersed hydrated lime, marble powders, mixing water and dispersing aids of not more than 0.45 by weight; custom coloured to match stone, to be approved by The Consultant and Masonry Consultant.

.5 The dispersed hydrated lime products may be obtained from Liner Rolpaint, Toronto, ON.

2. Syringes; plastic 10cc - 50cc.
3. Injection needles; length and gauge to suit application.
4. Pins; threaded nylon or stainless steel; length and diameter to suit application.
5. Resin for pin setting: Type to be agreed with The Consultant and Masonry Consultant.
6. Aggregate as supplied in Section 04065 -Historic Mortars, to pass 2.36 mm size.
7. Crushed black granite dust; to pass 2.36 mm sieve.
8. Ethyl Alcohol.
9. Clean water.
10. Sponges, cotton rags, absorbent towels.

11. <u>Materials Specified Elsewhere</u>

.1 Masonry Mortaring: Section 04 05 13
.2 Masonry Accessories: Section 04 05 23
.3 Unit Masonry: Section 04 20 00
.4 Masonry Cleaning: Section 04 01 20 52
.5 Reinforced Unit Masonry: Section 04 26 19
.6 Masonry Anchorage and Reinforcement: Section 04 04 15

Part 3 EXECUTION

3.1 PREPARATION

1. Seal and protect all openings, doors, windows and adjacent areas to prevent damage and the spread of construction dust, water or other materials into the building or onto adjacent sidewalks.
2. All sills and projecting courses are to be covered with rigid protection, secured into joints, for the duration of the work.
3. Any part of scaffolding, shoring or any construction plant shall not directly bear against the masonry. Provide isolating material of lumber or plywood with additional padding as necessary to prevent damage to the existing masonry.

3.2 TREATMENTS

1. The sequence of treatments for any block of stone will depend on the nature of the substrate. Confirm with The Consultant and Masonry Consultant concurrence with the treatments shown on the drawings. Report any variation prior to commencing work.

3.3 MORTAR REMOVAL FOR REPOINTING

1. Generally

.1 ***This project involves 25% repointing of all mortar joints in the contract area***.

.2 Mortar is defective when:

i It is cracked.
ii It is spalled, chalked, dusted or otherwise crumbling and excessively weathered back.
iii The Consultant states so in writing.

.3 Where mortar is found to be defective beyond specified raking depths, continue raking until sound mortar is encountered.

.4 Be aware that additional raking out beyond specified depths will be necessary and that voiding can be expected, requiring alternately backpointing or grouting prior to finish re-pointing.

.5 If masonry unseats or bond is broken, remove unit and reset.

2. Tools and Techniques

.1 Tools for cutting out shall be narrower than the joint.

.2 Cutting out of mortar shall be carried out by one of the following techniques.
i. Cutting out with hammer and chisels with dust channels, cutting away from the arrises to prevent spalling of the masonry.
ii. Flat-bladed quirks and light hammers, hacksaw blades or similar tools are to be used where fine joints are encountered.
iii. Small hand-held low-impact pneumatic carving tools, fitted with appropriate points and chisels to the approval of the Consultant for cutting out rock-faced work only.
iv. Hand held rotary saws or any type of grinder or wheel are not permitted on this project.

.3 Clean joints back for the full specified depth, removing all mortar on the masonry surfaces to a square surface of existing mortar at back of joint.

.4 Clear the joints of all loose particles of old mortar and leave ready for inspection.

3. Damage

.1 Take care to prevent damage to masonry units resulting from cutting out operation.

.2 Damage includes the widening of existing joints, nicks, gouges and chipped or scratched surfaces from cutting out tools, resulting from improper workmanship.

.3 Any damage to existing masonry as a result of the cutting out process is unacceptable. Damage shall result in the Contractor changing the approach, technique or individuals carrying out work, so that no damage occurs. Continuing damage shall result in the Consultant stopping the work and requiring all operatives involved in the work to undertake a three-day training workshop before recommencing cutting out operations on the building. All damaged masonry units shall be replaced at no change in the contract cost or schedule.

4. Inspection

.1 Provide access, permit inspection, correct any defects and obtain approval of all raked joints prior to commencing pointing.

