

**PART 1 GENERAL**

**1.01 RELATED REQUIREMENTS**

- .1 Section 04 03 07 – Historic - Masonry Repointing.
- .2 Section 04 03 08 – Historic - Mortaring.
- .3 Section 04 03 42 – Historic - Replacing Stone.
- .4 Section 04 03 43 – Historic - Dismantling Stone Masonry.
- .5 Section 04 05 00 – Common Work Results for Masonry.

**1.02 REFERENCES**

- .1 Definitions:
  - .1 Low-pressure water: less than 72 kPa (500 psi), measured at nozzle tip.
  - .2 Medium-pressure water: minimum 72 kPa (500 psi) and maximum 144 kPa (1000 psi), measured at nozzle tip.
- .2 Reference Standards:
  - .1 CSA Group
    - .1 CAN/CSA-Z94.4-11, Selection, Use, and Care of Respirators.
  - .2 Department of Justice Canada (Jus).
    - .1 Canadian Environmental Protection Act (CEPA), 1999.
  - .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
    - .1 Material Safety Data Sheets (MSDS).
  - .4 Transport Canada (TC)
    - .1 Transportation of Dangerous Goods Act, (1992, c. 34).

**1.03 PRICE AND PAYMENT PROCEDURES:**

- .1 Payment for work will be on a Lump Sum basis unless otherwise identified for payment on a Unit Price basis.
- .2 Lump Sum and Unit Price work are to be included in the Total Bid Amount.
- .3 Unit Prices will include all costs associated with products and execution as described herein and reflected in the contract. The following items of work will be paid based on actual quantities measured on site and validated by the Departmental Representative, and Unit Prices identified in the Bid Form.
  - .1 Dressing back thin plate exfoliation;
  - .2 Mechanical removal of gum;
  - .3 Mechanical removal of carbon crusts.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- .1 Sequencing:
  - .1 Dressing back thin plate exfoliation;
  - .2 Mechanical removal of gum;
  - .3 Mechanical removal of carbon crusts;
  - .4 Removal of biologic growths;
  - .5 Laser Cleaning.

**1.05 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide proposed cleaning method and type of protection from cleaning residue for in-place conditions.
- .3 Product Data:
  - .1 Provide technical data on cleaning materials, equipment, machinery, compressors, tools and nozzles.
  - .2 Submit WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .4 Samples:
  - .1 Provide samples of cleaning materials for approval of Departmental Representative.
- .5 Photographic documentation:
  - .1 Provide photographic documentation in accordance with Section 04 05 00 – Common Work Results for Masonry.

**1.06 QUALITY ASSURANCE**

- .1 Regulatory Requirements: ensure work is performed in compliance with CEPA and applicable Provincial regulations.
- .2 Comply with requirements of Workplace Hazardous Materials Information Sheet (WHMIS).
- .3 Mock-ups:
  - .1 Do mock-up tests in accordance with Section 01 45 00 - Quality Control.
  - .2 Notify Departmental Representative 48 hours before commencing cleaning of each test patch.
    - .1 Obtain approval from Departmental Representative before commencing test.
  - .3 Before proceeding with mock up:
    - .1 Ensure area of testing is masked-off and that adjacent surfaces and elements are protected.
    - .2 Ensure contaminated water is kept in containers and their disposal respects environmental regulations.
  - .4 Conduct tests on wall to determine effectiveness of each type of cleaning method, for each type of substrate and for a varied degree of soiling.

- .5 Conduct tests to determine effectiveness of water pressures, dwell time periods, flow rates and water temperatures, types of nozzles, spraying distances from wall surface.
- .6 Start with lowest impact tests and stop testing when desired level of cleaning is achieved, stop testing immediately when damage is caused.
- .7 Locate test patches in inconspicuous places as directed by Departmental Representative.
- .8 Conduct tests to determine best methods of protecting surrounding historic material, openings and plants, and masking ironwork during test cleaning procedure, and monitor for detrimental effects.
- .9 Do not proceed with work without approval of mock-up.
- .10 Allow 5 working days for inspection of mock-up by Departmental Representative.
- .11 Accepted mock-up will demonstrate minimum standard for work. Mock-up may remain as part of finished work.
- .4 Qualifications:
  - .1 Work of this section to be performed by qualified masons and skilled tradespersons, trained and experienced in historic masonry as per the Mandatory Requirements of the bid form (prequalification) in accordance with Section 04 05 00 – Common Work Results for Masonry.

**1.07 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials, as outlined in article "WASTE MANAGEMENT" of Section 01 00 10 – General Instructions.

**1.08 SITE CONDITIONS**

- .1 Ambient conditions:
  - .1 Do not use wet cleaning methods when there is threat of frost.
  - .2 Do not use chemical cleaners when temperature is below 10 degrees C.
  - .3 Follow manufacturer's written instructions on use of chemical cleaners in accordance with product's temperature range application.
  - .4 Provide shading to wall to avoid cleaning in full, hot sunlight.
  - .5 Do not clean if there is risk of cleaning materials being blown onto publicly accessible areas, or if other materials will be damaged by cleaning process.
  - .6 Protect work in the event of high winds.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

- .1 Use clean potable water free from contaminants.
- .2 Treat water having high metal content before use.
- .3 Use air free from oil or other contaminants.
- .4 Use masking material polyethylene, painter's masking tape, and metallic tape to approval of Departmental Representative.
- .5 Use surfactant (detergent) in concentrations less than 5% by volume.
- .6 Use proprietary biodegradable biocide, low viscosity liquid, pH neutral (9.5), containing no chlorine or acids.

**2.02 TOOLS AND EQUIPMENT**

- .1 Use brushes with stiff nylon bristles.
- .2 Use scrapers of wood and plastic.
- .3 Use artists metal spatulas.
- .4 Use water pumps fitted with accurate pressure regulators and gauges capable of being preset and locked at maximum specified levels.
- .5 Use hand pumped pressure tank/wand spray applicator.
- .6 Use air compressors equipped with on-line oil filters to avoid spraying oil onto masonry.
- .7 Use gun equipped with pressure gauge at nozzle end.
- .8 Use portable appliance, capable of delivering superheated water up to 150 degrees C at low volume and low pressure through fine nozzles, to generate steam.
- .9 Use laser cleaning system for general cleaning.

**PART 3 EXECUTION**

**3.01 SITE VERIFICATION OF CONDITIONS**

- .1 Record existing conditions, by means of photographs, before and after cleaning. Advise Departmental Representative of potential complications.
- .2 Report to Departmental Representative conditions of deteriorated masonry likely to affect cleaning, found before and during cleaning.
- .3 Obtain written approval of Departmental Representative before cleaning areas of deteriorated masonry.

**3.02 PREPARATION**

- .1 Protect operatives and other site personnel from hazards.
- .1 Ensure good ventilation in work area.

- .2 Ensure workers wear eye, head, and face protection, and protective gloves, coveralls, boots and respirator to CAN/CSA-Z94.4.
- .2 Place safety devices and signs near work areas as indicated and directed.
- .3 Provide a shelter around work area as indicated on Contract Drawings directed by Departmental Representative.
- .1 Obtain approval of sheltering method from Departmental Representative before commencing cleaning procedure.

### **3.03 PROTECTION OF IN PLACE CONDITIONS**

- .1 Cover and protect surfaces and non-masonry finishes not to be cleaned.
- .1 Obtain approval of protection method from Departmental Representative before commencing cleaning procedure.
- .2 Protect openings to prevent water entry.
  - .1 Protect exploratory masonry openings from water/chemical infiltration with polyethylene during cleaning.
- .3 Protect ironwork adjacent to masonry.
  - .1 Use previously tested methods approved by Departmental Representative. Methods may include:
    - .1 No protection, where not affected by cleaning method.
    - .2 Painter's masking tape or metallic tape applied directly to the painted surface.
    - .3 Metallic tape applied over painter's masking tape.
  - .2 Remove dust from substrate prior to application. Wipe surface with a dry lint free cloth, followed by the use of a damp lint free cloth. Wait for the surface to dry before applying the tape; leave in place 48 hour, or less, as determined during mock-ups.
- .4 Protect plants, gardens, shrubs from watering and chemicals.
- .5 Hang sheeting material from temporary fencing and tarpaulins from scaffolding to respectively enclose overspray and laser.
- .6 Protect drains from being blocked by residue.
- .7 Protect adjacent Work from spread of dust and dirt beyond work areas.

