

**Part 1            General**

**1.1                SECTION INCLUDES**

- .1      Description of Work.
- .2      Existing services.
- .3      Contract method.
- .4      Work sequence.
- .5      Contractor use of premises.
- .6      Owner occupancy.
- .7      Required on-site documentation.

**1.2                WORK COVERED BY CONTRACT DOCUMENTS**

- .1      Background information:
  - .1      The site is the Upper Banff Hot Springs, Banff National Park, Alberta. Parks Canada has full operational control of the site.
  - .2      Directly south of the Pool Building is an existing mass retaining wall constructed from rundle stone masonry. The exact age of the wall is unknown, but assumed to have been constructed in the late 1800's or early 1900's.
  - .3      The base of the retaining wall is founded on the crest of a relatively steep escarpment. The upper level is paved with asphalt and has recently been used as a storage area for road-clearing snow. The asphalt pavement is in very poor condition.
  - .4      Recently, a portion of the retaining wall appears to have suffered some structural distress. The distress is likely a consequence of unanticipated overload and excess hydrostatic pressure, which is thought to be a direct result of the road-clearing piles of snow stored immediately next to the wall.
- .2      Overall scope of Work:
  - .1      Upper Banff Hot Springs is a protected historical site, and as such the "fabric", or outward appearance of the infrastructure, shall be preserved whenever possible. And in that regard, only a small portion of the stone retaining wall will be rebuilt. The bulk of the wall will remain untouched, and strengthened by constructing a new cast-in-place-concrete retaining wall along the inside face of the stone wall.
  - .2      The top of the new concrete wall will be positioned below the underside of the pavement, and as such the new wall will be buried out of sight.
  - .3      The Work will include new asphalt pavement (in the immediate area), reconstruction of a nearby stone-wall planter, and a new stormwater drain.
- .3      Contract Documents:
  - .1      The Contract Documents consist of Drawings S1 to S19, as well as written specifications (consisting of several project-specific sections in NMS format).

- .2 The Contractor shall ensure that he has all of the Contract Documents.
- .3 Prior to proceeding with the Work, the Contractor shall review the Contract Documents, report any discrepancies and/or deficiencies in the Contract Documents, and then wait for further instructions from both Parks Canada and the Structural Engineer.
- .4 Execute the Work with the least possible interference or disturbance to the normal operations of the premises, including but not limited to, nearby building operations, the building occupants, and the general public. Arrange with Parks Canada's representative a pre-tender meeting to better understand the daily activity associated with the normal operations of the premises.

### **1.3 EXISTING SERVICES**

- .1 Before starting the Work, establish the location and extent of all buried service lines in the immediate area of the Work. Notify both and the Structural Engineer of all findings.
- .2 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in a manner approved by the Authorities Having Jurisdiction.
- .3 Where unknown services are encountered, immediately advise Parks Canada, and confirm findings in writing.
- .4 Record locations of maintained, re-routed and abandoned service lines.
- .5 Notify Parks Canada, the Structural Engineer, and all utility companies of any intended interruption of services, and obtain the required permission in writing to do so by Parks Canada and the utility companies.
- .6 Where the Work involves breaking into or connecting to existing services, give Parks Canada 48 hours' notice for necessary interruption of mechanical or electrical service, throughout the course of the Work. Minimize the number and duration of interruptions. Carry out the Work at times directed by governing authorities, and with minimum disturbance to pedestrian/vehicular traffic and tenant operations.
- .7 Provide alternative routes for pedestrian and vehicular traffic.
- .8 Submit schedule to, and obtain approval from Parks Canada for any shut-down or closure of active services or facilities, including power and communications services. Adhere to an approved schedule and provide notice to the affected parties.
- .9 When directed to do so by Parks Canada, provide temporary services to maintain critical building and tenant systems.
- .10 To allow continuity of normal traffic, provide adequate bridging over trenches needed to cross sidewalks or roads.
- .11 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

### **1.4 CONTRACT METHOD**

- .1 Construct the Work under a stipulated price contract.

- .2 In the event that requirements for Extra Work are discovered during construction, the Extra Work shall be paid in accordance with the unit rates provided by the Contractor, as part of the Contractor's bid document.
- .3 Prior to commencing any Extra Work, the extent of the Extra Work will be approved in writing by Parks Canada.

## **1.5 WORK SEQUENCE**

- .1 Construct the Work in such a manner to accommodate Parks Canada's continued operation of the premises during construction. Other than the immediate Work Area, do not close off public usage of the facilities.
- .2 Provide a Work Schedule and coordinate the Schedule with Parks Canada during construction.
- .3 Maintain fire access.

## **1.6 CONTRACTOR USE OF PREMISES**

- .1 Contractor shall limit the use of the premises for the Work Area, for reasonable storage of construction equipment, and for access to the immediate Work Area, and thereby maintain:
  - .1 Owner occupancy.
  - .2 Public usage.
- .2 Co-ordinate the use of the premises under direction of Parks Canada.

## **1.7 OWNER OCCUPANCY**

- .1 Parks Canada will occupy the premises during the entire construction period for the execution of normal operations.
- .2 Co-operate with Parks Canada in scheduling operations to minimize conflict and to facilitate Parks Canada's usage.

## **1.8 DOCUMENTS REQUIRED**

- .1 Maintain at job site, one copy of each document as follows:
  - .1 Contract Drawings.
  - .2 Specifications.
  - .3 Addenda.
  - .4 Reviewed Shop Drawings.
  - .5 List of Outstanding Shop Drawings.
  - .6 Change Orders.
  - .7 Other Modifications to Contract.
  - .8 Field Test Reports.
  - .9 Copy of Approved Work Schedule.
  - .10 Health and Safety Plan and Other Safety Related Documents.
  - .11 Other documents as specified.

**END OF SECTION**

**Part 1            General**

**1.1                SECTION INCLUDES**

- .1        Methods for removal of existing asphalt pavement.

**1.2                RELATED SECTIONS**

- .1        Section 32 11 19 - Granular Base and Sub-Base.
- .2        Section 32 12 17 - Asphalt Paving - Short Form.

**1.3                MEASUREMENT PROCEDURES**

- .1        Removal of existing asphalt pavement will be measured in square metres of surface actually removed regardless of depth removed or number of operations required.
- .2        Payment under this item will include operations involved in removing, hauling and disposal of designated pavement, as well as cleaning of remaining pavement surface.

**1.4                WASTE MANAGEMENT AND DISPOSAL**

- .1        Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Construction/Demolition Waste Management and Disposal.

**Part 2            Execution**

**2.1                PREPARATION**

- .1        Prior to beginning removal operation, inspect and verify with the Structural Engineer all areas, depths and lines of asphalt pavement to be removed.

**2.2                PROTECTION**

- .1        Protect existing pavement not designated for removal, lighting units and structures from damage. In event of damage, immediately replace or make repairs to approval of Parks Canada at no additional cost.

**2.3                REMOVAL**

- .1        Remove existing asphalt pavement to lines and grades as shown on the Drawings.
- .2        Prevent contamination of removed asphalt pavement by topsoil, underlying gravel or other materials.
- .3        Provide for suppression of dust generated by removal process.

**2.4                STOCKPILING OF MATERIAL**

- .1        Dispose of removed asphalt pavement off site daily to disposal areas acceptable to the Authority Having Jurisdiction.