5. Depth of Raking

.1 Raking shall be carried out to at least twice the width of the joint to a minimum depth, measured from the arris of the masonry unit, of not less than 20 mm.

.2 Generally:

i Stone masonry, mortar joints: 12 mm.

3.4 CUTTING OUT AND REPLACEMENT OF STONE

1. Cutting Out of Stone

.1 Cut out all damaged stone where indicated on the drawings for replacement or repair.

Obtain approval of The Consultant prior to proceeding.

.2 Where large blocks are scheduled for replacement, existing stone shall be cut out so that entire blocks may be reclaimed.

.3 All existing stone removed shall become property of the Owner unless specified otherwise.

.4 Contractors shall be responsible for shipping remaining stone to client's storage yard.

.5 Advise the Consultant of any damaged stone not identified for replacement or repair prior to commencing repair work.

.6 Where indenting stone pieces into block slightly undercut vertical beds and allow a few millimetres space at the rear.

.7 Generally indented stone shall have a minimum bearing of 150 mm on bed.

2. Setting Stone

.1 Drench dry stones with clean water just prior to setting.

.2 Install anchors, dowels and cramps.

.3 Set stones true and in alignment, maintain joint thicknesses with soaked softwood, or plastic wedges until bedding mortar has set.

.4 Pack exterior horizontal and vertical joints with plastic foam joint filler and leave ready for repointing.

.5 Remove wedges when dry without breaking them off.

.6 Grout vertical joints of projecting course.

.7 Pack exterior profile of these joints with plastic foam joint filler set to leave 30 mm from face of joint.

.8 Fill joints behind packing with liquid bedding mix.

.9 Sponge off any mortar droppings as work progresses.

.10 Remove plastic foam joint filler and leave joints ready for pointing.

3.5 REPAIR OF STONE

1. Indenting Stone Pieces into Block [Dutchman Repairs]

.1 Select stone to match surrounding colour, free from defects and with bedding to match adjacent work.

.2 Cut piece of sufficient surface area to cover the area of damage to be cut away to rectangular or square frame, min. 50 mm deep and rub and finish all bed faces to ensure fine, true, uniform arrises, with 1 mm joint between host stone and Dutchman.

.3 Transfer outline onto damaged area by scribing.

.4 Cut out to scribe lines using tempered chisels by hand ensuring that the edges are not plucked or spalled. Undercut bed joints as described in 3.3.3. above. Obtain approval from The Consultant before commencing any cutting on site.

.5 Drill the back of the piece and set minimum two stainless steel threaded pins with resin mortar minimum 10 mm, maximum 20 mm, allowing 15 mm projection and allow to cure.

.6 Transfer pin location and drill out host stone to receive pins.

.7 Grout holes with thixotropic resin mortar.

.8 Prepare repair mortar: stone dust mortar and butter cavity to receive piece.

.9 Ease piece into cavity, ensuring pins locate into holes and clean off mortar from face.

.10 Leave face of piece slightly proud and finish to original profile and finish by rubbing back or tooling as required. Rubbing back marks on existing stone are not permitted.

2. Repairs to Deteriorated Stone

.1 Repairs In-situ: Filling voids in stone

i Remove all existing mortar and filling materials from cracks and voids using hand tools. Do not damage surface of stone during removal.

ii Build up mortar in void by packing repair mortar in layers not exceeding 15 mm in depth.

iii Allow mortar to achieve thumb print hardness before applying next layer.

iv Finish mortar filling by stippling back mortar to compact the joint and finish it just behind the arrises of the stone.

.2 Repair of Cracked (Split) Stone

i Remove stone to be repaired by cutting out mortar around perimeter. Maintain support to surrounding masonry as necessary.

ii Clean surfaces of stone to be repaired.

iii Prepare thixotropic resin and resin: stone dust mortar.

iv Drill holes for stainless steel threaded pins to re-anchor stone together.

v Set pins with thixotropic resin mortar.

vi Apply repair mortar to entire surface of stone to be bonded.

vii Clamp using softwood shims and allow to set.

viii Remove any mortar squeezed out of crack promptly to prevent staining.

ix Re-set repaired stone.

.3 Pinning Back Surface and Filling

i. The number of pins and their location shall be agreed with the Consultant and Masonry Consultant prior to commencing work.

ii. Mask off surrounding areas to prevent the spread of dust

iii. Drill hole 50% larger than stainless steel pins. Stainless steel threaded pins will range from
2mm to 5mm in diameter.

iv. Clean dust from holes using acetone and cotton swabs

v. Determine dowel length, ensuring sufficient room for mortar plug at surface.

vi. Run resin stone dust mix into hole in order to set ends only of dowel.

vii. Place with fine tools or hypodermic syringes.

viii. Spread resin on dowel and place in hole, plug ends with cotton swabbing as necessary
to retain resin in hole.

ix. Remove swab and when resin set plug deep holes with repair mortar, shallow holes with
the lime shelter coat.

.4 Filing of Cracks

i. Flush crack with clean water until all dirt and loose material are flushed from crack.

ii. Carrying out final flushing with l0% ethyl alcohol solution.

iii. Prepare dispersed hydrated lime injection mortar by diluting with de-mineralized water up to 30%.

iv. Inject lime grout into cracks, ensuring complete tilling. Depending on the crack, filling may require

from a single application to multiple applications and where very deep, damming of the surface will be necessary to ensure complete filling.

v. Keep surface of stone clean of grout spills, as the work progresses. Do not allow grout to

be absorbed into surface.

vi. Where appropriate, use undiluted injection grout to fill outer parts of crack or where width

of crack warrants.

vii. Allow grout to harden.

viii. Prepare dispersed hydrated lime shelter coat for use.

ix. Inject shelter coat over the lime grout to mask the white colour. Pill out crack flush with adjacent

surface. Re-apply as necessary to achieve flush surface.

x. Clean up any spills or runs immediately.

.5 Grouting of Thin Plates of Stone

i. Where grouting is required, drill pattern of grouting and pouring holes. Hole diameters should be as small as possible.
ii. Ensure lowest point of hollow area is drilled to avoid trapping flushing water.
iii. Flush out with clean water followed by l0% ethyl alcohol solution.
iv. Grouting procedure may vary according to the situation, with filling of void either from the top holes or by filling up in lifts from the bottom. Ensure hollow areas are completely filled.
v. Grout using dispersed hydrated lime injection mortar, diluted not more than 30%, but at the appropriate viscosity to provide ideal flow for the particular condition.
vi. Empty gentle vibration to assist flow.
vii. Clean up all spills as the work proceeds.
viii. Fill all holes with lime shelter coat.

.6 Repair Mortar Fillings

i. Prepare samples of repair mortars to meet the variation of colour in the stone.

ii. The characteristics of the repair mortar when wet and dry should be similar to the stone in colour, texture and permeability.

iii. Prepare aggregates and stone dusts in order to avoid the use of pigments.

iv. Prepare mock-ups using repair mortar prepared in proportions varying from 1:6 to 1:9, dispersed hydrated lime putty to aggregates.

v. Pre-wet surface prior to application. Place repair mortars in up to l5mm layers and allow to harden before applying second layer.

vi. At surface slightly overfill, leaving repair mortar proud. Cover with damp absorbent towel.

vii. At appropriate time, work back repair mortar to finish flush with adjacent stone.

viii. Texture surface of repair mortar to match adjacent surface.
ix. Keep repair mortar damp for a minimum of three days.

.7 Application of Shelter Coat

i. The dispersed hydrated lime shelter coat may be applied as a surface treatment to weak and friable stone to consolidate the outer face of the stone and provide a sacrificial surface. Treat entire stone.
ii. Prepare surface by scraping back loose material with modern spatulas.
iii. Pre-wet surface.
iv. Apply lime shelter coat by brush, working it into the surface. Wipe off excess with burlap cloths and clean cotton rags.
v. Protect treated surface with damp absorbent towels or cotton rags. Keep damp for three days.

3. Resetting Misaligned Stone

.1 Remove stone units as necessary to reset all stone in true alignment.

.2 Drill stones for new dowels across joints and for cramps to tie back stone into core where possible.

.3 Re-set stone and install dowels and cramps.

