PARKS CANADA AGENCY

MOUNTAIN AVENUE IMPROVEMENTS
PROJECT # CT164101

TENDER DOCUMENTS

AUGUST 2018

Public Works and Government Services Canada

wood.

END OF SECTION

Part 1 General

1.1 PROJECT LOCATION

.1 The project is located on Mountain Avenue and within the parking lots in the immediate vicinity of the Rimrock Resort Hotel, Banff Gondola and Upper Hot Springs, within Banff National Park. The limit of work includes the southern end part of Mountain Ave, the access road to the lower parking lot, the parking lot nearby the Gondola Building, the upper parking lot, and part of the access road to the Upper Hot Springs.

1.2 SCOPE OF WORK

.1 The scope of work for this Contract comprises the construction of two (2) roundabouts, overlay of the existing upper and lower parking lots, and extension of the upper parking lot. The major items include paving, granular base, earthwork, concrete, retaining wall, signage, pavement marking, drainage, fencing, electrical and landscaping work.

1.3 CONTRACT METHOD

.1 Construct Work under combined price contract.

1.4 WORK BY OTHERS

.1 Co-operate with other Contractors in carrying out their respective works and carry out instructions from the Departmental Representative.

.2 Co-ordinate Work with that of other Contractors. If any part of the Work under this Contract depends for its proper execution or result upon work of another Contractor, report promptly to the Departmental Representative, in writing, any defects which may interfere with proper execution of Work.

.3 The Contractor shall be aware that there will be road work at the bottom run of Mountain Ave in September 2018 so short duration delays are expected throughout the day for a duration of about 2 weeks.

1.5 WORK SEQUENCE

.1 Construct Work in the stages defined below to accommodate Owner's continued use of premises during construction and public access.

.2 Co-ordinate Progress Schedule and co-ordinate with Owner Occupancy during construction.

.3 Required stages:

.1 Refer to section 01 14 00 – Work Restrictions.

.4 Maintain fire access/control throughout the duration of the Work.

.1 Within five (5) days after acceptance of Master Plan submit detailed Project Schedule in accordance with Section 01 32 16.19 – Construction Progress Schedule.

1.6 PROJECT MILESTONES

.1 Refer to section 01 14 00 – Work Restrictions.

1.7 LIQUIDATED DAMAGES

.1 Refer to GC 5.10 Assessments and Damages for Late Completion.

1.8 CONTRACTOR USE OF PREMISES

.1 The Contractor shall limit use of premises for Work to allow:

.1 Owner Occupancy.

.2 Work by other Contractors.

.2 Coordinate use of premises under direction of the Departmental Representative.

.3 The Contractor shall obtain a business license from Parks Canada Agency for Work in the National Park area.

.4 The Contractor shall obtain a vehicle work pass from Parks Canada Agency for all business and private vehicles it intends to use on site. All contractor vehicles on site should display the work pass.

.5 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.

.6 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Departmental Representative.

.7 At completion of operations, condition of existing work to be equal to or better than that which existed prior to construction, to the satisfaction of the Departmental Representative.

1.9 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

.1 Execute Work with no interference or disturbance to existing facilities, owner, public and normal use of premises. Arrange with Departmental Representative to facilitate execution of Work.

1.10 OWNER FURNISHED ITEMS

.1 Owner Responsibilities:

.1 Arrange for delivery of shop drawings, product data, samples, manufacturer's instructions, and certificates to Contractor.
.2 Deliver supplier's bill of materials to Contractor.
.3 Arrange and pay for delivery to site in accordance with Progress Schedule.
.4 Inspect deliveries jointly with Contractor.
.5 Submit claims for transportation damage.
.6 Arrange for replacement of damaged, defective or missing items.
.7 Arrange for manufacturer's field services; arrange for and deliver manufacturer's warranties and bonds to Contractor.

.2 Contractor Responsibilities:

.1 Designate submittals and delivery date for each product in progress schedule.
.2 Review shop drawings, product data, samples, and other submittals. Submit to Consultant notification of observed discrepancies or problems anticipated due to non-conformance with Contract Documents.
.3 Receive and unload products at site.
.4 Inspect deliveries jointly with Owner; record shortages, and damaged or defective items.
.5 Handle products at site, including uncrating and storage.
.6 Protect products from damage, and from exposure to elements.
.7 Assemble, install, connect, adjust, and finish products.
.8 Provide installation inspections required by public authorities.
.9 Repair or replace items damaged by Contractor or subcontractor on site.

.3 Schedule of Owner furnished items:

.1 Traffic Signs.
.2 Information Signs.

1.11 EXISTING SERVICES

.1 The Contractor shall perform utility locates, survey, hydrovac and provide copies to Departmental Representative prior to undertaking any Work.

.2 The Contractor shall obtain permission from Departmental Representative and utility companies prior to intended interruption of services.

.3 Where unknown services are encountered, immediately advise Department Representative and confirm findings in writing.

1.12 DOCUMENTS REQUIRED

.1 Maintain at job site, one copy of each document as follows:

.1 Contract Drawings, marked up with as-built information.

.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 Environmental Protection Plan.

.11 Traffic Accommodation Strategy.

.12 Quality Management Plan.

.13 Health and Safety Plan and Other Safety Related Documents.

.14 Other documents as specified.

.15 Restricted Activity Permits.

1.13 SURVEY RESPONSIBILITIES

.1 The Contractor is responsible for all surveying required to construct the Work to the lines and grades shown on the Drawings. Survey Work must be tied to the nearest Alberta Survey Control Monument or temporary benchmarks established by the Department Representative. Elevations shown on the Drawings are geodetic.

.2 The Contractor must conduct a survey circuit of the project monuments and submit a report to the Department Representative at least seven (7) days prior to installation of any works.

.3 The Contractor is responsible for quantity survey measurements for progress payment application.

.4 The Contractor will complete as-built survey of all Works for Record Drawings and provide the results to the Departmental Representative prior to Substantial Performance of the Work.

1.14 TRAFFIC ACCOMMODATION STRATEGY (TAS)

.1 The Contractor must prepare a traffic accommodation strategy for the project. The TAS must detail temporary construction signage and detours for public use of the park area during the construction work.

.2 No signs or advertisements, other than warning signs, are permitted on site.

.3 Signs and notices for safety and instruction shall be in both official languages. Graphic symbols shall be diamond grade and shall conform to CAN3-Z321.

.4 Maintain approved signs and notices in good condition for duration of project; and dispose of off-site on completion of project or earlier if directed by the Departmental Representative.

.5 Signage shall be coordinated with other Contractors.

.6 The Contractor shall maintain at least 3.5m lane width of Mountain Ave, the Access Road to the Lower Parking and the Access Road to the Upper Hot Springs accessible during the construction work with full time flaggers used for traffic control.

.7 Contractor shall maintain parking at either the Upper Parking Lot or the Lower Parking Lot at all times.

.8 The Contractor shall maintain access for public to the Gondola and the Upper Hot Springs at all times.

1.15 NATIONAL PARK REGULATIONS

.1 Contractor and all sub-contractors shall ensure that all work is performed in accordance with ordinances, laws, rules and regulations set out in the National Parks Act.

.2 Contractor and all sub-contractors shall obtain business licenses from Parks Canada Administration Office prior to commencement of work.

.3 Contractor and all sub-contractors shall comply with all laws and government regulations applicable to work under this contract.

.4 Contractor is responsible to ensure all sub-contractors comply with the National Park Regulations

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 ACCESS AND EGRESS

.1 Construction shall commence on September 4, 2018.

.2 Construction work shall stop on June 20, 2019 with the Contractor leaving the site in a fully operation state, and resume for deficiencies on September 4, 2019. No construction work is allowed between June 20, 2019 and September 4, 2019.

.3 All construction activities shall be completed by October 1, 2019.

.4 The site is to remain open to public throughout the construction periods.

.5 The Contractor shall ensure that the Upper Parking Lot or the Lower Parking Lot is available for parking at all times.

.6 The Contractor shall maintain access for the Gondola and Upper Hot Springs Operations as well as the public at all times.

.7 The Contractor shall maintain at least 3.5m lane width of Mountain Ave, the Access Road to the Lower Parking and the Access Road to the Upper Hot Springs accessible during the construction work.

.8 All base layers at paving shall be completed in fall 2018, avoiding gravel areas remaining over the winter. If any gravel areas remain at winter demobilization, the contractor shall be responsible for repairs and rehabilitation at remobilization. Contractor will be responsible for any heating and hoarding required to complete work within the project dates. Contractor will be responsible for protection of all works over the winter and summer demobilization periods.

.9 The Contractor shall provide a schedule to the Departmental Representative indicating the Winter demobilization and remobilization periods. The Contractor is responsible for any damage to site works during the winter shutdown period.

.10 Construction operations shall be conducted to cause minimal inconvenience to the public and to adjoining portions of the property. Contractor will be responsible for repairing any damage incurred to any portion of their access to the site, at the Contractor's cost.

.11 The Contractor is responsible for the development and supply of construction access to the Work as approved by the Departmental Representative.

1.2 USE OF THE SITE AND FACILITIES

.1 The Work Sites specified in the Contract shall only be used for the purposes of the Work.

.2 The Work Site will be specified by Parks Canada and shall only be used for the purposes of the Work. The Work Site will be made available by Parks Canada to the Contractor for its non-exclusive use for the duration of the Work, unless otherwise provided in the Contract Documents.

.3 The Contractor will not be permitted to set up a camp in the National Parks. PCA regulations prohibit anyone working within the Park from using public campground facilities.

.4 Contractor shall maintain adequate drainage at the Work Site.

.5 The Contractor is responsible for the snow removal within the project boundaries during the construction periods. The Contractor shall maintain operational and safe site access to the public.

.6 The Contractor shall keep the Work Site clean and free from accumulation of waste materials and rubbish regardless of source. Snow shall be removed by the Contractor as necessary and at their cost for the performance and inspection of the Work.

.7 The Contractor shall provide sanitary facilities for work force in accordance with governing regulations and Section 01 35 43 - Environmental Procedures. The Contractor shall post notices and take such precautions as required by local health authorities and keep area and premises in sanitary condition.

.8 Any damage to the Work Site caused by the Contractor shall be repaired by the Contractor at their expense.

.9 Pets shall not be brought to or maintained at the construction site.

1.3 WORKING TIMES

.1 Work in BNP is permitted between the following hours during the 2018 and 2019 season:

.1 Monday-Friday: 7:30am - 9:00pm

.2 Saturday: 10:00am – 10:00pm

.3 Work that has the potential to disrupt local business (noise or vibration) shall not start before 8:30am.

.2 No work will be permitted on Sundays unless prior written approval is granted by the Departmental Representative.

.3 The Contractor will not be permitted to work on any Alberta statutory holiday.

.4 Variance of the Working Times and any others are provided on the strict condition of satisfactory performance in all requirements as determined at the Departmental Representative's discretion and may be revoked at any time for any reason. It is provided on the presumption that no additional costs or any delay will be attributed to Parks Canada in relation to conducting Works in accordance with the Variance and if that is not the case, the Contractor shall not commence work under the Variance. No claims for additional costs, delays, schedule impacts, loss of productivity or other extra Works resulting from a Variance will be entertained.

1.4 UTILITIES

.1 The Contractor shall become familiar with all utilities and services adjacent to the Work and shall be responsible for cost of repair of any damage resulting from their operations.

.2 The Contractor shall establish and maintain direct and continuous contact with the owners or operators of any Utilities which may interfere with the Work. The Contractor

shall co- operate with them at all times and in all places of Work. The Contractor shall keep the Departmental Representative informed of all communications with the Utility companies and authorities.

.3 The Drawings include utility details from within the area for reference for installation of said utilities, however the Contractor remains fully responsible for determining the full and accurate extent of any other utilities within the area of their Works.

.4 The Contractor shall notify the Departmental Representative and the Utility companies at least seven (7) days in advance of any activities which may interfere with the operation of such Utilities.

.5 Whenever working in the vicinity of Utilities, the Contractor shall locate such Utilities and expose those that may be affected by the Work, using hand labour as required.

.6 The Contractor shall assess the possible impact of its operations on all Utilities that may be affected by its operations, and shall, in consultation with Utility owner(s), protect, divert, temporarily support or relocate, or otherwise appropriately treat such Utilities to ensure that they are preserved.

.7 The Contractor shall immediately report any damage to Utilities to the Departmental Representative and to the Utility company or authority affected; and shall promptly undertake such remedial measures as are necessary at no additional cost to the Owner.

1.5 SURVEY OF EXISTING CONDITIONS

.1 Submission of tender is deemed to be confirmation that the Contractor has inspected the Site and is conversant with all conditions affecting execution and completion of work.

.2 The Contractor shall regularly monitor the condition of the Work Site and of property on and adjoining the Work Site throughout the construction period; and shall immediately notify the Owner if any deterioration in condition is detected. Such monitoring shall cover all pertinent features and property including, but not limited to, buildings, structures, roads, pathways, walls, fences, slopes, light poles, sewers, culverts and landscaped areas.

.3 The Departmental Representative may, but shall not be obligated to, survey and record the condition of the Work Site and of property on or adjoining the Work Site prior to the commencement of construction by the Contractor. If requested and available, the Departmental Representative will provide a copy of the survey records to the Contractor for reference.

.4 Whenever supplied with survey records, the Contractor shall satisfy itself as to the accuracy and completeness of the survey records provided by the Departmental Representative for any area before commencing construction in that area.

.5 Commencement of construction in any area shall be interpreted to signify that the Contractor has accepted such survey records as being a true record of the existing conditions prior to construction.

.6 The provision of the records of a survey of existing conditions by the Departmental Representative shall in no way limit or restrict the Contractor’s responsibility to exercise proper care to prevent damage to all property within or adjacent to the Work Site, whether all such property is covered by the survey or not.

1.6 PROTECTION OF PERSONS AND PROPERTY

.1 The Contractor shall comply with all applicable safety regulations of WorkSafe AB and the Workers Compensation Act of British Columbia and Alberta including, but not limited to, Occupational Health and Safety Regulations and General Safety Regulations. Within the Site, the Contractor has all the responsibilities of an "employer" under the Workers Compensation Act and the Occupational Health and Safety Regulation and is designated as the "Prime Contractor". Other contractors will be working within the limits of construction of this project.

.2 Prime Contractor must comply with Workers Compensation Act and Occupational Health and Safety Regulation Section 20.3 Coordination of multiple employer workplaces.

.3 Comply with all applicable safety regulations of the Workers' Compensation Board of Alberta (WCB) including, but not limited to, WCB's Industrial Health and Safety Regulations, Industrial First Aid Regulations, and Workplace Hazardous Materials Information System Regulations, when working in that province.

.4 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

.5 The Contractor shall take all necessary precautions and measures to prevent injury or damage to persons and property on or near the Work Site.

.6 The Contractor shall promptly take such measures as are required to repair, replace or compensate for any loss or damage caused by the Contractor to any property or, if Parks Canada so directs, shall promptly reimburse to Parks Canada the costs resulting from such loss or damage.

.7 The Contractor shall be aware that there will be road work at the bottom run of Mountain Ave in September 2018 so short duration delays are expected throughout the day for a duration of about 2 weeks.

1.7 USE OF PUBLIC AREAS

.1 Off-road construction equipment will not be allowed outside the project limit of work, material loading areas, or alternate sites as designated and approved by the Departmental Representative.

.2 Asphalt, granular, embankment and excavation materials may be hauled on existing highway, but this shall be by standard highway trucks not exceeding legal highway load limits unless accepted in writing by the Departmental Representative.

.3 Flag persons shall be provided when vehicles are entering or exiting Work Site access points.

.4 The Contractor shall ensure that its vehicles and equipment do not cause nuisance in public areas. Access and egress locations for the site shall have rig matting if work is to be completed during wet periods. All vehicles and equipment leaving the Work Site and entering public roadways shall be cleaned of mud and dirt clinging to the body and wheels of the vehicle. All vehicles arriving at or leaving the Work Site and transporting materials shall be loaded in a manner that will prevent dropping of materials or debris on

the roadways and, where contents may otherwise be blown off during transit, such loads shall be covered by tarpaulins or other suitable covers. Spills of materials in public areas shall be removed or cleaned immediately by the Contractor at no cost to the Owner. Heavy equipment work shall not be done during saturated ground conditions, as directed by the Departmental Representative. All activities shall be in accordance with Section 01 35 43 – Environmental Procedures and the Environmental Protection Plan prepared for the project.

1.8 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.

1.9 SUPERVISORY PERSONNEL

.1 When requesting a Preconstruction Meeting, in accordance with Section 01 31 00 - Project Management and Coordination, the Contractor shall submit to the Departmental Representative confirmation of the names of the supervisory personnel and other key staff designated for assignment on the Contract.

.2 At a minimum, the following personnel shall be included in the list:

- .1 Contractor Manager
- .2 Project Superintendent;
- .3 Safety Representative;
- .4 Quality Control Manager;
- .5 Environmental Representative;
- .6 Traffic Control Representative;

.3 The above personnel shall perform the following duties:

- .1 Contractor Manager with full authority, as agent of the Contractor, to act on behalf of and legally bind the Contractor in connection with the Work and the Contract. The Contractor may, at its discretion, appoint one person as both Contractor Manager and Project Superintendent.
- .2 The Project Superintendent shall be employed full time with full authority to supervise the Work, who shall be directly available to the Department Representative during all active periods of Work. Either they or their designated deputy shall be present on the Work Site each and every workday that Work is being performed, from the commencement of Work to Total Performance of the Work.
- .3 The Project Superintendent shall nominate a Deputy Project Superintendent who shall have the authority of the Project Superintendent during the latter's absence.
- .4 The Safety Representative shall possess a minimum of 2 years' construction safety supervisory experience. Their duties shall encompass all matters of safety activities from commencement of Work until the Total Performance of the Work.
- .5 The Quality Control Representative shall be responsible for the development, implementation and execution of the Quality Management Plan and shall be the single point of contact for all quality related queries.

.6 The Traffic Control Representative shall be responsible for the development, implementation and execution of the Traffic Management Plan and shall be the single point of contact for all traffic control related queries.

.7 The Environmental Representative shall be responsible for the development, implementation and execution of the Environmental Protection Plan and shall be the single point of contact for all environmental related queries.

1.10 WASTE DISPOSAL

.1 All surplus, unsuitable and waste materials shall be removed from the Work Sites to approved sites outside the National Parks. Refer to Section 01 35 43 - Environmental Procedures.

.2 Deposit of any construction debris into any waterway is strictly forbidden.

.3 Cost for Waste Disposal described above shall be considered incidental to the Unit Price items and no additional payment will be made.

.4 Three “Bear Proof” garbage containers will be provided by PCA in accordance with Section 01 74 00 - Cleaning.

1.11 **WORK STOPPAGE**

.1 Give precedence to safety and health of public and site personnel and protection of the environment over cost and schedule considerations for Work.

END OF SECTION

Part 1 General

1.1 MEASUREMENT FOR PAYMENT

.1 For each unit price item, Departmental Representative will calculate payment based on tendered unit price and Departmental Representative's determination of units of work item completed.

.2 For lump sum price item, Departmental Representative will calculate payment based on tendered price and Departmental Representative's estimate of percentage of work item completed.

.3 Where a method of measurement for payment for a work item is not specified, payment for that item will be deemed to be incidental to the contract price.

.4 For each unit price item that requires survey for quantity verification, the Contractor shall submit all supporting survey data in electronic format to the Departmental Representative at least 7 days before submission of progress payment.

Part 2 Products

NOT USED

Part 3 Execution

This section prescribes the measurement and payment for items of Work described in the lump sum and unit rate price table. The measurement and payment clauses shall be read in conjunction with the various items of work listed in the lump sum and unit rate price table.

.1 General Requirements

.1 Mobilization and Demobilization

Payment for this item shall be compensation in full for costs of mobilization; permits; moving personnel, equipment, fencing, safety measures, and materials to the site; setting up temporary facilities; public notices; storage of materials; all preparation for performing the work; full demobilization of the above; site clean-up; site restoration; and costs associated with the warranty period.

Payment: Lump sum price bid.

Measurement: 25% of the lump sum will be included in the mobilization of fall 2018; 25% of the lump sum will be included in the demobilization of winter 2018; 25% of the lump sum will be included in the remobilization of spring 2019; 25% of the lump sum will be included in the final progress payment certificate; Mobilization/ demobilization will only be paid for as noted, regardless of the

number of times the Contractor mobilizes and demobilizes, due to any condition or circumstance.

.2 Demolition

.1 Clearing and Grubbing

Payment for this item shall be compensation in full for all clearing and grubbing of trees, stock piling, chipping, excavating, loading, removal and disposal to an approved disposal site of all roots, stumps, trees, limbs, brush, or other non-salvageable materials; all labour, permitting, equipment and materials required to complete the work; clean up, and any incidental work for which payment is not specified elsewhere.

Payment: Lump sum price bid.

Measurement: Lump sum payable based on the percentage of work complete.

.2 Paving Removal

Payment for this item shall be compensation in full for sawcutting, removal, hauling and disposing of asphaltic concrete pavement and granular base courses regardless of thicknesses to an approved disposal site; all labour, equipment and materials required to complete the work; clean up; and any other incidental work for which payment is not specified elsewhere.

Payment: Unit price bid per square meter of paving removed.

Measurement: Area shall be calculated from surveyed topography completed by the Contractor, with survey data submitted to the Departmental Representative for verification.

.3 Asphalt Cold Milling

Payment for this item shall be compensation in full for sawcutting, loading, hauling, off-site disposal, removal of asphalt and/or aggregate cuttings, milling flush to all gutter or other obstructions, all labour, equipment and materials required to complete the work; clean up; and any other incidental work for which payment is not specified elsewhere.

Payment: Unit price bid per square meter of asphalt milled.

Measurement: Area shall be calculated from surveyed topography completed by the Contractor.

.4 Remove, Salvage, and Dispose Existing Features

Payment for this work comprises the following items:

.4.1 Remove and Disposal of Existing Street Light

Payment for this item shall be full compensation for all materials, labour and equipment required for the removal and disposal of existing street light, including base, pole and

luminaires, cable exposed during the removal process, filling remaining area with bedding material, backfilling with compacted native material, rehabilitation of disturbed area to match immediate surrounding terrain, cleaning and all work incidental to the removal and disposal work. Each unit consist of an assembly of one base, one pole and one or more luminaires.

.4.2 Remove and Relocate Existing Traffic Signs

Payment for this item shall be compensation in full for the supply of all equipment, material and labour required to remove, and relocate signs as directed by the Departmental Representative, including concrete bases, posts and all hardware associated with the signs; backfilling with compacted native material, rehabilitation of disturbed area to match immediate surrounding terrain, cleaning; and all labour, equipment and materials required to complete the work; and any other incidental work for which payment is not specified elsewhere.

.4.3 Remove and Dispose Existing Traffic Signs

Payment for this item shall be compensation in full for the supply of all equipment, material and labour required to remove, and dispose signs as directed by the Departmental Representative, including concrete bases, posts and all hardware associated with the signs; backfilling with compacted native material, rehabilitation of disturbed area to match immediate surrounding terrain, cleaning; and all labour, equipment and materials required to complete the work; and any other incidental work for which payment is not specified elsewhere.

.4.4 Remove and Relocate Existing Information Signs

Payment for this item shall be compensation in full for the supply of all equipment, material and labour required to remove and relocate the information sign, including concrete bases, posts and all hardware associated with the signs; backfilling with compacted native material, rehabilitation of disturbed area to match immediate surrounding terrain, cleaning; and all labour, equipment and materials required to complete the work; and any other incidental work for which payment is not specified elsewhere.

.4.5 Remove and Dispose Existing Information Signs

Payment for this item shall be compensation in full for the supply of all equipment, material and labour required to remove and dispose the information sign, including concrete bases, posts and all hardware associated with the signs; backfilling with compacted native material, rehabilitation of disturbed area to match immediate surrounding terrain, cleaning; and all labour, equipment and materials required to complete the work; and any other incidental work for which payment is not specified elsewhere.

.4.6 Remove and Dispose Concrete Curb and Concrete Paving

Payment for this item shall be compensation in full for the supply of all equipment, material and labour required including saw cut of adjacent asphalt and/or concrete, removal, hauling and disposing of concrete curb and concrete paving (sidewalk), removal and disposal of any debris; backfilling with compacted native material, rehabilitation of disturbed area to match immediate surrounding terrain, cleaning; and all labour, equipment and materials required to

complete the work; and any other incidental work for which payment is not specified elsewhere.

.4.7 Remove and Dispose Retaining Concrete Blocks

Payment for this item shall be compensation in full for the supply of all equipment, material and labour required including saw cut of adjacent asphalt and/or concrete, removal, hauling and disposing of concrete blocks, removal and disposal of any debris; backfilling with compacted native material, rehabilitation of disturbed area to match immediate surrounding terrain, cleaning; and all labour, equipment and materials required to complete the work; and any other incidental work for which payment is not specified elsewhere.

.4.8 Remove and Dispose Jersey Barrier

Payment for this item shall be compensation in full for the supply of all equipment, material and labour required including removal, hauling and disposing of concrete Jersey barrier, removal and disposal of any debris. All labour, equipment and materials required to complete the work; and any other incidental work for which payment is not specified elsewhere.

.4.9 Remove and Relocate Interpretive Feature

Payment for this item shall be compensation in full for the supply of all equipment, material and labour required including removal, hauling and relocation of interpretive feature, removal and disposal of any debris. All labour, equipment and materials required to complete the work; and any other incidental work for which payment is not specified elsewhere.

.4.10 Existing Concrete Vault and CSP Trough Demolition and Disposal

Payment for this item shall be compensation in full for demolition of the concrete vault and the CSP trough, coordination with Parks Canada Agency for the demolition of the process; loading, hauling and disposal of the demolished vault and trough; protection of surface features, structures, and appurtenances, backfilling and grading; all labour, equipment and materials required to complete the work; clean up; and any other incidental work for which payment is not specified elsewhere.

.4.11 Relocate Existing Benches, Waste Receptacles and Planters

Payment for this item shall be compensation in full to remove and store the existing benches, waste receptacles and planters, demolishing and disposing of the existing base and all associated materials to an approved disposal site; re-install benches, waste receptacles and planters as shown on the drawings including anchors; backfilling with compacted native material, rehabilitation of disturbed area to match immediate surrounding terrain, cleaning; and all labour, equipment and materials required to complete the work; and any other incidental work for which payment is not specified elsewhere.

.4.12 Salvage Existing Boulders

Payment for this item shall be compensation in full for labour and equipment required to relocate salvaged boulders onsite and placement as specified and shown on the drawings.

.4.13 Remove and Dispose Existing fence

Payment for this item shall be compensation in full to remove and dispose the existing fence, demolishing and disposing of the existing base and all associated materials to an approved disposal site; backfilling with compacted native material, rehabilitation of disturbed area to match immediate surrounding terrain, cleaning; and all labour, equipment and materials required to complete the work; and any other incidental work for which payment is not specified elsewhere.

.4.14 Remove and Relocate Existing Flag Pole

Payment for this item shall be compensation in full for the supply of all equipment, material and labour required to remove and relocate the flag pole, including concrete bases, posts and all hardware associated with the pole. All labour, equipment and materials required to complete the work; and any other incidental work for which payment is not specified elsewhere.

.4.15 Remove and Dispose or Relocate Existing Delineators

Payment for this item shall be compensation in full to remove and dispose the existing damaged delineators and post foundations and all associated materials to an approved disposal site; remove and relocate the existing delineators and post foundations in good shape; all labour, equipment and materials required to complete the work; clean up; and all other incidental work for which payment is not specified elsewhere.

Payment: Lump sum price bid.

Measurement: Lump sum payable based on the percentage of work complete.

.3 Building

.1 Supply and Install Concrete Retaining wall

Payment for this item shall be compensation in full for the supply and install of concrete retaining wall in accordance with the contract documents, including excavation, subgrade preparation, weeping tile, granular base and compaction, formwork, concrete, supply and placement of all materials, reinforcing, finish curing and sealing, rundle stone veneer and capstones, mortar and associated accessories, backfilling; all labour, equipment and materials required to complete the work; cleanup; and all other incidental work for which payment is not specified elsewhere.

Payment: Unit price bid per linear meter of wall installed.

Measurement: Field measured along wall line.

.4 Infrastructure

.1 Supply and Install Maintenance Hole (Manhole)

Payment for this item shall be compensation in full for confirmation and locates of existing utilities, excavation, all necessary surface removal; offsite hauling and disposal of removed materials; shoring; de-watering; trench maintenance; supplying and installing of manhole; supplying, installing and adjusting to final grade of manhole frames and covers of the type specified; flushing; backfilling with approved material and compacting to the specified density beyond the standard trench, topsoil placement; seeding; clean up; all labour, equipment and materials required to complete the work; and any other incidental work for which payment is not specified elsewhere.

Payment: Unit price bid per each manhole.

Measurement: Each.

.2 Supply and Install Catchbasin

Payment for this item shall be compensation in full for confirmation and locates of existing utilities, excavation, all necessary surface removal; offsite hauling and disposal of removed materials; shoring; de-watering; trench maintenance; supplying and installing of catchbasin; supplying, installing and adjusting to final grade of catchbasin frames and covers of the type specified; flushing; backfilling with approved material and compacting to the specified density beyond the standard trench, topsoil placement; seeding; clean up; all labour, equipment and materials required to complete the work; and any other incidental work for which payment is not specified elsewhere.

Payment Unit price bid per each catchbasin

Measurement: Each.

.3 Supply and Install Curb Inlet

Payment for this item shall be compensation in full for confirmation and locates of existing utilities, excavation, all necessary surface removal; offsite hauling and disposal of removed materials; supplying and installing of curb inlet; supplying, installing and adjusting to final grade of pavement, tie to existing or new outfall; backfilling with approved material and compacting to the specified density behind the back of walk, topsoil placement; seeding; clean up; all labour, equipment and materials required to complete the work; and any other incidental work for which payment is not specified elsewhere.

Payment: Unit price bid per each curb inlet installed.

Measurement: Each.

.4 Supply and Install Culvert 450 mm diameter

Payment for this item shall be compensation in full for the supply and installation of all culvert pipe materials, including excavation, couplers and appurtenances, preparing the culvert bed, installing the pipe, backfilling, the supply and placement of hand laid riprap. All labour, equipment, material; clean up; and any other incidental work for which payment is not specified elsewhere.

Payment: Unit price bid per linear meter of culvert installed.

Measurement: Field measured along culvert.

.5 Supply and Install 450 mm PVC Pipe

The unit price bid for "450 mm dia. SDR 35 PVC Pipe" shall be considered full compensation for all materials, labour and equipment required for the installation of storm sewer line including: confirmation of existing tie-in inverts, supplying, loading, hauling, unloading of pipe, trenching to the required depth, supply and placement of granular bedding material, pipe installation to the specified line and grade, backfilling to roadway subgrade elevation, trench compaction, disposal of excess materials off site, connection to manholes and catch basins, and all work incidental to the completed installation of storm sewer line. Unit rate shall include the supply and installation of bedding a minimum of 300 mm above the top of pipe and 100 mm below invert of pipe.
Pipe will be measured horizontally, along the top of the pipe, from centreline of connection to centreline of connection.

Payment: Unit price bid per linear meter of pipe installed.

Measurement: Field measured along pipe.

.6 Remove Ex. Supply and Install New Catchbasin Grate and Top

Payment for this item shall be compensation in full for confirmation and locates of existing utilities, excavation, all necessary surface removal including existing catchbasin frame, grate and top; offsite hauling and disposal of removed materials; supplying and installing of catchbasin grate, frames and covers of the type specified and top to match final pavement elevation; flushing; backfilling with approved material and compacting to the specified density beyond the standard trench, topsoil placement; seeding; clean up; all labour, equipment and materials required to complete the work; and any other incidental work for which payment is not specified elsewhere.

Payment: Unit price per each catchbasin frame installed.

Measurement: Each.

.7 Supply and Install Gabion Mattress

The unit price bid for "Gabion Mattress" shall be considered full compensation for all materials, labour and equipment required to assembled and placed into position according to the contract drawings gabion mattress. Lacing wire or alternative fasteners shall be used to secure each unit to the adjoining one along the vertical reinforcement edges and the top selvedges. The base shall be tighly fastened and pinned to the ground and the lid shall be

secured with approved closure tool to ensure proper closure without excessive mesh deformation.

Payment: Unit price per square meter of Gabion Mattress

Measurement: Field measured area.

.8 Supply and Install Wood Fence

Payment for this item shall be compensation in full for supply and install of the fence in accordance with the contract documents. All labour, equipment, material; cleanup; and any other incidental work for which payment is not specified elsewhere.

Payment: Unit price bid per linear meter of fence installed.

Measurement: Field measured along fence line.

.9 Supply and Install Handrail

Payment for this item shall be compensation in full for supply and install of the fence in accordance with the contract documents. All labour, equipment, material; cleanup; and any other incidental work for which payment is not specified elsewhere.

Payment: Unit price bid per linear meter of fence installed.

Measurement: Field measured along handrail line.

.10 Install Monument and Plaques

Payment for this item shall be compensation in full for install of the monument and associated plaques; supply and install concrete bases in accordance with the contract documents. All labour, equipment, material; cleanup; and any other incidental work for which payment is not specified elsewhere.

Payment: Lump sum price bid.

Measurement: Lump sum payable based on the percentage of work complete.

.5 Earth and Surface Works

1. Strip Existing Vegetation and Topsoil

Payment for this item shall be compensation in full for the clearing and grubbing, stripping of surface vegetation (grass), separating vegetation from topsoil and disposing of vegetation at an approved disposal site, stockpiling all topsoil onsite for reuse; all labour, equipment and materials required to complete the work; cleanup; and all other incidental work for which payment is not specified elsewhere.

Payment: Unit price bid per square metre of stripping

Measurement: Field measured area.

.2 Rough Grading

.1 Common Excavation

Payment for this item shall be compensation in full for excavation, removal, hauling, placing at stockpile, compaction at stockpile, any dewatering required before or during construction, levelling, grading, moisture conditioning, hauling to site for backfill, compacting of native fill. Labour, equipment and materials required to complete the work; clean up; and any other incidental work for which payment is not specified elsewhere.

Stripped ground survey must be completed prior to commencing grading activities. Survey data to encompass entire working limit for each alignment.

Payment: Unit price bid per cubic meter of material excavated and stockpiled.

Measurement: Volumes shall be calculated by surveyed cross sections completed by the Contractor and differential digital terrain models (DTMs) developed to calculate volume.

.2 Fill

Payment for this item shall be compensation in full for hauling, placing, compacting, moisture adjustment and finishing of materials in embankments. Labour, equipment and materials required to complete the work; clean up; and any other incidental work for which payment is not specified elsewhere.

Payment: Unit price bid per cubic meter of fill.

Measurement: Volumes shall be calculated by surveyed cross sections completed by the Contractor and differential digital terrain models (DTMs) developed to calculate volume.

.3 Supply and Install Granular Sub-Base Course

Payment for this item shall be compensation in full for supplying, loading, hauling, unloading, placement, levelling and compacting to the specified thickness and density; all labour, equipment and materials required to complete the work; clean up; and any other incidental work for which payment is not specified elsewhere.

Payment: Unit price bid per ton of granular subbase course supplied and installed.

Measurement: Tonnage will be verified by providing copies of the trucking tickets to the Departmental Representative.

.4 Supply and Install Asphalt Paving

Payment for this item shall be compensation in full for supply of all equipment, material and labour required for the preparation of the mix design and mix formula, the supply and placing of a prime coat and/or tack coat as required, supply of aggregates and asphalt cement, mixing, transporting, placing, spreading, compacting the asphalt concrete to the specified thickness and density. All labour, equipment and materials required to complete the work; clean up; and any other incidental work for which payment is not specified elsewhere. Construction joints and adjustment of all utility structures to final elevations will be considered incidental to paving.

Payment: Unit Price bid per ton of hot mix asphalt concrete measured in place.

Measurement: Tonnage will be verified by providing copies of the trucking tickets to the Departmental Representative.

.5 Supply and Install Curb and Gutter or Curb

.1 Supply and Install Concrete Curb Type A (Standard Curb)

Payment for this item shall be compensation in full for the supply and installation of curb type A, including excavation and rough grading, subgrade preparation, granular base and compaction, supply and placement of all materials, jointing, reinforcing, finish curing and sealing; all labour and all other incidental work for which payment is not specified elsewhere.

Payment: Unit price bid per linear meter of curb type A installed.

Measurement: Field measured along curb line.

.2 Supply and Install Concrete Curb Type B (Mountable Curb)

Payment for this item shall be compensation in full for the supply and installation of curb type B, including excavation and rough grading, subgrade preparation, granular base and compaction, supply and placement of all materials, jointing, reinforcing, finish curing and sealing; all labour and all other incidental work for which payment is not specified elsewhere.

Payment: Unit price bid per linear meter of curb type B installed.

Measurement: Field measured along curb line.

.3 Supply and Install Concrete Curb Type C (Low Profile Rolled Curb with Gutter)

Payment for this item shall be compensation in full for the supply and installation of curb type C; including protection of newly paved asphalt concrete pavement, excavation and rough grading, subgrade preparation, granular base and compaction, supply and placement of all materials, jointing, reinforcing, finish curing and sealing; all labour, and any other incidental work for which payment is not specified elsewhere.

Payment: Unit price bid per linear meter of curb type C installed.

Measurement: Field measured along curb line.

.4 Supply and Install Concrete Curb Type D (Standard Curb & Gutter)

Payment for this item shall be compensation in full for the supply and installation of curb type D; including all saw cutting and all necessary surface removal, protection of newly paved asphalt concrete pavement, excavation, sub- grade preparation, placement of granular materials, formwork, supply and placing of concrete, doweling for tie-in, jointing, reinforcing, finishing, curing, sealing and backfilling, surface restoration; all labour, grading behind concrete structure and any other incidental work for which payment is not specified elsewhere.

Payment: Unit price bid per linear meter of curb type D installed.

Measurement: Field measured along curb line.

.6 Supply and Install Concrete Paving Type A

Payment for this item shall be compensation in full for the supply and installation of concrete paving type A, including excavation and rough grading, subgrade preparation, granular base and compaction, formwork, concrete, supply and placement of all materials, jointing, reinforcing, finish curing and sealing; all labour equipment and materials required to complete the work; cleanup; and all other incidental work for which payment is not specified elsewhere.

Payment: Unit price bid per square metre of Concrete Paving type A.

Measurement: Field measured area.

.7 Supply and Install Concrete Paving Type B

Payment for this item shall be compensation in full for the supply and installation of concrete paving type B, including excavation and rough grading, subgrade preparation, granular base and compaction, formwork, concrete, supply and placement of all materials,

jointing, reinforcing, finish curing and sealing; all labour, and all other incidental work for which payment is not specified elsewhere.

Payment: Unit price bid per square metre of Concrete Paving Type B.

Measurement: Field measured area.

.8 Premium for Curb Letdowns

Payment for this item shall be compensation in full for additional concrete forming and finishing required for wheel chair ramps.

Payment: Unit price bid per each letdown installed.

Measurement: Field survey of each letdown installed.

.9 Supply and Install Retaining Concrete Blocks

Payment for this item shall be compensation in full for the supply and installation of precast retaining concrete blocks; including all saw cutting and all necessary surface removal, protection of newly paved asphalt concrete pavement, excavation, subgrade preparation, placement of granular materials, supply and placing of concrete blocks, doweling for tie-in, jointing, reinforcing, finishing, curing, sealing and backfilling, surface restoration; all labour, grading behind concrete structure and any other incidental work for which payment is not specified elsewhere.

Payment: Unit Price bid per lineal meter for each type of retaining concrete blocks installed.

Measurement: Field measured for length of retaining concrete blocks.

.10 Supply and Install Low Profile Concrete Barrier

Payment for this item shall be compensation in full for the supply and installation of movable low profile concrete barrier; including protection of newly paved asphalt concrete pavement, supply and placing of low profile barrier; all labour, and any other incidental work for which payment is not specified elsewhere.

Payment: Unit Price bid per lineal meter for each type of low profile barrier installed.

Measurement: Field measured for length of barrier.

.11 Install Jersey Barrier

Payment for this item shall be compensation in full for the installation of relocated Jersey barriers as shown on the Contract drawings. All labour, equipment, material; clean up; and any other incidental work for which payment is not specified elsewhere.

Payment: Unit price bid per linear meter of Jersey barrier installed.

Measurement: Field measured along the Jersey barrier.

.12 Restore Existing Gravel Areas

Payment for this item shall be compensation in full for all materials, labour and equipment required to restore existing granular surfacing damaged during construction. Includes any subgrade preparation, supply and placement of granular to match existing, and all other incidental work for which payment is not specified elsewhere.

Payment: Lump sum price bid.

Measurement: Lump sum payable based on the percentage of work complete.

.6 Traffic Control Features

Payment for this item comprises all the following items:

.1 Supply and Install Traffic Signs

Payment for this item shall be compensation in full for the supply and installation of permanent traffic signage; submission of sign proof for review and acceptance, posts and preparation work, post installation, movable base; mounting hardware, surface restoration; all labour, equipment and materials required to complete the work; clean up; and any other incidental work for which payment is not specified elsewhere. The movable base can be ordered from ATS Traffic (https://store.atstraffic.ca/) or an equivalent product to the satisfaction of the Departmental Representative can be used.

.2 Install Information Signs

Payment for this item shall be compensation in full for the installation of the Client provided information signage and posts; installation of post; post excavation; supply and installation of concrete; mounting hardware; surface restoration; all labour, equipment and materials required to complete the work; clean up; and any other incidental work for which payment is not specified elsewhere.

.3 Supply and Install Delineator

Payment for this item shall be compensation in full for the supply and installation of delineator and post foundation; all labour, equipment and materials required to complete the work; clean up; and any other incidental work for which payment is not specified elsewhere.

.4 Pavement Marking

Payment for this item shall be compensation in full for the supply and painting of all pavement markings including longitudinal and transverse marking lines, parking stalls, gored areas, “no parking” areas, zebra crosswalks and directional arrows; all labour, equipment and materials required to complete the work; clean up; and any other incidental work for which payment is not specified elsewhere.

