

Union Station Revitalization Project
State of Good Repair
Waterproofing at Cab Stand

Project No. 07-0123-09 15
November 2021

Issued for Tender

SPECIFICATION VOLUME 1

PROJECT MANUAL

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Project Manual
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SPECIFICATIONS

VOLUME 1

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1 **GENERAL SCOPE OF WORK**

1.1 **GENERAL**

- .1 Contractor to review all available and referenced documents to satisfy itself that such intent is achieved. Contractor to identify, highlight and advise the Prime Consultant of any conflicts or misunderstandings of the Scopes, preventing achieving such intent.
- .2 Provide Labour and Material to complete the specified Scope of Work.
- .3 Contractor is responsible to advise the Owner in advance as to when service providers are required to remove any interfering infrastructure to facilitate construction activity.
- .4 Contractor to move all salvaged materials to a designated storage location at Union Station, as directed by the Owner.
- .5 Contractor to temporary remove all affected street and wayfinding signs and reinstate in old or new locations, as directed by Owner, upon the work completion.

1.2 **ARCHITECTURAL / STRUCTURAL**

- .1 Provide Labour and Materials to complete the Scope of Work as identified on the Drawings, within the boundary, as shown on the Architectural Plans. State of Good Repair Waterproofing scope to be coordinated and completed in conjunction with the Hostile Vehicle Mitigation blocks installation scope, along Front Street.

- .1 Work under State of Good Repair, Waterproofing of Cab Stand is limited to the following building areas:

- .1 00 Level; Front Street sidewalk and parapet wall above West moat Cab Stand.

- .2 B1 Level; Front Street West Moat Cab Stand retaining wall and ceiling.

1.3 **HERITAGE**

- .1 **(Heritage scope, clouded and highlighted in green throughout the Specification, to be priced separately)**

All masonry (West Moat Parapet Wall):

- .1 Re-point all damaged/cracked/deteriorated joints.
- .2 Back-point all joints as indicated in specifications.
- .3 Repair all damaged/abused stone as indicated in specs.
- .4 Restore the existing wall parging in the West Moat Cab Stand.
- .5 Restore the ceiling pattern in the West Moat Cab Stand

END OF SECTION

1 DIVISION OF WORK

- 1.1 Work specified in the specifications is divided into sections by the Consultant for ready reference only and not for the purpose of establishing limits of Subcontractor subcontracts.
- 1.2 Division of The Work amongst Subcontractors is the sole responsibility of the Contractor. The Consultant assumes no responsibility to act as an arbitrator to establish Subcontract limits.

2 EXAMINATION OF SITE AND DOCUMENTS

- 2.1 Make a careful examination of the Place of the Work, and investigate, at no cost or risk to the Owner, matters relating to the nature of The Project to be undertaken, the means of access and egress thereto and there from, the obstacles to be met with and the rights and interests which may be interfered with during the performance of The Work.
- 2.2 Make a careful examination of the extent of the Work to be performed and all matters which are referred to in the Contract Documents, or which are necessary for the full and proper construction of The Project and the conditions under which it will be performed.

3 PERMITS

- 3.1 Contractor shall apply for all Permits required (i.e. road closures, occupancy etc.)

4 EXAMINATION OF SURFACES AND CONDITIONS

- 4.1 The Contractor shall ensure each Subcontractor examines job conditions and the work to which his work is to be applied, anchored or connected.
- 4.2 Report unsatisfactory conditions likely to prevent the proper installation of work.
- 4.3 Correct unsatisfactory conditions before commencing the particular work.
- 4.4 Commencement of the work implies acceptance of conditions.

5 EXISTING UTILITIES

- 5.1 When breaking into or connecting to existing services or utilities, execute work at times directed by local governing authorities, with a minimum of disturbance to work, and to building occupants and to pedestrian and vehicular traffic. Co-ordinate work with the City.
- 5.2 Protect and maintain all existing active services.
- 5.3 Do not shut down any services without obtaining written approval from the building Owner.

6 COOPERATION

- 6.1 Ensure that all Subcontractors cooperate with each other in order that work will be carried out expeditiously and will be satisfactory in all respects at completion of the Project.
- 6.2 Ensure that all Subcontractors examine Drawings and Specifications covering the Work which may affect the performance of their own work.
- 6.3 Examine the work of all Subcontractors and correct defects and deficiencies which may adversely affect the Work.
- 6.4 Ensure that the Work is in compliance with the Contract Documents and accept responsibility for delays or costs resulting from failure to inspect, and any replacement required.
- 6.5 Be responsible for damage of any kind to The Work. Replace any materials or work so damaged that cannot be repaired or restored to the Consultant's satisfaction. Such repairs or replacements shall be made by the trade that performed the original work.
- 6.6 Ensure that all Subcontractors cooperate with other Subcontractors whose work attaches to or is affected by their own work and ensure that minor adjustments are made to make adjustable work fit to fixed work.
- 6.7 Ensure that Subcontractors requiring foundations or openings to be left for the installation of their work furnish the necessary information to the Subcontractors concerned in ample time.
- 6.8 Items to be built-in shall be supplied as and when required by the Subcontractor building in the items together with forms, templates, anchors, sleeves, inserts, measurements, shop drawings and accessories required to be fixed to or inserted in the Work and set in place or instruct the related Subcontractors as to their location.
- 6.9 Pay the cost of extra work caused by, and make up time lost as the result of, failure to provide the necessary cooperation, information or items to be fixed to or built into the Work in adequate time.

7 PROTECTION

- 7.1 Adequately protect the Work, existing buildings and equipment, fencing, service poles, wires, utilities above and below ground, paving located on this and adjoining properties from injury and damage at all stages of the operations, and maintain the protection until the Work is completed. Remove and replace at no expense to the Owner, any work and materials damaged that cannot be repaired or restored to the Consultant's satisfaction.

8 CONSTRUCTION WASTE MANAGEMENT

- 8.1 During construction, maintain the Work and access to the Work in tidy condition.
- .1 Comply with all applicable Environmental Protection Act of Ontario regulations relating to construction waste management including Ontario Regulation 102/94 and Ontario Regulation 103/94. Follow a strategy based on the 3R's hierarchy: Reduce, Reuse, Recycle.
- 8.2 At frequent and regular intervals during progress of the Work clean up Project Site, building and access to building, and dispose of waste materials, rubbish, and debris. Do not permit waste, rubbish, and debris to accumulate and become unsightly or hazardous.

8.3 Conduct clean-up and disposal operations to comply with local ordinances, anti-pollution laws and sorting or recycling requirements of City of Toronto and other authorities having jurisdiction.

9 **DIMENSIONS**

9.1 Wall thicknesses shown on the drawings are nominal only. In all cases, determine the actual sizes at the building.

9.2 Dimensions of shop fabricated portions of the building shall be verified on the site before shop drawings and fabrication are commenced.

9.3 Where dimensions are not available before fabrication is commenced, the dimensions required shall be agreed upon between the various trades concerned.

9.4 Owner will not accept claims for extra expense on the part of the Contractor by reason of non-compliance with this article.

10 **SETTING OUT**

10.1 Contractor shall establish the lot lines, restrictions and/or benchmarks as well as all other grades, lines, levels and temporary benchmarks.

10.2 Verify on the property, grades, lines, levels and dimensions shown, and report discrepancies in levels or dimensions to the Consultant before commencing work.

10.3 Work done prior to the receipt of the Consultant's decision, shall be at the risk of the Contractor.

10.4 Layout on the forms or floors, the locations of walls as a guide to the various Subcontractors, and layout or check the layout of other Subcontractors.

11 **DOCUMENTS ON SITE**

11.1 Keep on the site at all times, one copy of the drawings and specifications, including a Consultant's reviewed and stamped set of all shop drawings.

12 **POWDER ACTUATED FASTENINGS**

12.1 Powder actuated fastenings shall not be used on any portion of the Work, unless written consent for a specific use is obtained from the Consultant.

12.2 Only low velocity tools will be permitted under any condition. Operators to be qualified and to be in possession of a valid operator's certificate. Tools and operation shall conform to CSA Z166.

13 **OVERLOADING**

13.1 Take precautions to prevent the overloading of any part of the structure, false work, form work or scaffolding during the progress of the Work, and make good, at no expense to the Owner, all damage resulting from such overloading.

13.2 No load bearing members shall be cut, drilled or sleeved without the written consent of the Consultant.

14 **NUMBER OF ITEMS**

14.1 In cases where an item or part of materials or equipment is referred to in the singular number, it is intended that such reference shall apply to as many items or parts as are required to complete the Work.

15 **CASH FLOW**

15.1 Submit detailed breakdown of cost of Work in form acceptable to Consultant, divided to coincide with organization of specifications into sections and type of work, per month and coincident with approved construction schedule.

15.2 Cost breakdowns when totaled, shall be same as Contract Price.

15.3 Purpose of the cost breakdown is to assist Consultant with evaluation of progress draws and to assist Owner with cash flow arrangements.

16 **METRIC MEASUREMENT**

16.1 Drawings and Specifications for the project are prepared in accordance with the International Metric Standards which came into effect in Canada on 1 January, 1978.

16.2 Variations from the hard metric "base" bid will be allowed to ensure that the metric standards do not:

- .1 Limit the number of manufacturers able to participate in the bidding.
- .2 Cause a cost penalty to the project.
- .3 Adversely affect the scheduling of the project.
- .4 Preclude the submission of non-metric (Imperial) materials and/or equipment as "alternatives".
- .5 Create problems of connection at the interfaces (e.g. metric threads).

17 **INTERFERENCE DRAWINGS**

17.1 Prepare dimensioned interference drawings indicating relationship of new installations and existing and/or unforeseen conditions prior to commencement of work.

17.2 Before commencing installation, prepare drawings showing relationship of conduits, piping, sprinklers, communication and specialized equipment located within or on ceiling and walls.

17.3 Indicate locations of visible items such as, light fixtures, smoke detectors, sprinkler heads, communication grilles, and access panels occurring at these locations.

17.4 Drawings shall be initialed by responsible person of each Sub-Contractor involved along with Contractor's signature and submitted to Consultant for review and record purposes.

17.5 Consultant will provide background drawings for the purpose of preparation of interference drawings.

END OF SECTION

1 **CONSTRUCTION SEQUENCING AND MAINTENANCE OF OPERATIONS**

- 1.1 In order to keep the station operational for GO Transit, VIA, retail customers and tenants, construction activities must be restricted and separated, and protected pedestrian routes maintained as follows:
- .1 Front Street West Moat: Access to and from the moat must be maintained at all times, with pedestrian flow East to the Centre Moat tunnel and the Front St Promenade.
 - .2 Front Street West Sidewalk: Stage the waterproofing work into two phases ensuring a continuous 3m wide pedestrian passage in the east- west direction throughout each phase. Refer to drawing A-002. Hoarding should be appropriately positioned to facilitate this arrangement.
 - .3 The Contractor shall be aware of local events that could affect traffic management and work plans. This includes events at the Scotiabank Arena, which frequently draw large crowds in and around Union Station. The contractor's work schedule should include provisions for potential restrictions or pauses in construction activities to accommodate these events at no extra cost.
 - .4 All construction activities shall be planned and scheduled in consideration of seasonal events to minimize disruptions. The contractor shall proactively communicate construction schedules and any necessary adjustments to stakeholders and event organizers well in advance. Flexibility in construction timelines shall be maintained to accommodate unforeseen changes in event schedules or requirements.
 - .5 Provided the overall Work Restrictions and City Noise By-Laws are complied with, the City may allow for use of the York Street Moat for the purposes of removal of materials, deliveries, etc. for work being done in the Front Street West Moat between the hours of 23:59 and 05:00.
- 1.2 Lane closures, if any, must be approved by City Transportation Right of Way Management Services.
- 1.3 No exhausting/ventilation of any construction areas will be permitted into any indoor or public areas.
- 1.4 All construction activities shall be conducted such that existing building fresh air intakes are not affected.
- 1.5 No use of the City's loading dock will be permitted unless authorized by the Owner.
- .1 Obtain Owners permission and provide work plans prior to proceeding with Work.

2 **CONTRACTOR IS THE CONSTRUCTOR**

- 2.1 The Contractor is the Constructor for this project as defined by this Contract Scope of Work and as defined by the Ministry of Labour and will be responsible for administration and control of construction safety on the project site.
- 2.2 The Contractor is to be aware and coordinate with adjacent projects and as such will enter into a construction separation plan agreement to manage boundaries between sites and that separation in time and space is established and maintained.

END OF SECTION

1 EXTRA SCOPE ALLOWANCES

- 1.1 Cash Allowances, unless otherwise specified, cover actual cost to Contractor of services, products, construction machinery and equipment, freight, handling, unloading, storage, installation, and other authorized expenses incurred in performing the Work identified below.
- 1.2 The Contract Price, and not cash allowance, includes Contractor's overhead and profit in connection with such extra scope allowances.
- 1.4 The City reserves the right to require the Contractor to call competitive bids for portions of the Work to be paid for out of any or all cash allowances. The relationship of the Contractor and the Subcontractors performing portions of the Work to be paid out of cash allowances shall be such as between the Contractor and his Subcontractors.
- 1.5 The Contractor shall only perform the Work covered by the extra scope allowance on receipt of a change order signed by the City.
- 1.6 Any impacts on the construction schedule on account of extra scope allowance work (if any) are to be identified and included in the change order that adds the extra scope allowance work to the Contract.
- 1.7 Unexpended amounts of cash allowances may be reallocated to other specific cash allowances at the sole discretion of the City.
- 1.8 Unexpended amounts of cash allowances shall be deducted from the Contract Price at completion of the Work.
- 1.9 Unit rates to be used against cash allowances will be as per rates provided in the Contract Documents. Overhead and Profit to be in accordance with the terms of the Contract.
- 1.10 The extra scope allowances in lawful monies of Canada included in the Contract Price are:

1	Allowance for extended repairs of rusted rebars, sand blasting, new rebar lap	\$66,000
2	Design and Pricing Allowance	\$168,700
3	Phasing Allowance	\$160,600
4	Traffic Management	\$175,000
5	Supervision, certification etc.	\$75,000
6	Allowance for waterproofing flood test	\$10,000

END OF SECTION

1 **COORDINATION**

- 1.1 Coordinate scheduling, submittals, and Work of the various sections of specifications to assure efficient and orderly sequence of installation of interdependent construction elements.
- 1.2 Be responsible for completion and cleanup of Work in preparation for Substantial Completion.
- 1.3 After City occupancy of premises, coordinate access to Project Site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of City's activities.

2 **FIELD ENGINEERING**

- 2.1 Contractor shall employ a registered Land Surveyor, acceptable to the City, to provide the following services:
 - .1 Locate and protect survey control and reference points.
 - .2 Control datum for survey is that established by City provided survey.
 - .3 Provide field engineering services. Establish elevations, lines, and levels, utilizing recognized engineering survey practices.
 - .4 Submit a copy of registered site drawing and certificate signed by the Land Surveyor that the elevations and locations of the Work are in conformance with the Contract Documents.

3 **ALTERATION PROJECT PROCEDURES**

- 3.1 Materials: As specified in product sections; match existing products and work for patching and extending work.
- 3.2 Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity.
- 3.3 Remove, cut, and patch work in a manner to minimize damage and to provide a means of restoring products and finishes to original condition.
- 3.4 Refinish visible existing surfaces to remain in renovated areas, to specified condition for each material, with a neat transition to adjacent finishes.
- 3.5 Where new work abuts or aligns with existing, perform a smooth and even transition. Patched work to match existing adjacent work in texture and appearance.
- 3.6 When finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Consultant.
- 3.7 Where a change of plane of 6 mm or more occurs, submit recommendation for providing a smooth transition for Consultant's review or request instructions from Consultant.
- 3.8 Patch or replace portions of existing surfaces which are damaged, lifted, discolored, or showing other imperfections.
- 3.9 Finish surfaces as specified in individual product sections.

3.10 For work in Heritage (White) Zones, a procedure needs to be submitted for approval prior to the commencement of the work.

4 **PRE-CONSTRUCTION CONFERENCE**

4.1 Prime Consultant shall schedule a conference after Notice of Award and prior to Contractor occupancy of the Project Site.

4.2 Attendance Required: City, Prime Consultant, Contractor and Subcontractor.

4.3 Agenda:

- .1 Distribution of Contract Documents.
- .2 Submission of list of Subcontractors, list of products, Schedule of Values, and Construction Schedule.
- .3 Designation of personnel representing the parties in Contract, Owner, and Prime Consultant.
- .4 Safety requirements.
- .5 Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, contract changes and contract closeout procedures.
- .6 Scheduling.
- .7 Use of premises by City.
- .8 Owner's requirements and partial occupancy.
- .9 Construction facilities and controls provided by City.
- .10 Security and housekeeping procedures.
- .11 Procedures for mock-ups.
- .12 Construction separation agreement requirements.
- .13 Access procedures for accessing non-construction areas.
- .14 Procedures for the notification of conditions that differ from the Contract Documents – in particular the discovery of undocumented heritage fabric and materials.
- .15 Procedures for testing.
- .16 Procedures for maintaining record documents.
- .17 Requirements for start-up of equipment.
- .18 Inspection and acceptance of equipment put into service during construction period.

5 **PROGRESS MEETINGS**

5.1 Contractor shall schedule and administer meetings throughout progress of the Work.

- 5.2 Contractor shall make arrangements for meetings, prepare agenda with copies for participants, preside at meetings, record minutes, and distribute copies within five (5) working days to City, Prime Consultant and to all in attendance.
- 5.3 Attendance Required: Job superintendent, major Subcontractors and suppliers, City, and Prime Consultant as appropriate to agenda topics for each meeting.
- 5.4 Refer to the terms of the Contract for further details.
- 5.5 As a minimum, the following items shall be included on the Agenda:
- .1 Review minutes of previous meetings.
 - .2 Safety
 - .3 Review of Work progress.
 - .4 Field observations, problems, and decisions.
 - .5 Identification of problems which impede planned progress.
 - .6 Review of submittals schedule and status of submittals.
 - .7 Review of off-site fabrication and delivery schedules.
 - .8 Maintenance of progress schedule.
 - .9 Corrective measures to regain projected schedules.
 - .10 Planned progress during succeeding work period.
 - .11 Coordination of projected progress.
 - .12 Maintenance of quality and work standards.
 - .13 Effect of proposed changes on progress schedule and coordination.
 - .14 Other business relating to Work.
- 6 **PRE-INSTALLATION CONFERENCES**
- 6.1 When required in individual specification section, convene a pre-installation conference at Project Site prior to commencing work of the section.
- 6.2 Attendance Required: Parties directly affecting, or affected by, work of the specific section.
- 6.3 Notify Prime Consultant minimum four (4) days in advance of meeting date, unless indicated otherwise in specific trade section.
- 6.4 Prepare agenda, preside at conference, record minutes, and distribute copies within two (2) days after conference to participants, with two copies to Prime Consultant.
- 6.5 Review conditions of installation, preparation and installation procedures, and coordination with related work.
- END OF SECTION

1 **SCHEDULES REQUIRED**

1.1 Submit the following schedules:

.1 Construction Schedule in accordance with the Contract.

.2 Submittal Schedule in accordance with the Contract, containing the following:

.1 Shop Drawings Schedule

.2 Sample Schedule

.3 Product Data Schedule

2 **CONSTRUCTION SCHEDULE**

2.1 Prepare Construction Schedule using Primavera Version 6 or later.

2.2 In addition to hardcopy, ensure that the schedule information and electronic native file is 100% compatible and useable by the City.

2.3 Refer to the terms of the Contract for further details.

3 **SUBMITTAL SCHEDULE**

3.1 Include schedule for submitting shop drawings, product data, and samples.

3.2 Format for listings: the table of contents of this specification.

3.3 Identification of listings: by specification section numbers.

3.4 Indicate dates for submitting, review time, resubmission time, float time, last date for meeting fabrication schedule.

3.5 Refer to the terms of the Contract for further details.

END OF SECTION

1 **RELATED WORK**

1.1 Individual submittals are described under pertinent sections of this specification.

2 **SUBMITTALS**

2.1 Submit to Consultant, shop drawings, samples and other items, in strict accordance with the provisions of the Contract and these Submittal Procedures.