4. Strike Centring.

.1 Dressing of Stone at Flashing Upstands
.2 Where flashings are required to vertical stone surfaces to reglets, prepare stone as follows:

i Determine the location of all such situations and agree requirement for dressing of stone with the Consultant prior to proceeding.
ii Dress irregular stone surfaces to smooth face to accommodate flashing upstand dressed back against stone.
iii Use hand-held low impact pneumatic stone-carving chisels only.
iv Dress surfaces to smooth and true face.

5. Rubbing Back Stone

.1 Where indicated on drawings rub back friable stone to remove loose detail only.
.2 Agree all locations with The Consultant. Prepare sample etc. as below.
.3 Rub back with sandstone blocks to prevent marking of stone.

6. Dressing Back Stone

.1 Where indicated on drawings dress back stone.
.2 Agree all locations with The Consultant. Prepare sample for approval by The Consultant prior to commencing work.

.3 Dress back loose and friable stone using hand tools only.

.4 Leave stone without ledges which will trap moisture.

7. Cutting Drips in Stone

.1 At locations indicated on the drawings cut drip in soffit of stone.

.2 Mount guide to ensure accurate cuts.

.3 Cut drip using grinder, stopping short of ends.

.4 Finish ends by hand.

8. Removing Cement and Resin from Stone

.1 Remove all cement and resin surface coatings, patches and previous filling of cracks and repairs on surface of stone.

.2 Tools and technique for removal shall be agreed with The Consultant. Prepare sample for approval by The Consultant prior to commencing work.

.3 Removal shall be carried out using a combination of hand and power tools to minimise damage to surface.

.4 Where voids or cracks remain in stone as a result of removal of cements and resins, repair stone as described previously above.

3.6 HAND GROUTING

1. Hand grout voids that cannot be successfully filled by backpointing procedures. Obtain The Consultant's acceptance of voids and damming procedures prior to commencing grout operations.

2. Prior to grouting, ensure that grout will not penetrate into intentional cavities in walls by examining site conditions at back faces of voids and joints. Report findings to the Consultant. Grouting may occur only where intentional cavities cannot be filled by grouting operations. Take all measures required to contain grout in voids and joints to be grouted using temporary damming materials, and as specified below.

3. Carefully flush out joints and voids to be grouted to remove all loose materials and prewet backup materials. Do not oversoak wall, and ensure water does not penetrate to the interior, damage interior finishes, or flood intentional cavities.

4. Pack solid faces of joints to be grouted with non-staining, non-oily, plumber's hemp or other acceptable damming material to a minimum depth of 20 mm, so that grout will be contained in the joint or void, and the void can be filled solid. Where required to keep grout from intentional cavities in the walls, install temporary dams to back face of joint.

5. Form grout cup on wall at top of void or joint to be grouted using non-staining, non-oily, potters clay or other acceptable material to direct grout into voids without staining walls. Keep clay cups damp to prevent drying and cracking. Other methods of directing grout into voids and joints will be acceptable to Architect's approval.

6. Pour grout into joint or void via clay cup, until voids filled. Do not exceed one metre lifts or one vertical joint at any one time.
7. Continually observe interior and exterior faces of wall at grouting during grouting operations. Cease grouting if leaks occur at interior. Seal all leaks and make good all damage caused to the satisfaction of the Consultant.

8. Remove any grout spills immediately, using clean water and non-metallic bristle brushes to wash surfaces.

9. Allow grout to set for 24 hours, then remove hemp packing, temporary dams, grout cups, and other grouting aids.

10. Allow grout and wall to fully dry [minimum 3 weeks] before commencing finish pointing.

3.7 BACKPOINTING

1. Obtain acceptance of raked out work prior to commencing pointing operations.

2. Where cut out joints are deeper than raking out depths specified above, backpoint joints to bring mortar face to specified depth for raked out joints, in preparation for finish pointing. Where voids exist that conventional backpointing cannot fill, grout voids in accordance with 3.4 Hand Grouting above.