Payment for all Traffic Control Features: Lump sum price bid.

Measurement for all Traffic Control Features: Lump sum payable based on the percentage of work complete.

.7 Landscaping

1. Topsoil Placement

Payment for this item shall be compensation in full for the topsoil placement and fine grading of all shrub beds and seeded areas including all loading and hauling any stockpiled topsoil available for reuse, importing topsoil from offsite source as required, excavation, rough grading and placement to specified depths, fine grading and shaping, finishing, floating, removal or rocks and debris, nutrient testing of topsoil, soil amendments as required; all labour, equipment and materials required to complete the work; clean up; and any other incidental work for which payment is not specified elsewhere.

Payment: Unit rate payment per cubic metre.

Measurement: Field Measured area.

2. Supply and Install #2 Cont. Shrubs

Payment for this item shall be compensation in full for the supply and installation of #2 container shrubs including transportation and planting per contract documents; all labour equipment and materials required to complete the work; cleanup; watering and maintenance prior to CCC.

Payment: Unit price bid per each shrub installed

Measurement: Field survey of each shrub installed.

3. Supply and Install Seed

Payment for this item shall be full compensation for seeding, including preparing seed bed, applying seed and all incidental work for which payment is not specified elsewhere; all labour equipment and materials required to complete the work; cleanup; watering and maintenance prior to CCC.

Payment: Unit price bid per square metre.

Measurement: Field measured area.

4. Supply and Install Rundle Rock Mulch

Payment for this item shall be compensation in full for the supply and installation of rundle rock mulch in accordance with the details and depths specified; all labour equipment and materials required to complete the work; cleanup; and all incidental work for which payment is not specified elsewhere.

Payment: Unit price bid per square metre.

Measurement: Field survey.

5. Supply and Install Rundle Stone Boulders

Payment for this item shall be compensation in full for the supply and install of rundle stone boulders including subgrade preparation, transportation and placement; all labour, equipment and materials required to complete the work; cleanup; and all incidental work for which payment is not specified elsewhere.

Payment: Unit rate payment per boulder installation

Measurement: Field survey of each boulder installed.

6. Exterior Landscape Maintenance

Payment for this item shall be compensation in full for all materials, labour and equipment required to establish and maintain all soft landscape areas including remedial work or replacement of any soft landscaping that may have died or otherwise been rejected by the Consultant starting from CCC acceptance for a period of two growing seasons.

Payment: Lump sum price bid.

Measurement: Lump sum payment shall be distributed in progress payment throughout each growing season.

.8 Electrical

.1 **Distribution Enclosure - Supply and Install**

Payment for this item shall be full compensation for supplying and installing all materials necessary to provide the distribution enclosure and control equipment of the street lighting system according to the Drawings and Special Provisions. This shall also include supply and installation of the concrete pad and sand bedding, supply and installation of specified grounding system, electrical panel, breakers, photocell, energization, and the complete system testing and certification.

Payment: Unit price bid for Distribution Enclosure

Measurement: Each.

.2 **Secondary Cable - Supply and Install – 1C #12 RW90**

Payment for this item shall be full compensation for all materials, labour and equipment required for the installation of cables and required terminations; fittings, connections. Payment will be made for phase and neutral conductors. Bonding wire is considered incidental to complete the Work, no additional payment will be made.

Payment: Unit Price bid per linear meter.

Measurement: Field measured along centerline of trench.

.3 **Secondary Cable - Supply and Install – 1C #10 RW90**

Payment for this item shall be full compensation for all materials, labour and equipment required for the installation of cables and required terminations; fittings, connections. Payment will be made for phase and neutral conductors. Bonding wire is considered incidental to complete the Work, no additional payment will be made.

Payment: Unit Price bid per linear meter.

Measurement: Field measured along centerline of trench.

.4 **Secondary Cable - Supply and Install – 1C #8 RW90**

Payment for this item shall be full compensation for all materials, labour and equipment required for the installation of cables and required terminations; fittings, connections. Payment will be made for phase and neutral conductors. Bonding wire is considered incidental to complete the Work, no additional payment will be made.

Payment: Unit Price bid per linear meter.

Measurement: Field measured along centerline of trench.

.5 **Secondary Cable - Supply and Install – 1C #6 RWU90**

Payment for this item shall be full compensation for all materials, labour and equipment required for the installation of cables and required terminations; fittings, connections. Payment will be made for phase and neutral conductors. Bonding wire is considered incidental to complete the Work, no additional payment will be made.

Payment: Unit Price bid per linear meter.

Measurement: Field measured along centerline of trench.

.6 **Underground Electrical Conduit - Supply and Install - Trench Excavation**

Payment for this item shall be full compensation for excavating and preparing the base, supplying, hauling and placing select backfill material, supplying and installing one run of conduit, including all materials, fittings, pull boxes, backfilling, compacting, site restoration, traffic accommodation, and all labour, equipment, tools and incidentals necessary to complete the Work.

Payment: Unit Price bid per linear meter of trench installed.

Measurement: Field measured along centerline of trench.

.7 **Underground Electrical Conduit - Supply and Install – Existing Trench**

Payment for this item shall be full compensation for supplying and installing additional conduit in existing trench, all materials, fittings, pull boxes, and all labour, equipment, tools and incidentals necessary to complete the Work.

Payment: Unit Price bid per linear meter of conduit installed.

Measurement: Field measured along centerline of trench.

.8 **Underground Electrical Conduit - Supply and Install – Retaining wall**

Payment for this item shall be full compensation for supplying and installing one run of conduit embedded in the retaining wall, including all materials, fittings, pull boxes, backfilling, compacting, site restoration, traffic accommodation, and all labour, equipment, tools and incidentals necessary to complete the Work.

Payment: Unit Price bid per linear meter of conduit installed.

Measurement: Field measured along centerline of retaining wall.

.9 **Street Light Bases – Poles – Supply and Install**

Payment for this item shall be full compensation for supplying pre-cast bases, all excavation for the installation, disposal of soil, supply, placement and compaction of the sand bedding, supply and placement of concrete, rebar and anchor bolts, supply of concrete forms (if necessary), tamping, leveling, installation, and all labour, materials, equipment, tools and incidentals necessary to complete the Work to the satisfaction of the Consultant.

Payment: Unit price bid for each Pole Base.

Measurement: Each.

.10 **Street Light Bases – Bollards – Supply and Install**

Payment for this item shall be full compensation for supplying pre-cast bases, all excavation for the installation, disposal of soil, supply, placement and compaction of the sand bedding, supply and placement of concrete, rebar and anchor bolts, supply of concrete forms (if necessary), tamping, leveling, installation, and all labour, materials, equipment, tools and incidentals necessary to complete the Work to the satisfaction of the Consultant.

Payment: Unit price bid for each Bollard Base.

Measurement: Each.

.11 **Street Light Bases – Bollards on Retaining Wall – Supply and Install**

Payment for this item shall be full compensation for supplying and placement of concrete, rebar and anchor bolts, supply of concrete forms (if necessary), tamping, leveling, installation, and all labour, materials, equipment, tools and incidentals necessary to complete the Work to the satisfaction of the Consultant.

Payment: Unit price bid for each Bollard base on retaining wall.

Measurement: Each.

.12 **Street Light Standard – 20ft Pole + LED Luminaire – Supply and Install**

Luminaires with different light distribution patterns will be paid at the same unit price. This payment shall be full compensation for supplying all materials, labor, equipment, tools and incidentals required to complete the installation, testing and commissioning of the pole, luminaire, wiring and accessories; including the provision of all facilities required by the Consultant for inspections of the street light standard.

Payment: Unit price bid for each Street Light Standard – Pole + Luminaire

Measurement: Each.

.13 **Street Light Standard – Bollard – Supply and Install**

Light bollards of different heights will be paid at the same unit price. Payment for this item shall be full compensation for supplying all materials, labor, equipment, tools and incidentals required to complete the installation, testing and commissioning of the pole, luminaire, wiring and accessories; including the provision of all facilities required by the Consultant for inspections of the street light standard.

Payment: Unit price bid for each Street Light Standard - Bollard

Measurement: Each.

.14 **102mm DB2 Conduit for Primary – Supply and Install**

Payment for this item shall be full compensation for all materials, labour, FortisAlberta coordination, and equipment required for the successful installation of conduits within the trench deemed, as acceptable by the FortisAlberta Field Coordinator.

Payment: Unit Price bid per linear meter of conduit installed.

Measurement: Field measured along centerline of conduit.

.15 **Trenching for Primary**

Payment for this item shall be full compensation for all materials, labour, FortisAlberta coordination, and equipment required for the successful installation of conduits and appropriate compaction, backfill and sand bedding within the trench, as deemed acceptable by the FortisAlberta Field Coordinator.

Payment: Unit Price bid per linear meter of trench installed.

Measurement: Field measured along centerline of trench.

.16 **Transformer Base c/w Grounding – Supply and Install**

Payment for this item shall be full compensation for all materials, labour, FortisAlberta coordination, and equipment required for the installation of each transformer base and associated grounding, as deemed acceptable by the FortisAlberta Field Coordinator.

Payment: Unit price bid for each transformer base installed.

Measurement: Each

.17 **Traffic Counter Loops – Supply and Install**

Payment for this item shall be full compensation for all materials, labour, and equipment required for the successful installation, testing and commissioning of the traffic signal loops.

Payment: Lump sum price bid.

Measurement: Lump sum payable based on the percentage of work complete.

END OF SECTION

Part 1 General

1.1 APPLICATIONS FOR PROGRESS PAYMENT

.1 Contractor's responsibilities:

.1 Make applications for payment on account monthly as Work progresses.

.2 Date applications for payment last day of agreed monthly payment period and ensure amount claimed is for value, proportionate to amount of Work performed and products delivered to place of work at that date.

.3 Submit progress payment application to Departmental Representative within five (5) working days after each month end.

.4 Progress payment application to show estimate of percentage of work completed against each item of Lump Sum Price Breakdown.

.5 Progress payment application to include all labour and materials incorporated in Work and all materials stored at site.

.6 Progress payment application to include all agreed extras and deductions.

.7 Supply electronic copy of documentation to support payment application for materials on site in the form of itemized lists or unpriced purchase orders showing quantities.

.8 Supply other evidence required by Department Representative in support of progress claim including survey data.

.2 Departmental Representative’s responsibilities:

.1 Review Contractor's payment application, prepare Progress Payment Certificate and issue to Parks Canada Agency within ten (10) working days following receipt of Contractor's payment application.

.2 Departmental Representative's estimate of percentage of work completed will govern calculation of payment on all Progress Payment Certificates.

.3 Inform Contractor of amendments to claim by copy of Progress Payment Certificate. This work shall be incidental to contract and will not be measured for payment.

1.2 SCHEDULE OF VALUES

.1 Provide schedule of values supported by evidence as Departmental Representative may reasonably direct and when accepted by Departmental Representative, be used as basis for applications for payment.

.2 Verify unit rate quantities with Departmental Representative on site.

.3 Include statement based on schedule of values with each application for payment.

.4 Support claims for products delivered to Place of Work but not yet incorporated into Work by such evidence as Departmental Representative may reasonably require to establish value and delivery of products.

1.3 PROGRESS PAYMENT

.1 Progress payment submission to the Departmental Representative should match the structure of the Bid and Acceptance form.

.2 Departmental Representative will issue to Owner, no later than ten (10) days after receipt of an application for payment, certificate for payment in amount applied for or in such other amount as Departmental Representative determines to be due. If Departmental Representative amends application, Departmental Representative will give notification in writing to the Contractor giving reasons for amendment.

1.4 CHANGE ORDERS

.1 Complete and promptly return all contemplated change notice requests issued by Departmental Representative, quoting unit and/or lump sum prices as requested. Include appropriate supporting documentation to verify prices.

.2 Do not proceed with work affected by price request until authorized to do so by Change Order.

.3 Make no change in Work unless Change Order issued. Change Order is only valid when signed by Departmental Representative and Contractor.

1.5 SUBSTANTIAL PERFORMANCE OF WORK

.1 Prepare and submit to Departmental Representative comprehensive list of items to be completed or corrected and apply for a review by Departmental Representative to establish Substantial Performance of Work or Substantial Performance of designated portion of Work. Failure to include items on list does not alter responsibility to complete Contract.

.2 Departmental Representative shall state date of Substantial Performance of Work or designated portion of Work in certificate.

.3 Immediately following issuance of certificate of Substantial Performance of Work, in consultation with Departmental Representative, establish reasonable date for finishing Work.

1.6 PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF WORK

.1 After issuance of certificate of Substantial Performance of Work:

.1 Submit application for payment of holdback amount or partial holdback amount as deemed appropriate by Departmental Representative.

.2 Submit statutory declaration that accounts for labour, subcontracts, products, construction machinery and equipment, and other indebtedness which may have been incurred in Substantial Performance of Work and for which Owner might in be held responsible have been paid in full, except for amounts properly retained as holdback or as identified amount in dispute.

.2 After receipt of application for payment and sworn statement, Departmental Representative will issue certificate for payment of holdback amount or partial holdback amount as recommended by consulting engineer.

1.7 PROGRESSIVE RELEASE OF HOLDBACK

.1 Refer to G.C 5 Terms of Payment.

1.8 FINAL PAYMENT

.1 Submit application for final payment when Work is completed.

.2 Departmental Representative will review Work to verify validity of application. Departmental Representative will give notification that application is valid or give reasons why it is not valid.

.3 Departmental Representative will issue final certificate for payment when application for final payment is found valid

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 MEASUREMENT AND PAYMENT PROCEDURES

.1 This Work shall be incidental to the Contract and will not be measured for payment.

1.2 CHANGES TO DESIGN

.1 If a change from the IFC design is accepted in writing by the Departmental Representative and agreed on by the Contractor, a design variance letter will be issued by the Departmental Representative. The design variance letter must state what changes are being made from the IFC design and what the method of measurement for payment will be, if varying from the Contract Documents.

.2 The design variance letter must be signed by both the Contractor's Representative and the

.3 Departmental Representative prior to performing the Work.

.4 The Departmental Representative reserves the right to use as-built survey or neat line measurements for payment if for any reason tolerances are not in accordance with the IFC design.

1.3 COORDINATION

.1 Perform coordination of progress schedules, submittals, use of site, temporary utilities, construction facilities, and construction Work, with progress of Work of other Contractors, and Work by Owner, under instructions of the Departmental Representative.

1.4 PROJECT MEETINGS

.1 During the course of the Work, the Contractor shall attend weekly construction meetings as scheduled, chaired, and documented by the Departmental Representative.

.2 The agenda will include among other things, general construction, payment, scheduling, risk, quality, environmental, and safety management items as well as any other reasonably requested by the parties.

.3 The Contractor shall provide physical space and make arrangements for meetings at or near the Work Sites for all meetings that take place in relation to the Contract from their mobilization until their demobilization.

.4 Meetings held outside of the time noted above (before mobilization or after demobilization) will either be held in the local PCA Field Unit offices, or at the Owner's site office, as notified by the Departmental Representative.

.5 The Contractor will attend or otherwise ensure the attendance of their staff, subcontractors, Departmental Representatives, suppliers, or other key parties all other meetings identified in the Contract or reasonably requested by the Departmental Representative in an effort to resolve specific issues as they may arise.

.6 Meetings will be called and chaired by the Departmental Representative as required. The Contractor shall be represented at such meetings to the satisfaction of the Departmental Representative.

.7 As described in Section 01 35 43 – Environmental Procedures, an environmental briefing for all staff will take place before beginning work at the site.

1.5 CONSTRUCTION ORGANIZATION AND START-UP

.1 Within seven (7) days after award of Contract, request a Preconstruction meeting of Contract Representatives to discuss and resolve administrative procedures and responsibilities. Meeting shall be chaired by the Departmental representative who will prepare the minutes of the meeting.

.2 Senior representatives of the Owner, Departmental Representative, Contractor, major subcontractors, field inspectors and supervisors are to be in attendance.

.3 Agenda to include following:

.1 Appointment of official representative of participants in Work.

.2 Schedule of Work, progress scheduling in accordance with Section 01 32 16 – Construction Progress Schedules.

.3 Schedule of submittals in accordance with Section 01 33 00 – Submittal Procedures.

.4 Requirements for temporary facilities, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 – Construction Facilities.

.5 Site safety and security in accordance with Sections 01 14 00 – Work Restrictions, 01 35 29 – Health and Safety Requirements, 01 52 00 – Construction Facilities and 01 35 43 – Environmental Procedures.

.6 Quality Control in accordance with Section 01 45 00 – Quality Control.

.7 Proposed changes, change orders, procedures, approvals required, mark-p percentages permitted, time extensions, overtime, and administrative requirements.

.8 Owner-furnished materials.

.9 Monthly progress claims, administrative procedures, photographs, and holdbacks.

.10 Closeout procedures and submittals in accordance with Sections 01 77 00 –

.11 Closeout Procedures and 01 78 00 – Closeout Submittals. Insurances and transcript of policies.

.12 Other business.

.4 Comply with Departmental Representative's allocation of mobilization areas of site, for field offices and sheds, and for access, traffic, and parking facilities.

.5 Prior to commencing construction, the Contractor will schedule an on-site meeting with the ESO to review EIA mitigations. A minimum of 7 days notice will be required for this meeting.

.6 During construction, coordinate use of site and facilities through Departmental Representative's procedures for intra-project communications: submittals, reports and records, schedules, coordination of Drawings, recommendations, and resolution of ambiguities and conflicts.

.7 Comply with instructions of the Departmental Representative for use of temporary utilities and construction facilities.

.8 Coordinate field Departmental Representative and layout work with the Departmental Representative.

1.6 ON-SITE DOCUMENTS

.1 Maintain at job site, one copy each of the following:

.1 Contract Drawings if part of tender
.2 Specifications
.3 Addenda
.4 Reviewed Shop Drawings and mix designs
.5 Change Orders
.6 Other modifications to Contract
.7 Traffic Management Plan
.8 Safety Plan
.9 WHMIS
.10 Environmental Protection Plan
.11 Quality Control Plan and field test reports
.12 Copy of accepted Work schedule and most recent updated schedule
.13 Labour conditions and wage schedules
.14 Equipment rate schedule and applicable versions of the relevant rate guides
.15 Applicable current editions of municipal regulations and by-laws

1.7 SUBMITTAL SCHEDULE

.1 In accordance with Section 01 33 00 – Submittal Procedures.

.2 Prepare a schedule of the required submissions and the date the submissions will be made. Include columns for Actual Date of Submission, Review Comments Received, Final Submission and Final Acceptance Received. Provide this schedule to the Departmental Representative in Excel format.

.3 The Owner will not be responsible for any construction delays resulting from delays in submission acceptance if the submittal dates shown in the Submittal Schedule are not achieved.

1.8 PROJECT SCHEDULES

.1 In accordance with Section 01 32 16 - Construction Progress Schedules.

1.9 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit requests for payment for review, and for transmittal to Departmental Representative. Payment request on last day of the month.

.3 Submit requests for interpretation of Contract Documents, and obtain instructions through Departmental Representative.

.4 Process substitutions through Departmental Representative.

.5 Process change orders through Departmental Representative.

1.10 CLOSEOUT PROCEDURES

.1 In accordance with Section 01 77 00 - Closeout Procedures.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

.1 The Departmental Representative will schedule and administer weekly project meetings throughout the progress of the Work.

.2 The Departmental Representative shall prepare agenda for meetings.

.3 The Departmental Representative will distribute notice of each meeting five days in advance of meeting date to Owner and the Contractor.

.4 The Contractor shall provide physical space to accommodate minimum six individuals and make arrangements for meetings.

.5 The Departmental Representative will preside at meetings.

.6 The Departmental Representative will record the meeting minutes, include significant proceedings and decisions and identify actions by parties.

.7 The Departmental Representative will reproduce and distribute copies of minutes after meetings and transmit to meeting participants and, affected parties not in attendance.

.8 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 PRECONSTRUCTION MEETING

.1 Within ten (10) days after award of Contract, the Departmental Representative will request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.

.2 Representatives from Parks Canada Agency, Contractor, major Subcontractors and Departmental Representative will be in attendance.

.3 The Departmental Representative will establish time and location of meeting and notify parties concerned minimum five days before meeting.

.4 Agenda to include:

.1 Appointment of official representative of participants in the Work.

.2 Schedule of Work in accordance with 01 32 16.07.

.3 Schedule of submission of Shop Drawings. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.

.4 Requirements for temporary facilities, offices, storage sheds, utilities, fences.

.5 Health and safety requirements.

.6 Traffic Accommodation Strategy.

.7 Environmental Protection Plan.

.8 Quality Management.

.9 Delivery schedule of specified equipment.

.10 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, administrative requirements.

.11 Owner provided products.

.12 Record Drawings in accordance with Section 01 33 00 - Submittal Procedures.

.13 Monthly progress claims, administrative procedures, photographs, hold backs.

.14 Appointment of inspection and testing agencies or firms.

.15 Insurances, transcript of policies.

1.3 PROGRESS MEETINGS

.1 During course of Work and one week prior to project completion, progress meetings will be scheduled weekly.

.2 Contractor, major Subcontractors involved in Work, Owner representative and Departmental Representative are to be in attendance.

.3 The Departmental Representatives will notify parties of confirmed attendance minimum four (4) days prior to meetings.

.4 The Departmental Representative will record minutes of meetings and circulate to attending parties and affected parties not in attendance within three (3) days after meeting.

.5 Agenda to include the following:

.1 Review, approval of minutes of previous meeting.

.2 Review of Work progress since previous meeting.

.3 Field observations, problems, conflicts.

.4 Problems which impede construction schedule.

.5 Corrective measures and procedures to regain projected schedule.

.6 Revision to construction schedule.

.7 Progress schedule, during succeeding work period.

.8 Review submittal schedules: expedite as required.

.9 Maintenance of quality standards.

.10 Review proposed changes for effect on construction schedule and on completion date.

.11 Health and safety incidents or corrective actions.

.12 Traffic Accommodation.

.13 Erosion Control/Environmental Protection.

.14 Other business.

Part 2 Products

2.1 NOT USED.

Part 3 Execution

3.1 NOT USED.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.

.2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally, Bar Chart should be derived from commercially available computerized project management system.

.3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.

.4 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.

.5 Master Plan: summary-level schedule that identifies major activities and key milestones.

.6 Milestone: significant event in project, usually completion of major deliverable.

.7 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.

.8 Project Planning, Monitoring and Control System: overall system operated by Departmental Representative to enable monitoring of project work in relation to established milestones.

1.2 REQUIREMENTS

.1 Ensure master plan and detail schedules are practical and remain within specified Contract duration.

.2 Plan to complete Work in accordance with prescribed milestones and time frame.

.3 Limit activity durations to maximum of approximately five (5) working days, to allow for progress reporting.

.4 Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit to Departmental Representative within ten (10) working days of Award of Contract Bar Chart ((GANTT Chart) as Master Plan for planning, monitoring and reporting of project progress.

.3 Submit Project Schedule to Departmental Representative within five (5) working days of receipt of acceptance of Master Plan.

.4 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).

.5 Departmental Representative will review and return revised schedules within 5 working days.

.6 Revise schedule as required and resubmit within five (5) working days.

.7 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.4 PROJECT SCHEDULE

.1 Develop detailed Project Schedule derived from Master Plan.

.2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:

.1 Award.
.2 Submittal of Shop Drawings.
.3 Permits.
.4 Survey.
.5 Mobilization.
.6 Environmental Protection Plan (EPP), review and implementation.
.7 Health and Safety Plan, review and implementation.
.8 Traffic Accommodation strategy, review and implementation.
.9 Quality Management Plan.
.10 Construction work activities.
.11 Substantial Performance Inspection for each stage.
.12 Demobilization.
.13 Completion.

1.5 PROJECT SCHEDULE REPORTING

.1 Update Project Schedule on monthly basis reflecting activity changes and completions, as well as activities in progress.

1.6 PROJECT MEETINGS

.1 Discuss Project Schedule at progress meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

.1 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 Do not proceed with Work affected by submittal until review is complete.

.3 Present shop drawings, product data, samples and mock-ups in SI Metric units.

.4 Where items or information is not produced in SI Metric units converted values are acceptable.

.5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.

.6 Notify Departmental Representative in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.7 Verify field measurements and affected adjacent Work are co-ordinated.

.8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative’s review of submittals.

.9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative’s review.

.10 Keep one reviewed copy of each submission on site.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.

.2 The shop drawings shall be stamped and signed by a Professional Engineer registered in the Province of Alberta, Canada.

.3 Allow five days for Departmental Representative’s review of each submission.

.4 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.

.5 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.

.6 Accompany submissions with transmittal letter containing:

- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Identification and quantity of each shop drawing, product data and sample.
- .5 Other pertinent data.

.7 Submissions include:

.1 Date and revision dates.

.2 Project title and number.

.3 Name and address of:

.1 Subcontractor.

.2 Supplier.

.3 Manufacturer.

.4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

.5 Details of appropriate portions of Work as applicable:

.1 Capacities.

.2 Performance characteristics.

.3 Standards.

.4 Relationship to adjacent work.

.8 After Departmental Representative's review, distribute copies.

.9 Submit PDF of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.

.10 Supplement standard information to provide details applicable to project.

.11 If upon review by Departmental Representative no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

.12 The review of shop drawings by the Department Representative is for sole purpose of ascertaining conformance with general concept.

.1 This review shall not mean that the Department Representative approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

.2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.3 SAMPLES

.1 Submit for review samples in duplicates requested in respective specification Sections. Label samples with origin and intended use.

.2 Deliver samples prepaid to Departmental Representative's site office

.3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.

.4 Where colour, pattern or texture is criterion, submit full range of samples.

.5 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.

.6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.

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

1.4 PHOTOGRAPHIC DOCUMENTATION

.1 Submit electronic copy of colour digital photography in jpeg, standard resolution.

.2 Take photographs of site conditions before, during, and after construction. Take photographs of any unique or unusual items.

.3 Photographs will also be included in the weekly progress reports.

.4 Photographs to be submitted on CD. All photographs to be labelled with meaningful titles as part of closeout package.

1.5 REQUIRED CONTRACTOR SUBMITTALS

.1 General

.1 This Clause identifies the plan, program, and documentation required prior to mobilization on site and during the construction phase.

.2 Certificates and Transcripts

.1 Immediately after award of Contract, submit Workers' Compensation Board status.

.2 Submit transcript of insurance five (5) days after award of Contract.

.3 Pre-Mobilization Submittals

.1 Submit the following plans and programs to the Departmental Representative for review a minimum of five (5) days prior to mobilization to the project site. The Contractor shall not begin any site Work until the Departmental Representative has authorized acceptance of the submittals in writing. The Contractor shall not construe the Departmental Representative’s authorization of the submittals to imply approval of any particular method or sequence for conducting the Work, or for addressing health and safety or environmental concerns. Authorization of the programs shall not relieve the Contractor from the responsibility to conduct the Work in strict accordance with the requirements of Federal or Provincial regulations, this specification, or to adequately protect the health and safety of all workers involved in the project and any members of the public who may be affected by the project. The Contractor shall remain solely responsible for the adequacy and completeness of the programs and work practices, and adherence to them.

.1 Construction schedule for all Work in accordance with Section 01 32 16.19 – Construction Progress Schedule.

.2 Construction Staging Plan.

.3 Environmental Protection Plan in accordance with Section 01 35 43 – Environmental Procedures.

.4 Traffic Accommodation Strategy in accordance with the requirements identified in Section 01 11 00 – Summary of Work.

.5 Quality Management Plan in accordance with Section 01 45 00 – Quality Control.

.6 Health and Safety Plan in accordance with Section 01 35 29.06 – Health and Safety Requirements.

.7 Submit site-specific Health and Safety Plan within seven (7) days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:

.1 Results of site specific safety hazard assessment.

.2 Results of safety and health risk or hazard analysis for site tasks and operations found in the Work Plan.

.8 Submit copies of Contractor's authorized representative's work site health and safety inspection reports to the Departmental Representative and the authority having jurisdiction weekly.

.9 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.

.10 Submit copies of incident and accident reports.

.11 Submit WHMIS Material Safety Data Sheets (MSDS) to the Departmental Representative.

.12 The Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within five (5) days after receipt of plan. Revise plan as appropriate and resubmit plan to the Departmental Representative within five (5) days after receipt of comments from the Departmental Representative.

.13 The Departmental Representative's review of the Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.

.14 On site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

.4 Construction Phase Submittals

.1 Weekly Progress Reports that outline the Work completed to date as well as the anticipated Work to be performed for the following week on a day-by-day basis.

.2 Quality Control Inspection Reports – The Contractor shall maintain daily inspection reports that itemize the results of all Quality Control Inspections conducted by the Contractor. The reports shall be made available for review by the Departmental Representative upon request. A summary of all Quality

Control inspections conducted to date shall be submitted by the Contractor with each payment request.

.3 Survey of all utilities in the work area via locates submitted to the Department Representative.

.4 Campground Kiosk Shop Drawings.

.5 Underground utility shop drawings as referenced in the utility specifications.

.6 Water Treatment Facility shop drawings including structural, mechanical, electrical and process components.

.7 Septic tank and septic field shop drawings.

.8 Electrical shop drawings for the electrical work in the campground.

.9 Q-Free shop drawings for the smart parking.

.10 Sieve analysis for aggregate base course and granular sub-base course as per Section 32 11 23 – Aggregate Base Courses and Section 32 11 16.01 – Granular Sub-Base.

.11 Manufacturers test data and certification for pipe culvert.

.12 Manufacturers product data, specifications, and certification for traffic signs and posts.

.13 Asphalt concrete mix design and trial mix test results.

.14 Manufacturer's test data and certification that asphalt cement meets specified requirements prior to commencing work.

.5 Project Completion Submittals

.1 Record Documents in accordance with Section 01 78 00 - Closeout Submittals.

.2 Quality Assurance/Quality Control Records.

.3 Photo CD.

.4 Operating and Maintenance manuals.

.5 Warranty Management Plan in accordance with Section 01 78 00 – Closeout Submittals.

1.6 CERTIFICATES AND TRANSCRIPTS

.1 Immediately after award of Contract, submit Workers' Compensation Board status.

.2 Submit transcription of insurance immediately after award of Contract.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 MEASUREMENT PROCEDURES

.1 This work shall be incidental to contract and will not be measured for payment.

1.2 Related Requirements

.1 The Contractor shall provide traffic control in accordance with current edition of:

.1 Alberta Transportation Standard - Traffic Accommodation in Work Zones latest edition.

.2 Section 01 11 00 - Summary of Work

.3 Section 01 14 00 - Work Restrictions

1.3 GENERAL

.1 The Contractor shall develop and implement a Traffic Accommodation Strategy (TAS) prior to commencement of the Work in accordance with the requirements of the current edition of the Alberta Transportation Standard – Traffic Accommodation in Work Zones, except where specified otherwise.

.2 The Contractor shall submit the TAS to the Departmental Representative for review within five days of Contract award and prior to commencement of any work. The Departmental Representative shall provide review comments to the Contractor within two days. If revisions to the TAS are requested, the Contractor shall resubmit the TAS to the Departmental Representative within two days of receipt of comments.

.3 During execution of the Work, the Contractor will be required to update the TAS if dictated by changes in site or working conditions, or if requested by the Departmental Representative.

.4 The Contractor shall design, supply, erect, move and maintain all traffic control devices, signs, temporary pavement markings, other safety measures and provide staff to ensure safe passage of all traffic from commencement of site work to date of acceptance by the Departmental Representative.

.5 All traffic and warning signs shall be either bilingual or of a symbolic or pictorial.

.6 The Contractor shall coordinate traffic management procedures with other Contractors working in the area.

1.4 PROTECTION OF PUBLIC TRAFFIC

.1 Comply with requirements of Acts, Regulations and By Laws in force for regulation of traffic or use of roadways upon or over which it is necessary to carry out Work or haul materials or equipment.

.2 When working on existing travelled way:

.1 Place equipment in a position presenting a minimum of interference and hazard to traveling public.

.2 Keep equipment units as close together as working conditions permit and preferably on same side of travelled way.

.3 Do not leave equipment on travelled way overnight.

.4 Do not close any lanes of road without approval of Departmental Representative.

.5 Keep travelled way clean and of sufficient width to accommodate one 3.5 m wide lane for traffic.

.6 The traffic control measures will be monitored by the Departmental Representative, who may require modifications of these measures from time to time to achieve satisfactory traffic flow, safety of traveling public and coordination with adjacent contracts.

1.5 INFORMATIONAL AND WARNING DEVICES

.1 Provide and maintain signs, flashing warning lights and other devices required to indicate construction activities or other temporary and unusual conditions resulting from Project Work which requires road user response.

.2 Supply and erect signs, delineators, barricades and miscellaneous warning devices as specified in the current edition of the Alberta Transportation Standard – Traffic Accommodation in Work Zones.

.3 Place signs and other devices in locations recommended in the current edition of the Alberta Transportation Standard – Traffic Accommodation in Work Zones.

.4 Continually maintain traffic control devices in use:

.1 Check signs daily for legibility, damage, suitability and location. Clean, repair or replace to ensure clarity and reflectance.

.2 Remove or cover signs which do not apply to existing conditions.

1.6 CONTROL OF PUBLIC TRAFFIC

.1 Provide competent flag personnel, trained in accordance with, and properly equipped as specified in the current edition of the Alberta Transportation Standard – Traffic Accommodation in Work Zones, for situations as follows:

.1 When public traffic is required to pass working vehicles or equipment that block all or part of travelled roadway.

.2 When it is necessary to institute one-way traffic system through construction area or other blockage where traffic volumes are heavy, approach speeds are high and traffic signal system is not in use.

.3 Where temporary protection is required while other traffic control devices are being erected or taken down.

.4 For emergency protection when other traffic control devices are not readily available.

.5 In situations where complete protection for workers, working equipment and public traffic is not provided by other traffic control devices.

.6 When workmen or equipment are employed on travelled way over brow of hills, around sharp curves or at other locations where oncoming traffic would not otherwise have adequate warning.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 MEASUREMENT PROCEDURES

.1 This work shall be incidental to contract and will not be measured for payment.

1.2 REFERENCES

.1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulation

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

.3 Province of Alberta

.1 Occupational Health and Safety Act, R.S.A. - Updated 2013.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit site-specific Health and Safety Plan: Within seven days after award of contract and prior to commencement of Work. Health and Safety Plan must include:

.1 Results of site specific safety hazard assessment.

.2 Results of safety and health risk or hazard analysis for site tasks and operation.

.3 Submit 1 copy of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative weekly, including minutes of safety toolbox meetings.

.4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.

.5 Submit copies of incident and accident reports.

.6 Submit WHMIS MSDS - Material Safety Data Sheets to Departmental Representative.

.7 Submit an Emergency Response Plan to address any unforeseen or peculiar safety related factors, hazards or conditions during the performance of work. Advise the Departmental Representative immediately verbally and in writing if the Contractor identifies hazardous conditions.

.8 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within three days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within two days after receipt of comments from Departmental Representative.

.9 Departmental Representative’s review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.

.10 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Departmental Representative.

.11 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

.1 Emergencies: In the event of emergency call 911

.2 All other inquiries: Parks Canada Switch Board (403) 859-2224.

1.4 FILING OF NOTICE

.1 File Notice of Project with Provincial authorities prior to beginning of Work.

1.5 SAFETY ASSESSMENT

.1 Perform site specific safety hazard assessment related to project.

1.6 MEETINGS

.1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work.

.2 Conduct weekly safety meetings at the beginning of each week to discuss the scheduled work for that week and the associated safety hazards.

1.7 REGULATORY REQUIREMENTS

.1 Do work in accordance with Section 01 41 00 – Regulatory Requirements.

1.8 GENERAL REQUIREMENTS

.1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.

.2 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.9 RESPONSIBILITY

.1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

.2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.10 COMPLIANCE REQUIREMENTS

.1 Comply with the latest version of the Occupational Health and Safety Act, General Safety Regulation, and Code, Alberta

.2 Comply with R.S.Q., c. S-2.1, an Act respecting Health and Safety, and c. S-2.1, r.4 Safety Code for the Construction Industry.

.3 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.11 UNFORSEEN HAZARDS

.1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise Departmental Representative verbally and in writing.

1.12 HEALTH AND SAFETY CO-ORDINATOR

.1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:

.1 Have site-related working experience
.2 Have working knowledge of occupational safety and health regulations.
.3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
.4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
.5 Be on site during execution of Work and report directly to and be under direction of Registered Occupational Hygienist or site supervisor.

1.13 POSTING OF DOCUMENTS

.1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction, and in consultation with Departmental Representative.

1.14 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.

.2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.

.3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

1.15 WORK STOPPAGE

.1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 All Contractor operations shall be performed in such a manner that no detritus from his operations shall enter any river, waterway, ditch, or wetland within Banff National Park.

.2 If, in the opinion of the Departmental Representative, full containment of Contractor's detritus is not being achieved, operations may be ordered halted until the situation is rectified.

.1 Contactor to adhere to requirements identified in the Parks Canada Basic Impact Analysis document provided as a reference document.

1.2 NATIONAL PARK REGULATIONS

.1 The Contractor shall ensure that all work is performed in accordance with the ordinances, laws, rules and regulations set out in the Canada National Parks Act and Regulations.

.2 The Contractor and any sub-Contractors shall obtain a business license from the Parks Canada Administration Office in Banff prior to commencement of the contract.

.3 All Contractor's business and private vehicles are required to obtain a vehicle work pass from Parks Canada. These permits may be obtained free of charge from the Departmental Representative, PCA Environmental Officer.

1.3 CANADIAN ENVIRONMENTAL ASSESSMENT ACT (CEAA)

.1 Execution of the Work is subject to the provisions within the Canadian Environmental Assessment Act (CEAA) 2012 and subsequent amendments.

.2 The Contractor is required to prepare an Environmental Protection Plan (EPP), which will include the topics in the following sub sections.

.3 Failure to comply with or observe environmental protection measures as identified in these specifications may result in the Work being suspended pending rectification of the problems.

.4 The Contractor shall notify the ESO (Environmental Surveillance Officer) and the Departmental Representative in a reasonably timely manner of any actual or potential environmental incidents or failure of protection measures.

.5 The Contractor shall notify the ESO and the Departmental Representative immediately of any violations of environmental approvals, permits, authorizations or EPP measures.

1.4 RELICS AND ANTIQUITIES

.1 Give immediate notice to Departmental Representative if evidence of archaeological finds are encountered during construction, and wait for written instructions before proceeding with Work in this area.

.2 Relics and antiquities and items of historical or scientific interest such as cornerstones and contents, commemorative plaques, inscribed tablets, and similar objects found on the site shall remain the property of Parks Canada. Protect such articles and request directives from Departmental Representative.

.3 Provide forty-eight (48) hours notice Departmental Representative prior to commencing any work that may interfere with or affect any identified historical or archaeological site. Commence work only upon written instruction from Departmental Representative.

1.5 WILDLIFE

.1 Avoid or terminate activities on site that attract or disturb wildlife.

.2 Pets are not allowed on the work site, or in any administrative or laydown areas.

.3 All personnel will be instructed by Parks Canada's ESO or the Departmental Representative the procedures to follow in the event of wildlife appearance near or to attract or approach any wildlife seen near the site, and are to vacate their location in the event of aggressive behavior or persistent intrusion by bears, cougars, wolves, elk or moose. The ESO and the Departmental Representative are to be notified about the circumstance immediately. The Banff warden services will be called to determine the course of action. The general presence of wildlife observed near the construction site, any carcasses or unusual wildlife observations shall be reported to the ESO and the Departmental Representative.

1.6 FIRE PROTECTION AND CONTROL

.1 A fire extinguisher will be carried and available for use on each machine in the event of fire (e.g. ignited by a spark) to prevent the fire from burning the unit or spreading to other fuels in the work area. Basic firefighting equipment – e.g., three (3) shovels, two (2) pulaskis, and two (2) 20 litre backpack pumps shall be maintained at the construction site at a location known and easily accessible to all the Contractor's staff. Contractor's staff shall receive basic training in early response to wildfire events during the "environmental briefing".

.2 Machinery and equipment shall be operated in a manner and with all original manufacturers' safety devices to prevent ignition of flammable materials in the area.

.3 No smoking is allowed on the construction site to ensure that accidental ignition of any flammable material is prevented. Fires or burning of waste materials are not permitted.

.4 The Contractor shall maintain an awareness of the fire danger rating (Index) in the work area by contacting the Banff fire duty officer. Fire prevention care is to be commensurate with the Fire Index.

.5 In case of fire, the Contractor or worker shall take immediate action to extinguish the fire provided it is safe to do so. The ESO and the Departmental Representative shall be notified of any fire immediately.

.6 Deliberately lighting of fires or burning of waste materials is strictly not permitted.

1.7 SITE ACCESS AND PARKING

.1 A plan detailing access to the construction site shall be prepared by the Contractor and included in the EPP. This includes access and facilities at the work sites and within the work limits, including day-to-day entry/egress and plans for delivery and approach for large dimension materials will be anticipated and described. The access plan shall describe worker transportation to and from the construction site, and parking of workers' private vehicles. Specific details of any vehicles to transport workers to site or site equipment to be used on the trails are to be provided.

.2 Restrict vehicle movements to work limits.

.3 Do not park vehicles in areas beyond work limits, unless specifically authorized by the ESO and the Departmental Representative.

.4 A construction office is anticipated for the work. The construction office may be located at the site area, actual location subject to the approval of the Departmental Representative and ESO. It is anticipated the construction office may comprise the Contractor's main office and a materials testing trailer.

.5 As an alternative to the above mentioned locations, a Contractor's office and work headquarters may be established at another location at the discretion of the Departmental Representative. The Contractor shall prepare a plan regarding structures, equipment, waste materials management, water, power and sewage services, materials lay-down area, fuel storage, operations, etc. required at this location. The plan will be subject to review and approval by the Departmental Representative. This site may be shared with other Contractors.

