



PACKAGE B: R33 FORT LASALLE

THIS DOCUMENT CONTAINS A SECURITY REQUIREMENT

Specifications | Devis

Project Name Nom du projet :	Fort Lasalle Building R33 - Masonry Repairs - Phase 3
DND Project File :	500770978 OK-000023
DCC Project File :	KN169905
Drawing Number Numéro du projet :	K-K74-6602/55
Date Date :	2026-05-01
Location Emplacement :	Fort LaSalle R33, 20 Amiens Ave. Address Adresse Royal Military College of Canada, Kingston City Ville ON Province Province
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 A circular seal for a Licensed Professional Engineer in the Province of Ontario. The outer ring contains the text "LICENSED PROFESSIONAL ENGINEER" at the top and "PROVINCE OF ONTARIO" at the bottom. Inside the ring, there is a signature in blue ink. Below the signature, the name "H. SAFFARINI" is printed, followed by the license number "100128946" and the expiration date "2026-05-01".	 A circular seal for the Ontario Association of Architects. The outer ring contains the text "ONTARIO ASSOCIATION" at the top and "OF ARCHITECTS" at the bottom. Inside the ring, there is a signature in blue ink. Below the signature, the date "2026-05-01", the name "SHANE SOLOMON", the word "LICENCE", and the number "7362" are printed.	

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Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.
- .2 U.S. Environmental Protection Agency (EPA)/Office of Water
 - .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.2 SITE CONDITIONS

- .1 Hazardous Materials: Hazardous materials are present in building to be selectively demolished. Refer to Section 01 35 43 - Environmental Procedures.
- .2 Notify DCC Representative before disrupting building access or services.

Part 2 Products

Not used.

Part 3 Execution

3.1 EXAMINATION

- .1 Inspect building with DCC Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.
- .2 Locate and protect utilities. Preserve active utilities traversing site in operating condition.
- .3 Notify and obtain approval of utility companies before starting demolition.
- .4 Protection of In-Place Conditions:
 - .1 Prevent movement, settlement, or damage to adjacent structures, utilities, landscaping features, and parts of building to remain in place. Provide bracing and shoring required.
 - .2 Keep noise, dust, and inconvenience to occupants to minimum.
 - .3 Protect building systems, services and equipment.
 - .4 Provide temporary dust screens, covers, railings, supports and other protection as required.
 - .5 Perform Work in accordance with Section 01 70 12 – Safety Requirements.
- .5 Demolition/Removal:

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- .1 Remove items as indicated.
- .2 Remove parts of existing building to permit new construction.
- .3 Trim edges of partially demolished building elements to tolerances as defined by DCC Representative to suit future use.

3.2 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning and Waste Management.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning and Waste Management.
- .3 Refer to demolition drawings and specifications for items to be salvaged for reuse.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 00 - Cleaning and Waste Management.

END OF SECTION

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Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 04 03 07 – Heritage Masonry Repointing.
- .2 Section 04 03 08 – Heritage Mortars and Grouts

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CSA A179-04(R2014), Mortar and Grout for Unit Masonry.
 - .2 CSA-A371-04(R2014), Masonry Construction for Buildings.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .3 Environmental Abatement Council of Ontario (EACO).
 - .1 EACO Mould Abatement Guidelines Edition 2, 2010.
- .4 Canada's Historic Places.
 - .1 Standards and Guidelines for the Conservation of Historic Places in Canada Second Edition, 2010.

1.3 SUBMITTALS

- .1 Submit documents and samples.
- .2 Product Data: submit manufacturer's printed product literature, specifications and data sheet for each product:
 - .1 Indicate date of manufacture of product and shelf life.
 - .2 Indicate initial rate of absorption, saturation coefficient and compressive strength of bricks.
 - .3 Submit two copies of WHMIS MSDS.
- .3 A list of tools and equipment to be used for all masonry work including for raking and repointing joints and for mortar repairs.
- .4 DCC may request post award a list of workers, masons and foremen. The lists should be organized into teams of workers to be used for each of the following tasks:
 - .1 Masonry Cleaning:
 - .1 General cleaning of work area.
 - .2 Removal of specific stains such as copper, iron and paint.
 - .3 Removal of organic material.

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- .2 Wall restoration:
 - .1 Masonry raking and repointing
- .3 Mortar mixing: no more than two people should be assigned the task of mixing all mortars for the project. Both need to have been approved by the DCC Representative through the mock-up process.
- .4 Scheduling.
 - .1 Submit dates indicating critical stages in masonry work. Include supply date, and delivery to site.
- .5 Test Reports.
 - .1 Submit certified test reports showing compliance of materials with specified performance characteristics and physical properties.

1.4 QUALITY ASSURANCE - EXECUTION

- .1 Perform work in accordance with established procedures for historic masonry conservation and The Standards and Guidelines for the Conservation of Historic Places in Canada.
- .2 Masonry contractor
 - .1 Use single Masonry Contractor for all masonry work.
 - .2 Masonry contractor shall have a good level of understanding of structural behavior of masonry walls when masonry work involves replacing or repairing stones which are part of structural masonry work.
- .3 Masons:
 - .1 Ensure all personnel involved with historic masonry restoration are adequately trained and familiar with the requirements of this Section .
 - .2 Masons are to have proof of training for all proprietary restoration mortars and grouting.
- .4 Perform work under the observation of the DCC Representative.
 - .1 Provide demonstrated, specialized, skilled and competent trades persons who shall have experience in all types of specified work. The skills of individuals will be subject to review and acceptance by the DCC Representative. Review will include production of basic mock-ups for all types of work specified.
 - .2 No workers shall be substituted during the progress of the work without the written acceptance by the DCC Representative.
 - .3 All workers shall be required to demonstrate competence levels of each masonry procedure to the satisfaction of the DCC Representative, before being permitted to work on the building.

1.5 QUALITY ASSURANCE – MOCK-UPS

- .1 Construct mock-ups under supervision of DCC Representative to demonstrate a full understanding of specified procedures, techniques and formulations are achieved before

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- work commences. Construct mock-ups in accordance with Section 01 45 00 – Quality Control.
- .2 Construct mock-ups for each type of work procedure specified in part 3 of specifications 04 03 07 and 04 03 08.
 - .3 Work cannot proceed for each type of work procedure in part 3 of specifications 04 03 07 and 04 03 08 without a reviewed and accepted mock-up. There will be no exceptions.
 - .4 For all work procedures in part 3 of specifications 04 03 07 and 04 03 08, only workers who performed a given mock-up will be allowed to perform the specified work procedure in question. There will be no exceptions.
 - .5 Construct mock-ups to illustrate:
 - .1 General cleaning and cleaning for each type staining.
 - .2 Each type of repair procedure.
 - .3 Deep-raking and very-deep-raking out of mortar: 4 m including horizontal and vertical joints at the following locations: areas of wall to be dismantled and reconstructed; areas of removal of the outer stone wall and areas of wall to be repointed.
 - .4 Repointing: Each type of stonework and mortar type, including methodology to meet environmental requirements for mortar curing. Include front-pointing color mock-up on wall, minimum size 1 m2.
 - .5 Deep-Backpointing and very-deep-back-pointing: each type of stonework and mortar type, including methodology to meet environmental requirements for mortar curing.
 - .6 Mock-up will be used:
 - .1 To judge workmanship, substrate preparation, operation of equipment and material application.
 - .2 For testing to determine compliance with performance requirements.
 - .3 Quality and degree of finish required.
 - .7 Construct mock-up where indicated by DCC Representative.
 - .1 All mock-ups indicated above will be in same location.
 - .2 Coordinate and sequence activities accordingly.
 - .8 Notify DCC Representative 3 business days prior to the start of the mock-up and allow 3 business days for inspection of mock-up by DCC Representative before proceeding with work.
 - .9 Co-ordinate mock-ups to allow DCC Representative observation of entire process.
 - .10 Repeat mock-up until satisfactory results are obtained to satisfaction of DCC Representative.
 - .11 When accepted by DCC Representative in writing, mock-up will demonstrate minimum standard for this work. Only approved mock-up(s) will remain as part of finished Work. Replace mock-up(s) not approved using approved procedures

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- .12 Workers completing mock-up to be used for duration of project. In the event that masons change during the project, new masons are to complete new mock-up(s) as described in this section

1.6 QUALITY ASSURANCE – SITE REVIEWS

- .1 Make mason's workshop accessible to DCC Representative for site review of current work-in-progress.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 – Common Product Requirements.
- .2 Deliver materials to job site in dry condition.
- .3 Storage and Protection.
 - .1 Keep materials dry until use except where wetting of bricks or stone is specified. Protect from freezing and contamination.
 - .2 Store on pallets or plank platforms held off ground by means of plank or timber skids.
 - .3 Store in covered enclosed weather protected enclosure.
- .4 Do not use materials which have exceeded manufacturer's recommended shelf life.

1.8 ENVIRONMENTAL REQUIREMENTS

- .1 Execute all mortar work when ambient temperature and humidity meet requirements specified for 04 03 08 – Heritage Mortars and Grouts.
- .2 When ambient temperature drops below 10 degrees Celsius, provide heating and ventilation at own cost around curing area to ensure that stated environmental conditions are maintained for curing period. Take precautions to avoid overheating masonry.

1.9 PRE-CONSTRUCTION CONFERENCE

- .1 One (1) week prior to scheduled start of work of this Section, the representatives of the following entities shall meet at the project site: DCC Representative, contractor, materials manufacturer / supplier and representatives of other entities directly concerned with Work of this Section. This meeting will be coordinated through the Project Contractor.
- .2 Attendees shall review all pertinent details and specifications, noting any potential problems and evaluate for compliance with Contract Documents . The Conference will include but not be limited to the following:
 - .1 Verify Project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Coordination with other trades.
 - .4 Availability of materials.
 - .5 Warranty and submittal requirements.
 - .6 Scheduling.

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- .7 Scaffold and site installations
- .8 Additional items relating to the Work.
- .3 Attendees shall also inspect the worksite and review condition of site and substrates, protection requirements, determine where mock-ups will be prepared and where or how other requirements such as lighting and ventilation will be implemented.
- .4 Minutes will be taken of the meeting by the DCC Representative, including agreement or disagreement on matters of significance. A copy of the minutes will be furnished to all attendees.