- .2 Removed asphalt pavement which is to be recycled in hot mix asphalt concrete may be stockpiled at designated asphalt plant site.

## **2.5 FINISH TOLERANCES**

- .1 Finished surfaces in areas where asphalt pavement has been removed to be within +/-10 mm of grade specified but not uniformly high or low.

## **2.6 SWEEPING**

- .1 Sweep remaining asphalt pavement surfaces clean of debris resulting from removal operations using rotary power brooms and hand brooming as required.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 03 20 00 - Concrete Reinforcing.
- .2 Section 03 30 00 - Cast-in-Place Concrete.

**1.2 MEASUREMENT PROCEDURES**

- .1 No measurement will be made under this Section. The costs are included in the work for which concrete formwork and falsework is required.

**1.3 REFERENCES**

- .1 Canadian Standards Association (CSA)
  - .1 CAN/CSA A23.1, Concrete Materials and Methods of Concrete Construction.
  - .2 CAN/CSA O86.1, Engineering Design in Wood (Limit States Design).
  - .3 CSA O121, Douglas Fir Plywood.
  - .4 CSA O151, Canadian Softwood Plywood.
  - .5 CSA O437, Standards for OSB and Waferboard.
  - .6 CSA S269.1, Falsework for Construction Purposes.
  - .7 CAN/CSA S269.3, Concrete Formwork.

**1.4 SHOP DRAWINGS**

- .1 Submit shop drawings for formwork and falsework.
- .2 Shop drawings shall include shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1 for falsework drawings. Comply with CAN/CSA-S269.3 for formwork drawings.
- .3 Show all relevant formwork design data, such as permissible rate of concrete placement.
- .4 Show the sequence of erection and removal of formwork/falsework.
- .5 Each shop drawing submission shall bear stamp and signature of a qualified professional engineer registered or licensed in Province of Alberta.

**1.5 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.
- .4 Use sealers, form release and stripping agents that are non-toxic, biodegradable and have zero or low VOC's.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Formwork and form liner materials:
  - .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA O121, CSA O151, CSA O437, and CAN/CSA-O86.1.
- .2 Form ties:
  - .1 For concrete not designated as architectural, use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm in diameter in the concrete surface.
- .3 Form release agent: colourless mineral oil, non-toxic, biodegradable, low VOC's, and free of kerosene.
- .4 Falsework materials to CSA S269.1.

## **Part 3 Execution**

### **3.1 FABRICATION AND ERECTION**

- .1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with the Drawings.
- .2 Obtain the Structural Engineer's approval for the use of earth forms. If approved, hand trim sides and bottoms and remove all loose soil before placing the concrete.
- .3 Fabricate and erect falsework in accordance with CSA S269.1.
- .4 Do not place shores and mud sills on frozen ground.
- .5 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .6 Fabricate and erect formwork in accordance with CAN/CSA S269.3 and to tolerances required by CAN/CSA A23.1.
- .7 Form joints shall be well-aligned, watertight, and kept to a minimum number.
- .8 Use 20 mm chamfer strips on external corners and/or 20 mm fillets at interior corners, unless noted otherwise.
- .9 Form chases, slots, openings, drips, recesses, expansion joints and control joints as shown on the Drawings.
- .10 Install anchors, sleeves, and other inserts required to accommodate the Work specified in other sections. Ensure that all anchors and inserts will not protrude beyond the finished concrete surface.
- .11 Before placing concrete, clean all formwork in accordance with CAN/CSA A23.1.



- .12 After placing concrete, the formwork and falsework shall remain in place for following minimum lengths of time:
  - .1 3 days for walls, slabs and curbs.
  - .2 1 day for footings.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 03 10 00 - Concrete Forming and Accessories.
- .2 Section 03 30 00 - Cast-in-Place Concrete.

**1.2 REFERENCES**

- .1 American Concrete Institute (ACI)
  - .1 ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structure.
- .2 American National Standards Institute/American Concrete Institute (ANSI/ACI)
  - .1 ANSI/ACI 315, Details and Detailing of Concrete Reinforcement.
- .3 Canadian Standards Association (CSA)
  - .1 CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction.
  - .2 CAN3-A23.3, Design of Concrete Structures for Buildings.
  - .3 CAN/CSA-G30.18, Billet-Steel Bars for Concrete Reinforcement.

**1.3 SHOP DRAWINGS**

- .1 Submit shop drawings showing the placement of the reinforcement.
- .2 Indicate on shop drawings, bar bending details, lists, quantities of reinforcement, sizes, spacings, locations of reinforcement and mechanical splices (if approved by the Structural Engineer), with identifying code marks to permit correct placement without reference to structural drawings. Indicate sizes, spacings and locations of chairs, spacers and hangers. Prepare the shop drawings in accordance with the Reinforcing Steel Manual of Standard Practice (by the Reinforcing Steel Institute of Canada), ACI 315R and ANSI/ACI 315.
- .3 Detail splice lengths, bend diameters and clear cover in accordance with CAN3-A23.3, unless otherwise noted in the General Notes on the Drawings.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Substitute different size bars only if permitted in writing by the Structural Engineer.
- .2 Reinforcing steel: billet steel, Grade 400, deformed bars to CAN/CSA-G30.18, unless indicated otherwise.
- .3 Chairs, bolsters, bar supports and spacers to CAN/CSA-A23.1.
- .4 Mechanical splices are only permitted subject to approval by the Structural Engineer.

## **2.2 FABRICATION**

- .1 Fabricate reinforcing steel in accordance with CAN/CSA-A23.1, ACI 315R and ANSI/ACI 315, unless indicated otherwise on the Drawings.
- .2 For locations of reinforcement splices other than those shown on the Drawings, obtain the Structural Engineer's approval in writing.
- .3 Ship bundles of bar reinforcement; clearly identified in accordance with the bar bending details and lists.

## **2.3 SOURCE QUALITY CONTROL**

- .1 Upon request, provide the Structural Engineer with a certified copy of the mill test reports for the reinforcing steel, showing the physical and chemical analyses, no less than 4 weeks prior to commencing fabrication of the reinforcement.
- .2 Upon request, inform the Structural Engineer of the proposed source of the material to be supplied.

## **Part 3 Execution**

### **3.1 FIELD BENDING**

- .1 Do not field bend or field weld reinforcement, unless authorized in writing by the Structural Engineer.
- .2 When field bending is authorized, bend bars without heat, applying a slow and steady pressure.
- .3 Replace any bent bars which develop cracks or splits.

### **3.2 PLACING REINFORCEMENT**

- .1 Place reinforcing steel as indicated on the reviewed shop drawings, and in accordance with CAN/CSA-A23.1.
- .2 All bar support chairs shall be plastic. Bar support chairs shall be sufficient in number, strength, and stability to maintain the position of the full length of the horizontal and vertical reinforcement. If spacer bars are used to support the steel reinforcement, they shall be not less than 15M.
  - .1 The reinforcement in the footings shall be properly chaired off the gravel base. "Sand chairs" shall be used. The bars shall not be "hooked" into place. Refer to Detail 1/S19.
  - .2 In lieu of support chairs, and only for reinforcement in footings that is placed directly upon soil, normal-weight (not light-weight nor semi-light weight) concrete pavers may be used to support the reinforcement, providing that the bearing area of each paver is no less than 100 mm x 100 mm. In lieu of concrete pavers, inverted U-bars may be used to support the reinforcement, providing the depth of embedment of the ends of the bars into the soil is sufficient length to support both the weight of the reinforcement and the workers used to place the concrete. The bars shall not be suspended from tie-wire.