.6 A workers' accommodation camp will not be permitted.

1.8 EROSION AND SEDIMENT CONTROL (ESC) PLAN

.1 The Contractor must prepare an ESC plan for the project to be included in the Environmental Protection Plan. The plan must detail temporary and permanent environmental control measures that the Contractor will undertake to comply with all applicable legislation, regulations and approvals during the course of their construction. The plan should address the following items:

- .1 Pre-Construction Actions:
  - .1 Prepare and submit for review by Departmental Representative the "Environmental Protection Plan"
- .2 Construction Considerations:
  - .1 Clearing and excavation must start only after installing the sediment and runoff measures as per the plan which has been reviewed and accepted by the Departmental Representative. Only areas required for immediate construction activity and as approved by the Departmental Representative may be cleared. Additional control measures must be installed as excavation advances.
  - .2 Stockpiles can be located anywhere in the construction work areas approved by Departmental Representative. They must be stabilized against erosion immediately following stockpiling operations. Runoff from the stockpile areas must be contained to prevent contamination of drainage systems.
  - .3 Sediment and debris must be prevented from reaching waterways.
  - .4 Dust control measures must be implemented to prevent wind transport of dust from disturbed soil surfaces.
  - .5 On-going inspection and maintenance of Erosion and Sediment Controls must be performed by the Contractor until restoration is achieved.
- .3 Post-Construction Activities:
  - .1 All accumulated sediment and debris must be removed as required after construction activities are complete.
  - .2 Stockpile, storage and laydown areas must be cleaned and restored to pre-construction condition.
- .4 The ESC Plan must include natural area protection measures for natural areas impacted by the project.

1.9 DRAINAGE

.1 Provide temporary drainage and pumping required to keep excavations and site free from water.

.2 Prior to directing stored water off site, obtain approval from Departmental Representative and ESO.

.3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.10 SITE CLEARING AND PLANT PROTECTION

.1 Vegetation Clearing:

.1 Protect trees and plants on site and adjacent properties as shown in the Drawings.

.2 Protect trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m minimum.

.3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage.

.4 Avoid unnecessary traffic, dumping and storage of materials over root zones.

.5 Minimize stripping of topsoil and vegetation.

.6 Restrict tree removal to areas indicated in Contract Documents.

.7 Tree and vegetation clearing must occur outside of Environment Canada's restricted timing windows for migratory breeding birds, outside of May 1 to July 31.

.8 If any vegetation clearing is proposed between May 1 and July 31, nest sweeps must be conducted seven to ten (7-10) days prior to clearing and grubbing activities.

.9 If any nest or dens are discovered during work, the area must be flagged and work temporarily ceased until Departmental Representative has taken appropriate action.

.10 All works shall be undertaken in a manner that prevents the introduction or minimizes the spread of invasive alien species and noxious weeds.

.2 Soil Stripping

.1 Soil horizons must be excavated and stored separately. Organics and topsoil should be salvaged and replaced in the reverse order of excavation over mineral soils during re-contouring activities, wherever possible.

.2 Soils must be stored in separate piles on an impervious surface within temporary workspaces approved by the Departmental Representative. If soil storage is required for an extended period (greater than seven (7) days) or if heavy rain or wind is forecast, soil piles must be covered to reduce erosion loss.

1.11 POLLUTION CONTROL

.1 Maintain temporary erosion and pollution control features installed under this Contract.

.2 Control emissions from equipment in accordance with local authorities' emission requirements.

.3 Spills or releases of hazardous materials or deleterious substances that may cause damage to the environment or human health shall be immediately reported to Departmental Representative and, if required, to the Provincial authority.

.4 The Contractor shall take all reasonable measures to contain all spills. The Contractor shall contain, collect and dispose of spilled products at their expense.

.5 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

.6 All equipment must be properly maintained, in sound mechanical condition and free of any fuel, oil, and hydraulic fluid or coolant leaks.

.7 Equipment must be free of external grease, loose dirt or oil and the machinery must be pressure washed prior to the start of the project.

.8 All machinery must be equipped with emergency spill kits large enough to contain 110% of any possible spills or leaks of oil, fuel, hydraulic fluid or coolant during the project.

.9 The operators of the equipment must be familiar with how to properly use the spill kits in the event of an emergency.

.10 Fuel, oils, lubricants, chemicals, and any potentially hazardous material must not be dispelled into the environment.

.11 Machinery and vehicles must keep to roads, trails, or designated temporary workspaces and turnaround points. The Departmental Representative will identify approved off-road workspaces.

.12 Rutting and/or compaction of ground surfaces should be avoided as much as possible by keeping to designated work areas and away from wet locations.

.13 All areas with rutting damage or noticeable compaction from heavy equipment must be re-graded and back-filled if necessary.

.14 Any holes or depressions caused by site preparation or construction will be back-filled and compacted to an appropriate degree.

1.12 CONTRACTOR'S OPERATIONS

.1 Confine all operations to the work areas designated by the Departmental Representative. No activities of any kind may be carried out beyond those work areas without the written permission of the Departmental Representative.

.2 Do not store or stockpile construction materials in the trees bordering or being preserved on site. Do not unreasonably encumber the site with products.

.3 Provide sufficient sanitary facilities and maintain in a clean condition.

.4 Conduct operations at all times in such a manner as to preserve the natural features and vegetation in the area. Cut and fill slopes shall be blended with adjoining topography. Material from fill slopes shall not be permitted to slough or roll into surrounding tree cover or to bury any plant material designated to be retained.

.5 When in the opinion of the Departmental Representative, negligence on the part of the Contractor results in damage or destruction of vegetation, or other environmental or aesthetic features beyond the staked or designated work area, the Contractor shall be responsible, at his expense, for complete restoration including the replacement of trees, shrubs, topsoil, grass, etc. to the satisfaction of the Departmental Representative.

.6 Failure to comply with or observe environmental protection requirements as identified in these specifications may result in work being suspended pending rectification of the problems and operators of equipment being charged under the National Park Act.

1.13 START- UP AND ENVIRONMENTAL BRIEFING

.1 All staff employed at the construction site shall attend an orientation conducted by the Contractor regarding their individual and collective responsibilities, to ensure avoidable adverse environmental impact does not arise from their activities and personal choices. Employees must attend this briefing before beginning their work at the site. Each employee, having received the environmental briefing, will be issued a certification sticker to be displayed on their helmet. Employees of other service and materials providers who attend at the site – e.g., concrete truck operators, crane operators, and truck drivers must be apprised of their duty not to cause adverse environmental impact.

.2 Parks Canada will have an ESO attending the site to monitor the construction activity for conformance with the EPP. The ESO or alternate designated Parks Canada staff member will present the "environmental briefing". The ESO's main duties are to monitor the progress of the construction on an on-going basis to ensure compliance with environmental protection measures, and to provide guidance through the Departmental Representative, in the event of unanticipated environmental problems. Although the ESO has authority to enforce National Parks Act violations, direction to the Contractor will be the duty of the Departmental Representative.

1.14 HAZARDOUS PRODUCTS AND MATERIALS

.1 A list of products and materials to be used or brought to the construction site that are considered or defined as hazardous to the environment shall be presented in the EPP. Such products include, but are not limited to; grout, fuel, concrete finishing agents, paint, etc. A plan detailing the containment and storage, security, handling, use, unique spill response requirements and disposal of empty containers, surplus product or waste generated in the application of these products shall be presented in the EPP.

.2 Hazardous products shall be stored no closer than 100 m from any waterway.

.3 MSDS sheets for hazardous material are to be provided in a location accessible to all workers.

1.15 EQUIPMENT FUELLING AND MAINTENANCE

.1 A fuel delivery, storage and distribution plan shall be submitted. Topics to be addressed in the EPP will include, but not necessarily be limited to:

.1 Diesel and gasoline supply vehicles, including bulk tankers shall be parked more than 100 m from rivers.

.2 Fuel tanks with manual or electric pump delivery systems shall be used, gravity feed is not allowed.

.3 Fuelling personnel shall maintain immediate attention to and presence at the fuelling operation.

.4 Fuelling sites will be identified by the Contractor in the EPP.

.5 Lubricant changes and minor repairs shall be conducted at a location identified by the Contractor in consultation with the ESO. Waste lubricants, used filters and other waste maintenance products shall be removed from Banff National Park to recycling or certified disposal sites.

.6 Equipment shall be inspected daily for fluid/fuel leaks and maintained in good working order.

.7 Equipment to be used on the project site shall be thoroughly cleaned of soil, seeds and any debris or external contaminants outside the national park before delivery to the work site.

1.16 WASTE MATERIAL STORAGE AND REMOVAL

.1 The Contractor shall prepare a Construction and Waste management plan as a part of the EPP. The Plan shall include the following basic principle:

.1 Waste reduction which follows the 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.

.2 Wastes generated at the construction site are to be contained and removed in a timely and approved manner. The EPP shall detail the waste management procedures, including the following:

.1 Describe the management of waste.

.2 Construction wastes shall be stored in containers at an approved location and removed promptly when the containers are 90% full.

.3 A concerted effort to reduce, reuse and recycle materials is expected.

.4 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.

.5 Provide containers to deposit recyclable materials.

.6 Transport all recyclable materials to an approved recycling facility off site.

.7 Waste materials are to be disposed at a certified construction waste landfill outside Banff National Park. No burying, burning or discarding of waste materials will be permitted at the construction site, or elsewhere in Banff National Parks.

.8 No materials attractive to wildlife are to be stored at the site overnight – daily removal is mandatory. Human food products are to be contained in a manner so as not to attract animals and waste food stuffs are to be removed from the construction site every day.

.9 Portable container toilets are to be provided in sufficient numbers and locations to ensure convenient usage including frequency of pump out.

.3 All garbage must be stored and handled in conformance with the National Parks' Garbage Regulations.

.4 No food, domestic garbage or hazardous wastes may be deposited in the trade waste site.

.5 Dispose of all hazardous wastes in conformance with the Environmental Contaminates Act and applicable provincial regulations while observing the Code of Good Practice for Management of Hazardous and Toxic Wastes at Federal Establishments.

.6 Provide bear proof garbage containers on-site for domestic garbage generated on-site by Contractor's personnel and make arrangement for collection and disposal on a daily basis or when directed by the Departmental Representative.

.7 Maintain the site in a tidy condition, free from the accumulation of waste products, debris and litter.

.8 Do not dispose of or allow dispersing waste or volatile materials such as mineral spirits, oil or paint thinners or other hazardous wastes into waterways. Provide clean- up equipment and adequate supply of absorbent material on-site.

1.17 NOTIFICATION

.1 Departmental Representative or ESO will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.

.2 Contractor: after receipt of such notice, inform ESO and Departmental Representative of proposed corrective action and take such action for approval by ESO.

.1 Take action only after receipt of written approval by ESO.

.3 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.

.4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

Part 2 Products

2.1 NOT USED.

Part 3 Execution

3.1 CLEANING

.1 Leave Work area clean at end of each day as per Division 01.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment from the work site.

END OF SECTION

Part 1 General

1.1 MEASUREMENT PROCEDURES

.1 This work shall be incidental to contract and will not be measured for payment.

1.2 DEFINITIONS

.1 Quality Control (QC): The process of checking specific product or services to determine if they comply with relevant quality standards and identify ways to eliminate causes of unsatisfactory product or service performed. All material testing required is QC testing. All QC testing is to be conducted and paid by the Contractor.

.2 Quality Assurance (QA): The process of ensuring that the Contractor's Quality Management Plan (QMP) (QC, non-conformances, etc.) is being followed. The results of the QA are provided as feedback to both the Contractor and the Departmental Representative. Where required, the Contractor shall implement changes to the project based on the feedback received from the QA process.

1.3 QUALITY MANAGEMENT PROGRAM

.1 The Contractor shall prepare a Quality Management Plan. The purpose of the plan shall be to ensure the performance of the Work in accordance with Contract requirements.

.2 The Contractor shall submit the Quality Management Plan to the Departmental Representative for acceptance in accordance with Section 01 33 00 - Submittal Procedures. The Plan shall develop a logical system for tracking and documenting the Quality Control of the Work as well as the Contractor's internal Quality Assurance procedures to verify the compliance of the Quality Control process. A systematic format and a set of procedures patterned on a recognized Quality Control Standard will be acceptable, subject to review by the Departmental Representative.

.3 The Contractor shall appoint qualified and experienced Quality Control and Quality Assurance Personnel, who are dedicated to quality matters and who will report regularly to the Quality Control Manager and Quality Assurance Manager as well as Contractor's management at a level which shall ensure that Quality Control and Quality Assurance requirements are not to be subordinated to manufacturing, construction or delivery. The Quality Control and Quality Assurance Personnel shall be empowered by the Contractor to resolve quality matters. Personnel involved in Quality Assurance shall be independent of the Quality Control Process.

.4 The Quality Management Plan shall include samples of all forms to be filled in by the Quality Control and Assurance Personnel. All forms shall be signed by the Quality Control Manager and Quality Assurance Manager and submitted promptly to the Departmental Representative.

.5 The Quality Management Plan shall include:

.1 Distribution list, providing a list of names to whom the Plan shall be distributed.

.2 Title page, identifying the Contract, Contractor and copy number.

.3 Revision page, identifying the revision number and date of the Plan.

.4 Table of Contents.

.5 Revision control, tabulating the revision number, date of revision, description of revisions and authorized signature.

.6 Details of measuring and test equipment including methods and frequency of calibration.

.7 Purchasing details of all materials and equipment including procurement documents and vendor's Quality Control Program standards.

.8 Procedures for inspection of incoming items, in-process inspection and final inspection and tagging of all supply items.

.9 Details of special processes as identified by the Departmental Representative, including qualifications of personnel and certification.

.10 Procedures for shipping, packaging and storage of materials.

.11 Procedures for maintaining quality records and Statements of Compliance, including filing and storage of documents for a period of one year after Completion of the Works.

.12 Details of any non-conformance, including identification and recording of deficiencies, tagging procedures for "HOLD" or "REJECT" items, and final disposition of non-conformance forms by the Quality Control Manager

.13 Inspection and test checklists, including tabulated checklists describing all manufacturing and delivery activities such as Inspection or Test, frequency of tests, description of tests, acceptance criteria of tests, such as verification, witnessing or holding tests and sign-off by the Quality Control Manager and the Quality Assurance Manager, if the Quality Assurance Manager witnesses the tests.

.14 Forms used to ensure the application of the inspection and test checklist requirements. These forms shall be identified in the checklists and describe all testing requirements for Specification compliance.

.15 Details of the Quality Assurance Program including the Contractor's procedures to verify the compliance to the Quality Control process of on-site work and off-site work by fabricators.

.6 The Contractor must facilitate any independent Quality Assurance checks by representatives designated by the Departmental Representative.

.7 At completion of the Work a bound and itemized copy of all Quality Control and Quality Assurance documents and reports shall be prepared by the Contractor's Quality Control Manager and Quality Assurance Manager and submitted to the Departmental Representative.

1.4 TESTING

.1 Testing required to provide Quality Control and Quality Assurance to assure that the Work strictly complies with the Contract requirements shall include, but not be limited to:

.1 Granular, concrete, and asphalt materials and compaction testing; subgrade compaction testing; and all source acceptance testing;

.2 All testing specified in the Contract Documents; and

.3 Any other testing required as a condition for deviation from the specified Contract procedures.

.2 The quality control testing proposed and testing frequency shall at a minimum, achieve the requirements of the following:

.1 The testing requirements in the 2013 Alberta Transportation Standard Specifications for Highway Construction Manual and subsequent updates.

.2 Wherever these standard specifications refer to standards (e.g., CSA, ASTM, and others) the minimum testing frequencies in these standards shall be utilized.

.3 The Contractor must satisfy themselves that the test frequencies being completed are sufficient to ensure the quality requirements of the QMP.

.3 The Contractor shall be fully responsible and bear all costs for all quality control testing and shall conduct such testing in the following manner:

.1 Provide testing facilities and personnel for the tests and inform the Departmental Representative in advance to enable the Departmental Representative to witness the tests if it so desired;

.2 Notify the Departmental Representative when sampling will be conducted;

.3 Within one day after completion of testing, submit test results to the Departmental Representative; and

.4 Identify test reports with the name and address of the organization performing all tests, and the date of the tests.

.4 Approval of tested samples will be for characteristics or use named in such approval and shall not change or modify any Contract requirements.

.5 Testing agencies, their inspectors, and their representatives are not authorized to revoke, alter, relax, enlarge or release any requirement of the Contract Documents, nor to approve or accept any part of the Work.

.6 The Contractor shall be responsible for third party testing of materials incorporated into the works.

.7 The Departmental Representative may perform quality audits as desired. Such audits will not relax the responsibility of the Contractor to perform work in accordance with Specifications. To facilitate this work the Contractor shall:

.1 Notify Departmental Representative in advance of work which the Departmental Representative may want to test.

.2 Submit samples and/or materials required for testing, as specifically requested in the Specifications or as requested by the Departmental Representative. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in the work.

.8 Provide labour and facilities to obtain and handle samples and materials on site.

1.5 INSPECTION

.1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

.2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.

.3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

.4 Departmental Representative will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

1.6 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies will be engaged by the Departmental Representative for purpose of inspecting and/or testing portions of Work.

.2 Provide equipment required for executing inspection and testing by appointed agencies.

.3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.

.4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and reinspection.

1.7 ACCESS TO WORK

.1 Allow Departmental Representative, Owner and inspection/testing agencies access to Work, off site manufacturing and fabrication plants.

.2 Co-operate to provide reasonable facilities for such access.

1.8 PROCEDURES

.1 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.

.2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.

.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.9 REJECTED WORK

.1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

.2 Make good other Contractor's work damaged by such removals or replacements promptly.

.3 If in opinion of Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner will deduct from Contract Price difference in value between Work performed and that called for by

Contract Documents, amount of which will be determined by Departmental Representative.

1.10 REPORTS

.1 Submit 4 copies of inspection and test reports to Departmental Representative.

.2 Provide copies to subcontractor of work being inspected or tested.

1.11 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as requested.

.2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Departmental Representative and may be authorized as recoverable.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 MEASUREMENT PROCEDURES

.1 This work shall be incidental to contract and will not be measured for payment.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

1.3 INSTALLATION AND REMOVAL

.1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation within the work limits defined on the drawings.

.2 Identify areas which have to be gravelled to prevent tracking of mud.

.3 Indicate use of supplemental or other staging area.

.4 Provide construction facilities in order to execute work expeditiously.

.5 Remove from site all such work prior to the date specified for Final Completion in Section 01 11 00 - Summary of Work.

1.4 SITE STORAGE/LOADING

.1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.

.2 Do not load or permit to load any part of Work with weight or force that will endanger Work.

1.5 CONSTRUCTION PARKING

.1 Parking will be permitted on site provided it does not disrupt performance of Work or normal operations of the National Park. Parking areas must be approved by Departmental Representative, Gondola and Upper Hot Springs.

.2 Provide and maintain adequate access to project site.

1.6 SECURITY

.1 Provide and pay for responsible security personnel to guard site and contents of site after working hours and during holidays.

1.7 OFFICES

.1 If required by Contractor, provide office of sufficient size to accommodate required work activities of Contractor and all Sub-Contractors. Departmental Representative to approve location of trailer. The Departmental Representative will not require an office.

.2 Provide marked and fully stocked first-aid case in a readily available location.

.3 The Contractor is responsible for supplying and paying for power, telecommunications and water required for the execution of the Work.

1.8 EQUIPMENT, TOOL AND MATERIALS STORAGE

.1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.

.2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.

1.9 SANITARY FACILITIES

.1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.

.2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

1.10 PROTECTION AND MAINTENANCE OF TRAFFIC

.1 Provide access and temporary relocated roads as necessary to maintain traffic.

.2 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Departmental Representative.

.3 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs

.4 Protect travelling public from damage to person and property.

.5 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.

.6 Verify adequacy of existing roads and allowable load limit on these roads. Contractor is responsible for repair of damage to roads caused by construction operations.

.7 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.

.8 Dust control: adequate to ensure safe operation at all times.

.9 Provide snow removal during period of Work.

1.11 CLEAN-UP

.1 Remove construction debris, waste materials, packaging material from work site daily.

.2 Clean dirt or mud tracked onto paved or surfaced roadways.

.3 Store materials resulting from demolition activities that are salvageable.

.4 The Contractor to coordinate with the Departmental Representative for the available locations for storing new or salvaged material.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

END OF SECTION

Part 1 General

1.1 MEASUREMENT PROCEDURES

.1 This work shall be incidental to contract and will not be measured for payment.

1.2 INSTALLATION AND REMOVAL

.1 Provide temporary controls in order to execute Work expeditiously.

.2 Remove from site all such work prior to the date specified for Final Completion in Section 01 11 00 - Summary of Work.

.3 Install barriers to protect trees and plants designated to remain as per Section 01 35 43 - Environmental Procedure.

1.3 GUARD RAILS AND BARRICADES

.1 Provide secure barricades or as directed by the Departmental Representative around deep excavations.

1.4 ACCESS TO SITE

.1 In accordance to section 01 14 00.

1.5 PUBLIC TRAFFIC FLOW

.1 Provide and maintain competent signal flag operators, barricades, flares, and lights or as directed by the Departmental Representative to perform Work and protect public.

1.6 FIRE ROUTES

.1 Maintain access to property including overhead clearances for use by emergency response vehicles.

1.7 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

.1 Protect surrounding private and public property from damage during performance of Work.

.2 Be responsible for damage incurred.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 MEASUREMENT PROCEDURES

.1 This work shall be incidental to contract and will not be measured for payment.

1.2 REFERENCES

.1 If there is question as to whether products or systems are in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.

.2 Conform to latest date of issue of referenced standards in effect on date of submission of tenders, except where specific date or issue is specifically noted.

.2 Cost for such testing will be borne by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.3 QUALITY

.1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.

.2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.

.3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.4 Should disputes arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.

.5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.

.6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.4 AVAILABILITY

.1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

.2 In event of failure to notify Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Departmental

Representative reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.5 STORAGE, HANDLING AND PROTECTION

.1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.

.2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.

.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 heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.

.8 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

.9 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.6 TRANSPORTATION

.1 Pay costs of transportation of products required in performance of Work.

1.7 MANUFACTURER'S INSTRUCTIONS

.1 Unless otherwise indicated in 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.

.2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative will establish course of action.

.3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.

1.8 QUALITY OF WORK

.1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative if required Work is such as to make it impractical to produce required results.

.2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.

.3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.

1.9 CO-ORDINATION

.1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.

1.10 SETTING OUT OF WORK

.1 Departmental Representative will supply horizontal reference control points benchmark elevations only for this project.

.2 Contractor will set grades and layout work in detail from control points established by Departmental Representative.

.3 Contractor shall employ competent survey staff for complete detailed layout of work.

.4 Survey supervisor shall have experience in field survey work, including obtaining horizontal and vertical measurements, record keeping and calculation of quantities, generally associated with 3 to 5 years related experience.

.5 Contractor will be responsible for correction of any error associated with his layout.

.6 Contractor shall supply such devices as straight edges and templates required to facilitate Departmental Representative's inspection of work.

.7 Contractor shall supply stakes and other survey markers required for laying out the work.

.8 Cost of setting out of work will not be paid for directly but shall be considered incidental to contract unit prices tendered.

1.11 CONCEALMENT

.1 In finished areas conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.

.2 Before installation inform Departmental Representative if there is interference. Install as directed by Departmental Representative.

1.12 REMEDIAL WORK

.1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.

.2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.13 EXISTING UTILITIES

.1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, adjacent buildings and pedestrian and vehicular traffic.

.2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Owner's identification of existing survey control points and property limits.

1.2 QUALIFICATIONS OF SURVEYOR

.1 Qualified registered land surveyor, licensed to practise in Place of Work, acceptable to Departmental Representative.

1.3 SURVEY REFERENCE POINTS

.1 Existing base horizontal and vertical control points are designated on drawings.

.2 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.

.3 Make no changes or relocations without prior written notice to Departmental Representative.

.4 Report to Departmental Representative when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

.5 Require surveyor to replace control points in accordance with original survey control.

1.4 SURVEY REQUIREMENTS

.1 Establish two (2) permanent bench marks on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.

.2 Establish lines and levels, locate and lay out, by instrumentation.

.3 Stake for grading, fill and topsoil placement and landscaping features.

.4 Stake slopes.

.5 Establish pipe invert elevations.

.6 Stake batter boards for foundations.

.8 Establish lines and levels for utility lines and electrical work.

1.5 EXISTING SERVICES

.1 Before commencing work, establish location and extent of service lines in area of Work and notify Departmental Representative of findings.

.2 Remove abandoned service lines within 2m of structures. Cap or otherwise seal lines at cut-off points as directed by Departmental Representative.

1.6 LOCATION OF EQUIPMENT AND FIXTURES

.1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.

.2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.

.3 Inform Departmental Representative of impending installation and obtain approval for actual location.

.4 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

1.7 RECORDS

.1 Maintain a complete, accurate log of control and survey work as it progresses.

.2 On completion of foundations and major site improvements, prepare a certified survey showing dimensions, locations, angles and elevations of Work.

.3 Record locations of maintained, re-routed and abandoned service lines.

1.8 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit name and address of Surveyor to Departmental Representative.

.2 On request of Departmental Representative, submit documentation to verify accuracy of field engineering work.

.3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform and do not conform with Contract Documents.

1.9 SUBSURFACE CONDITIONS

.1 Promptly notify Consultant in writing if subsurface conditions at Place of Work differ materially from those indicated in Contract Documents, or a reasonable assumption of probable conditions based thereon.

.2 After prompt investigation, should Consultant determine that conditions do differ materially, instructions will be issued for changes in Work as provided in Changes and Change Orders.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 35 43 - Environmental Procedure

.2 Section 01 74 19 - Waste Management and Disposal

1.2 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris.

.2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.

.3 Clear snow and ice from access to building, bank/pile snow in designated areas as agreed with the Departmental Representative.

.4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.5 Provide on-site 3 containers for collection of waste materials and debris.

.6 Provide and use marked separate bins for recycling. Refer to Section 01 74 19 - Waste Management and Disposal.

.7 Dispose of waste materials and debris Section 01 74 19 - Waste Management and Disposal.

.8 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.

.9 Store volatile waste in covered metal containers, and remove from premises at end of each working day.

.10 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.

.11 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

.12 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.3 FINAL CLEANING

.1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.

.3 Prior to final review remove surplus products, tools, construction machinery and equipment.

.4 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental. Do not burn waste materials on site, unless approved by Departmental Representative.

.5 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.

.6 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, and walls.

.7 Clean lighting reflectors, lenses, and other lighting surfaces.

.8 Vacuum clean and dust building interiors, behind grilles, louvres and screens.

.9 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.

.10 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.

.11 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.

.12 Remove dirt and other disfiguration from exterior surfaces.

.13 Clean and sweep roofs, gutters, areaways, and sunken wells.

.14 Sweep and wash clean paved areas.

.15 Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.

.16 Clean roofs, downspouts, and drainage systems.

.17 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

.18 Remove snow and ice from access to building.

1.4 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section includes requirements for management of construction waste and disposal, which forms the Contractor's commitment to reduce and divert waste materials from landfill and includes the following:

.1 Preparation of a Draft Construction Waste Management Plan that will be used to track the success of the Construction Waste Management Plan against actual waste diversion from landfill.

.2 Preparation of a Construction Waste Management Plan that provides guidance on a logical progression of tasks and procedures to be followed in a pollution prevention program to reduce or eliminate the generation of waste, the loss of natural resources, and process emissions through source reduction, reuse, recycling, and reclamation.

.3 Preparation of monthly progress reports indicating cumulative totals representing progress towards achieving diversion and reduction goals of waste materials away from landfill and identifying any special programs, landfill options or alternatives to landfill used during construction.

.4 Preparation of a Construction Waste Management Report containing detailed information indicating total waste produced by the project, types of waste material and quantity of each material, and total waste diverted and diversion rates indicated as a percentage of the total waste produced.

.2 Owner has established that this project shall generate the least amount of waste possible and that processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors be employed by the Contractor.

1.2 RELATED REQUIREMENTS

.1 Section 01 52 00 - Construction Facilities

.2 Section 02 41 13 - Selective Site Demolition

1.3 REFERENCE STANDARDS

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

.1 ASTM E 1609 01, Standard Guide for Development and Implementation of a Pollution Prevention Program

.2 Recycling Certification Institute (RCI):

.1 RCI Certification Construction and Demolition Materials Recycling

1.4 DEFINITIONS

.1 Clean Waste: Untreated and unpainted; not contaminated with oils, solvents, sealants or similar materials.

.2 Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, re modeling, repair and demolition operations.

.3 Hazardous: Exhibiting the characteristics of hazardous substances including properties such as ignitability, corrosiveness, toxicity or reactivity.

.4 Non hazardous: Exhibiting none of the characteristics of hazardous substances, including properties such as ignitability, corrosiveness, toxicity, or reactivity.

.5 Non toxic: Not poisonous to humans either immediately or after a long period of exposure.

.6 Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

.7 Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

.8 Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form; recycling does not include burning, incinerating, or thermally destroying waste.

.9 Return: To give back reusable items or unused products to vendors for credit.

.10 Reuse: To reuse a construction waste material in some manner on the project site.

.11 Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

.12 Sediment: Soil and other debris that has been eroded and transported by storm or well production run off water.

.13 Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

.14 Toxic: Poisonous to humans either immediately or after a long period of exposure.

.15 Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

.16 Volatile Organic Compounds (VOC's): Chemical compounds common in and emitted by many building products over time through outgassing:

.1 Solvents in paints and other coatings;

.2 Wood preservatives; strippers and household cleaners;

.3 Adhesives in particleboard, fiberboard, and some plywood; and foam insulation.

.4 When released, VOC's can contribute to the formation of smog and can cause respiratory tract problems, headaches, eye irritations, nausea, damage to the liver, kidneys, and central nervous system, and possibly cancer.

.17 Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

.18 Construction Waste Management Plan: A project related plan for the collection, transportation, and disposal of the waste generated at the construction site; the purpose of the plan is to ultimately reduce the amount of material being landfilled.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate waste management requirements with all Divisions of the Work for the project, and ensure that requirements of the Construction Waste Management Plan are followed.

1.6 SUBMITTALS

.1 Provide required information in accordance with Section 01 33 00 - Submittal Procedures.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Draft Construction Waste Management Plan (Draft CWM Plan): Submit to Consultant a preliminary analysis of anticipated site generated waste by listing a minimum of five (5) construction or demolition waste streams that have potential to generate the most volume of material indicating methods that will be used to divert construction waste from landfill and source reduction strategies; Consultant will provide commentary before development of Contractor's Construction Waste Management Plan.

.3 Construction Waste Management Plan (CWM Plan): Submit a CWM Plan for this project prior to any waste removal from site and that includes the following information:

.1 Material Streams: Analysis of the proposed jobsite waste being generated, including material types and quantities forming a part of identified material streams in the Draft CWM Plan; materials removed from site destined for alternative daily cover at landfill sites and land clearing debris cannot be considered as contributing to waste diversion and will be included as a component of the total waste generated for the site.

.3 Recycling Haulers and Markets: Investigate local haulers and markets for recyclable materials, and incorporate into CWM Plan.

.4 Alternative Waste Disposal: Prepare a listing of each material proposed to be salvaged, reused, recycled or composted during the course of the project, and the proposed local market for each material.

.5 Landfill Materials: Identify materials that cannot be recycled, reused or composted and provide explanation or justification; energy will be considered as a viable alternative diversion strategy for these materials where facilities exist.

.6 Landfill Options: The name of the landfill where trash will be disposed of; landfill materials will form a part of the total waste generated by the project.

.7 Materials Handling Procedures: A description of the means by which any recycled waste materials will be protected from contamination, and a description of the means to be employed in recycling the above materials consistent with requirements for acceptance by designated facilities.

.8 Transportation: A description of the means of transportation of the recyclable materials, whether materials will be site separated and self hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site, and destination of materials.

1.7 PROJECT CLOSEOUT SUBMISSIONS

.1 Record Documentation: Submit as constructed information in accordance with Section 01 78 00 - Closeout Submittals as follows:

.1 Construction Waste Management Report (CWM Report): Submit a CWM Report for this project in a format acceptable to submittal requirements and that includes the following information:

.1 Accounting: Submit information indicating total waste produced by the project.

.2 Composition: Submit information indicating types of waste material and quantity of each material.

.3 Diversion Rate: Submit information indicating total waste diverted from landfill as a percentage of the total waste produced by the project.

.4 Transportation Documentation: Submit copies of transportation documents or shipping manifests indicating weights of materials, and other evidence of disposal indicating final location of waste diverted from landfill and waste sent to landfill.

.5 Alternative Daily Cover (ADC): Submit quantities of material that were used as ADC at landfill sites, and that form a part of the total waste generated by the project.

.6 Multiple Waste Hauling: Compile all information into a single CWM Report where multiple waste hauling and diversion strategies were used for the project.

.7 Photographs: Submit photographs of waste diversion facilities documenting location and signage describing usage of waste separation containers.

1.8 QUALITY ASSURANCE

.1 Resources for Development of Construction Waste Management Report (CWM Report): The following sources may be useful in developing the Draft Construction Waste Management Plan:

.1 Recycling Haulers and Markets: Investigate local haulers and markets for recyclable materials, and incorporate into CWM Plan.

.2 Waste-to-Energy Systems: Investigate local waste-to-energy incentives where systems for diverting materials from landfill for reuse or recycling are not available.

.2 Certifications: Provide proof of the following during the course of the Work:

.1 Compliance Certification: Provide proof that recycling center is third party verified and is listed as a Certified Facility through the registration and certification requirements of the Recycling Certification Institute.

1.9 **DELIVERY, STORAGE AND HANDLING**

.1 Storage Requirements: Implement a recycling/reuse program that includes separate collection of waste materials as appropriate to the project waste and the available recycling and reuse programs in the project area.

.2 Handling Requirements: Clean materials that are contaminated before placing in collection containers and ensure that waste destined for landfill does not get mixed in with recycled materials:

.1 Deliver materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to recycling process.

.2 Arrange for collection by or delivery to the appropriate recycling or reuse facility.

.3 Hazardous Waste and Hazardous Materials: Handle in accordance with applicable regulations.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 (CWM PLAN) IMPLEMENTATION

.1 Manager: Contractor is responsible for designating an on site party or parties responsible for instructing workers and overseeing and documenting results of the CWM Plan for the project.

.2 Distribution: Distribute copies of the CWM Plan to the job site foreman, each Subcontractor, the Owner, the Consultant and other site personnel as required to maintain CWM Plan.

.3 Instruction: Provide on site instruction of appropriate separation, handling, and recycling, salvage, reuse, composting and return methods being used for the project to Subcontractor's at appropriate stages of the project.

.4 Separation Facilities: Lay out and label a specific area to facilitate separation of materials for potential recycling, salvage, reuse, composting and return:

.1 Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid contamination of materials.

.2 Hazardous wastes shall be separated, stored, and disposed of in accordance with local regulations.

.5 Progressive Documentation: Submit a monthly summary of waste generated by the project to ensure that waste diversion goals are on track with project requirements:

.1 Submission of waste summary can coincide with application for progress payment, or similar milestone event as agreed upon between the Owner, Contractor and Consultant.

.2 Monthly waste summary shall contain the following information:

.1 The amount in tonnes or m^3 and location of material landfilled,

.2 The amount in tonnes or m^3 and location of materials diverted from landfill, and

.3 Indication of progress based on total waste generated by the project with materials diverted from landfill as a percentage.

3.2 SUBCONTRACTOR'S RESPONSIBILITY

.1 Subcontractors shall cooperate fully with the Contractor to implement the CWM Plan.

.2 Failure to cooperate may result in the Owner not achieving their environmental goals, and may result in penalties being assessed by the Contractor to the responsible Subcontractor's.

END OF SECTION

Part 1 General

1.1 MEASUREMENT PROCEDURES

.1 This work shall be incidental to contract and will not be measured for payment.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Acceptance of Work Procedures:

.1 Contractor's Inspection: Contractor: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.

.1 Notify Departmental Representative in writing of satisfactory completion of Contractor’s inspection and submit verification that corrections have been made.

.2 Request Departmental Representative’s inspection.

.2 Departmental Representative’s Inspection:

.1 Departmental Representative and Contractor to inspect Work and identify defects and deficiencies.

.2 Contractor to correct Work as directed.

.3 Completion Tasks: submit written certificates that tasks have been performed as follows:

.1 Work: completed and inspected for compliance with Contract Documents.

.2 Defects: corrected and deficiencies completed.

.3 Equipment and systems: tested, adjusted and fully operational.

.4 Certificates required by Utility companies: submitted.

.5 Operation of systems: demonstrated to Owner's personnel.

.6 The contractor must supply all Operations and Maintenance Manuals for any equipment is part of the contract – control panels, electrical panels, and other equipment.

.7 Work: complete and ready for final inspection.

.4 Final Inspection:

.1 When completion tasks are done, request final inspection of Work by Departmental Representative, and Contractor.

.2 When Work incomplete according to Departmental Representative, complete outstanding items and request re-inspection.

.5 Declaration of Substantial Performance: when Departmental Representative considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.

.6 Commencement of Lien and Warranty Periods: date of Owner's acceptance of submitted declaration of Substantial Performance to be date for commencement

for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.

.7 Final Payment:

.1 When Departmental Representative considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment.

.8 Payment of Holdback: after issuance of Certificate of Substantial Performance of Work, submit application for payment of holdback amount in accordance with contractual agreement.

1.3 FINAL CLEANING

.1 Undertake a final cleaning of the site at project completion:

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 All disturbed areas shall be returned to their original condition.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 MEASUREMENT PROCEDURES

.1 This work shall be incidental to contract and will not be measured for payment.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Pre-warranty Meeting:

- .1 Convene meeting one week prior to contract completion with Departmental Representative, to:
  - .1 Verify Project requirements.
  - .2 Review warranty requirements.
- .2 Departmental Representative to establish communication procedures for:
  - .1 Notifying construction warranty defects.
  - .2 Determine priorities for type of defects.
  - .3 Determine reasonable response time.
- .3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.
- .4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 One week prior to Substantial Performance of the Work, submit to the Departmental Representative, two final copies of operating and maintenance manuals in English.

.3 Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.

.4 Provide evidence, if requested, for type, source and quality of products supplied.

1.4 FORMAT

.1 Organize data as instructional manual.

.2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf [219 x 279] mm with spine and face pockets.

.3 When multiple binders are used correlate data into related consistent groupings.

- .1 Identify contents of each binder on spine.

.4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.

.5 Arrange content under Section numbers and sequence of Table of Contents.

.6 Text: manufacturer's printed data, or typewritten data.

.7 Drawings: provide with reinforced punched binder tab.

1.5 AS -BUILT DOCUMENTS AND SAMPLES

.1 Maintain, at site for Departmental Representative one record copy of:

.1 Contract Drawings.
.2 Specifications.
.3 Addenda.
.4 Change Orders and other modifications to Contract.
.5 Reviewed shop drawings, product data, and samples.
.6 Field test records.
.7 Inspection certificates.
.8 Manufacturer's certificates.

.2 Store record documents and samples in field office apart from documents used for construction.

.1 Provide files, racks, and secure storage.

.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.

.1 Label each document "PROJECT RECORD" in neat, large, printed letters.

.4 Maintain record documents in clean, dry and legible condition.

.1 Do not use record documents for construction purposes.

.5 Keep record documents and samples available for inspection by Departmental Representative.

1.6 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

.1 Record information on set of drawings, provided by Departmental Representative.

.2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.

.3 Record information concurrently with construction progress.

.1 Do not conceal Work until required information is recorded.

.4 Contract Drawings and shop drawings: mark each item to record actual construction, including:

.1 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
.2 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
.3 Field changes of dimension and detail.
.4 Changes made by change orders.
.5 Details not on original Contract Drawings.
.6 References to related shop drawings and modifications.

.5 Specifications: mark each item to record actual construction, including:

.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.

.2 Changes made by Addenda and change orders.

.6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

.7 The Contractor will complete as-built survey of all Works for Record Drawings and provide the results to the Departmental Representative prior to Substantial Performance of the Work.

.8 The acceptance of work and final inspection shall be in accordance to Section 01 77 00 – Clouseout Procedures.

.9 Provide digital photos, if requested, for site records.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes descriptions for demolishing, salvaging for re-use, recycling and removing site work items identified for removal in whole or in part, and for backfilling trenches and excavations resulting from site demolition activities.

1.2 RELATED REQUIREMENTS

.1 Section 01 74 19 – Waste Management and Disposal

1.3 REFERENCE STANDARDS

.1 Department of Justice Canada (Jus)

- .1 Canadian Environmental Assessment Act (CEAA), 2012
- .2 Canadian Environmental Protection Act (CEPA), 2012
  - .1 SOR/2003-2, On-Road Vehicle and Engine Emission Regulations
  - .2 SOR/2006-268, Regulations Amending the On-Road Vehicle and Engine Emission Regulations
  - .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34
  - .4 Motor Vehicle Safety Act (MVSA), 1995
  - .5 Hazardous Materials Information Review Act, 1985

.2 U.S. Environmental Protection Agency (EPA)

- .1 EPA CFR 86.098-10, Emission standards for 1998 and later model year Otto-cycle heavy-duty engines and vehicles
- .2 EPA CFR 86.098-11, Emission standards for 1998 and later model year diesel heavy-duty engines and vehicles
  - .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices

1.4 DEFINITIONS

.1 Selective Demolition: Sequencing demolition activities to allow separation and sorting of selected site materials.

.2 Hazardous Substances: dangerous substances, dangerous goods, hazardous commodities and hazardous products, including but not limited to: asbestos PCB's, CFC's, HCFC's poisons, corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or other material that can endanger human health or well being or environment if handled improperly.

.3 Draft Construction Waste Management Plan (Draft CWM Plan): Detailed inventory of materials in building indicating estimated quantities of reuse, recycling and landfill, prepared in accordance with Section 01 74 19- Construction Waste Management and Disposal and as follows:

.1 Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project.