1.10 DOCUMENTATION

- .1 Photographic Record: Prior to any work involving heritage materials, photograph the following:
 - .1 General view of the work.
 - .2 Detail shots of typical conditions and appearance at commencement of work.
 - .3 Location and date of photo must be clearly identified on each photo.
 - .4 Photograph quality: Well-illuminated, sharply focused, and free of motion blur.
 - .5 Resolution: Minimum 9-megapixel quality,
 - .6 Photographs to be on portable digital storage media in uncompressed RAW or JPEG format. Submit typical photographic sample and digital format to DCC Representative for review prior to commencement of Work.
- .2 Photographic Record: Documentation must be reviewed and accepted by DCC Representative before work may proceed.
- .3 Label (number) and photograph all masonry units. The labelling method shall be keyed in to 1:50 elevation drawings and sufficiently clear to allow future reinstallation, tracking of repairs for unit price tables, and general identification.

1.11 MEASUREMENT AND PAYMENT

- .1 Payment for masonry work shall be in accordance with the Unit Price Table and Balance of Project Lump Sum included in the Contract Documents.
- .2 The Tender Price shall include Unit Prices applied to the Estimated Quantities listed in the Unit Price Table, plus the Balance of Project Lump Sum.
- .3 Unit Price items apply to work identified in the Unit Price Table, including work shown on the drawings and any additional quantities of the same work authorized by the DCC Representative.
- .4 Final quantities for Unit Price items shall be determined by field measurement of completed and accepted work by the DCC Representative.
- .5 Estimated quantities shown in the Unit Price Table are provided for tender evaluation purposes only and do not represent guaranteed final quantities.
- .6 The Balance of Project Lump Sum includes all work shown on the drawings and specified that is not included under Unit Price items listed in the Unit Price Table, including Zone Repair work.
- .7 Where conflict exists between specification sections and the Unit Price Table regarding measurement and payment, the Unit Price Table shall govern measurement and payment. Specifications govern materials, execution, and workmanship.

Part 2 Products**2.1 MATERIALS**

- .1 Refer to related sections for stone, related materials, accessories and material preparation procedures.
- .2 Low pressure water rinsing equipment (3.5 MPa or 500 psi maximum). Maximum flow of 15 litres per minute. Pressure gauge at pump. Fan type nozzles.
- .3 Masonry cleaning: a non-ionic surfactant; a stiff bristle brush.

2.2 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 DCC Representative and allow free access to sources where materials were procured.

Part 3 Execution**3.1 VERIFICATION OF CONDITIONS**

- .1 Report in writing, to DCC Representative, areas of deteriorated masonry revealed and not conforming to specified requirements of the Work.

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- .2 Obtain DCC Representative's approval and instructions of repair and replacement of masonry units before proceeding with repair work.
- .3 Location restrictions for items embedded in exterior walls: place anchors, fasteners and metallic items required to be embedded in outer wythe at least 100 mm from the inner face of the outer wythe.

3.2 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.3 PROTECTION

- .1 Take necessary safety measures to protect workers, building occupants and environment from silica and lead contamination during removal of mortar.
- .2 Ensure workers are informed of hazards and trained in procedures prior to commencing work.

3.4 PREPARATION

- .1 Inspect site with DCC Representative and verify extent and location of mortar types prior to commencing installation.
- .2 Support:
 - .1 Construct shoring, cradling, and temporary framing work to support structure parts during removal and resetting operations, in accordance with approved drawings. Drawings to be stamped and signed by engineer experienced with historic masonry structures and registered in Province of Ontario.
 - .2 Leave work in safe condition when work is not in progress.
- .3 Take utmost care not to damage historic fabric. Make good any damage to the satisfaction of DCC Representative.
- .4 Seal and protect openings, doors, windows, and adjacent areas to prevent damage and spread of construction dust, water or other materials into the building.
- .5 Cover sills and projecting courses with rigid protection, secured into joints, for duration of work.
- .6 Prevent scaffolding, hoists or construction equipment from bearing directly against masonry or roof. Scaffolding should not be placed on the roof at anytime. Provide lumber or plywood with padding of sufficient thickness to prevent damage.
- .7 Obtain DCC Representative's approval prior to proceeding, for:
 - .1 Extent and type of stone to be replaced, repaired or removed.
 - .2 Methodology and tools to be employed before commencing work.
- .8 Determine precise exterior wall thicknesses at each level of building by drilling minimal size pilot holes. Repair and make good holes to match existing condition.

INSTALLATION

- .1 Do masonry work in accordance with CSA-A371 except where specified otherwise.
- .2 Build masonry plumb, level, and true to line, with vertical joints in alignment.
- .3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting. Coursing shall match existing.

3.6 CONSTRUCTION

- .1 Remove, repair and replace masonry as indicated.
- .2 Jointing.
 - .1 Allow joints to set just enough to remove excess water, then finish joint as specified.
 - .2 Finish stone joints as specified in Section 04 03 07 – Heritage Masonry Repointing.

3.7 SITE TOLERANCES

- .1 Tolerances in notes to Clause 5.3 of CSA-A371 apply.

3.8 FIELD QUALITY CONTROL

- .1 Coordinate site work and inspections with DCC Representative. Provide minimum 3 working days prior to each phase of the work.
- .2 DCC Representative site reviews to be completed at the following times:
 - .1 Prior to Work to identify and quantify repair locations and types.
 - .2 Following initial demolition to confirm all loose, deteriorated, or unsound
 - .3 materials have been removed from the substrate.
 - .4 Following preparation to review substrate and preparation of Work
- .3 Inspection and Testing will be carried out as specified in other Sections.
- .4 Notify inspection agency minimum of 24 hours in advance of requirement for tests.
- .5 Inspection or testing by DCC Representative will not augment or replace Contractor quality control nor relieve contractual responsibility

3.9 CLEANING

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.
- .3 Final wash down of walls
 - .1 A light rinse (500 psi maximum) may be performed at the discretion of the DCC Representative following a mock-up. Washing pressure to be determined through a mock-up.

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- .2 Minimize the amount of water used.
- .3 A non-ionic surfactant may be used at the discretion of the DCC Representative.
- .4 Brush surface vigorously by hand with a stiff bristle brush.
- .5 Rinse with low pressure wash (500 psi maximum).

3.10 PROTECTION – WORK AND MATERIALS

- .1 At end of each working day, cover unprotected work with waterproof membranes. Membranes should extend to 0.5 m over surface area of work and be tightly installed to prevent finished work from drying out too rapidly.
- .2 Protect masonry and other work from marking and impact damage. Protect completed work from mortar droppings. Use non-staining coverings.
- .3 Maintain protection for minimum three weeks.

END OF SECTION

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Part 1 General**1.1 SUMMARY**

- .1 Section includes:
 - .1 Cutting out of joints.
 - .2 Back-pointing.
 - .3 Finish pointing.

1.2 RELATED REQUIREMENTS

- .1 Section 04 03 01 – Heritage Common Work Results for Masonry
- .2 Section 04 03 08– Heritage Mortars and Grouts

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CSA-A371-04(R2014, Masonry Construction for Buildings, 2004.
- .2 Ontario Ministry of Labour/Queen's Printer for Ontario.
 - .1 Guideline – Lead on Construction Projects, 2011.
 - .2 Guideline – Silica on Construction Projects, 2011.

1.4 DESIGNATED SUBSTANCES

- .1 Refer to 01 35 43 Environmental Protection.
- .2 Refer to Ontario Ministry of Labour's Guideline – Lead on Construction Projects and Guideline – Silica on Construction Projects for abatement procedures.

1.5 DEFINITIONS

- .1 Raking: the removal of loose/deteriorated mortar until sound mortar is reached.
- .2 Deep-raking: removal of loose/deteriorated mortar beyond a depth of 100 mm and up to 300mm.
- .3 Very-deep-raking: removal of loose/deteriorated mortar beyond a depth of 300 mm and up to 600 mm.
- .4 Back-pointing – filling an empty mortar joint to within 25 mm of stone face by either pushing mortar into the joint or by joint grouting
- .5 Deep-back-pointing – back-pointing joints that are deeper than 100 mm to a depth of 300 mm.
- .6 Very-deep-back-pointing - back-pointing joints that are deeper than 300 mm to a depth of 600 mm.

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- .7 Repointing: the general term for filling and finishing of masonry joints from which mortar is missing or has been raked out. It includes grouting, back-pointing, deep-back-pointing, and very-deep-back-pointing as required, as well as finish pointing.
- .8 Deep-repointing: a specific type of repointing that requires deep-back-pointing, but not very-deep-back-pointing.
- .9 Very-deep-repointing: a specific type of repointing that requires very-deep-back-pointing.
- .10 Tooling: finishing of masonry joints using tool to provide final contour.

1.6 SYSTEM DESCRIPTION

- .1 Work of this Section includes but is not limited to:
 - .1 Visually inspecting for obvious signs of deteriorated masonry and testing/verification of masonry joints.
 - .2 Raking, deep-raking and very-deep raking unsound joints as required.
 - .3 Preparation of masonry surface including joints surface cleaning, flushing of voids and open joints, and masonry wetting.
 - .4 Repointing work shall be measured and paid in accordance with the Unit Price Table where the work corresponds to Unit Price items A1, A2, or F.
 - .5 Repointing work shown on the drawings but not included under Unit Price items shall be included in the Balance of Project Lump Sum.
 - .6 Unit Price repointing quantities shall be measured in the field by the DCC Representative based on completed and accepted work.
 - .7 Unit Price repointing includes but is not limited to:
 - .1 Repair Item A1 – removal and repointing of limestone joints up to 49 mm deep.
 - .2 Repair Item A2 – removal and repointing of limestone joints from 50 mm to 150 mm deep.
 - .3 Repair Item F – skyward joint treatment.
 - .8 Unit Price work shall include all labour, materials, equipment, preparation, curing, protection, and cleaning required to complete the work.
 - .9 Where the extent of work varies from estimated quantities, payment shall be based on measured quantities accepted by the DCC Representative in accordance with the Unit Price Table.

1.7 QUALITY ASSURANCE - EXECUTION

- .1 Refer to the requirements of Section 04 03 01 – Heritage Common Work Results for Masonry.

1.8 SAMPLES AND MOCK-UPS

- .1 Submit samples and construct mock-ups in accordance with Section 04 03 01 – Heritage Common Work Results for Masonry.