### **3.04 EXECUTION OF CLEANING**

- .1 Proceed with cleaning in accordance with written instructions of methods, systems, tools and equipment approved by Departmental Representative.
- .2 Dry brush or scrape accumulations from bays and piers.
- .3 Pre-wet masonry surface when necessary. Work from bottom of wall upwards.
- .4 Do not exceed maximum pressure at nozzle or have nozzle closer to masonry than approved by Departmental Representative at tests.
- .5 Keep nozzle minimum 300 mm distance away from masonry surface as approved by Departmental Representative.

- .6 Stop work when cleaning has detrimental effect on surrounding material and plants.
- .7 Avoid prolonged wetting and excessive water penetration.
- .8 Brush and scrape only to supplement water washing.
- .9 Undertake water spray to soften and loosen heavy deposits, then brush. Remove thick incrustations with wooden or plastic scrapers.
- .10 Dressing back thin plate exfoliation:
  - .1 Remove detaching thin surface plates of stone presenting exfoliation.
  - .2 Use hand tools namely chisels, mallets, and wooden wedges to prevent marking of stone.
  - .3 Determine locations with Departmental Representative before commencing work.
- .11 Mechanical removal of gum:
  - .1 Use a surfactant (non-ionic) solution to assist in the steam cleaning process.
    - .1 Use previously tested steam approved by Departmental Representative.
  - .2 Scrub with bristle brushes until deposit lifts, wipe and rinse away.
  - .3 Perform process for each individual piece 50 x 50mm.
- .12 Mechanical removal of carbon crusts:
  - .1 Remove loose carbon/gypsum crusts within recessed zones of sculpted, carved, profiled, and moulded elements; sculptures; or other decorative carved detailing.
  - .2 Scrape using softwood sticks and wedges.
- .13 Removal of biologic growths:
  - .1 General cleaning of all stone surfaces to remove biologic growths from all facets including recesses.
  - .2 Remove vegetation and organic biologic growth growing in or on masonry including biofilm, lichen growth, algae and moss.
  - .3 Apply biocide liberally on all surfaces using a hand pumped spray applicator. Let dwell 24 hours.
  - .4 Rinse with "Medium-Pressure Water Cleaning". Rinsing is complete when the surfactant suds stop appearing in the spent rinse water. Thorough process for rinsing requires slow/methodic passes with pressure and fixed with fan-tip nozzle in back/forth directions with certain overlap with each pass taking place.
- .14 Medium-Pressure Water Cleaning:
  - .1 Remove stains and accumulated dirt with medium-pressure maximum 800 psi wash-down at flow rate of 0.25 L/s.
  - .2 Use a fan-type nozzle with minimum 375 mm spread.
  - .3 Hold nozzle minimum 300 mm from masonry surface.
- .15 Laser Cleaning:
  - .1 General cleaning of all stone surfaces to remove atmospheric black pollutant deposit/soiling, ferric stains, etc. from all facets including recesses.

- .2 Proprietary laser ablation for surface treatment, cleaning and stain removal from masonry with technology capable of completely removing contaminants, residue and coatings without damaging the stone surface and its mineral matrix.
  - .1 System to provide gentle cleaning with light only, without abrasion; non-contact / non-kinetic cleaning where only the laser light touches the surface.
  - .2 System cannot incorporate chemicals, residues or consumables, nor use water, unless indicated otherwise, or liquids that can cause moisture damage and corrosion.
  - .3 System to be easy to operate and with precision adjustment.
- .3 Use pre-wetting to compliment and assist with the laser cleaning work.
- .4 Use mobile enclosure system in accordance with Section 01 56 00 – Temporary Barriers and Enclosures. Design system to protect persons outside the immediate work area from emitting laser radiation. Arrange system to allow for fast setup times and flexibility.
- .5 Use integrated laser fume extraction system to keep the exposed parts of the optic clean and eliminate fumes, particles and odours. Provide filter units with integrated HEPA and gas filters.
- .6 Use integrated safety interlock switches in the event of full or partial system failure.

### **3.05 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Rinse off masonry to satisfaction of Departmental Representative until no indications of chemicals are present and pH of surface is neutral.
- .3 Rinse from bottom to top and from top to bottom.
- .4 Clean up work area as work progresses. At end of each work day remove debris and waste from site.
- .5 Upon completion, clean and restore areas used for work to condition at least equal to that previously existing.
  - .1 Perform a final rinse of masonry by "Medium-Pressure Water Cleaning" to remove dirt and dust generated by construction activities.
- .6 Waste Management: separate waste materials for reuse and recycling as outlined in article "WASTE MANAGEMENT" of Section 01 00 10 – General Instructions.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
  - .2 Collect, neutralize and dispose of water and chemicals in accordance with contract requirements, applicable regulations and Canadian Environmental Protection Act, (CEPA).
- .7 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**

**PART 1 GENERAL**

**1.01 RELATED REQUIREMENTS**

- .1 Section 04 03 06 – Historic - Masonry Cleaning.
- .2 Section 04 03 08 – Historic - Mortaring.
- .3 Section 04 03 42 – Historic - Replacing Stone.
- .4 Section 04 03 43 – Historic - Dismantling Stone Masonry.
- .5 Section 04 05 00 – Common Work Results for Masonry.

**1.02 REFERENCES**

- .1 Definitions:
  - .1 Raking: removal of loose/deteriorated mortar to a depth suitable for repointing until sound mortar, and/or 4x joint thickness and/or a specified mm depth is reached.
  - .2 Repointing: filling and finishing of masonry joints from which mortar is missing, has been raked out or has been omitted.
  - .3 Back Pointing: repointing to depths greater than minimum raked depths specified, to bring mortar face to specified depth for raked joints.
  - .4 Finish Pointing: repointing face of joint, to depth specified for raked joints.
  - .5 Tooling: finishing of masonry joints using tool to provide final contour.
- .2 Reference Standards:
  - .1 CSA Group
    - .1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
    - .2 CAN/CSA-A179-04(R2014), Mortar and Grout for Unit Masonry.

**1.03 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for all products and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
  - .1 Provide labelled samples of materials to be used on project for approval before work commences.
- .4 Test and Evaluation Reports:
  - .1 Provide certified test reports showing compliance with specified performance characteristics and physical properties.



- .2 Provide laboratory test reports certifying compliance of mortar ingredients with specifications requirements.

**1.04 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Work of this section to be performed by qualified masons and skilled tradespersons, trained and experienced in historic masonry as per the Mandatory Requirements of the bid form (prequalification) in accordance with Section 04 05 00 – Common Work Results for Masonry.
  - .2 Obtain written approval from Departmental Representative for changes to qualified personnel.
- .2 Mock-ups:
  - .1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.
  - .2 Construct mock-up 600mm x 600mm to demonstrate raking and repointing procedures for each type of below grade and above grade masonry material specified in locations designated by Departmental Representative.
  - .3 Notify Departmental Representative 48 hours before commencing mock-up.
    - .1 Obtain approval from Departmental Representative before commencing mock-up.
  - .4 Construct mock-up under supervision of Departmental Representative to demonstrate a full understanding of specified procedures, techniques and formulations is achieved before work commences.
  - .5 Construct mock-up where directed by Departmental Representative.
  - .6 Work not to proceed prior to approval of mock-up. Allow 48 hours for inspection of mock-up by Departmental Representative before proceeding with masonry repointing work.
  - .7 Repeat mock-up until results obtained are to satisfaction of Departmental Representative.
  - .8 Mock-up will be used to:
    - .1 Judge quality of work, substrate preparation, operation of equipment, material preparation and application, and curing methods.
    - .2 Determine joint finish required.
    - .3 Test to determine compliance with property requirements.
  - .9 Accepted mock-up will demonstrate minimum standard for this work. Mock-up will remain as part of finished work.
- .3 Laboratory tests for mortar:
  - .1 Contractor to include costs for provision of laboratory testing of pointing mortars during mock-ups and on a continuing weekly basis.
  - .2 Test following properties, at a minimum, will be tested:
    - .1 Compressive strength: 7 day and 28 day.
    - .2 Air entrainment percentage.