.4 Waste Management Coordinator (WMC): contractor's representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.

.5 Construction Waste Management Plan (CWM Plan): Written plan addressing opportunities for reduction, reuse, or recycling of materials prepared in accordance with Section 01 74 19- Waste Management and Disposal.

.6 Construction Waste Management Report (CWM Report): Written report identifying actual materials that formed CWM Plan for reduction, reuse, or recycling of materials

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate with Departmental Representative for the material ownership including the following:

.1 Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

.2 Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered during demolition remain Owner's property:

.1 Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.

.2 Pre-Demolition Meetings.

.1 Convene pre-installation meeting week before beginning work of this Section, with Departmental Representative to:

.1 Verify project requirements.

.2 Verify existing site conditions adjacent to demolition work

.3 Coordinate with other construction sub trades

.4 Examine existing site conditions adjacent to demolition work, prior to start of Work

.5 Waste reporting requirements

.2 Ensure key personnel attend.

.3 WMC will provide verbal report on status of waste diversion activity at each meeting.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

.1 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Shop Drawings:

.1 Submit for review and approval selective site demolition drawings, diagrams or details showing sequence of selective site demolition.

.2 Schedule of Selective Site Demolition Activities and indicate the following:

.1 Detailed sequence of selective site demolition and removal work, with starting and ending dates for each activity

.2 Coordination for shutoff, capping, and continuation of utility services

.3 Locations of temporary partitions and means of egress

.3 Construction Waste Management Plan (CWM Plan): Submit a plan of demolition area indicating extent of temporary facilities and supports, methods of removal and demolition prepared by a professional Engineer in accordance with requirements of Authority Having Jurisdiction, and as follows:

.4 Proposed Dust Control, Noise Control Measures: Submit statement or drawing that indicates measures proposed for use, proposed locations, and proposed time frame for their operation.

.5 Inventory: Submit a list of items that have been removed and salvaged after selective site demolition is complete

.1 Pre demolition photographs: Submit photographs indicating existing conditions of adjoining construction and site improvements prior to starting Work. Include finish surfaces that may be misconstrued as damage caused by selective site demolition operations.

.6 Provide certificates from disposal facilities to Departmental Representative.

.7 No interruption to any of the utility services is allowed.

1.7 QUALITY ASSURANCE

.1 Regulatory Requirements: ensure Work is performed in compliance with applicable Provincial/Territorial regulations.

.2 Comply with hauling and disposal regulations of Authority Having Jurisdiction.

1.8 SITE CONDITIONS

.1 Perform work in accordance with Section 01 35 43 – Environmental Procedures.

.2 Environmental protection:

.1 Ensure Work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.

.2 Fires and burning of waste or materials is not permitted on site.

.3 Burying of rubbish waste materials is not permitted.

.4 Disposal of waste of volatile materials including but not limited to, mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers, is not permitted.

.5 Ensure proper disposal procedures are maintained throughout the project.

.3 Pumping of water containing suspended materials into watercourses, storm or sanitary sewers or onto adjacent properties, is not permitted.

.4 Protect trees, plants and foliage on site and adjacent properties where indicated.

.5 Prevent extraneous materials from contaminating air beyond application area, by providing temporary enclosures during demolition work.

.6 Cover or wet down dry materials and waste to prevent blowing dust and debris. Control dust on all temporary roads.

.7 Conduct selective site demolition so Owner's operations will not be disrupted:

.1 Provide not less than 72 hours' notice to Owner of activities that will affect operations.

.2 Maintain access to existing walkways, exits, and other adjacent occupied or used facilities:

.1 Closing or obstructing walkways, exits, or other occupied or used facilities without written permission from the Departmental Representative is not permitted.

.8 The Departmental Representative assumes no responsibility for Selective Site elements being demolished:

.1 Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

.2 Before selective site demolition, remove, protect and store salvaged items as directed by Owner

.1 Salvage items as identified by the Departmental Representative.

.2 Deliver to the Owner as directed.

1.9 EXISTING CONDITIONS

.1 Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

.2 If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify the Departmental Representative. Hazardous materials will be removed by Owner under a separate contract or as a change to the Work.

.3 If material resembling spray or trowel applied asbestos or other designated substance listed as hazardous be encountered in course of demolition, stop work, take preventative measures, and notify the Departmental Representative immediately. Proceed only after receipt of written instructions have been received from the Departmental Representative.

.4 Site elements that will be demolished are based on their condition on date that tender is accepted.

Part 2 Products

2.1 Not used.

Part 3 Execution

3.1 EXAMINATION

.1 Survey existing conditions and correlate with requirements indicated to determine extent of selective site demolition required.

.2 The Departmental Representative does not guarantee that existing conditions are the same as those indicated in Project Record Documents.

.3 Inventory and record the condition of items being removed and salvaged.

.4 When unanticipated mechanical, electrical, or structural elements are encountered, investigate and measure the nature and extent of the element. Promptly submit a written report to the Departmental Representative

.5 Engage a professional Engineer to perform an engineering survey of conditions of adjacent buildings to determine whether removing any site element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective site demolition operations.

.6 Verify that hazardous materials have been remediated before proceeding with site demolition operations.

3.2 PREPARATION

.1 Temporary Erosion and Sedimentation Control:

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to: requirements of authorities having jurisdiction.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during demolition.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal after completion of demolition work.

.2 Protection of in-place conditions:

.1 Prevent movement, settlement or damage of adjacent structures, services, walks, paving, trees, landscaping, adjacent grades, properties and parts of existing building to remain.

.1 Provide bracing, shoring and underpinning as required.

.2 Repair damage caused by demolition as directed by the Departmental Representative.

.2 Support affected site elements and, if safety of site element being demolished adjacent structures or services appears to be endangered, take preventative measures, stop Work and immediately notify the Departmental Representative.

.3 Prevent debris from blocking surface drainage system, elevators, mechanical and electrical systems which must remain in operation.

.3 Utilities:

.1 Locate and protect utilities. Preserve active utilities traversing site in operating condition.

.2 Notify affected utility companies before starting work and comply with their requirements.

.3 Mark location and termination of utilities.

3.3 REMOVAL AND DEMOLITION OPERATIONS

.1 Identify designated utilities within demolition areas.

.2 Remove items as indicated on the drawings.

.3 Disruption of items designated to remain in place is not permitted.

.4 When removing existing traffic sign or information sign, remove existing concrete foundation if there is any.

.5 Removal of pavements, curbs and gutters:

.1 Square up adjacent surfaces to remain in place by saw cutting or other method approved by the Departmental Representative.

.2 Protect adjacent joints and load transfer devices.

.6 Stockpile topsoil for final grading and landscaping per Section 31 14 13 Soil Stripping and Stockpiling:

.1 Provide erosion control and seeding if not immediately used.

.7 Salvage:

.1 Dismantle items containing materials for salvage and reuse, and stockpile or store at locations approved by the Departmental Representative.

.8 Disposal of Material:

.1 Dispose of materials not designated for salvage or reuse on site at authorized facilities approved in Waste Reduction Workplan or as instructed by the Departmental Representative

3.4 STOCKPILING

.1 Label stockpiles, indicating material type and quantity.

.2 Designate appropriate security resources/measures to prevent vandalism, damage and theft.

.3 Locate stockpiled materials convenient for use in new construction to eliminate double handling wherever possible.

.4 Stockpile materials designated for alternate disposal in location which facilitates removal from site and examination by potential end markets, and which does not impede disassembly, processing, or hauling procedures.

3.5 REMOVAL FROM SITE

.1 Remove stockpiled material as directed by the Departmental Representative, when it interferes with operations of project.

.2 Remove stockpiles of like materials by alternate disposal option once collection of materials is complete.

3.6 RESTORATION

.1 Restore areas and existing works outside areas of demolition to conditions that existed prior to beginning of Work.

.2 Use soil treatments and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

3.7 CLEANING

.1 Progress Cleaning:

.1 Leave Work area clean at end of each day.

.2 Remove debris, trim surfaces and leave work site clean, upon completion of Work

.3 Use cleaning solutions and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00- Cleaning.

.3 Waste Management: separate waste materials for reuse recycling in accordance with Section 01 74 19- Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes descriptions for demolishing, salvaging, recycling and removing of asphalt paving identified in whole or in part, resulting from site demolition activities a required by scope of work.

1.2 RELATED REQUIREMENTS

.1 Section 02 41 13 - Selective Site Demolition

.2 Section 01 74 19 – Waste Management and Disposal

1.3 PRICE AND PAYMENT

.1 Payment for this item shall be in accordance with Section 01 27 00 Measurement and Payment.

1.4 REFERENCE STANDARDS

.1 Canada Green Building Council (CaGBC)

.1 LEEDr Reference Guide for Building Design and Construction, Version 4.

.2 Department of Justice Canada (Jus)

.1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.

.2 Canadian Environmental Protection Act, 1999 (CEPA), c. 33.

.3 U.S. Environmental Protection Agency (EPA) / Office of Water

.1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.5 DEFINITIONS

.1 Demolish: Detach items from existing construction and legally dispose of them off site, unless indicated to be removed and salvaged or removed and reinstalled.

.2 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed, removed and salvaged, or removed and reinstalled

.3 Draft Construction Waste Management Plan (Draft CWM Plan): Detailed inventory of materials in building indicating estimated quantities of reuse, recycling and landfill, prepared in accordance with Section 01 74 19 - Construction Waste Management and Disposal and as follows:

.1 Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project.

.4 Waste Management Coordinator (WMC): Contractor representative responsible for

supervising waste management activities as well as coordinating related, required submittal and reporting requirements.

.5 Construction Waste Management Plan (CWM Plan): Written plan addressing opportunities for reduction, reuse, or recycling of materials prepared in accordance with Section 01 74 19 - Waste Management and Disposal.

.6 Construction Waste Management Report (CWM Report): Written report identifying actual materials that formed CWM Plan for reduction, reuse, or recycling of materials prepared in accordance with Section 01 74 19 - Waste Management and Disposal.

1.6 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate requirements for Waste Management and Disposal for materials being re used or recycled in accordance with Section 01 45 16.19:

.1 Divert excess materials from landfill

.2 Separate materials identified for recycling place in identified areas in accordance with Waste Management Plan

.3 Label location of salvaged material's storage areas and provide barriers and security devices

.4 Remove materials that cannot be salvaged for re use or recycling and dispose of in accordance with applicable codes at licensed facilities

.2 Pre-Construction Meeting: Arrange a pre-construction meeting in accordance with Section 01 31 19 - Project Meetings; attended by Departmental Representatives, Contractor's key personnel, waste management coordinator and other stakeholder if required to discuss the following:

.1 Verify project requirements.

.2 Review site conditions.

.3 Coordination with other Subcontractors.

.4 Examine existing site conditions adjacent to demolition work, prior to start of Work.

.5 Waste reporting requirements.

1.7 ACTION AND INFORMATIONAL SUBMITTALS

.1 Action Submittals: Provide following submittals before starting work of this Section:

.1 Shop Drawings: Submit shop drawings indicating diagrams or details showing sequence of demolition work.

.2 Informational Submittals: Provide following submittals during course of work:

.1 Certificates: Submit copies of certified weigh bills, bills of lading or receipts from authorized disposal sites and re use and recycling facilities for material

removed from site on as agreed by Departmental Representative.

.3 Sustainable Design Submittals:

.1 Erosion and Sedimentation Control: submit copy of erosion and sedimentation control plan in accordance with EPA 832/R-92-2005.

.2 Construction Waste Management: Submit project [CWM Plan] highlighting recycling and salvage requirements in accordance with Section 01 74 19 - Waste Management and Disposal.

1.8 QUALITY ASSURANCE

.1 Regulatory Requirements: ensure Work is performed in compliance with all applicable Provincial/Territorial regulations.

.2 Comply with hauling and disposal regulations of Authority Having Jurisdiction.

1.9 SITE CONDITIONS

.1 Protect existing site features to remain or identified for salvage or re use; make repairs and restore to a similar condition to existing where damage to these items occurs as directed by Consultant and at no cost to Owner:

.1 Remove and store salvaged materials to prevent contamination.

.2 Store and protect salvaged materials as required for maximum preservation of material.

.3 Handle salvaged materials same as new materials.

.2 Perform pavement removal work to prevent adverse effects to adjacent watercourses, groundwater and wildlife, and to prevent excess air and noise pollution:

.1 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers or onto adjacent properties.

.2 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with Authorities Having Jurisdiction.

.3 Protect existing site features and structures, trees, plants and foliage on site and adjacent properties.

Part 2 Products

2.1 EQUIPMENT

.1 Use cold milling, planning or grinding equipment with automatic grade controls capable of operating from stringline, and capable of removing part of pavement surface to depths or grades indicated.

Part 3 Execution

3.1 PREPARATION

.1 Verify extent and location of asphalt identified for removal, disposal, alternative disposal, recycling, salvage and items to remain.

.2 Locate and protect utilities, preserve active utilities traversing site in operating condition.

.3 Temporary Erosion and Sedimentation Control:

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction, sediment and erosion control drawings, sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

.4 Prior to beginning removal operation, inspect and verify with the Departmental Representative, depths and lines of asphalt pavement to be removed.

.5 Protection: protect existing pavement not designated for removal, light units and structures from damage. In event of damage, immediately replace or make repairs to approval of Departmental Representative at no additional cost.

3.2 REMOVAL

.1 Remove existing asphalt pavement to lines and grades as indicated on the drawings and agreed with the Departmental Representative on site.

.2 Demolition of pavements, curbs and gutters:

.1 Square up adjacent surfaces to remain in place by saw cutting or other method acceptable to the Departmental Representative on site.

.2 Protect adjacent joints and load transfer devices.

.3 Protect underlying and adjacent granular materials where they are exposed and identified to remain.

.4 Prevent contamination with base course aggregates, when removing asphalt pavement for subsequent incorporation into hot mix asphalt concrete paving.

.3 Use equipment and methods of removal and hauling which do not damage or disturb underlying pavement.

.4 Prevent contamination of removed asphalt pavement by topsoil, underlying gravel or

other materials.

.5 Suppress dust generated by removal process.

3.3 FINISH TOLERANCES

.1 Finished surfaces in areas where asphalt pavement has been removed within +/- 5 mm of grade specified but not uniformly high or low.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

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

.4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

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

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CAN/CSA-O86-14, Engineering Design in Wood.

.3 CSA O121-08(R2013), Douglas Fir Plywood.

.4 CSA O151-09(2014), Canadian Softwood Plywood.

.5 CSA O153-13, Poplar Plywood.

.6 CAN/CSA-O325.0-16, Construction Sheathing.

.7 CSA O437 Series-93(R2011), Standards for OSB and Waferboard.

.8 CSA S269.1-16, Falsework and Formwork.

.9 CAN/CSA-S269.3-M92(R2003), Concrete Formwork.

.2 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for proprietary materials used in formwork liners and coatings and include product characteristics, performance criteria, physical size, finish, and limitations.

.2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements 01 35 43 - Environmental Procedures.

1.3 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 Retain a professional engineer registered or licensed in Alberta, Canada, with experience in formwork and falsework design of comparable complexity and scope, to perform following services as part of Work of this Section:

.1 Design of formwork and falsework:

.2 Review, stamp, and sign fabrication and erection Shop Drawings, design calculations and amendments.

.3 Conduct on-site inspections and prepare and submit inspection reports verifying this part of Work is in accordance with Contract Documents and reviewed Shop Drawings. Perform inspections a minimum of once per month.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect formwork from damages.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Materials and resources in accordance with Section 01 47 15 - Sustainable Requirements: Construction**.**

.2 Do verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification.

.3 Formwork materials:

.1 For concrete without special architectural features, use wood and wood product formwork materials to CAN/CSA-O86.

.2 For concrete with special architectural features, use formwork materials to CSA-A23.1/A23.2.

.3 Rigid insulation board: to CAN/ULC-S701.

.4 Form release agent: Proprietary, non-volatile material not to stain concrete or impair subsequent application of finishes or coatings to surface of concrete, derived from agricultural sources, non-petroleum containing, non-toxic, biodegradable.

.5 Falsework materials: to CSA-S269.1.

.6 Sealant: to Section 07 92 00 - Joint Sealants.

Part 3 Execution

3.1 REMOVAL AND RESHORING

.1 Leave formwork in place for following minimum periods of time after placing concrete.

.1 2 days for walls and sides of beams.

.2 2 days for columns.

.3 14 days for beam soffits, slabs, decks and other structural members, or 3 days when replaced immediately with adequate shoring to standard specified for falsework.

.4 2 days for footings and abutments.

.2 Remove formwork when concrete has reached 70 % of its 28 day design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.

.3 Provide necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.

.4 Space reshoring in each principal direction at not more than 3000 mm apart.

.5 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

3.2 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.2 Leave Work area clean at end of each day.

.3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal 01 35 21 - LEED Requirements.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 American Concrete Institute (ACI)

.1 SP-66-04, ACI Detailing Manual 2004.

.2 ASTM International (ASTM)

.1 ASTM A 143/A 143M-07(2014), Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.

.2 ASTM A 1064/A 1064M-16b, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

.3 CSA Group (CSA)

.1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CAN/CSA-A23.3-14, Design of Concrete Structures.

.3 CSA-G30.18-09(R2014), Carbon Steel Bars for Concrete Reinforcement.

.4 CSA-G40.20/G40.21-13(R2014), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.5 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.6 CSA W186-M1990(R2016), Welding of Reinforcing Bars in Reinforced Concrete Construction.

.4 Reinforcing Steel Institute of Canada (RSIC)

.1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for proprietary materials used in Cast-In-Place Concrete and additives and include product characteristics, performance criteria, physical size, finish, and limitations.

.2 When Chromate solution used as replacement for galvanizing non-prestressed reinforcement, provide product description for review by Consultant prior to its use.

.3 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements and 01 35 43 - Environmental Procedures.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Alberta.

.1 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and SP-66.

.2 Indicate placing of reinforcement and:

.1 Bar bending details.

.2 Lists.

.3 Quantities of reinforcement.

.4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Consultant, with identifying code marks to permit correct placement without reference to structural drawings.

.5 Indicate sizes, spacings and locations of chairs, spacers and hangers.

.3 Detail lap lengths and bar development lengths to CAN/CSA-A23.3, unless otherwise indicated .

.1 Provide type C tension lap splices where indicated unless otherwise indicated.

.4 Indicate position and size of openings in slabs and walls. Coordinate with trades requiring openings.

.4 Quality Assurance Submittals:

.1 Submit in accordance with Section 01 45 00 - Quality Control and as described in PART 2 - SOURCE QUALITY CONTROL.

.2 Mill Test Report: upon request, submit to Consultant certified copy of mill test report of reinforcing steel, minimum 4 weeks prior to beginning reinforcing work.

.3 Upon request submit in writing to Consultant proposed source of reinforcement material.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory

packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Substitute different size bars only if permitted in writing by Consultant.

.2 Reinforcing steel: billet steel, grade 400, deformed bars to CSA-G30.18, unless indicated otherwise.

.3 Reinforcing steel: weldable low alloy steel deformed bars to CSA-G30.18.

.4 Cold-drawn annealed steel wire ties: to ASTM 1064/A 1064M.

.5 Deformed steel wire for concrete reinforcement: to ASTM 1064/A 1064M.

.6 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.

.7 Tie wire: 1.5 mm diameter annealed wire.

.8 Mechanical splices: subject to approval of Consultant.

.9 Plain round bars: to CSA-G40.20/G40.21.

2.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2.

.2 Obtain Consultant's written approval for locations of reinforcement splices other than those shown on placing drawings.

.3 Upon approval of Consultant, weld reinforcement in accordance with CSA W186.

.4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.3 SOURCE QUALITY CONTROL

.1 Provide Consultant with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to beginning reinforcing work.

Part 3 Execution

3.1 PREPARATION

.1 Galvanizing to include chromate treatment.

.1 Duration of treatment 1 hour per 25 mm of bar diameter.

.2 Conduct bending tests to verify galvanized bar fragility in accordance with ASTM A 143/A 143M.

3.2 FIELD BENDING

.1 Do not field bend or field weld reinforcement except where indicated or authorized by Consultant.

.2 When field bending authorized, bend without heat, applying slow and steady pressure.

.3 Replace bars, which develop cracks or splits.

3.3 PLACING REINFORCEMENT

.1 Cutting or puncturing vapour retarder is not permitted; repair damage and reseal vapour retarder before placing concrete.

.2 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1/A23.2.

.3 Use plain round bars as slip dowels in concrete.

.1 Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint.

.2 Apply thick even film of mineral lubricating grease when paint is dry.

.4 Prior to placing concrete, obtain Consultant's approval of reinforcing material and placement.

.5 Maintain cover to reinforcement during concrete pour.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM C 260/C 260M-10a(2016), Standard Specification for Air-Entraining Admixtures for Concrete.

.2 ASTM C 309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.3 ASTM C 494/C 494M-16, Standard Specification for Chemical Admixtures for Concrete.

.4 ASTM C 881/C 881M-15, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

.5 ASTM C 1017/C 1017M-13e1, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

.6 ASTM D 1751-04(2013)e1, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.3 CSA Group

.1 CSA A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA A283-06-R2016, Qualification Code for Concrete Testing Laboratories.

.3 CSA A3000-13, Cementitious Materials Compendium.

1.2 ABBREVIATIONS AND ACRONYMS

.1 Portland Cement: hydraulic cement, blended hydraulic cement (XXb - b denotes blended) and Portland-limestone cement types:

.1 GU - General use cement.

.2 MS and MSb - Moderate sulphate-resistant cement.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for proprietary materials used in Cast-In-Place Concrete and additives and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements and 01 35 43 - Environmental Procedures.

.3 Site Quality Control Submittals:

.1 Provide testing results for review by Consultant and do not proceed without written approval when deviations from mix design or parameters found.

.2 Concrete pours: provide accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 - FIELD QUALITY CONTROL.

.3 Concrete hauling time: provide for review by Consultant deviations exceeding maximum allowable time of 120 minutes for concrete delivered to site of Work and discharged after batching.

1.4 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 Provide Consultant, minimum 4 weeks prior to starting concrete work, with valid and recognized certificate from plant delivering concrete.

.1 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture meet specified requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements:

.2 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.

.1 Modifying maximum time limit without receipt of prior written agreement from Consultant and concrete producer as described in CSA A23.1/A23.2. is prohibited.

.2 Deviations submitted for review by Consultant.

.3 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

1.6 SITE CONDITIONS

.1 Placing concrete during rain or weather events that could damage concrete is prohibited.

.2 Protect newly placed concrete from rain or weather events in accordance with CSA A23.1/A23.2.

.3 Cold weather protection:

.1 Maintain protection equipment, in readiness on Site.

.2 Use such equipment when ambient temperature below 5°C, or when temperature may fall below 5°C before concrete cured.

.3 Placing concrete upon or against surface at temperature below 5°C is prohibited.

.4 Hot weather protection:

.1 Protect concrete from direct sunlight when ambient temperature above 27°C.

.2 Prevent forms of getting too hot before concrete placed. Apply accepted methods of cooling not to affect concrete adversely.

.5 Protect from drying.

Part 2 Products

2.1 PERFORMANCE CRITERIA

.1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established by Consultant and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

2.2 MATERIALS

.1 Portland Cement: Normal Portland Cement in accordance with CSA A3000, Type GU; Sulphate Resisting Portland Cement in accordance with CSA A3000, Type HS.

.2 Water: to CSA A23.1.

.3 Aggregates: to CSA A23.1/A23.2.

.4 Admixtures:

.1 Air entraining admixture: to ASTM C 260.

.2 Chemical admixture: to ASTM C 1017. Consultant to approve accelerating or set retarding admixtures during cold and hot weather placing.

2.3 MIXES

.1 Ensure materials used in concrete mix have been submitted for testing and meet requirements of CSA A23.1.

.2 Co-ordinate construction methods to suit Consultant concrete mix proportions and parameters.

.3 Identify and report immediately to Consultant when concrete mix design and parameters pose anticipated problems or deficiencies related to construction.

Part 3 Execution

3.1 PREPARATION

.1 Obtain Consultant's written approval before placing concrete.

.1 Provide 24 hours minimum notice prior to placing of concrete.

.2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing .

.3 During concreting operations:

.1 Development of cold joints not allowed.

.2 Ensure concrete delivery and handling facilitate placing with minimum of re-handling, and without damage to existing structure or Work.

.5 Disturbing reinforcement and inserts during concrete placement is prohibited.

.6 Prior to placing of concrete obtain Consultant's approval of proposed method for protection of concrete during placing and curing in adverse weather.

.7 Protect previous Work from staining.

.8 Clean and remove stains prior to application for concrete finishes.

.9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, workability, air content, temperature and test samples taken.

3.2 INSTALLATION / APPLICATION

.1 Do cast-in-place concrete work to CSA A23.1/A23.2.

.2 Sleeves and inserts:

.1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, column capitals or columns, except where indicated or approved by Consultant .

.2 Where approved by Consultant, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.

.3 Sleeves and openings greater than 100 x 100 mm not indicated reviewed by Consultant.

.4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from Consultant before placing of concrete.

.5 Confirm locations and sizes of sleeves and openings shown on drawings.

.6 Set special inserts for strength testing as indicated and as required by non-

destructive method of testing concrete.

.3 Anchor bolts:

.1 Set anchor bolts to templates in co-ordination with appropriate trade prior to placing concrete.

.2 Grout anchor bolts in preformed holes or holes drilled after concrete has set only after receipt of written approval from Consultant.

.1 Formed holes: 100 mm minimum diameter.

.2 Drilled holes: 25 mm minimum diameter larger than bolts used to manufacturers' recommendations.

.3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.

.4 Set bolts and fill holes with shrinkage compensating grout epoxy grout.

.5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.

.4 Drainage holes and weep holes:

.1 Install weep hole tubes and drains as indicated.

3.3 FIELD QUALITY CONTROL

.1 Site tests: conduct tests as follows in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.1 Concrete pours.

.2 Slump.

.3 Air content.

.4 Compressive strength at 7 and 28 days.

.5 Air and concrete temperature.

.2 Inspection and testing of concrete and concrete materials carried out by testing laboratory designated by-Consultant for review to CSA A23.1/A23.2.

.1 Ensure testing laboratory certified to CSA A283.

.3 Ensure test results are distributed for discussion at pre-pouring concrete meeting between testing laboratory and Consultant.

3.4 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM C 309-03, Liquid Membrane-Forming Compounds for Curing Concrete.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-25.20-95, Surface Sealer for Floors.

.3 CSA Group (CSA)

.1 CAN/CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction//Methods of Test for Concrete.

.4 South Coast Air Quality Management District (SCAQMD), California State

.1 SCAQMD Rule 1113-A2016, Architectural Coatings. CSA Group (CSA)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for concrete finishes and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Provide two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements 01 35 43 - Environmental Procedures. WHMIS MSDS acceptable to Labour Canada and Health and Welfare Canada for concrete floor treatment materials. Indicate VOC content in g/L.

.3 Include application instructions for concrete floor treatments.

1.3 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 Minimum 4weeks prior to starting concrete finishing work, provide proposed quality control procedures for review by Consultant on following items:

.1 Hardening.

.2 Sealing.

.3 Curing.

.4 Finishes.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials in accordance with Section 01 74 19 - Waste Management and Disposal.

1.5 SITE CONDITIONS

.1 Temporary lighting: Minimum 1200 W light source, placed 2.5 m above floor surface, for each 40 sq m of floor being treated.

.2 Electrical power: Provide sufficient electrical power to operate equipment normally used during construction

.3 Work area: Make work area water tight protected against rain and detrimental weather conditions.

.4 Temperature: Maintain minimum 10 degrees C ambient temperature for 7 days before installation and minimum 48 hours after completion of work and maintain relative humidity maximum 40% during same period.

.5 Moisture: Ensure concrete substrate within moisture limits prescribed by flooring manufacturer.

.6 Safety: Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

.1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction 01 35 21 - LEED Requirements.

.2 Do verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification.

2.2 PERFORMANCE REQUIREMENTS

.1 Product quality and quality of work in accordance with Section 01 61 00 - Common Product Requirements.

.2 Submit written declaration components used compatible and not adversely affect finished flooring products and their installation adhesives.

Part 3 Execution

3.1 EXAMINATION

.1 Verify site conditions surfaces ready to receive work and elevations recommended by manufacturer's written instructions.

3.2 PREPARATION OF EXISTING SLAB

.1 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radiused edges unless otherwise indicated.

.2 Saw cut control joints to CAN/CSA-A23.1, 24 hours maximum after placing of concrete.

.3 Use mechanical stripping to remove chlorinated rubber or existing surface coatings.

.4 Use protective clothing, eye protection, respiratory equipment during stripping of chlorinated rubber or existing surface coatings.

3.3 CONCRETE STAINING

.1 Coordinate with Section 03 30 00 for wet curing. Liquid curing compounds not permitted under staining.

.2 Cure concrete for minimum 60 days.

.3 Clean and prepare concrete in accordance with manufacturers written instructions.

.4 Apply 2 coats of chemical stain materials in accordance with manufacturers written instructions; obtain Consultant's acceptance after application of both first and second coats.

.5 Apply recommended cure/seal materials in accordance with manufacturer's written instructions, in number of coats to achieve flat floor lustre.

3.4 APPLICATION

.1 Apply concrete finishing floor hardener in accordance with manufacturer's written instructions.

.2 After floor treatment dry, seal control joints and joints at junction with vertical surfaces with sealant.

.3 Apply floor treatment in accordance with Sealer manufacturer's written instructions.

.4 Clean **over spray. Clean** sealant from adjacent surfaces.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.6 PROTECTION

.1 Protect finished installation in accordance with manufacturer's instructions.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 04 43 23 Quarried Stone Veneer Cladding.

1.2 REFERENCE STANDARDS

.1 CSA Group

.1 CSA A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CAN/CSA-A179-14, Mortar and Grout for Unit Masonry.

.3 CAN/CSA-A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.2 International Masonry Industry All-Weather Council (IMIAC)

.1 Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

.3 South Coast Air Quality Management District (SCAQMD)

.1 SCAQMD Rule 1168-[05], Adhesive and Sealant Applications.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for masonry mortar and grout and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS MSDS. Indicate VOC's mortar, grout, parging, colour additives and admixtures. Expressed as grams per litre (g/L).

.2 Samples:

.1 Samples:

.1 Submit two 15mm x 30mm dry state ribbon samples of coloured mortar for review prior to commencement of work.

.2 Submit confirmation of source or product data sheet, prior to mixing or preparation of mortars, to Departmental Representative of:

.1 Aggregates.

.2 Cement.

.3 Lime.

.4 Colour pigment samples.

.3 Manufacturers' Instructions: submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.2 Storage and Handling Requirements:

.1 Store materials off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect masonry mortar and grout packages from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.6 SITE CONDITIONS

.1 Ambient Conditions: maintain materials and surrounding air temperature to:

.1 Minimum 10 degrees C prior to, during, and 48 hours after completion of masonry work.

.2 Maximum 32 degrees C prior to, during, and 48 hours after completion of masonry work.

.2 Weather Requirements: CAN/CSA-A371

Part 2 Products

2.1 MATERIALS

.1 Use same brands of materials and source of aggregate for entire project.

.2 Cement:

.1 Portland Cement: to CAN/CSA-A3000, Type GU - General use hydraulic cement (Type 10)

.3 Aggregate: supplied by one supplier.

.1 Fine Aggregate: to CAN/CSA-A179.

.2 Course Aggregate: to CAN/CSA-A179.

.4 Water: clean and potable.

.5 Lime:

.1 Hydrated Lime: to CAN/CSA-A179, Type N

.6 Anti-freeze compounds: do not use any anti-freeze liquid, salts or other substances to lower the freezing point of the mortar.

.7 Pigments: Color black. Mixed with mortar to match color of adjacent stone work. Contractor to record mix proportion for future reference. Not to exceed 10% of the weight of the Portland cement mix.

2.2 MORTAR MIXES

.1 Mortar for exterior masonry above grade:

.1 Type N based on proportion specifications, producing not less than 10Mpa at 28 days.

2.3 MORTAR MIXING

.1 Use pre-blended, pre-coloured mortar prepackaged under controlled factory conditions. Ingredients batching limitations to within 1% accuracy.

.2 Mix mortar ingredients in accordance with CAN/CSA-A179 in quantities needed for immediate use.

.3 Maintain sand uniformly damp immediately before mixing process.

.4 Add mortar colour in accordance with manufacturer's instructions. Provide uniformity of mix and colouration.

.5 Using anti-freeze compounds including calcium chloride or chloride-based compounds is prohibited.

.6 Adding air entraining admixture to mortar mix is prohibited.

.7 Use a batch type mixer in accordance with CAN/CSA-A179.

.8 Pointing mortar: prehydrate pointing mortar by mixing ingredients dry, then mix again adding just enough water to produce damp unworkable mix that will retain its form when pressed into ball. Allow to stand for not less than 1 hour no more than 2 hours then remix with sufficient water to produce mortar of proper consistency for pointing.

.9 Re-temper mortar only within two hours of mixing, when water is lost by evaporation.

.10 Use mortar within 2 hours after mixing at temperatures of 32 degrees C, or 2-1/2 hours at temperatures under 10 degrees C.

2.4 GROUT MIXES

.1 Grout: Non-shrunk, minimum compressive strength of 12.5 MPa at 28 days. Maximum aggregate size and grout slump: CAN/CSA-A179.

2.5 GROUT MIXING

.1 Mix batched and delivered grout in accordance with CSA A23.1/A23.2 transit mixed.

.2 Mix grout ingredients in quantities needed for immediate use in accordance with CAN/CSA-A179 fine grout.

.3 Add admixtures in accordance with manufacturer's instructions; mix uniformly.

.4 Using calcium chloride or chloride based admixtures is prohibited.

2.6 MIX TESTS

.1 Testing Mortar Mix:

.1 Test mortar to in accordance with CAN/CSA-A179. Test prior to construction for:

.1 Compressive strength.

.2 Consistency.

.3 Mortar aggregate ratio.

.4 Sand/cement ratio.

.5 Water content and water/cement ratio.

.6 Air content.

.7 Splitting tensile strength.

.2 Testing Grout Mix:

.1 Test grout in accordance with CAN/CSA-A179. Test prior to construction for:

.1 Compressive strength.

.2 Sand/cement ratio.

.3 Water content and water/cement ratio.

.4 Slump.

.3 Submit samples to laboratory of mix and water proposed to be used on the project for testing to ensure that the mortar will not produce efflorescence. Do not begin masonry work until the proposed mortar mix tests are approved by the Departmental Representative.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for masonry installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of the Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from the Departmental Representative.

3.2 PREPARATION

.1 Apply bonding agent to existing concrete surfaces.

3.3 CONSTRUCTION

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

3.4 MIXING

.1 Pointing mortar can be mixed using a regular paddle mixer. Only electric motor mixers are permissible. Mixers run on hydrocarbons are not permitted, due to fumes. Mixing by hand pre-approved by the Departmental Representative.

.2 Clean mixing boards and mechanical mixing machine between batches.

.3 Mortar: weaker than units it is binding.

.4 Contractor to appoint one individual to mix mortar, for duration of project. In event that this individual is changed, mortar mixing must cease until new individual is trained, and mortar mix is tested.

.5 Thoroughly mix ingredients in quantities needed for immediate use.

.6 Adjust consistency of mortar by adding maximum amount of water consistent with workability to provide maximum tensile bond strength. Air content in mortar to be kept to minimum.

.7 Mix mortar to an initial flow of 100 to 115, having a flow after suction of not less than 70%.

.8 For masonry work which has an upward facing horizontal exterior exposure, air entrain mortar to provide 4-6% air content.

.9 Use all mortar within 2 hours of mixing temperatures over 27°C, under 10°C – 2.5 hours.

.10 Mortar may be retempered within 2 hours of mixing to replace water lost by evaporation. Do not retemper mortar after 2 hours of mixing.

.11 Remove all excess mortar.

3.5 MORTAR PLACEMENT

.1 Install to manufacturer's instructions.

.2 Install mortar to requirements of CAN/CSA-A179.

.3 Install mortar and grout to requirements of Section 04 43 23 Quarried Stone Veneer Cladding.

.4 Remove excess mortar from grout spaces.

3.6 GROUT PLACEMENT

.1 Install grout in accordance with manufacturer's instructions.

.2 Install grout in accordance with CAN/CSA-A179.

.3 Work grout into masonry cores and cavities to eliminate voids.

.4 Installing grout in lifts greater than 400 mm, without consolidating grout by rodding is prohibited.

.5 Displacing reinforcement while placing grout is prohibited.

3.7 FIELD QUALITY CONTROL

.1 Site Tests, Inspection:

.1 Test and evaluate mortar prior to construction in accordance with CAN/CSA-A179.

.2 Test and evaluate grout prior to construction to CAN/CSA-A179; test in conjunction with masonry unit sections specified.

3.8 CLEANING

.1 Progress Cleaning:

.1 Leave Work area clean at end of each day.

.2 Remove droppings and splashings using clean sponge and water.

.3 Clean masonry with low pressure clean water and soft natural bristle brush.

.4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

3.9 PROTECTION

.1 Cover completed and partially completed work not enclosed or sheltered with waterproof covering at end of each work day. Anchor securely in position.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 04 53 13 Masonry Mortar & Grouting

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM C144-11, Standard Specification for Aggregate for Masonry Mortar.

.2 ASTM C207-06 (2011), Standard Specification for Hydrated Lime for Masonry Purposes.

.3 ASTM C568/C568M, Standard Specification for Limestone Dimension Stone.

.4 ASTM C616/C616M, Standard Specification for Quartz-Based Dimension Stone.

.2 CSA Group

.1 CAN/CSA-A370-04(R2009), Connectors for Masonry.

.2 CAN/CSA-A371-04(R2009), Masonry Construction for Buildings.

.3 CAN/CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.3 South Coast Air Quality Management District (SCAQMD)

.1 SCAQMD Rule 1168-05, Adhesive and Sealant Applications.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for quarried stone veneer cladding and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Alberta, Canada.

.2 Indicate sizes and sections of stone veneer, arrangements of joints and bonding, anchoring, dowelling and cramping.

.3 Each section of stone indicated on shop drawings must bear corresponding number marked on its back or bed.

.3 Samples:

.1 Submit 2 complete sets representing manufacturer's full range of available colours, textures, and patterns.

.2 Submit two (2) 200mm x 200mm x 12mm thick samples of stone to the Departmental Representative for review. Indicate range of colour and finish to be provided for this project.

.3 Provide two (2) samples of each type of tie.

1.4 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports, including sand gradation tests in accordance with CAN/CSA-A179, showing compliance with specified performance characteristics and physical properties.

.2 Mock-ups:

.1 Construct a 10m^2 mock-up panel of exterior quarried stone veneer construction for review by the Departmental Representative prior to proceeding with the remainder of the installation

.2 Sample installations must indicate all materials, maximum and minimum sizes and distribution of various sizes, colors, shades, graining, joints, mortar color, fastening system and level of workmanship.

.3 Adjust sample installation as required to meet the requirements of the contract documents and gain acceptance of the by the Departmental Representative, at no additional cost to the owner.

.4 Accepted sample installations will become the standard for the project and may remain in-situ if approved. Any work which does not match the accepted sample will be rejected and replaced with work to match accepted sample at no additional cost to the owner.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.2 Storage and Handling Requirements:

.1 Store materials in dry location approved by the Departmental Representative and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect quarried stone veneer cladding from nicks, scratches, and blemishes. Protect stockpiles at all time from weather, dirt and damage.

.3 Replace defective or damaged materials with new.

1.6 SITE CONDITIONS

.1 Ambient Conditions:

.1 Do not install at temperatures below 12 degrees C or above 38 degrees C.

.2 Maintain temperatures at or above 12 degrees C until cementitious materials have fully cured.

.3 Do not apply epoxy mortar and grouts at temperatures below 15 degrees C or above 25 degrees C.

.2 Field Measurements:

.1 Make site measurements necessary to ensure proper fit of members.

Part 2 Products

2.1 MATERIALS

.1 Stone Veneer:

- .1 Black Rundle Flagstone as supplied by Thunderstone Quarries, Kamenka Quarry Ltd. or pre-approved alternate.
- .2 Stone to have a split face finish, with tightly spaced graining, that can be shaped without excessive splitting or fragmentation.
- .3 Irregular pieces, sizing to vary with no pieces smaller than 200mm in length.
- .4 Colour and texture to match approved sample.

.2 Stone Cap:

- .1 Black Rundle Stone as supplied by Thunderstone Quarries, Kamenka Quarry Ltd. or pre-approved alternate.
- .2 Machine split cap stones to lengths and tolerances indicated on the drawings.

.3 All metal supports, connectors and anchors to conform to CSA A370 and A371, double hot dip galvanized except as specified.

.4 Threaded rods: Hilti HY-150

.5 Masonry Ties: Corrugated strip-tie to confirm to CSA-A370-94. Manufactured by Fero Corp or pre-approved alternate.

.6 Steel Angel: Steel Angle ledger 90x90x10 double dip galvanized

.7 Stainless Steel pints: 12.5mm diameter x 200mm long stainless steep pints to ASTM A666, type 304.

.8 Veneer wall ties to concrete backup:

- .1 Anchors, Dowels, Ties (steel to ASTM A36) sizes and configurations required for support of stone applicable to superimposed loads and seismic loads.
- .2 Masonry ties to be double hot dip galvanized spaced at 400 mm o.c unless otherwise indicated on drawings.

.9 Perforated and Non-perforated Rigid Drain Pipe: 100mm dia. Polyvinyl Chloride (PVC) conforming to CSA B182.1M (if applicable).

2.2 MORTAR AND ADHESIVE MATERIALS

.1 As specified in Section 04 05 13 Masonry Mortar and Grouting.

2.3 GROUT

.1 As specified in Section 04 05 13 Masonry Mortar and Grouting.

2.4 FABRICATION AND MANUFACTURE

.1 Split stone accurately to sizes, shapes and details indicated on the reviewed shop drawings.