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- .2 Perform following mock-ups:
 - .1 Cutting out mortar joints, 4 square meter of stone.
 - .2 Back-pointing, 4 square meter of stone.
 - .3 Finish-pointing, 4 square meter of stone.

1.9 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store, handle and protect materials in accordance with Section 04 03 01 – Heritage Common Work Results for Masonry.

1.10 EXISTING CONDITIONS

- .1 Obtain DCC Representative's approval and instructions before proceeding with raking out of joints.
- .2 Existing pointing mortars may contain silica, classifying it as a hazardous material under specific conditions. Follow provincial guidelines for the safe removal and disposal of silica including the Ministry of Labour's Guideline – Silica on Construction Projects.
- .3 Existing pointing mortars may also contain lead. Follow provincial guidelines for the safe removal and disposal of lead including the Ministry of Labour's Guideline – Lead on Construction Projects.

Part 2 Products

2.1 MATERIALS

- .1 Refer to 04 03 08 - Heritage Mortars and Grouts

Part 3 Execution

3.1 GENERAL

- .1 Perform work in accordance with CSA-A371 and approved mock-ups.
- .2 Tool and compact using jointing tool to force mortar into joint.
- .3 Finish joints square and slightly recessed.
- .4 Use suitable approved jointing tool to finish joints.
- .5 Obtain DCC Representative's approval prior to proceeding, for:
 - .1 Condition of raked-out joints prior to commencing grouting, back-pointing or repointing operations.
 - .2 Condition of voids and damming procedures prior to commencing grouting operations.
 - .3 Methods to prevent materials entering or penetrating wall cavities of building.

3.2 RAKING JOINTS

- .1 Rake joints free of deteriorated and loose mortar, dirt and other undesirable material.

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- .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:
 - .1 Cutting out with hammer and chisels with dust channels, cutting away from the arrises to prevent spalling of the masonry.
 - .2 Flat-bladed quirks and light hammers, hacksaw blades or similar tools are to be used where fine joints are encountered.
 - .3 Small hand-held low-impact pneumatic carving tools, fitted with appropriate points and chisels to the approval of the DCC Representative for cutting out rock-faced work only.
 - .4 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 surface to a square surface of existing mortar at back of joint.
 - .4 Using pressurized air, blow out loosened mortar, being sure to contain dust expelled into the work area while doing so.
 - .5 Briefly flush out joints using a low-pressure water rinse to remove all small particles of dust.
 - .6 Clear out all loose particles and leave ready for inspection.
- .3 Depth of raking:
 - .1 Clean joints to full depth of deteriorated mortar but in no case to less than 25mm.
 - .2 Supporting stones during deep/very-deep raking and deep/very deep repointing:
 - .1 Sequence of deep/very-deep -raking and deep/very-deep repointing/grouting will need to be planned such that the wall is sufficiently supported at all times.
 - .2 Use shims and bracing as required.

3.3 BACK-POINTING

- .1 Fill open joints and voids where depths exceed 25 mm.
- .2 Back-pointing is not to begin before approval is given by the DCC Representative.
- .3 Provide sufficient wetting of the masonry wall, including joints and stones to ensure wall will remain damp but not wet. This will require many hours of intermittent wetting of the wall prior to back-pointing commencement.
- .4 Leave surface wet and free of standing water.
- .5 Build-up mortar in layers maximum 30 mm and minimum 12 mm in depth.
- .6 Allow bottom layers to set before applying subsequent layers. Maintain joint width.
- .7 Finish face of mortar to depth of 25 mm.
- .8 Leave the exposed back-pointed surface keyed that is grooved or dimpled, to improve bonding of finish-pointing.

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- .9 Set up a pre-wetted burlap and polyethylene “curtain” in front of the wall. Provide a temporary structure for securing the burlap-polyethylene curtain such that it remains a uniform 50-100 mm distance from the wall.

3.4 FINISH POINTING: MORTAR

- .1 Immediately prior to pointing, thoroughly wet joints to control absorption.
- .2 Allow water to soak into masonry and mortar. Leave surface wet and free of standing water.
- .3 Completely fill with mortar.
- .4 If surface of masonry units or stone has worn rounded edges keep pointing back from surface to keep same width of joint. Avoid feather edges. Pack mortar solidly into voids and joints with positive adhesion to contact surfaces.
- .5 Keep masonry damp while pointing is being performed.
- .6 Pointing in freezing weather is not permitted. Refer to Section 04 03 01 – Heritage Common Work Results for Masonry for environmental requirements.
- .7 At initial set, finish joints with stippling action using a short stout bristle brush to compact joint. Produce textured finish, exposing aggregate. Do not project mortar beyond arrises or feather mortar.
- .8 Keep recessed joints approximately 1 mm back from arrises.
- .9 Remove excess mortar from masonry face before it sets. Finish jointing neatly.
- .10 Provide full protection from direct sun, wind and temperatures below 10 degrees C during and after completion of all work involving mortars for up to 3 weeks after mortar work completion.

3.5 RESETTING LOOSE STONE

- .1 Fix dislodged masonry units in correct location with water-soaked softwood wedges.
- .2 Insert and compress firm mortar to within 40 mm of pointing surface. Allow mortar to set minimum 24 hours.
- .3 Pull out wood wedges when dried and shrunken.
- .4 Point to surface in one layer.

3.6 CLEANING

- .1 Clean surfaces of mortar droppings, stains and other blemishes resulting from work of this contract as work progresses.
- .2 Do further cleaning after mortar has set and cured.
- .3 Clean masonry with stiff natural bristle brushes and plain water only.

3.7 CURING

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- .1 Immediately upon completion of back pointing and finish pointing establish conditions identified in Environmental Conditions Requirements to cure mortars as specified in the applicable section. See Environmental Requirements in Section 04 03 08.

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES:

- .1 The preparation and supply of mortars to be used for masonry work and conservation mortar repair fills.

1.2 RELATED REQUIREMENTS

- .1 Section 04 03 01 – Heritage Common Work Results for Masonry
- .2 Section 04 03 07 – Heritage Masonry Repointing

1.3 REFERENCES

- .1 American Society for Testing and Materials International (ASTM).
 - .1 ASTM C144-04, Standard Specification for Aggregate for Masonry Mortar
 - .2 ASTM C207-06(R2011), Standard Specification for Hydrated Lime for Masonry Purposes.
 - .3 ASTM C780-14, Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
 - .4 ASTM B29-03 (2009), Standard specification for refined lead.
 - .5 C1713 Standard Specification for mortar for the Repair of Historic Masonry
 - .6 ASTM C1489 – Lime Putty for Structural Purposes
 - .7 EN 459-1 – Building Lime
 - .8 ASTM C1713 – Mortar for Repair of Historic Masonry
- .2 Canadian Standards Association (CSA International).
 - .1 CAN/CSA-A3000-08, Cementitious Materials Compendium.
 - .2 CSA-A179-04 (R2014), Mortar and Grout for Unit Masonry.
- .3 Health Canada / Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .4 European standards.
 - .1 EN 459-1:2010, Building Lime. Definitions, specifications and conformity criteria.
 - .2 EN 459-2:2010, Building Lime. Test Methods.

1.4 QUALITY ASSURANCE

- .1 The mixing of mortars shall only be done by masons having experience in the preparation of cement-lime mortars. Material must be fresh with proof of manufacture on labels. Materials that are older than stated date of use are not acceptable.
- .2 Store materials in dry conditions away from wet or moisture.

1.5 ALLOWABLE TOLERANCES

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- .1 Mortar compression strength for cement-lime-sand mortar or natural hydraulic lime mortar used for pointing shall be 5 MPa minimum, 8 MPa maximum at 28 days, and shall not exceed the strength of the adjacent stone.
- .2 Air content of plastic mix, using meter designed to record air content of mortars to EN 459-2: 12 % minimum, 15 % maximum.
- .3 Vicat Cone penetration of mortar mix in plastic state, to ASTM C780: 22 mm minimum, 28 mm maximum, for pointing mortar; penetration of bedding mortar may exceed maximum by not more than 25 %.

1.6 SUBMITTALS

- .1 Submit documents and samples in accordance with Section 01 33 00 - Submittal Procedures, and Section 04 03 01 – Heritage Common Work Results for Masonry.
- .2 Samples:
 - .1 Colour matched samples for front-pointing mortar: provide up to 5 samples for each mortar type of 100 mm diameter and 25 mm thick. Cure as specified in related sections. Final color review is to occur from mock-ups on wall.
 - .2 Prepare samples to represent same exposure conditions of building. Fully cure minimum 7 days.
- .3 Additional cubes for testing. Provide additional series of cubes for long term testing by DCC Representative as follows:
 - .1 For all mortar types: up to 5 sets of cubes from selected mortar batches as directed by DCC Representative.

1.7 TEST REPORTS

- .1 Submit test reports in accordance with Section 01 45 00 – Quality Control.
- .2 Test results to show that properties are appropriate to particular mortar mix.
- .3 Test reports required for each mortar type minimum 30 days prior to commencement of work:
 - .1 Sieve analysis of proposed sand.
 - .2 Air content of mortar mix in plastic state.
 - .3 Vicat cone penetration of mortar mix.
 - .4 Compressive Strength of mortar at 28 and 90 days, prior to commencing work, or as directed by DCC Representative.
- .4 Test reports required following commencement of work. For all mortars and grouts carry out all of the following tests for the first 5 batches and for every 10th subsequent batch:
 - .1 Air content of mortar mix.
 - .2 Vicat cone penetration measurements.
 - .3 Compressive strength of cement/lime/sand mortar at 7, 28 and 90 days.
- .5 Mock-up: provide colour matched samples on wall for final acceptance of materials.

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- .6 Refer to Section 04 03 01 – Heritage Common Work Results for Masonry for other quality assurance requirements.