- .3 Sample mortar for testing purposes directly on site.
- .4 Testing laboratory to be approved in writing by Departmental Representative.

**1.05 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store cementitious materials and aggregates in accordance with CSA A23.1/A23.2.
  - .3 Store lime putty in plastic lined sealed drums.
  - .4 Keep material dry. Protect from weather, freezing and contamination.
  - .5 Remove rejected or contaminated material from site.
  - .6 Replace defective or damaged materials with new.

**1.06 SITE CONDITIONS**

- .1 Ambient conditions:
  - .1 Maintain masonry temperature between 10 and 27 degrees C for duration of work.
  - .2 When ambient temperature is below 10 degrees C or is forecast to fall below 10 degrees C within 24 hours:
    - .1 Maintain temperature of lime at or above 10 degrees C at all times.
    - .2 Store mortar materials for immediate use within heated enclosure. Allow mortar materials to reach minimum temperature of 10 degrees C before use.
    - .3 Heat and maintain sand temperature to minimum 10 degrees C and maximum 30 degrees C.
      - .1 Heat and maintain water temperature to minimum of 20 degrees C and maximum of 30 degrees C:
    - .4 Provide hot water to a maximum 30 degrees C on site during cold weather.
    - .5 Provide enclosure system around curing area to ensure that stated conditions are maintained for curing period.
    - .6 Use heated temporary enclosures to maintain temperatures above 10 degrees C in cold weather with written approval of Departmental Representative.
    - .7 Submit enclosure system for approval from Departmental Representative.
  - .2 Remove work exposed to temperatures lower than 10 degrees C as directed by Departmental Representative.
  - .3 When ambient temperature is above 21 degrees C:
    - .1 Protect repointed areas from direct sunlight and wind.

- .2 Use protective methods acceptable to the Departmental Representative.
- .4 Provide humid cure for a minimum of 7 days.
- .5 Use and prepare mortar when the ambient air temperature is between 10 and 27 degrees C at the location of the work.
- .6 Maintain sand temperature between 10 and 30 degrees C.
- .7 Mix cement with water or with aggregate or with water-aggregate mixtures when ambient air temperature is between 10 and 30 degrees C.
- .8 Maintain mortar mix temperature between 10 and 30 degrees C.

## **PART 2 PRODUCTS**

### **2.01 MORTAR**

- .1 Mortar: in accordance with CAN/CSA-A179 and Section 04 03 08 - Historic - Mortaring.
- .2 Proportion Specification:
  - .1 In accordance with CAN/CSA-A179 and Section 04 03 08 - Historic - Mortaring.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- .1 Verification of Conditions: verify masonry, staging and storage areas and notify Departmental Representative in writing of conditions detrimental to acceptable and timely completion of Work.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform in writing Departmental Representative of unacceptable conditions immediately upon discovery.
- .2 Notify Departmental Representative immediately if evidence of hazardous materials is discovered in work area.
- .3 Stop work in that area and report to Departmental Representative immediately evidence of hazardous materials.

### **3.02 PROTECTION OF IN-PLACE CONDITIONS**

- .1 Protection requirements are specified in Section 04 05 00 - Common Work Results for Masonry.

### **3.03 SPECIAL TECHNIQUES**

- .1 Examine mortar joints.
  - .1 Examine horizontal and vertical joints to determine which were struck first and whether they are the same style, as well as aspects of quality of work which establish authenticity of original work.
  - .2 Replicate the style selected by Departmental Representative.

### 3.04 RAKING JOINTS

- .1 Use manual raking tool to obtain clean masonry surfaces.
  - .1 Remove deteriorated and adhered mortar from masonry surfaces to full depth of stone, unless the mortar is unusually hard in which case less than 50 mm, leaving square corners and flat surface at back of cut.
  - .2 Clean out voids and cavities encountered.
- .2 Remove mortar without chipping, altering or damaging masonry units.
- .3 Where use of power tools to remove mortar is deemed appropriate and approved in writing by Departmental Representative:
  - .1 Flat-bladed quirks and light hammers, hacksaw blades or similar tools may be employed where fine joints are encountered.
  - .2 Small hand-held low-impact pneumatic carving tools, fitted with appropriate points and chisels to the approval of the Departmental Representative may be employed for rock-faced work.
  - .3 Hand held rotary or oscillating diamond saw blades narrower than the mortar joint may be employed to supplement other techniques.
  - .4 Rake out to centre of joint only, to a maximum depth that is equal to half of joint width. Mortar must remain on each side of saw cut. Raking must not touch masonry units.
  - .5 Stop saw cut 50 to 75 mm from end of vertical and discontinuous horizontal joints. Do not cut into masonry units.
  - .6 Notify Departmental Representative to inspect raking, prior to removing remaining mortar with hand tools.
  - .7 Remove remaining mortar with hand tools.
- .4 Replace stone damaged as a result of careless raking of saw cutting, at no cost, as selected by the Departmental Representative.
- .5 Remove mortar from top, bottom and side joints, with back surface of joint square and of an even depth.

### 3.05 REPOINTING

- .1 When required replacement work is complete carry out repointing.
- .2 Before repointing, wash down wall to be repointed and allow to dry to damp, but not wet. Ensure that dust and debris are removed from joints and wall surfaces prior to repointing.
- .3 Leave no standing water.
- .4 Keep masonry damp while pointing is being performed.
- .5 Completely fill joint with mortar.
  - .1 If surface of masonry units has worn rounded edges keep pointing back 1 mm from surface to maintain same width of joint
  - .2 Avoid feathered edges.
  - .3 Pack mortar firmly into voids and joints, ensuring full contact with back and sides of joint and leaving no voids.

- .6 Build-up pointing in layers no less than 12 mm and not exceeding 40 mm in depth.
  - .1 Allow each layer to set before applying subsequent layers.
  - .2 Maintain joint width.
- .7 Finish joints to match existing profile as directed by Departmental Representative.
  - .1 Tool, compact and finish using mason's slick to force mortar into joint. Ensure jointing tool fits within width of joint. Use tools of varying widths to meet this requirement.
  - .2 Provide final exposed aggregate texture when mortar has dried to thumb-print hardness by striking surface of joint with a stiff bristle brush thus exposing the arris by 1 mm.
- .8 Remove excess mortar from masonry face before it sets.

### **3.06 PROTECTION DURING CURING PROCESS**

- .1 Cover completed and partially completed work not enclosed or sheltered at end of each work day.
  - .1 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 Cover with waterproof tarps to protect newly laid mortar from frost, rainfall and rapid drying conditions such as wind.
  - .1 Maintain tarps in place for minimum of 2 weeks after repointing.
  - .2 Ensure that bottoms of tarps permit airflow to reach mortar in joints.
- .3 Anchor coverings securely in position.
- .4 Damp cure:
  - .1 Provide damp cure for back pointing and finish pointing mortars, at a minimum temperature of 10 degrees C.
  - .2 Install and maintain wetted burlap protection during the curing process , using heavy and tight-woven burlap:
    - .1 Minimum 7 days.
  - .3 Wet mist burlap only - ensure no direct spray reaches surface of curing mortar.
  - .4 Ensure burlap is not in contact with masonry. Leave air space of minimum 50 mm between burlap and masonry.
  - .5 Shade areas of work from direct sunlight and maintain constant dampness of burlap.
  - .6 Provide for off-hours and week-end work as required to maintain specified curing conditions.
- .5 Protect from drying winds. Pay particular attention at corners of structure.
- .6 Maintain ambient temperature of minimum 10 degrees C after repointing masonry for:
  - .1 Minimum 14 days using dry heated enclosures as required.