.2 Back check stone as required to structural work indicated. Cut holes as required for anchorages, cramps and dowels, etc. Cut and drill stone as required for installation in built-in work.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that work of other sections previously installed under other Sections or Contracts are acceptable for quarried stone veneer cladding installation in accordance with manufacturer's written instructions.

.1 Inform the Departmental Representative of unacceptable conditions, defects, discrepancies in accuracy or suitability in the location, bearing and retaining of structural members immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from the Departmental Representative.

3.2 PREPARATION

.1 Protect adjacent finished materials from damage due to masonry work.

.2 Back-check stone contacting structural members as indicated. Allow minimum of 25 mm clearance between back of stone and steel and concrete structural members. Shape beds of stone resting on structural work to fit supports.

.3 Cut stones for anchors, clamps, dowels and support systems. Do not cut holes in exposed surfaces.

3.3 INSTALLATION

.1 Construction in accordance with CAN/CSA-A371.

3.4 STEEL ANGELES

.1 Install angle required for stone support.

.2 Fasten angle to wall with 3-16mm dia. X 200mm L threaded rod, embdedded 150mm, unless otherwise specified on the drawings.

3.5 STONE VENEER ANHORAGE

.1 Install ties in accordance with CSA-S304 and CSA-A370-94.

.2 Install at maximum 400mm O.C. vertically and at every vertical joint horizontally.

.3 Use only rotary drills, without percussion.

.4 Place additional ties so that there is a tie not more than 100mm from edge of wall.

3.6 VENEER INSTALLATION

.1 Clean stone exposed surfaces by washing with stiff fibre brush and water.

.2 Drench dry stones with clean water just before setting.

.3 Make joints 12 mm thick.

.4 Set stones plumb, true, level in full bed of mortar with vertical joints slushed full except where otherwise specified. Completely fill anchor, dowel and lifting holes. Keep edges and faces aligned to respect indicated tolerances.

.5 Coordinate location of mortar joints with locations of masonry ties. Ensure that the connectors are bedded solidly in the mortar joints and not in contact with stone surfaces.

.6 Remove mortar droppings and splashings from face of stone before mortar is set. Sponge stone free of mortar along joints as work progresses.

.7 Place plastic or lead setting pads or soft-wood wedges under stones to maintain joint thickness. Set heavy stones and projecting courses after mortar in courses below has hardened sufficiently to support weight.

.8 Prop and anchor projecting stones until wall above is set.

.9 Use soaked softwood wedges to support stone in proper alignment until mortar has set. Remove wedges when dry and without breaking them off, fill voids with pointing mortar.

.10 Tool joints after initial set has occurred.

.11 Rake out joints to 25 mm depth and make ready for pointing with pointing mortar. Sponge stone face along joints and remove droppings and splashed mortar immediately.

.12 Cap with a single cap stone that span the full width of the wall, including overhang. Machine split capstone to lengths as indicated on the drawings.

.13 Slope capstone with a minimum 1% slope, unless otherwise indicated.

.14 Set capstone with unfilled vertical joints.

.15 Brush raked out joints clean, remove wedges, and fill joints with pointing mortar. Color of mortar to match adjacent stone. Pack mortar and work it into joints.

.16 Pointing: remove dirt and loose mortar from joints by using pressure air stream.

.1 Wet joints for mortar pointing. Dry joints for sealant pointing.

.2 Point joints with pointing mortar in 2 stages. Rub smooth with plastic tool to slightly concave joint.

3.7 TOLERANCES

.1 To CAN/CSA-A371

3.8 CLEANING

.1 Progress Cleaning:

.1 Leave Work area clean at end of each day.

.2 At end of each working day, brush off loose mortar from stone face.

.3 At completion, wash stonework with stiff-fibre brushes and clean water.

3.9 PROTECTION

.1 Protect vertical corners, projecting areas, and the like, with protection boards. Cover walls at night and during rain.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 10 53 Miscellaneous Rough Carpentry

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM A 53/A 53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A269M-15a, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

.3 ASTM A307-14, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.2 CSA Group

.1 CSA G40.20-13 /G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CAN/CSA G164-[M92 (R2003)], Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CSA W59-13, Welded Steel Construction (Metal Arc Welding) Metric.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Shop Drawings:

.1 Submit drawings stamped and signed by professional Engineer registered or licensed in Alberta, Canada.

.2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

.3 Include erection drawings, elevations and details where applicable.

.4 Indicate welded connections using standard welding symbols. Clearly indicate net weld lengths.

1.4 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 QUALIFICATIONS

.1 Fabricator and erector must be certified and approved by the Canadian Welding Bureau in conformance with CSA W47.1-92 Division 1 or 2.2. Perform welding using currently licensed welders only. Submit evidence of certification to Bow Valley Safety Inspections prior to commencement of work.

.2 Welding procedures, welders and welding operations shall be qualified in accordance with Canadian Welding Bureau Standards.

.3 All welders employed to weld load carrying structures in the field must possess a valid "S" classification Class "O" certificate issued by the Canadian Welding Bureau.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.2 Storage and Handling Requirements:

.1 Store materials in dry location off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

1.7 FIELD QUALITY CONTROL

.1 Verify all dimensions on site prior to fabrication.

Part 2 Products

2.1 MATERIALS

.1 Supply new materials, free from defects impairing strength, durability or appearance, of best commercial quality for purposes specified.

.2 Steel sections and plates: to CSA G40.20/G40.21, Grade 300W.

.3 Steel pipe: to ASTM A53/A53M, grade b, black galvanized finish, size as indicated on the drawings.

.4 Welding materials: to CSA W59.

.5 Welding electrodes: to CSA W48 Series.

.6 Bolts and anchor bolts: to ASTM A307.

2.2 FABRICATION

.1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.2 Provide flush countersunk screws or bolts to all exposed mechanical fastenings, located consistent with design.

.3 Where possible, fit and shop assemble work, ready for erection.

.4 Exposed welds continuous for length of each joint. File or grind exposed welds smooth and flush.

.5 Thoroughly clean all surfaces of rust, scale, grease and foreign matter prior to prime painting or galvanizing.

2.3 FINISHES

.1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/$m^2$to CAN/CSA-G164.

2.4 PIPE RAILINGS

.1 Fabricate all steel handrails as detailed. Accurately and uniformly fabricate all components. Fabricate all handrails to Alberta Building Code Current requirements.

.2 Attach railing to wood posts as detailed.

.3 Cap ends of tube rails with 3 mm steel plate, welded. Grind to smooth finish.

.4 Galvanize exterior pipe railings after fabrication.

.5 Provide anchor bolts, bolts, bolt washers and nuts, lag screws, expansion shields, toggles, straps, sleeves, brackets, etc. where required and where indicated.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts acceptable for metal fabrications installation in accordance with manufacturer's written instructions.

.1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions remedied [and after receipt of written approval to proceed from the Departmental Representative.

3.2 ERECTION - GENERAL

.1 Do welding work in accordance with CSA W59 unless specified otherwise.

.2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.3 Provide suitable means of anchorage acceptable to the Departmental Representative such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.4 Exposed fastening devices to match finish and be compatible with material through which they pass.

.5 Supply components for work by other trades in accordance with shop drawings and schedule.

.6 Touch-up rivets, field welds, bolts and burnt or scratched surfaces with primer after completion of:

.1 Primer: maximum VOC limit 250 g/L to GS-11.

.7 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

.1 Primer: maximum VOC limit 250 g/L to GS-11.

3.3 PIPE RAILINGS

.1 Install pipe railings to wood posts as indicated.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by metal fabrications installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 05 50 00 Metal Fabrications

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM A123/A123M-[15], Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A153/A153M-[09] Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.3 ASTM F1667-[13] Standard Specification for Driven Fasteners: Nails, Spikes and Staples.

.2 Canadian Wood Council

.1 Wood Design Manual [2010 (R2014)] Edition

.2 Engineering Guide for Wood Frame Construction [2014]

.3 CSA International

.1 CAN/CSA-A123.2-03 (R2013), Asphalt Coated Roofing Sheets.

.2 CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.

.3 CSA O141-05 (R2014), Softwood Lumber.

.4 CAN/CSA-S406-92 (R2008), Construction of Preserved Wood Foundations.

.5 CAN/CSA-Z809-08, Sustainable Forest Management.

.4 Forest Stewardship Council (FSC)

.1 FSC-STD-01-001-2004, FSC Principle and Criteria for Forest Stewardship.

.5 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber 2010.

.6 Sustainable Forestry Initiative (SFI)

.1 SFI-2015-2019 Standard.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit product data for wood products and accessories and include characteristics, performance criteria, physical size, finish and limitations.

.2 Submit MSDS and Product Information sheet for approval of surface finish material by Departmental Representative.

.2 Shop Drawings:

.1 Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components.

.2 Indicate details of construction, profiles, jointing, fastening and other related details.

1.4 MOCK UP:

.1 10m of fencing; if approved can remain in situ.

1.5 SAMPLES:

.1 Submit two (2) samples of each wood component in 600mm lengths illustrating wood drawing and specified finish.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.2 Storage and Handling Requirements:

.1 Store materials and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wood products from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.7 SYSTEM DESCRIPTION

.1 Fence Height: As indicated on Drawings.

.2 Line Post Spacing: At intervals not exceeding 2 metres.

Part 2 Products

.1 Lumber:

.1 Seasoned, select grade or commercial Western Red Cedar, S4S, Kiln dry, graded and stamped in accordance with current National Lumber Grades Authority (NLGA) Standard Grading Rules for Canadian Lumber.

.2 Moisture Content: maximum 19% at time of installation.

.3 Finger jointed lumber is not acceptable.

.2 Preservative:

.1 Valhalla Lifetime Wood Treatment Non-Toxic Wood Stain or approved alternate.

.2 Must not cause seeping or staining of adjacent surfaces once applied and installed in field.

2.2 ACCESSORIES

.1 Nails and Spikes

.1 Use common spiral nails and spiral spikes except where indicated otherwise.

.2 Use hot dip galvanized finished steel to ASTM A123/A123M for exterior work

.2 Bolt, nut, washer, screw and pin type fasteners: hot dip galvanized finish to CSA G164-M92 (R2003).

.3 Handrail

.1 Per 05 50 00 Metal Fabrications.

.4 Flame-Retardant: to CSA O80.20 CSA O80.27 to provide:

.1 Flame Spread Classification: to meet local codes and regulations

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for fence installation.

.1 Inform the Departmental Representative of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from the Departmental Representative.

3.2 FENCE INSTALLATION

.1 Set posts plumb as indicated on drawings.

.2 Install members true to line, levels and elevations. Space uniformly, unless otherwise indicated on the drawings.

.3 Construct continuous members from pieces of longest practicable length.

.4 Install spanning members with "crown-edge" up.

3.3 ERECTION TOLERANCES

.1 Maximum Variation From Plumb: 6 mm.

.2 Maximum Offset From True Position: 25 mm.

.3 Components shall not infringe adjacent property lines.

3.4 PRESERVATIVE APPLICATION

.1 Treat western cedar to CSA O80 using ‘Lifetime Wood Treatment’ preservative to obtain minimum net retention recommended by preservative manufacturer in kg/m3 of wood. Apply per manufacturers recommendations.

3.5 CLEANING

.1 Progress Cleaning:

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

3.6 WASTE MANAGEMENT

.1 Separate waste materials for reuse and recycling.

.2 Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill. Prevent saw dust and wood shavings from entering the storm drainage system.

.3 Do not burn scrap lumber that has been pressure treated.

.4 Do not send lumber treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

3.7 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by rough carpentry installation.

3.8 SCHEDULE OF DIMENSTION LUMBER

.1 Fence Posts, Rails and Appearance Board:

.1 Western Red Cedar, No. 2 or better

.2 All other components:

.1 Western Red Cedar, No. 2 or better

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Refer to Parks Canada, Exterior Signage Standards and Guidelines – Version 1, March 2007.

.2 Refer to Manual on Uniform Traffic Control Devices, 2009 edition.

.3 Section 01 27 00 – Measurement and Payment

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 26 05 00 - Common Work Results for Electrical.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

Part 2 Products

2.1 VEHICLE COUNTING SYSTEM

.1 System: sensing loops required to activate existing counting system when vehicle enters or exits.

.2 Vehicle detector: manufacturers standard unit for use in temperature range of -40 degrees C to 85 degrees C.

.3 Prefabricated loops designed to be overlaid with hot asphalt.

.4 Loop wire: 9 mm diameter, double jacketed, four conductors, with cross-linked polyethylene insulation.

.5 Lead-in cable: 9 mm diameter, double jacketed, two conductor, with cross-linked polyethylene insulation.

.6 Reno A&E PLH preformed loops, as supplied by Q-Free TCS Inc or approved equivalent.

Part 3 Execution

3.1 INSTALLATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

.2 Install of parking control system to equipment manufacturer's instructions.

.3 Locate equipment where indicated or as directed by Consultant.

.4 Test and adjust complete system for proper function and leave in perfect working order. Test the system for proper count in each direction of traffic and for each vehicle class, in accordance with manufacturer’s recommendations.

.5 Loops shall cover the entire width of the driving lane, except for 0.6m on either side of the driving lane.

.6 Lead-in cable shall be of sufficient length to reach the existing vehicle counting system without requiring splicing.

.7 Existing loop wire conduit ends at existing edge of pavement. Adjust conduit length so it ends at proposed edge of pavement.

.8 Place the PLH Preformed Loop in the proper position and orientation on the asphalt base lift.

.9 Route the lead-in cable to the desired termination point.

.10 Cut the fiberglass backed mastic tape (included with the PLH) into 2” x 4” or 3” x 4” strips. Use the mastic tape (and optional corner brackets) to hold the loop and lead-in cable in place.

.11 Place a minimum of 1 inch of asphalt over the loop before any heavy equipment (paver) contacts the loop cables.

.12 Apply the top lift.

.13 Supply and install other electrical wiring, conduit junction boxes, transformers, circuit breakers and auxiliary components required for complete installation.

.1 Conform to CSA and local requirements.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 74 00 – Cleaning.

1.2 REFERENCES

.1 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)

.2 National Electrical Manufacturers Association (NEMA)

.3 Institute of Electrical and Electronic Engineers (IEEE)

.4 Canadian Standards Association (CSA International)

.5 Canadian Electrical Code (CEC) (CSA 22.1 – latest edition)

.6 Area Electrical Inspection Authority

.7 FortisAlberta Service and Metering Guide

.8 FortisAlberta Customer Installed Pre-Cast Base, Grounding, and Ducting

1.3 SUBMITTALS

.1 Shop Drawings and Product Data

.1 Twenty (20) days prior to fabrication, submit for the approval of the Departmental Representative, the shop drawings, product data and samples as specified, indicating details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment and materials. Include data on manufacturer's recommended environmental conditions for equipment affected by temperature and humidity.

.2 Provide vendor shop drawings including but not limited to wiring, single line and schematic diagrams where applicable. Wiring drawings or diagrams shall show interconnection among work of different Sections.

.3 Cross or block out from manufacturer's standard product data sheets all data inapplicable or irrelevant to project.

.4 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

.2 Certificates

.1 Within 7 days of inspection, submit inspection certificates of any authority having jurisdiction of any part of the Work.

.3 Project Record Documents

.1 Comply with requirements of Section 01 78 00- Closeout Submittals

.2 Record accurately all changes that are made during construction.

.4 Reports

.1 Collect and submit field reports including the following:

.1 Start-up and testing reports.

.2 Manufacturer start-up and testing reports.

.2 Electrical Permit

.1 Copy of electrical permit obtained from authority having jurisdiction.

1.4 QUALITY ASSURANCE

.1 Regulatory requirements

.1 Comply with Safety Codes Act and rules and regulations made pursuant thereto, including Canadian Electrical Code.

.2 Unless otherwise indicated, all references in the Contract Documents to "Canadian Electrical Code" or "CEC" refers to the edition of the Canadian Electrical Code, Part I, CSA C22.1 - latest edition and the variations made thereto by Alberta regulation, which are in force on the date of bid closing for the Contract.

.3 Should any instance occur in this Specification or on the Drawings in which the materials or construction methods called for are less than the minimum requirements of the above codes, the requirements of the codes to take precedence, and the Contractor is to supply the materials and perform the work as though called for to the minimum code standards.

.4 All electrical products to be tested, certified and labelled in accordance with a certification program accredited by the Standards Council of Canada. Where a product is not so labelled, provide written approval by the authority having jurisdiction.

.5 Aforementioned minimum standards are not to detract from the quality of materials or methods of installation shown where these exceed said standards.

.6 Submit to authority having jurisdiction and utility company, necessary number of drawings and specifications for examination and approval prior to commencement of electrical work. Pay associated fees.

.7 Notify the Departmental Representative of changes required by Electrical Inspection Authority prior to making changes. Make reasonable changes and alterations required by the Inspection Authority at no extra cost to Parks Canada Agency.

.8 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices as per the conditions of Provincial Act respecting manpower vocational training and qualification.

.1 Employees registered in provincial apprentices' program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.

.2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

1.5 INTENT

.1 The Contractor shall furnish all labour, materials and necessary equipment to provide complete and operating electrical systems as set forth on the plans and in these Specifications, and as called for elsewhere in the Contract documents. Any work, even if not shown or specified, which is obviously necessary or reasonably implied to complete the work, shall be carried out as if it was both shown and specified.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: provide Consultant with schedule within 2 weeks after award of Contract.

1.7 SYSTEM STARTUP

.1 Instruct Consultant and operating personnel in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation and ensure that operating personnel are conversant with aspects of its care and operation.

Part 2 Products

2.1 MATERIALS AND EQUIPMENT

.1 All equipment and material to be new and CSA certified and conform to EEMAC Standards. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Authority and the Departmental Representative.

.2 Where two or more items of the same kind are required, all such items to be the product of a single manufacturer.

2.2 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of inspection authorities.

.2 Decal signs, minimum size 175 x 250 mm.

2.3 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.4 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows:

.1 Nameplates: lamicoid, 3 mm thick plastic engraving sheet, black matt white finish face, white core, lettering accurately aligned and engraved into core mechanically attached with self-tapping screws.

.1 Sizes as follows:

NAME PLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.

.3 Wording on nameplates and labels to be approved by Consultant prior to manufacture.

.4 Allow for minimum of twenty-five (25) letters per nameplate and label.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.7 Terminal cabinets and pull boxes: indicate system and voltage.

.8 Transformers: indicate capacity, primary and secondary voltages.

2.5 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, numbered colored plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

Part 3 Execution

3.1 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

.2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.3 CONDUIT AND CABLE INSTALLATION

.1 Promptly install work in advance of concrete pouring or similar work. Provide sleeves and any materials to be embedded in concrete and locate them where required.

.2 Complete all cutting required for electrical installation. Do not cut structural members without the written consent of the Departmental Representative.

.3 Patch and repair surfaces damaged by cutting for electrical work.

3.4 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.5 FIELD QUALITY CONTROL

.1 Load Balance:

.1 Measure phase current to panel boards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Provide upon completion of work, load balance report as directed in PART 1 - Submittals: phase and neutral currents on panel boards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.

.2 Conduct following tests for Quality Control:

.1 Power distribution system including phasing, voltage, grounding and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.5 Systems: communications and electronic safety and security.

.6 Proper operation of the traffic counter loops

.7 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing.

.3 Carry out tests in presence of Consultant.

.4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

3.6 CLEANING

.1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No.18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.

.2 CSA C22.2 No.65, Wire Connectors.

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.3 National Electrical Manufacturers Association (NEMA)

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper alloy sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CSA C22.2 No.65, with current carrying parts of Copper alloy sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:

.1 Connector body and stud clamp for stranded copper conductors.

.2 Clamp for stranded copper conductors.

.3 Stud clamp bolts.

.4 Bolts for copper conductors.

.5 Sized for conductors as indicated.

.4 Clamps or connectors for armoured cable, flexible conduit, as required to: CAN/CSA-C22.2 No.18.

Part 3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

.2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.

.3 Install fixture type connectors and tighten. Replace insulating cap.

.4 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 26 05 00 - Common Work Results for Electrical.

.3 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No .0.3, Test Methods for Electrical Wires and Cables.

1.3 PRODUCTS DATA

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

Part 2 Products

2.1 BUILDING WIRES

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 600 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

.3 Copper conductors: size as indicated, with 600 V insulation of chemically cross-linked thermosetting polyethylene material rated RWU90.

Part 3 Execution

3.1 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

.2 In underground ducts in accordance with Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

.3 Provide a green insulated bond conductor in all conduits sized in accordance with CSA C22.1-2015, Canadian Electrical Code, Part 1.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for connectors and terminations.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 26 05 00 – Common Work Results for Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.41, Grounding and Bonding Equipment.

1.4 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

1.5 CERTIFICATES

.1 Obtain inspection certificate of compliance covering high voltage stress coning from Departmental Representative and include it with as-built drawings and maintenance manuals.

Part 2 Products

2.1 CONNECTORS AND TERMINATIONS

.1 Copper short barrel compression connectors to CSA C22.2 as required sized for conductors.

.2 Contact aid for aluminum cables where applicable.

Part 3 Execution

3.1 INSTALLATION

.1 Install stress cones, terminations, and splices in accordance with manufacturer's instructions.

.2 Bond and ground as required to CSA C22.2 No.41.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)

.2 Institute of Electrical and Electronics Engineers (IEEE)

.3 Canadian Standards Association, (CSA International)

.1 CAN/CSA Z32-1999, Electrical Safety and Essential Electrical Systems in Health Care Facilities.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

Part 2 Products

2.1 EQUIPMENT

.1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.

.2 Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, tinned, soft annealed, size as indicated.

.3 Rod electrodes: copper clad steel 19 mm dia by 3 m long.

.4 Plate electrodes: copper, surface area 0.2 m², 1.6 mm thick.

.5 Grounding conductors: bare stranded copper, tinned, soft annealed, size as indicated.

.6 Insulated grounding conductors: green.

.7 Ground bus: copper, size as required, complete with insulated supports, fastenings, connectors.

.8 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

.1 Grounding and bonding bushings.

.2 Protective type clamps.

.3 Bolted type conductor connectors.

.4 Thermit welded type conductor connectors.

.5 Bonding jumpers, straps.

.6 Pressure wire connectors.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for grounding equipment installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by Thermit process.

.5 Use mechanical connectors for grounding connections to equipment provided with lugs.

.6 Soldered joints not permitted.

.7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.9 Install separate ground conductor to outdoor lighting standards.

.10 Connect building structural steel and metal siding to ground by welding copper to steel.

.11 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.12 Bond single conductor, metallic armoured cables to cabinet at supply end and load end.

.13 Ground secondary service pedestals.

3.3 MANHOLES

.1 Install conveniently located grounding stud, electrode, size 1/0 AWG stranded copper conductor in each manhole.

.2 Install ground rod in each manhole so that top projects through bottom of manhole.

.3 Provide with lug to which grounding connection can be made.

3.4 ELECTRODES

.1 Install rod, electrodes and make grounding connections.

.2 Bond separate, multiple electrodes together.

.3 Use size 3/0 AWG copper conductors for connections to electrodes.

.4 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.5 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting.

3.6 GROUNDING BUS

.1 Install copper grounding bus mounted on insulated supports on wall of electrical room.

.2 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections size 2/0AWG.

3.7 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results -Electrical.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 26 05 00 - Common Work Results for Electrical.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

Part 2 Products

2.1 BUSHINGS, KNOCKOUT CLOSURES, AND LOCKNUTS

.1 Bushings, Knockout Closures and Locknuts: to CSA C22.2 No. 18, corrosion resistant.

Part 3 Execution

3.1 INSTALLATION

.1 Mount cabinets with top not higher than 2m above grade.

3.2 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Install size 2 identification labels indicating system name, voltage and phase.

.3 Submit, for Parks Canada Agency approval, a list of the wording of the identification before ordering.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.

.2 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

Part 2 Products

2.1 CONDUITS

.1 Rigid PVC conduit: to CSA C22.2 No. 211.2.

2.2 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 Factory "ells" where 90° bends are required for 25 mm and larger conduits.

.3 Expansion/Deflection coupling suitable for direct burial and embedded in concrete

.1 Accommodating axial or parallel deflection of ¾” and angular deflection of 30°.

.2 Constructed with a neoprene outer jacket, PVC coupling ends and stainless steel jacket straps.

2.3 PULL WIRE

.1 Polypropylene.

Part 3 Execution

3.1 INSTALLATION

.1 Install rigid PVC conduits for electrical systems as indicated and in accordance with CAN/CSA A23.1.

.2 Use rigid PVC for conduits installed underground and in the retaining wall.

.3 Provide one empty conduit from the panel to the tour bus parking area, for future use by others.

.4 Minimum conduit size for lighting and power circuits: 21mm.

.5 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.6 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.7 Install deflection/expansion couplings when transitioning from retaining wall to underground installations.

.8 Install pull wire in empty conduits.

.9 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.10 Dry conduits out before installing wire.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 26 05 00 - Common Work Results for Electrical.

.3 Section 31 23 33.01 – Excavating, Trenching and Backfilling

1.2 REFERENCES

.1 Canadian Standards Association, (CSA International)

.2 Insulated Cable Engineers Association, Inc. (ICEA)

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

Part 2 Products

2.1 CABLE PROTECTION

.1 Provide buried marker tape.

2.2 MARKERS

.1 Continuous traceable CSA approved marker tape warning of buried power or telephone cables.

Part 3 Execution

3.1 INSTALLATION OF DUCTS

.1 Install duct in accordance with manufacturer's instructions at depth as indicated on drawings.

.2 Clean inside of ducts before laying.

.3 Ensure full and even support every 1.5 m throughout duct lengths.

.4 Slope ducts with 1 to 400 minimum slope.

.5 During construction, cap ends of ducts to prevent entrance of foreign materials.

.6 Pull through each duct a wooden mandrel not less than 300 mm long and of a diameter 6mm less than internal diameter of duct, followed by a stiff bristle brush to remove sand, earth and other foreign matter. Pull stiff bristle brush through each duct immediately before pulling-in cables.

.7 In each duct install polypropylene pull cord continuous throughout each duct run with 3 m spare rope at each end.

.8 Install markers at depth as indicated on drawings for entire length of run.

.9 After 150mm thick of sand bedding is in place, lay ducts maintaining 75 mm clearance from each side of trench to nearest duct, then cover with an additional 150 mm of sand fill.

3.2 CABLE INSTALLATION IN DUCTS

.1 Install cables as indicated in ducts.

.2 Do not pull spliced cables inside ducts.

.3 Install multiple cables in duct simultaneously.

.4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

.5 To facilitate matching of color coded multi-conductor control cables, reel off in same direction during installation.

.6 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.

.7 After installation of cables, seal duct ends with duct sealing compound.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results -Electrical.

.2 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.3 Check phase rotation and identify each phase conductor of each feeder.

.4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 mega-ohms.

.5 Pre-acceptance tests.

.1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.

.2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

.6 Acceptance Tests

.1 Ensure that terminations and accessory equipment are disconnected.

.2 Ground shields, ground wires, metallic armour and conductors not under test.

.3 Leakage Current Testing.

.1 Raise voltage in steps from zero to maximum values as specified by ICEA manufacturer for type of cable being tested.

.2 Record leakage current at each step.

.7 Provide Departmental Representative with list of test results showing location at which each test was made, circuit tested and result of each test.

.8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Service equipment and installation.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 26 05 00 - Common Work Results for Electrical.

.3 Section 26 05 28 – Grounding: Secondary.

.4 Section 26 05 31 – Splitters, Junction, Pull Boxes and Cabinets.

.5 Section 26 27 16 – Electrical Cabinets and Enclosures

.6 Section 26 28 16.01 – Panel boards: Breaker Type.

.7 Section 26 28 16.02 – Moulded Cases Circuit Breakers.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

Part 2 Products

2.1 EQUIPMENT

.1 Enclosed circuit breaker: in accordance with Section 26 28 16.02 – Moulded Case Circuit Breakers, rating as indicated on drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Install service equipment.

.2 Connect to incoming service.

.3 Connect outgoing load circuits.

.4 Check factory made connections for mechanical security and electrical continuity.

.5 Make grounding connections in accordance with Section 26 05 28 – Grounding: Secondary.

.6 Make provision for power supply authority’s metering.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for standard and custom breaker type panelboards.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 26 05 00 - Common Work Results for Electrical.

.3 Section 26 28 16.02 - Moulded Case Circuit Breakers.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.29, Panelboards and enclosed Panelboards.

1.1 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

.2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

Part 2 Products

2.1 PANELBOARDS

.1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.2 120/240 V panelboards: single phase, 3 wire, solid neutral design, bus and breakers rated for 65 kA (symmetrical) interrupting capacity or as indicated.

.3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.5 Two keys for each panelboard and key panelboards alike.

.6 Copper bus with neutral of same ampere rating as mains.

.7 Mains: suitable for bolt-on breakers.

.8 Trim with concealed front bolts and hinges.

.9 Trim and door finish: baked grey enamel.

2.2 BREAKERS

.1 Breakers: to Section 26 28 16.02 - Moulded Case Circuit Breakers.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.3 Half sized or twin breakers and/or plug-in breakers will not be accepted.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Nameplate for each panelboard size 4 engraved as indicated.

.3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit.

Part 3 Execution

3.1 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Mount panelboards to height specified in Section 26 05 00 - Common Work Results for Electrical.

.3 Connect loads to circuits.

.4 Connect neutral conductors to common neutral bus with respective neutral identified.

.5 Measure and balance loads as specified in Section 26 05 00 – Common Work Results for Electrical.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 26 05 00 – Common Work Results for Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA C22.2 No.94.1-07, Enclosures for Electrical Equipment, Non Environment Considerations.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA 250-2008, Enclosures for Electrical Equipment (1000 Volts Maximum).

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

1.4 CERTIFICATES

.1 Obtain inspection certificate of compliance covering high voltage stress coning from Departmental Representative and include it with as-built drawings and maintenance manuals.

Part 2 Products

2.1 ELECTRICAL CABINET

.1 The cabinet shall be 60 Amps, 120/240V, 1 Ph, 3W.

.2 The cabinet shall be made of Marine Grade Aluminum, with a black textured powder finish.

.3 EEMAX 3R Enclosure.

.4 The panel shall have a utility meter socket.

.5 Single front outer hinged door c/w 3 point padlockable stainless steel handle.

.6 Soft machine formed driphood and doors for public safety.

.7 Cross-brake style roof for improved drainage.

.8 Equipped with a convenience GFCI 5-15R receptacle, light and switch, and internal heater.

.9 The cabinet shall have a photocell and lighting contactors.

.10 The cabinet shall supply both photocell-controlled circuits and continuous power circuits.

.11 The cabinet shall have a Hand-Off-Auto switch for the controlled circuits.

.12 The cabinet shall be equipped with an astronomical clock to allow for seasonal adjustments of lighting circuits.

.13 Concrete bases shall be of reinforcement that meets CSA A23.3.04, clause 7.8 Minimum Reinforcement in Slabs at minimum.

.14 The cabinet shall be AC Dandy Model A4-DHP-1-60-120/240 or approved equivalent.

.15 The cabinet base shall be Armtec #4-0046 or approved equivalent.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for grounding equipment installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Mount equipment in enclosure

.2 Label electrical cabinets and enclosure to Section 26 05 00 - Common Work Results for Electrical.

END OF SECTION

Part 1 General

1.1 RELATED SECTION

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 26 05 00 - Common Work Results for Electrical.

.3 Section 26 24 16.01 – Panel boards – Breaker Type.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA-C22.2 No. 5-02, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

.2 Include time-current characteristic curves for breakers with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

Part 2 Products

2.1 INTERRUPTING RATING

.1 All circuit breakers shall be of minimum interrupting capacity of 65,000 A symmetrical (rms).

2.2 BREAKERS GENERAL

.1 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

.2 Common-trip breakers: with single handle for multi-pole applications.

.3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

.4 Circuit breakers with interchangeable trips as indicated.

2.3 THERMAL MAGNETIC BREAKERS

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.4 MAGNETIC BREAKERS

.1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.

2.5 SOLID STATE TRIP BREAKERS

.1 Moulded case circuit breaker to operate by means of solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and longtime short time instantaneous tripping for phase ground fault short circuit protection.

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for contactors for system voltages up to 600 V

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 26 05 00 - Common Work Results for Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.14, Industrial Control Equipment.

1.4 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

Part 2 Products

2.1 CONTACTORS

.1 Contactors: to CSA C22.2 No.14.

.2 Mechanically held controlled by pilot devices as indicated and rated for type of load controlled. Half size contactors not accepted.

.3 Breaker combination contactor as indicated.

.4 Complete with 2 normally open and 2 normally closed auxiliary contacts unless indicated otherwise.

.5 Mount in CSA Enclosure 1 unless otherwise indicated.

.6 Control transformer: in accordance with Clause 2.2.

.7 50 / 50 Control contactor with N/O and N/C contacts for load split operation. Contactor shall have adjustable ON-OFF time setting capabilities

2.2 CONTROL CIRCUIT TRANSFORMERS

.1 Single phase, dry type.

.2 Primary: as required V, 60 Hz ac.

.3 Secondary: 120 V, AC.

.4 Rating: as required VA.

.5 Secondary fuse: as required A.

.6 Close voltage regulation as required by magnet coils and solenoid valves.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Size 4 nameplate indicating name of load controlled as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Install contactors and connect auxiliary control devices.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCES

.1 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE C62.41, Surge Voltages in Low-Voltage AC Power Circuits.

.2 Canadian Standard Association (CSA).

.1 Luminaires to CSA C22.2 No. 49.

.2 Lighting poles to CSA C22.2 No. 206

.3 Underwriter's Laboratories Canada (ULC).

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit complete photometric data prepared by recognized independent testing laboratory.

.3 Photometric data to include VCP and spacing criterion.

.4 Details of fixtures listed in specifications, may include features considered exclusive to one manufacturer. It is not the intent of this specification to limit the submission of luminaires to one manufacturer and other manufacturers may submit bids on equal equipment.

.5 All luminaires shall be delivered to the site completely assembled and in original cartons. Ensure the availability of a dry and protected storage space before delivery of luminaires.

.6 Luminaires of the same or similar type shall be supplied by the same manufacturer.

Part 2 Products

2.1 GENERAL

.1 It is the contractor's responsibility to verify the quantities before ordering the material.

.2 Provide lighting fixtures new and complete with all mounting accessories, junction boxes, trims, frames and lamps.

.3 Refer to electrical drawings for Luminaire Schedule showing existing fixtures and mounting details.

.4 All luminaires enclosure doors shall have stainless steel bolts / screws coated with anti-seize lubricant.

.5 All luminaires, accessories and components shall be CSA approved.

.6 All luminaires shall comply with ANSI C136 series – Standards for Roadway and Area Lighting Equipment.

2.2 STEEL POLES

.1 Steel poles: to CSA C22.2 No.206-13, designed for underground wiring and designed for gusted wind velocity of 160km/h, and:

- .1 Mounting on concrete anchor frangible base (breakaway couplings) where indicated.
- .2 Style: Round Straight Steel Pole
- .3 Terminating in single curved arm refer to drawings for details.
- .4 Access handhole above pole base for wiring connections, with welded-on reinforcing frame and bolted-on cover. Handhole bolts shall be coated with anti-seize lubricant.
- .5 Size: nominal 7700mm height (6100mm (20') shaft + 1600mm (63") arm).
- .6 Anchor bolts: New galvanized bolts, steel shims, nuts and high strength polyurethane covers (sized to fit fasteners).
- .7 All steel shall be hot dip galvanized after fabrication with a minimum coating of 600g/m^2 as per ASTM A123/ A123M.
- .8 The silicon content of the galvanized steel shall be: for shaft Si <= 0.04%, for Base Plate Si<= 0.04% or 0.15% <= Si <= 0.25%.
- .9 Outer surfaces of pole to be powder coated black after galvanizing.
- .10 Casting to be powder coated black inside and out.
- .11 Two-piece aluminum base cover.
- .12 Grounding lug.
- .13 Poles shall be able to support two 1.8m x 0.9m (6'x3') banners.
- .14 CECO #CE 55R20 5.5" rd. x 20ft tall pole with Sternberg R2PT arm or equivalent.

2.3 LUMINAIRES

.1 Type ST2, ST3, ST4

- .1 General Description
  - .1 Decorative down light luminaire with a bell styled dome shape.
  - .2 Luminaire to be installed on a Candy Cane pole arm.
  - .3 Spun aluminum housing with polyester powder-coat paint.
  - .4 Finish: Black powder-coat paint.
  - .5 Source of light is Light Emitting Diodes (LED).
  - .6 BUG rating with U-0
  - .7 Colour Temperature: 2700K
  - .8 Vertical Hanged Mount
  - .9 IP65 rated housing

.10 Life expectancy: 100,000 hours @ 25 °C, L70, based on TM21 rating method.

.11 Sternberg 1527LED-F-4ARC27T "X'- MDH03-FG-EZ-BKT or approved equivalent.

.12 Photometric distribution pattern: Type II for ST2, Type III for ST3, Type IV for ST4

.2 Type B

.1 General Description

.1 Top housing made of low copper cast aluminum.

.2 Lower housing made of seamless extruded aluminum.

.3 Heights of 30", 36" and 42"

.4 Finish: black textured powder-coated paint

.5 Source of light is Light Emitting Diodes (LED).

.6 BUG rating with U-0.

.7 Colour Temperature: 3000K

.8 Injected molded acrylic optics with asymmetrical photometric distribution.

.9 Standard 0-10V dimming and 10KV surge protection.

.10 IP66 rated.

.11 Life expectancy: 350,000 hours @ 25 °C, L70, based on TM21 rating method.

.12 Eaton Invue Arbor ABB-B1-LED-42-D1-A-BK-8030 or approved equivalent.

Part 3 Execution

3.1 INSTALLATION

.1 Locate and install luminaires as indicated.

.2 Install poles and bollards true and plumb in accordance with manufacturer's instructions.

.3 Check luminaire orientation, level and tilt.

.4 Connect luminaire to lighting circuit as per drawings.

.5 Perform tests in accordance with Section 26 05 00 – Common Work Results – Electrical.

.6 Protect all luminaires from construction dust and debris.

.7 Clean all lighting reflectors, lenses and other lighting surfaces at time of final cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 32 11 23 Aggregate Base Courses

.2 Section 32 11 16.01 Granular Sub-base

.3 Section 32 13 13 Concrete Paving

.4 Section 32 15 40 Crushed Stone Surfacing

1.2 REFERENCES

.1 ASTM International

.1 ASTM D4791-10, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

.2 U.S. Environmental Protection Agency (EPA)/Office of Water

.1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for aggregate materials and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Samples:

.1 Submit, in air-tight containers, 4.5 kg sample of each type of fill to testing laboratory. Submit test results to the Departmental Representative.

.2 Pay cost of sampling and testing of aggregates which fail to meet specified requirements.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Transportation and Handling: handle and transport aggregates to avoid segregation, contamination and degradation.

.2 Storage: store washed materials or materials excavated from underwater 24 hours minimum to allow free water to drain and for materials to attain uniform water content.

Part 2 Products

2.1 MATERIALS

.1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, free from adherent coatings and injurious amounts of disintegrated pieces or other deleterious substances.

.2 Flat and elongated particles of coarse aggregate: to ASTM D4791.

.1 Greatest dimension to exceed 5 times least dimension.

.3 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:

.1 Screenings produced in crushing of quarried rock, boulders, gravel or slag.

.4 Coarse aggregates satisfying requirements of applicable section to be one of or blend of following:

.1 Crushed rock.

.2 Gravel and crushed gravel composed of naturally formed particles of stone.

.3 Light weight aggregate, including slag and expanded shale.

2.2 SOURCE QUALITY CONTROL

.1 Inform Departmental Representative of proposed source of aggregates and provide access for sampling 4 weeks minimum before starting production.

.2 If materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate alternative source.

.3 Advise Departmental Representative 4 weeks minimum in advance of proposed change of material source.

.4 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

Part 3 Execution

3.1 STOCKPILING:

.1 Stockpile aggregates on site in locations as indicated unless directed otherwise by Departmental Representative. Do not stockpile on completed pavement surfaces.

.2 Stockpile aggregates in sufficient quantities to meet project schedules.

.3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.

.4 Except where stockpiled on acceptably stabilized areas, provide compacted sand base not less than 300 mm in depth to prevent contamination of aggregate. Stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into Work.

.5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.

.6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Departmental Representative within 48 hours of rejection.

.7 Stockpile materials in uniform layers of thickness as follows:

.1 Maximum 1.5 m for coarse aggregate and base course materials.

.2 Maximum 1.5 m for fine aggregate and sub-base materials.

.3 Maximum 1.5 m for other materials.

.8 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.

.9 Do not cone piles or spill material over edges of piles.

.10 Do not use conveying stackers.

.11 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

3.2 CLEANING

.1 Progress Cleaning: leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.

.4 Restrict public access to temporary abandoned stockpiles by means acceptable to the Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 31 14 13 – Soil Stripping and Stockpiling

1.2 REFERENCES

.1 U.S. Environmental Protection Agency (EPA)/Office of Water

.1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.3 DEFINITIONS

.1 Clearing consists of cutting off trees and brush vegetative growth to not more than specified height above ground and disposing of felled trees, previously uprooted trees and stumps, and surface debris.

.2 Close-cut clearing consists of cutting off standing trees, brush, scrub, roots, stumps and embedded logs, removing at, or close to, existing grade and disposing of fallen timber and surface debris.

.3 Clearing isolated trees consists of cutting off to not more than specified height above ground of designated trees and disposing of felled trees and debris.

.4 Underbrush clearing consists of removal from treed areas of undergrowth, deadwood, and trees smaller than 50 mm trunk diameter and disposing of fallen timber and surface debris.

.5 Grubbing consists of excavation and disposal of stumps and roots, and boulders and rock fragments less than 300mm diameter, to not less than specified depth below existing ground surface.