- .3 Metal tie-wire (used to secure the steel reinforcement) shall not extend more than 5 mm into the concrete cover.
- .4 The hooked dowels between the strip footings and walls shall be tied in place. They shall not be “wet set”.
- .5 The Structural Engineer shall review the placement of the steel reinforcement prior to each concrete pour. The Contractor shall give the Structural Engineer a minimum of 48 hours’ notice prior to the time required for inspection of the steel reinforcement. Prior to placing the concrete, obtain the Structural Engineer’s approval to do so in writing.
- .6 Ensure that the cover to the reinforcement is maintained during placement of the concrete.

**END OF SECTION**

**Part 1            General**

**1.1               RELATED SECTIONS**

- .1       Section 03 10 00 - Concrete Forming and Accessories.
- .2       Section 03 20 00 - Concrete Reinforcing.

**1.2               MEASUREMENT PROCEDURES**

- .1       Cast-in-place concrete in superstructure will not be measured but will be paid for as a fixed price item.
- .2       Heating of water and aggregates and providing cold weather protection will be considered incidental to work.
- .3       Cooling of concrete and providing hot weather protection will be considered incidental to work.

**1.3               REFERENCES**

- .1       American Society for Testing and Materials (ASTM)
  - .1       ASTM C260, Specification for Air-Entraining Admixtures for Concrete.
  - .2       ASTM C494, Specification for Chemical Admixtures for Concrete.
- .2       Canadian Standards Association (CSA)
  - .1       CAN/CSA-A5, Portland Cement.
  - .2       CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction.
  - .3       CAN/CSA-A23.2, Methods of Test for Concrete.

**1.4               CERTIFICATES**

- .1       Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CAN/CSA-A23.1.
- .2       All concrete shall be supplied by a CSA approved ready-mix company. Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CAN/CSA-A23.1.

**1.5               QUALITY ASSURANCE**

- .1       Minimum 4 weeks prior to starting concrete work, submit proposed quality control procedures for the Structural Engineer's approval for following items:
  - .1       Falsework erection.
  - .2       Hot weather concrete.
  - .3       Cold weather concrete.
  - .4       Curing.
  - .5       Finishes.
  - .6       Formwork removal.

.7 Joints.

## **1.6 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials.
- .2 Use trigger operated spray nozzles for water hoses.
- .3 Designate a cleaning area for trucks and tools to limit water use and runoff.
- .4 Carefully coordinate the specified concrete work with weather conditions.
- .5 Prevent plasticizers, water-reducing agents and air-entraining agents from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with an inert, non-combustible material and remove for disposal. Dispose of all waste in accordance with applicable local, provincial and national regulations.
- .6 Choose least harmful, appropriate cleaning method which will perform adequately.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Portland cement (with no more than 40 percent supplementary cementing materials) to CAN/CSA-A5.
- .2 Water to CAN/CSA-A23.1.
- .3 Aggregates to CAN/CSA-A23.1. Coarse aggregates to be normal density.
- .4 Air entraining admixture to ASTM C260.
- .5 Chemical admixtures to ASTM C494. The Structural Engineer shall approve any accelerating or set-retarding admixtures (during cold and hot weather placing) prior to use.

### **2.2 MIXES**

- .1 Proportion normal density concrete in accordance with CAN/CSA-A23.1, to give following quality for all concrete.
  - .1 Class of exposure: S-1.
  - .2 Cement:
    - .1 Type HS (Type 50) Portland cement.
    - .2 Type HSb blended hydraulic cement.
    - .3 Mix of Type HS Portland cement and HSb blended hydraulic cement.
  - .3 Minimum compressive strength at 56 days: 35 MPa.
  - .4 Maximum water-to-cementing materials ratio: 0.40.
  - .5 Nominal size of coarse aggregate: 20 mm.
  - .6 Air content: 4 to 7 percent.

- .7 To limit the extent of shrinkage as much as possible, the cement content and water/cement ratio shall be minimized. Water-reducing admixtures and/or superplasticizers may be used to reduce the water/cement ratio.
- .8 Calcium chloride, or any admixture formulation containing chloride ions, shall not be used.

## **Part 3 Execution**

### **3.1 PREPARATION**

- .1 Obtain approval from both the Structural Engineer and Parks Canada before placing concrete. Provide 48 hours' notice prior to placing concrete.
- .2 Prior to placing concrete, obtain the Structural Engineer's approval of proposed method for protection of the concrete during placing and curing, especially when adverse weather is forecast.
- .3 Timber 'ladders', embedded into the concrete and used to brace the top of the retaining wall formwork, are not allowed.
- .4 Sleeves and inserts.
  - .1 No sleeves, ducts, pipes or other openings shall pass through walls or footings, except as indicated on the Drawings, or as approved by the Structural Engineer.
  - .2 Check locations and sizes of sleeves and openings shown on the Drawings
  - .3 Do not eliminate or displace reinforcement to accommodate openings or inserts. If openings or inserts cannot be located as specified, obtain approval of modifications from the Structural Engineer before placing concrete.
- .5 In locations where new concrete is dowelled to either existing work or existing infrastructure, drill holes in existing concrete. Embed steel dowels (consisting of deformed steel reinforcing bars) with adhesives manufactured by Hilti (Canada) Ltd. and installed in direct accordance with the manufacturer's directions. No substitutions will be permitted.
- .6 If the ambient temperature is expected to fall below 10°C, the Contractor shall provide heating and/or hoarding in accordance with the exposure classification (7 days). The methods of hoarding and heating the concrete shall be reviewed and approved in writing by the Structural Engineer.

### **3.2 CONSTRUCTION**

- .1 Complete cast-in-place concrete work, including placing and curing, in accordance with CAN/CSA-A23.1.
- .2 Placing.
  - .1 Placing concrete is permitted only after approval of equipment and mix.
  - .2 All concrete shall be placed in its final position within 90 minutes of batching.
  - .3 Concrete shall be protected from premature drying and extremes of temperature.

- .4 Cold-weather concreting is not recommended. However, in the event that the Contractor chooses to work through the winter months, the concrete shall be protected from freezing.
- .5 Concrete shall not be placed against frozen earth.
- .6 Ensure reinforcement is not disturbed during concrete placement.
- .7 Use procedures acceptable to the Structural Engineer, or those noted in CAN/CSA-A23.1, to remove excess bleed water. Ensure surface is not damaged.
- .3 Finishing.
  - .1 Finish concrete in accordance with CAN/CSA-A23.1.
  - .2 Unless otherwise indicated on the Drawings, rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges.
- .4 Curing.
  - .1 Cure concrete in accordance with CAN/CSA-A23.1.
  - .2 Cure concrete at no less than 10°C for no less than 7 days, or the time necessary to gain 70 percent of the compressive cylinder strength.
  - .3 All formwork must remain in place in accordance with the exposure classification (7 days).
- .5 Do not place load upon new concrete until authorized by the Structural Engineer.