1.8 ENVIRONMENTAL REQUIREMENTS

- .1 Relative Humidity (RH) must be greater than 50 % during installation.
 - .1 Curing conditions for cement hydrated-lime sand mortar: maintain for a period of 7 days, 100% humidity.
 - .2 For all mortar work provide temperatures between 10 and 27 degrees Celsius 48 hrs prior and 14 days following the application of mortars.
- .2 Comply with requirements of WHMIS regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of MSDS acceptable to Labour Canada.
- .3 Execute work when ambient temperature is between 10 and 27 degrees Celsius. When ambient temperature is below 10 degrees Celsius, provide heating as required.
- .4 Prepare and maintain temperature of mortar between 10 and 27 degrees Celsius until used.
- .5 When temperature is 10 degrees Celsius or less:
 - .1 Store cements and sands for immediate use within heated enclosure. Allow these materials to reach minimum temperature of 10 degrees Celsius (that is equilibrium with air temperature in enclosure).
 - .2 Heat water to minimum of 20 degrees Celsius and maximum of 25 degrees Celsius:
 - .3 At time of use, the temperature of the mortar is to be minimum of 10 degrees Celsius and maximum of 27 degrees Celsius.
 - .4 Provide monitoring electronic thermometers that can register low and high temperatures during any selected period of time. Placement of thermometers and frequency of observations shall be as directed by the DCC Representative. As a minimum, hourly temperature readings are required during mortar curing. Submit temperature data on a weekly basis during cold temperatures.
- .6 Do not mix cement with water or with sand or with water-sand mixtures having higher temperature than 25 degrees Celsius.

Part 2 Products

2.1 MATERIALS

- .1 No pre-bagged general purpose mortars shall be used.
- .2 Proprietary heritage conservation mortars specifically formulated for limestone repair and approved by the DCC Representative may be used
- .3 Use one and same manufacture and supplier for sources of each mortar material for entire project.

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.4 Water: potable, clean and free from contaminants. Pre-treat water having high iron or other metal content to prevent staining.

.5 Sand:

.1 To ASTM C144, sharp, screened and washed siliceous pit sand, free of any organic material, graded as specified to approval of DCC Representative.

.2 Sand is to be dry and kept dry throughout the work period. Sand to be stored in waterproof and lid secured container in a dry and roofed storage location.

.6 Mason must custom blend/grade sand.

.7 Grading of sand: sieve analysis for mortar joints greater than 10 mm in width:

SIEVE SIZE	PERCENTAGE BY WEIGHT PASSING EACH SIEVE	PERCENTAGE BY WEIGHT RETAINED ON EACH SIEVE
4.75 mm	100	0
2.36 mm	90	10
1.18 mm	70	20
600 microns	50	20
300 microns	30	20
150 microns	15	15
75 microns	15	15

.8 Grading of sand: sieve analysis for mortar joints between 6 mm and 10 mm in width:

SIEVE SIZE	PERCENTAGE BY WEIGHT PASSING EACH SIEVE	PERCENTAGE BY WEIGHT RETAINED ON EACH SIEVE
4.75 mm	100	0
2.36 mm	100	0
1.18 mm	90	10
600 microns	70	20
300 microns	40	30
150 microns	15	25
75 microns	0	15

.9 Grading of sand: sieve analysis for mortar joints less than 6 mm in width

SIEVE SIZE	PERCENTAGE BY WEIGHT PASSING EACH SIEVE	PERCENTAGE BY WEIGHT RETAINED ON EACH SIEVE
4.75 mm	100	0
2.36 mm	100	0
1.18 mm	100	0
600 microns	75	25
300 microns	50	35
150 microns	25	25
75 microns	0	15

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- .10 Sand shall be dry.
- .11 Lime:
 - .1 Hydrated lime conforming to ASTM C207, Type S or SA, for use in cement-lime mortars.
 - .2 Natural Hydraulic Lime (NHL 2 or NHL 3.5) conforming to EN 459-1, where specified.
- .12 Portland cement: to CAN/CSA-A3000, type 10 normal, white, non-staining. All cements and limes to be stored and used in accordance with manufacturer's recommendations, including maximum shelf life.
- .13 Colour additives: inorganic pigment, dry powder, mineral oxide type.

2.2 EQUIPMENT AND ACCESSORIES

- .1 A regular paddle mixer: an open rectangular type. Only electric motor mixers are permissible. Mixers run on hydrocarbons are not permitted, due to fumes.
- .2 Mixing by hand for repointing mortars is not acceptable unless approved by the DCC Representative.
- .3 Submit mixing tools and container for approval prior to starting pointing work.
- .4 A digital electronic balance with a capacity of 2000 g and precision of 0.1 g, and a second digital electronic balance with a capacity of 200 g and a precision of 0.01 g.
- .5 Vicat Cone penetrometer for measuring consistency.
- .6 A standard pressure pot for injecting grout.
- .7 Hard bristle nylon brush.
- .8 Graduated cylinders purchased from a lab supply store, 2 L, 1 L, 500 mL volumes.
- .9 Appropriately sized buckets for mortar mixing: 7.5 L (2 gallon); 13 L (3.5 gallon); and 19 L (5gallon).
- .10 Clean rags.
- .11 Stopwatches for measuring mortar mixing times.
- .12 Back-pointing and front-pointing protection: a 6 mil polyethylene sheet; burlap fabric; a supporting structure to secure polyethylene-burlap curtain the proper distance from the wall during curing.

2.3 MORTAR

- .1 Mortar Type Designations
 - .1 Mortar Type A – Lime putty-based repair mortar.
 - .2 Mortar Type B – Hydrated lime-based repair mortar.
 - .3 Mortar Type C – Portland cement–lime mortar.
 - .4 Mortar Type D – Natural Hydraulic Lime mortar using NHL 2 or NHL 3.5.

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- .2 Provide materials, aggregates, proportions, mixing, testing, curing, and performance characteristics of Mortar Types A, B, C, and D in accordance with this Section.
- .3 For locations of use and application of Mortar Types A, B, C, and D in repair work and repointing work, refer to Sections 04 03 45 and 04 03 07.
- .4 Where requirements for mortar composition, proportions, mixing, testing, or curing are referenced in other Sections, the requirements of this Section shall govern.
- .5 Mortar Types A, B, C, and D shall comply with the compressive strength limits specified under Allowable Tolerances.
- .6 Type C proportions:
 - .1 Proportion will be based on attaining an MPa of between 5 and 8 after 28 days compression testing. The anticipated proportion for the mix is: One part white Portland cement: one part hydrated lime type SA: 6 parts aggregate. Pigments not to exceed 6% of aggregate volume. Water proportion will be based on a consistency using Vicat Cone penetration and as directed by the DCC Representative.
 - .2 The mortar mix proportions may be adjusted from time to time during work to provide specified mortar strength and consistency.
- .7 Mortar Types A, B, and D shall be proportioned to achieve performance compatible with adjacent stone and existing historic mortar, and shall not exceed compressive strength limits specified in this Section.
- .8 Final mix proportions for Types A, B, and D shall be determined by testing and approved by the DCC Representative.

Part 3 Execution**3.1 PREPARATION - GENERAL**

- .1 Place safety devices and signs near the work as directed by DCC Representative.

3.2 MIXING - GENERAL

- .1 Mix mortar ingredients in quantities for use within periods specified. Maximum of one re-temper is allowed.
- .2 Use only power driven paddle mixers. Use one mixer exclusively for each coloured mortar. Use one mixer exclusively for cement-lime and one for hydraulic lime mixes.
- .3 Add water slowly while mixing until all lumps are eliminated.
- .4 Mix to a consistency to meet specified performance requirements. Adjust water content as required.
- .5 Maintain uniformity of each mix throughout project. Contractor is to appoint no more than two individuals to mix mortar, for duration of project. In the event that both these individuals must be changed, mortar mixing must cease until the new individual is trained, and mortar mix is tested.

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- .6 Use separate mixers for each type of pigmented mortar. If approved local sand is used the need for pigments may be nullified.

3.3 MIXING – CEMENT-LIME-SAND MORTAR

- .1 Use mortar within 2 hours. Re-temper only by remixing, but do not add water.
- .2 Prepare measuring boxes to ensure accurate proportioning of mortar ingredients.
 - .1 Each box to contain exact volume proportion for each specific mix ingredient.
 - .2 Assume an approximate mix of 1 part white Portland cement, 1 lime and 6 parts sand. Mix should be prepared using litre volume quantities: 1 L cement; 1 L lime; 6 L sand, unless directed otherwise the DCC Representative.
 - .3 The DCC Representative may ask for a mixture of 1:2.5:8 depending on the compressive strength test results.
- .3 Mix all dry ingredients for approximately 3 minutes.
- .4 Pour all the water into the bucket containing the dry ingredients. Mix for 3 minutes.
- .5 Let stand for 3 minutes.
- .6 Mix for a further 3 minutes until thoroughly blended and mortar has reached consistency determined by Vicat Cone penetration testing.
- .7 Add just sufficient water to obtain workable consistency for setting units. Avoid too wet a mix which stains the face of the work. Vicat Cone penetration may be slightly greater for bedding mixes, but should not exceed maximum value specified by more than 20 %. Record water quantities and use for subsequent mixes to help ensure uniformity of all subsequent mixes.
- .8 Adjust mix proportions based on percentage bulking shown in the test.
- .9 Submit mixing tools and container for approval prior to starting pointing work.
- .10 Clean all mixing boards and mechanical mixing machine between batches.
- .11 Mortar must be weaker than the units it is binding.
- .12 Mortar must not contain elements detrimental to the original masonry or surrounding materials.

3.4 FIELD QUALITY CONTROL

- .1 Follow proper batching procedure.
- .2 Use batching box.
- .3 Monitor mixing time.
- .4 Record water quantities and repeat for subsequent mixes.
- .5 Record Vicat test.
- .6 Record location where each batch of mortar is placed in wall area.
- .7 Take mortar samples for testing when applicable.