2.2 All submittals to the Prime Consultant's office to include prepaid carrying and all other charges.

2.3 The Contractor shall keep one reviewed copy of each submission at the Project Site.

3 **SHOP DRAWINGS**

3.1 The term shop drawings means drawings, diagrams, illustrations, schedules, performance charts, product data, brochures and other data which are to be provided by the Contractor to illustrate details of portions of the work.

3.2 The Contractor shall arrange for the preparation of clearly identified shop drawings as the Consultant may reasonably request.

3.3 Prior to submission to the Consultant, the Contractor shall review all shop drawings. By this review the Contractor represents acknowledgement that all field measurements, field construction criteria, materials, catalogue numbers and similar data have been verified and shop drawings have been coordinated with the requirements of the work and of the contract documents.

.1 The Contractor's review of each shop drawing shall be indicated by a "reviewed" stamp, with control number, project name, date and signature of reviewer.

.2 Submittals not stamped, identified with a control number and project name, signed and dated will be returned without being examined and considered rejected.

3.4 The Contractor shall submit shop drawings to the Consultant for review in orderly sequence and sufficiently in advance to allow for the Consultant's proper review and so as to cause no delay to the Work.

3.5 If either the Contractor or the Consultant so requests, they shall jointly prepare a schedule fixing the dates for submission and return of shop drawings.

3.6 Shop Drawings Processing Time: Allow time for submittal review, including time for re-submittals, as indicated below.

3.7 Time for review shall commence on Consultant's receipt of submittal. If a shop drawing is received after 12 noon, it will be considered as received the next working day for the purposes of the processing time.

.1 For scheduling purposes allow 10 Working Days following submission and 10 working days following resubmission. Consultant will advise Contractor if additional time is required for technical or co-ordination review.

.2 Concurrent Review: When concurrent review of submittals by Prime Consultant's Subconsultants, City, or other parties is required, allow a minimum of fifteen (15) working days for initial review of each submittal. Direct transmittal to Consultant's Subconsultants will not be permitted.

- .3 If at any time the Contractor submits unusually large number of shop drawings, the Consultant will, within 5 working days of receipt of such drawings, provide the Contractor with an estimate of time necessary for processing such shop drawings.
- .4 Failure to provide submittals in ample time in advance of Work to permit correct and accurate processing by the Consultant is not considered sufficient reason for extension of Contract Time and no claim for extension will be authorized.
- 3.8 Shop drawings shall be submitted in electronic format as a PDF or DWG file via the Project Website or other means of electronic file delivery. Scanned drawings will only be accepted if legible. Illegible drawings will be rejected.
- 3.9 Contractor shall identify primary contact to be added to the Website for shop drawings submission and receipt of reviewed drawings and notifications.
- 3.10 With prior approval of the Consultant, catalogue cuts showing all aspects, design, sizes, components and rough-in information for equipment may be submitted as shop drawings. Supplement standard information to provide details applicable to project.
- 3.11 The Contractor shall make changes in shop drawings which the Consultant may require consistent with the contract documents and resubmit unless otherwise directed by the Consultant. When resubmitting, the contractor shall notify the Consultant in writing of any revision other than those requested by the Consultant.
- 3.12 Shop drawings shall define the division of responsibility between different trades. Shop drawings shall show materials, methods of construction and attachment or anchorage, erection diagrams, connections and other details necessary to complete the work. Shop drawings shall show cross references to drawings and specifications.
- 3.13 The review by the Consultant is for the sole purpose of ascertaining conformance with the general design concept. The review shall not mean that the Consultant approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor, and such review shall not relieve the Contractor of its responsibility for errors or omissions in the shop drawings or of its responsibility for meeting all requirements of the contract documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of the work of all subtrades and work of other contractors.
- 3.14 Any adjustments made on the shop drawings by the Consultant are not intended to change the Contract Price. If the Contractor deems that such adjustments affect the value of the work, he shall so state in writing before proceeding with the fabrication and installation of the work.
- 3.15 Make shop drawings accurately to a scale sufficiently large to show pertinent features of the item to be supplied and the method of connection to the work including attachments, reinforcing, anchorage and location of exposed fastenings.
- 4 REPRODUCTION OF DRAWING ELECTRONIC FILES**
- 4.1 Reproduction of the Consultants drawings to serve as background for Shop Drawings will be permitted. The Contractor shall remove all identification or reference to the City or Consultants from the drawings that are used for this purpose.

4.2 Make payment to the Consultant for the cost of reproduction plus Harmonized Sales Tax (HST) based on the number of drawing electronic files as indicated below.

.1 1 to 10 files: \$600.00

.2 11 to 20 files: \$700.00

4.3 The release of electronic files by the Prime Consultant does not imply transfer of copyright or ownership to the Contractor. The Contractor shall be responsible for all liabilities and damages resulting from the use of these files.

5 **SAMPLES**

5.1 Submit Samples, when requested by the Consultant, showing material, colour and finish. Materials used in the construction shall correspond to the reviewed samples.

5.2 Submit samples in such quantities which are required to be returned plus one which will be retained by the Consultant.

5.3 Identify each sample with Project Number, Job Name, Date of Submittal, Type of Material, Names of Contractor, Subcontractor and Manufacturers.

5.4 Reviewed samples will become standard of workmanship and material against which installed Work will be verified.

6 **COLOURS**

6.1 Unless the precise colour and pattern is specifically described in the Contract Documents, whenever a choice of colour or pattern is available in a specified product, submit accurate colour charts from the manufacturer's standard range of colours and pattern charts to the Prime Consultant for review and selection.

6.2 Unless all available colours and patterns have identical costs and identical wearing capabilities and are identically suited for the installation, completely describe the relative costs and capabilities of each.

7 **HERITAGE RESTORATION**

7.1 Submit written Record/Procedure of:

.1 Final masonry mortar mixes and colour for all Heritage mortar work.

.2 Stone surface treatments matching existing.

8 **PROGRESS PHOTOGRAPHS**

8.1 Submit typical photographic sample in digital format to Consultant for review.

- 8.2 Upon commencement of the Work, and thereafter at bi-weekly intervals, supply to the Consultant, photographs in digital format with sufficient views from 4 locations of the progress of all parts of the Work.
- 8.3 Each photograph shall be dated and locations noted on digital files.
- 8.4 Cost of all progress photographs, including site photographs in Heritage sensitive areas, shall form part of the Contract Price.
- 8.5 Provide Site Photographs in Heritage sensitive areas as described below.

- 8.6 Contractor shall document the work in Heritage sensitive areas prior to the start, during and after finishing, especially any work requiring the dismantling of stone or exposed surface finish. This procedure is required by Parks Canada.
- .1 Site Photographs:
- .1 Submit typical photographic sample in printed and digital format to Consultant for review, prior to commencement of Work.
- .2 Prior to removing heritage fabric, photograph the following:
- .1 General view of the Work.
- .2 Detail shots of design elements, patterns, and ornamental features.
- .3 Submit photographs for areas of heritage fabric to be dismantled, replaced or to receive surface treatment. Record all sides and entire faces and arrange as a montage.
- .4 Submit photographs as part of weekly report.
- .3 On completion of work, photograph areas for final comparison.
- .4 Photograph quality: Well-illuminated, proper exposure, on professional quality film and printed on archival quality photographic paper.
- .5 Provide 227 x 184 mm photographs in archival mountings assembled in a binder and submitted in 3 copies to the Consultant.
- .6 Include copy of photographs on portable digital storage media. Minimum 9 megapixel quality, RAW format.

9 IDENTIFICATION OF SUBMITTALS

- 9.1 Completely identify each submittal and re-submittal by showing at least the following information:
- .1 Project Number and Title.
- .2 Date of Submittal.
- .3 Name of Subcontractor.
- .4 Control Number.
- .5 Name and address of submitter, plus name and telephone number of the individual who may be contacted for further information.

- .6 Drawing Number and Specification Section number to which the submittal applies.
- .7 Whether this is an original submittal, or re-submittal.
- .8 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

10 **COORDINATION OF SUBMITTALS**

- 10.1 Prior to submittals for Consultant's review, use all means necessary to fully coordinate material, including the following procedures:
 - .1 Determine and verify field dimensions and conditions, materials, catalogue numbers and similar data.
 - .2 Coordinate as required with the trades and with public authorities involved.
 - .3 Secure necessary approvals from public authorities and others and signify by stamp, or other means, that they have been secured.
 - .4 Clearly indicate deviations from the Contract Documents.
- 10.2 Unless otherwise specifically permitted by the Consultant, make submittals in groups containing associated items; the Consultant may reject partial submittals as not complying with the provisions of the Contract Documents.
- 10.3 Make submittals far enough in advance of scheduled dates of installation to provide required time for reviews, for securing necessary reviews, for possible revision and re-submittal, and for placing orders and securing delivery so as to cause no delay in the work or in the work of other contractors.
- 10.4 Do not proceed with Work affected by a submittal until review is complete.
- 10.5 Costs of delays occasioned by tardiness in making submittals shall not be borne by the City.

END OF SECTION

- 1 General
- 1.1 **RELATED SECTIONS**
 - .1 Section 01 33 00 – Submittal Procedures.
- 1.2 **REFERENCES**
 - .1 National Fire Protection Association (NFPA).
 - .1 NFPA 241 - Standard for safeguarding Construction, Alteration, and Demolition Operations, 2004 Edition.
 - .2 Canadian Standards Association (CSA International).
 - .1 CAN/CSA-S350-M1980 (2003) - Code of Practice for Safety in Demolition of Structures.
 - .2 CSA O80.20-M89, Fire-Retardant Treatment of Lumbering Pressure Processes.
 - .3 CSA O80.27-M89, Fire-Retardant Treatment of Plywood by Pressure Processes.
 - .3 Human Resources and Skills Development Canada.
 - .1 FC 301 Standard for Construction Operations
 - .2 FC 302 Standard for Welding and Cutting.
 - .4 Parks Canada.
 - .1 Standards and Guidelines for the Conservation of Historic Places in Canada, published by Parks Canada (2003).
- 1.3 **PERFORMANCE REQUIREMENTS**
 - .1 The Contractor is responsible for any damage to or loss of Heritage Materials occurring as a result of site, handling, transport and storage activities.
 - .2 Ensure materials, equipment and procedures safely support existing structure and construction live loads;
 - .3 Apply methods that minimize the risk of damage to Heritage Materials.
- 1.4 **DEFINITIONS**
 - .1 White Zones: Areas containing or potentially containing Heritage Materials, this include the West Moat parapet wall and structure below at the moat level (walls, columns).
 - .2 Heritage Materials: Existing materials located in the White Zones deemed essential to the heritage value of the building. These include but are not limited to:
 - .1 Exterior masonry (Indiana limestone, Queenston)
 - .2 Interior masonry (Zumbro, Wallace Sandstone)
 - .3 Plaster and artificial stone ceilings, vaults and walls
 - .4 Wood trim, doors, windows, casings
- 1.5 **SHOP DRAWINGS**
 - .1 Submit shop drawings in accordance with Section 01 33 00.

1.6 **PROCEDURES**

- .1 Submit detailed work procedures indicating tools used inside or near heritage areas. Describe additional measures to be implemented to ensure vibration protection of heritage fabric.

1.7 **QUALITY ASSURANCE**

- .1 Perform work in accordance with The Standards and Guidelines for the Conservation of Historic Places in Canada, published by Parks Canada.

2 Execution

2.1 **PROTECTIVE MEASURES – GENERAL**

- .1 Provide protective measures for any and all heritage materials.
- .2 Anchoring or attachment to historic materials:
 - .1 The use of any mechanical fasteners into or onto any heritage material is prohibited.
 - .2 In the event that dust, dirt, and liquid barriers require attachment to historic materials, only non-permanent removable, non-residue adhesive tapes may be used on the heritage material.

2.2 **PROTECTIVE MEASURES - EXTERIOR**

- .1 Provide barriers in all locations where exterior masonry may be damaged by normal site activities.

2.3 **PROTECTIVE BARRIERS**

- .1 Provide protective barriers and coverings to protect heritage walls and floors from abrasion, impact, dust, dirt and liquids.
- .2 Protective barriers are the responsibility of the Contractor and is subject to review by the Consultant.

2.4 **VIBRATIONS AND DISPLACEMENTS**

- .1 Protect sensitive heritage items from vibrations and sudden movements by combining bracing, rigid paneling and full-surface padding as required.
- .2 Use of high-impact mechanical demolition tools is prohibited within 10 m of White Zones.

2.5 **PREVENTION OF WATER / LIQUID / PARTICULATE DAMAGE**

- .1 Maintain proper water-shedding conditions at all times to ensure that water does not infiltrate inside the building.
- .2 Provide waterproofing sheeting and wrapping to cover heritage materials so that in the event that any demolition procedure causes liquids to come into contact with the heritage materials.
- .3 Water or any aqueous mixtures may produce significant damage to heritage items. Protect heritage items to remain in place from all contact with water or other aqueous mixture.

END OF SECTION

1 General

1.1 **HERITAGE STANDARDS AND DEFINITIONS**

- .1 Conservation: All activities involved in the protection and retention of heritage resources. Actions or processes that are aimed at safeguarding the *character-defining elements* of a heritage building materials, details, and spaces so as to retain its *heritage value* and extend its physical life. This may involve “*Preservation*,” “*Rehabilitation*,” “*Restoration*,” or a combination of these actions or processes.
- .2 Conservator: The person who is responsible for the care and treatment of heritage objects.
- .3 Demolish: Include labour, materials, and equipment necessary to tear down completely or to remove completely. Refer to the relevant specification sections for the appropriate methodology.
- .4 Existing to Remain: Include labour, materials, and equipment necessary to protect heritage materials and finishes indicated to remain against soiling and damage during adjacent construction activities. Refer to the relevant specification sections for the appropriate methodology.
- .5 Mock-up: Include labour, materials, and equipment necessary to demonstrate in the presence of the Consultant the methodology, materials, and workmanship required for each intervention described in the specifications. Mock-ups for each intervention are to be done prior to the start of that work.
- .6 Remove: Include labour, materials, and equipment necessary to remove and legally dispose of items except those indicated to be salvaged, reinstalled, or to remain the Owner’s property. Refer to the relevant specification sections for the appropriate methodology.
- .7 Preserve: Include labour, materials, and equipment necessary to save, protect, and maintain heritage finishes and details utilizing specialized treatments to correct defects, improve appearance, and stabilize materials in order to prevent decay or deterioration.
- .8 Refurbish: Include labour, materials, and equipment necessary to make an existing finish, material, or equipment, appear, function, and operate like new. Refer to the relevant specification sections for the appropriate methodology.
- .9 Repair: Include labour, materials, and equipment necessary to replace or correct broken, damaged or faulty components or elements, or to make minor alterations or renovations to it in order to maintain its operating efficiency. Refer to the relevant specification sections for the appropriate methodology.
- .10 Replace: Include labour, materials, and equipment necessary to remove existing materials which can no longer perform their proper function and their replacement with as exact a substitute as possible (i.e. the replacement of damaged marble tile with new that match the existing in material, pattern and exposure).
- .11 Restore: Include labour, materials, and equipment necessary to restore which is defined as the action or process of accurately revealing, recovering or representing the state of a historic space, material, or component, as it appeared at a particular period in its history while protecting its heritage value. Refer to the relevant specification sections for the appropriate methodology.
- .12 Salvage: Include labour, materials, and equipment necessary to save dismantled material for reuse, reinstallation, re-fabrication. Refer to the relevant specification sections for the appropriate methodology.

END OF SECTION

1 GENERAL REQUIREMENTS

- 1.1 Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
- .1 Specific quality assurance and quality control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of products.
- .2 Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality control procedures that facilitate compliance with the Contract Document requirements.
- .3 Requirements for Contractor to provide quality assurance and quality control services required by Consultant, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

2 DEFINITIONS

- 2.1 Quality Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- 2.2 Quality Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Consultant.
- 2.3 Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.
- 2.4 Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
- 2.5 Product Testing: Tests and inspections that are performed by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.
- 2.6 Source Quality Control Testing: Tests and inspections that are performed at the plant, mill, factory, or shop.
- 2.7 Field Quality Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- 2.8 Testing Agency: An entity engaged to perform specific tests, inspections, or both.
- 2.9 Experienced: An entity having successfully completed previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

3 **CONFLICTING REQUIREMENTS**

- 3.1 General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Consultant for a decision before proceeding.
- 3.2 Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Consultant for a decision before proceeding.

4 **SUBMITTALS**

- 4.1 Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- 4.2 Schedule of Tests and Inspections: Prepare in tabular form and include the following:
- .1 Specification Section number and title.
 - .2 Description of test and inspection.
 - .3 Identification of applicable standards.
 - .4 Identification of test and inspection methods.
 - .5 Number of tests and inspections required.
 - .6 Time schedule or time span for tests and inspections.
 - .7 Entity responsible for performing tests and inspections.
 - .8 Requirements for obtaining samples.
 - .9 Unique characteristics of each quality-control service.
- 4.3 Reports: Prepare and submit four copies of certified written reports that include the following:
- .1 Date of issue.
 - .2 Project title and number.
 - .3 Name, address, and telephone number of testing agency.
 - .4 Dates and locations of samples and tests or inspections.
 - .5 Names of individuals making tests and inspections.
 - .6 Description of the Work and test and inspection method.

- .7 Identification of product and Specification Section.
 - .8 Complete test or inspection data.
 - .9 Test and inspection results and an interpretation of test results.
 - .10 Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 - .11 Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - .12 Name and signature of laboratory inspector.
 - .13 Recommendations on retesting and reinspecting.
- 4.4 Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

5 **QUALITY ASSURANCE**

- 5.1 General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- 5.2 Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- 5.3 Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- 5.4 Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- 5.5 Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.
- 5.6 Specialists: Certain Sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated. Requirement for specialists shall not supersede requirements of authorities having jurisdiction.
- 5.7 Testing Agency Qualifications: An independent agency with the experience and capability to conduct testing and inspecting indicated, and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

- 5.8 Factory Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- 5.9 Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
- .1 Contractor responsibilities include the following:
 - .1 Provide test specimens representative of proposed products and construction.
 - .2 Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - .3 Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - .4 Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
 - .5 Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
 - .6 When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.
 - .2 Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Consultant with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

6 **QUALITY CONTROL**

- 6.1 Owner's Testing: The Owner may require during progress of the Work, testing and inspection by an independent testing company as directed by the Consultant, or as required in these Specifications, to determine if materials provided for the Works meet the specified requirements.
- .1 Where independent inspection and testing are required by the Contract Documents, the cost of these services shall be paid for by the Owner, except where cash allowances have been included for the specific inspection and testing. In this case, the Contractor shall pay independent inspection and testing company charges authorized by the Owner from the cash allowances included for these services.
 - .2 Retesting and Reinspection: When initial tests indicate non-compliance with the Contract Documents, costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be deducted by the Owner from the Contract Price. Retesting and resinpsection shall be performed by the same testing agency as the initial tests.
 - .3 Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.

- 6.2 Code Compliance and Contractor's Convenience Testing
- .1 Code Compliance Testing: Inspection and tests required by codes or ordinances, or by an authority having jurisdiction shall be the responsibility of the Contractor and shall be paid for by the Contractor.
 - .2 Contractor's Convenience Testing: Inspection or testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor and paid for by Contractor as part of the Contractor 's overhead expenses.
 - .3 Engage a qualified testing agency to perform these quality-control services. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 - .4 Submit a certified written report, in triplicate, of each quality-control service.
 - .5 Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
 - .6 Retesting/Reinspecting: Provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- 6.3 Manufacturer's Field Services: Where indicated, engage a factory authorized service representative to inspect field-assembled components and equipment installation, including service connections.
- 6.4 Testing Agency Responsibilities
- .1 Cooperate with Consultant, Contractor and Subcontractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - .2 Notify Consultant, Contractor and Subcontractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - .3 Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 - .4 Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements
 - .5 Submit a certified written report, in duplicate, of each test, inspection, and similar quality- control service through Contractor.
 - .6 Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 - .7 Do not perform any duties of Contractor or Subcontractor.
- 6.5 Contractor Responsibilities
- .1 Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - .1 Access to the Work.
 - .2 Incidental labour and facilities necessary to facilitate tests and inspections
 - .3 Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples

- .4 Facilities for storage and field curing of test samples.
- .5 Delivery of samples to testing agencies.
- .6 Preliminary design mix proposed for use for material mixes that require control by testing agency.
- .7 Security and protection for samples and for testing and inspecting equipment at Project site.
- .2 Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
 - .1 Schedule times for tests, inspections, obtaining samples, and similar activities.
- .3 Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality assurance and quality control services required by the Contract Documents. Submit schedule within 30 days of date established for commencement of the Work.
 - .1 Distribution: Distribute schedule to Owner and Consultant, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.
 - .2 Establishing Schedule: By advance discussion with the selected testing and inspection agencies, determine the time required for the agencies to perform their duties and the time required for the issuance of resulting reports. Allow for the times in the construction schedule.
 - .3 Schedule Revisions: Co-ordinate revisions with the testing and inspection agencies when changes to the construction schedule are necessary.
 - .4 Schedule Adherence: Provide advance notice to the testing laboratory and to the inspection company of when testing of the Work is required. If the testing laboratory is ready to perform its functions according to the schedule and is prevented from doing so due to incompleteness of the work, extra costs for testing attributable to the delay will be back charged to the Contractor.