### **3.3 FIELD QUALITY CONTROL**

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory in accordance with CAN/CSA-A23.1. Non-destructive Methods for Testing Concrete shall be in accordance with CAN/CSA-A23.2.
- .2 The Testing Laboratory will be retained by the Contractor.
- .3 The Testing Laboratory will maintain accurate records of poured concrete items to indicate the date, the location of the concrete, the quality of the concrete (including the slump and level of air entrainment), the air temperature and the test samples taken.
- .4 For each concrete pour, the Testing Laboratory shall cast at least five 4-inch-diameter by 8-inch-long concrete cylinders, to be used for verification of the compressive strength. One at 7 days, one at 14 days, and two at 56 days. The extra cylinder is available for use at the Structural Engineer's discretion. Cure the extra cylinder on the job site under the same conditions as the concrete which it represents. During cold-weather concreting, the Structural Engineer may require that additional test cylinders be cast and tested, and which will be considered additional work.
- .5 Inspection or testing by the Testing Laboratory will not augment or replace Contractor quality control, nor relieve the Contractor of his contractual responsibility.

**END OF SECTION**



## **Part 1 General**

### **1.1 RELATED SECTIONS**

- .1 Section 04 03 08 - Historic – Mortaring
- .2 Section 04 03 42 - Historic - Replacement of Stone

### **1.2 MEASUREMENT PROCEDURES**

- .1 The volume of stone masonry requiring either repointing, repair or replacement has been estimated to be 8 m<sup>3</sup>. In addition, roughly 50 percent of the stone blocks on the top of the wall are loose and require resetting. The total area requiring resetting has been estimated to be 7 m<sup>2</sup>.
- .2 Based on the 8 m<sup>3</sup> volume and the 7 m<sup>2</sup> area, the work will be tendered on a fixed price basis and will include all costs associated with supplying materials and executing the work, as described in the Contract Documents.
- .3 In the event that requirements for extra work are discovered during construction, the extra work shall be paid in accordance with the unit rates provided by the Contractor, as part of the Contractor's bid document.
- .4 Prior to commencing any extra work, the extent of the extra work will be approved in writing by Parks Canada.

### **1.3 REFERENCES**

- .1 Canadian Standards Association (CSA)
  - .1 CSA A23.1, Construction Materials and Methods of Concrete Construction.
  - .2 CAN3 A371, Masonry Construction for Buildings.

### **1.4 DEFINITIONS**

- .1 Raking: the removal of loose/deteriorated mortar until sound mortar is reached.
- .2 Repointing: the filling and finishing of masonry joints from which mortar is either missing, or has been raked out.
- .3 Tooling: the finishing of masonry joints using the proper tool to provide the final contour.
- .4 Repair: using adhesives to bond sections of fractured masonry.
- .5 Consolidation: strengthening masonry units to prevent deterioration (spalling).
- .6 Descaling: the removal of loose portions of the masonry (usually spalled areas) through impact with a brush-hammer or similar device.

### **1.5 SYSTEM DESCRIPTION**

- .1 Work of this Section includes, but is not limited to:

- .1 Visual inspections for obvious signs of deteriorated masonry and masonry joints.
- .2 Raking unsound joints.
- .3 Preparation of the masonry, including joints, surface cleaning, flushing of voids and open joints, and masonry wetting.
- .4 Repointing of masonry joints.
- .5 Removal of loose portions of stone blocks.
- .6 Resetting any dislodged stone blocks.
- .7 Properly curing the mortar.
- .8 Grouting small voids by hand.
- .9 Replacement of deteriorated or missing stone blocks.

## **1.6 QUALIFICATIONS**

- .1 The masonry shall be completed by certified masons, with experience in restoration of historic stone masonry. Each mason shall provide a certificate of qualification upon request.
- .2 All masons shall have minimum of 10 years experience with historic masonry.
- .3 At any given time, the lead mason shall have good level of understanding of the structural behaviour of “mass-type” stone block masonry walls.
- .4 The Structural Engineer has the right to reject any mason who does not demonstrate appropriate abilities or experience.

## **1.7 MOCK-UPS**

- .1 Before the work commences, the Contractor shall construct a mock-up, 1.0 m high x 1.0 m wide x 0.3 m thick, to demonstrate a full understanding of specified procedures, techniques and formulations for the repointing, repair or replacement of the work required to remediate the damaged and/or deterioration portions of the masonry wall.
- .2 Construct mock-up where directed.
- .3 The colour of the new mortar shall match the existing mortar.
- .4 Parks Canada and the Structural Engineer will review the mock-up. Allow 24 hours for the review process before proceeding with the bulk of the remedial work.
- .5 Once the mock-up has been accepted, the accepted work will serve as the minimum standard for the remainder of the work. The accepted mock-up shall remain as part of finished work.

## **1.8 DELIVERY, STORAGE AND HANDLING**

- .1 Store cementitious materials and aggregates in accordance with CSA A23.1.
- .2 Store lime putty in plastic-lined sealed drums.
- .3 Keep materials dry. Protect materials from weather, freezing and contamination.
- .4 Ensure that manufacturer's labels and seals are intact upon delivery.

- .5 Remove rejected or contaminated material from site.

## **1.9 PROTECTION**

- .1 The Mason shall ensure that the Work started at any given time of day can be completed by day's end. At the end of each working day, and to prevent the recently completed work from curing too quickly, the work area shall be covered with weatherproof coverings. Drape the coverings over the top of the wall and extend the coverings no less than 0.5 m beyond any Work completed in the past 3 days. Anchor the coverings securely in position.
- .2 The Contractor shall ensure that all nearby work and infrastructure is protected from damage due to ongoing work.

## **1.10 EXISTING CONDITIONS**

- .1 All unanticipated damage or deterioration to the masonry wall shall be reported in writing to the Structural Engineer, as soon as reasonably possible. Before any work to remediate the damage/deterioration shall commence, the Structural Engineer will review the damage/deterioration, and make recommendations for the appropriate repairs.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Mortar materials shall be in accordance with Section 04 03 08 - Historic - Mortaring.

## **Part 3 Execution**

### **3.1 GENERAL**

- .1 Perform work in accordance with CAN3 A371.
- .2 Use manual raking tool to remove deteriorated mortar and ensure that no masonry units are chipped, altered or damaged by work to remove mortar.
- .3 Tool and compact using suitable jointing tool to force mortar into joint.
- .4 Finish joints to match existing joints, except where specified otherwise.

### **3.2 REPOINTING**

- .1 Inspect joints visually for obvious signs of deteriorated masonry. Perform random tests on joints where obvious signs of deterioration not present, as follows:
  - .1 Physically inspect joints for voids and weaknesses using hammers or other approved means.
  - .2 Physical testing protocols shall be coordinated with and approved by the Structural Engineer.
- .2 Rake damaged or deteriorated joints:

- .1 Rake unsound joints free of deteriorated and loose mortar, dirt and other undesirable material.
- .2 Clean joints to full depth of deteriorated mortar, but in no case to less than twice the joint thickness, or 50 mm whichever is more. Clean out any voids and cavities.
- .3 Without damaging texture of exposed joints, use compressed air to initially remove any fine particles from open joints and voids.
- .4 Use low pressure water to flush out open joints and voids, and if not free-draining, remove any standing water with compressed air.
- .3 Repoint:
  - .1 Dampen joints and completely fill with mortar. If surface of stone has worn rounded edges keep pointing back from surface to keep same width of joint. Avoid feather edges. Pack mortar solidly into voids and joints.
  - .2 Keep masonry damp while pointing is being performed.
  - .3 Do no pointing in freezing weather. Refer to Section 04 03 08 for cold-weather protection of mortar.
  - .4 Build-up pointing in layers not exceeding 12 mm in depth. Allow previous layers to set before applying subsequent layers.
  - .5 Tool joints to match weathered joints.
  - .6 Remove excess mortar from the face of the stone before it sets.