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END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

- .1 Resetting, replacement, and rebuilding of heritage stone masonry units removed under Section 04 03 43.
- .2 Installation of replacement stone supplied under Section 04 43 00.
- .3 Reconstruction of masonry facework and backing where stones have been removed for conservation purposes.
- .4 Installation of replacement stone units, including fitting, bedding, alignment, and integration into existing masonry

1.2 RELATED REQUIREMENTS

- .1 Section 04 43 00 – Stone Supply
- .2 Section 04 03 01 – Heritage Common Work Results for Masonry
- .3 Section 04 03 07 – Heritage Masonry Repointing
- .4 Section 04 03 08 – Heritage Mortars and Grouts
- .5 Section 04 03 43 – Heritage Masonry Removals
- .6 Section 04 03 45 – Heritage Masonry Repairs

1.3 DEFINITIONS

- .1 Replacement Stone: New stone supplied to replace removed or deteriorated original stone units.
- .2 Reset Stone: Existing stone unit removed and reinstalled in original or adjusted location.
- .3 Natural Bed: Orientation of stone corresponding to its original geological bedding plane.
- .4 Core: Interior backing material located behind face stone

1.4 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 and Section 04 03 01.
- .2 Installation Procedures:
 - .1 Submit written description of installation methodology including: stone handling, fitting and bedding, core reconstruction, alignment control.
- .3 Samples:
 - .1 Submit sample of installation tooling and surface finish where requested. Note: Stone material samples are specified in Section 04 43 00

1.5 QUALITY ASSURANCE

- .1 Work shall be performed by masons experienced in heritage masonry conservation.
- .2 Maintain consistency of workmanship throughout the project.
- .3 Perform work under continuous review of the DCC Representative

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Comply with Section 04 03 01 and Section 04 43 00.
- .2 Protect stone from damage, staining, and moisture infiltration.
- .3 Store stone clear of ground on timber skids

Part 2 Products

2.1 REPLACEMENT STONE

- .1 Provide replacement stone in accordance with Section 04 43 00 – Stone Supply.
- .2 Fabricate stone to match existing dimensions, bedding orientation, and surface finish

2.2 MORTAR MATERIALS

- .1 Mortar: refer to Section 04 03 08 – Heritage Mortars and Grouts.
- .2 Mortar shall match existing mortar in colour, texture, permeability and strength.

2.3 ACCESSORIES

- .1 Shims: Softwood or approved non-staining material.
- .2 Water: Clean and potable.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that removal work has been completed in accordance with Section 04 03 43.
- .2 Verify substrate condition is suitable for rebuilding.
- .3 Notify DCC Representative of unsuitable conditions.

3.2 PREPARATION

- .1 Clean masonry openings of loose material, dust, and debris.
- .2 Ensure core and bearing surfaces are sound and ready to receive new stone.
- .3 Do not proceed until conditions are approved.

3.3 FITTING AND CUTTING

- .1 Field measure each opening prior to installation.
- .2 Cut and dress replacement stone to achieve accurate fit, matching joint widths, proper bedding orientation
- .3 Maintain original joint width unless otherwise directed.
- .4 Maximum deviation from required dimensions: 2 mm.

3.4 INSTALLATION

.1 General

- .1 Install stone in accordance with approved conservation practices.
- .2 Maintain natural bedding orientation.
- .3 Install stone without forcing or wedging.

.2 Bedding

- .1 Dampen stone and substrate prior to installation.
- .2 Set stone in full mortar bed.
- .3 Ensure full contact between stone and bearing surface.

.3 Alignment

- .1 Set stone plumb, level, and aligned with adjacent masonry.
- .2 Maintain continuity of coursing and joint alignment.
- .3 Maximum deviation: Plumb: 3 mm in 3 m; Level: 3 mm in 3 m; Plane of wall: 5 mm in 3 m
- .4 Core Reconstruction
 - .1 Reconstruct core using stone and mortar to match original construction.
 - .2 Fill voids completely.
 - .3 Ensure proper bonding between face stone and backing.
- .5 Temporary Support
 - .1 Provide temporary support as required until mortar has cured.
 - .2 Remove supports without damaging masonry.

3.5 RESETTling EXISTING STONES

- .1 Reset salvaged stones in original locations unless otherwise directed.
- .2 Install in accordance with requirements for replacement stone.

3.6 TOLERANCES

- .1 Joint width variation: maximum +/- 2 mm from existing.
- .2 Alignment with adjacent masonry: visually consistent.

3.7 CLEANING

- .1 Clean exposed stone surfaces immediately after installation.
- .2 Use water and natural fibre brush.
- .3 Do not use acids, harsh chemicals, or abrasive cleaning methods.

3.8 PROTECTION

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- .1 Protect installed masonry from damage and weather.
- .2 Prevent rapid drying, freezing, or saturation.
- .3 Maintain protection until masonry is fully cured.

3.9

COORDINATION

- .1 Coordinate with: Section 04 03 43 for removals, Section 04 03 45 for repairs, Section 04 03 07 for repointing

END OF SECTION

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Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Careful dismantling and removal of heritage stone masonry units designated for repair, resetting, or replacement.
 - .2 Documentation, marking, cataloguing, protection, and storage of removed masonry units.
 - .3 Removal of deteriorated mortar and backing materials as required to permit conservation work.
 - .4 Preparation of masonry substrate and wall core to receive rebuilding work under Section 04 03 42.

1.2 RELATED REQUIREMENTS

- .1 Section 04 03 01 – Heritage Common Work Results for Masonry
- .2 Section 04 03 07 – Heritage Masonry Repointing
- .3 Section 04 03 08 – Heritage Mortars and Grouts
- .4 Section 04 03 42 – Heritage Masonry Replacements and Rebuilding
- .5 Section 04 03 45 – Heritage Masonry Repairs
- .6 Section 04 43 00 – Stone Supply

1.3 DEFINITIONS

- .1 Salvaged Stone: Existing masonry unit removed for resetting or repair.
- .2 Replacement Location: Masonry location where original stone has been removed and will receive replacement stone.
- .3 Core: Interior backing material behind face masonry.

1.4 STORAGE AND PROTECTION

- .1 Deliver, store, handle and protect materials in accordance with Section 04 03 01 – Heritage Common Work Results for Masonry.
- .2 Protect stones and facilitate their resetting.
- .3 Protect dismantled masonry units from exposure to water, elements, and potential mechanical damage inside a covered storage and work area at the location assigned by DCC Representative.

1.5 EXISTING CONDITIONS

- .1 Refer to Section 04 03 01 – Heritage Common Work Results for Masonry.

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1.6 QUALITY ASSURANCE - EXECUTION

- .1 Refer to requirements of Section 04 03 01 – Heritage Common Work Results for Masonry.
- .2 Removal procedures shall minimize damage to existing masonry, adjacent construction, and salvaged stones.
- .3 Do not proceed with dismantling until documentation and methodology have been reviewed.

1.7 SUBMITTALS

- .1 Submit documents in accordance with Section 04 03 01 – Heritage Common Work Results for Masonry.
- .2 Document and mark the following:
 - .1 Stones and other elements that are dismantled are to be numbered and identified on an elevation drawing, 1:50 scale. Dismantling cannot proceed without a reviewed dismantling shop drawing. Elevation drawing can be an annotated photograph. Each stone to be dismantled must be clearly visible and annotated for the drawing to be reviewed.
 - .2 Wood platforms or other equipment used to transport and store stones.
 - .3 Work and storage areas.
- .3 Prepare chart or card-index to help locate any stone or unit when necessary, and to control availability of platforms and of work and storage areas.
- .4 Keep chart or card-index up-to-date and, if required, produce copy every day.
- .5 Ensure chart or card-index contains relevant information as indicated.
- .6 Submit up-to-date copies of chart or card-index, as well as chronological information concerning each numbered unit (individual cards of units), when requested.

Part 2 Products

2.1 MATERIALS

- .1 Not Used

Part 3 Execution

3.1 PREPARATION

- .1 Consider nature of soil, to avoid damage to ground and stones and facilitate expedient execution of work.
- .2 Obtain DCC Representative's approval prior to proceeding, for:
 - .1 Extent and type of stone to be replaced, repaired or removed.
 - .2 Methodology and tools to be employed before commencing work.

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- .3 Condition of cut out damaged stone for replacement or repair.

3.2 DISMANTLING PROCEDURE

- .1 Dismantling procedure for wall areas.
 - .1 Construct scaffold.
 - .2 Provide elevation and vertical control points for areas to be dismantled. These locations are to be shown on drawing together with reference bench mark.
 - .3 Identify stones with approved numbering system. Chalk should be used for this procedure until the upper bed of the stone can be identified.
 - .4 Record the condition of stone before dismantling.
 - .5 In-situ photographs of stones.
 - .6 Transfer annotations and numbering to CAD.
 - .7 Tabular inventory of stone conditions noting cracks, spalls, heavy deterioration and other conditions.
 - .8 Record the thickness of the original existing joints before dismantling.
 - .9 Identify stones that are candidates to be replaced and measure in-situ.
 - .10 Submit stone record and inventory to DCC Representative for review.
 - .11 Review recorded conditions with DCC Representative on site. And confirm stones identified for repair or replacement.
 - .12 Dismantle stones.
 - .13 Place stones in a single layer on skids complete with reference drawing for their location in the wall.
 - .1 Provide separate skids of stones identified for additional repair or replacement.
 - .2 Provide separate skid for previously identified stones for repairs.
 - .14 Review with DCC Representative “on the bench” repairs of stone.

3.3 TEMPORARY MARKING AND RECORDING

- .1 Mark stone to be removed, on top bed, before removal. Mark adjacent stones not to be removed to ensure accuracy of re-installation.
- .2 Provide associated documents specified in Section 04 03 01 – Heritage Common Work Results for Masonry.
- .3 Use numbering, marking, and positioning system acceptable to DCC Representative.
- .4 Ensure marking remains clearly visible until resetting of stone.
- .5 Ensure markings and adhesive are removed without damaging units. Use no solvent, acid or other chemical product.
- .6 Work shall not proceed until DCC Representative approves submission of documentation required in Section 04 03 01, Documentation.

3.4 PROTECTION

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- .1 Protect adjacent masonry from marking and damage during dismantling.

3.5 SUPPORT

- .1 Provide temporary supports in accordance with Section 04 03 01 – Heritage Common Work Results for Masonry.

3.6 LOOSENING STONES (DISMANTLING AND DISASSEMBLY)

- .1 Use approved methods to loosen stones without causing damage either to stones or to other architectural elements. Remove stones in original integral condition and size. Use of hardwood is acceptable; metal wedges or levering devices are not permitted.
- .2 Do joint cutting and removing of stone in accordance with Section 04 03 01 – Heritage Common Work Results for Masonry.
- .3 Do not use circular millstone or saw, steel tools exerting concentrated pressure on edge of stone. Obtain DCC Representative's approval for use of power tools before commencing work. Use approved site personnel for the use of power tools for this type of work.
- .4 Obtain DCC Representative's approval for use of pneumatic tools before commencing work. Use of pneumatic hammers properly sized for joints that will not apply concentrated pressure on edges of stone. Use approved site personnel for the use of pneumatic tools for this type of work.
- .5 Loosen wet masonry only when temperature is above freezing point
- .6 Free large stones using Lewis pins or for top bed lift out with nylon belts. Properly space belts to provide safe and even bearing for stone. Strap or reinforce cracked or damaged stones. Remove in one piece without placing stress at fracture points.
- .7 Clean loose and deteriorated wall cores to sound material to the limits described on structural drawing.
 - .1 At locations where the outer stone wythe is to be removed the extent of removal is approximately 300mm and includes the removal of parging coat on the inner core stone to provide a surface suitable for reconstruction.
- .8 Remove dust, mortar and stone fragments.
- .9 Remove loose material from deteriorated stones.
- .10 Retain and store stone off-cuts for re-use as wall core material.
- .11 Remove wall core to limits shown on drawings.