7 **TEST AND INSPECTION LOG**

- 7.1 Prepare a record of tests and inspections. Include the following:
 - .1 Date test or inspection was conducted.
 - .2 Description of the Work tested or inspected.
 - .3 Date test or inspection results were transmitted to Consultant.
 - .4 Identification of testing agency or special inspector conducting test or inspection.
- 7.2 Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Consultant's reference during normal working hours.

8 **REPAIR AND PROTECTION**

- 8.1 On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
- 8.2 Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.

- 8.3 Protect construction exposed by or for quality-control service activities.
- 8.4 Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality control services.

END OF SECTION

1 **STANDARDS AND CODES**

- 1.1 Contract forms, codes, specifications, standards, manuals and installation, application and maintenance instructions, referred to in the Specifications unless otherwise specified and unless otherwise stated in the governing building code, shall be the latest published editions at the date of the Tender submission.
- 1.2 Conform to standards, in whole or in part, as stated in the Specifications.
- 1.3 If there is question as to whether any product or system is in conformance with applicable standards, the Owner reserves the right to have such products or systems tested at the Contractor's cost to prove conformance.
- 1.4 The cost for such testing will be borne by the Owner in the event of conformance with the Contract Documents or by the Contractor in the event of non-conformance.

2 **SPECIFIED OPTIONS**

- 2.1 When only one manufacturer's catalogued trade name is specified, provide only that catalogued trade name, material or product.
- 2.2 When more than one manufacturer's trade name is specified for a material or product, the choice is the Contractor's.
- 2.3 When more than one manufacturer's catalogued trade name is specified along with a referenced standard, the choice is the Contractor's on condition the material or product complies with the referenced standard.
- 2.4 When a material or product is specified by reference to a standard only, the Contractor may select any material or product that meets or exceeds the specified standard.
- 2.5 When a material or product is specified by prescriptive or performance specification, the Contractor may select any material or product meeting or exceeding the specification.
- 2.6 When a material or product is specified by reference to a standard or by prescriptive or performance specification, upon request of the Consultant, obtain from the manufacturer, an independent testing laboratory reporting, showing that the material or product meets or exceeds the specified requirements.

3 **QUALITY**

- 3.1 Products, materials, equipment and articles, referred to as Products throughout the specifications, incorporated into the Work shall be new, not damaged or defective, and of the best quality comparable with the specifications for the purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- 3.2 Defective products, whenever identified prior to the completion of work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is a precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- 3.3 Should any dispute arise as to the quality or fitness of products, the decision rests strictly with the Consultant based upon the requirements of the Contract Documents.

3.4 Unless otherwise indicated in the specifications, maintain uniformity of manufacture for any particular or like item throughout the work.

4 **AVAILABILITY**

4.1 Immediately upon award of Contractor, review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify the Consultant of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of work.

4.2 In the event of failure to notify the Consultant at commencement of work and should it subsequently appear that work may be delayed for such reason, the Contractor shall, as determined by the Consultant and at no increase in Contract Price, temporarily install another product until such time as specified product becomes available, at which time the temporarily installed product shall be removed and the specified product installed.

5 **PRODUCT DELIVERY, STORAGE, HANDLING AND PROTECTION**

5.1 Handle and store products in a manner to prevent damage, adulteration, deterioration and soiling to the products, other building components, assemblies, other products, the structure, the site and surrounding property and in accordance with manufacturer's instructions when applicable.

5.2 Remove and replace damaged products at own expense and to the satisfaction of the Consultant.

5.3 Delivery and Handling:

- .1 Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
- .2 Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
- .3 Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
- .4 Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

5.4 Storage:

- .1 Store packaged or bundled products in original and undamaged condition with manufacturer's seals and labels intact. Do not remove from packaging or bundling until required in the work, except where otherwise specified for a specific item.
- .2 Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.

- .6 Store sheet materials and lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in a heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.

6 **TRANSPORTATION**

- 6.1 Pay costs of transportation, including custom taxes, of products required in the performance of the work.
- 6.2 Transportation cost of products supplied by the Owner will be paid for FOB curb side at the site by the Owner. Unload, handle and store such products.

7 **WORKMANSHIP**

- 7.1 Workmanship shall be the best quality, executed by workers experienced and skilled in the respective duties for which they are employed. Immediately notify the Consultant if required work is such as to make it impractical to produce the required results.
- 7.2 Do not employ any unfit person or anyone unskilled in their required duties.
- 7.3 Decisions as to the quality or fitness of workmanship in cases of dispute rest solely with the Consultant whose decision is final.

8 **SPECIAL PROTECTION AND PRECAUTIONS**

- 8.1 Comply with the requirements of the workplace hazardous materials information system (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and the provision of material safety data sheets (MSDS).

9 **FASTENINGS**

- 9.1 Provide metal fastenings and accessories in the same texture, sheen, colour and finish as adjacent materials, unless indicated otherwise.
- 9.2 Use noncorrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in the affected specification section.
- 9.3 Prevent electrolytic action between dissimilar metals and materials.
- 9.4 Space anchors within their load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
- 9.5 Keep exposed fastenings to a minimum, space evenly and install neatly.
- 9.6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

10 **MANUFACTURER'S INSTRUCTIONS**

- 10.1 Unless otherwise indicated in the specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
- 10.2 Notify the Consultant in writing, of conflicts between the specifications and manufacturer's instructions, so that the Consultant may establish the course of action.
- 10.3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes the Consultant to require removal and re-installation at no increase in the contract price.

11 **TRADEMARKS AND LABELS**

- 11.1 Trademarks and labels, including applied trademarks and labels are not acceptable in the finished work, except those required for operating instructions, or when located in mechanical, electrical and control rooms.
- 11.2 Remove trademarks and labels by grinding, if necessary, painting out where the particular surface is being painted, or if on plated parts, replace with new plain plated or non-ferrous metal parts.

END OF SECTION

1 **DEFINITIONS**

- 1.1 Cutting: Removal of in-place construction necessary to permit installation or performance of other Work. Cutting does not include mere drilling of holes to accommodate screws, anchors, bolts or other fasteners, such drilling is part of each Section's installation function.
- 1.2 Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

2 **SUBMITTALS**

2.1 Submit written request in advance of cutting or patching which affects:

- .1 Structural integrity of any element of Work and of Project.
- .2 Integrity of weather-exposed or moisture-resistant elements.
- .3 Efficiency, maintenance, or safety of any operational element.
- .4 Visual qualities of sight-exposed elements.
- .5 Work of Owner or other Contractor.

2.2 Include in request:

- .1 Identification of Project.
- .2 Location and description of affected Work.
- .3 Statement on necessity for cutting or patching.
- .4 Description of proposed work, and Products to be used.
- .5 Alternatives to cutting and patching.
- .6 Effect on work by Owner or separate Contractor.
- .7 Written permission of affected separate contractor.
- .8 Date and time work will be performed.

3 **PREPARATION**

- 3.1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
- 3.2 After uncovering, inspect conditions affecting performance of Work.
- 3.3 Beginning of cutting or patching means acceptance of existing conditions.
- 3.4 Provide supports to assure structural integrity of surroundings; devices and methods to protect other portions of Work from damage.
- 3.5 Provide protection from elements for areas which may be exposed by uncovering Work; maintain excavations free of water.

- 4 **EXECUTION**
- 4.1 Execute cutting, fitting, and patching including excavation and fill, to complete the Work.
- 4.2 Do not cut, drill or sleeve load-bearing members without obtaining written approval for each condition.
- 4.3 Fit the several parts together, to integrate with other work.
- 4.4 Uncover Work to install ill-timed work.
- 4.5 Remove and replace defective and non-conforming work.
- 4.6 Remove samples of installed Work for testing if directed by the Consultant.
- 4.7 Perform work by methods to avoid damage to other work, and which will provide proper surfaces to receive patching and finishing.
- 4.8 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- 4.9 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
- 4.10 Restore Work with new Products in accordance with requirements of Contract Documents.
- 4.11 Fit work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces and with suitable allowance for deflections and expansions and contractions.
- 4.12 Completely seal voids of penetrations of fire rated wall, ceiling, and floor constructions with firestopping material, full thickness of the construction element.
- 4.13 Refinish surfaces to match adjacent finishes. Refinish continuous surfaces to nearest intersection. Refinish entire assembly.

END OF SECTION

1 General

1.1 **SUMMARY**

.1 Section Includes:

- .1 Administrative and procedural requirements for cutting and patching of Heritage Materials.

1.2 **RELATED SECTIONS**

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 35 91 – Historic Protective Measures.
- .3 Section 01 35 92 – Heritage Standards and Definitions.
- .4 Refer to individual Sections specifying Heritage Work for specific requirements and limitations applicable to cutting and patching of Heritage Materials.

1.3 **PRECEDENCE**

- .1 Cutting and patching work shall be performed in accordance with this Section's requirements.
- .2 Requirements of this Section apply to all trades, including Structural, Mechanical, and Electrical trades.

1.4 **QUALITY ASSURANCE**

- .1 Cutting and patching work governed by this Section shall be performed exclusively by qualified workers specialized in Heritage restoration work, according to type of Heritage Material involved.
- .2 Related trades requiring cutting and patching of Heritage Materials to perform their work shall coordinate closely with specialized Contractor executing the cutting and patching for scheduling and sequencing of the work.
- .3 Cutting and patching work in Heritage Materials is described on drawings. Locations and dimensions of openings in Heritage Materials shown on the drawings cannot be changed or modified in any way unless approved by Heritage Consultant.
- .4 No changes or deviation from original cutting and patching layout will be permitted unless they are indicated and documented in the required cutting and patching proposal.
- .5 Heritage Consultant may require a mock-up of cutting and patching work, as indicated in individual Sections.

1.5 **SUBMITTALS**

- .1 Prior to any cutting and patching in Heritage Materials, submit a Cutting and Patching Proposal in accordance with Section 01 33 00.
- .2 Mandatory Cutting and Patching Proposals: specialized Contractor performing cutting and patching in Heritage Materials shall submit a proposal for each area describing procedures sufficiently in advance of the time cutting and patching will be performed so that Heritage Consultant can approve these procedures before proceeding.

- .3 Include the following information, as applicable, in the proposal:
 - .1 Extents of cutting and patching required, and as indicated on the drawings.
 - .2 Photograph of area where cutting is required.
 - .3 Show modifications and deviations from original design and justify reason for modification.
 - .4 Show how work will be performed indicating tools, methods, and materials.
 - .5 Indicate dates when cutting and patching will be performed.
 - .6 Approval by Heritage Consultant to proceed with cutting and patching does not waive the Heritage Consultant's right to later require complete removal and placement of unsatisfactory work.

END OF SECTION

1 General

1.1 **SUMMARY**

- .1 At the Cab Stand walls as well as at the north and south walls under the centre pedestrian bridge, there is a heritage concrete finish that has exposed aggregate and was described in the original documents as a bush-hammer concrete finish.
- .2 This section includes:
 - .1 Cleaning and preparation of existing heritage cast-in-place concrete surfaces to make ready for surface finish repairs where required.
 - .2 Application of mortar surfacing to prepared surfaces.
- .3 Refer to 03 01 33 Concrete Rehabilitation for concrete spall repairs, delamination repairs, treatment of embedded corroded steel elements and repairs to the Cab Stand ceiling.

1.2 **REFERENCES**

- .1 American Society for Testing and Materials (ASTM), latest revision.
 - .1 ASTM D412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension.

1.3 **QUALITY ASSURANCE**

- .1 Work shall be performed by a firm having not less than 5 years successful experience in comparable concrete resurfacing projects and employing personnel skilled in the restoration process and operations indicated.
 - .1 Only skilled journeyman masons and/or cement finishers who are familiar and experienced with the materials and methods specified and are familiar with the design requirements shall be used for concrete restoration.
 - .2 One skilled journeyman mason or cement finisher, trained and certified by the concrete repair system manufacturer shall be present at all times during concrete restoration and shall personally direct the work.
- .2 Mock-Ups:
 - .1 Prior to start of concrete resurfacing, prepare the following samples where directed by Consultant and in his presence. Obtain Consultant's approval of samples before proceeding with the work.
 - .2 Cleaning: demonstrate materials and methods to be used for cleaning existing concrete surface and condition on a sample area determined by Heritage Consultant. Test adjacent non-masonry materials for possible reaction with cleaning materials. Allow waiting period of duration indicated, but not less than 7 calendar days after completion of sample panels for negative reactions.
 - .3 Resurfacing: prepare a sample of resurfacing work on a sample area determined by Heritage Consultant. Resurfacing shall demonstrate methods and quality of workmanship expected.

- .4 Allow samples to cure at least three days before obtaining acceptance of colour and texture and detailing match. Samples shall be viewed from an approved distance.
- .3 Source of Materials: obtain materials for resurfacing, coating, sealing and crack repair from a single source manufacturer to ensure match quality, colour, texture and detailing.

1.4 **SUBMITTALS**

- .1 Product Data: submit manufacturer's technical data for each product indicated including recommendations for their application and use. Include test reports and certifications substantiating that products comply with requirements.
- .2 Do not order materials or start work before receiving the written approval.
- .3 For the purposes of initial matching of surfacing matrix color and aggregate size and distribution, please provide minimum samples sizes of 200mm by 200mm. Numerous samples may be required.
- .4 A one metre by one metre wall mock-up is required before final approval of surfacing mortar color and aggregate size and distribution.

1.5 **MOCK-UPS**

- .1 At least one mock-up is required for matching color and aggregates: 1 metre square.
- .2 Further mock-ups may be required to establish the final level of sandblasting required to expose aggregate.

1.6 **SEQUENCING**

- .1 Perform concrete resurfacing work in the following sequence:
 - .1 Identify areas that need resurfacing together with the Heritage Consultant. Refer to Unit Prices in bid documents for estimated quantities.
 - .2 Remove existing unsound materials from area indicated to be resurfaced.
 - .3 Repair areas with significant delamination and/or corroded steel elements as per 03 01 33 Concrete Rehabilitation.
 - .4 Clean area indicated to be resurfaced using mechanical means.
 - .5 Pressure wash area to be resurfaced.
 - .6 Resurface existing concrete as indicated.

1.7 **SUPERVISION**

- .1 Contractor shall engage manufacturer's technical representative at Contractor's expense, to provide:
 - .1 Periodic review of work in progress: as a minimum, manufacturer's technical representative shall be present to review conditions and methods prior to start of work, mock-ups, and a final review shall be performed upon Substantial Performance of Work.

2 Products

2.1 **SURFACING MORTAR**

- .1 Surfacing mortar shall be the Edison Custom System 45, a two-component, latex-modified, cementitious compounds as manufactured by Edison Coatings Inc., (800) 697-8055, or approved equal.
- .2 Mortar surfacing anchoring: consult requirements with manufacturer. Assume that for patches over 25mm deep, stainless steel helifix pins spaced at 150mm c/c will be required. Recommended product: Helifix Patch Pin by Helifix.
- .3 Colours and texture of surfacing compound are as selected by Heritage Consultant. Send samples of existing mortar finish to Edison Coatings for matching of mortar colour and aggregate distribution. Sample sizes are to be as per manufacturer's recommendation but assume a 200mm by 200mm minimum size
- .4 Manufacturer will match colour and aggregate distribution and aggregate shape of existing concrete surface based on a sample of the existing. Contact manufacturer for sample requirements and provide sample as instructed. Liaise with Heritage Consultant to ensure sample is representative of original surface.
- .5 The existing surface has large aggregate. New surfacing material must have at a minimum 6mm and 13mm aggregate sizes.
- .6 Water used for cleaning, mixing and finishing shall be clean, potable, free from oil, acid, injurious amounts of vegetable matter, alkalies or other salts.
- .7 No colorants, accelerators, bonding agents or other additives shall be added to the patching compound without express written direction of the manufacturer.
- .8 Edison Coatings "System 22 Retarder" may be used during the application of the surfacing mortar. Whether or not this product will be necessary is to be determined based on mock-up results. Manufacturer's instructions and recommendations are to be followed.
- .9 A standard pressure-pot sand-blaster with a pressure gauge and pressure regulation capability (50psi or more as established with the Heritage Consultant), or a JOS system, may be used after the surfacing product has sufficiently hardened or cured (at the discretion of the Heritage Consultant). Whether or not blasting will be used is to be confirmed during mock-ups, and will be done following manufacturer's recommendations. The existing surface has exposed aggregate which may only be achieved by sandblasting.
- .10 Crack sealant: refer to 03 01 33 Concrete Rehabilitation.
- .11 The products specified herein shall be assumed to meet the performance criteria specified. If a proposed equal is submitted, thorough lab testing shall be required to establish equivalent performance levels. An independent testing laboratory shall be utilized as determined by the Heritage Consultant, and shall be paid for by the submitting party.

3 Execution

3.1 **SURFACE PREPARATION**

- .1 Prior to patching, all surfaces must be prepared in accordance with this section of the specifications.
- .2 Remove unsound concrete, using lightweight hammers.
- .3 Grind and/or sand entire face of concrete to be resurfaced down to sound concrete. Once cleaned, test surfaces for alkalinity/carbonation with a 1-2% solution of phenolphthaline. Surfaces which do not indicate alkalinity (solution turns pink) shall require further demolition.
- .4 For areas of significant spalling or delamination, cracks and for areas with embedded corroded steel elements, refer to 03 01 33 Concrete Rehabilitation for repair procedures. Once repairs are completed as per 03 01 33, ensure finished repaired surface is recessed sufficiently compared to the surrounding original textured finish, so that the heritage surfacing can be applied flush to the main wall plane. Proceed with procedures in this spec for resurfacing the repaired surface.
- .5 Pressure wash all indicated surfaces using 3000-4000 psi water blast, as required to remove all dust and dirt. Abrasive shall be used in combination with water when cleaning repair cavities, as required to eliminate micro-cracked surface materials resulting from demolition. No water with concrete dust shall be allowed to remain on any surface following washing, and must be immediately removed, prior to drying and rehardening.
- .6 The result of this preparation shall render a surface clean, meaning having complete exposure of sound original material without any deposits of contaminants, foreign matter or loose material, which could affect the bond or long-term durability of the surface and the patching compound.

3.2 **CRACK REPAIR**

- .1 Refer to 03 01 33 Concrete Rehabilitation.

3.3 **PRIMING OF REINFORCING STEEL**

- .1 Refer to 03 01 33 Concrete Rehabilitation.

3.4 **CONCRETE SURFACING**

- .1 Depending on the depth and size of repair, anchoring may be required. Confirm anchoring requirements with manufacturer.
- .2 Follow all manufacturer's installation recommendations.
- .3 Following preparation, as specified above, Contractor shall maintain work area in a clean condition, including materials, equipment and workers' footwear, to avoid tracking in of contaminants, dirt, dust, mud or other materials which may interfere with adhesion and durability of repairs.
- .4 The procedure described below assumes a parging application for localized or shallow repairs, either no more than 50mm in depth, or up to 1m² in surface area. For areas larger than 1m² and smaller than 2m², a cast-in-place application may be required depending on mock-up results. For areas larger than 2m², assume a cast-in-place application will be

required. The cast-in-place application must not be shallower than 100mm, meaning the existing finish at large damaged areas must be removed to a minimum depth of 100mm. Assume a stainless steel shelf angle will be required to support the finish, as well as vertical and horizontal rebar anchored to the back-up wall. Assume best practice cast-in-place procedures will be required, including the use of vibration and ensuring the back-up wall is clean and sound.