### **3.3 RESETTING**

- .1 Set dislodged stone blocks in place with either firm mortar or water-soaked wood wedges (hardwood or softwood, as applicable).
- .2 Insert and compact firm mortar to within 50 mm of the pointing surface. Allow the mortar to set for 24 hours.
- .3 Once dry (and thereby shrunken), remove the wood wedges.
- .4 Point to the mortar surface in no less than two layers.

### **3.4 GROUTING**

- .1 At this time, grouting is unexpected. In the event that the Contractor encounters large unanticipated pockets, the pockets shall be filled with stone block.

### **3.5 REPAIR**

- .1 Fractured units shall not be repaired. Small pieces shall be discarded. Large pieces shall be reset with mortar between the fracture lines. The suitability of any given fractured unit for reinstallation shall be at the discretion of the mason.

### **3.6 CLEANING**

- .1 All surfaces shall be cleaned free of mortar droppings, stains and other blemishes that result from the work, on an ongoing basis throughout the course of the work.
- .2 Supplemental cleaning may be required after the mortar has set and cured.

- .3 Clean the masonry with stiff natural-bristle brushes and plain water only. Vinegar or other chemicals are not to be used unless approved in writing by the Structural Engineer.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED WORK**

- .1 Section 04 03 07 - Historic - Masonry Repointing and Repair
- .2 Section 04 03 42 - Historic - Replacement of Stone

**1.2 REFERENCES**

- .1 CAN/CSA A5, Portland Cement.
- .2 CSA A82.56, Aggregate for Masonry Mortar.
- .3 CSA A179, Mortar and Grout for Unit Masonry.

**1.3 MEASUREMENT PROCEDURES**

- .1 The volume of stone masonry requiring either repointing, repair or replacement has been estimated to be 8 m<sup>3</sup>.
- .2 Based on the 8 m<sup>3</sup> volume, the work will be tendered on a fixed price basis and will include all costs associated with supplying materials and executing the work, as described in the Contract Documents. Supply and installation of the mortar shall be included in the fixed price.
- .3 In the event that requirements for extra work are discovered during construction, the extra work shall be paid in accordance with the unit rates provided by the Contractor, as part of the Contractor's bid document. Supply and installation of the mortar shall be included in the unit rates.
- .4 Prior to commencing any extra work, the extent of the extra work will be approved in writing by Parks Canada.

**1.4 ALLOWABLE TOLERANCES**

- .1 Minimum concrete-mortar compression strength of 20 MPa at 7 days.
- .2 Minimum concrete-mortar compression strength of 35 MPa at 56 days.
- .3 If the mortar fails to meet the 7-day compressive strength requirement, but meets the 56-day requirement, it shall be considered acceptable. If the mortar fails to meet the 7-day compressive strength requirement, but its strength at 7 days exceeds two-thirds of the value, the Contractor may elect to continue the Work at his own risk while awaiting the results of the 56-day tests, or to redo the affected Work.

**1.5 MOCK-UPS**

- .1 Prior to starting the masonry work, review the existing pointing styles.
- .2 Before the work commences, the Contractor shall construct a mock-up, 1.0 m high x 1.0 m wide x 0.3 m thick, to demonstrate a full understanding of specified procedures,

techniques and formulations for the repointing, repair or replacement of the work required to remediate the damaged and/or deterioration portions of the masonry wall.

- .3 Construct mock-up where directed.
- .4 The colour of the new mortar shall match the existing mortar.
- .5 Parks Canada and the Structural Engineer will review the mock-up. Allow 24 hours for the review process before proceeding with the bulk of the remedial work.
- .6 Once the mock-up has been accepted, the accepted work will serve as the minimum standard for the remainder of the work. The accepted mock-up shall remain as part of finished work.

## **1.6 ALTERNATIVES**

- .1 Should the Contractor choose to alter any of the requirements in this Section, the changes shall be reviewed and approved in writing by the Structural Engineer.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Portland cement to CAN/CSA A5.
- .2 Fine sand to CSA A82.56; passing a 1.18 mm sieve.
- .3 Potable Water.
- .4 For “white mortar” use white silica sand, white Portland cement (or masonry cement) and lime.
- .5 For “coloured mortar” use coloured sand, or ground, coloured, natural aggregates, or metallic-oxide pigments, or carbon-black, in suitable concentrations to match the existing. The weight of the metallic oxides shall not exceed 15 percent of the weight of the binder materials. The weight of carbon black shall not exceed (blank) percent of the weight of the binder materials

### **2.2 COLD WEATHER STORAGE REQUIREMENTS**

- .1 When the ambient temperature is 10°C or less:
  - .1 Store sand and cementitious materials for immediate use within a heated enclosure. Allow these materials to reach minimum temperature of 10°C before use in preparing the mortar.
  - .2 Heat the water to minimum of 20°C and maximum of 30°C.
  - .3 Do not mix cement with water, or with aggregate, or with water-aggregate mixtures having a temperature higher 25°C.
- .2 At the time of use, the temperature of the mortar shall be a minimum of 15°C and maximum of 25°C.

- .3 Obtain approval from the Structural Engineer for the type of enclosure and the means of heating the materials.

## **2.3 MIX DESIGN REQUIREMENTS FOR CONCRETE MORTAR**

- .1 Proportion normal density concrete in accordance with CAN/CSA-A23.1, to give following quality for all concrete.
  - .1 Class of exposure: S-1.
  - .2 Cement:
    - .1 Type HS (Type 50) Portland cement.
    - .2 Type HSb blended hydraulic cement.
    - .3 Mix of Type HS Portland cement and HSb blended hydraulic cement.
  - .3 Minimum compressive strength at 56 days: 35 MPa.
  - .4 Maximum water-to-cementing materials ratio: 0.40.
  - .5 Nominal size of coarse aggregate: 5 mm.
  - .6 Air content: 4 to 7 percent.
  - .7 To limit the extent of shrinkage as much as possible, the cement content and water/cement ratio shall be minimized, but not so much as to impede the workability of the mortar. Water-reducing admixtures and/or superplasticizers may be used to reduce the water/cement ratio.
  - .8 Calcium chloride, or any admixture formulation containing chloride ions, shall not be used.
  - .9 All mortar shall be batched on site. The size of each batch shall be limited to no more than what can be placed in its final position within 90 minutes of batching.

## **Part 3 Execution**

### **3.1 PREPARATION**

- .1 Slake processed lime in water for not less than 24 hours or soak hydrated lime in water for not less than 12 hours.
- .2 Place safety devices and signs near the work.

### **3.2 MIXING**

- .1 Prepare mortar by mixing cement, sand and water in specified proportions:
- .2 Mix mortar ingredients in quantities for use in no more than 90 minutes.
- .3 Use manual mixing as long as quantities of materials and water are accurately controlled and the method of mixing is approved by the Structural Engineer.
- .4 Operate power-driven mixer (fully charged) for no less than (blank) minutes and no more than (blank) minutes.
- .5 Slowly add water while mixing dry ingredients until all lumps are eliminated.
- .6 Mix to a consistency of soft mush.