3.7 HANDLING

- .1 Place detached stones in a single layer on wood surfaces during handling. Prevent contact with metal.
- .2 When stones are lowered to ground, place directly on wooden platforms that will be used for transport or storage. Do not place stones directly on ground.
- .3 Clean stones free of mortar and provide permanent protection.

- .4 Transport and keep stones on wooden platforms in orderly stacks with markings readily identifiable.
- .5 Ensure that edges of stones do not come into contact with any hard object.
- .6 Protect wet stones from freezing.

3.8 TEMPORARY STORAGE

- .1 Place stones in designated area of site for cleaning, detailed inspection and for final marking, before storage. Storage area must be covered and protected from the elements.
- .2 Place stones in a single layer on skids complete with reference drawing for their location in the wall.
 - .1 Provide separate skids of stones identified for additional repair or replacement.
 - .2 Provide separate skid for previously identified stones for repairs.
 - .3 Review with Consultant "on the bench" repairs of stone.
- .3 Ensure stones are accessible and easily removed, and placed so as to be retrieved quickly, when required.

3.9 CLEANING

- .1 Do cleaning operations at above freezing temperature. After cleaning, protect wet stones against freezing until dry.
- .2 Clean stones by wet scrubbing with vegetable fibre brush unless otherwise instructed by DCC Representative. Do not use high pressure water jet.
- .3 Remove excess mortar and resins by methods having written approval of DCC Representative.
- .4 Ensure masonry does not dry out too quickly. Drying process of stones may be accelerated by fans or unit heaters.

3.10 SALVAGE AND RE-USE

- .1 Removed stones intended to be replaced must be salvaged and catalogued. They may be used for repairs if each individual unit meets the following criteria:
 - .1 Sound;
 - .2 Free of salts;
 - .3 Cut to new profile;
 - .4 As directed by DCC Representative.

3.11 EXCESS STONES

- .1 Any excess stones at end of Work shall remain the property of DCC Representative. Deliver all excess stones on palettes to DCC Representative: address to be confirmed. Catalogue all excess stones. Submit document indicating size and quantity of all blocks.

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END OF SECTION

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Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Repair of existing heritage stone masonry units using conservation methods compatible with Kingston (Gull River Formation) limestone and Queenston limestone, as applicable.
 - .2 Crack repair using lime-based injection grouts.
 - .3 Surface repair using lime-based repair mortars.
 - .4 Dutchman repairs using replacement stone inserts set in lime-based repair mortar.
 - .5 Bench repair of removed stones prior to reinstallation under Section 04 03 42.

1.2 RELATED REQUIREMENTS

- .1 Section 04 03 01 – Heritage Common Work Results for Masonry
- .2 Section 04 03 07 – Heritage Masonry Repointing
- .3 Section 04 03 08 – Heritage Mortars and Grouts
- .4 Section 04 03 42 – Heritage Masonry Replacements and Rebuilding
- .5 Section 04 03 43 – Heritage Masonry Removals
- .6 Section 04 43 00 – Stone Supply

1.3 PERFORMANCE REQUIREMENTS

- .1 Preserve, wherever possible, the character and materials of existing masonry without unnecessarily removing or altering original fabric.
- .2 Repairs shall be compatible with existing stone in strength, permeability, thermal movement, and appearance.
- .3 Repair methods shall not introduce stresses that could damage existing limestone.
- .4 Mechanical anchorage, pinning, doweling, stitching, or insertion of metal reinforcement into Kingston limestone is not permitted .

1.4 SUBMITTALS

- .1 Submit repair procedures and repair mortar formulations in accordance with Section 01 33 00 and Section 04 03 01.
- .2 Submit samples of repair mortar and shelter coat demonstrating colour and texture match.
- .3 Submit description of crack repair and Dutchman repair procedures.

1.5 MOCK-UPS

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- .1 Execute mock-up for each type of conservation procedure, in accordance with Section 04 03 01 – Heritage Common Work Results for Masonry.
- .2 Where applicable, repeat repair mortar mock-ups as necessary to match variations in stone colour.

1.6 QUALITY ASSURANCE

- .1 Work shall be performed by masons experienced in heritage masonry conservation.
- .2 Perform repairs using methods consistent with accepted conservation practice.
- .3 Repairs shall be subject to review by DCC Representative.

Part 2 Products**2.1 MATERIALS - GENERAL**

- .1 Use materials compatible with Kingston limestone or Queenston limestone, as applicable,
- .2 and approved by DCC Representative.
- .3 Materials shall be breathable and compatible with existing masonry.
- .4 Repair mortars shall conform to Section 04 03 08 – Heritage Mortars and Grouts.
- .5 Mortar Types A, B, C, and D shall be as defined in Section 04 03 08. Mortar composition, proportions, mixing, testing, and curing shall conform to Section 04 03 08.
- .6 Mortars may be proprietary pre-mixed products or field-mixed mortars approved by DCC Representative and conforming to Section 04 03 08.

2.2 LIME INJECTION MORTAR

- .1 Proprietary lime injection mortar composed of hydrated lime, fine aggregates, and water.
- .2 Mortar shall be compatible in permeability and strength with host stone.
- .3 Colour shall be adjusted as required to match adjacent stone.

2.3 REPAIR MORTARS

- .1 Repair Mortar Type A:
 - .1 Lime putty-based repair mortar with aggregates and stone dust.
 - .2 Used for fine crack repairs, shelter coats, and surface consolidation
- .2 Repair Mortar Type B:
 - .1 Hydrated lime-based repair mortar with aggregates and stone dust.
 - .2 Used for general stone repair fills and Dutchman bedding unless otherwise specified.
- .3 Repair Mortar Type C:
 - .1 Portland cement–lime repair mortar conforming to Section 04 03 08.

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- .2 Used where existing repairs or adjacent mortars are cement-lime based and compatibility is required.
- .4 Repair Mortar Type D:
 - .1 Natural Hydraulic Lime (NHL) mortar conforming to Section 04 03 08.
 - .2 Use NHL 2 or NHL 3.5 as specified or as directed by DCC Representative.
 - .3 Used for skyward joints, weather-exposed repairs, and locations subject to increased moisture exposure.
- .5 Where requirements of this Section differ from Section 04 03 08 regarding mortar composition, proportions, mixing, testing, or curing, the requirements of Section 04 03 08 shall govern.

2.4 DUTCHMAN REPAIR STONE

- .1 Stone shall match existing stone in colour, texture, and bedding orientation.
- .2 Stone shall be supplied in accordance with Section 04 43 00.

Part 3 Execution**3.1 EXAMINATION**

- .1 Examine stones identified for repair.
- .2 Confirm repair locations with DCC Representative prior to commencing work.

3.2 PREPARATION

- .1 Clean repair areas of loose material, debris, and contaminants.
- .2 Protect adjacent masonry from damage during repair work.
- .3 Obtain DCC Representative's approval for sequence of treatments for each type and area of stone prior to commencing work.

3.3 IN PLACE CRACK INJECTION REPAIR

- .1 Flush crack with clean water until all dirt and loose material are removed.
- .2 Carry out final flushing with 10 % ethyl alcohol solution.
- .3 Prepare lime injection mortar by diluting with de-mineralized water up to 30 %.
- .4 Inject mortar full into cracks. Repeat applications as necessary. Dam deep cracks to ensure complete filling.
- .5 Clean surface of stone free of mortar as work progresses. Do not allow grout to be absorbed into surface.
- .6 Where appropriate, use mortar undiluted to fill outer parts of crack or where width of crack warrants.
- .7 Allow mortar to harden.

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.8 Inject shelter coat over mortar to mask white colour. Fill crack flush with adjacent surface.

.9 Immediately clean up spills or runs.

3.4 REPAIRING OF REMOVED CRACKED STONE

.1 Remove stone in accordance with Section 04 03 43.

.2 Clean surfaces to be repaired.

.3 Apply lime putty mortar to entire faces of stone to be bonded.

.4 Clamp stone using softwood shims to protect arrises. Allow mortar to set.

.5 Cut back mortar upon initial set and fill to surface with lime shelter coat.

.6 Promptly remove excess mortar from crack to prevent staining.

.7 Prepare repaired stone for reinstallation under Section 04 03 42.

3.5 REPAIR MORTAR FILLS AND SURFACE REPAIRS

.1 Use repair mortar type A, B, C, or D as directed by DCC Representative and as required to match existing conditions.

.2 Prepare surfaces to receive repair mortar: remove previous repair materials and clean out loose debris from host stone.

.3 Wet host stone surface prior to application.

.4 Place repair mortars in maximum 15 mm layers. Allow mortar to harden before applying successive layers (lifts).

.5 Slightly overfill at surface and cover with damp absorbent towel.

.6 At appropriate time, finish mortar flush with adjacent stone.

.7 Texture surface of mortar to match adjacent surface.

.8 Maintain mortar damp for minimum 3 days.

3.6 DUTCHMAN REPAIRS

.1 Select new stone for Dutchman to match colour and characteristics of host stone, free from defects and with same direction of bedding as adjacent work.

.2 Cut piece of sufficient surface area to cover area of damage. Cut to rectangular or square frame, minimum 50 mm deep.

.3 Transfer outline onto damaged area by scribing.

.4 Hand chisel cut-out accurately to lines free of rough edges and spalled surfaces. Slightly undercut bed joints for tight fit of Dutchman insert. Obtain DCC Representative's review before commencing cutting.

.5 Form recess in existing stone to receive Dutchman repair with key.

.6 Prepare repair mortar Type B, C, or D and butter over entire surface of Dutchman and cavity to receive stone.

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- .7 Carefully insert stone into cavity fully bedded in repair mortar.
- .8 Clean off mortar from face.
- .9 Leave face of stone piece with slight projection. Finish to match host stone by rubbing back or tooling. Rubbing back or tooling marks on existing stone are not permitted.