1.4 SUBMITTALS

.1 Samples:

.1 Submit manufacturer’s technical data sheets of each material listed below for approval prior to delivery of materials to project site.

.2 Tree wound paint: one liter can with manufacturer's label.

.3 Herbicide: one liter can with manufacturer's label.

.2 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.3 Submit manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

.1 Do construction occupational health and safety in accordance Federal and Provincial regulations.

.2 Safety Requirements: worker protection.

.1 Workers must comply with Alberta Occupational Health and Safety requirements when applying herbicide materials.

.2 Workers must not eat, drink or smoke while applying herbicide material.

.3 Clean up spills of preservative materials immediately with absorbent material and safely discard to landfill.

1.6 STORAGE AND PROTECTION

.1 Prevent damage to culverts, trees, areas left undisturbed, natural features, existing buildings, existing pavement, utility lines, site appurtenances, water courses, and root systems of trees which are to remain.

.1 Repair damaged items to approval of Departmental Representative.

.2 Replace trees designated to remain, if damaged, as directed by Departmental Representative.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Consider felled timber from which saw logs, pulpwood, posts, poles, ties, or fuel wood can be produced as saleable timber.

.1 Lumber: to be either cut up into firewood and delivered to location specified by the Departmental Representative or chipped and delivered to Lake Louise Waste Water Treatment Plant.

Part 2 Products

2.1 MATERIALS

.1 Not Used.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 PREPARATION

.1 Inspect site and verify with Departmental Representative, items designated to remain.

.2 Locate and protect utility lines: preserve in operating condition active utilities traversing site.

.1 Notify Departmental Representative immediately of damage to or when unknown existing utility lines are encountered.

.2 When utility lines which are to be removed are encountered within area of operations, notify Departmental Representative in ample time to minimize interruption of service.

.3 Notify utility authorities before starting clearing or grubbing.

.4 Keep roads and walks free of dirt and debris.

3.3 APPLICATION

.1 Manufacturer's instructions: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.4 CLEARING

.1 Clearing includes felling, trimming, cutting of trees into sections and satisfactory disposal of trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within cleared areas.

.2 Clear as indicated, by cutting at height of not more than 300 mm above ground. In areas to be subsequently grubbed, height of stumps left from clearing operations to be not more than 1000 mm above ground surface.

.3 Cut off branches overhanging area cleared as directed by Departmental Representative.

.4 Cut off unsound branches on trees designated to remain as directed by Departmental Representative.

3.5 CLOSE CUT CLEARING

.1 Close cut clearing to ground level.

.2 Cut off branches overhanging area cleared as directed by Departmental Representative.

.3 Cut off unsound branches on trees designated to remain as directed by Departmental Representative.

3.6 ISOLATED TREES

.1 Cut off isolated trees as directed by Departmental Representative at height of not more than 300 mm above ground surface.

.2 Grub out isolated tree stumps.

.3 Prune individual trees as indicated.

.4 Trim trees designated to be left standing within cleared areas of dead branches 4 cm or more in diameter; and trim branches to heights as indicated.

.5 Cut limbs and branches to be trimmed close to bole of tree or main branches.

3.7 UNDERBRUSH CLEARING

.1 Clear underbrush from areas as indicated at ground level.

3.8 GRUBBING

.1 Remove and dispose of roots larger than 7.5 cm in diameter, matted roots, and designated stumps from indicated grubbing areas.

.2 Grub out stumps and roots to not less than 200 mm below ground surface.

.3 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension, but less than 0.25 m3.

.4 Fill depressions made by grubbing with suitable material and to make new surface conform with existing adjacent surface of ground.

3.9 REMOVAL AND DISPOSAL

.1 Remove cleared, grubbed materials to offsite.

.2 Boulders to be stockpiled on site as designated by Departmental Representative.

3.10 FINISHED SURFACE

.1 Leave ground surface in condition suitable for immediate grading operations stripping of topsoil to approval of Departmental Representative.

3.11 CLEANING

.1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 32 91 19.13 Topsoil Placement and Finish Grading

.2 Section 31 22 13 Rough Grading

.3 Section 31 11 00 Clearing and Grubbing

1.2 REFERENCES

.1 U.S. Environmental Protection Agency (EPA)/Office of Water

.1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

Part 2 Products

2.1 Not Used

.1 Not Used.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 STRIPPING OF TOPSOIL

.1 Ensure that procedures are conducted in accordance with applicable Federal and Provincial requirements.

.2 Remove topsoil before construction procedures commence to avoid compaction of topsoil.

.3 Handle topsoil only when it is dry and warm.

.4 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected as determined by the Departmental Representative.

.5 Clear and Grub areas in accordance with Section 31 11 00 Clearing and Grubbing.

.6 Remove vegetation from target areas by non-chemical means and dispose of stripped vegetation off site at a designated facility.

.7 Commence topsoil stripping after area has been cleared of weeds, brush, grasses and removed from site.

.8 Strip topsoil to depths required.

.1 Avoid mixing topsoil with subsoil.

.9 Pile topsoil in berms in locations as directed by the Departmental Representative.

.1 Stockpile height not to exceed 2.5 - 3 m.

.10 Dispose of unused topsoil off-site at a designated facility.

.11 Protect stockpiles from contamination and compaction.

.12 Cover topsoil that has been piled for long term storage, with trefoil or grass to maintain agricultural potential of soil.

3.3 PREPARATION OF GRADE

.1 Verify that grades are correct and notify Departmental Representative if discrepancies occur do not begin work until instructed by Departmental Representative

.1 Grade area only when soil is dry to lessen soil compaction.

.2 Grade soil establishing natural contours and eliminating uneven areas and low spots, ensuring positive drainage.

3.4 CLEANING

.1 On completion and verification of performance, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 32 19 19.13 Topsoil Placement and Finish Grading

.2 Section 32 11 23 Aggregate Base Courses

.3 Section 32 11 16.01 Granular Sub-Base

.4 Section 31 14 13 Soil Stripping and Stockpiling

.5 Section 32 13 13 Concrete Paving

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM D698-[07e1], Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m^3).

1.3 EXISTING CONDITIONS

.1 Examine subsurface investigation report available from Departmental Representative.

.2 Known underground and surface utility lines and buried objects are as indicated on site plan.

Part 2 Products

2.1 MATERIALS

.1 Fill material: Selected material from excavation or other sources, approved by the Departmental Representative for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

.2 Excavated or graded material existing on site suitable to use as fill for grading work if approved by the Departmental Representative.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for rough grading installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of the Departmental Representative.

.2 Inform the Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from the Departmental Representative.

3.2 STRIPPING OF TOPSOIL

.1 Refer to Section 31 14 13 Soil Stripping and Stockpiling.

3.3 GRADING

.1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated on the Drawings.

.2 Rough grade to following depths below finish grades:

.1 600 mm for shrub beds.

.2 150 mm for seeded areas.

.3 250 mm for pedestrian concrete paving.

.4 750 mm for vehicular concrete paving.

.3 Slope rough grade away from building.

.4 Prior to placing fill over existing ground, scarify surface to depth of 150 mm minimum before placing fill over existing ground. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.

.5 Compact filled and disturbed areas to maximum dry density to ASTM D698, as follows:

.1 85 % under landscaped areas.

.2 95 % under paved and walk areas.

.6 Do not disturb soil within branch spread of trees or shrubs to remain.

3.4 TESTING

.1 Inspection and testing of soil compaction will be carried out by testing laboratory designated by ULC. Costs of tests will be paid the Contractor.

.2 Submit testing procedure, frequency of tests, to the Departmental Representative for approval.

.3 Submit test results to Departmental Representative.

3.5 CLEANING

.1 Progress Cleaning: Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

3.6 PROTECTION

.1 Protect existing trees, fencing, landscaping, natural features, bench marks, buildings, pavement, surface or underground utility lines which are to remain as directed by the Departmental Representative. If damaged, restore to original or better condition unless directed otherwise.

.2 Maintain access roads to prevent accumulation of construction related debris on roads.

END OF SECTION

Part 1 General

1.1 MEASUREMENT PROCEDURES

.1 This work shall be incidental to contract and will not be measured for payment.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 FINISHING AND COMPACTING SUBGRADE

.1 The excavated sections shall be ploughed to a depth of at least 150 mm below the surface of the subgrade and replaced and compacted to a minimum of ninety eight percent (98%) of Standard Proctor Density. The cut shall be left sufficiently high so that the surface after compaction can be trimmed to the final grade, and any loose material resulting from this operation removed. All depressions caused by the finishing rollers shall be removed during the final blading operation. Finished subgrade surfaces shall be within plus or minus 30 mm of established grade, but not uniformly high or low.

3.2 EXCAVATION BELOW GRADE

.1 Unsuitable Materials: When topsoil, muskeg, or other soft areas are encountered below the finished subgrade, which in the opinion of the Departmental Representative require removal, the area shall be undercut and the unsuitable material excavated, loaded and disposed of outside of Park. These materials shall be replaced with granular sub-base course gravel.

.2 Placing Fill: Fill material shall be placed in successive horizontal layers not exceeding 150 mm.

.3 Compaction: The compaction will be sufficient to obtain a minimum density of 98% of maximum dry density in accordance with ASTM D698 (Method C or D), unless otherwise stated in the specifications. Where it is necessary to add or remove moisture from the soil to obtain the compaction, it shall be done as part of the requirements of this section.

3.3 THE FOLLOWING TESTS SHALL BE EMPLOYED TO ESTABLISH COMPACTION PROCEDURES

.1 The maximum dry density of the soil shall be determined by ASTM procedure D-698 (Moisture Density Relationships of soils), to be determined for each soil type. The optimum moisture content of the soil shall be determined from the laboratory compaction curve established.

.2 The field density of soils shall be determined by ASTM D-2922 – Determining density of soil and soil aggregate in place by nuclear methods (shallow depth).

3.4 NORMAL COMPACTED THICKNESSES OF LIFTS

Equipment Type	Cohesive Soils	Non-Cohesive Soil
Vibratory Sheepsfoot Packer	300 mm	300 mm
Sheepsfoot Packer	200 mm	--
Pneumatic Tire	200 mm	200 mm
Vibratory Roller	150 mm	300 mm
Pneumatic Tamper (contact area < 130 sq cm)	100 mm	100 mm
Pneumatic Tamper (contact area > 130 sq cm)	100 mm	100 mm
Mechanical Tamper (diesel or gas – jumping jack)	100 mm	100 mm

.1 Thickness of lifts for other equipment shall be determined by laboratory testing procedures during the construction process. The Departmental Representative may grant approval in writing to alter lift thicknesses upon evidence of satisfactory compaction at other lift thicknesses.

END OF SECTION

Part 1 General

1.1 MEASUREMENT PROCEDURES

.1 This work shall be incidental to contract and will not be measured for payment.

1.2 DEFINITIONS

.1 Topsoil:

.1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

.2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 mm in any dimension.

.2 Waste material: excavated material unsuitable for use in Work or surplus to requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.

1.4 EXISTING CONDITIONS

.1 Buried services:

.1 Before commencing work verify location of buried services on and adjacent to site.

.2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.

.3 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.

.4 Prior to beginning excavation Work, notify applicable Departmental Representative, establish location and state of use of buried utilities and structures. Authorities having jurisdiction to clearly mark such locations to prevent disturbance during Work.

.5 Confirm locations of buried utilities by careful soil hydrovac methods.

.6 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.

.7 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing or re-routing. Costs for such Work to paid by the Departmental Representative.

.8 Record location of maintained, re-routed and abandoned underground lines.

.9 Confirm locations of recent excavations adjacent to area of excavation.

.2 Existing buildings and surface features:

.1 Conduct, with Departmental Representative condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by Work.

.2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by Departmental Representative.

Part 2 Products

2.1 MATERIALS

.1 Backfill material for top dressing roadway sideslopes, disturbed areas, and landscape rehabilitation adjacent to new concrete slabs and curbs: Topsoil.

.2 For Granular fill and pipe bedding refer to Section no. 33 42 13

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 SITE PREPARATION

.1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

.2 Sawcut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly in accordance with Section 02 41 13 - Selective Site Demolition.

.3 Strip topsoil from work areas to the full depth of organic material.

3.3 PREPARATION/ PROTECTION

.1 Protect existing features in accordance with Section 01 56 00 - Temporary Barriers and Enclosures and applicable local regulations.

.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 to Departmental Representative approval.

.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.

3.4 STOCKPILING

.1 Stockpile fill materials in areas designated by Departmental Representative.

.1 Protect fill materials from contamination.

.2 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

3.5 DEWATERING AND HEAVE PREVENTION

.1 Keep excavations free of water while Work is in progress.

.2 Provide for Departmental Representative's approval details of proposed dewatering or heave prevention methods.

.3 Protect open excavations against flooding and damage due to surface run-off.

.4 Dispose of water in accordance with Section 01 35 43 - Environmental Procedures to approved areas and in a manner not detrimental to public and private property, or portion of Work completed or under construction.

3.6 EXCAVATION

.1 Advise Departmental Representative at least two days in advance of excavation operations.

.2 Excavate to lines, grades, elevations and dimensions as directed by Departmental Representative.

.3 Remove concrete, asphalt, walks and other obstructions encountered during excavation in accordance with Section 02 41 13 - Selective Site Demolition.

.4 Excavation must not interfere with bearing capacity of adjacent foundations.

.5 For trench excavation, unless otherwise authorized by Departmental Representative in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.

.6 Keep excavated and stockpiled materials safe distance away from edge of trench.

.7 Restrict vehicle operations directly adjacent to open trenches.

.8 Dispose of surplus and unsuitable excavated material outside of Park.

.9 Do not obstruct flow of surface drainage.

.10 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.11 Notify Departmental Representative when bottom of excavation is reached.

.12 Obtain Departmental Representative approval of completed excavation.

.13 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.

.14 Hand trim, make firm and remove loose material and debris from excavations.

.1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.

3.7 RESERVATION OF MATERIAL

.1 Whenever gravel, sand topsoil, or any other material suitable for special use is encountered, it shall be deemed to be the property of the Contractor and shall be disposed of properly outside of Park.

3.8 DISPOSAL OF MATERIAL

.1 Excavated materials shall be utilized as fill if required on any portion of the work being carried out under this Contract.

.2 Sufficient material will be kept on site for backfill of curbs. Overhaul will not be paid to haul back to an area which contained a surplus of excavated soil suitable for this purpose.

.3 All materials deemed to be in excess of requirements or unsuitable shall be disposed of appropriately by the Contractor outside of Park.

3.9 BACKFILLING

.1 Do not proceed with backfilling operations until completion of following:

.1 Departmental Representative has inspected and approved installations.

.2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

.3 Do not use backfill material which is frozen or contains ice, snow or debris.

3.10 RESTORATION

.1 Upon completion of Work, remove waste materials and debris, trim slopes, and correct defects as directed by Departmental Representative.

.2 Reinstate lawns to elevation which existed before excavation.

.3 Reinstate pavements, sidewalks, and curb and gutter disturbed by excavation to thickness, structure and elevation in accordance with the specifications, drawings, or as directed by the Departmental Representative.

.4 Clean and reinstate areas affected by Work as directed by Departmental Representative.

.5 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Alberta Transportation's Standard Specifications for Highway Construction, Edition 15, August 2013;

1.2 MEASUREMENT AND PAYMENT

.1 Measure geotextiles in square metres of surface covered by material. No allowance will be made for seams and overlaps.

1.3 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM A 123/A 123M- 09, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM D 4491-99a(2009), Standard Test Methods for Water Permeability of Geotextiles by Permittivity.

.3 ASTM D 4595-09, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.

.4 ASTM D 4716- 08, Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.

.5 ASTM D 4751-04, Standard Test Method for Determining Apparent Opening Size of a Geotextile.

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum 2007).

.2 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-4.2 No. 11.2-2004, Textile Test Methods - Bursting Strength - Ball Burst Test (Extension of September 1989).

.2 CAN/CGSB-148.1, Methods of Testing Geotextiles and Complete Geomembranes.

.1 No.2-[M85], Methods of Testing Geosynthetics - Mass per Unit Area.

.2 No.3-[M85], Methods of Testing Geosynthetics - Thickness of

Geotextiles.

.3 No.6.1-[93], Methods of Testing Geotextiles and Geomembranes - Bursting Strength of Geotextiles Under No Compressive Load.

.4 No.7.3-[92], Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles.

.5 No. 10-[94], Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size.

.4 CSA Group

.1 CSA G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.5 Ontario Provincial Standard Specifications (OPSS)

.1 OPSS 1860-[November 2010], Material Specification for Geotextiles.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer's instructions, printed product literature and data sheets for geotextiles and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:

.1 Provide following samples 1 week prior to beginning Work.

.1 Minimum length of 2 m of roll width of geotextile.

.2 Methods of joining.

.4 Test and Evaluation Reports:

.1 Submit copies of mill test data and certificate at least [4] weeks prior to start of Work.

.5 Sustainable Design Submittals:

.1 LEED Canada-NC Version 1.0 CI and Version 1.0 Submittals: in accordance with Section 01 35 21 - LEED Requirements.

.2 Construction Waste Management:

.1 Provide project Waste Management Plan and Waste Reduction Workplan highlighting recycling and salvage requirements.

.2 Provide calculations on end-of-project recycling rates, salvage rates, and landfill

rates demonstrating that 75 % of construction wastes were recycled or salvaged.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect geotextiles from direct sunlight and UV rays.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Woven geotextile with accordance to Alberta Transportation’s Type 2 properties.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for geotextile material installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental.

3.2 INSTALLATION

.1 Place geotextile material in accordance with manufacturer's recommendations.

.2 Place geotextile material smooth and free of tension stress, folds, wrinkles and creases.

.3 Overlap each successive strip of geotextile 600 mm over previously laid strip.

.4 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.

.5 After installation, cover with overlying layer within 4 hours of placement.

.9 Replace damaged or deteriorated geotextile to approval of Departmental Representative.

.10 Place and compact soil layers in accordance with Section 31 23 33.01 - Excavating,

Trenching and Backfilling, 31 24 13 - Roadway Embankments, 33 46 16 - Subdrainage Piping and 35 31 19 - Revetments.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: separate waste materials for reuse or recycling in accordance with Section 01 74 19 - Waste Management and Disposal and Section 01 35 21 - LEED Requirements.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Vehicular traffic not permitted directly on geotextile.

.2 Do not overload soil or aggregate covering on geotextile.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 31 05 16 - Aggregate for Earthwork

1.2 PRICE AND PAYMENT PROCEDURES

.1 Measurement procedures:

.1 Measure crushed rock mattress in cubic metres of crushed rock placed as indicated.

1.3 REFERENCE STANDARDS

.1 Gabion Mattresses manufactured according to ASTM A975-97 - Guidelines for Double Twisted Hexagonal Mesh Gabions.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for gabion mattresses and include product characteristics, performance criteria, physical size, finish and limitations.

Part 2 Products

2.1 MATERIALS

.1 Mattress material to following requirements:

.1 Crushed quarry stone consisting of hard durable particles free from clay lumps, frozen material and other deleterious materials, and free from splits, seams or defects likely to impair its soundness during handling or under action of water.

.2 Relative density: to ASTM C 127, not less than 2.65.

.3 Gradations: to ASTM C 136 and ASTM C 117. Sieve sizes: to CAN/CGSB-8.2.

Sieve Designation	% Passing
150 mm	100
100 mm	50 - 80
75 mm	20 - 65
50 mm	10 - 55

.4 Top 300 mm layer of mattress: graded with maximum particle size of 50 mm.

.2 Rock scour protection:

.1 Quarried rock: uniformly graded.

.2 Quarried rock: to be free from splits, seams or defects likely to impair its soundness during handling or by action of water and to approval of Departmental Representative.

.3 Rock, cubical and angular in shape with ratio of maximum to minimum dimensions of less than 3.

.3 Geotextile soil stabilization: in accordance with Section 31 32 19.16 - Geotextile soil stabilization.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for gabion mattresses installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PREPARATION

.1 Environmental Protection:

.1 Provide erosion and sediment control measure to prevent migration of suspended sediments in downstream areas and erosion of on-site soils/sediments during execution of Work in accordance with Section 01 35 43 - Environmental Procedures.

3.3 PLACEMENT

.1 Ensure that no frozen material is used in placing.

.2 Do not place mattress material until bottom area has been reviewed by Departmental Representative.

.3 Place geotextiles in accordance with Section 31 32 19.16 - Geotextile soil stabilization.

.4 Place mattress materials to dimensions as indicated.

.5 Each gabion mattress unit shall be assembled by tying or fastening all connecting seams. The binding wire shall be tightly looped around every other mesh opening along the seams in such a manner that single and double loops are alternated. An alternative wire fastener may be used in lieu of lacing wire. The alternative wire fasteners shall be applied at approximately 100mm – 150mm intervals on all vertical and horizontal seams. No less than 3 fasteners per 300mm on any given seam.

.6 Prevent segregation in placing of material sizes.

.7 Do not place material during weather judged unsuitable by Departmental Representative.

.8 Place material immediately prior to planned placement of timber cribs concrete caissons.

.9 Do not displace or damage geotextile when placing crushed rock mattress.

3.4 TOLERANCES

.1 Surface of mattress to be parallel with elevation as indicated with mean elevation of surface within 75 mm of elevations as indicated.

.2 Establish mean elevation from spot elevations taken at 2m intervals.

.1 Do not allow spot elevation to differ more than 50mm from mean.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 References

.1 Alberta Transportation, Standard Drawing CB-6, 2.5M1 – Hand Laid Riprap (Rock or Sacked Material).

Part 2 Products

2.1 STONE

.1 All materials necessary for rip rap installations shall be supplied by the Contractor. Materials shall be resistant to weathering and water action. Sandstone or shale materials shall not be used. Materials supplied by the Contractor shall meet the following requirements.

.2 Hand placed rip-rap:

Rounded River Cobble Gradation	
Size (mm)	% Passing
150	100
100	60-100
25	30-80
No. 4 Sieve	15-55
No. 30 Sieve	5-35
No. 200 Sieve	0-10

2.2 GEOTEXTILE FILTER

.1 Geotextile: in accordance with Section 31 32 19.16 - Geotextile Soil Stabilization.

Part 3 Execution

3.1 PLACING

.1 Where rip-rap is to be placed on slopes, excavate trench at toe of slope to dimensions as indicated.

.2 Fine grade area to be rip-rapped to uniform, even surface. Fill depressions with suitable material and compact to provide firm bed.

.3 Place geotextile on prepared surface in accordance with Section 31 32 19.16 - Geotextile Soil Stabilization and as indicated. Avoid puncturing geotextile. Vehicular traffic over geotextile not permitted.

.4 Place rip-rap to thickness and details as indicated.

.5 Place stones in manner approved by Departmental Representative to secure surface and create a stable mass. Place larger stones at bottom of slopes.

.6 Hand placing:

.1 Use larger stones for lower courses and as headers for subsequent courses.

.2 Stagger vertical joints and fill voids with rock spalls or cobbles.

.3 Finish surface evenly, free of large openings and neat in appearance.

.7 Aprons shall be required at both the inlet and outlet aprons.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 31 05 16 Aggregate for Earthwork

.2 Section 32 16 00 Curbs, Gutters and Sidewalks

.3 Section 32 22 13 Rough Grading

.4 Section 32 11 23 Aggregate Base Courses

1.2 REFERENCES

.1 ASTM International

.1 ASTM C117-04, Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C131-06, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.3 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft3) (600kN-m/m3).

.5 ASTM D1557-09, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft3) (2,700kN-m/m3).

.6 ASTM D1883-07e2, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.

.7 ASTM D4318-10, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

1.3 MEASUREMENT PROCEDURES

.1 This work shall be incidental to contract and will not be measured for payment.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Storage and Handling Requirements:

.1 Stockpile minimum 50% of total aggregate required prior to beginning operation.

.2 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.1 Stockpile as directed by Departmental Representative in location to minimize environmental impacts to adjacent landscaping and in accordance with 31 05 16 Aggregate for Earthwork.

.3 Replace defective or damaged materials with new.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.

Part 2 Products

2.1 SAMPLES

.1 At least two weeks prior to commencing work, inform the Departmental Representative of proposed source of aggregates and provide access for sampling.

.2 Sampling and testing shall have been completed no more than 90 days prior to use unless otherwise reviewed and accepted by the Department Representative.

2.2 MATERIALS CERTIFICATION

.1 Aggregates: At least two weeks prior to commencing work provide:

.1 Test data reports representing granular sub-base processed into stockpile. Submit one (1) complete aggregate gradation analysis report for every 1,000 tonnes of each material required for the project or one complete analysis for each production day when production is less than 1,000 tonnes. Include percentage of crushed coarse aggregate particles in reports.

.2 Certification that the physical properties of the aggregates meet the requirements of this section.

.3 Reports and certification shall be provided by an independent testing consultant under the signature and professional seal of a qualified materials engineer.

.2 At least two weeks prior to contemplated change in source of aggregates, provide written notification to the Departmental Representative and provide new materials certification in accordance with the requirements of this section.

2.3 GRANULAR SUB BASE

.1 Material in accordance with Section 31 05 16 - Aggregate for Earthwork and following requirements:

.1 80mm Crushed stone or gravel.

.2 Crushed stone or gravel consisting of hard, durable, angular particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials.

.3 Physical properties of Aggregates:

Los Angeles Abrasion, loss, %	50 max.
Liquid Limit, %	25 max.
Plasticity Index, %	6 max.
Lightweight Particles, %	5 max.
California Bearing Ratio, when compacted to 100% of ASTM D698	20 min.
Crushed particles (1 face plus 5 000 sieve fraction), %	25 min.

.2 Gradation to be within the following limits when tested to ASTM C-136 and ASTM C-117 with sieve sizes to CAN/CGSBD 8-GP-2M rather than ASTM E11, and to have a smooth curve without sharp breaks when plotted on a semi-log grading chart.

Sieve Size	Percent Passing by Weight
75 000	100
25 000	65-100
10 000	40-100
5 000	30-90
2 500	25-65
630	15-35
160	5-15
80	3-10

Part 3 Execution

3.1 PREPARATION

.1 The Contractor shall maintain the subgrade to the specified section, free from ruts, waves and undulations until granular sub-base material is placed. The subgrade shall be in a firm dry condition and must be approved by the Departmental Representative before gravel is placed. The depositing of granular sub-base on a soft, muddy or rutted subgrade will not be permitted.

3.2 PLACING

.1 Place material on a clean unfrozen surface, properly shaped and compacted and free from snow and ice.

.2 Place using methods which do not lead to segregation or degradation of aggregate. Use approved methods to create uniform windrow of material along a crown line or high side of a one-way slope.

.3 Place material to full width in layers not exceeding 150 mm in compacted thickness.

.4 Shape each layer to a smooth contour and compact to the specified density before succeeding layer is placed.

.5 Remove and replace any portion of a layer in which material becomes segregated during compaction.

3.3 COMPACTING

.1 Ensure compaction equipment is capable of obtaining required material densities.

.2 Efficiency of equipment not specified to be proved at least as efficient as specified equipment at no extra cost and written approval must be received from Departmental Representative before use.

.3 Equipped with device that records hours of actual work, not motor running hours.

.4 Moisture condition of granular sub-base course materials to be within plus or minus 3 percent of the optimum moisture content of the material.

.5 Compact to density not less than 98% of maximum dry density in accordance with ASTM D698 (Method C or D).

.6 Shape and compact alternately to obtain a smooth, even and uniformly compacted sub-base.

.7 In areas not accessible to rolling equipment, compact to specified density with approved mechanical tampers.

3.4 PROOF ROLLING

.1 For proof rolling use standard roller of 45400 kg gross mass with four pneumatic tires each carrying 11350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 730 mm.

.2 Obtain written approval from the Departmental Representative to use non standard proof rolling equipment.

.3 Proof roll at level in granular base as indicated.

.4 If use of non standard proof rolling equipment is approved, the Departmental Representative to determine level of proof rolling.

.5 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.

.6 Where proof rolling reveals areas of defective subgrade:

.7 Remove base, sub-base and subgrade material to depth and extent as directed by the Departmental Representative.

.8 Replace base material and compact in accordance with this Section.

.9 Where proof rolling reveals defective base or sub-base, remove defective materials to depth and extent as directed by the Departmental Representative and replace with new materials in accordance with Section 31 05 16 Aggregate for Earthwork and this section at no extra cost.

3.5 FINISH TOLERANCES

.1 Finished sub-base surfaces shall be within plus or minus 10 mm of established grade, but not uniformly high or low.

.2 Correct surface irregularities by loosening and adding or removing materials until surface is within the specified tolerances.

3.6 MAINTENANCE

.1 Maintain finished sub-base in a condition conforming to this section until succeeding material is applied or until acceptance.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 31 05 16 Aggregate for Earthwork

.2 Section 32 16 00 Curbs, Gutters and Sidewalks

.3 Section 32 15 40 Crushed Stone Surfacing

.4 Section 32 22 13 Rough Grading

.5 Section 32 11 16.01 Granular Sub-base

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM C117-04, Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C131-06, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.3 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft3) (600kN-m/m3).

.5 ASTM D1557-09, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft3) (2,700kN-m/m3).

.6 ASTM D1883-07e2, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.

.7 ASTM D4318-10, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

1.3 MEASUREMENT PROCEDURES

.1 This work shall be incidental to contract and will not be measured for payment.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Storage and Handling Requirements:

.1 Stockpile minimum 50% of total aggregate required prior to beginning operation.

.2 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.1 Stockpile as directed by Departmental Representative in location to minimize environmental impacts to adjacent landscaping and in accordance with 31 05 16 Aggregate for Earthwork.

.3 Replace defective or damaged materials with new.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.

Part 2 Products

2.1 SAMPLES

.1 At least two weeks prior to commencing work, inform the Departmental Representative of proposed source of aggregates and provide access for sampling.

.2 Sampling and testing shall have been completed no more than 90 days prior to use unless otherwise reviewed and accepted by the Department Representative.

2.2 MATERIALS CERTIFICATION

.1 Aggregates: At least two weeks prior to commencing work provide:

.1 Test data reports representing granular base processed into stockpile. Submit one (1) complete aggregate gradation analysis report for every 1,000 tonnes of each material required for the project or one complete analysis for each production day when production is less than 1,000 tonnes. Include percentage of crushed coarse aggregate particles in reports.

.2 Certification that the physical properties of the aggregates meet the requirements of this section.

.3 Reports and certification shall be provided by an independent testing consultant under the signature and professional seal of a qualified materials engineer.

.2 At least two weeks prior to contemplated change in source of aggregates, provide written notification to the Departmental Representative and provide new materials certification in accordance with the requirements of this section.

2.3 GRANULAR BASE

.1 Granular base: material in accordance with Section 31 05 16 - Aggregate for Earthwork and following requirements:

.1 25mm Crushed stone or gravel.

.1 Crushed stone or gravel consisting of hard, durable, angular particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials.

.2 Physical properties of Aggregates:

% Fracture, by weight (2 faces)	60 min.
Los Angeles Abrasion, loss, %	45 max.
Liquid Limit, %	25 max.
Plasticity Index, %	6 max.
Lightweight Particles, %	5 max.
California Bearing Ratio, when compacted to 100% of ASTM D698	80 min.

.3 Gradation to be within the following limits when tested to ASTM C-117 with sieve sizes to CAN/CGSBD 8-GP-2M rather than ASTM E11, and to have a smooth curve without sharp breaks when plotted on a semi-log grading chart.

Sieve Size	Percent assing by eight
25 000	100
16 000	73-94
10 000	56-80
5 000	40-66
1 250	24-45
315	13-27
160	9-19
80	4-10

Part 3 Execution

3.1 PREPARATION

.1 The Contractor shall maintain the subgrade to the specified section, free from ruts, waves and undulations until granular sub-base material is placed. The subgrade shall be in a firm dry condition and must be approved by the Departmental Representative before gravel is placed. The depositing of granular sub-base on a soft, muddy or rutted subgrade will not be permitted.

3.2 PLACING

.1 Place material on a clean unfrozen surface, properly shaped and compacted and free from snow and ice.

.2 Place using methods which do not lead to segregation or degradation of aggregate. Use approved methods to create uniform windrow of material along a crown line or high side of a one-way slope.

.3 Place material to full width in layers not exceeding 150 mm in compacted thickness.

.4 Shape each layer to a smooth contour and compact to the specified density before succeeding layer is placed.

.5 Remove and replace any portion of a layer in which material becomes segregated during compaction.

3.3 COMPACTING

.1 Ensure compaction equipment is capable of obtaining required material densities.

.2 Efficiency of equipment not specified to be proved at least as efficient as specified equipment at no extra cost and written approval must be received from Departmental Representative before use.

.3 Equipped with device that records hours of actual work, not motor running hours.

.4 Moisture condition of granular sub-base course materials to be within plus or minus 3 percent of the optimum moisture content of the material.

.5 Compact to density not less than 98% of maximum dry density in accordance with ASTM D698 (Method C or D).

.6 Shape and compact alternately to obtain a smooth, even and uniformly compacted sub-base.

.7 In areas not accessible to rolling equipment, compact to specified density with approved mechanical tampers.

3.4 PROOF ROLLING

.1 For proof rolling use standard roller of 45400 kg gross mass with four pneumatic tires each carrying 11350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 730 mm.

.2 Obtain written approval from the Departmental Representative to use non standard proof rolling equipment.

.3 Proof roll at level in granular base as indicated.

.4 If use of non standard proof rolling equipment is approved, the Departmental Representative to determine level of proof rolling.

.5 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.

.6 Where proof rolling reveals areas of defective subgrade:

.7 Remove base, sub-base and subgrade material to depth and extent as directed by the Departmental Representative.

.8 Replace base material and compact in accordance with this Section.

.9 Where proof rolling reveals defective base or sub-base, remove defective materials to depth and extent as directed by the Departmental Representative and replace with new materials in accordance with Section 31 05 16 Aggregate for Earthwork and this section at no extra cost.

3.5 FINISH TOLERANCES

.1 Finished sub-base surfaces shall be within plus or minus 10 mm of established grade, but not uniformly high or low.

.2 Correct surface irregularities by loosening and adding or removing materials until surface is within the specified tolerances.

3.6 MAINTENANCE

.1 Maintain finished sub-base in a condition conforming to this section until succeeding material is applied or until acceptance.

END OF SECTION

Part 1 General

1.1 MEASUREMENT PROCEDURES

.1 This work shall be incidental to contract and will not be measured for payment.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Samples:

.1 Submit two - 1 L samples of asphalt tack coat material proposed for use in new, clean, airtight, sealed, wide mouth jars or bottles made with plastic to Departmental Representative, at least 14 days prior to beginning Work.

.2 Sample asphalt tack coat material to: ASTM D 140.

.3 Provide access on tank truck for Departmental Representative to sample asphalt material to be incorporated into Work to ASTM D 140.

1.3 QUALITY ASSURANCE

.1 Upon request from Departmental Representative, submit manufacturer's test data and certification that asphalt prime material meets requirements of this Section.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labeled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect asphalt tack coats from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Deliver, store and handle materials in accordance with ASTM D 140.

.5 Provide, maintain and restore asphalt storage area.

Part 2 Products

2.1 MATERIALS

.1 Anionic emulsified asphalt: to CAN/CGSB-16.2, grade SS-1h.

.2 Cut-back asphalt: to AASHTO M081-92-UL, grade RC-70 or RC-250.

.3 Water: clean, potable, free from foreign matter.

2.2 EQUIPMENT

.1 Equipment required for Work of this Section to be in satisfactory working condition and maintained for duration of Work.

.2 Pressure distributor:

.1 Designed, equipped, maintained and operated so that asphalt material can be:

.1 Maintained at even temperature.

.2 Applied uniformly on variable widths of surface up to 5 m

.3 Applied at readily determined and controlled rates from 0.2 to 5.4 L/m^2 with uniform pressure, and with allowable variation from any specified rate not exceeding 0.1 L/m^2.

.4 Distribute in uniform spray without atomization at temperature required.

.2 Equipped with meter, registering travel in metres per minute, visibly located to enable truck driver to maintain constant speed required for application at specified rate.

.3 Equipped with pump having flow meter graduated in units of 5 L or less per minute passing through nozzles and readily visible to operator. Pump power unit to be independent of truck power unit.

.4 Equipped with easily read, accurate and sensitive device which registers temperature of liquid in reservoir.

.1 Measure temperature to closest whole number.

.5 Equipped with accurate volume measuring device or calibrated tank.

.6 Equipped with nozzles of same make and dimensions, adjustable for fan width and orientation.

.7 Equipped with nozzle spray bar, with operational height adjustment in increments of 0.6 metres and capable of being raised or lowered.

.8 Cleaned if previously used with incompatible asphalt material.

Part 3 Execution

3.1 APPLICATION

.1 Apply asphalt tack coat only on clean and dry surface.

.2 Dilute asphalt emulsion with water at 1:1 ratio for application.

.1 Mix thoroughly by pumping or other method approved by Departmental Representative.

.3 Apply asphalt tack coat evenly to pavement surface at 0.5 L/ m^2.

.4 Paint contact surfaces of curbs, gutters, headers, manholes and like structures with thin, uniform coat of asphalt tack coat material.

.5 Apply asphalt tack coat only when air temperature greater than 10 degrees C and when rain is not forecast within 2 hours minimum of application.

.6 Apply asphalt tack coat only on unfrozen surface.

.7 Evenly distribute localized excessive deposits of tack coat by brooming as directed by Departmental Representative.

.8 Where traffic is to be maintained, treat no more than one half of width of surface in one application.

.1 Control traffic in accordance with Section 01 35 00.06 - Special Procedures for Traffic Control.

.9 Keep traffic off tacked areas until asphalt tack coat has set.

.10 Re-tack contaminated or disturbed areas as directed by Departmental Representative.

.11 Permit asphalt tack coat to set before placing asphalt pavement.

.12 Submit summary report within 3 days minimum of date of application and include information as follows:

.1 Total area tack coated.

.2 Quantity of tack coat used.

.3 Mean application rate.

.4 Actual product quantity used when using equipment on pressure distributors.

.5 Dipstick measurements or electronic printouts are acceptable.

.13 Carry out measurements in presence of Departmental Representative upon request.

.14 Inspect tack coat application to ensure uniformity.

.1 Re-spray areas of insufficient or non-uniform tack coat coverage as directed by Departmental Representative.

.2 Ensure tack coating performed using hand held devices is consistent in appearance with adjacent areas of machine applied material.

3.2 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 – Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 – Cleaning.

END OF SECTION

Part 1 General

1.1 MEASUREMENT PROCEDURES

.1 This work shall be incidental to contract and will not be measured for payment.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 – Submittal Procedures.

.2 Samples:

.1 Submit two 1 L samples of asphalt prime proposed for use in new, clean, air tight sealed, wide mouth jars or bottles made with plastic, to Departmental Representative, 14 days prior to commencing Work.

.2 Sample asphalt prime coat materials in accordance with ASTM D 140.

.3 Provide access on tank truck for Departmental Representative to sample asphalt material to be incorporated into Work, in accordance with ASTM D 140.

1.3 QUALITY ASSURANCE

.1 Upon request from Departmental Representative, submit manufacturer's test data and certification that asphalt prime material meets requirements of this Section.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Storage and Handling Requirements:

.1 Deliver, store and handle materials to ASTM D 140.

.2 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.3 Store and protect asphalt prime coats from nicks, scratches, and blemishes.

.4 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIAL

.1 Asphalt material: to CAN/CGSB-16.2, grade SS-1.

.2 Sand blotter: clean granular material passing 4.75 mm sieve and free from organic matter or other deleterious materials.

.3 Water: clean, potable, free from foreign matter.

2.2 EQUIPMENT

.1 Pressure distributor:

.1 Designed, equipped, maintained and operated so that asphalt material can be:

.1 Maintained at even temperature.

.2 Applied uniformly on variable widths of surface up to 5 m.

.3 Applied at controlled rates from 0.2 to 5.4 L/m^2 with uniform pressure, and allowable variation from any specified rate not exceeding 0.1 L/m^2.

.4 Distributed in uniform spray without atomization at temperature required.

.2 Equipped with meter registering travel distance in metres per minute, visibly located to enable truck driver to maintain constant speed required for application at specified rate.

.3 Equipped with pump having flow meter graduated in units of 5 L or less per minute passing through nozzles and readily visible to operator.

.1 Pump power unit to be independent of truck power unit.

.4 Equipped with easily read, accurate and sensitive device which registers temperature of liquid in reservoir.

.1 Temperature to be measured to nearest whole number.

.5 Equipped with accurate volume measuring device or calibrated tank.

.6 Equipped with nozzles of same make and dimensions, adjustable for fan width and orientation.

.7 Equipped with nozzle spray bar, with operational height adjustment in increments of 0.6 metres and capable of being raised or lowered.

.8 Cleaned if previously used with incompatible asphalt material.

.2 Aggregate Spreader:

.1 Apply blotter sand to primed surfaces using roll type spreader, or rotating disc sander capable of applying aggregate at variable widths and at variable rates.

Part 3 Execution

3.1 APPLICATION

.1 Proceed with application of asphalt prime coat only after receipt of written approval of granular base surface from Departmental Representative.

.2 Cutback asphalt:

.1 Heat asphalt prime for pumping and spraying.

.2 Apply asphalt prime to granular base at rate as directed by Departmental Representative.

.3 Apply on dry surface unless otherwise directed by Departmental Representative.

.3 Anionic emulsified asphalt:

.1 Dilute asphalt emulsion with clean water at 1:1 ratio for application.

.2 Mix thoroughly by pumping or other method approved by Departmental Representative.

.3 Apply diluted asphalt emulsion at 3.0L/m^2.

.4 Apply diluted asphalt emulsion on damp surface unless otherwise directed by Departmental Representative.

.4 Apply asphalt prime only on unfrozen surface.

.5 Apply asphalt prime coat only when air temperature is greater than 10 degrees C and when rain is not forecast within 2 hours minimum of application.

.6 Paint contact surfaces of curbs, gutters, headers, manholes and like structures with thin, uniform coat of asphalt prime material.

.7 Where traffic is to be maintained, treat no more than one-half width of surface in one application.