- .5 Prior to surfacing, repair areas shall be kept continuously wet for at least 20 minutes prior to application of surfacing compound. Before surfacing, excess water shall be blown, vacuumed or otherwise removed from the surface, leaving the surface damp or saturated/surface dry.
- .6 Vigorously brush apply a thin slurry coat of 1 part Custom 45 liquid and 3 parts powder. Apply surfacing mortar immediately after priming.
- .7 Mix Parts A and B in consistent proportions. Determine the powder to liquid proportion which works and handles best for the application and keep same mix for entire job. Mix ratios are generally between 5:1 and 7:1 by weight. Do not mix more material than can be applied in fifteen minutes. Mix as per manufacturer's instructions.
- .8 When placing the surfacing compound, care shall be taken to assure that all corners and gaps under reinforcing steel and entire cavity profile is completely filled and properly compacted to prevent formation of voids or unbonded areas. "Work" the material into corners and gaps, and onto cavity sidewalls using pressure on the trowel to assure good contact between patch and substrates.
- .9 Do not retemper material which has begun to set. Discard any unused material after 20 minutes. Do not excessively wet surfaces after placement or as an aid to trowelling. Limit surface water addition to light misting and do not wet or rework repeatedly.
- .10 As established during mock-ups, Edison Coatings "System 22 Retarder" may be used during application of the surfacing mortar in order to facilitate later abrasive cleaning once the surfacing product has sufficiently hardened or cured. Manufacturer's instructions and recommendations are to be followed in applying the retarder.
- .11 Observe the curing requirements for each day's working conditions, as specified herein. Do not extend wet curing beyond the maximum specified. Do not expose to weather until adequate strength has been reached, as affected by working and curing conditions.
- .12 Abrasive blasting may be required after the surfacing material has sufficiently hardened or cured. This may be necessary so as to obtain the desired textured surface and sufficiently expose aggregate as in the original finish. Exact finishing procedure is to be determined during mock-ups.

END OF SECTION

- 1 General
- 1.1 **SUMMARY**
- .1 Section Includes:
- .1 Labour, Products, equipment and services necessary to complete the work of this Section.
- 1.2 **WORK SUMMARY**
- .1 Cab Stand Repair
- .1 Apply one-component, polymer-modified, early strength-gaining, cementitious mortar that is appropriate for overhead concrete repair to the entire soffit of the Cab Stand extending from Nw to Fw north of G23. Use Sika® MonoTop-623 or equivalent.
- .2 The above repair shall produce a uniform colour surface of light grey, similar to the original concrete.
- .3 The repair shall have such a thickness that satisfies minimum thickness per product manufacturer specification and yet shall have a low enough thickness such that the original board-formed appearance is not modified.
- .4 In localized areas where corrosion and spalling are visible, the same product can be used, after appropriate substrate preparation, including chipping to sound concrete, reinforcement rust removal and replacement with equivalent where deterioration exceeds 20%. Surface is to be profiled to produce the board-formed appearance.
- .5 Where thicker mortar is required in 4 above board-formed look will be generated to match the remainder of the soffit.
- .6 A mock up for the soffit coating in 1 above and the repair for spalling in 4 above shall be performed and reviewed by the Consultant and the Heritage Architect before proceeding with the rest of the work.
- .7 Refer to specification section 03 01 30 for Cab Stand wall resurfacing
- 1.3 **SCHEDULING**
- .1 Coordinate in advance of performing work in each area, with the Owner, the barricading off of areas and the location of any storage areas necessary.
- 1.4 **QUALITY ASSURANCE**
- .1 Where products are specified by trade name, only those products shall be used. Contractor will not be paid for work performed using products by other manufacturers.
- .2 Have pre-installation conference at the work site with the technical representative of specified products. Purpose of conference is to examine each crack in detail and to discuss repair procedure and the correct use of the specified products. Notify the Owner and the Consultant 48 hours in advance, of the time of the meeting. Minute the meeting in detail, and provide the product manufacturer, the Owner and Consultant with copies.
- .3 Schedule execution of the work to occur when cracks have expanded by temperature to their widest, yet still warm enough for the repair materials to properly set and cure. Cracks widen when temperature drops.
- .4 Have at all times on the site, copies of manufacturers specifications and data sheets specified as those specifications and data sheets form part of the Contract Documents and are descriptive of work to be performed.

1.5 **EXAMINATION**

.1 Prior to submitting an offer for the work, thoroughly examine existing conditions.

2 Products

2.1 **MATERIALS**

.1 Cab Stand Repair

.1 Repair and Reprofiling Mortar: One-component, polymer-modified and early strength-gaining, cementitious mortar for overhead and vertical repair and reprofiling mortar with integral corrosion Inhibitor, Sika MonoTop-623 by Sika Canada Inc., or equivalent by Euclid or BASF, 3 mm nominal coating such that the board form patterns are maintained.

3 Execution

3.1 **CONCRETE REPAIRS**

.1 Perform concrete rehabilitation work in accordance with drawings and manufacturer's specifications and data sheets.

.2 Protect vehicles and people from dust and damages.

.3 Keep work areas clean at all times. Remove and dispose of cut-out concrete and other products of demolition, daily and on completion.

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

- .1 Materials, equipment and procedures to pressure inject water-based acrylic gel, for external sealing of areas with ground contact, area injection into highly porous, jointed, or cracked building materials, as well as sealing cavities, and for stabilization of concrete and soil.

1.2 SUBMITTALS

- .1 Submit two copies of manufacturer's literature for products furnished, including application instructions, appropriate Safety Data Sheets (SDS), and other safety requirements.
- .2 Submit a letter attesting to the following:
 - .1 Workers that will perform work for this section have a minimum of 5 years' experience, successfully applying the materials specified in this section, or that workers have been properly trained, and will be supervised by someone who is properly trained and has necessary experience.
 - .2 Workers and supervisors have read and understand requirements described in the manufacturer's literature, and application instructions.
 - .3 Workers will have proper and adequate equipment, including a plural component pump, so as to be able to complete the work according to provisions of this section, and the manufacturer's instructions.

1.3 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver materials to job site in sealed undamaged containers with labels intact and legible, indicating material name, date of manufacture and lot number.
- .2 Store material indoors or covered outdoors, at temperatures not below 32 degrees Fahrenheit.

1.4 PROJECT CONDITIONS

- .1 Install material in accordance with safety and weather conditions required by the manufacturer or as modified by applicable rules and regulations of local, state and federal authorities having jurisdiction.
- .2 Curing conditions for water-based low viscosity acrylic gel:
 - .1 Do not apply if the air temperature is lower than 32 degrees Fahrenheit or if temperatures are expected to drop below 32 degrees Fahrenheit within 24 hours of application; or higher than 120 degrees Fahrenheit.
 - .2 Cure times are affected by water temperature. Lower temperatures and/or excess water can extend or prevent curing.

2 PRODUCTS

2.1 MATERIALS

- .1 "KOSTER Injection Gel G4" or equivalent.
- .2 Products shall be solvent-free, low viscosity, water-based, highly elastic, hydro-acrylic gel resistant to pressurized water.
- .3 It is the responsibility of the contractor to correctly mix proportions to achieve a consistent curtain injection. The suitable use of materials shall be approved by the Engineer.

2.2 ACCESSORIES

- .1 Distributor Lances and Injector (packer) as recommended by the manufacturer.
- .2 Solvent as recommended by the manufacturer.
- .3 Oil as recommended by the manufacturer for filling material hose lines after use.

2.3 EQUIPMENT

- .1 2-component injection pumps are required with a fixed mix ratio from 1:1 with an integral flush.
- .2 Solvent and moisture resistant hose.
- .3 Distributor Lances and Injection Superpackers (for curtain and area injection) usually 18mm x 300, 18mm x 550mm, or 13 x 150.
- .4 Hammer Drill, air powered or electric.
- .5 Masonry drill bits various lengths and proper diameter to match injectors.
- .6 Air compressor with compressor rating of 18 CFM @ 150 psi.

3 EXECUTION

3.1 PREPARATION

- .1 The Installation Contractor shall thoroughly review the entire surface of area to be chemical gel injected to determine the applicability of gel materials in respect to thickness of wall or floor, existence of any foreign materials harmful to the application of the chemical gel used, inspection of soil grade, deterioration of concrete surface and existing cracks which shall be repaired and sealed prior to the application.
- .2 If Installation Contractor finds any cracks/joints being too wide to receive an application of the gel material to be used, he shall submit to the Engineer a complete report regarding the locations, existing minimum and maximum thickness and length of cracks/joints. The Engineer shall verify the non-applicability of the material to be used in cracks/joints reported with the material manufacturer or supplier and direct the contractor with a proper repair method of cracks/joints prior to application of the gel material.
- .3 Where any detrimental foreign materials exist, the contractor shall follow the recommendations of the chemical gel material manufacturer (subject to the Engineer's approval) in respect to the material and methods of cleaning or removing the foreign materials.
- .4 Drill holes through the construction member to be sealed in a diamond pattern of maximum 12 inches horizontally and vertically, every second row centrally offset, or in a consistent grid pattern where the second row is directly below first packer placed. The diameter of the boreholes shall be based on the packers chosen.
- .5 Clean existing joints and are seal using suitable means prior to injection. Drill holes along crack on alternating sides of the crack at a 45 degree angle to the surface at a maximum distance of 19.5 inches from each other on each side.

3.2 APPLICATION

- .1 Chemical gel shall be pumped and pressure injected in the lance or packers that have been inserted into pre-drilled holes. Use packers compatible with the gel material to be installed.
- .2 Allow the gel material sufficient time to flow into all lances or packers.
- .3 Clean surfaces of excess chemical gel used by means recommended by the manufacturer. Lances or packers shall not extend beyond the plane of the surface of the existing concrete.

- .4 The Contractor shall be responsible for performing test injections at a minimum of 3 selected locations to finalize material selections, injection procedures, and testing procedures prior to the start of work.

3.3 FIELD QUALITY ASSURANCE

- .1 A warranty shall be submitted to the Engineer which guarantees that in the event of any water leak through injected areas, the material manufacturer/supplier and the Installation Contractor will jointly repair areas which have failed any time during the warranty period of five (5) years with no cost to owner.

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

- .1 Materials, equipment and procedures to pressure inject water reactive chemical grout, for sealing concrete cracks.

1.2 SUBMITTALS

- .1 Submit two copies of manufacturer's literature for products furnished, including application instructions, appropriate Material Safety Data Sheets (MSDS), and other safety requirements.
- .2 Submit a letter attesting to the following:
 - .1 Workers that will perform work for this section have a minimum of 5 years experience, successfully applying the materials specified in the section, or that workers have been properly trained, and will be supervised by someone who is properly trained and has the necessary experience.
 - .2 Workers and supervisors have read and understand requirements described in the manufacturer's literature, and application instructions.
 - .3 Workers will have proper and adequate equipment, including two separate pumps; one for pumping water, and one for pumping grout, so as to be able to complete the work according to provisions of this section, and the manufacturer's instructions.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to job site in sealed undamaged containers with labels intact and legible, indicating material name, date of manufacture and lot number.
- .2 Store materials indoors or outdoors and covered, at temperatures not exceeding 85 degrees Fahrenheit (29 degrees Celsius).

1.4 PROJECT CONDITIONS

- .1 Install materials in accordance with safety and weather conditions required by the manufacturer or as modified by applicable rules and regulations of local, state and federal authorities having jurisdiction.
- .2 Seal doors, windows, air intakes, elevators and other openings that could allow vapors to migrate into occupied spaces.
- .3 Ventilate interior and exterior application areas, and all occupied spaces adjacent to application areas, during the application of grout.
- .4 Remove open fires and spark producing equipment from the application area until vapors have dissipated.
- .5 Curing Conditions for Water Reactive Grout:
 - .1 Cracks/Joints must be wet or the materials will not properly react and cure. KOSTER 2 IN 1 or equivalent can be injected into wet or dry cracks
 - .2 Do not apply if the air temperatures are lower than 40 degrees Fahrenheit (4 degrees Celsius) or if temperatures are expected to drop below 40 degrees Fahrenheit (4 degrees Celsius) within 24 hours of application; or higher than 120 degrees Fahrenheit (48 degrees Celsius).
 - .3 Cure times are affected by water temperature. Lower temperatures and/or lack of water can extend or prevent curing.

2 PRODUCTS

2.1 MANUFACTURER

- .1 Koster American Corporation or equivalent manufacturer.

2.2 MATERIALS

- .1 Water reactive elastomeric chemical grouts meeting or exceeding the following typical physical and performance properties:
 - .1 Rigid Closed Cell Foam for rapid reaction with flowing water
 - .2 Elastic, viscoplastic foam for rapid reaction with flowing water
 - .3 Elastic Foam when it comes in contact with water, Elastic Solid Body Resin if it does not come in contact with water

Table 1 - Typical Physical properties for Urethane Grout

Property	Measuring Standards & Conditions	Results
Appearance	Visual Pale	Yellow
Viscosity	ASTM D 4889 @ 70°F	200-300 cps
Weight per Gallon	ASTM D 4659	
	+/- 0.1 lbs./gal.	9.18 lbs./gal.
	(+/- 0,01 kg/litre)	(1,1 kg/litre)
Flash Point		225°F
Corrosiveness		Non-corrosive

Table 2 - Typical Performance Properties

Property	Measuring Standards and Conditions	Results
Density	ASTM D 4659	6.2-14 lbs./ft ³ (226 kg/m ³)
Tensile Strength	ASTM D 3574-86	80 - 90 psi (0,55 – 0,62 MPa)
Elongation	ASTM D 3574-86	30 - 800 %
Shrinkage	ASTM D 756 Procedure D, ASTM D 1042	<10 % linear shrinkage
Toxicity		Non-toxic in cured form, contact manufacturer for more information

2.3 ACCESSORIES

- .1 Additives and cleaners as recommended by manufacturer.
- .2 Oil-free oakum or open cell urethane backer rod.
- .3 Cleaner or suitable solvent as recommended by the manufacturer.

2.4 **EQUIPMENT**

- .1 Two pumps are required, one for pumping water and one for pumping grout. Pumps must have a maximum pressure capacity of 500 to 3000 psi (35 – 204 bars) and a minimum volume capacity of 1/3 gpm (2,5 litre/minute) at full pressure.
 - .1 Injection Pump
- .2 Solvent and moisture resistant hose: minimum ¼ inch I.D. (6mm).
- .3 Two application control valves with fluid filled gauges, and dampeners, 0-3000 psi (0-204 bars) that are compatible with pumps.
- .4 Superpacker or One Day Site Packer with male zerk fittings, usually 1/2 inch (13mm) diameter (with extra zerk fittings).
- .5 Hammer drill, air powered or electric.
- .6 Masonry drill bits various lengths and proper diameter to match injectors.
- .7 Generator and/or compressor

3 **EXECUTION**

3.1 **PREPARATION**

- .1 Clean mineral deposits (if present) from the crack face. This should help the applicator inspect the cracks, to understand crack location and size. Precise crack location is required to determine location of the holes for injectors. Crack size determination is required to decide injector spacing.
- .2 Crack cleaning may be done by one or all the following methods: high pressure water, wire brush, light duty chipping hammer, grinding wheel.
- .3 Remove any and all materials that are in the joint area. Clean out the joint completely if possible. Joint cleaning can be done by the same methods listed in 3.1.2.

3.2 **PREPARATION**

- .1 Clean mineral deposits (if present) from the crack face. This should help the applicator inspect the cracks, to understand crack location and size. Precise crack location is required to determine location of the holes for injectors. Crack size determination is required to decide injector spacing.
- .2 Crack cleaning may be done by one or all the following methods: high pressure water, wire brush, light duty chipping hammer, grinding wheel.
- .3 Remove any and all materials that are in the joint area. Clean out the joint completely if possible. Joint cleaning can be done by the same methods listed in 3.2.2

3.3 **EXAMINATION**

- .1 Inspect the areas to be sealed with grout to assure that the surfaces are clean and wet. Materials will not properly cure if pumped into a dry crack/joint.
- .2 Assure that the injectors are properly seated, to avoid leaking material, and a loss of pumping pressure.

3.4 **APPLICATION – DRILLING HOLES FOR INJECTORS**

- .1 Do NOT drill directly into a crack unless concrete is less than 6 inches (15 cm) thick, or if offset drilling is not possible.
- .2 Injection Test Holes: Drill one or two injection holes on the right or left side of the crack. These first injection holes are test holes to determine which side of the crack should be sealed first

and how far materials will travel along the crack. Only the water pump should be charged and ready to pump for test holes. If something goes wrong during test hole pumping, it is very easy to clean a water pump.

- .3 Do not fill the material pump, or open pails of grout, until AFTER the test hole pumping.
- .4 For a vertical wall, always begin drilling at the lowest point of a crack and work up. Drill the first injection hole at the lowest point on the crack possible. Drill the second injection hole on the same side of the crack, approximately 12 inches (30cm) up the crack from the first injection hole. Remember that injection holes are drilled at a 45-degree angle to intersect the crack halfway into the concrete.
- .5 Drilling Injection Holes in Concrete less than 6 inch (15 cm) thick
 - .1 Concrete 6 inches (15 cm) thick or less may require drilling the injection holes directly into the cracks to properly seal them.
 - .2 Drill the injection holes deeper than 2 inches (5 cm), but not more than 5 inches (12mm) deep, to expose a larger area of crack surface to the materials. This will allow deeper penetration and better pressure relief. More crack surface area exposed in the injection hole equals lower pump pressure required to seal the crack. Surface sealing the crack may be required.
- .6 Drilling Injection holes in Concrete 6 to 36 inches (15 cm – 91 cm) thick
 - .1 Determine injection hole position. This is one of the most important phases of the sealing process. Correct injection hole position allows proper injector installation and adequate material pumping. Incorrect injection hole position may prevent grout flow into the crack.
 - .2 A simple rule of thumb for injection hole location is: the distance from the crack to the injection hole origin, equals one-half of the concrete thickness. For example, drill injection holes for 12 inch (30 cm) thick concrete 6 inches (15 cm) from the crack.
 - .3 Drill injection holes at 45 degree angle to intersect the crack halfway through the concrete. At a 45 degree, angle, the injection hole depth equals the hypotenuse of a right triangle.
 - .4 Drill injection holes deep enough to assure intersection with the crack. Drill hole depth is unpredictable because crack direction is irregular. Drill an injection hole and test for crack intersection by pumping water into the hole. (Note: a 16 inch (41 cm) deep 45 degree angle injection hole can be drilled into 12 inch (30 cm) thick concrete without drilling through the concrete. If the injection holes are not properly drilled, the materials may not be evenly pumped into cracks, and may not completely seal the entire crack depth. Consequently, water may penetrate into sealed cracks behind the material. If fissures and honeycombs in the concrete exist behind the sealed cracks, small amounts of water may move around the sealed crack. Evidence of this will appear as damp or wet spots along the crack.
- .7 Drilling Injection Holes in Concrete Greater than 36 inches (91 cm) thick: Determine injection hole origin and drill injection holes in concrete greater than 36 inches (91 cm) the same as concrete 36 inches (91 cm) thick. Therefore, injection hole origin is 18 inches (46 cm) from the crack. Injection hole depth is 28 – 30 inches (71 cm – 76 cm) minimum, intersecting the crack 18 inches (46cm) deep in the concrete (see figure 10). Surface damming techniques using activated oakum or foam backer rod will help force the grout further back into the crack, when wider cracks are encountered.
- .8 The spacing between the holes is critical, and is a function of crack width. The tighter the crack, the closer the holes. Typically, holes will be spaced 1½ times the distance that the test water travels. With very wide cracks that have a surface dam over them, the spacing may be quite large.

3.5 APPLICATION – INSTALLING PACKERS

- .1 Insert the Packer in the hole.
- .2 Lightly tap on the socket (possibly reversed) or installation tool with a rubber mallet to ensure a snug fit, and insertion to the proper depth. Do not strike the zerk fitting with the hammer.
- .3 Tighten the Packer using a deep socket and a ratchet. Tighten until snug.
- .4 To test, pump water into the packer, beginning with low pressure.
- .5 Increase pressure slowly and incrementally. Sudden surges of pressure can cause the packer to shoot out of the hole, in a very dangerous manner.
- .6 Check for leaking water as pressure is increased.
- .7 If water is leaking around the Packer, stop pumping water and slowly tighten.
- .8 Resume pumping water, incrementally increasing pressure.
 - .1 Continue to increase the pressure and watch for leaking water. Slowly tighten 1 to 2 turns each time leaks are observed, until the pressure required to pump the material is reached, but the injector is not leaking. **CAUTION! DO NOT TEST PUMP WITH GROUT. USE WATER. DO NOT OVER-TIGHTEN PACKERS.** Tightening packers until resistance or friction is felt may cause spalling or additional cracks in the concrete, before resistance is felt. Also, injection holes drilled too close to the crack may cause spalling between the crack and the injection hole.