- .7 Prepare and maintain the temperature of the mortar between 10°C and 40°C until used.

### **3.3 FIELD QUALITY CONTROL**

- .1 Follow proper batching procedure.
- .2 Use a batching box.
- .3 Monitor the mixing time.
- .4 For every cubic meter of mortar, the Testing Laboratory shall cast at least five 4-inch-diameter by 8-inch-long concrete cylinders, to be used for verification of the compressive strength. One at 7 days, one at 14 days, and two at 56 days. The extra cylinder is available for use at the Structural Engineer's discretion. Cure the extra cylinder on the job site under the same conditions as the concrete which it represents. During cold-weather concreting, the Structural Engineer may require that additional test cylinders be cast and tested, and which will be considered additional work.
- .5 The Testing Agency shall record the slump and level of air entrainment.

### **3.4 TEST REPORTS**

- .1 The Testing Laboratory shall email all test results to both Parks Canada and the Structural Engineer with 24 hours of completing each test.

### **3.5 CLEANING**

- .1 Remove any mortar droppings from the face of the stone before the mortar is set.
- .2 Clean masonry with low pressure clean water and a soft natural bristle brush.

### **3.6 PROTECTION OF COMPLETED WORK**

- .1 Cure mortar at no less than 10°C for no less than 7 days or the time necessary to gain 70 percent of the compressive cylinder strength.
- .2 The mortar shall be protected from premature drying and extremes of temperature.
- .3 Cover completed and partially-completed work not enclosed or sheltered with waterproof coverings at the end of each work day. Anchor the coverings securely in position.
- .4 If the ambient temperature is expected to fall below 10°C, the Contractor shall provide heating and/or hoarding in accordance with the exposure classification (7 days). The methods of hoarding and heating the concrete shall be reviewed and approved in writing by the Structural Engineer.
- .5 Cold-weather construction is not recommended. However, in the event that the Contractor chooses to work through the winter months, the Work shall be protected from freezing temperatures.

**END OF SECTION**

## **Part 1 General**

### **1.1 RELATED SECTIONS**

- .1 Section 04 03 07 - Historic - Masonry Repointing and Repair
- .2 Section 04 03 08 - Historic – Mortaring

### **1.2 REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
  - .1 ASTM C144, Standard Specification for Aggregate for Masonry Mortar.
  - .2 ASTM C206, Specification for Finishing Hydrated Lime.
- .2 Canadian Standards Association (CSA)
  - .1 CAN/CSA A5, Portland Cement.
  - .2 CSA A179, Mortar and Grout for Unit Masonry.

### **1.3 OVERALL SCOPE OF WORK**

- .1 The existing retaining wall is a “mass-type” of retaining wall constructed from stone masonry. The stone “blocks” are rundle stone. The mortar is concrete. The concrete appears to have a relatively small coarse aggregate size, likely no more than 6 mm.
- .2 A portion of the existing mass retaining wall is damaged and needs to be rebuilt (repointed, repaired or replaced). The total volume of stone masonry that needs to be rebuilt is approximately 8 m<sup>3</sup>.
- .3 As seen from the outside face of the wall, the shape of the damaged portion is somewhat “parabolic” in shape. Refer to Detail 1/S15. The parabolic nature of the damage may or may not allow the undamaged portion of the wall to “arch” over the damaged portion wall during remediation.
- .4 Once the inside face of the wall is excavated, approximately half the width of the wall can be rebuilt. For the purpose of tendering the Work, the Contractor shall assume the stone blocks will be replaced.
- .5 Before the work on the inside face begins, and to ensure that the replacing the blocks is best option for remediating the inside half of the wall, both the Mason and the Structural Engineer shall review condition of the stone wall and at which time the Structural Engineer might reduce the degree of Work from replacement to either repair or repointing.
- .6 To ensure that no stones fall free during the rebuilding process, the Mason shall ensure that no more than a small portion of the wall be removed at any given time, likely no more than two or three blocks at once, and working from the base of the wall up. The number of stone blocks that can be removed at once is at the discretion of the Mason, with the safety of the workers being the primary concern.
- .7 Once the inside half has been rebuilt, the new concrete retaining wall shall be constructed. Once the new concrete retaining wall has properly cured, the outside half of

the wall can be rebuilt (repaired or replaced, not repointed). Similar to that of the inside half, the Mason shall ensure that no more than a small portion of the wall be removed at any given time.

- .8 If at any given time, either the Mason or the Structural Engineer thinks that temporary shoring is required, suitable options shall be discussed in detail by both parties, and then approved in writing by both parties,

#### **1.4 MEASUREMENT PROCEDURES**

- .1 The volume of stone masonry requiring either repointing, repair or replacement has been estimated to be 8 m<sup>3</sup>. In addition, roughly 50 percent of the stone blocks on the top of the wall are loose and require resetting. The total area requiring resetting has been estimated to be 7 m<sup>2</sup>.
- .2 Based on the 8 m<sup>3</sup> volume and the 7 m<sup>2</sup> area, the work will be tendered on a fixed price basis and will include all costs associated with supplying materials and executing the work, as described in the Contract Documents.
- .3 In the event that requirements for extra work are discovered during construction, the extra work shall be paid in accordance with the unit rates provided by the Contractor, as part of the Contractor's bid document.
- .4 Prior to commencing any extra work, the extent of the extra work will be approved in writing by Parks Canada.

#### **1.5 SAMPLES**

- .1 Every effort shall be made to ensure the existing stone can be reused. In the event that some of the stone is no longer reusable, new stone shall be sourced by the Contractor, and samples submitted to Parks Canada for approval.
- .2 Submit samples of replacement stones not less than 30 days before the masonry work begins.
- .3 In light of the age of the wall, samples from the original quarry would be coincidental at best. As such, submit samples of replacement stones from a quarry having similar stone as the existing wall. Submit three sets of stones as follows, each set from a different currently worked bed of the quarry, and accompanied by a quarry certification:
  - .1 three stones sized and dressed to match the existing stone units.
- .4 Prior to approval of the all or none of the samples, the Structural Engineer may require additional samples, sized and cut as required for compressive strength tests.
- .5 Submit mortar samples in quantity and size specified in CSA A179.

#### **1.6 QUALIFICATIONS**

- .1 The masonry shall be completed by certified masons, with experience in restoration of historic stone masonry. Each mason shall provide a certificate of qualification upon request.
- .2 All masons shall have minimum of 10 years experience with historic masonry.

- .3 At any given time, the lead mason shall have good level of understanding of the structural behaviour of “mass-type” stone block masonry walls.
- .4 The Structural Engineer has the right to reject any mason who does not demonstrate appropriate abilities or experience.

## **1.7 MOCK-UPS**

- .1 Prior to starting the masonry work, review the existing pointing styles.
- .2 Before the work commences, the Contractor shall construct a mock-up, 1.0 m high x 1.0 m wide x 0.3 m thick, to demonstrate a full understanding of specified procedures, techniques and formulations for the repointing, repair or replacement of the work required to remediate the damaged and/or deterioration portions of the masonry wall.
- .3 Construct mock-up where directed.
- .4 The colour of the new mortar shall match the existing mortar.
- .5 Parks Canada and the Structural Engineer will review the mock-up. Allow 24 hours for the review process before proceeding with the bulk of the remedial work.
- .6 Once the mock-up has been accepted, the accepted work will serve as the minimum standard for the remainder of the work. The accepted mock-up shall remain as part of finished work.