3.7 BENCH REPAIRS

- .1 Perform repairs to removed stones prior to reinstallation under Section 04 03 42.
- .2 Prepare repaired stones for reinstallation.

3.8 CLEANING

- .1 Clean repaired areas using water and natural fibre brushes.
- .2 Do not use acids or abrasive cleaning methods.

3.9 PROTECTION

- .1 Protect repaired masonry from damage, freezing, and rapid drying.
- .2 Maintain protection until repairs are fully cured.

END OF SECTION

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Part 1 General

1.1 SUMMARY

- .1 General Requirements
 - .1 The specification shall be read as a whole by all parties concerned. Sectioning of the specification is for convenience. Each Section may contain more or less than the complete work of any trade. The contractor is solely responsible to make clear to the Subcontractors the extent of their work.
- .2 Section Includes
 - .1 Supply of limestone masonry units for heritage masonry replacement and repair work, including:
 - .1 Plain replacement blocks
 - .2 Moulded replacement blocks (where applicable)
 - .3 Dutchman repair stone inserts
 - .2 Supply of replacement stone matching existing Kingston (Gull River Formation) limestone.
 - .3 Supply, fabrication, and delivery of replacement stone ready for final site fitting under Section 04 03 42.
 - .4 Note: This project does not include ornamental carving, lettering, or sculptural stone unless specifically indicated.
- .3 Unit Prices
 - .1 Unit prices for stone supply shall apply to the applicable Unit Price items listed in the Unit Price Table.
 - .2 Unit prices shall apply to Estimated Quantities for tender evaluation and to final measured quantities of completed and accepted work.
 - .3 Unit prices shall include:
 - .1 Quarrying and selection of stone
 - .2 Cutting
 - .3 Fabrication
 - .4 Tooling, dressing, and finishing
 - .5 Quality control
 - .6 Handling and delivery to site
 - .4 Unit prices shall not include removal, dismantling, preparation, installation, pointing, or finishing, except where specifically included in a Unit Price item.

1.2 REFERENCES

- .1 Standards
 - .1 Be governed by the requirements of the following ASTM Standards referenced in the specification:

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- .1 ASTM C97/C97M - Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone
- .2 BRE 141 Porosity, Saturation Coefficient, and Apparent Density
- .3 ASTM C170/C170M Standard Test Method for Compressive Strength of Dimension Stone
- .4 ASTM C1721 Petrographic Analysis
- .5 ASTM C568 Specification for Limestone Dimension Stone
- .6 ASTM C880/C880M - Standard Test Method for Flexural Strength of Dimension Stone.
- .7 ASTM C99/C99M - Standard Test Method for Modulus of Rupture of Dimension Stone
- .8 ASTM C119 Standard Terminology Relating to Dimension Stone
- .9 ASTM C88 Modified Determination of Resistance to Salt Crystalization.
- .10 BS EN 772 Uni-directional Freeze-Thaw Testing

1.3 DEFINITIONS

.1 Limestone

- .1 Limestone: a sedimentary rock composed principally of calcium carbonate (the mineral calcite) or the double carbonate of calcium and magnesium (the mineral dolomite) or mixture of the two.
- .2 Limestone Classification:
 - .1 Type I Low Density: limestone having a density ranging from 1760 through 2160 kg/m³ (110 through 135 lb/ft³).
 - .2 Type II Medium Density: limestone having a density greater than 2160 through 2560 kg/m³ (135 through 160 lb/ft³).
 - .3 Type III High Density: limestone having a density greater than 2560 kg/m³ (160 lb/ft³).

.2 Block Finishes

- .1 Sawn:
 - .1 Flat straight surface showing no saw marks.
- .2 Rubbed:
 - .1 A flat straight surface showing no saw marks. Rubbed with carborundum abrasive to remove tool marks and scratches.
 - .2 Edges are to be eased to a radius of less than 1 mm.
- .3 Tooled:
 - .1 Continuous parallel lines across the face of the stone. The depth and opening of the lines must match the original work adjacent to the replacement blocks.
- .4 Picked:
 - .1 Random punched pattern of round concave holes across face of stone at approximately 5mm centres.

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.3 Geological Definitions

- .1 Stylolites: thin, darker (often clay or organic-rich) deposits that can be vulnerable to swelling under saturated conditions. Stylolites are recognized to be intrinsic to some sedimentary limestones and are identified as waving or suture seams that weave or run lineally along the bedding direction of the stone.

.4 Block Types

- .1 Plain: Blocks generally flat and rectangular, sometimes two, three or four dressed faces. They may have a tooled finish.

.5 Stone Grade

- .1 Standard:
 - .1 Stone free of open or loose bedding planes and joints, sand or clay pockets and large concretions.
- .2 Select:
 - .1 Stone free of all bedding planes, joints, sand or clay pockets, concretions and hollow fossils.

1.4 SYSTEM DESCRIPTION**.1 Performance Requirements**

- .1 Limestone shall conform to the "Physical Requirements for Limestone" as listed herein.
- .2 All stone shall be sawed, cut, split, or otherwise finished or shaped, and shall specifically exclude moulded, cast or otherwise artificially aggregated units composed of fragments, and also crushed and broken stone.
- .3 Stone shall be sound, durable, and free of imperfections such as starts, cracks, and stylolite seams that would impair its structural integrity under normal environments of use.
- .4 Tight stylolitic seams may be tolerated if less than 0.5mm, no more than two for low-height (<229mm) blocks, and no more than four for tall-height (>230mm) blocks. No apparent division seams of this tolerance will be accepted. No stylolitic seams will be tolerated within the top or bottom joint bed zones of less than 60mm.
- .5 The desired colour and the permissible natural variations in colour and texture shall match clean samples of stone accepted by DCC Representative.
- .6 Stone shall be free of minerals that may cause objectionable staining under normal environments of use.
- .7 Exposed block faces shall be generally free of inclusions and seams of a different colour or type than the host stone.

.2 Workmanship and Materials

- .1 All work shall be executed by craftsmen skilled in the trade. New work shall match adjacent original work in quality and aesthetic appearance.
- .2 All stone shall be of the highest quality, fine grained, free of staining oxides and suitable for incorporation into the existing fabric.

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1.5 SUBMITTALS

- .1 Submission Requirements
 - .1 Make submissions in accordance with the requirements set out in DCC Division 1 Section 01 33 00 - Submittal Procedures.
- .2 Stone Supply Schedule
 - .1 During the course of the work provide a final schedule of replacement blocks and dutchmen.
 - .1 Indicate their approximate size and required bedding plane direction.
- .3 Product Data
 - .1 Confirm in writing the stone geological data including:
 - .1 Geological Classification
 - .2 Geological Formation
 - .3 Quarry Bed
 - .4 Quarry
- .4 Shop Drawings
 - .1 Refer to drawings for general location, quantity and general shape of stone units required.
 - .2 The DCC Representative will review and adjust the block replacement schedule after scaffolding is installed and again when deteriorated blocks are being repaired.
 - .3 Measure stones on site for actual size, configuration and profile required to suit existing site conditions.
 - .4 On fabricator's shop drawings show in detail the sizes, sections, dimensions, bedding planes, joint arrangement and bonding details and any other related features requested by the DCC Representative.
 - .5 The shop drawings and sketches shall be altered by the subcontractor as required by the DCC Representative.
 - .6 Schedule the blocks and mark them on the shop drawings.
 - .1 Mark all blocks with the scheduled numbers shown on the shop drawings painted on a concealed face.
 - .7 Provide a complete stone supply schedule, with dimensioned cutting and setting details.
- .5 Samples
 - .1 Submit ten (10) sawn 50 x 50 x 50 mm cubes with true square sides, accurate to 1 mm tolerance of each sample in accordance with ASTM C170.
 - .2 Submit four (4) 75 x 150 x 25 mm slab samples of each type required.
 - .3 Slab samples shall represent the typical colour, grain, texture, and finish of the completed work, and shall match the existing adjacent stonework on site.
 - .4 Obtain samples from a range of blocks representative of the products to be provided.

- .5 Submit slab samples illustrating all required surface finishes, including but not limited to the following:
 - .1 Sawn
 - .2 Rubbed
 - .3 Tooled

1.6 QUALITY ASSURANCE

- .1 Personnel Qualifications
 - .1 Provide for work to be done by skilled and experienced tradesmen specializing in the type of work specified.
- .2 Affidavits
 - .1 Provide a current affidavit from an approved testing laboratory that the supplied materials conform to the requirements of this specification.
- .3 Pre-construction Meeting
 - .1 A pre-construction meeting is to take place between the Contractor, the DCC Representative and the Quarry Representative to review the quality control programme, the delivery schedule and the review procedures.
 - .2 The Contractor and DCC Representative is to review the building and identify the stones to be replaced, the Contractor is to provide the range and quantity of replacement units required to complete the work and prepare for the Quarry or Quarry Representative a schedule of replacement units.
- .4 Selection of Quarry Blocks
 - .1 The DCC reserves the right to select suitable quarry blocks either at the quarry or the yard of the stone distributor for use on this project.
 - .1 Provide no less than three weeks notice to the DCC Representative to allow for organization of the selection process.
- .5 Selection of Fabrication Units
 - .1 The sawn units must be presented during DCC quality selection visits at the fabrication shop.
 - .2 The Unit Price Table dimensions are to be of the finished product. Any oversizing for tooling and initial review are to be included in the unit cost of the finished stone units.
 - .3 The Fabricator will slab and cut the identified quarry blocks to the oversized dimensions and present for review on its natural bed the six sawn sides of each cut stone.
 - .1 The stones must not be stacked and must be presented on pallets so that all sides can easily be reviewed in good lighting conditions.
 - .4 The DCC Representative will review each stone and either reject or accept it following the tolerances defined for flaws including, but not limited to fissures, stylotites or other voiding or partings.