### **3.07 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.

- .2 Clean surfaces thoroughly of mortar droppings, stains and other blemishes resulting from work of this contract on a daily basis, as work progresses.
- .3 Remove droppings and splashings using clean water and thick cotton rags.
- .4 Clean masonry with stiff natural bristle brushes and plain water only if mortar has fully cured.
- .5 Obtain approval of Departmental Representative prior to using other cleaning methods for persistent stains.
- .6 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .7 Waste Management: separate waste materials for reuse and recycling as outlined in article "WASTE MANAGEMENT" of Section 01 00 10 – General Instructions.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**3.08 PROTECTION OF COMPLETED WORK**

- .1 Protect adjacent finished work against damage which may be caused by on-going work.

**END OF SECTION**

**PART 1 GENERAL**

**1.01 RELATED REQUIREMENTS**

- .1 Section 04 03 06 – Historic - Masonry Cleaning.
- .2 Section 04 03 07 – Historic - Masonry Repointing.
- .3 Section 04 03 42 – Historic - Replacing Stone.
- .4 Section 04 03 43 – Historic - Dismantling Stone Masonry.
- .5 Section 04 05 00 – Common Work Results for Masonry.

**1.02 REFERENCES**

- .1 ASTM International
  - .1 ASTM C 144-11, Standard Specification for Aggregate for Masonry Mortar.
  - .2 ASTM C 207-06(2011), Standard Specification for Hydrated Lime for Masonry Purposes.
  - .3 ASTM C 260/C 260M-10a, Standard Specification for Air-Entraining Admixtures for Concrete.
  - .4 ASTM C 780-12, Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
  - .5 ASTM C 1072-11, Standard Test Method for Measurement of Masonry Flexural Bond Strength.
- .2 CSA International
  - .1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
  - .2 CAN/CSA-A179-04(R2009), Mortar and Grout for Unit Masonry.
  - .3 CAN/CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

**1.03 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for mortar and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Prior to mixing or preparation of mortars submit for review to Departmental Representative confirmation of source or product data sheet of:
    - .1 Aggregate.
    - .2 Cement.
    - .3 Lime.
    - .4 Pigments.

- .3 Samples:
  - .1 Provide samples in quantity and size in accordance with CAN/CSA-A179.
- .4 Test reports:
  - .1 Submit test results during site work as directed by Departmental Representative's as follows:
    - .1 Sieve analysis: sand.
    - .2 Bulking analysis: sand.
    - .3 Air content: mortar mix in plastic state.
    - .4 Vicat cone penetration: mortar mix.
    - .5 Mortar compressive strength: at 7 and 28 days or otherwise required.

#### **1.04 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Work of this section to be performed by qualified masons, trained and experienced in lime mortar preparation for historic masonry as per the Mandatory Requirements of the bid form (prequalification) in accordance with Section 04 05 00 – Common Work Results for Masonry.
  - .2 Mortar to be mixed by same mechanics throughout project.
- .2 Mock-ups:
  - .1 Construct mock-up in accordance with Section 01 45 00 - Quality Control and Section 04 03 07 – Historic - Masonry Repointing.

#### **1.05 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store cementitious materials and aggregates in accordance with CSA A23.1/A23.2.
  - .3 Store lime putty in plastic lined sealed drums.
  - .4 Protect from weather, freezing and contamination.
  - .5 Remove rejected or contaminated material from site.
  - .6 Store and protect mortar materials from nicks, scratches, and blemishes.
  - .7 Replace defective or damaged materials with new.

#### **1.06 SITE CONDITIONS**

- .1 Ambient Conditions:



- .1 Provide weather-tight enclosure to store materials and mix mortars, maintain air temperature above 10 degrees C at all times.
- .2 Maintain maximum/minimum thermometers and relative humidity gauges on site and in enclosures.
  - .1 Maintain a daily record of temperature and humidity.
- .2 Install relative humidity and temperature equipment, record temperature and relative humidity and submit report to Departmental Representative.

## PART 2 PRODUCTS

### 2.01 MATERIALS

- .1 Use same manufacture and supplier for sources of each mortar material for entire project.
- .2 Water: potable, clean and free from contaminants.
- .3 Sand: to ASTM C144.

.1	For mortar joints greater than 10 mm in width		
	SIEVE SIZE	% BY WEIGHT PASSING EACH SIEVE	% BY WEIGHT RETAINED ON EACH SIEVE
	No. 4 (4.75 mm)	100	0
	No. 8 (2.36 mm)	90	10
	No. 16 (1.18 mm)	70	20
	No. 30 (600 micron)	50	20
	No. 50 (300 micron)	30	20
	No. 100 (150 micron)	15	15
	No. 200 (75 micron)	15	15
.2	For mortar joints between 6mm and 10 mm in width		
	SIEVE SIZE	% BY WEIGHT PASSING EACH SIEVE	% 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
.3	For mortar joints less than 6mm in width		
	SIEVE SIZE	% BY WEIGHT PASSING EACH SIEVE	% 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

- .4 Sharp, screened and washed siliceous pit sand, free of organic material, with final grading as specified, colour to match sand from Gillan Sand pit located at Renfrew, Ontario to approval of Departmental Representative.
- .5 Custom blend sands where necessary to provide appropriate gradation.
- .6 Sand for finish pointing to be dry with moisture content not exceeding 1%.
- .4 Portland cement: to CAN/CSA-A3000, type 10 normal, white, non-staining.
- .5 Lime:
  - .1 Air-entrained dolomitic lime, Type SA lime: to ASTM C 207. Type SA lime contains air-entraining agent.
- .6 Colour:
  - .1 Inorganic pigment, dry powder, mineral oxide type. Use minimum amount necessary.
  - .2 Coloured admixtures: maximum 8% of binder content by mass.
- .7 Air entrainment: to ASTM C 260/C 260M, agent compatible with lime mortar mixes to Departmental Representative's approval.
- .8 Spiral paddle mill comprising a mechanically driven rotating barrel with integral internal paddles.

## **2.02 MORTAR MIXES**

- .1 Proportion requirements:
  - .1 Portland cement-lime mortar:
    - .1 For pointing and bedding above and below grade: type 1:2.5:8, based on proportion specifications, consisting of one parts white Portland cement, two and a half parts lime, and eight parts sand and buff pigment; mix to 8-12% air content.

## **2.03 ALLOWABLE TOLERANCES**

- .1 Mortar compression strength:
  - .1 Minimum 2 MPa, maximum 3 MPa, cured for 7 days;
  - .2 Minimum 2.5 MPa, maximum 3.5 MPa, cured for 28 days.

## **PART 3 EXECUTION**

### **3.01 GENERAL PREPARATIONS**

- .1 Traditional Mortar:
  - .1 Prepare measuring boxes to ensure accurate proportioning of materials.
  - .2 Maintain separate measuring boxes for each component.
  - .3 Ensure sand is tested and volume corrected for bulking.
  - .4 Ensure air entraining agent is available together with a graduated container for accurate volume measurements.
  - .5 Ensure testing equipment is ready and in working order.

- .6 Apply Vicat cone test to ensure desirable performance of the mortar and record results.

### 3.02 BULKING OF SAND

- .1 Test sand for bulking:
  - .1 At start of work.
  - .2 After each new delivery of sand.
  - .3 After severe change in weather.
- .2 Test and adjust sand quantities for bulking:
  - .1 Obtain sample of sand which accurately reflects average condition of pile of damp sand, as follows:
    - .1 Take 4 shovels full of sand, each from a different level of the pile, and mix thoroughly.
    - .2 Place sand in a conical pile and divide into 4 quarters with a board. Remove 2 opposite quarters from pile, and combine remaining 2 quarters and mix thoroughly.
    - .3 Repeat quartering and mixing procedure until a sample of size required for testing remains.
  - .2 Fill a 1-litre capacity jar, about two-thirds full with damp sand to be tested. Drop sand in loosely. Do not pack it in. Level off surface, measure depth of damp sand (D).
    - .1 Carefully empty sand into another container, and half fill first container with water.
    - .2 Pour back about half of test sample of sand slowly into water so it is entirely saturated. Rod it thoroughly to remove air.
    - .3 Add rest of sand, rodding again to remove air and level off surface. Measure depth of saturated sand (S), which will be less than depth of damp sand.
    - .4 Calculate percentage bulking using formula:  $(D-S) \times 100\% / S = \text{percentage bulking}$ ; where D = depth of damp sand, and S = depth of saturated sand.
  - .3 Increase volume of sand by percentage bulking shown in test.

### 3.03 PREPARATION OF MORTAR

- .1 Lime-Cement Mortar:
  - .1 Prepare measuring boxes to ensure accurate proportioning of dry lime putty and sand.
  - .2 Mix dry lime and sand thoroughly in spiral- blade mechanical mixer for minimum 3 maximum 10 minutes. Do not add water. No spots or streaks of lime to remain upon completion of mixing.
  - .3 Add water as required.

### 3.04 PREPARATION OF LIME-SAND ROUGHAGE (COARSE STUFF)

- .1 Store lime sand roughage in air-tight plastic bins.

- .2 Keep prepared material from freezing. Discard frozen material.
- .3 Maintain measuring containers for correct quantity of materials for use in batches.
- .4 Thoroughly clean mortar boards, measuring boxes and mixers between batches.

### **3.05 MIXING**

- .1 General:
  - .1 Use batching box.
  - .2 Follow proper batching procedure.
  - .3 Monitor mixing time.
- .2 Mortar:
  - .1 Mix Characteristics:
    - .1 Pointing mortar: slightly stiffer than bedding mortar with a consistency such that the mortar can be hand-formed into a stiff ball.
    - .2 Record amount of water required to reach this consistency and use for subsequent mixes.
  - .2 Prepare only enough mortar to be used within one hour. Do not re-temper mortar beyond this time.
- .3 Follow manufacturer instructions when premixed mortar is used.
- .4 Contractor to appoint 1 individual to mix mortar for duration of project. If this individual must be changed, mortar mixing must cease until new individual is trained, and mortar mix is tested.

### **3.06 CONSTRUCTION**

- .1 Do masonry mortar and grout work in accordance with CAN/CSA-A179 except where specified otherwise.

### **3.07 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .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 11 - Cleaning.
- .3 Remove droppings and splashings using clean sponge and water.
- .4 Clean masonry in accordance with Section 04 03 06 – Historic - Masonry Cleaning.
- .5 Obtain approval of Departmental Representative prior to using other cleaning methods for persistent stains.
- .6 Waste Management: separate waste materials for reuse and recycling as outlined in article "WASTE MANAGEMENT" of Section 01 00 10 – General Instructions.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**3.08 PROTECTION OF COMPLETED WORK**

- .1 Cover completed and partially completed work not enclosed or sheltered at end of each work day.
- .2 Enclose and protect work using wetted burlap.
- .3 Cover with waterproof tarps to prevent weather from eroding recently laid material.
  - .1 Maintain tarps in place for minimum of 2 weeks after laying.
  - .2 Ensure that bottoms of tarps permit airflow to reach mortar in joints.
- .4 Anchor coverings securely in position.

**END OF SECTION**

**PART 1 GENERAL**

**1.01 RELATED REQUIREMENTS**

- .1 Section 04 03 06 – Historic – Masonry Cleaning
- .2 Section 04 03 07 – Historic - Masonry Repointing.
- .3 Section 04 03 08 – Historic - Mortaring.
- .4 Section 04 03 43 – Historic - Dismantling Stone Masonry.
- .5 Section 04 05 00 – Common Work Results for Masonry.

**1.02 REFERENCES**

- .1 Definitions:
  - .1 Lewis: instrument inserted at top of stone as means of attachment in raising and lowering. Holds stone by means of keys or wedges fitted to dovetailed recess.
  - .2 Dogs: metal appliance for securing parts or members together by means of one or more projecting teeth or bent portions, lug, cramp.
- .2 Reference Standards:
  - .1 CSA Group
    - .1 CAN/CSA-A179-04(R2014), Mortar and Grout for Unit Masonry.

**1.03 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for masonry materials and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
  - .2 Submit drawings describing method of stone replacement, including removal, shoring and erection.
- .4 Samples:
  - .1 Submit samples of replacement.
    - .1 Submit 1 of each type of masonry accessory specified.
  - .2 Provide mortar samples in quantity and size specified in CAN/CSA-A179 and in accordance with Section 04 03 08 – Historic - Mortaring.

**1.04 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for masonry work for incorporation into manual.

**1.05 QUALITY ASSURANCE**

- .1 Allow Departmental Representative access to mason's workshop for inspection of current work-in-progress.
- .2 Qualifications:
  - .1 Work of this section to be performed by qualified masons and skilled tradespersons, trained and experienced in historic masonry as per the Mandatory Requirements of the bid form (prequalification) in accordance with Section 04 05 00 – Common Work Results for Masonry.
  - .2 Departmental Representative has right to reject masons who do not demonstrate appropriate abilities or experience. Refer to Section 01 61 00 - Common Product Requirements.
  - .3 Masons employed on this project throughout course of project must meet above requirements. Where, during course of project, masons leave work force, replacement masons must also meet requirements.
- .3 Mock-ups:
  - .1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.
  - .2 Construct mock-up 600mm x 600mm to demonstrate rebuilding with specified materials and methods for each type of below grade and above grade.
  - .3 Use existing stonework when constructing job mock-up.
  - .4 Construct mock-up where directed by Departmental Representative.
  - .5 Notify Departmental Representative minimum of 48 hours prior to construction of mock-up.
  - .6 Work not to proceed prior to approval of mock-up. Allow 48 hours for inspection of mock-up by Departmental Representative before proceeding with stone repair work.
  - .7 When accepted, mock-up will demonstrate minimum standard for this work.
  - .8 Retain mock-up as part of finished work.

**1.06 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Prevent damage and soiling of finishes when transporting, storing and handling.
- .4 Keep materials dry. Protect against weather, freezing and any source of contamination.
- .5 Do not place stones directly on the ground.

**1.07 SITE CONDITIONS**

- .1 Ambient conditions:
  - .1 Maintain ambient temperature for repointing masonry in accordance with Section 04 03 07 – Historic - Masonry Repointing.

**PART 2 PRODUCTS**

**2.01 EXISTING STONE**

- .1 Use hard, sound, and clean existing stone salvaged on site only with Departmental Representative's approval.

**2.02 MORTAR**

- .1 Mortar: in accordance with Section 04 03 07 - Historic – Masonry Repointing.

**2.03 ACCESSORIES**

- .1 Obtain each type of material from a single manufacturer.
- .2 Anchors, cramps, dowels: stainless steel type 316.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- .1 Verification of Conditions: verify masonry, staging and storage areas and notify Departmental Representative in writing of conditions detrimental to acceptable and timely completion of Work.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform in writing Departmental Representative areas of deteriorated masonry not previously identified.
  - .3 Obtain Departmental Representative's approval and instructions for repair and replacement of masonry units before proceeding with repair work.
  - .4 Stop work immediately and report to Departmental Representative evidence of hazardous materials.

**3.02 PREPARATION**

- .1 Move and lift stone units using means to prevent damage. Submit stone units dropped or impacted to Departmental Representative for inspection and approval. Do not make holes or indentations for Lewises or dogs on face or top side of stone.
- .2 Place safety devices and signs near work area as directed in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
- .3 Install and remove shoring or other supports in accordance with professional engineer design.
- .4 Install and remove self-supporting scaffolding in accordance with Section 01 52 00 - Construction Facilities.



- .5 Protection of in-place conditions:
  - .1 Protect adjacent plant material and fragile surfaces.

### **3.03 STONE REMOVAL**

- .1 Stone removal in accordance with Section 04 03 43 - Historic - Dismantling Stone Masonry.
- .2 Remove loose material from stones.
- .3 Clean dust, mortar and stone fragments from slot.

### **3.04 RAKING JOINTS**

- .1 Raking joints in accordance with Section 04 03 07 - Historic - Masonry Repointing.

### **3.05 MOVING STONES**

- .1 Use Lewises or dogs to lift stones to working level.
- .2 Move stones horizontally on carts or sleds.
- .3 Slide stones into place on wood ramps.
- .4 Protect edges of stone from damage when hoisting and lifting from position. Use separators or wood shims to isolate units from hoisting belts.

### **3.06 STONE REPLACEMENT**

- .1 Co-ordinate bond pattern, coursing height and joint width with existing stonework in area.
- .2 Clean dust and stone fragments from slot.
- .3 Clean stone by washing with water and natural fibre brush before laying.
- .4 Before proceeding with Work, inspect cleaned surface with Departmental Representative.
- .5 Install anchors, dowels and cramps.
  - .1 Obtain approval of Departmental Representative of placement of anchors, dowels and cramps prior to placing mortar.
  - .2 Use non-corrosive anchors, dowels and cramps to fix stone.
- .6 Dampen slot's surfaces before applying mortar.
- .7 Apply bedding mortar.
  - .1 Lay stones on full beds of mortar.
  - .2 Lay heavy stones and projecting stones after mortar in courses below has hardened sufficiently to support weight.
  - .3 Prop and anchor projecting stones until wall above is set.
  - .4 Set large stones on water soaked softwood wedges to support stone in proper alignment until mortar has set. Remove wedges when dry, do not break off.
  - .5 Set stones to match alignment of adjacent stones plumb, true, level in full bed of mortar with vertical joints buttered and placed full except where otherwise specified.
  - .6 Fill anchor completely, dowel and lifting holes and voids left by removed edges.

- .8 Fill vertical joints buttered and placed full in face, and at vertical joint between wythes.
- .9 Tool joints with a round jointer to provide smooth joints compressed uniformly concave.
- .10 Rake bedding mortar back to a minimum depth of 25 mm and make ready for pointing with pointing mortar in separate operation.

**3.07 FILLING JOINTS/POINTING**

- .1 Fill joints and point: in accordance with Section 04 03 07 - Historic - Masonry Repointing.
- .2 Joint preparation:
  - .1 Rake out joints before bedding mortar sets.
  - .2 Leave stone surfaces clean.
  - .3 Ensure back of joint is vertical, sound, uniform and ready for pointing.

**3.08 REPOINTING**

- .1 Do pointing work in accordance with Section 04 03 07 - Historic - Masonry Repointing.

**3.09 PROTECTION OF WORK**

- .1 Cover completed and partially completed work not enclosed or sheltered at end of each work day.
  - .1 Extend membranes 0.5 m beyond surface area of work.
    - .1 Prevent finished work from drying out too rapidly.
  - .2 Cover with waterproof tarps to prevent weather from eroding recently laid and repointed material.
    - .1 Maintain tarps in place for minimum of 2 weeks after repointing.
    - .2 Ensure that bottoms of tarps permit airflow to reach mortar in joints.
  - .3 Anchor coverings securely in position.
  - .4 Damp cure:
    - .1 Provide damp cure for pointing mortars.
      - .1 Install and maintain wetted burlap protection during the curing process:
        - .1 Minimum 7 days.
      - .2 Wet mist burlap only - ensure no direct spray reaches surface of curing mortar.
      - .3 Shade areas of work from direct sunlight and maintain constant dampness of burlap.
  - .5 Protect from drying winds. Pay particular attention at corners.
  - .6 Inspect tarps daily for duration of curing.

**3.10 CLEANING**

- .1 Confirm acceptance of mock-up cleaning operations to demonstration from Departmental Representative before starting cleaning work.

- .2 Clean stone surfaces of adhesive or mortar residue resulting from work performed without damaging stone or joints.
- .3 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .5 Waste Management: separate waste materials for reuse and recycling as outlined in article "WASTE MANAGEMENT" of Section 01 00 10 – General Instructions.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- .6 Protect plants, grass and soil from accumulation of water used for cleaning.

**END OF SECTION**

**PART 1 GENERAL**

**1.01 RELATED REQUIREMENTS**

- .1 Section 04 03 06 – Historic – Masonry Cleaning
- .2 Section 04 03 07 – Historic - Masonry Repointing.
- .3 Section 04 03 08 – Historic - Mortaring.
- .4 Section 04 03 42 – Historic - Replacing Stone.
- .5 Section 04 05 00 – Common Work Results for Masonry.

**1.02 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit method of reference numbering for dismantling stone prior to start of stone removal to Departmental Representative for approval.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
  - .2 Submit drawings for shoring, bracing and temporary framing work.
- .4 Site Quality Control Submittals:
  - .1 Provide up-to-date copies of stone location recording system chart or card index, as well as chronological information concerning each numbered unit (individual cards of units), when requested.

**1.03 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual. Include:
  - .1 Photographically record stonework to be dismantled and rebuilt in accordance with Section 04 05 00 – Common Work Results for Masonry.

**1.04 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Work of this section to be performed by qualified masons and skilled tradespersons, trained and experienced in historic masonry as per the Mandatory Requirements of the bid form (prequalification) in accordance with Section 04 05 00 – Common Work Results for Masonry.
- .2 Mock-ups:
  - .1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.

- .2 Perform mock-up 600 mm x 600 mm to demonstrate dismantling procedures for each type of below and above grade masonry condition specified in locations designated by Departmental Representative.
- .3 Notify Departmental Representative minimum of 48 hours prior to construction of mock-up.
  - .4 Perform mock-up under supervision of Departmental Representative to demonstrate a full understanding of specified procedures and techniques is achieved before work commences.
- .5 Perform mock-up where directed by Departmental Representative.
- .6 Work not to proceed prior to approval of mock-up. Allow 48 hours for inspection of mock-up by Departmental Representative before proceeding with masonry dismantling work.
- .7 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of finished work.

**1.05 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Protect and store stones to facilitate their resetting.
  - .1 Store dismantled masonry units on wood pallets, protected from exposure to water, elements, and potential mechanical damage within a shed or fully covered under polyethylene.
  - .2 Submit storage and identification system to Departmental Representative for review.

**1.06 AMBIENT CONDITIONS**

- .1 Loosen wet masonry only when temperature is above 5 degrees C.
- .2 Store dismantled material in accordance with Section 04 05 00 – Common Work Results for Masonry.
  - .1 Keep stones dry.
  - .2 Protect stones from freezing.

**PART 2 PRODUCTS**

**2.01 NOT USED**

- .1 Not Used.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- .1 Examine masonry, staging and storage areas and notify Departmental Representative in writing of conditions detrimental to acceptable and timely completion of Work.

- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.
- .4 Report in writing, to Departmental Representative areas of deteriorated stone not identified in the documents. Obtain Departmental Representative's approval and instructions for repair of stone before proceeding.
- .5 Stop work in that area and report to Departmental Representative immediately evidence of hazardous materials.

**3.02 PREPARATION**

- .1 Obtain Departmental Representative's approval for alternative methodology and tools to be employed before commencing the work.

**3.03 PROTECTION**

- .1 Prevent damage to wall, ironwork, trees, landscaping, and utility lines which are to remain.
- .2 Make good damage incurred.
- .3 Protect surrounding components from damage during work.
- .4 Make good damage to historic fabric.
- .5 Obtain Departmental Representative's approval for repair methodology.

**3.04 SPECIAL TECHNIQUES**

- .1 Number and identify stones and other elements on Base Drawings to be provided by Departmental Representative following contract award in accordance with Section 01 78 00 – Closeout Submittals.
- .2 Before dismantling stones, indicate dimensions of each numbered stone in removal area on a drawing.
- .3 Temporary Marking and Recording:
  - .1 Mark stone, on face, before removal using marking product which can be completely erased when required without damaging masonry unit:
    - .1 Waxless chalk directly on stone.
  - .2 Tracking relocated stones and other masonry units:
    - .1 Use numbering, marking, and positioning system shown on drawing.
  - .3 Mark/Identify:
    - .1 Stones and other elements or components to show identity and position.
    - .2 Wood pallets or other equipment used to transport and store stones.
    - .3 Work and storage areas.
    - .4 Location from which stones are removed on drawings.
- .4 Stone location recording system.

- .1 Prepare chart or card index to:
  - .1 Help locate stones or units when necessary.
  - .2 To manage availability of platforms.
  - .3 To manage work and storage areas.
- .2 Keep chart or card index up-to-date and, if required, produce copy every day.
- .3 Prepare chart or card index to contain relevant information as indicated by example on drawing.
- .5 Ensure that temporary marking will remain in use resistant to weather, handling and cleaning until final marking of stones.
- .6 Remove markings and adhesive without damaging units:
  - .1 Brush with vegetable fibre brush: either dry or with water.
  - .2 Use no solvent, acid or other chemical product

### **3.05 TEMPORARY SHORING**

- .1 Construct shoring and bracing, and other temporary framing work needed to support structure, or parts of it, during removal operations and in anticipation of resetting, according to approved shop drawings.

### **3.06 METHOD FOR LOOSENING STONES**

- .1 Use approved methods to loosen stones which will cause no damage either to stones or to other architectural elements.
- .2 Prior to removing a stone approved for replacement or re-installation, rout out existing mortar joints around the stone.
- .3 Remove mortar from top, bottom and side joints, with the back surface of the joint square and of an even depth.
- .4 Use only hand held tools with mallet.
- .5 Obtain Departmental Representative's approval for use of power tools before commencing work.
- .6 Ensure that adjacent stones are not used as lever points in removal of stone.
- .7 Loosen wet masonry when temperature is above freezing.

### **3.07 DISMANTLING AND MOVING STONES**

- .1 Avoid damaging arrises of stone when removing mortar and freeing up.
- .2 Remove excess mortar using hand tools.
- .3 Use wood wedges where required to remove or dislocate stone.
- .4 Use regularly inspected nylon hoisting belts. Use minimum 2 belts per stone.
- .5 Protect stone from damage when hoisting and lifting from position.
  - .1 Use separators or wood shims to isolate units from hoisting belts.

- .6 Where damage occurs to stone, report to Departmental Representative and repair stone as directed by Departmental representative.
- .7 Make good damage incurred at no additional cost to Contract.
- .8 Obtain review of repaired damage by Departmental Representative.

**3.08 HANDLING**

- .1 Usage of Lewis bolts for handling stone is permitted.
- .2 Place detached stones on wood surfaces during handling. Prevent contact with metal.
- .3 When stones are lowered to ground, place directly on wooden platform used for transport or storage.
- .4 Transport and keep stones on wooden platforms.
- .5 Ensure that sharp edges of stones do not come into contact with hard objects.

**3.09 TEMPORARY STORAGE STAGING AREA**

- .1 Place stones in designated area of site for cleaning, detailed inspection and for final marking, before storage.
- .2 Make stones accessible and retrievable when required.

**3.10 CLEANING**

- .1 Clean stones in accordance with Section 04 03 06 - Historic - Cleaning Masonry.

**3.11 FINAL MARKING**

- .1 Do final marking after cleaning, on surface that supports good adhesion and legibility and will not be visible after resetting.
- .2 Do marking in colour. Dimensions: legible from a distance.
- .3 Ensure that marking product used will not affect mortar to stone adhesion when resetting.
- .4 Ensure marking product used will survive storage until resetting of stone.

**3.12 FINAL STORAGE**

- .1 When stones are placed under shelter:
  - .1 Design and ventilate shelter to keep condensation from forming on internal surfaces.
- .2 Lay out storage so that each stone will have its numbered face visible, and be accessible or removable without having to move adjacent stones.
- .3 Show layout of stones to be stored on record drawing.
- .4 Store rubble stone in a wood box.

**END OF SECTION**



**PART 1 GENERAL**

**1.01 RELATED REQUIREMENTS**

- .1 Section 02 27 30 – Electrical Investigations.
- .2 Section 02 30 00 – Subsurface Investigations.
- .3 Section 04 03 06 – Historic - Masonry Cleaning.
- .4 Section 04 03 07 – Historic - Masonry Repointing.
- .5 Section 04 03 08 – Historic - Mortaring.
- .6 Section 04 03 42 – Historic - Replacing Stone.
- .7 Section 04 03 43 – Historic - Dismantling Stone Masonry.

**1.02 REFERENCES**

- .1 CSA Group
  - .1 CAN/CSA-A371-04(R2009), Masonry Construction for Buildings.
- .2 International Masonry Industry All-Weather Council (IMIAC)
  - .1 Recommended Practices and Guide Specification for Cold Weather Masonry Construction.

**1.03 ADMINISTRATIVE REQUIREMENTS**

- .1 Pre-installation meetings: comply with Section 01 32 16.06 - Construction Progress Schedule - Critical Path Method (CPM). Conduct pre-installation meeting prior to commencing work of this Section to:
  - .1 Verify project requirements, including mock-up requirements.
  - .2 Verify substrate conditions.
  - .3 Co-ordinate products, installation methods and techniques.
  - .4 Sequence work of related sections.
  - .5 Co-ordinate with other building subtrades.
  - .6 Review manufacturer's installation instructions.
  - .7 Review masonry cutting operations, methods and tools and determine worker safety and protection from dust during cutting operations.
  - .8 Review warranty requirements.
- .2 Sequencing: sequence with other work in accordance with Section 01 32 16.06 - Construction Progress Schedule - Critical Path Method (CPM). Comply with manufacturer's written recommendations for sequencing construction operations.

**1.04 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:

- .1 Submit manufacturer's instructions, printed product literature and data sheets for masonry and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
  - .2 Submit shop drawings detailing temporary bracing required, designed to resist wind pressure and lateral forces during installation.
- .4 Samples:
  - .1 Provide samples as follows:
    - .1 2 cured, and coloured samples of mortar, illustrating mortar colour and colour range, supplemented with specific requirements in Section 04 03 07 – Historic - Masonry Repointing.
    - .2 2 of each type of masonry accessory and mortar component specified, supplemented by specific requirements in Section 04 03 42 – Historic - Replacing Stone.
    - .3 Samples: used for testing and when accepted become standard for material used.
- .5 Certificates: submit manufacturer's product certificates certifying materials comply with specified requirements.
- .6 Test and Evaluation Reports:
  - .1 Submit certified test reports in accordance with Section 01 45 00 - Quality Control.
  - .2 Test reports to certify compliance of mortar ingredients with specified performance characteristics and physical properties.
- .7 Installer Instructions: provide manufacturer's installation instructions, including storage, handling, safety and cleaning.
- .8 Photographic documentation:
  - .1 Submit photographic documentation of existing conditions before, during and after work, with overall views and close-ups in accordance with Section 01 33 00 - Submittal Procedures.

## **1.05 QUALITY ASSURANCE**

- .1 Mock-ups:
  - .1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.
  - .2 Construct mock-up to demonstrate procedures/techniques and show quality of work for:
    - .1 Cleaning showing each type of method, in accordance with Section 04 03 06 – Historic - Masonry Cleaning.

- .2 Dismantling showing method for loosening stones, raking joints, dismantling and moving stones, in accordance with Section 04 03 43 – Historic - Dismantling Stone Masonry and Section 04 03 07 – Historic - Masonry Repointing.
- .3 Replacing showing resetting, replacement, jointing/repointing, and mortar preparation in accordance with Section 04 03 42 – Historic - Replacing Stone and Section 04 03 07 – Historic - Masonry Repointing.
- .3 Mock-up used:
  - .1 To judge quality of work, substrate preparation, operation of equipment and material application.
  - .2 For testing to determine compliance with performance requirements.
- .4 Construct mock-up where directed by Departmental Representative.
- .5 Allow 48 hours for inspection of mock-up by Departmental Representative before proceeding with work.
- .6 When accepted by Departmental Representative, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of finished work.
- .7 Start work only upon receipt of written acceptance of mock-up by Departmental Representative.
- .2 Qualifications:
  - .1 Work of this section and the related sections to be performed by qualified masons and skilled tradespersons, trained and experienced in historic masonry as per the Mandatory Requirements (prequalification) of the bid form.
  - .2 Maintain supervisor (foreperson) for full-time field supervision of job site while work is in progress. Masons / trade qualified journeyman and registered apprentices in the ratio of no more than one to one; maximum one apprentice per journeyman.
  - .3 Supervisor must have training and experience similar in nature and scope to specified work as per the Mandatory Requirements.
  - .4 Experienced and qualified masons to carry out dismantling, erection, assembly and installation of masonry work in a traditional manner.
  - .5 Only workers accepted by Departmental Representative during mock-ups will be authorized to perform related work.

**1.06 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect material from nicks, scratches, and blemishes.
  - .3 Keep materials dry until use.

- .4 Store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids.
- .5 Replace defective or damaged materials with new where agreed with Departmental Representative beforehand.

- .4 Packaging Waste Management: remove for reuse and return as outlined in article "WASTE MANAGEMENT" of Section 01 00 10 – General Instructions.

## 1.07 SITE CONDITIONS

- .1 Ambient Conditions: assemble and erect components when temperatures are above 10 degrees C.
- .2 Weather Requirements: to CAN/CSA-A371 and to IMIAC - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.
- .3 Cold weather requirements:
  - .1 To CAN/CSA-A371 with following requirements.
    - .1 Maintain temperature of mortar between 10 degrees C and 30 degrees C until batch is used or becomes stable.
    - .2 Maintain ambient temperature of masonry work and its constituent materials between 10 degrees C and 30 degrees C and protect site from windchill.
    - .3 Maintain temperature of masonry above 10 degrees C for minimum of 14 days, after mortar is installed.
    - .4 Preheat unheated wall sections in enclosure for minimum 72 hours above 10 degrees C, before applying mortar.
  - .2 Hot weather requirements:
    - .1 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.
    - .2 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until masonry work is completed and protected by flashings or other permanent construction.
  - .3 Spray mortar surface at intervals and keep moist for maximum of 7 days after installation.

## PART 2 PRODUCTS

### 2.01 MATERIALS

- .1 Masonry materials are specified elsewhere in related Sections:
  - .1 Section 04 03 07 – Historic - Masonry Repointing.
  - .2 Section 04 03 42 – Historic - Replacing Stone.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- .1 Examine conditions, substrates and work to receive work of this Section.
- .2 Examine openings to receive masonry units. Verify opening size, location, and that opening is square and plumb, and ready to receive work of this Section.
  - .1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .2 Proceed with installation after unacceptable conditions have been remedied and after receipt of written approval from Departmental Representative.
- .3 Verification of Conditions:
  - .1 Verify that:
    - .1 Substrate conditions which have been previously installed under other sections or contracts, are acceptable for product installation in accordance with manufacturer's instructions prior to installation of masonry units.
    - .2 Field conditions are acceptable and are ready to receive work.
    - .3 Built-in items are in proper location, and ready for roughing into masonry work.
  - .2 Commencing installation means acceptance of existing substrates.

**3.02 PREPARATION**

- .1 Perform exploratory openings for investigations in accordance with Section 02 41 13 – Selective Site Demolition and Section 04 03 43 – Historic - Dismantling Stone Masonry.
- .2 Surface Preparation: prepare surface in accordance with manufacturer's written recommendations.
- .3 Establish and protect lines, levels, and coursing.
- .4 Protect adjacent materials from damage and disfiguration.

**3.03 INSTALLATION**

- .1 Do masonry work in accordance with CAN/CSA-A371 except where specified otherwise.
- .2 Build masonry plumb, level, and true to line, with vertical joints in alignment, respecting construction tolerances permitted by CAN/CSA-A371.
- .3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

**3.04 CONSTRUCTION**

- .1 Jointing:
  - .1 Allow joints to set just enough to remove excess water, then rake joints uniformly to 1 mm depth and compress with square tool to provide smooth, compressed, raked joints of uniform depth where raked joints are indicated.
- .2 Investigations:

- .1 Cut exploratory openings in existing work as indicated.
- .2 Openings in walls: reviewed by Departmental Representative.
- .3 Make good existing work. Use materials to match existing.

**3.05 SITE TOLERANCES**

- .1 Tolerances in notes to CAN/CSA-A371 apply.

**3.06 FIELD QUALITY CONTROL**

- .1 Site Tests, Inspection:
  - .1 Perform field inspection and testing in accordance with Section 01 45 00 - Quality Control.
  - .2 Notify inspection agency minimum of 48 hours in advance of requirement for tests.

**3.07 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Waste Management: separate waste materials for reuse and recycling as outlined in article "WASTE MANAGEMENT" of Section 01 00 10 – General Instructions.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**3.08 PROTECTION**

- .1 Temporary Bracing:
  - .1 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.
  - .2 Bracing reviewed by Departmental Representative.
  - .3 Brace masonry walls as necessary to resist wind pressure and lateral forces during construction.
- .2 Moisture Protection:
  - .1 Keep masonry dry using waterproof, non staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until completed and protected by flashing or other permanent construction.
  - .2 Cover completed and partially completed work not enclosed or sheltered with waterproof covering at end of each work day. Anchor securely in position.
  - .3 Air Temperature Protection: protect completed masonry as outlined in "SITE CONDITIONS" of this specification Section.

**3.09 SCHEDULE OF EXPLORATORY OPENINGS**

- .1 General
  - .1 Cutting out and dismantling are incremental activities whereby Departmental Representative will indicate progressive work based on review.

- .2 Use hand tools for cutting out joints and dismantling in accordance with Section 04 03 07 – Historic - Masonry Repointing and Section 04 03 43 – Historic - Dismantling Stone Masonry.
  - .1 Salvage dismantled masonry units and accessories for reuse.
  - .2 Collect mortar samples for review of condition/deterioration.
- .3 Remove light standard and perform related testing in accordance with Section 02 27 30 – Electrical Investigations; targeted light standards to be identified by Departmental representative.
- .4 Reset salvaged stones and repoint joints in accordance with Section 04 03 42 – Historic - Replacing Stone and Section 04 03 08 – Historic - Mortaring.
- .2 Below grade
  - .1 Perform "TESTS PITS" in accordance with Section 02 30 00 – Subsurface Investigations.
  - .2 Perform 1 opening at each Test Pit; whereby facing Test Pits on the north and south sides are counted separately.
  - .3 At each opening
    - .1 Dismantle 3 foundation stones in accordance with Section 04 03 43 – Historic - Dismantling Stone Masonry.
    - .2 Collect a large sample of core foundation (original) mortar for laboratory testing; mortar specimen testing not in contract.
    - .3 Cut out mortar joints – bed joint and head joint on either side of selected base stone – for two base stones, full depth of stone in accordance with Section 04 03 07 – Historic - Masonry Repointing.
- .3 Above grade
  - .1 Wall bays
    - .1 Perform 1 opening on the north side and 1 opening on the south side of each targeted wall bays identified in drawings – namely 2 openings per numbered wall bay.
    - .2 Dismantle 3 rock faced stones per opening in accordance with Section 04 03 43 – Historic - Dismantling Stone Masonry.
  - .2 Piers type A, C, and D/DD
    - .1 Dismantle 4 rock faced stones per pier in accordance with Section 04 03 43 – Historic - Dismantling Stone Masonry; drawings identify targeted piers.
  - .3 Piers type B/BB, E, F, and G
    - .1 Cut out 4 horizontal and 6 vertical full-length mortar joints per pier; drawings identify targeted piers.
    - .2 Cut out mortar joints full depth of stone in accordance with Section 04 03 07 – Historic - Masonry Repointing.
  - .4 Cap stones

- .1 Dismantle cap stones in accordance with Section 04 03 43 – Historic -  
Dismantling Stone Masonry; drawings identify targeted cap stones/piers.

**END OF SECTION**