## **1.8 PROTECTION**

- .1 The Mason shall ensure that the Work started at any given time of day can be completed by day’s end. At the end of each working day, and to prevent the recently completed work from curing too quickly, the work area shall be covered with weatherproof coverings. Drape the coverings over the top of the wall and extend the coverings no less than 0.5 m beyond any Work completed in the past 3 days. Anchor the coverings securely in position.
- .2 The Contractor shall ensure that all nearby work and infrastructure is protected from damage due to ongoing work.

## **Part 2 Execution**

### **2.1 PREPARATION**

- .1 Place safety devices and signage near the work area, as directed and approved by Parks Canada.
- .2 Install temporary shoring and scaffolding as required.
- .3 To avoid contamination from construction debris, cover nearby vegetation.

### **2.2 REMOVAL OF EXISTING STONE**

- .1 Rake out the mortar joints of the stones in the area in need of rebuilding.

- .2 Remove all loose material from the stones.
- .3 Remove all dust, mortar and other debris from the pocket.

### **2.3 INSERTING NEW STONE**

- .1 Clean each stone by washing with water and natural fibre brush.
- .2 Dampen surfaces of slot and apply mortar. The mortar shall have a consistency to be easily and uniformly trowelled into the pocket and yet support the weight of the stones.
- .3 Reinstall the stones in a full bed of mortar and point the mortar to match the existing wall.
- .4 Remove any mortar droppings from the face of the stone before the mortar is set.

### **2.4 FILLING JOINTS AND POINTING**

- .1 Fill joints and repoint in accordance with Section 04 03 07 - Historic Structures - Masonry Repointing and Repair.
- .2 To promote proper curing, keep new mortar wet for 3 days after initial set.

**END OF SECTION**

## **Part 1 General**

### **1.1 REFERENCES**

- .1 Canadian Standard Association (CSA)
  - .1 CAN/CSA-A23.1-[ M94], Concrete Materials and Methods of Concrete Construction.
- .2 American Society for Testing and Materials (ASTM)
  - .1 ASTM D 698-91, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600kN-m/m<sup>3</sup>).

### **1.2 SOIL REPORT**

- .1 No soil report is available for the project.
- .2 In the absence of a geotechnical report, the following soil parameters were assumed for the design of the retaining wall.
  - .1 Unit weight of soil = 20 kN/m<sup>3</sup>
  - .2 At-rest lateral earth pressure coefficient,  $k_0 = 0.50$
  - .3 Active lateral earth pressure coefficient,  $k_a = 0.33$ .
  - .4 Passive lateral earth pressure coefficient,  $k_p = 3.00$ .
- .3 In absence of a soluble sulphate test, the concentration of water-soluble sulphates in the soils assumed to be greater than 2 percent; Class S-1 exposure (“very severe”).
- .4 The frost depth adjacent to heated structures shall be no greater than 1.2 m; for unheated (isolated) structures, no greater than 2.1 m.
- .5 The total volumetric flow into the weeping tile system shall be no more than 100 liters per minute.
- .6 Prior to construction of the new concrete retaining wall, the Owner shall retain a locally-based Geotechnical Engineer, registered in the Province of Alberta, to complete a field review of the open excavations and thereby verify the soil conditions.
- .7 The height of the retaining wall, as well as the depth of backfill each side of the wall, is not consistent along the length of the wall. The variable nature of the wall means that the factors of safety are not consistent along the length of wall. That being said, the factor of safety against translation is no less than 1.5 and the factor of safety against rotation is no less than 2.

### **1.3 REGULATIONS**

- .1 Shore and brace excavations, protect slopes and banks and perform all work in accordance with Provincial and Municipal regulations whichever is more stringent.

#### **1.4 TESTS AND INSPECTIONS**

- .1 Testing of materials and compaction of backfill will be carried out by a testing laboratory designated by Parks Canada.
- .2 Not later than one week before backfilling or filling, provide to the designated testing agency a 25 kg sample of backfill material proposed for use.
- .3 Do not begin backfilling or filling operations until material has been approved for use by the Engineer.
- .4 Not later than 48 hours before backfilling with approved material, notify the designated testing agency so that compaction tests can be carried out by the designated testing agency.
- .5 Before commencing work, conduct with the Engineer a condition survey of existing structures, trees and other plants, fencing, service poles, overhead wires paving, and any other nearby infrastructure which may be affected by work.

#### **1.5 BURIED SERVICES**

- .1 Before commencing work, establish the location of all buried services on and adjacent to the site.
- .2 Arrange with the appropriate authority for relocation of buried services that interfere with execution of work. Prior to proceeding with the relocation of services, the costs of relocating services shall be agreed to in writing by Parks Canada.
- .3 Remove obsolete buried services within 2 m of foundations. Cap cut-offs.

#### **1.6 PROTECTION**

- .1 Protect excavations from freezing.
- .2 Keep excavations clean, free of standing water and loose soil.
- .3 Where soil is subject to significant volume change due to change in moisture content, cover and protect the soil to the satisfaction of the Engineer.
- .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
- .5 Protect buried services that are required to remain undisturbed.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 The gravel beneath the slab-on-grade shall be a locally available, well-graded, 'road base' type gravel (Type A to OPSS1010) and shall be compacted in no more than 150 mm lifts to no less than 100 percent of standard proctor density.

- .2 The washed-crushed gravel backfill shall be Crushed Granular 20-0 to CCDG14.02 and shall be lightly tamped to consolidate the aggregate.
- .3 The lean mix concrete shall be proportioned and mixed to provide:
  - .1 Minimum compressive strength of 1 MPa at 28 days.
  - .2 Minimum compressive strength of 0.1 MPa at 24 hours.
  - .3 Maximum Portland cement content of 25 kg/m<sup>3</sup>.
  - .4 Concrete aggregates: to CAN/CSA-A23.1.
  - .5 Portland cement: Type N (Type 10).
  - .6 Slump: 150 to 200 mm.

### **Part 3 Execution**

#### **3.1 CLEARING AND GRUBBING**

- .1 Remove existing asphalt pavement within areas designated on drawings.
- .2 Dispose of cleared pavement off site daily to disposal areas acceptable to the Authority Having Jurisdiction.

#### **3.2 EXCAVATION**

- .1 Excavation walls shall comply with the recommendations outlined in the guidelines detailed in the 'General Safety Regulation' of the Occupational Health and Safety Act (current edition). In the event that site restrictions dictate otherwise, the Contractor shall contact the Structural Engineer for additional instructions.
- .2 No excavated material shall be stored on site. Either dispose or store off site daily to disposal/storage areas acceptable to the authority having jurisdiction.
- .3 Excavate as required to carry out work, in all materials met. Do not disturb soil or rock below bearing surfaces. Notify the Structural Engineer when excavations are complete. Unusual subsurface conditions may warrant changes to the structural design, as recommended by either the Structural Engineer or the Geotechnical Engineer. If bearings are unsatisfactory, additional excavation will be authorized in writing and paid for as additional work. Excavation taken below depths shown without the Structural Engineer written authorization to be filled with concrete of same strength as the footings at the Contractor's expense.
- .4 Tufa is a variety of limestone formed when carbonate minerals precipitate out of ambient temperature water. Not only is it prevalent in the immediate area, it is also a protected geological formation. In the event that any tufa is encountered during excavation, all work shall cease until further direction on how to proceed is provided by Parks Canada.
- .5 The native material beneath the new concrete footings shall be inorganic and undisturbed. In the event that any inorganic material is disturbed during excavation, the material shall be re-compacted to 100 percent standard proctor density, or removed and the depressions filled with lean mix concrete. Any organic material or soft or moist layers of inorganic material shall be removed and replaced with competent material, and compacted to 100 percent standard proctor density, or the material shall be removed and the depressions filled with lean mix concrete.