NOTE: Water injection is as important as grout injection itself. Therefore, proper equipment is critical.

Some applicators may attempt to use the same pump and control valve (gun) for both the water and grout injection, flushing the pump with solvent after each use of the water or grout. The pump will ultimately become clogged with activated foam grout. Some applicators may even try to skip water injection. This may cause the material not to cure, if the crack is dry, and sufficient moisture to react with the grout is not present. Uncured grout in cracks will eventually migrate out of the crack and create an unacceptable situation.

3.6 APPLICATION – WATER INJECTION

- .1 Clean, potable water must be used to flush cracks. Water must be injected into a crack prior to the injection of grout, for the following reasons:
 - .1 Water exiting the crack indicates the injection hole has crossed the crack. If water is not observed exiting the crack, and the pressure gauge reading is at, or near the maximum pressure output of the pump (2500 - 3000 psi) (170 – 204 bars), the injection hole may not have crossed the crack. Even though the injection hole was drilled several inches past the hypothetical location of the crack, it may be necessary to drill deeper or drill another injection hole on the opposite side of the crack. This is one reason one or two test injection holes are used, to start.
 - .2 Water is pumped to flush out debris, organic matter, sand, silt, and anything else that will restrict the flow of grout through the crack. Flush each injector for 3 to 5 minutes minimum with water to ensure the crack is clean. The time will vary due to thickness of the concrete, and the amount of contamination in the crack. Clean potable water must be used to flush cracks.
 - .3 Water is pumped to sufficiently wet the crack, so the grout will catalyze. Even if the crack is already wet, it must be flushed with clean water so a proper and predictable reaction occurs. Contaminated water may not allow the grout to react or cure properly.

- .4 Water is sometimes used as a carrier medium for the accelerator. When used, accelerators can be added to the water injection side, or the grout side, depending on which grout is used.
- .5 Monitoring the pressure gauge on the injection control valve will indicate, to a trained operator, the volume of water being pumped into a crack at any given time. This will help him anticipate the volume of grout that will be pumped into the crack.
- .6 Water is pumped to determine the distance water or grout will travel, in each direction, from the injector. This distance is needed to determine the spacing of injectors. A good rule of thumb: allow approximately 30% - 50% overlap between injectors.
- .7 Water Injection requires a secondary pump. DO NOT use the same pump that is used with injection material. Any residual moisture can cause a reaction with injections material that may cease or damage the pump.
- .8 When pumping water or grouts into an injector use care to increase the pressure very slowly. Sudden pressure increases can blow out the injector or crack the concrete. Use the proper injection control gun to avoid accidents.

3.7 **APPLICATION – DRILL REMAINING INJECTION HOLES**

- .1 Using spacing determined by 3.4, drill the remaining holes required.
- .2 Install injectors per 3.4

3.8 **APPLICATION – GROUT INJECTION**

- .1 Begin injecting grout immediately after the cracks have been flushed with fresh water. Do not flush cracks, then wait until the next day to begin grout injection. If grout injection has not begun 30 minutes after water injection, or if cracks appear dry, re-inject water into the cracks. Re-tightening injectors may also be required. The rubber gasket on the injector will relax over time. Use caution and water test the injectors, slowly building pressure. Further, if an accelerator is used in the injection water, the grout injection must begin immediately, because accelerator can evaporate from the water.
- .2 Begin injecting the grout slowly, building pressure on the injector. If recommended equipment is used, the applicator will have control of pressures. Pump grout at the lowest possible pressure with the application control valve fully open. Refer to the schedules for a pressure guide that may be associated with varying crack sizes. Sealing fine cracks at high pressures, with the application control valve in the full open position, may cause cracking, spalling or other damage, to weak concrete. Build pressure very slowly for fine cracks. Pump pressure should be 3000 psi (204 bars) maximum and the control valve should not be fully open. This should slowly allow efficient volumes to be pumped into the crack.
- .3 When grout injection begins, water is displaced from the crack and injection hole. Water may continue to run from the crack for several minutes before grout appears. The first sign of grout is a very light foamy substance, which thickens over time to look like shaving cream. Continue injecting grout until pure resin flows from the crack and until grout has travelled the desired distance between the injectors. Varying grout pump pressure will help the grout travel as far as possible. If grout does not travel the required distance between injectors, it may be necessary to drill an injection hole between existing injectors.
- .4 Always re-inject a small amount of water into the injection hole after injecting grout. This assures that the remaining material in the hole will be reacted.

3.9 **APPLICATION – LARGE CRACKS**

- .1 Large crack (30 mils, 70 microns or larger) injection techniques vary slightly from the fine crack injection. However, the same equipment is required for both applications.

- .2 First, clean concrete surface a minimum of 2 inches (5 cm) out on each side of the crack. Second, if the crack is not leaking at the time of grout injection, and the concrete is dry, apply a surface seal over the face of the crack to restrict the flow of water and grout. This will contain grout and water in the crack. If a surface seal is not installed over a large crack, grout may run from the crack before reacting and curing. Leave a 1/16 inch (1,6 mm) inspection hole every 12 inches (30 cm) in the seal. Inspection holes will allow visual inspection of grout travel. Inspection holes may be plugged with a small piece of wood as the grout begins to flow.
- .3 Drill 45 degree angle injection holes approximately 18 inches (45 cm) apart beginning at the lowest point of the crack on a vertical surface. This spacing may be increased or decreased depending on the flow of material from hole to hole.
- .4 Install and seat Superpackers. Pump water and grout according to procedures described previously. As water is pumped onto each injector, confirm travel distance between inspection holes. After thoroughly flushing with water, begin grout injection. Pump grout until pure resin, not foam, exits the inspection holes.
- .5 As a steady grout flow begins to exit each inspection hole, a small wood plug should be wedged tightly in the hole creating a dam. Continue pumping each injector, plugging the nearest inspection hole as pure grout begins to exit.
- .6 Using Water Diversion Holes:
 - .1 A large crack with running water requires a different technique for proper sealing. The surface of the crack is generally thoroughly saturated, which makes it impossible to use some kinds of sealing compounds. The pressure of the running water will generally blow off any surface seal, as well as any material wedged into the crack (oakum). To make a surface seal effective, leaking water and the pressure must be diverted.
 - .2 Drill the injection holes and install the Superpackers in every other hole. Test the Superpackers thoroughly for proper seating, Water should flow from the hollow hole, sometimes in a fast stream. Install all Superpacker and inject. After a few minutes the water flowing from the face of the crack may slow as water is diverted through the injectors. If water continues to flow from the crack, as well as the packers, more water must be diverted. Drill more injection holes and install packers on the opposite side of the crack. Stagger new holes between previously drilled holes. Water flow from crack should be adequately diverted. Install surface seal.

3.10 **APPLICATION – GENERAL**

- .1 Once the crack is sealed, and each injector has been pumped with grout, inject a small quantity of water into each injector. This will help materials in drill holes to cure.
- .2 Allow adequate time (approximately 24 hours) for materials to fully cure.
- .3 Reinject areas that still appear wet, and allow to cure.
- .4 Remove injectors.
- .5 Scraping, or an electric, angle grinder (with a cupped wire wheel) can remove excess cured material, so that the repair is flush with the adjacent surface.
- .6 A surface sealer can be applied to cover injection holes and sealed crack, for aesthetics, if required.

3.11 **FIELD QUALITY ASSURANCE**

- .1 Warranty shall be submitted to the Engineer which guarantees that in the event of any water leak through injected areas, the material manufacturer/supplier and the Installation

Contractor will jointly repair areas which have failed any time during the warranty period of five (5) years with no cost to owner.

END OF SECTION

1 General

1.1 **SUMMARY**

.1 Section Includes:

- .1 Cutting out of joints,
- .2 Back-pointing
- .3 Finish pointing
- .4 ~~Cutting and repointing of Guastavino tile vault joints.~~

1.2 **RELATED SECTIONS**

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 35 91 – Heritage Protective Measures.
- .3 Section 04 03 08 – Heritage Mortars and Grouts.
- .4 Section 04 03 45 – Heritage Masonry Repairs.

1.3 **REFERENCES**

- .1 Canadian Standards Association (CSA International).
 - .1 CSA-A371-04, Masonry Construction for Buildings.

1.4 **DEFINITIONS**

- .1 Raking: the removal of loose/deteriorated mortar until solid/sound mortar is reached. This includes the removal of pointing mortar from the face of the stone at the joint edge.
- .2 Repointing: filling and finishing of masonry joints, original or new, from which mortar is missing or has been raked out. Includes backpointing and finish pointing.
- .3 Tooling: finishing of masonry joints using tool to provide final contour.

1.5 **QUALITY ASSURANCE**

- .1 Contractor: a company with successful performance in heritage conservation work similar to that specified for this project.
- .2 Conservation procedures described require a degree of patience, dexterity and attention to detail that are not necessarily a full time occupational interest of all builder masons.
- .3 Workers abilities: Perform work in accordance with established procedures for Heritage masonry conservation and The Standards and Guidelines for the Conservation of Heritage Places in Canada, published by Parks Canada.
- .4 Work shall be supervised and performed by personnel having recent experience with heritage restoration work of the type specified and displaying appropriate abilities as demonstrated through mock-ups.
- .5 Workers shall be specialized in techniques related to the type of heritage material involved.

1.6 PRODUCT DELIVERY, HANDLING AND STORAGE

- .1 Deliver, store and handle products in accordance with manufacturer's recommendations, using means and methods to prevent damage, deterioration and loss, including theft.
 - .1 Schedule delivery to minimize long term storage at site and to prevent overcrowding of construction spaces.
 - .2 Coordinate delivery with installation time ensuring minimum holding time for flammable, hazardous, easily damaged items, or items sensitive to deterioration, theft and other losses.
 - .3 Deliver products to site in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.
 - .4 Inspect products upon delivery ensuring compliance with Contract Documents, and ensuring products are undamaged and properly protected.
 - .5 Store products at site to facilitate inspection and measurement of quantity or counting of units.
 - .6 Store heavy materials to prevent endangering supporting construction.
 - .7 Store products subject to damage by elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.
- .2 Promptly inspect shipments to assure products comply with requirements, quantities are correct, and products are undamaged.

1.7 SEQUENCING AND SCHEDULING

- .1 Ensure that raking and backpointing on any given facade is complete before performing cleaning operations defined in Section 04 03 06.

1.8 PROJECT CONDITIONS

- .1 General Project conditions are defined in Section 04 03 01.
- .2 Existing Conditions
 - .1 Existing pointing mortars contain substantial quantities of lead and silica, classifying it as a hazardous material under specific conditions. Perform work specified in the present sections according to the precautions and procedures specified in Section 02 83 21.
- .3 Environmental Requirements
 - .1 Environmental requirements for mortar preparation, application and curing are specified in Section 04 03 08.

1.9 MOCK-UPS

- .1 Submit samples and construct mock-ups in accordance with Section 01 33 00, and Section 04 03 01.

- .2 Perform following mock-ups:
 - .1 Cutting out of mortar from joints: 4 square meters stone.
 - .2 Cut out abused stone arris, 4 adjacent stones to include ashlar and moulded profiled stones.
 - .3 Back-pointing. Quantity and locations as for 2.1 above.
 - .4 Front-pointing. Quantity and locations as for 2.1 above.
- .3 To ensure an accurate final colour match, Heritage Consultant shall review finish pointing mock-ups no less than 14 days after application of mortars or when humidity is determined to be sufficiently lost from the fresh placed mortar.

Note that all mortar colours will be initially judged on sample mortar “puck” of 100mm diameter by 25mm thickness. Allow for 30 days to complete this initial sample selection. Upwards of 12 colour sample “pucks” may be required for each mortar colour.

1.10 **CLEANING**

- .1 At completion, remove extra materials, tools and rubbish and leave area clean and ready for inspection.
- .2 Where required, install heritage protections as indicated when directed by Consultant.

2 **Products**

2.1 **MATERIALS AND PREPARATION**

- .1 Materials, proportions and preparation: to Section 04 03 08.

3 **Execution**

3.1 **GENERAL**

- .1 Perform work in accordance with CSA-A371 and approved mock-ups.
- .2 Stone masonry joint widths typically range between 6 and 10 mm. When raking and re-pointing, use only tools that are specifically designed for thin joints. All tools must be have width dimension that is less than that of the joint.
- .3 Tool and compact using jointing tool to force mortar into joint. All tools must be of thinner width than joints to ensure full and positive fit deep into joints.
- .4 Finish joints so they are cut flat and within 1 mm of the joint arris. Never cut flush or out onto the stone face, except for joints that have been previously widened or otherwise abused by previous joint cutting out work.
- .5 Use suitable approved jointing tool to finish joints. Provide a weathered texture to finish joints such that the aggregate are exposed. This is achieved by final compacting with a stiff fibre brush.

Where joints are abused, the profile of the overcutting will be prepared in such a way that a slight undercut along the sides of the abused overcut line will be made to a depth of 25 mm. A grinder of not more than 100 diameter will be allowed for this preparation work.

- .6 Obtain Heritage Consultant's approval prior to proceeding, for:
 - .1 Condition of raked-out joints prior to commencing grouting, backpointing or repointing operations.
 - .2 Condition of voids and damming procedures prior to commencing grouting operations.
 - .3 Methods to prevent materials entering or penetrating wall cavities of building.

3.2 **SCOPE OF RE-POINTING WORK**

- .1 Re-point 100% of joints in stone facades
- .2 Cutting out and back-pointing vertical joints: 20% of joints to a depth of 25-75mm; 40% of joints to a depth of 75-125mm; 30% of joints to a depth greater than 125mm.
- .3 Cutting out and back-pointing horizontal joints: 10% of joints to a depth of 25-75mm; 10% of joints to a depth of 75-125mm; 5% of joints to a depth greater than 125mm.
- .4 Perform additional grinder cutting of abused arrises on 55% of stone joints. Exact locations to be confirmed on site by Heritage Consultant following initial inspection of cut out joints

3.3 **CUTTING OUT (RAKING) OF JOINTS**

- .1 General
 - .1 Cut out joints to a depth of 20 mm or to firm mortar.
 - .2
 - .3 Perpendicular joints must be cut back to even depth throughout length of joint.
 - .4 Voids which are present beyond the specified depth shall be grouted or deep-back-pointed to required depth prior to commencing front-pointing procedures. Stones courses generally alternate between 4^{'''} and 8^{'''} stones.
 - .5 Any damage to stone, such as chipping, widening of joints, gouging or any other damage caused by careless cutting out procedures will not be tolerated. Working with patience and care, and utilizing the prescribed hand tools will prevent any damage by the mason. The Contractor will be responsible for repairing or replacing any damaged stones at his/her own cost and to the satisfaction of the Heritage Consultant.
- .2 Method and procedure
 - .1 Only hand-held tools with mallet or pneumatic driven percussion at low stroke speed will be allowed. Grinders with rotary disk blades are not to be used for cutting out joints. This will be strictly enforced.
 - .2 Chisels used for cutting out work must be of size which is narrower than the joint width and dove-tailed in shaped to prevent damage to front arrises of the stone.
 - .3 In the event of a joint narrower than 2 mm or where masonry units actually make contact, joints can be opened to minimum required depth using small hack-saws, or, with the permission of the Heritage Consultant, using a small diameter (4 inch) diamond blade on a rotary grinder.
 - .4 Mortar must be removed from tops, bottoms and sides of joints, with the back surface of the joint square and of an even depth.

- .5 Remove repointing mortar from the face of the stone at the joint edge. This „over-pointing“ of the existing joint may not be immediately visible until after the wall is cleaned. At such time, remove all over-pointing with a sharp chisel as required and as directed by the Heritage Consultant.
- .6 Depth gauges should be used by each mason working to remove joints in order to ensure that he or she is working to a precise depth at all times.
- .7 Remove all loose mortar deep within joints in order to expose the extent of voids that may be present.
- .8 Using pressurized air, blow out loosened mortar, being sure to contain the dust expelled into the work area while doing so.
- .9 Briefly flush out all joints using low pressure water rinse to remove all small particles of dust.
- .10 The Heritage Consultant shall review the cutting out of joints before the next scheduled stage of work can proceed. During this review, Heritage Consultant shall identify any joints requiring additional cutting.

3.4 **ADDITIONAL GRINDING OF ABUSED ARRISES**

- .1 During initial review of cut out joints, Heritage Consultant will identify locations where existing stone arris has been damaged in such a way that a uniform re-pointing depth of 20 mm cannot be achieved.
- .2 In such locations, carefully cut out stone arris along the joint line at right angles to the wall face using 50 mm grinders to a depth of 20 mm.
- .3 Maintain existing stone face contour. Ensure that grinding operation does not damage the exposed face of the stone beyond the edge of the arris.

3.5 **BACK-POINTING**

- .1 Soak burlap in a bucket just prior to commencing back-pointing. Wring excess water. Pre-wet enough burlap to cover the area to be back-pointed.
- .2 Cut a 6 mil polyethylene sheet to the size of the area to be back-pointed.
- .3 Set up a burlap and polyethylene “curtain” in front of the wall, pre-wet, and raised into temporary position ready for dropping at the end of back-pointing procedure. . Burlap is to be hung such that when it falls, it will be a minimum of 100mm from the masonry surface. The polyethylene sheet is hung over the burlap to prevent rapid moisture evaporation from wall and burlap.
- .4 Back-pointing is not to begin before approval is given by the Heritage Consultant.
- .5 Provide sufficient wetting of the masonry wall, including joints and stones to ensure wall will remain damp but not wet for at least 1 day. This will require many hours of intermittent wetting of the wall prior to back-pointing commencement.
- .6 Do not place mortar in joints if there is standing water. Providing maximum humidity of units, yet avoiding a soaked condition of the wall prior to back-pointing requires attentive patience and care.
- .7 Fill joints to within 20 mm of joint face ready for front-pointing using rigid pointing tools that fit the joints.

- .8 Packing and tamping tools must be of various widths to accommodate the easy passage of mortar into the back of joint in order to prevent voids.
- .9 Pack mortar into deep recessed areas of empty joints first. Fill only in 40 mm lifts at a time, proceeding with additional lifts only when the mortar has become thumbprint hard. Leave the exposed back-pointed surface keyed that is grooved or dimpled, to improve bonding of front-pointing.
- .10 If more than one lift is being installed, add the subsequent lift as soon as the previous lift is thumbprint hard, such that both lifts are able to cure and fuse together.
- .11 Pack mortar to ensure full contact with back and sides of joint walls to ensure positive adhesion.
- .12 Remove all smears or droppings of mortar from surface of stone within one hour after completing the back-pointing of a specific joint.
- .13 Do not directly mist or wet back-pointing mortar once it has been placed and tamped.
- .14 Drop pre-hung, pre-wetted and temporarily raised burlap “curtain” and polyethylene sheet 100 to 50 mm from the wall face, secure it taut and moistened with light misting nozzle attached to a hose. In warm conditions ensure burlap is installed no more than 30 minutes after back-pointing done.
- .15 Maintain burlap and polyethylene sheet in a wetted state for 3 days, 24 hours a day. Provide a temporary structure for securing the burlap-polyethylene curtain such that it remains a uniform 50-100mm distance from the wall. Simply tying the burlap ends to the scaffold is not acceptable.
- .16 Provide full protection from direct sun and wind until procedures for back-pointing is completed.

3.6 **FRONT (FINISH) POINTING**

- .1 Soak burlap in a bucket just prior to commencing back-pointing. Wring excess water. Pre-wet enough burlap to cover the area to be back-pointed.
- .2 Cut a 6 mil polyethylene sheet to the size of the area to be back-pointed.
- .3 Set up a burlap and polyethylene “curtain” in front of the wall, pre-wet, and raised into temporary position ready for dropping at the end of front-pointing procedure to serve a curing protection. Burlap is to be hung such that when it falls, it will be a minimum of 100mm from the masonry surface. The polyethylene sheet is hung over the burlap to prevent rapid moisture evaporation from wall and burlap.
- .4 Front-pointing will only proceed after approval is given by the Heritage Consultant.
- .5 Moisten, but do not allow standing water on surface of back-pointing and joint wall surfaces before commencing with front-pointing.
- .6 Pack mortar into joints in one single lift using appropriate hand tools for placing mortar into joints, making sure that mortar is pushed into all cavities of the joint back and sides.
- .7 Do not smear mortar onto face of stones. Clean any mortar smears or drops with clean water and moistened sponge within one hour of placing mortar in the joints.
- .8 Joint should be finished flat, and should be recessed from joint face by a maximum of 1mm such that the arris of the stone is just exposed, or as decided upon mock-ups with Heritage Consultant.
- .9 The face of joint should be finished by tamping with a stiff “churning” type brush. This will provide an “aged” or weathered look to the finished joints. Smooth slicked finish to front-

pointed joints will not be accepted and will be cut out and completed to satisfaction of the Heritage Consultant.

- .10 Do not directly mist or wet front pointing mortar once it has been placed, cut, tamped, and finished with the churn brush.
- .11 Drop pre-hung, pre wetted and temporarily raised burlap “curtain” and polyethylene sheet, 100 to 50 mm from the wall face, moistened with light misting nozzle attached to a hose. Be certain that misting is not so forceful that it penetrates the burlap and wets the front pointed joints.
- .12 Maintain burlap and polyethylene sheet in wetted state for 7 days, 24 hours a day. Provide a temporary structure for securing the burlap-polyethylene curtain such that it remains a uniform 50-100mm distance from the wall. Simply tying the burlap ends to the scaffold is not acceptable.
- .13 Provide full protection from direct sun, wind and temperatures below 10 degrees C during and after completion of all work involving mortars for up to 3 weeks after mortar work completion.

3.7

CURING

- .1 Immediately upon completion of backpointing and finish pointing establish environmental conditions required to cure mortars as specified in applicable sections.

END OF SECTION

1 General

1.1 **SUMMARY**

.1 Section Includes:

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

1.2 **RELATED SECTIONS**

- .1 Section 01 33 00 – Submittal Procedures.
.2 Section 01 35 91 – Heritage Protective Measures.
.5.4 Section 04 03 01 – Heritage Common Work Results For Masonry.
.6.5 Section 04 03 05 – Heritage Masonry for Minor Works. Section 04 03 01 – Heritage Common Work Results For Masonry.
.7.6 Section 04 03 08 – Heritage Mortars and Grouts. Section 04 03 05 – Heritage Masonry for Minor Works.
.8.7 Section 04 03 42 – Heritage Unit Masonry Replacements. Section 04 03 08 – Heritage Mortars and Grouts.
.9.8 Section 04 03 43 – Heritage Masonry Removals. Section 04 03 42 – Heritage Unit Masonry Replacements.
.10.9 Section 04 03 45 – Heritage Masonry Repairs. Section 04 03 43 – Heritage Masonry Removals.
.10

1.3 **REFERENCES** Section 04 03 45 – Heritage Masonry Repairs.

- .1 American Society for Testing and Materials (ASTM)

1.3 **REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
- .1 ASTM C141-97(2005) Standard Specification for Hydraulic Hydrated Lime for Structural Purposes
.2 ASTM C926 Standard Specification for Application of Portland Cement-based Plaster.
- .2 Canadian Standards Association International (CSA)
- .1 CSA A179-04 Mortar and Grout for Unit Masonry.
.2 CSA A82.M56 Aggregate for Masonry Mortar.
.3 CAN/ CSA-A5-M93, Portland Cement.

1.4 **QUALITY ASSURANCE**

- .1 The mixing of mortars shall only be done by mechanics having a minimum of 3 years experience in the preparation of cement-lime mortars.
.2 Hydraulic lime must be delivered in dated and sealed airtight bags or containers.
.3 Material must be fresh with proof of manufacture on labels. Materials that are older than stated date of use are not acceptable.

- .4 Store materials in dry conditions away from wet or moisture.

1.5 SUBMITTALS

- .1 Submittals shall meet requirements of Section 01 33 00.
- .2 Submit manufacturer's installation instructions.
- .3 Several samples should be submitted to provide a range of colours in a range of colour established after consultation with the Heritage Consultant.
- .4 Aggregates and materials:
 - .1 Submit samples of aggregate and dry materials in transparent, 500ml plastic jars with secure screw top lids. Mark with permanent marker the identification of the contents. Provide date of submission.
 - .2 Submit samples of the following:
 - .1 White cement
 - .2 Hydraulic lime
 - .3 Aggregate
 - .4 Pigments
 - .5 Prepared aggregates of each colour used for Conservation mortar repairs.
- .5 Mortars:
 - .1 Submit 50mm cube test specimens in accordance with CSA A179-94.
 - .2 Submit samples of each type of mortar mix in 100 mm diameter x 20 mm thick disks. Samples must be set and cured, and labelled with a reference to a specific mixture which can be reviewed and repeated as necessary.
- .6 Conservation Mortar Repair:
 - .1 In addition to sample disks of conservation repair mortar, each sample must also be placed into a cut slot of 100mm long x 20mm deep x 20mm wide. This slot will be cut into a stone taken from the building in order to display the qualities of colour and texture matching the exposed surface. As it is normal that many repair mortar samples are prepared before an acceptable match is found, this sample-display block should be prepared to accommodate up to 20 samples.
- .7 Submit mock-up as described in Section 04 03 01 – Heritage - Common Work Results For Masonry

1.6 ANALYSIS

- .1 Design Performance Requirements
 - .1 The following pre-construction testing is required to ensure pointing mortar meets the design performance criteria.
 - .2 Mortar compressive strength: minimum 2.5 MPa, maximum 5 MPa at 7 days.
 - .3 Mortar compressive strength: minimum 3.5 MPa, maximum 7MPa at 28 days.
 - .4 Air content of plastic mix: not less than 8%, nor more than 12%.
 - .5 Vicat Cone penetration of mortar mix in plastic state: not less than 18mm, nor more than 22mm. for pointing mortar. Bedding mortar may exceed the maximum penetration by not more than 20%.

- .2 Testing Standards:
 - .1 CSA A179-04 Mortar and Grout for Unit Masonry (for cube strength).
 - .2 ASTM C780 Pre-Construction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry (for Vicat Cone test).
- .3 Test Reports Prior to Commencement of Work:
 - .1 Sieve analysis of proposed sand.
 - .2 Bulking analysis of proposed sand in condition as delivered to site and after any change in environment conditions.
 - .3 Compressive strength of mortar at 7 days, 28 days, and 90 days.
 - .4 Vicat Cone penetration of mortar mix.
 - .5 Air content of mortar mix in plastic state.
- .4 Test Following Commencement of Work to be submitted at the intervals indicated:
 - .1 Vicat Cone penetration on every batch for the first three days and thereafter on a daily basis at the discretion of the Heritage Consultant.
 - .2 Compressive strength of mortar for 7 and 28 day, 90 day tests on a weekly basis at the discretion of the Heritage Consultant. Tests must be done at a minimum at the beginning of major mortar work, such as before rebuilding a large area, or before repointing an elevation.
 - .3 Air content of mortar mix in plastic state on a weekly basis at the discretion of the Heritage Consultant.

1.7 **PROJECT CONDITIONS**

- .1 General Project conditions are defined in Section 04 03 01.
- .2 When overnight ambient temperatures are expected to fall below 10 degrees Celsius during the curing period:
 - .1 Store cements and sands for immediate use within heated enclosure. Allow these materials to reach minimum temperature of 10 degrees Celsius (that is equilibrium with air temperature in enclosure).
 - .2 Do not mix cement with water or with sand or with water-sand mixtures having higher temperature than 25 degrees Celsius.
 - .3 Heat water to minimum of 20 degrees Celsius and maximum of 25 degrees Celsius:
 - .4 At time of use temperature of mortar to be minimum of 10 degrees Celsius and maximum of 27 degrees Celsius.
- .3 A mortar shed is required for mortar mixing on site. Minimum dimension is 10 m².

2 Products

2.1 **MATERIALS**

- .1 No pre-bagged mortars are to be used.
- .2 Use same brands of materials and source of aggregate for entire project.
- .3 Mortar and grout: to CSA A179.

- .4 Calcium chloride is not to be used for any mortar.
- .5 Colour: dry powdered in organic pigments as manufactured by, Rockwood Pigments. The maximum quantity permitted in dry form will not exceed 8% of the total binder volume.
- .6 Water: potable, or from approved non-potable supply: clean and free from contaminants.
- .7 Graduated cylinders purchased from a lab supply store, 2L, 1L, 500mL volumes.
- .8 Appropriately sized buckets for mortar mixing: 7.5L (2 gallon); 13L (3.5 gallon); and 19L (5gallon).
- .9 A level table for mixing mortars.
- .10 Clean rags.
- .11 Stopwatches for measuring mortar mixing times.
- .12 Back-pointing and front-pointing protection: a 6 mil polyethylene sheet; burlap fabric; a supporting structure to secure polyethylene-burlap curtain the proper distance from the wall during curing.
- .13 Aggregates: to CSA A179.

- .1 Sand is to be dry 100% and kept dry throughout the work period. Sand to be stored in water proof and lid secured container in a dry and roofed storage location.
- .2 Sand must conform to CSA A82.56M. (Aggregate for Masonry Mortar) sharp, screened and washed pit sand, free of any organic material, with final grading and colour to approval of the Heritage Consultant.
- .3 Sand to be custom blended and conforming to the following sieve analysis:

.1 Aggregate to be used for repointing and rebuilding: Colour buff. The building is composed of dressed stones with fine joints

Sieve Size		Percentage by weight passing	Percentage by weight retained
Imperial	Metric		
No. 4	4.75 mm	100	0
No. 8	2.36 mm	100	0
No. 16	1.18 mm	90	10
No.30	0.600 mm	70	25
No. 50	300 microns	40	30
No. 100	150 microns	15	20
No. 200	75 microns	0	15

.2 Aggregate to be used for conservation repair mortars: as used for pointing mortar.

- .14 Hydraulic Lime: Conform to ASTM C141-97, Fresh (no more than 6 months from the fabricated date), Eminently hydraulic lime, finely ground, Moderately hydraulic. Acceptable product:

- .1 St. Astier hydraulic lime, NHL 13 (supplied by Daubois Inc. Montreal) with air entrainment mixed on site with aggregate and pigments: for mortar repairs including wide cracks. Also to be used for joints at the bull-nose course.
- .15 Hydraulic lime base grout. Acceptable product:
 - .1 Flowmix, F-20 hydraulic lime grout as supplied from Daubois Ltd. Montreal, Qc.
- .16 Hydrated, lime: ASTM C 207, type SA. Acceptable product: Bondcrete, Type SA lime.
- .17 Dispersed Hydrated Lime Mortar
 - .1 Acceptable supplier (no substitutions):
 - .1 Deffner & Johann GmbH, Mühläcker Straße 13 | D-97520 Rötthlein, Germany. Contact: M. Sarre, sarre@deffner-johann.de
 - .2 Lime injection mortar: proprietary compound of dispersed hydrated lime, marble powders, mixing water and dispersing aids of not more than 0.4 % by weight.
 - .3 Acceptable product: CalXnova Kalk-Injektionsmörtel, Eimer à 5 kg
 - .2 For thin cracks and fissures: use Dispersed Hydrated Lime (DHL) for Injection and Shelter Coat. Supplier: VGR, Toronto tel: 905-672-2736.
 - .3 Lime shelter coat: proprietary compound of dispersed hydrated lime, marble powders, mixing water and dispersing aids of not more than 0.45 % by weight; custom coloured to match variations of individual stones, to approval of Heritage Consultant.
 - .1 Acceptable product: CalXnova Kalkschlämme grob, Eimer à 20 kg
- .18 Pigmentation: dry powdered inorganic pigments. Acceptable product:
 - .1 Rockwood Pigments.
- .19 Portland cement: CAN/CSA-A5, white, non staining, normal, type GU. Federal white Portland Cement, conform to CAN3-A5-M77, type normal (symbol 10). Product Acceptable:
 - .1 Federal White Cement Ltd., Ingersoll, Ontario.
- .20 Parging system:
 - .1 Bond coat: Restoration Latex RL1 by Edison Coatings
 - .2 Base coat: Cem Plast 54 base M-FR cement plaster system with fibre reinforcement, by Edison Coatings, mixed with Restoration Latex RL-1 as per manufacturer's instructions.
 - .3 Finish coat: Cem Plast 54 Finish FM by Edison Coatings.
- .21 Concrete curb repairs:
 - .1 Custom System 45 by Edison Coatings.

2.2 **MORTAR MIX PROPORTIONS**

- .1 Building and repointing mortar mix:
 - .1 Proportion will be based on attaining an MPa of between 5 and 8 after 90 days compression testing. The anticipated proportion for the mix is: One part white Portland cement: 2 parts hydrated lime type SA: 8 parts aggregate. Pigments not to exceed 6% of aggregate volume. Water proportion will be based on a

consistency using vicat cone penetration and as directed by the Heritage Consultant.

- .2 Conservation repair mortar mix:
 - .1 One part hydraulic lime (NHL13): three parts aggregate. Pigments not exceeding 4% of total aggregate volume may be added. Once the proportions of mortar mix ingredients are approved, the mix will not be altered without approval of the Heritage Consultant.
- .3 Grout:
 - .1 Proportions as per Manufacturer's Instructions or directed by the Heritage Consultant. Grout to be injected with a standard pressure pot as per mock-ups.
- .4 Guastavino vault repointing and bedding mortars:
 - .1 Mortar mixes are to be confirmed by the Masonry Conservator. For the bedding mortar the mix will be: one part white Portland cement: 1/2 part hydrated lime type SA: 4 parts aggregate. Front-pointing mix is to be confirmed.
 - .2 Contractor is to prepare upwards of three different mortar mixes for different stages of the Guastavino tile restoration procedures.
 - .3 Mixing and mixing procedure is to be confirmed with mock-ups.

2.3 **EQUIPMENT**

- .1 All mortar used for rebuild areas or wall building can be mixed using a regular paddle mixer, an open rectangular type. Only electric motor mixers are permissible. Mixers run on hydrocarbons are not permitted, due to fumes.
- .2 Mixing by hand for repointing mortars must be pre-approved by the Engineer-Architect and must be carried out using a high speed, 2500rpm, drill with paddle mixer attachment. Mixing to be completed in sufficiently small container so as to allow full contact of the paddle with the mortar during the mixing process, thus insuring thorough incorporation of ingredients and air-entrainment.
- .3 A drill manufactured for the dedicated work of mixing mortars must be used. It should be the open rectangular, double paddle type.
- .4 Submit mixing tools and container for approval prior to starting pointing work.
- .5 A digital electronic balance with a capacity of 2000 grams and precision of 0.1 grams, and a second digital electronic balance with a capacity of 200g and a precision of 0.01g. Acceptable type:
 - .1 Ohaus, as supplied by ITM Instruments Inc.
- .6 Vicat Cone penetrometer for measuring consistency, model no. H-3133.
- .7 A standard pressure pot for injecting grout.
- .8 Hard bristle nylon brush.
- .9 Custom-made joint profiling trowel to reproduce the existing raised mortar joint at the Guastavino vault ceiling.

3 Execution

3.1 **SAFETY**

- .1 Hydraulic and non-hydraulic limes can burn skin and eyes, and should not be inhaled.

- .1 Place signage and take appropriate safety precautions when handling, mixing, or working with lime cements.

3.2 PREPARATIONS

- .1 Procure or construct measuring boxes and other durable containers to ensure accurate measuring of the various materials.
- .2 Retain and maintain in clean condition between uses separate measuring boxes for each ingredient of mixture.
- .3 Set-up and maintain a digital, electronic balance as described in 2.3.2 above for measuring weight of pigments.

3.3 PREPARATION OF LIME-CEMENT MORTAR

- .1 No pre-packaged mortars are to be used. No exceptions. All mortars are to be mixed on site as per this section.
- .2 Use mortar within 2 hours. Re-temper only by remixing, but do not add water.
- .3 Prepare measuring boxes to ensure accurate proportioning of mortar ingredients.
 - .1 Each box to contain exact volume proportion for each specific mix ingredient.
 - .2 Assume an approximate mix of 1 part white Portland cement, 2 lime and 8 parts sand. Mix should be prepared using litre volume quantities: 1L cement; 2L lime; 8L sand, unless directed otherwise the Heritage Consultant.
- .4 Mix all dry ingredients in a bucket with a paddle mixer for approximately 3 minutes.
- .5 Pour all the water into the bucket containing the dry ingredients. Mix for three minutes.
- .6 Let stand for 3 minutes.
- .7 Mix for a further 3- minutes until thoroughly blended and mortar has reached consistency determined by Vicat Cone penetration testing.
- .8 Add just sufficient water to obtain workable consistency for setting units. Avoid too wet a mix which stains the face of the work. Vicat Cone penetration may be slightly greater for bedding mixes, but should not exceed maximum value specified by more than 20%. Record water quantities and use for subsequent mixes to help ensure uniformity of all subsequent mixes.
- .9 Adjust mix proportions based on percentage bulking shown in the test.
- .10 Submit mixing tools and container for approval prior to starting pointing work.
- .11 Conservation repair mortar will be mixed in small quantities as needed. Mixing will be carried out by hand and small paddle on electric drill.
- .12 Clean all mixing boards and mechanical mixing machine between batches.
- .13 Mortar must be weaker than the units it is binding.
- .14 Mortar must not contain elements detrimental to the original masonry or surrounding materials.
- .15 Contractor to appoint one individual to mix mortar, for duration of project. In the event that this individual must be changed, mortar mixing must cease until the new individual is trained, and mortar mix is tested.

3.4 PREPARATION OF CONSERVATION REPAIR MORTAR

- .1 Verify all mortar mix formulations for repair mortars with the Heritage Consultant before proceeding.
- .2 Mortar mix: one part hydraulic lime (NHL 13), three parts assorted colored aggregates, and pigments.
- .3 Mix together in small quantities (to total approx. 500ml) dry hydraulic lime, aggregate and pigments.
- .4 Add predetermined quantity of water and mix well by a small paddle on electric drill (2500 rpm). Mix to create a plastic consistency, and let stand for 5 minutes.
- .5 Mix repair mortar again using a drill and paddle. Only add water to it if consistency has become dry. Mixture should form readily into a cohesive ball with slight cracks appearing when squeezed.
- .6 Use repair mortar for 2 hours only. Never add additional water. Keep covered with plastic while using to prevent moisture loss.

3.5 **PARGING**

- .1 Surface preparation:
 - .1 Remove existing parging as indicated on dwgs. Consult Hazardous Materials Specifications for proper abatement procedures.
 - .2 Remove all dust and debris from exposed brick surface. Remove loose mortar from joints. A high pressure wash may be required, but verify with Heritage Consultant before proceeding to limit water infiltration into the wall.
 - .3 The result of this preparation shall render a surface clean, meaning having complete exposure of sound original material without any deposits of contaminants, foreign matter or loose material, which could affect the bond or long-term durability of the surface and the patching compound.
 - .4 Refer to manufacturer instructions for any additional recommendations and requirements.
- .2 Application:
 - .1 Refer to ASTM C926 for additional information.
 - .2 Apply bond coat on brick as per manufacturer's instructions.
 - .3 Prepare base coat as per manufacturer's instructions.
 - .4 Apply base coat to a maximum thickness of 25 mm. If a thicker parging layer is required apply a second base coat to required thickness. No plaster mesh is required.
 - .5 Fill base coat flush into brick joints first and then proceed with application over entire surface.
 - .6 Apply a 3mm thick finish coat as per manufacturer's instructions. Prepare finish base coat as per manufacturer's instructions and to match existing limestone colour.