3. Immediately prior to pointing, thoroughly wet joints in order to control absorption.

4. Allow water to soak into masonry and mortar, leaving no standing water but remaining wet.

5. For backpointing, fill all joints full with pointing mortar, compacting mortar firmly into joints to ensure positive adhesion to all inner surfaces. Place mortar in layers, maximum 30 mm thick, minimum 12 mm thick, allowing each layer to set to thumbprint hard before placing next layer. Bring face of mortar in backpointed joint to specified depth for raked out joints, measured from the arris of the masonry unit, leave ready for final pointing.

6. Prevent mortar from being placed or smeared onto face of stone to prevent mortar staining of masonry faces during backpointing.

7. Keep work clean, remove all droppings as work proceeds, and again at the end of each day.

3.8 POINTING OF JOINTS

1. General

.1 Obtain The Consultant's acceptance of raked out, backpointed, and grouted work prior to commencing pointing operations.

.2 Prevent mortar from being placed or smeared onto face of stone to prevent mortar staining of masonry faces during pointing.

.3 Allow water to soak into masonry and mortar, leaving no standing water but remaining wet.

.4 Fill all bed and head joints full with pointing mortar, compact joints firmly to ensure positive adhesion to all inner surfaces.

.5 Thoroughly compact mortar into joint.

.6 At initial set, finish joints with stripping action using a short stout bristle brush to compact the joint further and produce a textured finish, exposing the aggregate. Do not project the mortar past the arrises or feather the mortar.

.7 On the rock faced work keep joints back approximately 3 mm behind arrises. On the cut stone and decorative work keep joints back approximately 1 mm behind arrises.

.8 Keep work clean, remove all droppings and clean faces of masonry units as work proceeds and again at the end of each day.

2. Protection on Completion

.1 Protect newly laid mortar from frost, rainfall or rapid drying conditions for three weeks.
.2 Protect newly laid mortar from frost until mortar is fully cured; minimum 3 weeks.
.3 Provide burlap enclosure and misting for minimum 48 hours to prevent initial shrinkage of mortar.

3.9 PREPARATION OF REGLETS

1. Cut and prepare reglets for all flashings where required.

2. Cut reglets 12 mm high and 25 mm deep for copper flashings and cut reglets 20 mm high and 30 mm deep for lead flashings. Obtain approval of The Consultant before cutting any stonework. Remove all loose mortar or stone to clean, square face at the back of the reglet.

3. Use straight edges to maintain accurate cuts.

3.10 REMOVAL OF SURPLUS EQUIPMENT AND METAL FIXINGS, INCLUDING POINTING OF SCAFFOLDING TIE HOLDS

1. Remove all metal fixings, brackets, wires, bolts, nails, screws and shields from masonry.
2. Remove any anchors or plugs by coring to ensure their complete removal.
3. Repoint where removed from mortar joints and at fixings on striking the scaffold.
4. Where removed from masonry unit and masonry unit will not be replaced patch hole with repair mortar.
5. Finish flush with face of masonry unit.
6. Do not permit this matrix to spread onto face of masonry.

3.11 CUTTING OUT AND REPLACEMENT OF DETERIORATED BRICK

1. Cut out all damaged back up brick and prepare for replacement with new brick.
2. Brick is damaged when:

.1 It is cracked, chipped or spalled.
.2 The outer face of the brick is hollow, detached or missing.
.3 The Consultant states so in writing.

3. Maintain stability of structure at all times.

3.12 LOCALIZED REPLACEMENT OF BRICKS

1. Bond, coursing and jointing to match existing.
2. Dampen back up masonry thoroughly and evenly; allow surface to dry.
3. Set bricks in full bed of mortar true to line and level with adjacent units.
4. Ensure cavity to rear of brick is filled solidly with mortar.
5. Fill and compact bed and vertical joints until filled solidly with mortar.
6. Tool joints flush to match existing.

3.13 REBUILDING AREAS OF BRICKWORK

1. Carry out work all as described in drawings.
2. In addition the following requirements apply:
   .1 Where replacing in excess of four bricks in one area, install masonry ties to bond facing with back up wythes of masonry.
   .2 Ties should be randomly installed except where areas are sufficiently large for ties to be set every 600 mm. horizontally and every 400 mm. vertically with staggered centres.
   .3 Ensure ties are solidly set in back up wythe.

End of Section 04 05 20 91.