- .6 Excavate for slabs and paving to subgrade levels. In addition, remove all topsoil, organic matter, debris and other loose and harmful matter encountered at subgrade level.
- .7 The Contractor shall ensure the excavation is protected from water ponding on the base. To prevent any ponding, isolated 'pockets' shall be avoided and the base of the excavation shall slope towards a temporary sump hole. The sump hole shall be equipped with a sump pump.

### 3.3 BACKFILLING

- .1 Do not commence backfilling until fill material and spaces to be filled have been inspected and approved by the Geotechnical Engineer.
- .2 Remove snow, ice, construction debris, organic soil and standing water from spaces to be filled.
- .3 Cold weather earthwork is not recommended. However, in the event that the Contractor chooses to work through the winter months, the base of the excavation shall be protected from freezing. The methods of hoarding and heating the excavation shall be reviewed and approved by both the Geotechnical Engineer and the Structural Engineer. In absolutely no instance shall the material used for backfill or road base be frozen.
- .4 Compact existing subgrade under walks, paving, and slabs on grade, to same compaction as specified for fill. Fill excavated areas with [selected subgrade material] [gravel and sand] compacted as specified for fill.
- .5 Placement of soil:
  - .1 Place backfill, fill and basecourse material in to more than 150 mm lifts. Add water as required to achieve specified density.
  - .2 Place lean-mix-concrete as required. Consolidate and level the lean-mix-concrete with internal vibrators.
- .6 Compact each layer of material to following densities for material to ASTM D 698:
  - .1 Washed-crushed gravel: lightly tamp to consolidate the aggregate.
  - .2 Coarse-washed sand: lightly tamp to consolidate the aggregate.
  - .3 Gravel 'base' (beneath the asphalt pavement): 98 percent SPD.
  - .4 Gravel 'sub-base' (beneath the gravel 'base'): 98 percent SPD.
  - .5 Surface of the native soil (beneath the gravel 'sub-base'): 95 percent SPD.
- .7 Compaction of backfills shall be verified by the Geotechnical Engineer. At least one inspection by the Geotechnical Engineer is required to review the Contractor's compaction techniques. Inspections are required at the onset of compaction.
- .8 The Contractor shall give the Geotechnical Engineer a minimum of 48 hours' notice prior to the time required for each inspection.

### 3.4 GRADING

- .1 Finished grades shall drain away from infrastructure and paved areas, to catch basins and other disposal areas approved by the Structural Engineer. Grades shall be gradual between finished spot elevations shown on drawings.

**3.5 SHORTAGE AND SURPLUS**

- .1 Supply all necessary fill to meet backfilling and grading requirements.
- .2 Dispose of surplus material off site.

**END OF SECTION**

## **Part 1 General**

### **1.1 RELATED SECTIONS**

- .1 Section 02 41 14 – Asphalt Pavement Removal
- .2 Section 32 12 17 - Asphalt Paving - Short Form.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Granular base and sub-base materials: in accordance with the following requirements:

- .1 Crushed; pit run or screened stone, gravel or sand.
- .2 Gradations to be within the following limits specified when tested to ASTM C117. Sieve sizes to CAN/CGSB 8.2.
- .3

Sieve	Percent Passing	
	Sub-base	Base
100 mm	-	-
75 mm	[100]	-
50 mm	-	-
37.5 mm	-	-
25 mm	[55-100]	[100]
19 mm	-	-
12.5 mm	-	-
9.5 mm	-	-
4.75 mm	[25-100]	[25-85]
2.00 mm	[15-80]	-
0.425 mm	[4-50]	[5-30]
0.180 mm	-	-
0.075 mm	[0-8]	[0-10]

- .4 Other Properties as follows:
  - .1 Fracture by mass, 60% minimum
  - .2 Los Angeles degradation to ASTM C131 (loss by mass), 45% maximum.
  - .3 Liquid Limit to ASTM D4318, 25% maximum.
  - .4 Plasticity Index to ASTM D4318, 6% maximum.
  - .5 Particles smaller than 0.02 mm to ASTM D422, 3% maximum.
  - .6 Soaked CBR to ASTM D1883, 40% minimum when compacted to 100% of ASTM D1557.

## **Part 3            Execution**

### **3.1                PLACING**

- .1      Place the granular sub-base after the subgrade is inspected and approved by the Geotechnical Engineer. Place the granular base after the sub-base is inspected and approved by the Geotechnical Engineer.
- .2      Place the granular base and sub-base in the areas shown on the Drawings, to the specified depth and grades.
- .3      Ensure no frozen material is placed.
- .4      Place the materials only on clean unfrozen surfaces, free from snow or ice.
- .5      Place the granular materials using methods which do not lead to segregation. Remove and replace any portion of the layer in which the material has become segregated during spreading.
- .6      Place the material in uniform layers not exceeding 100 mm (compacted thickness). The Geotechnical Engineer may authorize thicker lifts if the specified compaction can be achieved.
- .7      Shape each layer to a smooth contour and compact to specified density before the next layer is placed.

### **3.2                COMPACTION**

- .1      Compaction equipment shall be capable of obtaining the required material densities.
- .2      Compact the materials to a density of not less than 98 percent maximum dry density in accordance with ASTM D698.
- .3      Shape and roll alternately to obtain smooth, even and uniformly compacted material.
- .4      Apply water as necessary during compaction to obtain specified density.
- .5      In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by the Geotechnical Engineer.
- .6      Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

### **3.3                SITE TOLERANCES**

- .1      The finished surfaces of the base and sub-base shall be within 10 mm of the elevations shown on the Drawings, but not uniformly high or low.

### **3.4                PROTECTION**

- .1      Maintain the finished sub-base in a condition conforming to this section until the base is constructed. Maintain the finished base in a condition conforming to this section until the asphalt pavement is constructed.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 02 41 14 – Asphalt Pavement Removal
- .2 Section 32 11 19 - Granular Base and Sub-Base.

**1.2 REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM)
  - .1 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m<sup>3</sup>).
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB 16.3, Asphalt Cements for Road Purposes.

**1.3 WASTE MANAGEMENT AND DISPOSAL**

- .1 Divert unused asphalt to facility capable of recycling materials.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Asphalt concrete: to CAN/CGSB 16.3.

**Part 3 Execution**

**3.1 FOUNDATIONS**

- .1 Granular sub-base and base:
  - .1 200 mm compacted thickness of granular sub-base.
  - .2 100 mm compacted thickness of granular base.

**3.2 PAVEMENT THICKNESS**

- .1 Pavements for parking lots:
  - .1 Wear course: 100 mm of asphalt concrete.

**3.3 PAVEMENT CONSTRUCTION**

- .1 Construction of asphalt concrete in accordance with CAN/CGSB 16.3

**END OF SECTION**