END OF SECTION

- 1 General
- 1.1 **SUMMARY**
 - .1 Section Includes:
 - .1 Description of conservation, repair and modification operations applicable to stone and terracotta masonry
- 1.2 **RELATED SECTIONS**
 - .1 Section 01 33 00 – Submittal Procedures.
 - .2 Section 01 35 91 – Heritage Protective Measures.
 - .3 Section 04 03 01 – Heritage Common Work Results for Masonry.
 - .4 Section 04 03 07 – Heritage Masonry Repointing.
 - .5 Section 04 03 08 – Heritage Mortars and Grouts.
 - .6 Section 04 03 42 – Heritage Unit Masonry Replacements.
 - .7 Section 04 03 43 – Heritage Masonry Removals and Rebuilding.
 - .8 Section 04 03 45 – Heritage Masonry Repairs.
- 1.3 **QUALITY ASSURANCE**
 - .1 Contractor: a company with minimum five (5) years successful performance in heritage conservation work similar to that specified for this project.
 - .2 Workers abilities:
 - .1 Minimum worker abilities are defined in Section 04 03 01.
 - .2 Workers shall be specialized in repair and restoration techniques described in part 3 of this section.
 - .3 Heritage Consultant reserves the right to reject workers who do not demonstrate appropriate abilities or experience.
 - .4 Experienced Heritage Conservators will act on the Heritage Consultant's behalf for review of mock-ups, procedures, and submittals related to the work of this Section.
- 1.4 **WORK RESULTS**
 - .1 Preserve wherever possible, character and materials of existing masonry without necessarily restoring surfaces and building facades to original as-built condition.
 - .2 Common work results are defined in Section 04 03 01.
 - .3 Materials and procedures specified in this Section shall serve as basis for submittals.
 - .4 Recording and documentation of heritage items shall meet general requirements set out in Section 04 03 01, and specific requirements described in this section.
 - .5 All procedural methods and techniques employed shall meet requirements of Part 3 – Execution.

1.5 SUBMITTALS

- .1 Submittals shall meet requirements of Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet.
 - .2 Submit copies of WHMIS MSDS - Material Safety Data Sheets.
- .3 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions, including storage, handling and Project conditions.
- .4 Manufacturer's Warranty:
 - .1 Submit manufacturer's warranty documents for review.
- .5 Samples:
 - .1 Submit duplicate samples of each type material / item required, showing full range of colours, textures, finishes, and other variations related to visual characteristics expected in finished work.

1.6 DOCUMENTATION

- .1 Label and photograph all damaged masonry units prior to performing repairs.
- .2 Photograph repaired units after completion of repair. Ensure that size and view of photos taken prior to and after the intervention are sufficiently consistent to allow comparison.

1.7 MOCK-UPS

- .1 Execute mock-up for each type of conservation procedure, in accordance with Section 04 03 01.
- .2 Where applicable, repeat repair mortar mock-ups as necessary to match variations in stone colour.
- .3 To ensure an accurate colour match, Heritage Consultant shall review mortar repair mock-ups no less than 4 days after application of mortars.

2 Products

2.1 MATERIALS - GENERAL

- .1 Use materials and equipment approved by Heritage Consultant.
- .2 Aggregate: to Section 04 03 08 - Heritage Mortars, to pass 2.36 mm sieve.
- .3 Stone dust: crushed sandstone to pass 2.36 mm sieve, buff colour.
- .4 Syringes: plastic, 10 to 50 cc.
- .5 Injection needles; length and gauge to suit application.
- .6 Dowels: stainless steel; length and diameter to suit application.
- .7 Epoxy Resin: low and high viscosity epoxy resin product types to suit application and to approval of Heritage Consultant. Must be insensitive to moisture during cure.
- .8 Ethyl Alcohol.

- .9 Clean water.
- .10 Sponges, cotton rags, absorbent towels.
- .11 Tape for curing protection: aluminium type, pressure-sensitive, fluid-resistant, 38 mm minimum width.

2.2 **STONE DUTCHMAN INSERTS**

- .1 Indiana limestone:
 - .1 Sourcing for inserts is new quarried stone as defined in Section 04 03 42.
- .2 Queenston limestone:
 - .1 Source material for carving supplied by owner.

2.3 **STONE REPAIR MORTARS**

- .1 See section 04 03 08 for mortars used in stone repairs.

2.5 **EQUIPMENT**

- .1 Equipment for specific interventions are listed in related sections.
- .2 Provide all standard masonry tools, accessories, and equipment used in masonry restoration.
- .3 In addition, supply the following smaller specialized tools and equipment:
 - .1 Small 14.5 volt cordless drills of good quality, such as Metabo.
 - .2 Small 100 mm grinders.
 - .3 HEPA vacuum cleaners equipped with thin brush heads.
 - .4 Tungsten Carbide tipped drill bits of 2 – 6 mm for drilling small holes.
 - .5 Light weight, quick-release clamps of various sizes.
 - .6 Strap clamps.
 - .7 Hilti DDEC1 plunge-type core drill, capable of coring hole of 6mm.
 - .8 Metal artist spatulas of various sizes.
 - .9 Carbide-tipped scriber for marking cut lines on stone.
 - .10 Neoprene carvers mallet, small size (127 mm diameter).
 - .11 Small carbide-tipped chisels of sizes 6 to 13 mm.
 - .12 Multi-use “Dremel” tool with diamond discs.
 - .13 Carborundum rubbing of fine, medium, and coarse grain, as supplied by Derusha Supplies, 1-800-567-6199.

3 Execution

3.1 **GENERAL**

- .1 Approximate location of stone units to repair is indicated on drawings.

- .2 Allow for a thorough review of existing conditions by Heritage Consultant before work begins in order to note any unforeseen conditions.
- .3 Obtain Heritage Consultant's approval for sequence of treatments for each type and area of stone prior to commencing work.
- .4 The Heritage Consultant will mark, on the face of masonry or otherwise give direction at all locations of work to be conducted before work begins.
- .5 Provide the Heritage Consultant with 48 hours' notice prior to commencing each intervention on a new area of the masonry.

3.2 **STONE DUTCHMEN INSERTS**

- .1 Location and dimension of cutting required to remove deteriorated stone will be marked and agreed upon by the Heritage Consultant prior to cutting.
- .2 Only stones marked on drawings or otherwise marked out by the Heritage Consultant shall be cut into for purposes of inserting a Dutchman.
- .3 Adjacent masonry units should not be cut into, displaced, or in any way damaged while cutting or removing of masonry units.
- .4 Heritage Consultant shall approve methods and tools used for cutting out purposes.
- .5 Cutting out will follow precise incised lines (scribed) which are squared and following right angles, clean sided, and to an even specified depth.
- .6 Cut out deteriorated portion to a minimum of 75mm for D1 repairs and 100 mm for D2 and D3 repairs, behind wall or arris line. For moulded dutchman, cut out 100mm from the lowest seated edge.
- .7 Smooth the bottom and side surface of the prepared cavity to receive the new stone. For a moulded dutchman cavity, when cutting into a curved profile, cut into the stone along the radius of the curve. All thin edges of a cavity are to be avoided.
- .8 In cases where the dutchman repair includes the full depth of stone make cavity good behind dutchman.
- .9 Cut new stone to dimension to fit prepared cavity snug. A tolerance of 1 mm will be allowed between Dutchman insert and host stone joints. 3 mm is the tolerance for the back side of the joint.
- .10 Dutchman inserts are to have the same bedding orientation as the host stone.
- .11 Smooth, tool or carve surface to match exposed surface of stone adjacent to the prepared cavity. Do not rub, tool or in any way affect the original surface of stone adjacent to the Dutchman insert. Dutchman insert must be shaped and prepared to fit in all aspects of dimension prior to being fixed in place. For Queenston dutchman repairs, finish surface with a traditional hand-swung bush-hammer so as to imitate the original bush-hammered surface.
- .12 Provide attachment of insert stone to cavity by inserting one or two stainless steel rods into back side of new stone set in epoxy. The drilled holes should reach 50-75 mm into connecting surface. The holes must be thoroughly cleaned before epoxy is injected. Blow holes clean with compressed dry air through nozzle that reaches to bottom of drilled hole. Adapt nozzle with extension if necessary. Apply viscous epoxy resin adhesive just prior to setting stone in place. Epoxy resin must be insensitive to moisture and wet during curing.
- .13 Dry set dutchman insert stone to insure required tight fit and flush with adjacent surface. It must be aligned with an evenly wide joint of 1 mm maximum surrounding it.
- .14 Use soup-like consistency slurry of hydraulic lime (NHL 13) colour matched to stone colour

to set and fill cavity joint around Dutchmen. This will require thorough soaking of stone surfaces prior to applying the slurry. It is critical that all preparations are made such that the insertion can be made and secure quickly before slurry thickens. Slurries are to be mixed fresh everyday as required. During use, store in a lid-sealed container to prevent drying.

- .15 Wedge in place where possible to do so using adjacent mortar joints.
- .16 Allow epoxy to cure, keeping Dutchman insert damp with wetted rags and plastic. Cut joint slurry flush with surface, sponge clean all stone surfaces to remove slurry stains. Reapply damp protection and leave for 14 days to insure curing. Upon removal of damp protection, insure all joints are filled flush by injecting a DHL shelter coat which is coloured to match the limestone when dry. The various types of Dutchman repairs are defined by the following definitions:
 - .1 Dutchman Plain: Dutchman on plain ashlar face.
 - .2 Dutchman Molded: Dutchman on carved detail.

3.3 **RUBBING AND DRESSING BACK OF FRIABLE SURFACES ON STONE**

- .1 Where surface of stone is scaling or disaggregating, gently rub using hand-held carborundum blocks, and pluck with small hand-held tools. Do not gouge or leave visually incompatible markings on the surface.
- .2 Should the surface display significant thin-plate exfoliation or similar condition, dress back using larger hand held tools to remove until sound surface. Strict caution must be used to avoid aggressive removal of material from the surface.
- .3 Bevel the edge of any edges of retained and firm surface plates to ensure water shedding.
- .4 If required by Heritage Consultant, stitch the bevelled edge and inject/shelter coat/fill any fissure along the bevelled line (refer to 3.14 below).

3.4 **SEALING FISSURES OR CRACKS IN STONE**

- .1 Where open fissures or cracks are present, a preventative conservation intervention treatment to seal the openings will be carried out.
- .2 Flush the crack with clean water to remove any loose particles as well as to thoroughly wet the surface of the crack.
- .3 If necessary, wider cracks (i.e. over 4 mm) will require facing up the crack with hot glue in order to retain the grout to the injected areas of the crack. The DHL is injected through ports placed along the length of the crack a maximum of 100 mm apart.
- .4 Such cracks will be grouted for the purpose of reaching the deep recesses of the crack crevice. After this is done, wide cracks (above 4mm wide) will be filled with repair mortar and, if appropriate, shelter coated. Keep DHL injection thoroughly mixed at all times using a submersible blender. If lumps occur and prevent passage through injecting needle, then strain DHL with a fine nylon sieve. Keep DHL covered in sealed container at all times when not in use in order to prevent caking, lumping, and collection of scaffold dust/debris.
- .5 Mix grout with de-ionized water to consistency that allows easy flow from a #12 and/or #16 hole size needle attached to a syringe containing the DHL injection grout and/or DHL shelter coat.
- .6 Under normal circumstances, the grout is applied to fill deep recesses of cracks, while the shelter coat is used to fill the top surface of the crack, and pigmented to match the stone colour.
- .7 Starting at the base of the crack, move needle slowly upward along crack opening, allowing

capillary suction to draw the grout inward as the syringe moves.

- .8 Wipe grout or shelter coat flush with surface and clean adjacent surface of stone from spills or wiped smears.
- .9 Use 100% cotton cloths only which have been rinsed and wrung clean in unclouded water.
- .10 Repeat procedure until the crack is sealed. Be certain that the last application is completed using the pigmented DHL shelter coat.

3.5 **MECHANICAL CONSOLIDATION OF CRACKS IN STONE**

- .1 Heritage Consultant will mark location for stitches.
- .2 Drill small holes as marked by Heritage Consultant to a minimum depth of 50 mm beyond line of crack being stitched. Hole diameters and depths will be determined by the Heritage Consultant.
- .3 Clean hole thoroughly, first blowing out with forced dry air from compressor, Adapt nozzle as necessary to reach to bottom of hole easily such that all dust is blown from the bottom and evacuated upwards and out of the drilled hole.
- .4 Inject with epoxy, adjusting viscosity to prevent unnecessary flow into unwanted voids. Inject holes with sufficient epoxy resin, thickened to control viscosity, to allow stainless steel rod to be inserted without spilling onto surface of the stone.
- .5 Any spills must be cleaned immediately from surface using appropriate solvent.
- .6 Once epoxy is set, drill out cured epoxy from top 12 mm of hole and fill with a colour matching repair mortar.
- .7 Complete repair of crack following procedures outlined above for Sealing fissures or cracks in stone using DHL injection grout and DHL shelter coat.
- .8 Where the crack is wider than 4 mm or where voids are considered too large along the edge of the crack, procedures outlined below for mortar fills and repairs will be carried out.

3.6 **STONE WITH FRACTURES THAT THREATEN TO DIVIDE THE STONE**

- .1 Where possible, the following procedure should be carried out prior to removing a broken stone from the wall. This is a preventative measure against complete division.
- .2 From the joint sides or, only if necessary, through face of the stone, drill holes to a depth of 100mm beyond line or fracture. Heritage Consultant will mark line for drilling these holes.
- .3 Clean hole using vacuum with small diameter attachment to reach to bottom of hole. Follow this with a cotton swab wetted with Acetone.
- .4 Do not allow dust or moisture to enter the hole once it has been cleaned.
- .5 Fractures that might allow bleeding out of injected epoxy must be sealed first by micro grouting using DHL injection grout.
- .6 Inject holes with sufficient epoxy resin, thickened to control viscosity, to allow stainless steel rod to be inserted without spilling onto surface of the stone.
- .7 Any spills must be cleaned immediately from surface using appropriate solvent.
- .8 Once epoxy is set, drill out cured epoxy from top 12 mm of hole and fill with a colour matching repair mortar.
- .9 Complete repair of crack following procedures outlined above for Sealing fissures or cracks in stone using DHL injection grout and DHL shelter coat.
- .10 Divided portions of broken stone will be reattached along broken surfaces.

- .11 Drill 2 parallel holes of suitable diameter on one broken surface, marking angle of drill direction on outside of stone with chalk. Holes should 100 mm deep.
- .12 Raise this portion of stone and lower onto exact position of second broken half of stone. Once together, tap stone to loosen dust from drilled hole. Extend chalked lines marking angle of drill on second, undrilled portion of stone.
- .13 Lift up originally drilled half. Location of corresponding holes to be drilled in second portion will be marked by small piles of drilling dust. Mark these locations and drill holes to a minimum of 100 mm depth. Ensure that drilling follows previously determined angle.
- .14 Thoroughly clean holes using vacuum cleaner and small attachments that fit to bottom of hole. Following this, wipe hole with cotton swabs that have been wetted with acetone.
- .15 Fill holes with gel form epoxy resin sufficiently to allow for stainless steel threaded rod to be inserted without spillage onto broken surfaces.
- .16 A thin coating of DHL injection grout is brushed onto the broken surfaces just prior to bringing the two portions firmly together. Be certain to pre-wet the interfaces surfaces before applying DHL injection grout.
- .17 Restrain position using clamps placed to provide compressive pressure between portions.
- .18 Complete repair of crack following procedures outlined above for Sealing fissures or cracks in stone using DHL injection grout and DHL shelter coat.
- .19 Where the crack is wider than 4 mm or where voids are considered too large along the edge of the crack, procedures outlined below for mortar fills and repairs will be carried out.

3.7**BROKEN STONES**

- .1 Divided portions of broken stone will be reattached along broken surfaces.
- .2 Drill 2 parallel holes of suitable diameter on one broken surface, marking angle of drill direction on outside of stone with chalk. Holes should 100 mm deep.
- .3 Raise this portion of stone and lower onto exact position of second broken half of stone. Once together, tap stone to loosen dust from drilled hole. Extend chalked lines marking angle of drill on second, undrilled portion of stone.
- .4 Lift up originally drilled half. Location of corresponding holes to be drilled in second portion will be marked by small piles of drilling dust. Mark these locations and drill holes to a minimum of 100 mm depth. Ensure that drilling follows previously determined angle.
- .5 Thoroughly clean holes using vacuum cleaner and small attachments that fit to bottom of hole. Following this, wipe hole with cotton swabs that have been wetted with acetone.
- .6 Fill holes with gel form epoxy resin sufficiently to allow for stainless steel threaded rod to be inserted without spillage onto broken surfaces.
- .7 A thin coating of DHL injection grout is brushed onto the broken surfaces just prior to bringing the two portions firmly together. Be certain to pre-wet the interfaces surfaces before applying DHL injection grout.
- .8 Restrain position using clamps placed to provide compressive pressure between portions.
- .9 Complete repair of crack following procedures outlined above for Sealing fissures or cracks in stone using DHL injection grout and DHL shelter coat.
- .10 Where the crack is wider than 4 mm or where voids are considered too large along the edge of the crack, procedures outlined below for mortar fills and repairs will be carried out.

3.8 MORTAR FILLS AND REPAIRS

- .1 Where deterioration is localized, damaged surfaces can be returned to a flush or otherwise weatherproof surface where previously a void or localized loss had occurred. It is therefore crucial that the repair mortar and the preparation of the cavity to which it is applied be matching to the surface of the stone with regards to colour and texture.
- .2 A mortar repair will be judged as failed if it is cracked and/or sounds hollow to tapping.
- .3 The locations for mortar repairs will be determined and marked out by the Heritage Consultant.
- .4 Cut out deteriorated portion to form a cavity, making certain that the shoulders of the perimeter are slightly under cut so that the bottom of the cavity is of a greater surface area than the cavity opening at the exposed surface of the stone.
- .5 Depth of cavity to be 20 mm unless the substrate is not sound, in which case, cut depth to sound substrate depth.
- .6 If cavity is overhanging, prepare an armature for the mortar to be secured against the pull of gravity. Armature will be formed from 1 mm stainless steel wire shaped into a “staple”, the two turned ends of which are placed into predrilled holes of 10mm depth and secured with epoxy paste. Be certain that the armature is set no closer to the surface than 10 mm.
- .7 Clean cavity thoroughly with HEPA vacuum equipped with brush heads and dampen.
- .8 Using small spatula-type tools, press the repair mortar into the cavity. If the cavity is deeper than 25 mm, place the repair mortar in two lifts. The mortar should over-fill the cavity by a slight amount.
- .9 Protect the repair mortar with a moistened cloth for several hours. When it just yields to thumb pressure, the mortar is ready for cutting and/or shaping and texturing. The time it takes before the cutting can take place will vary and depend on ambient temperature and humidity.
- .10 Apply and fix in place a moistened cloth over which is placed a sheet of plastic which is fixed and sealed at the edges securely to control evaporation. Maintain in place for 7 days.
- .11 Mist periodically over a 5 days period if required, but not necessary if humidity is observed by beading on the inside surface of the plastic protection sheet.
- .12 At certain areas of significant exposure, mortar repairs may receive a shelter coat in order to provide additional protection. The Heritage Consultant will determine where such applications are necessary.

3.9 SHARD REPAIR

- .1 This refers to detached portions of stone detail which become detached, usually at corners when, for instance, mortar joints are cut away during repointing procedures, etc.
- .2 Clean detached surfaces of dust and dirt by scrubbing with water and brush if necessary.
- .3 Apply small dab of polyester resin to dry, middle area surface of detached portion.
- .4 Working quickly, squeeze the two surfaces together to secure original fitting together.
- .5 Cut any squeeze out of polyester resin while in the gel stage just prior to hardening.
- .6 Proceed with repair as for crack fill described in above (Mechanical consolidation of cracks in stone), whereby stitching and filling is carried out to complete the repair.

3.10 CLEANING

- .1 Clean mock-up to demonstrate cleaning operations to Consultant before starting cleaning work.
- .2 Clean stone work surfaces after repairs have been completed and mortar has set.
- .3 Clean stone surfaces of grout or mortar residue resulting from work performed without damage to stone or joints.
- .4 Clear site of debris, surplus material and equipment, leaving work area in clean and safe condition.

3.11 CONCRETE REPAIRS AT QUEENSTON CURBS

- .1 Chip out all loose concrete and debris under the existing Queenston curbs. Support the curb stones as required. Assume 10% of curb stones will require resetting.
- .2 Fill cavities using Custom System 45 concrete repair mortar. Follow all manufacturer's instructions.

END OF SECTION

- 1 General
 - 1.1 **SUMMARY**
 - .1 Section Includes:
 - .1 Labour, Products, equipment and services necessary to complete the work of this Section.
 - 1.2 **QUALITY ASSURANCE**
 - .1 Installer: Trained and approved by the manufacturer and having a minimum three years experience in the installation of the work described in this Section and can show evidence of satisfactory completion of projects of similar size, scope and type.
 - .2 Maintenance seminars: Provide, to the Owner, training seminars and recommendations on Product maintenance procedures.
 - .3 Pre-installation meeting: Two weeks prior to commencing work of this Section, arrange for manufacturer's technical representative to visit the site and review preparatory and installation procedures to be followed, conditions under which the work will be done, and inspect the surfaces to receive the work of this Section. Advise the Consultant of the date and time of the meeting.
 - .4 Manufacturer's site inspection: Have the manufacturer's technical representative inspect the Work at suitable intervals during application and at conclusion of the work of this Section, to ensure the Work is correctly installed. When requested, submit manufacturer's inspection reports and verification that the work of this Section is correctly installed.
 - 1.3 **PROTECTION**
 - .1 Protect surfaces which are not to be waterproofed from soiling by spillage or other cause in connection with the work of this Section.
 - .2 Protect waterproofed areas until permanent membrane protection is placed.
 - .3 Do not leave protection board and insulation exposed to sunlight for excessive length of time. If required, cover protection board and insulation to prevent damage and curling, in accordance with manufacturer's recommendations.
 - 1.4 **WARRANTY**
 - .1 Provide a written ten (10) years material, labour and workmanship warranty, commencing from date of Substantial Performance, covering the replacement or making good of defects in materials and workmanship.
- 2 Products
 - 2.1 **MATERIALS**
 - .1 Membrane (WP-1): CGSB 37-GP-50M, reinforced hot applied, liquid membrane system, 6125 by Hydrotech Membrane Corporation, CCW 500R System by Carlisle, 790-11 by Bakor Inc., or Tremproof 6100 System by Tremco.
 - .2 Primer: CGSB 37-GP-9, compatible with membrane and approved by membrane manufacturer.

- .3 Construction and control joint reinforcing sheet: Minimum 1.19 mm thick, Standard Elastosheet 6147 by Hydrotech Membrane Corporation, or approved equivalent.
- .4 Expansion joint reinforcing sheet: Minimum 1.60 mm thick, Heavy Duty Elastosheet 6146 by Hydrotech or other approved equivalent.
- .5 Reinforcing sheet adhesive: As recommended by the reinforcing sheet manufacturer.
- .6 Sheet Membrane and Flashing: 90 mil thick composite consisting of a self adhering rubberized asphalt membrane laminated to a high strength, heat resistant woven polypropylene mesh to be used at upturns, downturns, drains, protrusions, CW 711-90 by Carlisle or other approved equivalent.
- .7 Membrane reinforcing fabric: Polyester spunbonded fabric, minimum 914 mm wide rolls, CCW-500 by Carlisle, Reemay style 2017 by DuPont Canada Inc., or other approved equivalents.
- .8 Protection board: minimum 3 mm thick, semi-flexible board consisting of a core of blended asphalt and mineral fillers laminated between faces of asphalt saturated felt, CCW-H by Carlisle, Vibraflex by W.R. Meadows of Canada Ltd., or other acceptable equivalents.
- .9 High-Density Insulation (INS-1): CAN/ULC S701, Type 4, high compressive strength, extruded polystyrene insulation, minimum RSI (R) value of 0.88 (5.0) per 25 mm to ASTM C518 and C177, minimum compressive strength of 690 kPa (100 psi) to ASTM D1621, thickness as indicated on drawings, STYROFOAM™ Brand HIGHLOAD 100 Insulation by Dow Chemical.
- .10 Joint Filler: Sealtight Rescor Type S by W.R. Meadows of Canada Ltd., or other approved equivalents. Filler thickness shall be twice the width of the opening to be filled.

3 Execution

3.1 EXAMINATION AND PREPARATION

- .1 Examine surfaces to receive membrane waterproofing. Report defects which would impair performance of waterproofing.
- .2 Ensure substrates have cured before commencing membrane application.
- .3 Maintain equipment in good condition, equip kettles with thermometers which accurately register the temperature of the membrane material at all times.
- .4 Free substrates from dust and loose particles, grease, paint, frost, form oil and other material detrimental to the bond of the membrane materials.
- .5 Employ light sand blasting, or steam cleaning where necessary to remove form oil. Surfaces to receive membrane materials shall be free from moisture. Apply heat if required to produce dry substrate.
- .6 Free substrate cavities and/or shutter marks which will damage the membrane. Grind edges and corners to bullnose with minimum radius of 38 mm. Fill inside corners with fillets or cants.
- .7 Maintain ambient and substrate temperatures at minimum 10 degree C for a period of 48 hours before, during and after membrane application except as otherwise authorized by the Consultant in writing.

3.2 **INSTALLATION - MEMBRANE**

- .1 Install materials in accordance with the recommendations of the manufacturer.
- .2 Co-operate with other Sections to ensure watertight junctions with drains, vents, and other items passing through membrane.
- .3 Apply primer at the coverage rate recommended by the membrane manufacturer for the particular surface porosity.
- .4 Do not permit primer to collect in pools. Prevent seepage through joints. Allow primer to dry and/or cure thoroughly.
- .5 Do not exceed temperature of 232 degree C in melting kettle; use an approved double wall kettle.
- .6 Apply first layer of membrane compound between 175 degree C and 212 degree C to a minimum thickness of 3 mm to form a continuous membrane.
- .7 Install control joint reinforcing sheet in 300 mm wide strips centred over cracks and construction joints in the substrate, and junctions of horizontal and vertical surfaces, embedded in a 3 mm thick coating of membrane material. Carry membrane over strips extending membrane 150 mm minimum at strip edges.
- .8 Install control joint type rubber sheet collar and seal with membrane compound and stainless steel clamps around pipes, vents, drains and other protrusions.
- .9 Install expansion joint reinforcing sheet in strips centred over expansion joints, extending minimum 150 mm beyond each side of joint, embedded in a 3 mm thick coating of membrane material on each side of expansion joint. Carry membrane over strips extending membrane 150 mm minimum at strip edges.
- .10 Apply membrane reinforcing fabric and firmly press into hot membrane first layer. Overlap fabric minimum 50 mm.
- .11 Apply second layer of membrane compound over the fabric between 175 degree C and 212 degree C to a minimum thickness of 3 mm to form a continuous membrane.
- .12 Extend membrane up vertical surfaces, over associated steps, ramps and metal elements, and elsewhere as shown on Drawings, to make the substrate waterproof.
- .13 Bar completed areas from traffic until membrane protection is installed.
- .14 Protection board may be omitted at areas where membrane is to be covered with insulation, if the insulation is placed immediately after the membrane and separation sheet are installed.
- .15 Provide separation sheet on top layer of membrane where insulation is installed and no protection board is provided.

3.3 **INSTALLATION - MEMBRANE PROTECTION**

- .1 Lay insulation boards in moderate contact. Cut and fit around peripheries and items passing through the insulation. Ensure a uniform and continuous thermal barrier.

3.4 **CLEANING**

- .1 Clean and make good to the Consultant's approval surfaces soiled or otherwise damaged in connection with the work of this Section. Pay the cost of replacing finishes or components that cannot be satisfactorily cleaned.

- .2 On completion of the work check area drains in waterproofed areas and ensure their cleanliness and proper function, and remove debris, equipment and excess material from the site.

END OF SECTION

PART - 1 GENERAL

1.1 SECTION INCLUDES

- .1 Cementitious crystallizing waterproofing for interior / exterior walls and floor slabs with non-active leaks.
- .2 Cementitious crystallizing waterproofing for interior / exterior walls and floor slabs with active leaks.

1.2 RELATED SECTIONS

- .1 Section 03 06 30 - Cast-In Place Concrete: Installation and curing requirements according to ACI 302.

1.3 REFERENCES

- .1 ARMY C-E - Standard Practice for Unified Facilities Criteria and Unified Facilities Guide Specifications.
- .2 American Society for Testing and Materials (ASTM) C 109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).
- .3 International Concrete Repair Institute (ICRI) Guideline No. 03732, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings and Polymer Overlays.

1.4 SUBMITTALS

- .1 Product Data: Manufacturer's data sheets on each product to be used, including:
 - .1 Preparation instructions and recommendations.
 - .2 Storage and handling requirements and recommendations.
 - .3 Installation methods.

1.5 PERFORMANCE REQUIREMENTS

- .1 The waterproofing system shall be a cement based mix containing chemicals which penetrate with moisture into the capillary tracts and activate to form crystals which close the capillaries to produce the waterproofing effect. The cementitious waterproofing system shall become a permanent, integral part of the structure and shall be non-toxic, inorganic, free of calcium chloride and sodium based compounds. The cementitious waterproofing system shall be KOSTER NB-1 or equivalent. Compatible Bonding agent and primer.

1.6 QUALITY ASSURANCE

- .1 Manufacturer Qualifications:
 - .1 Manufacturer shall have no less than five years experience in manufacturing crystallizing cementitious waterproofing systems. The system shall be specifically formulated and marketed for waterproofing. System design shall not have changed for a minimum of five consecutive years prior to start of the work.
- .2 Installer Qualifications:
 - .1 Applicator shall be approved by the manufacturer, experienced in surface preparation and application of the material and shall be subject to inspection and control by the manufacturer.
 - .2 Installer shall have no less than three years experience installing the specified waterproofing systems, or have been factory certified and trained in the manufacturer's Training Program.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver products to the job site in their original unopened containers, clearly labeled with the manufacturer's name and brand designation.
- .2 Store products in an approved ventilated dry area; protect from contact with soil, dampness, freezing and direct sunlight.
- .3 Handle products in a manner that will prevent breakage of containers and damage to products.
- .4 Liquids should not be stored in areas with temperatures in excess of 90° F (32° C) or below 40° F (4° C).

1.8 PROJECT CONDITIONS

- .1 Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
 - .1 Do not apply cementitious waterproofing to unprotected surfaces in wet weather or to surfaces on which ice, frost or water is visible.
 - .2 Do not apply cementitious waterproofing when the temperature is lower than 40° F (4° C), or expected to fall below this temperature within 24 hours from time of application.
 - .3 Do not apply cementitious waterproofing in rain, snow, fog or mist.
- .2 Protection: Protect cementitious waterproofing to prevent damage from active rain for a minimum period of 24 hours from time of application.

1.9 WARRANTY

- .1 Installer of waterproofing system shall provide standard installation warranty for workmanship.

PART - 2 PRODUCTS

2.1 MANUFACTURER

- .1 Acceptable Manufacturer: KOSTER American Corporation or other equivalent manufacturer.
- .2 Provide the materials of one manufacturer throughout the project as specified.

2.2 SYSTEM - NON-ACTIVE LEAKS

- .1 Waterproofing: Cementitious, crystallizing cement-based mix containing chemicals which penetrate with moisture into the capillary tracts and activate to form crystals which close the capillaries to produce a cementitious waterproofing system that becomes a permanent, integral part of the structure and is non-toxic, inorganic and free of added chlorides and added sodium-based compounds.
- .2 Product: NB 1 Grey or equivalent
 - .1 Approved for use in drinking water environments in compliance with NSF/ANSI 61
- .3 Physical Properties:
 - .1 Positive Side Waterproofing: No signs of leakage, softening or discoloration up to 200 psi (1,379 kPa) (462 feet (140.5 m) of water head).
 - .2 Negative Side Waterproofing: no sign of leakage up to 200 psi (1,379 kPa) (462 feet (140.5 m) of water head).
 - .3 Compressive strength (ASTM C109, 28 days): 3,330 psi (23 MPa) average.

- .4 Abrasion Resistance (ASTM D 4060, 28 days): 2.7 x 10⁻⁴ gram per cycle/47 cycles per mil.

2.3 **SYSTEM - ACTIVE LEAKS**

- .1 Product: KOSTER KD 2 System or equivalent
 - .1 System package for the negative side waterproofing of cementitious surfaces against pressurized water such as internal basement waterproofing.

2.4 **ADDITIONAL PRODUCTS**

- .1 Bonding Emulsion. Use where recommended by manufacturer to increase elasticity, flexibility, reduce water absorption, and improve bonding to steel. Do not use if compliance with NSF/ANSI 61 for drinking water contact is required.
- .2 NB 1 Fast or equivalent. Fast setting, cementitious coating containing crystallizing and capillary-plugging agents. May be used for waterproofing below grade against pressurized and non-pressurized water in combination with TG 500 or equivalent.

PART - 3 EXECUTION

3.1 **EXAMINATION**

- .1 Do not begin installation until substrates have been properly prepared.

3.2 **PREPARATION**

- .1 Clean surfaces thoroughly prior to installation. All concrete surfaces must be solid, sound and free of all laitance, oils, grease, curing agents or other foreign materials.
- .2 Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- .3 Clean surfaces to receive cementitious waterproofing, chip or abrasive blast to a CSP-3 (ICRI Guideline 3102R13) profile to remove defective materials and foreign matter such as paint, dirt, grease, curing agents and form release agents and mineral salts.
- .4 If concrete surface has been previously treated with other agents, notify manufacturer before proceeding.
- .5 Repair cracks, expansion joint, control Joints, and open surface honeycombs.
 - .1 Use Bonding Emulsion with manufacturer approved concrete repair materials. Comply with manufacturer's requirements and technical data information.
- .6 Moving joints and cracks shall be treated and detailed as expansion joints. The shoulders are coated with NB-1 or equivalent and an elastic sealant in accordance with sealant manufacturer's instructions.
- .7 Honeycombed areas, cavities, recesses and chipped out areas where form ties have been cut, etc., must be routed/bush hammered to sound base and repaired according to manufacturer's instructions and patched flush with Repair Mortar.
- .8 Uneven brick or block work must be first rendered flush with Repair Mortar.
- .9 Construction Joints: Construction joints should be thoroughly cleaned and dampened. Apply one slurry coat of NB 1 Grey or equivalent at the rate of 2.25 lbs per sq. yd (100 square feet per bag). After it has reached an initial set, dampen if dry and apply a second coat at the same rate. Pour concrete while the second coat is still less than 6 hours old to assist in bonding and to form an uninterrupted membrane.

- .10 Cant Strips and Coves between Horizontal and Vertical Areas: Where cant strips or coves are specified it is desirable that the cementitious waterproofing be applied behind the cove strip. Repair Mortar should be used.

3.3 **INSTALLATION - NON ACTIVE LEAKS**

- .1 Install in accordance with manufacturer's instructions.
- .2 For areas with active leaks, provide active leak materials and installation per manufacturer's requirements before applying non-active leak system.
- .3 Mixing:
- .1 For positive side applications prepare a mixing liquid of at least 1-part Bonding Emulsion to 7 parts clean water in a separate container. Mix the liquid with the NB 1 Grey or equivalent to a thick slurry consistency.
- .2 For negative side applications prepare a mixing liquid of at least 1-part Bonding Emulsion with 3 parts water. Mix the liquid with the NB 1 Grey or equivalent to a thick slurry consistency.
- .3 In hot weather with temperatures exceed 90 ° F or when dry winds prevail prepare a mixing liquid of at least 1-part SB Bonding Emulsion to 5 parts water for the mixing liquid. Mix the liquid with the NB 1 Grey or equivalent to a thick slurry consistency.
- .4 Application - General:
- .1 Moisture presence in the surface is necessary to begin the crystallization process.
- .2 Wet the dry surfaces thoroughly with clean water immediately prior to applying the slurry, making sure that no running or ponding water is present at time of application.
- .3 Apply the slurry with a cement brush in two coats or spray apply in one coat. Work in such a way as to leave no areas void and no pin holes. Back brush if spray applied except on smooth concrete surfaces.
- .5 Application - Brush:
- .1 The NB 1 Grey or equivalent is applied at a rate of 2.25 lbs per square yard (100 square feet per bag) per coat. Brush application on surfaces other than formed concrete (positive side) is a minimum of 4.5 lb per square yard (2.4 kg/sq. m) in two coats, allowing excess water to run off first.
- .2 Work in alternating coats from vertical to horizontal if brush applied on rough surfaces
- .3 Allow the first coat to dry to the touch with no transfer of material or apply second coat when first coat cannot be mechanically damaged. Wet the first coat with water prior to application of second coat, allowing excess water to run off first.
- .4 The NB 1 Grey or equivalent is self-curing. Do not apply any additional curing methods. Do not cover for 12 hours.
- .6 Application - Spray:
- .1 Dampen surfaces with clean water just prior to spraying or prime with manufacturer specified product.
- .2 Surface should be damp to the touch with no standing or running water.
- .3 Use conventional spray machine suitable for spraying cementitious material, operating with air pressure between 70-80 psi, a 1/8 inch (3 mm) nozzle and 1 Inch (25 mm) delivery hose.

- .4 If material is sprayed, only one coat at a rate of 4.5 lb per square yard (2.4 kg/sq. m) is required on rough surfaces and 2.25 lb per square yard (1.2 kg/sq. m) on formed concrete for positive side applications. Alternatively, the material can be spray applied at a rate of 3.5 lbs per sq. Yd. using an 8mm nozzle, keeping the nozzle at a distance of 2 feet from the surface. Backbroom the first coat. Apply the second coat with a 4mm nozzle. Apply the material at 1 lb. per sq. ft.
- .5 Work in alternating coats from vertical to horizontal if brush applied on rough surfaces
- .6 Allow the first coat to dry to the touch with no transfer of material or apply second coat when first coat cannot be mechanically damaged. Wet the first coat with water prior to application of second coat, allowing excess water to run off first.
- .7 Cure if required by the manufacturer. Do not cover for 12 hours.
- .7 For broadcast and trowel application consult manufacturer for installation requirements and application techniques.

3.4 **INSTALLATION - ACTIVE LEAKS**

- .1 Install in accordance with manufacturer's instructions.
- .2 Procedure:
 - .1 Do not allow more than 3 minutes to elapse between steps. Treat small areas of surface to completion before proceeding to next area.
 - .2 Stop active leak by forcefully hand-rubbing KD 2 Blitz powder or equivalent into the leak until leakage has stopped completely.
 - .3 Remove excess powder with dry brush.
 - .4 Apply non-active leak system as a top coating after active leak system has cured.

3.5 **PROTECTION**

- .1 Protect cementitious waterproofing from contact with acid (below pH 7) and sulfates in concentrations exceeding limits for Portland Cement Type I/II.
- .2 Touch-up, repair or replace damaged products before Substantial Completion.
- .3 Do not apply the cementitious waterproofing in temperatures below 40° F.
- .4 Do not use curing compounds or water to bring mixture back to brushable consistency.
- .5 The treated area must be kept clear for at least 48 hours before backfilling or applying any concrete screed or other topping.
- .6 Unless broadcast and trowel application is used, the cementitious waterproofing is not designed to be a wearing surface. When waterproofing a horizontal surface that will be a subjected to traffic the area must be covered by concrete, cement, tile or other protective screed after 48 hours.
- .7 Cured membrane may be painted. Do not use lime-based paints.
- .8 Protect the treated area from temperatures below 40° F during application and for 24 hours after application.
- .9 Use potable water for mixing and cleaning.

END OF SECTION

NOTE: The application / location for the materials indicated is not limited to the list below and is to be used in conjunction with and may be supplemented by, the Specifications, Schedules and Drawings. Refer to Drawing A-00 ‘Concourse Improvements’

CODE	ITEM	DESCRIPTION	APPLICATION / LOCATION
STN-1	Stone	Indiana Limestone Thickness: 100 mm	Parapet wall cladding, Cab Stand columns
P-3	Stone	Granite: Kershaw Finish: Flamed Finish Thickness: 75mm Supplier: Marble Trend	Sidewalk stone pavers
P-4	Stone	Granite: Atlantic Black Finish: Flamed Finish Thickness: 75mm Supplier: Marble Trend	Sidewalk stone pavers
P-9	Concrete	Unit Paver: Umbriano – ‘Winter Marvel’ Thickness: 100mm Supplier: Unilock	Union Plaza paving
P-10	Concrete	Unit Paver: Umbriano – ‘Midnight Sky’ Thickness: 100mm Supplier: Unilock	Union plaza paving

END OF SECTION

This specification should be read in conjunction with the following (included in the tender documents):

- a. Specification Volume 2 – Union Station– Hostile Vehicle Mitigation Scheme issued by DGA
- b. Tender Drawings issues by NORR
- c. Tender Drawings issued by DGA
- d. Civil Drawings issued by Toronto Engineering & Construction Services
- e. City of Toronto – TS Standard Specification for Road Works - as a reference

Attachments:

1. 2023-07-13 Union Station Wayfinding Program - for reference