- .5 A sample sawn stone selected by the DCC Representative at the stone fabricator shop as a quality-control example.
 - .1 The DCC Representative will mark areas of the block face that are considered acceptable and areas (if existing) that are not acceptable.
 - .2 The block is to be kept at the stone fabrication shop for the duration of the project and serve as the standard of quality for all project stone replacement units.
- .6 Required samples of tooling are to be provided for review by the DCC Representative before any stone units are fabricated.
- .7 Once accepted the Contractor will acquire the stone units for the project.
 - .1 Note that the Contractor is responsible for finish tooling and site dimensioning of the stone in depth, width and height to fit the requirements of the Contract.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Packing and Shipping
 - .1 Carefully pack and crate all fabricated stone units for shipment.
 - .2 Carefully unload stone units at the site with competent workmen and appropriate equipment. Do not drop, crack, soil or chip units.
- .2 Storage and Protection
 - .1 Stack rough blocks and fabricated units on skids, clear of the ground and protect against soiling or staining.
 - .2 Cover blocks and units with clean plastic sheets, well tied-down during extended storage or as required to prevent damage.
 - .3 When stones are stacked, separate the faces by non-staining skids. Use only two skids per stone, and support at the quarter points of the blocks.
 - .4 Use only skids made of white pine, poplar or yellow pine, that do not contain excessive resin. Do not use chestnut, oak or similar woods containing tannin.
 - .5 Obtain direction from the DCC Representative as to the location and the amount of storage areas available at the worksite for materials.

Part 2 Products

2.1 SUPPLIERS

- .1 General
 - .1 The product named is to establish performances and quality required.
- .2 Kingston Limestone
 - .1 The replacement stone for acceptable Kingston Limestone must be geologically identical to the existing stone. By geologically identical is meant the micritic limestone that comes from the Gull River Formation of southeast Ontario. Two types are alternately bedded within this formation: those that develop a

distinctive white patina (calcium carbonate rich) upon aging and those that develop a distinctly buff coloured patina upon aging. For the purposes of this project supply, the selection must only come from those quarry beds that provide patinas that are distinctively white. Other types of limestone will not be accepted as they will have negative effect with regards to aged patina, chemical and structural incompatibility with the existing fabric

- .1 Stone shall be tested and minimum physical requirements for Medium Density Limestone per ASTM C568 shall be met including:
 - i. Bulk Specific Gravity > 2160 kg/m³
 - ii. Water Absorption < 3.0% by weight
 - iii. Modulus of Rupture > 3.4 MPa
 - iv. Compressive Strength > 55 MPa
- .2 Acceptability of stone will also be determined by the weathered colour of the stone. Samples to include examples of weathered faces.
- .2 Acceptable Kingston (Gull River Formation) Limestone Quarries are:
 - .1 Rideauview Contracts, 2091 Washburn Road, Inverary ON, Contact: Jim Jackson Tel: 613-546-7779
 - .2 Allstone Quarry Products, 5700 Concession Rd. B&C, Ramara ON. Contact: Peter Melo Tel: 905-939-8491
 - .3 Drain Bros. Excavating Limited – Armour Stone Division Halimen Quarry Asphodel 11th Line #25, Norwood ON, Contact: Chris Brown Tel: 705-639-2301

These quarries have been confirmed to include stone from the Gull River Formations, however; DCC makes no guarantee as to the availability or quality of the final stones. The contractor is responsible for confirming with quarry availability, schedule and final quality of all stone material as per the requirements of these specifications.

2.2 QUALITY CONTROL AND STONE SELECTION PROCEDURES

- .1 The Contractor must account for and abide by the following stone procurement quality control and assurance program:
 - .1 Only stones that have been reviewed and approved by the DCC Representative are to be used in construction where replacement stone is required.
 - .2 The review procedures are as follows:
 - .1 A preconstruction meeting will occur with the DCC Representative and the Quarry representative to review the quality control program, the schedule and the review procedures.
 - .2 The quarry blocks and quarry wall will be reviewed by the DCC Representative and the Quarry representative. The DCC Representative will identify blocks that have the potential of producing acceptable quality stones.

- .3 Following the Contractor's review of the building and identification with the DCC Representative of the stones to be replaced, the Contractor is to provide the range of dimensions of stones required for the work, and prepare for the Quarry a list of stone dimensions.
- .2 Review and Approval of Replacement Stone Units:
 - .1 All replacement stone, including rough slabs, sawn blocks, and individual finished replacement stone units, shall be subject to review and approval by the DCC Representative prior to incorporation into the Work.
 - .2 Individual replacement stone units shall be presented for review following completion of all required fabrication and finishing, and prior to delivery to site or installation.
 - .3 No stone unit shall be installed unless it has been individually reviewed and accepted by the DCC Representative.
 - .4 Stone units shall be presented for review in a manner that allows full visual inspection of all faces under adequate lighting conditions.

2.3 FABRICATION

- .1 Verification
 - .1 Preliminary sizes for blocks are shown on DCC Unit Rate Table for guidance and bidding purposes only.
 - .2 Exact rough and finished block sizes for cutting and costing are to be verified by the contractor after examination of the contract drawings and review of field conditions.
- .2 Thickness and Tolerances
 - .1 Refer to the thicknesses shown on detail drawings. Stones are to be fabricated from one piece of rock. Stone shall be cut so as to lie on the natural bed unless specified otherwise herein.
 - .2 Fabricate stones to within 2 mm in 900 mm of length or height.
 - .3 Fabricate rubbed, radiused, moulded or frame-sawn faces of slabs to within 1 mm of specified thickness of adjacent work.
- .3 Joint Thickness
 - .1 To match original joint thickness.
- .4 Finishes
 - .1 Provide finishes shown on DCC Unit Rate Table and tender drawings.
- .5 Bedding
 - .1 Fabricator to confirm that the new or replacement stone matches the bedding of the existing adjacent stone of the building.
 - .1 The direction of the bedding plane may be changed by the DCC Representative from the original direction if it is not the most appropriate direction for the particular block.

- .2 Bedding plane is to be shown on shop drawings.
 - .3 Bedding plane is to be marked on a concealed face on all finished blocks.
- .2 Bedding planes of dutchmen are to align with that of the host stone.
- .3 Bedding planes are to be generally as follows:
 - .1 Ashlar, rubble and block work: flat (natural)-bedded
 - .2 Cornices, deep (>50mm) mouldings and undercut work: edge-bedded
- .6 Dressing
 - .1 The exposed faces of blocks cut to be used as dutchmen are to be left rough-cut for final dressing or finishing in situ.
- .7 Cutouts and Chases
 - .1 Internal corners and edges on cutouts are to be square and true. Do not overcut internal edges whether concealed or not.
 - .2 Provide internally radiused drip edges. Drip radiuses to be 12 mm unless otherwise specified or shown on the drawings.
- .8 Defects
 - .1 Shipped blocks are to be without chips or other defects. Minor chips to edges (less than 3 mm) will be reviewed by the DCC Representative for possible acceptance.
 - .2 Field repair of edges and inherent defects using epoxy-and-stone dust type patching material is not permitted.
 - .3 Factory application of epoxy-and-stone-dust type patching material to repair defective material is not permitted.

Part 3 Execution**3.1 PREPARATION FOR DELIVERY**

- .1 Carefully pack stone to prevent damage.
- .2 Clearly identify each stone unit.

3.2 DELIVERY

- .1 Deliver stone ready for installation under Section 04 03 42.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 ASTM International
 - .1 ASTM B32-08 (2014), Standard Specification for Solder Metal.
 - .2 ASTM B370-12, Standard Specification for Copper Sheet and Strip for Building Construction.
- .2 Copper Development Association (CDA)
 - .1 Copper in Architecture.

1.2 SUBMITTALS

- .1 Section 01 33 00: Submission Procedures.
- .2 Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- .3 Samples: Submit duplicate samples of sheet metal material, 150 x 150 mm (6 x 6 inches) in size, illustrating metal finish and colour.
- .4 Installation Data: Manufacturer's special installation requirements.

1.3 QUALITY ASSURANCE

- .1 Perform work in accordance with CDA standard details and requirements.
- .2 Maintain one (1) copy of each document on site.
- .3 Fabricator Qualifications: Company specializing in manufacturing the Products specified in this section.
- .4 Installer Qualifications: Company specializing in performing the work of this section.

1.4 DELIVERY, STORAGE, AND PROTECTION

- .1 Section 01 61 00: Transport, handle, store, and protect products.
- .2 Stack material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- .3 Prevent contact with materials which may cause discolouration or staining.

Part 2 Products

2.1 SHEET MATERIALS

- .1 Copper sheet: To ASTM B370, cold rolled, H00 temper designation. Sheet material to be uniform in quality and temper, free of pinholes and de-wetted areas, clean, smooth, commercially flat and straight, and free from injurious dents and defects.
 - .1 Flashing: 4.8 kg/m² (16 oz/ft²).
 - .2 Cleats and other similar formed components: 6.1 kg/m² (20 oz/ft²).

2.2 ACCESSORIES

- .1 Fasteners: Stainless steel.
- .2 Slip sheet: 4 lb red rosin-sized building paper.
- .3 Solder: To ASTM B32; provide 50-50 tin/lead or lead-free alternative of similar or greater strength solder.
- .4 Flux: Killed acid flux.

2.3 FABRICATION

- .1 Form sections true to shape, accurate in size, square, and free from distortion or defects.
- .2 Fabricate cleats of same material as sheet, interlockable with sheet.
- .3 Form pieces in longest possible lengths.
- .4 Hem exposed edges on underside 13 mm (1/2 inch); mitre and seam corners.
- .5 Form material with standing or flat lock seams as indicated or to match existing details.
- .6 Fabricate corners from one piece with minimum 450 mm (18 inch) long legs; seam for rigidity, seal with sealant.
- .7 Fabricate vertical faces with bottom edge formed outward 13 mm (1/2 inch) and hemmed to form drip.
- .8 Fabricate flashings to allow toe to extend 25 mm (1 inch) over roofing. Return and brake edges.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify existing conditions before starting work.
- .2 Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, reglets in place, and nailing strips located.
- .3 Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

- .1 Install starter and edge strips, and cleats before starting installation.
- .2 Install reglets in masonry joints as indicated.

3.3 INSTALLATION

- .1 Conform to drawing details and with guidelines of CDA Copper in Architecture manual.
- .2 Slip sheet: Where installation is to be directly on cementitious or wood substrates, install red rosin paper slip sheet beneath copper flashing.
- .3 Secure flashings in place using concealed fasteners.
- .4 Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- .5 Insert flashings into reglets to form tight fit. Secure in place with expansion anchors. Mortar in place with approved mortar.
- .6 Solder metal joints for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.
- .7 Touch up damage to sheet metal with clear lacquer coating.

3.4 FIELD QUALITY CONTROL

- .1 Section 01 45 00: Field inspection.
- .2 Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION