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PART 1 - GENERAL

- 1.1 Related Sections .1 Section 04 03 08 - Masonry Mortar
- .2 Section 04 03 41 - Repair of Stone
- 1.2 References .1 Canadian Standards Association (CSA)
- .1 CSA A23.1-14, Construction Materials and Methods of Concrete Construction.
- .2 CAN/CSA-A371-14, Masonry Construction for Buildings.
- 1.3 Definitions .1 Raking: the removal of loose/deteriorated mortar until sound mortar, or minimum depth of 25 mm is reached. To be measured from surface of original joint mortar, not edge of stone.
- .2 Repointing: filling and finishing of masonry joints from which mortar is missing, has been raked out, or has been omitted.
- .3 Tooling: finishing of masonry joints using tool to provide final contour.
- .4 Repair: using adhesives to rebond sections of fractured masonry.
- 1.4 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 Identifying unsound joints and areas requiring stone repair or resetting.
- .3 Raking identified unsound joints.
- .4 Preparation of masonry surface including joints, surface cleaning, flushing of voids and open joints, and masonry wetting.
- .5 Repointing of all masonry joints.
- .6 Removal of loose portions on stone surface.
- .7 Resetting of dislodged masonry units.
- .8 Ensuring cure of mortar.
- .9 Grouting by hand, small voids.
- .10 Repair of fractured masonry units or spalled units.
- .11 Reconstruction of stone masonry at wall pilasters where damaged/dislocated.
- .12 Low pressure water cleaning of all exposed stone masonry surfaces.
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- 1.5 Samples .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit labelled samples of materials used on project for approval before work commences.
- 1.6 Qualifications .1 Contractor-Mason:
- .1 Use single Contractor-mason for all masonry work. Ensure Contractor-mason has 10 years minimum experience in masonry work especially historic stone masonry.
- .2 Ensure mason has certificate of qualification with experience in stone masonry. Ensure that all masonry work is strictly undertaken by certified masons.
- .2 Cement grouting: grouting activities should be undertaken by experienced workers in manipulation and cement grouting methods.
- 1.7 Mock-ups .1 Construct mock-up in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Construct mock-up to demonstrate repair procedure for each type of masonry material specified, repointing, caulking, stone repair and cleaning.
- .3 Construct mock-up under supervision of Departmental Representative to demonstrate that a full understanding of specified procedures, techniques and formulations are achieved before work commences.
- .4 Construct mock-up where directed.
- .5 Allow 48 hours for inspection of mock-up by Departmental Representative before proceeding with masonry repointing and repair work.
- .6 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of finished work.
- 1.8 Delivery, Storage and Handling .1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Store cementitious materials and aggregates in accordance with CSA A23.1.
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- .3 Store lime putty in plastic lined sealed drums.
  - .4 Keep material dry. Protect from weather, freezing and contamination.
  - .5 Ensure that manufacturer's labels and seals are intact upon delivery.
  - .6 Remove rejected or contaminated material from site.
- 1.9 Storage and Protection
- .1 Deliver, store, handle and protect materials of this section in accordance with Section 01 61 00 - Common Product Requirements.
  - .2 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.
  - .3 Protect adjacent finished work against damage which may be caused by on-going work.
- 1.10 Existing Conditions
- .1 Investigate possible structural problems and report before beginning masonry work.
  - .2 Study pointing styles and methods of reproducing them, and submit sample for approval before starting work.
  - .3 Examine horizontal and vertical joints to determine which were struck first and whether they are same style, as well as other aspects of workmanship which establish authenticity of original work.
- 1.11 Environmental Requirements
- .1 When temperature is 10°C or less:
    - .1 Store cements and sands for immediate use within heated enclosure. Allow these materials to reach minimum temperature of 10°C (that is in equilibrium with air temperature in enclosure).
    - .2 Heat water to minimum of 20°C and maximum of 30°C:
      - .1 At time of use temperature of mortar to be minimum of 15°C and maximum of 30°C.
      - .2 Do not mix cement with water or with aggregate or with water-aggregate mixtures having higher temperature than 30°C.
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- .2 Obtain approval from Departmental Representative for methods of enclosure and protection.

## PART 2 - PRODUCTS

### 2.1 Materials

- .1 Mortar materials: to Section 04 03 08 - Masonry Mortar.

### 2.2 Grout

- .1 Grout: Hydraulic lime injection grout for consolidation and filling of voids in stone masonry. To be Grout F-20 by Daubois, or approved alternate.

## PART 3 - EXECUTION

### 3.1 General

- .1 Perform work in accordance with CAN/CSA-A371.
- .2 Use manual raking tool to remove deteriorated mortar and ensure that no masonry units are chipped/altered/damaged by work to remove mortar.
- .3 Tool and compact using jointing tool to force mortar into joint.
- .4 Finish joints to match existing joints, except where specified otherwise.
- .5 Use suitable approved jointing tool to form compacted concave tooled joints.

### 3.2 Repointing

- .1 Procedure of testing: Inspect joints visually for obvious signs of deteriorated masonry. Test joints not visually deteriorated as follows:
  - .1 Test for voids and weakness by using hammers or other approved means.
  - .2 Perform testing in co-operation with Departmental Representative so that unsound joints can be marked and recorded.
- .2 Raking joints:
  - .1 Rake unsound joints free of deteriorated and loose mortar, dirt and other undesirable materials.
  - .2 Clean joints to full depth of deteriorated mortar but in no case to less than 25 mm. Clean out voids and cavities encountered.
  - .3 Clean by compressed air, surfaces of joints without damaging texture of exposed joints.

.4 Flush open joints and voids; clean open joints and voids with low pressure water and, if not free draining, blow clean with compressed air.

.5 Leave no standing water.

.3 Repointing:

.1 Dampen joints and completely fill with mortar. If surface of 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.

.2 Keep masonry damp while pointing is being performed.

.3 Do no pointing in freezing weather.

.4 Build-up pointing in layers not exceeding 12 mm in depth. Allow bottom layers to set before applying subsequent layers. Maintain joint width.

.5 Tool joints behind masonry face with identical tools used for weathered joints. Match weathered joint.

.6 Remove excess mortar from masonry face before it sets. Finish jointing neatly as specified.

3.3 Resetting Stone

.1 Fix dislodged stone units in correct location with water soaked wedges.

.2 Insert and compress firm mortar to within 50 mm of pointing surface. Allow mortar to set 24 hours.

.3 Pull out wood wedges when dried and shrunken.

.4 Point to surface in two layers.

3.4 Grouting

.1 Install grout in voids and cavities between and behind stone.

.2 Clean out void with water until water runs clear.

.3 Fill joints and cracks with mortar set back 50 mm from final mortar surface.

.4 Pour grout through tube or mortar cup until void is full.

.5 Point as rest of work.

3.5 Repair

.1 Repair fractured units without losing pieces or worsening damage or damaging adjacent units.

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- .2 Refer to related Section 04 03 41 - Repair of Stone.
- .3 Reinstall repaired units into work and repoint with specified mortar as rest of work.
- 3.6 General 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.
- 3.7 Low Pressure Water Cleaning
- .1 Low Pressure Water Cleaning:
- .1 Pre-wet masonry surface when necessary. Work from bottom of wall upwards.
- .2 Remove dirt with moderate pressure wash-down.
- .3 Avoid prolonged wetting and excessive water penetration.
- .4 Use previously tested chemical cleaners only approved by Departmental Representative. Follow manufacturer's recommended dwell time.
- .5 Use previously tested heated water approved by Departmental Representative.
- .6 Do not exceed maximum pressure at nozzle or have nozzle closer to masonry than approved by Departmental Representative at tests.
- .2 Use brushing and scraping only to supplement water washing.
- .3 Soften and loosen heavy deposits with prolonged water spray, then brush. Remove thick incrustations with wooden or plastic scrapers.
- .4 Use chemical cleaners approved by Departmental Representative for stain and soil removal.
- 3.8 Clean-up
- .1 Rinse off masonry to satisfaction of Departmental Representative.
- .2 Rinse from bottom to top and from top to bottom.
- .3 Clean up work area as work progresses. At end of each work day remove debris and waste from site.
- .4 Upon completion, clean and restore areas used for work to condition at least equal to that previously existing.

**END OF SECTION**

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PART 1 - GENERAL

- 1.1 Related Work .1 Section 04 03 07 - Masonry Repointing and Repair.
- 1.2 References .1 American Society for Testing and Materials (ASTM).  
.1 ASTM C144-11 Standard Specification for Aggregate for Masonry Mortar.  
.2 ASTM C150/C150M-15 Standard Specification for Portland Cement.  
.3 ASTM C207-06(2011) Standard Specification for Hydrated Lime for Masonry Purposes.  
.4 ASTM C1329/C1329M-15 Standard Specification for Mortar Cement.  
.2 Canadian Standards Association (CSA).  
.1 CSA A179-14 Mortar and Grout for Unit Masonry.  
.3 National Lime Association, USA: Bulletin 213, 'Lime Handling, Application and Storage', (Latest Edition).
- 1.3 Allowable Tolerances .1 Mortar compression strength minimum 3.8 MPa, maximum 10 MPa, cured for 28 days.
- 1.4 Submittals .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- 1.5 Contractor's Quality Control Testing .1 The contractor is responsible for retaining and paying costs for a testing agency to carry out the quality control tests on the masonry mortar. The contractor's testing agency must demonstrate an understanding of the test procedures and a past history of conducting the minimum quality control tests. Subsequent to the testing agency being retained by the contractor, the testing agency and the contractor must meet with the Departmental Representative to review the quality control requirements.
- 1.6 Test Reports .1 Prior to start of work on site submit 3 sets of test results to show that properties are appropriate to particular mortar mix.  
.2 Test results to include compressive strengths for masonry mortar at 7 and 28 days, in accordance with CSA A179.
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- 1.7 Environmental Requirements
- .1 Execute work when ambient temperature is above 10°C. When ambient temperature is below 10°C care and heat work as directed by Engineer.
  - .2 Prepare and maintain temperature of mortar between 5°C and 50°C until used.
- 1.8 Scheduling of Work
- .1 Submit work schedule indicating anticipated progress stages within time of final completion shown in bid document.
  - .2 Take measures necessary to complete work within approved schedule time. Schedule may not be changed without approval.
- 1.9 Alternatives
- .1 Obtain Departmental Representative's approval before changing manufacturer's brands or sources of supply of mortar materials during entire contract or other methods of mixing mortar specified elsewhere in this specification.

PART 2 - PRODUCTS

- 2.1 Materials
- .1 Restoration Mortar: based on cement and mineral fillers specially formulated for the restoration of stone elements. To be Neostone C35 by Daubois, or approved alternate.
  - .2 Repointing Mortar: premixed repointing mortar based on GV hydraulic cement, type 'S' hydrated lime and well graded sand. To be Restomix by Daubois, or approved alternate.
  - .3 Water: potable or from approved non-potable supply.

PART 3 - EXECUTION

- 3.1 Preparation
- .1 Workers handling Hydraulic Lime and Masonry Mortar shall use appropriate safety protection equipment in accordance with Bulletin 213, "Lime Handling, Application and Storage", published by the National Lime Association, Arlington, VA., U.S.A. (Tele:703-243-5463)
  - .2 Place safety devices and signs near the work as directed by Departmental Representative.
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| <u>3.2 Mixing</u>                       | .1 | Prepare mortar in strict accordance with manufacturer's requirements.   |
| <u>3.3 Useful Life of Mortar</u>        | .1 | Use mixed mortar within one and one-half hour after mixing.   |
|   | .2 | Do not re-temper mortar.  |
| <u>3.4 Cleaning</u>                     | .1 | Remove droppings and splashings using clean sponge and water.   |
| <u>3.5 Protection of Completed Work</u> | .1 | Cover completed and partially completed work not enclosed or sheltered with waterproof covering at end of each work day. Anchor securely in position. |

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**END OF SECTION**

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PART 1 - GENERAL

- 1.1 Related Sections .1 Section 04 03 07 - Masonry Repointing and Repair.
- 1.2 Definitions .1 Repair of Stone: any repair, other than cosmetic, i.e. superficial, and replacement, done to restore original appearance and function of partly deteriorated stones.
- .2 Filling: material used to rebuild broken or deteriorated part of stone.
- .3 Adhesive: material used as adhesive to fasten broken/fractured stone elements by direct application at fracture interface and/or by application to added reinforcing elements such as dowels.
- 1.3 Samples .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- 1.4 Mock-ups .1 Construct mock-ups in accordance with Section 04 03 07 - Masonry Repointing and Repair.
- .2 Allow 48 hours for inspection of mock-ups by Departmental Representative before proceeding with stone repair work.
- .3 When accepted, mock-ups will demonstrate minimum standard for this work. Mock-up may remain as part of finished work.
- 1.5 Delivery, Storage and Handling .1 Deliver, store, handle, and protect materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Store materials in a dry area and supported free of ground.
- 1.6 Environmental Requirements .1 Maintain temperature between 21°C and 24°C during repair and 48 hours after, throughout thickness of stone.
- .2 Choose epoxy resin compatible with humidity condition of stone as specified by manufacturer.
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- .3 Provide for temporary enclosures and heating equipment to maintain specified temperatures. Take precautions to avoid overheating masonry.
- 1.7 Existing Condition .1 Before beginning work, record and report non-conforming work to Departmental Representative.

PART 2 - PRODUCTS

- 2.1 Materials .1 Chemical Adhesive: for bonding of cut stone repairs.  
.1 Chemolit polyester adhesive, transparent knife-grade with Chemor liquid colorant C-44 (if required). Both manufactured by Chemor Inc., or approved alternate.
- .2 Water: clean and free of deleterious materials such as acid, alkali and organic material in accordance to CSA A179.
- .3 Dowels: stainless steel or equivalent non-corrosive metal, 10 mm diameter.
- .4 Stone slabs: to have similar mechanical and aesthetic properties as existing.
- 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 Departmental Representative and allow free access to sources where materials were procured.

PART 3 - EXECUTION

- 3.1 Repairs to Existing Stones .1 Repairs to existing sandstone units are classified as follows:  
.1 Repair of Fractured Stone  
.2 Refacing Partially Deteriorated Stone With Slab.  
.3 Partial Stone Replacement..  
.4 Other - As approved by Departmental Representative.
- .2 Departmental Representative to have final say on method of repair to be used on stone in wall.

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- 3.2 Mock-ups .1 Examples of each type of proposed stone repair are to be submitted by the Contractor for review. The Departmental Representative's acceptance of the mock-ups will serve as the standard of acceptance for the repairs.
- 3.3 Preparation .1 Remove decayed section of stones until sound surface is reached. Obtain Departmental Representative's approval for methodology and tools to be employed before commencing this work.
- 3.4 Repair of Fractured Stone .1 Obtain Departmental Representative's approval for repair methodology before commencing work.
- .2 Remove elements which require minor repair. Do not damage existing Work.
- .3 Drill 100 mm deep holes in each section at fracture. Hole diameter to suit adhesive manufacturer's recommendations.
- .4 Insert 10 mm diameter dowels, minimum 150 mm long, and apply chemical adhesive to holes and interface. Let adhesive cure for 24 hours minimum.
- .5 Reinstate consolidated element into work and repoint with specified mortar. Joints to match existing.
- 3.5 Refacing Partly Deteriorated Stone With Slab .1 Remove decayed stone until sound surface is reached.
- .2 Drill properly sized holes, 75 mm deep, at interface of existing and new stone slabs.
- .3 Insert 10 mm diameter dowels into existing stone and apply specified grout to holes and interface.
- .4 Make horizontal dovetailed grooves at interface of existing and new stone slabs.
- .5 Apply chemical adhesive to dovetailed grooves and interface of existing stone.
- .6 Fill dowel holes and dovetailed grooves of new stone slab with specified grout. Erect new stone slab into position. Secure stone temporarily to allow grout to set.
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Dickson Brook  
Culvert Repairs  
Parks Canada  
Fundy National Park, NB  
Project No. R.078605.001

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Repair of Stone

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3.6 Protection of                      .1     Protect finished work from impact damage for a period  
Completed Work                      of two weeks.

**END OF SECTION**

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