.8 Prevent overlap at junction of applications.

.9 Do not prime surfaces that will be visible when paving is complete.

.10 Apply additional material to areas not sufficiently covered as directed by Departmental Representative.

.11 Keep traffic off primed areas until asphalt prime has cured.

.1 Control traffic in accordance with Section 01 35 00.06 - Special Procedures for Traffic Control.

.12 Permit prime to cure before placing asphalt paving.

3.2 USE OF SAND BLOTTER

.1 If asphalt prime fails to penetrate within 24 hours, spread sand blotter material in amounts required to absorb excess material.

.2 Allow sufficient time for excess prime to be absorbed as directed by Departmental Representative.

.3 Apply second application of sand blotter as required.

.4 Do not roll blotter sand.

.5 Sweep and remove excess blotter material.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 – Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 – Cleaning.

END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

1.2 DEFINITIONS

.1 End Product Specification (EPS) – A specification whereby the methods of construction are not defined. Under EPS the Departmental Representative will monitor the Contractor's control of the process that produces the items of construction and will accept or reject the end product according to a specified acceptance plan. The Contractor is responsible for quality control. End product acceptance, including quality acceptance is the responsibility of the Departmental Representative.

.2 Lot – A Lot is a portion of the Work being considered for acceptance, and is defined as the following:

.1 The entire project quantity for each mix type.

.2 At the Departmental Representative's discretion, any portion of the Work may be deemed a Lot.

Part 2 Products

2.1 MATERIALS

.1 Asphalt cement:

.1 Asphalt cement shall be prepared by the refining of petroleum and shall not foam when heated to 177 C.

.2 The tolerance allowed by ASTM for testing precision will be applied for acceptance of asphalt cement.

.2 Asphalt cement shall meet the following requirements for 150/200A binder grade:

Table 2.1.2

Properties of 150/200A Asphalt Cement for Roads (Refer to Government of Alberta – Transportation, Standard Specifications for Highway Construction, Specification 5.7 – Supply of Asphalt)		
TEST CHARACTERISTICS	ASTM TEST METHOD	TEST RESULT
Absolute Viscosity at 60°C (Pascals/sec)	D2171	Penetration (150) 78 – 155 (200) 50 – 92
Kinematic Viscosity at 135°C (mm^2/sec)	D2170	Penetration (150) 255 – 360

		(200) 205 – 285
Penetration at 25°C, 100g, 5 sec (dmm)	D5	150 – 200
Ductility of residue at 25°C (minimum cm)	D113	100
Solubility in Trichlorethylene (minimum %)	D2042	99.5
Flash Point – Cleveland Open Cup (°C)	D92	205
Test on Residue from Thin Film Oven Test (D 1754) Ratio of Absolute Viscosity to Original Absolute Viscosity	D2171	4.0

.3 Aggregates:

.1 Coarse aggregate is aggregate retained of the 5,000 μm sieve; fine aggregate is aggregate passing the 5,000 μm sieve.

.2 Aggregate material shall be crushed stone or gravel consisting of hard, durable, angular particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials.

.3 Gradation to be within limits specified, when tested to ASTM C-136 and ASTM C-117 with sieve sizes to CAN/CGSB 8-GP-2M rather than ASTM E11.

.4 Aggregate shall be processed to meet the following requirements:

.1 Natural fines shall be pre-screened and stockpiled with not more than 10% of material retained in the 5,000 μm sieve and 100% passing the 10,000 μm sieve.

.2 Fine fraction or manufactured sand to contain not more than 20% of material retained on the 5,000 μm sieve.

.5 Physical properties of aggregates to meet the requirements in Table 2.1.3.5

Table 2.1.3.5

Aggregate Physical Property Requirements

REQUIREMENT	TEST STANDARD	MIX TYPE I
Los Angeles Abrasion, Grading B (% loss)	C131	32.0 max.
Magnesium Sulphate Soundness (% loss)	C88	
Coarse Aggregate:		12.0 max.
Fine Aggregate:		12.0 max.

Lightweight Particles (%)	C123	1.5 max.

.6 Blend sand:

.1 To consist of natural of manufactured sand passing the 5,000 μm sieve.

.2 Stockpile volumes shall be maintained to ensure a minimum of 5 000 tonne of plant mix production at all times.

.7 Blended Aggregate Requirements:

.1 Aggregate Gradation Requirements, including RAP, to meet the requirements of the following table.

Table 2.1.3.7.1

Blended Aggregate Gradation Requirements

SIEVE SIZE (μm)	Percent Passing Type I	
	Max.	Min.
25,000	-	-
20,000	-	100
16,000	100	97
12,500	95	85
10,000	85	70
5,000	65	50
2,500	50	40
1,250	40	30
630	30	20
315	23	15
160	16	6
80	8.0	4.0

.2 Coarse Aggregate Fracture: Of coarse fraction (retained on 5,000 μm sieve size) the percentage of particles with two (2) or more fractured faces shall be by mass:

.1 Mix Type I – 80% minimum

.3 Flat and Elongated Particles: Of coarse fraction (retained on the 5,000 μm sieve size) the percentage of flat and elongated particles greater than a 5:1 ratio shall be by mass less than 10%.

.4 Manufactured Sand: Of total fine fraction (passing 5,000 μm sieve size), manufactured sand shall be by mass:

.1 Mix Type I – 70% minimum

.5 For mixes incorporating RAP, 50% of the RAP sand portion shall be considered manufactured sand.

.6 The sand equivalent value (ASTM D2419, mechanical method) determined for the fine aggregate portion shall be:

.1 Mix Type I – 45% minimum

.7 Of total aggregate, the maximum RAP portion shall be by mass:

.1 Mix Type I – 15% maximum

.8 Delivery and Storage

.1 Aggregates: Stockpile minimum of 50% of total amount of aggregate required before commencing trial mix designs.

.2 Reclaimed Asphalt Pavement (RAP): Stockpile minimum of 100% of total amount of RAP required before commencing trail mix designs.

2.2 MIX DESIGN

.1 An asphalt mix design must be prepared and submitted to the Departmental Representative for review and approval at least seven days prior to the work. The Contractor shall use qualified engineering and testing services licensed to practice in the Province of Alberta.

.2 The mix design shall follow the Marshall method of mix design as outlined in the latest edition of the Asphalt Institute Manual Series No. 2 (MS-2), and shall include five separate trial values of asphalt content.

.3 Design of mix:

.1 Mix Type I – 75 blows on each face of test specimens.

.4 Include the following data with mix design submission:

.1 Aggregate specific gravity and asphalt absorption.

.2 Sand equivalent, coarse aggregate fracture, flat and elongated particles, and percent manufactured sand values.

.3 Asphalt cement supplier/refinery, specific gravity and mixing and compaction temperatures, based on temperature-viscosity properties of asphalt cement.

.4 Job mix formula including aggregate gradation and blending proportions, and design asphalt content.

.5 Maximum relative density at each trial asphalt content.

.6 Where reclaimed asphalt pavement (RAP) is to be incorporated into the mix supply, RAP gradation, RAP asphalt cement content and design recycle percentage.

.7 Data to satisfy the requirements of the following:

Table 2.2.4.7

Mixture Physical Property Requirements

PROPERTY	REQUIREMENTS
	Mix Type I
Marshall Stability (kN)	10.0 min.
Marshall Flow (0.25 mm units)	8 – 14
Marshall Immersion Index of Retained Stability (%)	75 min.
Air Voids (%)	3.8 – 4.2
Voids in Mineral Aggregate (VMA) (%)	13.5 – 15.0
Voids Filled With Asphalt	65 – 75

(VFA) (%)	
Film Thickness (μm)	7.0 – 8.5

2.3 JOB MIX FORMULA (JMF)

.1 Subject to approval by the Departmental Representative, the aggregate proportioning (including RAP), target gradation, asphalt content and air void content from the Mix Design will become the Job Mix Formula (JMF) for the supply of hot mix asphalt.

.2 Once established, no alterations to the JMF will be permitted unless the Contractor submits a new JMF and approved by the Departmental Representative.

.3 If the sum of any alterations to the JMF is in excess of any one of the following limits, a new Mix Design is required.

± 5% passing the 5,000 μm sieve size

± 1% passing the 80μm sieve size

± 0.30% asphalt content

.4 Any alteration to the JMF shall not result in properties which do not meet the requirements of this Specification.

2.4 PRODUCTION TOLERANCES

.1 All mixtures shall be supplied to the JMF within the range of tolerances specified.

.2 Asphalt cement content: ± 0.30% of JMF value.

.3 Temperature: Mix temperature at point of plant discharge shall not vary from that specified in the JMF by more than ± 10°C.

.4 Aggregate Gradation:

Table 2.4.4

AGGREGATE PASSING SIEVE SIZE (μm)	TOLERANCE (% BY MASS)
Max. Size to 5,000	± 5.0
2,500 & 1,250	± 4.0
630 & 315	± 3.0
160	± 2.0
80	± 1.0

.5 Air Voids: ± 1.0 % of the JMF value.

.6 Mixture Properties: Marshall Stability, Marshall Flow, Voids Filled with Asphalt, Voids in Mineral Aggregate, and Film Thickness as per requirements identified in Table 2.2.4.7.

.7 Moisture in Mix: Maximum permissible moisture, at point of plant discharge, is 0.2% by mass of mix.

.8 Asphalt cement recovered from freshly produced hot mix by the Abson Method, ASTM D1856 and subsequently tested in accordance with ASTM D5, shall retain a minimum value of 50% of its original penetration value.

Part 3 Sampling and Testing

3.1 GENERAL

.1 The Departmental Representative shall have access to all production processes and materials used for the work to monitor material quantity as often as deemed necessary. Such inspection and testing shall not relieve the Contractor of the responsibility for meeting the requirements of this specification.

.2 At least five days prior to commencing work, inform the Departmental Representative of the proposed source of aggregates and provide access for sampling, and provide samples of asphalt cement.

3.2 QUALITY CONTROL

.1 Quality Control is the responsibility of the Contractor throughout every stage of the work from aggregate processing to the final accepted product. Tests performed by the Departmental Representative will not be considered as Quality Control tests.

.2 The Contractor shall be totally responsible for production of materials and construction that meets all specified requirements.

.3 All quality control shall be conducted by qualified personnel. The Contractor shall bear the cost of all quality control testing and consulting services.

.4 Pre-Production testing and sampling and minimum frequencies are described in the following table:

Table 3.2.4
Pre-Production Quality Control Requirements

Quality Control Requirement	Test Standard	Minimum Frequency
Asphalt Cement Certification	-	Once per year or for change in supplier.
Aggregate Physical Properties Table 2.1.3.5	Table 2.1.3.5	Once per year, or for change in source.
Crushed Coarse Aggregate Gradation Analysis and Fracture Content	ASTM C 136 ASTM D 5821	One for every 1,000 tonnes of each class of material processed into stockpile, or one analysis for each material, every production day when production rate is less than 1,000 tonnes.
Manufactured Sand Aggregate Gradation	ASTM C 117 ASTM C 126	
Natural Fine Aggregate Gradation	ASTM C 117 ASTM C 126	
Blend Sand Aggregate Gradation	ASTM C 117 ASTM C 126	
Reclaimed Asphalt Pavement (RAP) Asphalt Content and	ASTM D 2172 ASTM C117	One for each 500 tonnes delivered to stockpile, or one for each location when delivery rate is less

Extracted Aggregate Gradation	ASTM C 136	than 500 tonnes.
Penetration of Asphalt Cement Recovered from RAP by Abson Method	ASTM D 1856 ASTM D 5	One for each 2,000 tonnes delivered to stockpile.
Trial Mix Design by Marshall Method Section 2.2	Asphalt Institute MS-2	One per mix type every 3 years, or as required for a change in asphalt cement supply, aggregate gradation or aggregate source. See Note 1.
Marshall Immersion Test for Bitumen	AASHTO T245-97-UL [2004]	Minimum frequency not specified.
Plant Calibration	-	As required.

Note 1: A laboratory/plant JMF verification is required each year when a trial mix design is not conducted.

.5 Post-Production testing and sampling and minimum frequencies are described in the following table:

Table 3.2.5
Post-Production Quality Control Requirements

Quality Control Requirement	Test Standard	Minimum Frequency
Hot Mix Asphalt Analysis (including Asphalt Content, Aggregate Gradation, Marshall Density and Void Properties)	ASTM D 6307 ASTM C117 ASTM C 136 ASTM D 3203	One for every 500 tonnes of each mix type supplied under this specification. See note 1.
Quality Control Charts (including 3 test running average for Binder Content, Aggregate Gradation, Marshall Density and Void Properties)	-	For each hot mix analysis. Test results and updated 3 test running average to be submitted to the Departmental Representative as they become available.
Marshall Immersion Test for Bitumen	AASHTO T245-97-UL [2004]	Minimum frequency not specified.
Hot Mix Asphalt Temperature	-	Minimum frequency not specified.
Cold Feed Aggregate Analysis	ASTM C 117 ASTM C 1236	Minimum frequency not specified.
Maximum Relative Density of Hot Mix Asphalt	ASTM D 2041	Minimum frequency not specified.
Compaction Monitoring (Core or Nuclear Density)	ASTM D 2726 ASTM D 2950	Minimum frequency not specified. See note 2.

Note 1: Where an individual test indicates non-compliance, another test shall be initiated immediately.

Note 2: Coring is subject to approval by the Departmental Representative.

.6 Pre-Production Quality Control test data shall be reported to the Departmental Representative five days prior to commencing the project, or as requested.

.7 Post-Production Quality Control test data shall be reported to the Departmental Representative daily as the work proceeds.

3.3 QUALITY CONTROL COMPLIANCE WITH SPECIFIED TOLERANCES

.1 Asphalt Content, Aggregate Gradation and Mixture Properties

.1 The test data derived by Post-Production Quality Control mix testing, described in Section 3.2, shall be compared to the tolerances set forth in Section 2.4 of this specification. The Contractor shall document, and make available to the Departmental Representative, any adjustments made to correct non-compliance with the specified tolerances.

.2 The Contractor shall suspend mix production when the 3 test running average for any property is outside of the specified tolerance limits for three consecutive tests. Supply shall not commence again until it is demonstrated that corrective action has been taken.

.2 Hot Mix Asphalt Temperature

.1 Plant mix that does not meet temperature requirements of Section 2.4.3, at the point of plant discharge shall be subject to rejection at the discretion of the Departmental Representative.

3.4 ACCEPTANCE SAMPLING AND TESTING

.1 Within this specification, certain requirements, limits and tolerances are specified regarding supplied materials and workmanship. Compliance with these requirements shall be determined from acceptance testing as described in this section.

.2 Acceptance testing is the responsibility of the Departmental Representative.

.3 Initial acceptance testing will be undertaken free of cost to the Contractor.

.4 Asphalt concrete pavement for pathways will be subject to acceptance testing at the Departmental Representative's discretion.

.5 Sampling and acceptance testing is described in the following table:

Table 3.4.4
Acceptance Testing Requirements

Acceptance Testing	Test Standard	Minimum Frequency
Hot Mix Asphalt Analysis (including Binder Content, Aggregate Gradation, Marshall Density, Maximum Relative Density, Void Properties, Marshall	ASTM D 6307 ASTM C 117 ASTM C 136 ASTM D 2041 ASTM D 3203	For each mix type, one test for each 3,500 sq.m. of placement, or three tests per Lot, whichever is greater. See note 1.

Stability and Flow)		
Marshall Immersion Test for Bitumen	AASHTO T245-97-UL [2004]	Minimum frequency not specified.
Compaction Testing (Core Density) and Thickness Determination	ASTM D 2726 ASTM D 3549	For each mix type, one test for each 2,000 sq.m. of placement, or three tests per Lot, whichever is greater.
Hot Mix Asphalt Temperature	-	Minimum frequency not specified.

Note 1: The Departmental Representative may, at their discretion, acquire the minimum number of mix samples, but reduce the number of tests to a minimum of one (1). Should non-compliance be indicated by the sample(s) tested, the Departmental Representative reserves the option to test the remaining samples.

.6 Acceptance Sampling Procedures:

.1 Loose mix samples shall be acquired from the Work site in accordance with Alberta Transportation Test (ATT) procedure ATT-37. Auger samples may be used if approved by both the Departmental Representative and the Contractor.

.2 The timing of mix sampling shall be stratified, with each sample representing a similar production quantity.

.3 Core locations will be selected using stratified random sampling procedures. The Lot will be divided into segments meeting or exceeding the minimum specified frequency and of approximately equal area. In each segment a test site will be located using random numbers to determine the longitudinal and transverse coordinates.

.4 Areas within 3 metres of transverse joints or 0.3 metres of a mat edge are excluded from compaction acceptance sampling and testing.

.7 Reporting Protocols:

.1 Test reporting accuracy shall be as stipulated in the referenced test procedures, including:

.1 Gradation to the nearest whole number, except the percent passing the 80 μm sieve, which shall be reported to the nearest 0.1%.

.2 Binder content to the nearest 0.01%.

.3 Air voids and compaction to the nearest 0.1%.

.4 Thickness to the nearest whole millimeter (mm).

.2 Lot averages shall be reported to the same accuracy as test results.

Part 4 Execution

4.1 CONTINUITY OF PRODUCTION

.1 During the time period that work is in progress on any project for which this specification is in effect, and at the Departmental Representative's discretion, the plant may be limited to producing only the mix type required for that project.

4.2 MIX PRODUCTION

.1 Preparation of Mineral Aggregate

.1 The Mineral aggregates shall be at as low a temperature as is consistent with proper mixing and lay down and in no case to exceed 165°C.

.2 Composition of Mixture

.1 The mineral aggregate, reclaimed asphalt pavement (where applicable) and asphalt cement shall be mixed in a manner to produce a homogeneous mixture in which all particles of the mineral aggregate are uniformly coated.

.2 Incorporate RAP such that it does not come in direct contact with the burner flame.

.3 Plant emissions shall not exceed the limits set by Alberta Environment.

4.3 PREPARATION FOR PAVING

.1 The Contractor shall provide the Departmental Representative a minimum of six hours notice of the intention to commence paving over any previously approved primed or tacked surface.

.2 The hot asphalt mixture shall be laid upon a dry firm surface, true to grade and cross-section and free from all loose or foreign material. No hot mix shall be placed when the surface is wet or when other conditions prevent proper spreading, finishing or compaction.

.3 If undercutting, and subsequent backfill with asphalt concrete is done, the backfill operation shall be performed sufficiently far ahead of the paving operation to allow the asphalt concrete time to cool down enough to support equipment.

4.4 HOT MIX ASPHALT PLACING TEMPERATURE

.1 No hot mix asphalt shall be dispatched to the field unless the temperature, as issued by Environment Canada, is rising and meets the following minimum temperature requirements.

.1 Thickness less than or equal to 50 mm: 7°C

.2 Thickness greater than 50 mm: 2°C

.2 A tolerance will be permitted for plant start-up.

.3 No surface lift asphalt shall be placed regardless of temperature until the road surface is 5°C or higher.

4.5 HOURS OF OPERATION

.1 No loads of hot mix asphalt shall be dispatched from the plant after sunset or during hours of darkness unless loads can be placed and compacted in accordance with these specifications, and suitable artificial illumination is provided, all subject to the Departmental Representative's approval.

4.6 TRANSPORATION OF HOT MIX ASPHALT

.1 Trucks shall be equipped with tarpaulins of sufficient weights and size to cover the entire open area of the truck box. Regardless of weather conditions, tarpaulins shall be used.

.2 Vehicles used for the transportation of hot mix asphalt from the plant to the site of work shall have tight metal boxes previously cleaned of all foreign matter. The inside surface may be lightly lubricated with a soap solution just before loading. Excess lubrication will not be permitted.

.3 For purposes of checking asphalt mixture temperatures, trucks shall have an accessible 13 mm diameter hole drilled into the driver's side of the truck box, at a distance of 0.3 metres from the bottom of the box and 150 mm clear of the reinforcing ribs.

.4 The speed and weight of hauling trucks shall be regulated so that, in the opinion of the Departmental Representative, no damage will occur to any portion of the work underway. The Contractor at their own expense shall repair any damage to the tack coat, prime coat or the existing surface caused by the Contractor's equipment.

4.7 HOT MIX ASPHALT SPREADERS

.1 The spreading machine shall be self-propelled and capable of placing a uniform layer of asphalt mix to the depth and grades as shown on the plans or as indicated by the Departmental Representative.

.2 The screed shall include a tamping bar or vibratory strike-off device for use when required. The screed shall strike-off the mix to the depth and cross-section specified and produces a finished surface of uniform texture.

.3 Control of the screed shall be by automatic sensing devices. Longitudinal control shall be accomplished by a sensor, which follows a string line, ski, or other reference. The grade sensor shall be movable and mounts provided so that grade control can be established on either side of the paver. A slope control sensor shall also be provided to maintain the proper transverse slope of the screed. Use automatic grade control or GPS control for paving operations.

4.8 HAND TOOLS

.1 Only lutes shall be used during the spreading operation and when the asphalt is worked by hand in areas in which the paver cannot reach.

.2 Tamping irons may be used to consolidate the material along structures inaccessible to the rollers. Mechanical compaction equipment, satisfactory to the Departmental Representative, may be used instead of tamping irons.

.3 For purposes of checking the finished surface, the Contractor must provide and carry on each paving machine a 3 metre straight edge and slope measuring level.

4.9 PRE-LEVELLING FOR ASPHALT CONCRETE

.1 Pre-levelling of uneven surfaces over which asphalt concrete is to be placed shall be accomplished by the use of asphalt concrete placed with a grader, paver, hand or by a combination of these methods as directed by the Departmental Representative.

.2 After placement, the asphalt concrete used for pre-levelling shall be compacted thoroughly with pneumatic tired rollers.

4.10 PAVING OPERATIONS

.1 The asphalt concrete shall be placed to the design thickness as shown on the contract drawings. On new construction where an established reference is lacking, a string-line reference will be required. Adjacent mats on the same lift are to be controlled by use of the grade sensor. No relaxation of the above procedure will be permitted without written approval of the Departmental Representative.

.2 The spreader shall be operated in such a manner as to distribute the asphalt concrete mix to proper cross section, width and thickness without causing segregation of the mix. Segregated areas, which may occur, shall be corrected immediately. The forward motion of the spreader shall be controlled so that no irregularities in the pavement surface are caused by excessive speed. The rate of placement of the mixture shall be uniform, and shall be co-ordinated with the production rate of the asphalt plant without intermittent operation of the spreader.

.3 Any failure of the machine or operation to produce a smooth, uniformly dense mat, free from irregularities, shall be corrected immediately to the satisfaction of the Departmental Representative.

4.11 AREAS INACCESSIBLE TO THE PAVING MACHINE

.1 Areas that are inaccessible to the paving machine may be paved by other methods, as approved by the Departmental Representative.

.2 In small areas or where the use of mechanical equipment is not practical, the mix may be spread and finished by hand. The asphalt mixture shall be dumped on the area and immediately thereafter distributed into place by shovels and spread with lutes in a loose uniform layer, uniform density and correct depth. Material must be handled so as to avoid segregation.

4.12 COMPACTION

.1 The Contractor shall supply sufficient compaction equipment to:

.1 Provide a compaction rate that will equal or exceed the placing rate of the spreader.

.2 Ensure the specified compaction is attained before the temperature of the mat falls below 80°C.

4.13 LONGITUDINAL AND TRANSVERSE JOINTS

.1 Longitudinal and transverse joints shall be made in a manner consistent with industry standards. Coarse aggregate removed from the hot mix during joint preparation shall not be broadcast onto the mat.

.2 Paving joints shall not be placed in the same vertical plane. Longitudinal joints shall be offset at least 150 mm and transverse joints shall be offset at least 2 metres.

.3 Longitudinal joints shall not be located within travel lanes, unless approved by the Departmental Representative.

.4 Edges where additional pavement is to be placed shall be vertically formed to true line. A lute shall be used immediately behind the paver when required to obtain a true line and vertical edge.

.5 The exposed edges of all cold asphalt joints and the face of concrete curb and gutter shall be cleaned and painted with a thin coat of asphalt tack.

.6 At the end of each day's paving of the surface course and upper lift of the base course mix, the uncompleted paving mats shall be provided with vertically cut transverse joints. Joints between old and new pavements or between successive days' work shall be carefully made in such a manner as to ensure a thorough and continuous bond between the old and new surfaces.

4.14 OPENING TO TRAFFIC

.1 Prior to any application of traffic, paving mats shall be sufficiently cool to resist and deformation or surface scuffing.

.2 The Departmental Representative may, at their discretion, require means of cooling (e.g. application of water) completed pavements prior to opening to traffic.

.3 At their discretion, the Departmental Representative may prohibit traffic from travelling on newly paved surfaces for any length of time deemed necessary.

Part 5 End Product Acceptance

5.1 GENERAL

.1 The Contractor shall provide an end product conforming to the quantity and tolerance requirements of this specification. Where no tolerances are specified, the standard of workmanship shall be in accordance with accepted industry standards.

.2 Acceptance of any Lot will occur if there are no obvious defects and the Lot mean results for asphalt content, pavement density, air voids and thickness meet or exceed the specified tolerances.

5.2 ASPHALT CONTENT

.1 The Asphalt Content must be within ± 0.30% of the approved JMF value, as specified in Section 2.4.

5.3 PAVEMENT COMPACTION

.1 Lot Mean Pavement Compaction must be equal to or greater than 93% of the Lot Mean Maximum Relative Density.

5.4 AIR VOID CONTENT

.1 The Air Voids must be within ± 1.0% of the JMF value, as specified in Section 2.4.

5.5 THICKNESS

.1 Pavement of any type found to be deficient in thickness by more than 13.0 mm shall be removed and replaced by pavement of specified thickness, at the Contractor's expense.

.2 The Lot Mean Thickness for any Lot will be determined on the basis of the acceptance cores described in Table 3.4.4. Core thickness shall be determined in accordance with ASTM D 3549.

.3 If the deficiency of any individual core exceeds 13 mm, additional cores may be extracted in the proximity to the location of the core of excessive deficiency, to identify the extremities of the pavement area subject to be removed and replaced. The Contractor shall pay for such additional coring.

.4 For payment, the Lot Mean Thickness must be equal to, or greater than, the specified thickness.

5.6 SMOOTHNESS

.1 The completed asphalt concrete surface shall be true to the dimensional and tolerance requirements of the specifications and drawings. Unless detailed otherwise in the contract documents, the tolerances in both profile and crown are:

.1 Base course: 10 mm in 3 m

.2 Surface Course: 5 mm in 3 m

.2 When deviations in excess of the above tolerances are found, the pavement surface shall be corrected by methods satisfactory to the Departmental Representative. Correction of defects shall be carried out until there are no deviations anywhere greater than the allowable tolerances.

5.7 SEGREGATION

.1 The finished surface shall have a uniform texture and be free of segregated areas. A segregated area is defined as an area of the pavement where the texture differs visually from the texture of the surrounding pavement.

.2 All segregation will be evaluated by the Departmental Representative to determine repair requirements.

.3 The severity of segregation will be rated as follows:

.1 Slight: The matrix of asphalt cement and fine aggregates is in place between the coarse aggregate particles, however there is more stone in comparison to the surrounding acceptable mix.

.2 Moderate: Significantly more stone that the surrounding mix, and exhibit a lack of surrounding matrix.

.3 Severe: Appears as an area of very stony mix, stone against stone, with very little or no matrix.

.4 Segregated areas shall be repaired by the Contractor as directed by the Departmental Representative. The following methods of repair are identified.

.1 Slight: Squeegee asphalt to completely fill the surface voids.

.2 Moderate: Slurry seal for full mat width.

.3 Severe: Removal and replacement or overlay.

.5 All repairs shall be regular in shape and finished using good workmanship practices to provide and appearance suitable to the Departmental Representative.

.6 Any other methods of repair proposed by the Contractor will be subject to the approval of the Departmental Representative.

.7 Repairs will be carried out by the Contractor at their expense.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 31 05 16 Aggregate for Earthwork

.2 Section 32 11 23 Aggregate Base Courses

.3 Section 32 11 16.01 Granular Sub-base

.4 Section 32 22 13 Rough Grading

1.2 REFERENCES

.1 ASTM International

.1 ASTM C309-[11], Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.2 ASTM C666/C666M-[03 (2008)], Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.

.3 ASTM D2628-[91 (2011)], Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.

.4 ASTM D3569-[95 (2000)], Standard Specification for Joint Sealant, Hot-Applied, Elastomeric, Jet-Fuel-Resistant Type for Portland Cement Concrete Pavements.

.5 ASTM D5329-[09], Standard Test Methods for Sealants and Fillers, Hot-Applied, For Joints and Cracks in Asphaltic and Portland Cement Concrete Pavements.

.6 ASTM D6690 -[12], Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

.2 CSA Group

.1 CSA A23.1/A23.2-[09], Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CSA-A3000-[13], Cementitious Materials Compendium.

.3 CSA G30.18-[09], Carbon Steel Bars for Concrete Reinforcement.

.4 CSA G40.20/G40.21-[13], General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Mix design requirements:

.1 Submit concrete mix design to Departmental Representative for review and approval 4 weeks prior to commencing work.

.3 Mock-Ups:

.1 For each colour and finish, construct mock-up using processes and techniques intended for use on permanent work, including curing

procedures. Include samples of control, construction and expansion joints in sample panels. Individual workers who will perform the work for the Project will produce mock-up.

.2 Obtain Departmental Representative's approval of mock-up before proceeding with installation of project concrete.

.3 Accepted mock-up provides visual standard for work.

.4 Mock-up shall remain in place through completion of the work for use as a quality standard for finished work.

.5 Remove mock-up when directed.

.6 Inform Departmental Representative of proposed source of materials and provide access for sampling at least five days prior to commencing work.

.4

1.4 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: Company or person specializing Portland cement concrete paving with documented 5 experience.

.2 Certifications:

.1 Submit to Departmental Representative manufacturer's test data and certification that following material meets criteria and requirements of this section prior to starting concrete work:

.1 Portland Cement.

.2 Blended Hydraulic Cement.

.3 Supplementary Cementing Material.

.4 Admixtures.

.5 Joint Sealants.

.6 Curing Materials.

.7 Joint Filler.

.2 Submit certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA A23.1/A23.2, and that mix design is adjusted to prevent alkali aggregate reactivity problems.

.3 Obtain cementitious material from same source throughout.

Part 2 Products

2.1 FORM MATERIALS

.1 Form Materials: Wood forms, profiled to suit requirements and site conditions.

.2 Joint Filler: to ASTM D1751.

2.2 REINFORCEMENT

.1 Synthetic Fibre reinforcement: Per City of Calgary Standard Specifications Roads Construction, Current Edition.

.2 Dowels: Per City of Calgary Standard Specifications Roads Construction, Current Edition.

2.3 CONCRETE MATERIALS

.1 Concrete Materials: In accordance with City of Calgary Standard Specifications Roads Construction, Current Edition.

.2 Cement: CAN/CSA-A3000

.1 Colour as indicated:

.1 Standard Grey: no colour additives, standard grey

.3 Air Entrainment: ASTM C260/C260M.

.4 Fine and Mix Aggregates: o CSA A23.1/A23.2 and to following requirements:

.1 Coarse aggregate:

.1 Produce coarse aggregate in at least two separate sizes which, when combined, yields gradation specified. Each component size to form approximately equal percentage of total coarse aggregate.

.2 Gradation: to CSA A23.1/A23.2, table 5, nominal size 28-5.

.3 Flat and elongated particles: to CSA A23.1/A23.2 (13A) (length to width and width to thickness ratio greater than 3) not to exceed 0.5 % by mass.

.2 Fine aggregate:

.1 Gradation: to CSA A23.1/A23.2, Table 1. Material passing 0.160 mm sieve: maximum 5 %.

.2 Aggregates for use in concrete pavement shall not be susceptible to D-cracking. Unless field experience, aggregate history or prior laboratory testing have proven otherwise.

.3 Aggregates for use in concrete pavement shall be tested in accordance with ASTM C666/C666M. Test shall be in accordance with Procedure A for a period of 350 cycles.

.5 Water: Potable, not detrimental to concrete.

.6 Supplementary cementing materials: to CSA A3000.

.7 Air entraining admixture: to ASTM C260/C260M.

.8 Chemical admixtures: to ASTM C494/C494M. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.

.9 Curing compound: to ASTM C309, Type 1-D or 2.

.10 Protective covers and insulation for cold weather concreting: to CSA A23.1/A23.2.

2.4 MIXES

.1 Mix and deliver concrete to ASTM C94/C94M.

.2 Select proportions for normal weight concrete in accordance with the following:

.1 The concrete supplier to provide field test criteria to achieve specified performance criteria.

.3 Provide concrete to the following criteria:

.1 Flexural Strength: 4.2 MPa at 28 days.

.2 Compressive Strength: 32 MPa at 28 days.

.3 Air Entrained.

.4 Use accelerating admixtures in cold weather only when approved by the Departmental Representative. Use of admixtures will not relax cold weather placement requirements.

.5 Use calcium chloride only when approved by Departmental Representative.

.6 Use set retarding admixtures during hot weather only when approved by the Departmental Representative.

Part 3 Execution

3.1 EXAMINATION

.1 Verify compacted subgrade is acceptable and ready to support paving and imposed loads.

.2 Verify gradients and elevations of base are correct.

.3 Inform the Departmental Representative of unacceptable conditions immediately upon discovery.

3.2 GRADE PREPARATION

.1 Do grade preparation work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Construct embankments using excavated material free from organic matter or other objectionable materials.

.1 Dispose of surplus and unsuitable excavated material outside of Park.

.3 Place fill in maximum 150 mm layers and compact to at least 95% of maximum dry density to ASTM D 698.

3.3 GRANULAR BASE AND SUBABSE

.1 In accordance with section 32 11 23 - Aggregate Base Course.

.2 Prepare subbase in accordance with City of Calgary Standard Specifications Roads Construction, Current Edition.

.3 Obtain Departmental Representative’s approval of subgrade before placing granular base.

.4 Place granular base material to lines, widths, and depths as indicated.

.5 Compact granular base in maximum 150 mm layers to at least 95% of maximum density to ASTM D 698.

3.4 FORMING

.1 Place and secure forms to correct location, dimension, profile, and gradient.

.2 Assemble formwork to permit easy stripping and dismantling without damaging concrete.

.3 Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.5 REINFORCEMENT

.1 Place reinforcement at mid-height of slabs.

.2 Interrupt reinforcement at contraction and expansion joints.

.3 Place dowels to achieve pavement and curb alignment as detailed.

.4 Provide dowelled joints per City of Calgary Standard Specifications Roads Construction, Current Edition.

3.6 PLACING CONCRETE

.1 Obtain Departmental Representative's approval of granular base prior to placing concrete.

.2 Place concrete as specified.

.3 Place concrete in accordance with City of Calgary Standard Specifications Roads Construction, Current Edition.

.4 Ensure reinforcement, inserts, embedded parts, formed joints and accessories are not disturbed during concrete placement.

.5 Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

3.7 TOLERANCES

.1 Finish surfaces to within 3 mm in 3 m as measured with 3 m straight edge placed on surface.

3.8 EXPANSION AND CONTRACTION JOINTS

.1 Install tooled transverse contraction joints after floating, when concrete is stiff, but still plastic as indicated on the drawings

.2 Install expansion joints as directed by the Departmental Representative.

.3 When sidewalk is adjacent to curb, make joints of curb, gutters and sidewalk coincide.

3.9 ISOLATION JOINTS

.1 Install isolation joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, buildings, or permanent structure.

.2 Install joint filler in isolation joints in accordance with Section 03 30 00.09 – Cast in Place Concrete.

.3 Seal isolation joints with sealant in accordance with Section 03 30 00.09 – Cast in Place Concrete.

3.10 FINISHING

.1 Paving, Curbs and Gutters: Light broom.

.1 Broom texture the surface of the slab at right angles to the normal direction of traffic. Use a stiff fiber bristled broom for Coarse Broom Finish and a fine hair broom for Fine Broom Finish. Match selected control sample.

.2 Curb Let Downs: Per City of Calgary Standard Specifications Roads Construction, Current Edition.

3.11 CURING

.1 Cure concrete by adding moisture continuously in accordance with CSA-A23.1/A23.2 to exposed finished surfaces for at least 1 day after placing, or sealing moisture in by curing compound as directed by the Departmental Representative.

.2 Where burlap is used for moist curing, place two pre-wetted layers on concrete surface and keep continuously wet during curing period.

.3 Apply curing compound evenly to form continuous film, in accordance with manufacturer's requirements.

3.12 BACKFILL

.1 Allow concrete to cure for 7 days prior to backfilling.

.2 Backfill to designated elevations with material as directed by Departmental Representative.

.1 Compact and shape to required contours as directed by Departmental Representative.

3.13 DEFECTIVE CONCRETE

.1 Concrete is defective when:

.1 It contains: honeycombing, embedded debris, uncontrolled shrinkage cracking, or other surface defects as identified by the Departmental Representative.

.2 It is damaged by freezing.

.3 It is placed at too high temperature.

.4 Average 28 day strength of any three consecutive strength tests is less than specified minimum 28 day strength.

.5 Any 28 day strength test result is more than 3.5 MPa below the specified minimum 28 day strength.

.6 Standard deviation of 28 day strength test results exceeds CSA A23.1/A23.2 clause 17.6.7.1 requirements.

3.14 REPAIR/RESTORATION

.1 Repair of defective concrete work:

.1 Where defective concrete is identified by Departmental Representative during plastic condition, repair using methods approved by Departmental Representative.

.2 Grind off high surface variations where directed by Departmental Representative.

.2 Remove and replace defective concrete where directed by Departmental Representative.

.1 Remove minimum 3 m of pavement by sawing through concrete across full lane width.

.2 Replace with new concrete to this specification.

.3 Construct contraction joint at boundary between sawn face of existing concrete and new concrete.

3.15 CLEANING

.1 Proceed in accordance with Section 01 74 00 – Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.16 FIELD QUALITY CONTROL

.1 Testing firm will take cylinders and perform slump tests in accordance with ACI 301.

.2 One (1) additional test cylinder will be taken during cold weather and cured on site under same conditions as concrete it represents.

.3 One slump test will be taken for each set of test cylinders taken.

.4 Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.17 SCHEDULES

.1 Concrete Paving Type A: Pedestrian

.1 32 MpA 28 day concrete, 100mm thick, fibre reinforcement, Standard Grey, Light Broom Finish

.2 Concrete Paving Type B: Vehicular

.1 32 MpA 28 day concrete, 175mm thick, fibre reinforcement, Standard Grey, Light Broom Finish

.3 Concrete Curb Type A: Standard Curb

.1 32 MpA 28 day concrete, fibre reinforcement, Standard Grey, Light Broom Finish

.4 Concrete Curb Type B: Mountable Curb

.1 32 MpA 28 day concrete, fibre reinforcement, Standard Grey, Light Broom Finish

.5 Concrete Curb Type C: Low Profile Rolled Curb with Gutter

.1 32 MpA 28 day concrete, fibre reinforcement, Standard Grey, Light Broom Finish

.6 Concrete Curb Type D: Standard Curb and Gutter

.1 32 MpA 28 day concrete, fibre reinforcement, Standard Grey, Light Broom Finish

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures and Section 01 35 00.06 - Special Procedures for Traffic Control.

1.2 MEASUREMENT AND PAYMENT

.1 In accordance with Section 01 27 00 – Measurement and Payment .

1.3 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM E 1360 90 (2000) e1, Standard Practice for Specifying Color by Using the Optical Society of America Uniform Color Scales System.

.2 ASTM D 4797 88(2004) Standard Test Methods for Chemical and Gravimetric Analysis of White and Yellow Thermoplastic Traffic Marking Containing Lead Chromate and Titanium Dioxide.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.4 Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - [current edition].

.1 MPI #32, Traffic Markings Paint, Alkyd.

.2 MPI #97, Latex Traffic Marking Paint.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed product literature and data sheets for pavement markings and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements and 01 35 43 - Environmental Procedures.

.3 Samples:

.1 Submit to Departmental Representative following material sample quantities at least 4 weeks prior to commencing work.

.1 Two 1 L samples of each type of paint.

.2 Sampling to MPI Painting Manual.

.2 Mark samples with name of project and its location, paint manufacturer's name and address, name of paint, MPI specification number and formulation number and batch number.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operations and Maintenance Data: submit information on materials relative to work of this Section for inclusion in operations and maintenance manual and as follows:

.1 The Contractor shall be totally responsible for quality control inspection throughout every stage of the Work to ensure that materials and workmanship comply with the requirements of this specification.

.2 The Contractor shall develop and submit in writing to the Consultant a Quality Control Inspection Program (QCIP) that addresses all the elements that affect the quality of the line painting including but not limited to:

- Paint Application Rates,
- Pavement Surface and Atmospheric Conditions,
- Line Widths, Line Lengths and Space Lengths.

.3 The Contractor shall maintain records of QCIP data, complaints from the public, and other details relevant to the Work and shall provide these records to the Departmental Representative daily.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect paint from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse and return as specified in Construction Waste Management Plan in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Alkyd Traffic Paint and Markings:

.1 To MPI #32, Alkyd traffic marking meeting requirements of ASTM D 4797.

.2 Colour: to ASTM E 1360, yellow & white in accordance with MPI Architectural Painting Specification Manual.

.3 Upon request, Departmental Representative will supply qualified product list of paints applicable to work. Qualified paints may be used but Departmental Representative reserves right to perform further tests.

.2 Latex traffic Paint and Markings:

.1 To MPI #97, Latex traffic marking meeting requirements of ASTM D 4797.

.2 Colour: to ASTM E 1360 yellow & white in accordance with MPI Architectural Painting Specification Manual.

.3 Upon request, Departmental Representative will supply qualified product list of paints applicable to work. Qualified paints may be used but Departmental Representative reserves right to perform further tests.

.3 Thinner: to MPI listed manufacturer.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates and surfaces to receive pavement markings acceptable for product installation in accordance with MPI instructions prior to pavement markings application.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Pavement surface: dry, free from water, frost, ice, dust, oil, grease and other deleterious materials.

.3 Proceed with Work only after unacceptable conditions rectified.

3.2 EQUIPMENT REQUIREMENTS

.1 Paint applicator: approved pressure type with positive shut-off distributor capable of applying paint in single, double and dashed lines and capable of applying marking components uniformly, at rates specified, and to dimensions as indicated.

3.3 TRAFFIC CONTROL

.1 In accordance with Section 01 35 00.06 - Special Procedures for Traffic Control.

3.4 APPLICATION

.1 Pavement markings: laid out by Departmental Representative.

.2 Unless otherwise approved by Departmental Representative, apply paint when air temperature minimum 10 degrees C, wind speed maximum 60 km/h and no rain forecast within next 4 hours.

.3 Apply traffic paint evenly at rate of 3 m² /L to form minimum 8 mil dry film thickness, in accordance with MPI Architectural Painting Specification Manual "Preparation of Surfaces" and "Application" for "Approved Product" listing.

.4 Do not thin paint unless approved by Departmental Representative.

.5 Symbols and letters to dimensions indicated.

.6 Paint lines of uniform colour and density with sharp edges.

.7 Thoroughly clean distributor tank before refilling with paint of different colour.

3.5 TOLERANCE

.1 Paint markings: within plus or minus 12 mm of dimensions indicated.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.1 Remove insulation material spilled during installation and leave work area ready for application of wall board.

.3 Waste Management: separate waste materials for reuse and recycling.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 PROTECTION

.1 Protect pavement markings until dry.

.2 Repair damage to adjacent materials caused by pavement marking application.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 32 93 10 Trees, Shrubs and Ground Cover Planting

.2 Section 32 92 19.13 Mechanical Seeding

.3 Section 32 22 13 Rough Grading

.4 Section 31 14 13 Soil Stripping and Stockpiling

1.2 REFERENCES

.1 Agriculture and Agri-Food Canada

.1 The Canadian System of Soil Classification, Third Edition, 1998.

.2 Canadian Council of Ministers of the Environment

.1 PN1340-2005, Guidelines for Compost Quality.

.3 U.S. Environmental Protection Agency (EPA)/Office of Water

.1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Quality control submittals:

.1 Soil testing: submit certified test reports showing compliance with specified performance characteristics and physical properties as described in PART 2 - SOURCE QUALITY CONTROL.

.2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

Part 2 Products

2.1 TOPSOIL

.1 Use native topsoil stripped and stockpiled, provided it meets specified requirements.

.2 If native topsoil is inadequate in quantity, qualities, or both, use imported topsoil meeting specified requirements for balance of topsoil required.

.1 Soil texture based on The Canadian System of Soil Classification, to consist of 20 to 70% sand, minimum 7% clay, and contain 2to 10% organic matter by weight.

.2 Mixture of particulates, micro organisms and organic matter which provides suitable medium for supporting intended plant growth.

.3 Contain no toxic elements or growth inhibiting materials. Free of roots, rocks, subsoil, debris, large weeds and foreign matter.

.4 Finished surface free from:

.1 Debris and stones over 50 mm diameter.

.2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.

.5 Consistence: friable when moist.

.6 pH value of minimum 5.4 and maximum 7.0.

2.2 SOIL AMENDMENTS

.1 Supply and apply all soil conditioning amendments at rate determined from topsoil analysis for all imported topsoil at the expense of the Contractor.

2.3 SOURCE QUALITY CONTROL

.1 Advise Departmental Representative of sources of topsoil to be utilized with sufficient lead time for testing.

.2 Contractor is responsible for amendments to supply topsoil as specified.

.3 Soil testing by recognized testing facility for PH, P and K, and organic matter.

.4 Testing of topsoil will be carried out by testing laboratory designated by Departmental Representative.

.1 Soil sampling, testing and analysis to be in accordance with Provincial standards.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 PREPARATION OF EXISTING GRADE

.1 Verify that grades are correct.

.1 If discrepancies occur, notify Departmental Representative and do not commence work until instructed by the Departmental Representative.

.2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.

.3 Remove debris, roots, branches, stones in excess of 50mm diameter and other deleterious materials.

.1 Remove soil contaminated with calcium chloride, toxic materials and petroleum products.

.2 Remove debris which protrudes more than 75mm above surface.

.3 Dispose of removed material off site.

.4 Cultivate entire area which is to receive topsoil to minimum depth of 100mm.

.1 Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

3.3 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL

.1 Place topsoil after Departmental Representative has accepted subgrade.

.2 Spread topsoil in uniform layers not exceeding 150 mm.

.3 Spread topsoil to following minimum depths after settlement.

.1 150 mm for seeded areas.

.2 600 mm for shrub beds.

.4 Manually spread topsoil/planting soil around trees, shrubs and obstacles.

3.4 FINISH GRADING

.1 Grade to eliminate rough spots and low areas and ensure positive drainage.

.1 Prepare loose friable bed by means of cultivation and subsequent raking.

.2 Consolidate topsoil to required bulk density using equipment approved by Departmental Representative.

.1 Leave surfaces smooth, uniform and firm against deep foot printing.

3.5 ACCEPTANCE

.1 Departmental Representative will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading.

3.6 SURPLUS MATERIAL

.1 Dispose of materials not required off site.

3.7 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 32 91 19.13 – Topsoil Placement and Grading

.2 Section 31 22 13 - Rough Grading

.3 Section 32 93 10 – Trees, Shrubs and Groundcover Planting

1.2 SUBMITTALS FOR INFORMATION

.1 Product Data:

.1 Seed.

.2 Submit copy of purchase order and invoice/receipt from seed supplier indicating all seeds, quantity and lots acquired and all original seed package labels, **including Latin/botanical name of each species**. Submit at completion of seeding, when requested by The City project manager, to confirm total quantity of seed purchased and used on project. Contractor shall ensure all original seed labels are preserved and maintained during seeding operations

.3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.4 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

1.3 QUALITY ASSURANCE

.1 Qualifications:

.1 Landscape Contractor: to be a Member in Good Standing of Landscape Alberta Nursery Trades Association.

.2 Landscape Planting Supervisor: Landscape Industry Certified Technician with Softscape Installation designation.

1.4 DELIVERY, STORAGE, AND PROTECTION

.1 Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

Part 2 Products

2.1 SEED MIXTURE

.1 Suppliers:

.1 Supplier as approved by the Departmental Representative.

.2 Qualifications

.1 Supplier shall provide see certificates for review by the Departmental Representative

.3 Substitutions:

.1 Not permitted.

.4 Seed Mixture:

.1 Sow seeds uniformly at rate of 45kg / hectare.

% By Weight	Common Name	Species Name
25	Slender Wheatgrass	Elymus trachycaulus
20	Spike Trisetum	Trisetum spicatum
15	Mountain brome	Bromus carinatus
15	June grass	Koeleria macrantha
15	Hairy Wild Rye	Leymus innovatus
10	Tufted Hair Grass	Deschampsia cespitosa).

2.2 SOIL MATERIALS

.1 Topsoil: As specified in 32 91 19.13 – Topsoil Placement and Grading

Part 3 Execution

3.1 EXAMINATION

.1 Verify that prepared soil base is ready to receive the work of this section.

.2 Do not perform work under adverse field conditions such as wind speeds over 10 km/h, frozen ground or ground covered with snow, ice or standing water.

.3 Ensure areas to be seeded are moist to depth of 150 mm before seeding.

3.2 PREPARATION OF SUBSOIL

.1 Per Section – 312213 Rough Grading

.2 Prepare subsoil to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

.3 Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated subsoil.

.4 Scarify subsoil to a depth of 75 mm where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted sub-soil.

3.3 PLACING TOPSOIL

.1 Per section – 329119.13 Topsoil Placement and Finish Grading

.2 Spread topsoil to a minimum depth of 150 mm over area to be seeded. Rake until smooth.

.3 Place topsoil during dry weather and on dry unfrozen subgrade.

.4 Remove vegetable matter and foreign non-organic material from topsoil while spreading.

.5 Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.

.6 Install edging at periphery of seeded areas in straight lines to consistent depth.

.7 Coordinate with installation of underground sprinkler system piping and watering heads.

3.4 BROADCAST SEEDING

.1 No seeding shall be done on frozen soil or when conditions are not favourable for successful seed germination.

.1 Seeding shall be laid down before November 1 2016 or else wait until Spring 2017 to lay seed.

.2 No seeding shall be laid down between November 1 2016 and Spring 2017.

.2 Optimal seeding periods for native grasses are:

Mid to late May, early June – no later than June 30.

Late September – after first hard frost, when plants go dormant.

.3 Apply seed at a rate as indicated in 2.2 of this section during calm weather and when soil moisture content is adequate for germination. Do not sow immediately following rain, when ground is too dry, or during windy periods.

.4 Sow seed in two directions, 50% of seed in one direction and remaining 50% of seed at right angles to first seeding pattern.

.5 Cover broadcasted seed by raking and chain harrowing followed by rolling with roller not exceeding 50 kg.

.6 All equipment will be stopped during rainfall events of more than 1mm. Work may resume once the surface of the soil has dried off. This is to prevent seed and dirt from sticking to the equipment during the seeding process.

3.5 RESEEDING DURING ESTABLISHMENT PERIOD

.1 After germination of seed, repair and reseed dead or bare spots to allow establishment.

.2 In spring of the following growing season after application, repair and reseed dead or bare spots to allow establishment.

.3 Continue to repair and reseed dead or bare spots until Final Acceptance.

3.6 SEED PROTECTION

.1 Identify seeded areas with stakes and string around area periphery.

.2 Cover seeded slopes where grade is 1:3 or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.

.3 Lay fabric smoothly on surface, bury top end of each section in 150 mmdeep excavated topsoil trench. Provide 300 mm overlap of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil.

.4 Secure outside edges and overlaps at 900 mm intervals with stakes.

.5 Lightly dress slopes with topsoil to ensure close contact between fabric and soil.

.6 At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 150 mm.

3.7 MAINTENANCE

.1 Manually water as required to ensure healthy and vigorous growth.

.2 Mow grass at regular intervals to maintain at a maximum height of 65 mm. Do not cut more than 1/3 of grass blade at any one mowing.

.3 Neatly trim edges and hand clip where necessary.

.4 Immediately remove clippings after mowing and trimming.

.5 Water to prevent grass and soil from drying out.

.6 Roll surface to remove minor depressions or irregularities.

.7 Mow or weed eat re-seeded areas as required to eliminate weeds and invasive species.

.8 Immediately reseed areas which show bare spots.

.9 Protect seeded areas with warning signs during maintenance period.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 31 11 00 Clearing and Grubbing

.2 Section 31 14 13 Soil Stripping and Stockpiling

.3 Section 32 91 19.13 Topsoil Placement and Grading

.4 Section 32 92 20 Seeding

1.2 DESCRIPTION

.1 This section specifies requirements for planting shrubs within the roundabouts.

1.3 MEASUREMENT FOR PAYMENT

.1 All units of measurement for payment will be as specified in Section 01 27 00 – Measurement and Payment and as shown in the Unit Price Table.

1.4 REFERENCE STANDARDS

.1 Agriculture and Agri-Food Canada:

.1 Plant Hardiness Zones in Canada, 2000.

.2 Alberta Conservation Information Management System List of Elements in Alberta - Vascular Plants.

.1 Found online at www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-acims/download-data

.3 Canadian Nursery Landscape Association (CNLA):

.1 Canadian Standards for Nursery Stock, 2006.

.4 Vegetation Removal and Restoration/Reclamation Guidelines. Banff National Park. Parks Canada.

.5 Woody/Vegetative Debris Management Guidelines. 2017. Parks Canada.

1.5 DEFINITIONS

.1 Topsoil: The top layer of soil containing organic material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

.2 Mycorrhiza: association between fungus and roots of plants. This symbiosis, enhances plant establishment in newly landscaped and imported soils.

1.6 ADMINISTRATIVE REQUIREMENTS

.1 Scheduling: obtain approval from Departmental Representative of schedule 7 days in advance of shipment of plant material.

.2 Schedule to include:

.1 Quantity and type of plant material.

.2 Shipping dates.

.3 Arrival dates on site.

.4 Planting Dates.

1.7 SUBMITTALS

.1 Submit accordance with as Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for trees, shrubs, ground cover, fertilizer, and mulch and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:

.1 Submit samples of rock mulch to Departmental Representative for approval.

.2 Provide images and samples of all proposed boulders for approval. Where possible, boulders should be reviewed on site or at the source quarry / yard.

1.8 QUALITY ASSURANCE

.1 Qualifications:

.1 Nursery Qualifications: Company specializing in growing and cultivating the plants with minimum three (3) years experience.

.2 Landscape Contractor: to be a Member in Good Standing of Landscape Alberta Nursery Trades Association (LANTA).

.3 Landscape Planting Supervisors: “Landscape Industry Certified” Technician with Softscape Installation Specialization as regulated by Canadian Nursery Landscape Association (CNLA).

1.9 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Product Requirements.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.1 Protect plant material from frost, excessive heat, wind and sun during delivery.

.2 Protect plant material from damage during transportation:

.1 Delivery distance is less than 30 km and vehicle travels at speeds under 80 km/h, tie tarpaulins around plants or over vehicle box.

.2 Delivery distance exceeds 30 km or vehicle travels at speeds over 80 km/h, use enclosed vehicle where practical.

.3 Protect foliage and root balls using anti desiccants and tarpaulins, where use of enclosed vehicle is impractical due to size and weight of plant material.

.4 Pad all points of contact between plant material and equipment.

.3 Unload and inspect all plants immediately upon arrival to site and water as required. Trees with cracked or broken root balls or leaders will not be accepted.

.4 Storage and Handling Requirements:

.1 Immediately store and protect plant material which will not be installed within 24 hours in accordance with supplier's written recommendations and after arrival at site in storage location approved by Engineer.

.2 Protect stored plant material from frost, wind and sun and as follows:

.1 For pots and containers, maintain moisture level in containers.

.3 Store and manage manufactured materials in a weatherproof location in accordance with manufacturer's written instructions.

.4 Packaging Waste Management:

.1 Collect and separate for disposal and recycling all palettes, crates, padding and packaging materials.

.2 Dispose / recycle materials at appropriate facilities.

1.10 WARRANTY

.1 Contractor hereby warrants that plant materials as itemized on the plant list will remain free of defects, but for two (2) full growing seasons following the year of installation.

.2 End of warranty inspection will be conducted by Parks Canada Vegetation Specialist.

.3 Engineer reserves the right to extend the Contractor’s warranty responsibilities for an additional one year if, at the end of the initial warranty period, leaf development and growth is not sufficient to ensure future survival.

.4 Non-native vegetation will be removed by the Contractor during the warranty period. Weeds will be hand-pulled twice in July and twice in August. Weeds shall include any species listed as exotic on the Alberta Conservation Information Management System (ACIMS). When removing weeds, care will be taken to ensure all parts of the plant including roots are removed. Responsible personnel will have knowledge and expertise to identify plant species.

1.11 SUBSTITUTION

.1 All substitutions shall be made through a change order to the Contract.

1.12 RESTORATION AREAS

.1 Areas to be restored as shown on drawings.

.2 Refer to 32 92 20 Seeding for requirements for seeding.

.3 In the majority of areas where utility line removal and replacement will occur, a minimum trench width of 3.0 m will be required and require restoration planting.

.4 If the contractor is required to disturb areas beyond the areas shown on the drawing, the contractor is responsible for restoring this additional area at no additional cost to the Owner.

Part 2 Products

2.1 SHRUB PLANTING

.1 Plant shrubs as shown on Drawing.

2.2 PLANT MATERIAL

.1 Type of root preparation, sizing, grading and quality: comply to Canadian Standards for Nursery Stock.

.1 Only native species of wild provenance shall be installed. No cultivars are permitted.

.2 Trees and shrubs shall have genetic origin from locations within 400 km of the project site and from Plant Hardiness Zone 2, 3, or 4. To the extent possible, the origin of plant material shall be of similar or lower elevation and latitude.

.2 Plant material: plants shall be generally true to type and structurally sound, well branched, healthy and vigorous and free of disease, insect infestations, insect eggs, rodent damage, sunscald, frost cracks and mechanical wounds. They shall be densely foliated when in leaf and have a healthy, well-developed root system. Pruning cuts shall show vigorous bark on all edges and all parts shall be moist and show live, green cambium tissue when cut.

.3 Shrubs shall have natural form typical of the species with a minimum of four canes.

2.3 TOPSOIL

.1 Per section 32 91 19.13 Topsoil Placement and Grading.

.2 Topsoil shall be replaced where stripping occurred immediately following final grading of subsoil.

.3 Soils shall be left rough and loose to provide an irregular and undulating surface.

.4 Following topsoil replacement, vehicle and equipment traffic shall be prohibited to prevent soil compaction.

2.4 WATER

.1 Free of impurities that would inhibit plant growth.

.2 Contractor to supply all related hoses, trucks, sprinklers as required at no cost to Client.

2.5 MULCH

.1 40mm Rundle Rock Mulch

2.6 BOULDERS

.1 Rundle Rock Boulders

.1 Boulder dimensions to range between:

.1 800mm – 1500mm width

.2 500mm – 1500mm height above finished grade

2.7 FERTILIZER

.1 Fertilizer shall not be used.

2.8 AMENDMENT

.1 Synthetic commercial type as recommended by soil test report.

.1 Ensure new root growth is in contact with mycorrhiza.

.2 Use mycorrhiza as recommended by manufacturer's written recommendations.

2.9 ANTI-DESICCANT

.1 Wax-like emulsion.

2.10 FLAGGING TAPE

.1 Fluorescent, orange colour.

2.11 SOURCE QUALITY CONTROL

.1 Obtain approval from Departmental Representative of plant material prior to planting. Previous approval of plant material shall not impair the right of Departmental Representative during construction to reject plants which have been damaged or which, in any way, do not conform to the Specifications.

.2 Imported plant material must be accompanied with necessary permits and import licenses. Conform to Federal, Provincial or Territorial regulations.

Part 3 Execution

3.1 PLANTING SEASON

.1 Plant trees, shrubs and ground covers only during periods that is normal for such work. It is recommended that all coniferous material should be planted by mid August to allow for root establishment and energy storage prior to winter.

3.2 EXAMINATION

.1 Verification of Conditions: verify conditions of substrate previously installed under other Sections are acceptable for planting installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Engineer.

.2 Inform Engineer of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

.4 Commencement of planting operations implies acceptance of subgrade.

3.3 PRE-PLANTING PREPARATION

.1 Proceed only after receipt of written acceptability of plant material from Departmental Representative.

.2 Remove damaged roots and branches from plant material.

.3 Apply anti-desiccant to conifers and deciduous trees in leaf in accordance with manufacturer's instructions.

.4 Locate and protect utility lines.

.5 Notify and acquire written acknowledgment from utility authorities before beginning excavation of planting pits for trees and shrubs.

.6 Planting areas shall be free of weeds prior to excavation and preparation for planting.

3.4 EXCAVATION AND PREPARATION OF PLANTING BEDS

.1 Establishment of sub-grade for planting beds in accordance with Section 31 22 13 - Rough Grading.

.2 Preparation of planting beds in accordance with Section 32 91 19.13 - Topsoil Placement and Grading.

.3 Stake out location and obtain approval from Departmental Representative prior to excavating.

3.5 BOULDER PLACEMENT

.1 Prepare subgrade in accordance with contract documents.

.2 Clean boulder prior to placement. Do not use wire brushes or implements which can mark or damage exposed surfaces.

.3 Contractor shall review stone placement and orientation of all boulders with Departmental Representative.

.4 All boulders should be installed at a minimum of 1.3 of the boulder itself below finish grade.

.5 The final location of the boulders shall be at the discretion of the Departmental Representative.

3.6 PLANTING

.1 For bare root stock, place 50 mm backfill soil in bottom of hole.

.1 Plant trees and shrubs with roots placed straight out in hole.

.2 For jute burlapped root balls, cut away top one third of wrapping and wire basket without damaging root ball.

.1 Do not pull burlap or rope from under root ball.

.3 For container stock or root balls in non-degradable wrapping, remove entire container or wrapping without damaging root ball.

.4 Plant vertically in locations as indicated.

.5 Orient plant material to give best appearance in relation to structure, roads and walks.

.6 For trees and shrubs:

.1 Backfill soil in 150 mm lifts.

.1 Tamp each lift to eliminate air pockets.

.2 When two thirds of depth of planting pit has been backfilled, fill remaining space with water.

.3 After water has penetrated into soil, backfill to finish grade.

.2 Form watering saucer as indicated.

.7 For ground covers, backfill soil evenly to finish grade and tamp to eliminate air pockets.

.8 Water plant material thoroughly.

.9 After soil settlement has occurred, fill with soil to finish grade.

.10 Install and maintain fence around tree and shrub planting areas during the 1 year establishment period to prevent damage by herbivory.

3.7 MULCHING

.1 Ensure soil settlement has been corrected prior to mulching.

.2 Spread mulch as indicated.

3.8 MAINTENANCE DURING ESTABLISHMENT PERIOD

.1 Conduct maintenance of trees, shrubs and groundcovers as required. Maintenance activities include watering, hand pulling weeds, and replacement of any staking or fencing installed to protect plants.

.2 Contractor shall control weeds during the warranty period as described in Section 1.11.

.3 Perform following maintenance operations from time of planting to acceptance by Departmental Representative.

.1 Water to maintain soil moisture conditions for optimum establishment, growth and health of plant material without causing erosion.

.2 For evergreen plant material, water thoroughly in late fall prior to freeze-up to saturate soil around root system.

.3 Remove weeds during summer/fall periods.

.4 Replace or respread damaged, missing or disturbed mulch.

.5 For non-mulched areas, cultivate as required to keep top layer of soil friable.

.6 If required to control insects, fungus and disease, use appropriate control methods in accordance with Federal, Provincial and Municipal regulations. Obtain product approval from Departmental Representative prior to application.

.7 Remove dead or broken branches from plant material.

.8 Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.

3.9 MAINTENANCE DURING WARRANTY PERIOD

.1 From time of acceptance by Departmental Representative to end of warranty period, perform following maintenance operations.

.1 Water to maintain soil moisture conditions for optimum growth and health of plant material without causing erosion.

.2 Reform damaged watering saucers.

.3 Remove weeds monthly.

.4 Replace or respread damaged, missing or disturbed mulch.

.5 For non-mulched, unseeded areas, cultivate monthly to keep top layer of soil friable.

.6 If required to control insects, fungus and disease, use appropriate control methods in accordance with Federal, Provincial and Municipal regulations. Obtain product approval from Departmental Representative prior to application.

.7 Apply fertilizer in early spring as indicated by soil test.

.8 Remove dead, broken or hazardous branches from plant material.

.9 Keep trunk protection and tree supports in proper repair and adjustment.

.10 Remove trunk protection, tree supports and level watering saucers at end of warranty period.

.11 Remove and replace dead plants and plants not in healthy growing condition.

.12 All required replacements shall be of plants of the same size and species as specified on the Drawing and shall be supplied and planted in accordance with the Drawing and Specifications.

.13 Submit monthly written reports to Departmental Representative identifying:

.1 Maintenance work carried out.

.2 Development and condition of plant material.

.3 Preventative or corrective measures required.

3.10 ACCEPTANCE

.1 Trees, shrubs and groundcovers will be accepted by Engineer provided plant materials are in a vigorous, healthy condition, meet or exceed the sizes indicated on the Drawing, are structurally sound and of a shape and form typical of the species.

3.11 CLEANING

.1 Progress Cleaning: Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 MEASUREMENT PROCEDURES

.1 Measure excavation and backfill in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling.

.2 Measure maintenance holes and catch basins in units within depth classifications as follows, measured from top of cover or grating to lowest pipe invert top of base slab as shown on the drawings.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for maintenance holes and catch basin structures and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Alberta, Canada.

Part 2 Products

2.1 MATERIALS

.1 Precast maintenance hole units: to ASTM C 478M, circular or oval.

.1 Top sections eccentric cone or flat slab top type without opening offset for vertical ladder installation.

.2 Monolithic bases to be approved by Departmental Representative and set on concrete slabs cast in place.

.2 Precast catch basin sections: to ASTM C478M.

.3 Joints: made watertight using rubber rings, bituminous compound, epoxy resin cement or cement mortar.

.4 Mortar:

.1 Aggregate: CSA A82.56.

.2 Masonry Cement: to CAN/CSA-A3002.

.5 Ladder rungs: to CSA G30.18, No.25M billet steel deformed bars, hot dipped galvanized to ASTM A 123/A 123M.

.6 Rungs to be safety pattern drop step type.

.7 Adjusting rings: to ASTM C 478M.

.8 Concrete Brick: to CAN/CSA-A165 Series.

.9 Drop maintenance hole pipe: same as sewer pipe.

.10 Galvanized iron sheet: approximately 2 mm thick.

.11 Steel gratings, I-beams and fasteners: as indicated.

.12 Frames, gratings, covers to dimensions as indicated and following requirements:

.1 Metal gratings and covers to bear evenly on frames.

.1 Frame with grating or cover to constitute one unit.

.2 Assemble and mark unit components before shipment.

.2 Gray iron castings: to ASTM A 48/A 48M, strength class 30B.

.3 Castings: coated with two applications of asphalt varnish sand blasted or cleaned and ground to eliminate surface imperfections.

.4 Maintenance hole frames and covers: with perforations and complete with two 25 mm square lifting holes.

.5 Catch basin frames and covers to City of Calgary standards.

.6 Maintenance hole frames and covers to City of Calgary standards.

.13 Granular bedding and backfill: in accordance with Section 31 05 16 - Aggregate Materials and following requirements:

.1 Crushed gravel.

.2 Gradations to be within limits specified when tested to ASTM C 136 and ASTM C 117 . Sieve sizes to CAN/CGSB-8.1.

.3 Table:

Sieve Designation	% Passing
25 mm	100
16 mm	90-100
10 mm	45-75
5 mm	0-15
1.25mm	0-5

.4 Concrete mixes and materials: in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.14 Unshrinkable fill: in accordance with Section 31 23 33.01 - Excavating, Trenching and

Backfilling.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for maintenance holes and catch basin structures installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 EXCAVATION AND BACKFILL

.1 Excavate and backfill in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling and as indicated.

.2 Obtain approval of Departmental Representative before installing outfall structures, maintenance holes or catch basins.

3.3 CONCRETE WORK

.1 Use 25 MPa concrete in accordance with Section 03 30 00 - Cast-in-Place Concrete.

3.4 INSTALLATION

.1 Construct units in accordance with details indicated, plumb and true to alignment and grade.

.2 Complete units as pipe laying progresses.

.1 Maximum of 3 units behind point of pipe laying will be allowed.

.3 Dewater excavation to approval of Departmental Representative and remove soft and foreign material before placing concrete base.

.4 Cast bottom slabs directly on undisturbed ground.

.5 Set precast concrete base on 150 mm minimum of granular bedding compacted to 100% corrected maximum dry density maximum density to ASTM D 698.

.6 Precast units:

.1 Set bottom section of precast unit in bed of cement mortar and bond to concrete slab or base.

.2 Make each successive joint watertight with Departmental Representative's

approved rubber ring gaskets, bituminous compound, cement mortar, epoxy resin cement, or combination of these materials.

.3 Clean surplus mortar and joint compounds from interior surface of unit as work progresses.

.4 Plug lifting holes with [precast] concrete plugs set in cement mortar or mastic compound.

.8 Compact granular backfill to 98% maximum density to ASTM D 698.

.9 Place frame and cover on top section to elevation as indicated.

.1 If adjustment required use concrete ring.

.10 Clean units of debris and foreign materials.

.1 Remove fins and sharp projections.

.2 Prevent debris from entering system.

3.5 LEAKAGE TEST

.1 Install watertight plugs or seals on inlets and outlets of each new maintenance hole and fill maintenance hole with water.

.2 Leakage not to exceed 0.3% per hour of volume of maintenance hole.

.3 If permissible leakage is exceeded, correct defects.

.4 Repeat until approved by Departmental Representative.

.5 Departmental Representative will issue Test Certificate for each maintenance hole passing test.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 27 00 – Measurement and Payment

.2 Section 01 33 00 - Submittal Procedures

.3 Section 01 61 00 - Common Product Requirements

.4 Section 01 74 00 - Cleaning

.5 Section 01 74 19 - Waste Management and Disposal

.6 Section 31 05 16 – Aggregate for Earthwork

.7 Section 31 23 33.01 – Excavation, Trenching and Backfilling.

.8 Section 33 05 16 – Maintenance Holes and Catch Basin Structures.

1.2 PRICE AND PAYMENT PROCEDURES

.1 In accordance with Section 01 27 00 – Measurement and Payment.

1.3 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM C 117, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C 136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D 698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).

.4 ASTM D 3034, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

.5 ASTM F 794, Standard Specification for Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1-[M89], Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2-[M88], Sieves, Testing, Woven Wire, Metric.

.3 CSA International

.1 CAN/CSA-B1800-[06], Thermoplastic Non-pressure Pipe Compendium - B1800 Series.

1.4 SCHEDULING

.1 Schedule Work to minimize interruptions to existing services and to maintain existing flow during construction.

.2 Submit schedule of expected interruptions for approval and adhere to approved schedule.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for pipes, and backfill and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

.4 Samples:

.1 Inform Departmental Representative at least 4 weeks prior to beginning Work, of proposed source of bedding materials and provide access for sampling.

.5 Certification to be marked on pipe.

.6 Test and Evaluation Reports: submit manufacturer's test data and certification at least 2 weeks prior to beginning Work.

.7 Manufacturer's Instructions: submit to Departmental Representative 1 copy of manufacturer's installation instructions.

.8 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations.

.2 Store and protect pipes from damage.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse as specified in Construction Waste Management Plan in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 PLASTIC PIPE

.1 Type PSM Poly Vinyl Chloride (PVC): to ASTM D 3034.

2.2 PIPE BEDDING AND SURROUND MATERIAL

.1 Granular material in accordance with Section 31 05 16 - Aggregate Materials and following requirements:

.1 Crushed or screened stone, gravel or sand.

.2 Gradations to be within limits specified when tested to ASTM C 136 and ASTM C 117. Sieve sizes to CAN/CGSB-8.2.

.2 Table:

Sieve Designation (mm)	% Passing	
	Stone / Gravel	Gravel / Sand
200	-	-
75	-	-
50	-	-
38.1	-	-
25	100	-
19	-	-
12.5	65-90	100
9.5	-	-
4.75	35-55	50-100
2.00	-	30-90
0.425	10-25	10-50
0.180	-	-
0.075	0-8	0-10

2.3 BACKFILL MATERIAL

.1 Type 3 in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Unshrinkable fill: in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

Part 3 Execution

3.1 PREPARATION

.1 Clean pipes and fittings of debris and water before installation, and remove defective materials from site to approval of Departmental Representative.

3.2 TRENCHING

.1 Do trenching Work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Protect trench from contents of sewer.

.3 Trench alignment and depth to approval of Departmental Representative prior to placing bedding material and pipe.

3.3 GRANULAR BEDDING

.1 Place bedding in unfrozen condition.

.2 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness.

.3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.

.1 Do not use blocks when bedding pipes.

.4 Shape transverse depressions as required to suit joints.

.5 Compact each layer full width of bed to at least 95% maximum density to ASTM D 698.

.6 Fill excavation below bottom of specified bedding adjacent to manholes or catch basins with lean mix concrete.

3.4 INSTALLATION

.1 Lay and join pipe in accordance with manufacturer's recommendations and to approval of Departmental Representative.

.2 Handle pipe using methods approved by Departmental Representative.

.3 Lay pipes on prepared bed, true to line and grade with pipe inverts smooth and free of sags or high points.

.1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.4 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.

.5 Joint deflection permitted within limits recommended by pipe manufacturer.

.6 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.7 Install plastic pipe and fittings in accordance with CAN/CSA-B1800.

.8 When any stoppage of Work occurs, restrain pipes as directed by Departmental Representative, to prevent "creep" during down time.

.9 Plug lifting holes with Departmental Representative approved prefabricated plugs, set in shrinkage compensating grout.

.10 Cut pipes as required for special inserts, fittings or closure pieces, as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.11 Make watertight connections to manholes and catch basins.

.1 Use shrinkage compensating grout when suitable gaskets are not available.

.12 Use prefabricated saddles or approved field connections for connecting pipes to existing sewer pipes.

.1 Joint to be structurally sound and watertight.

.13 Temporarily plug open upstream ends of pipes with removable watertight concrete, steel or plastic bulkheads.

3.5 PIPE SURROUND

.1 Place surround material in unfrozen condition.

.2 Upon completion of pipe laying, and after Departmental Representative has inspected pipe joints, surround and cover pipes as indicated.

.1 Leave joints and fittings exposed until field testing is completed.

.3 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.

.4 Place layers uniformly and simultaneously on each side of pipe.

.5 Compact each layer from pipe invert to mid height of pipe to at least 95% maximum density to ASTM D 698.

.6 Compact each layer from mid height of pipe to underside of backfill to at least 95% maximum density to ASTM D 698.

.7 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.

3.6 BACKFILL

.1 Place backfill material in unfrozen condition.

.2 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.

.3 Under paving and walks, compact backfill to at least 95% maximum density to ASTM D 698. In other areas, compact backfill to at least 90% maximum density to ASTM D 698.

.4 Place unshrinkable backfill in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

3.7 FIELD TESTS AND INSPECTIONS

.1 Repair or replace pipe, pipe joint or bedding found defective.

.2 Draw tapered wooden plug with diameter of 50 mm less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction directed by Departmental Representative.

.3 Remove foreign material from sewers and related appurtenances by flushing with water.

3.8 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: separate waste materials for reuse and in accordance with Section 01 74 19 - Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 SCHEDULING

.1 Schedule Work to minimize interruptions to existing services and to maintain existing traffic flow during construction. Ensure one lane is always open.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for pipes and backfill and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:

.1 Inform Consultant at least 4 weeks before beginning Work, of proposed source of bedding materials and provide access for sampling.

.4 Certification: to be marked on pipe.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations.

.2 Store and protect pipes from damage.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 CORRUGATED STEEL PIPE

.1 Corrugated steel pipe: to CAN/CSA-G401.

.2 Water-tight cut-off collars: as indicated.

.3 Corrugated fluming: to CAN/CSA-G401.

2.2 GRANULAR BEDDING [AND BACKFILL]

.1 Granular bedding and backfill material to Section 31 05 16 - Aggregate Materials and following requirements:

.1 Crushed pit run or screened stone, gravel or sand.

.2 Gradations to be within limits specified when tested to ASTM C 136 and ASTM C 117. Sieve sizes to CAN/CGSB-8.2.

.2 Table:

Sieve Designation	% Passing
200 mm	-
75 mm	100
50 mm	-
38.1 mm	-
25 mm	-
19 mm	-
12.5 mm	-
9.5 mm	-
4.75 mm	25-85
2.00 mm	-
0.425 mm	5-30
0.180 mm	-
0.075 mm	0-10

.3 Concrete mixes and materials for bedding, cradles, encasement, supports: to Section 03 30 00 - Cast-in-Place Concrete.

Part 3 Execution

3.1 PREPARATION

.1 Temporary Erosion and Sedimentation Control:

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 TRENCHING

.1 Do trenching Work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Obtain Departmental Representative's approval of trench line and depth prior to placing bedding material or pipe.

3.3 BEDDING

.1 Dewater excavation, as necessary, to allow placement of culvert bedding in dry condition.

.2 Place 200 mm minimum thickness of approved granular material on bottom of excavation and compact to 95% minimum of maximum density to ASTM D 698.

.3 Shape bedding to fit lower segment of pipe exterior so that width of at least 50% of pipe diameter is in close contact with bedding and to camber as indicated or as directed by Parks Canada Representative, free from sags or high points.

.4 Place bedding in unfrozen condition.

3.4 LAYING CORRUGATED STEEL PIPE CULVERTS

.1 Begin pipe placing at downstream end.

.2 Ensure bottom of pipe is in contact with shaped bed or compacted fill throughout its length.

.3 Lay pipe with outside circumferential laps facing upstream and longitudinal laps or seams at side or quarter points.

.4 Lay paved invert or partially lined pipe with longitudinal centre line of paved segment coinciding with flow line.

.5 Do not allow water to flow through pipes during construction except as permitted by Departmental Representative.

3.5 JOINTS: CORRUGATED STEEL CULVERTS

.1 Corrugated steel pipe:

.1 Match corrugations or indentations of coupler with pipe sections before tightening.

.2 Tap couplers firmly as they are being tightened, to take up slack and ensure snug fit.

.3 Insert and tighten bolts.

.4 Repair spots where damage has occurred to spelter coating by applying two coats of asphalt paint approved in writing by Departmental Representative or two coats of zinc rich epoxy paint.

.2 Structural plate:

.1 Erect in final position by connecting plates with bolts at longitudinal and circumferential seams.

.2 Drift pins may be used to facilitate matching of holes.

.3 Place plates in sequence recommended by manufacturer with joints staggered so that not more than three plates come together at any one point.

.4 Draw bolts up tight, without overstress, before beginning backfill.

.5 Repair spots where damage has occurred to spelter coating by applying two coats of asphalt paint or two coats of zinc rich epoxy paint approved by Parks Canada Representative.

3.6 BACKFILLING

.1 Backfill around and over culverts as indicated or as directed by Departmental Representative.

.2 Place granular backfill material backfill material, approved in writing by Departmental Representative, in 150 mm layers to full width, alternately on each side of culvert, so as not to displace it laterally or vertically.

.3 Compact each layer to 95% maximum density to ASTM D 698 taking special care to obtain required density under haunches.

.4 Protect installed culvert with minimum 600 mm cover of compacted fill before heavy equipment is permitted to cross.

.1 During construction, width of fill, at its top, to be at least twice diameter or span of pipe and with slopes not steeper than 1:2.

.5 Place backfill in unfrozen condition.

3.7 FLUMING

.1 Assemble and install fluming as indicated.

.2 Set top edges of fluming flush with side slope.

3.8 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 PRICE AND PAYMENT PROCEDURES

.1 In accordance with Section 01 27 00 – Measurement and Payment.

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM B 209M-10, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

.2 Canadian General Standards Board (CGSB)

.1 CGSB 62-GP-11M-78(R1987), Marking Material, Retroreflective, Enclosed Lens, Adhesive Backing.

.3 Manual of Uniform Traffic Control Devices for Canada 2014.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for vehicle post delineators and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples

.1 Submit to Departmental Representative at least 4 weeks prior to commencing work, following samples of materials proposed for use:

.1 Reflective markers.

.2 Galvanized steel posts.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground, indoors, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect vehicle post delineators from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse as specified in Construction Waste Management Plan in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 REFLECTIVE MARKERS

.1 200 x 100 mm with 20 mm radius corners aluminum base panel with permanently attached reflective sheeting:

.1 Aluminum base panel: to ASTM B 209M, 1.6 mm thick, degreased and etched or treated with light amorphous chromate type coating.

.2 Reflective sheeting: to CGSB 62-GP-11M, type I, class I, reflectivity level I. Colour: yellow or white to match colour of roadway edge line.

2.2 STEEL POSTS

.1 Steel posts: galvanized steel sign standards 2 m long, flanged, "U" shaped in cross section, measuring 65 mm wide by 30 mm deep. Metal thickness: 4.5 mm. Pre-drill bolt holes in locations as indicated.

.2 Bolts: 65 mm long galvanized steel, 9 mm minimum diameter. Each bolt to be complete with two nylon washers, cast block spacer and galvanized steel nut.

2.3 L54 DELINEATOR MARKERS

.1 L54 Delineator Markers shall be used where indicated on the plans. The L54 Delineator Marker system shall consist of two main components: A stand-alone raised base and a high target value channelizer equipped with signage. Approved manufacturer is QWICK KURB, INC; Model number L54 base and L104 MEGA-MARKER or equivalent.

.2 **Stand-Alone Raised Base:** The raised base shall consist of a single monolithic unit. The base shall be a minimum of 10” (25.4 cm] and a maximum of 12” (30.48 cm] in width, and a minimum of 3 1/2” (8.89 cm] and a maximum of 4” (10.16 cm] in height. The length of the base parallel to traffic shall be 3’ (0.91 m] – 4’ (1.22 m] long and the ends facing oncoming traffic hall be tapered. The separator cross section shall be gently curved so as to provide minimal resistance to vehicle tires, thereby allowing emergency vehicles to cross the separator. To increase target value in daylight hours, the entire rounded surface of the separator shall be colored yellow or white to conform to the traffic pavement markings that they supplant.

Durability is a prime consideration, and the raised base must be sturdy and capable of resisting crushing effects of traffic impacts. Thus raised base shall be composed of recycled or virgin polyvinyl chloride plastic with a sufficient durable mass to achieve a weight of at least 10 pounds per linear foot, and documentary support will be required

from an independent engineering testing laboratory certifying that a representative section of a unit was subjected to compression force of at least 3,500 psi in a Universal Testing Machine and that the tested sample rebounded after 24 hours to within 90% of its original height.

Manufacturer shall provide necessary mounting hardware depending on the surface the base is to be installed upon.

.3 **HIGH TARGET VALUE CHANNELIZERS:** High target value channelizers shall consist of a single piece top shell affixed to a detachable flexible rubber boot that support a panel in a vertical position, and are capable of restoring the channelizer to the vertical position if struck by a vehicle. The top portion of the channelizers shall be composed of a single piece white high impact plastic molded shell capable of directly receiving retro-reflective sheeting. To provide better visibility, the general cross-sectional shape of the panel shall be elliptical.

Elliptical channelizers shall have a mounting height of 40 to 44 inches above the mounting surface and be between 8 to 10 inches wide. The panels shall be equipped with a 28 inch tall by 8 inch wide Type IV retro-reflective sheeting and shall be applied to both sides of the panel. The color of the retro-reflective sheeting shall match the color of Stand-Alone Raised Base.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for vehicle post delineators installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 ASSEMBLY

.1 Fasten reflective markers to steel posts using bolts, washers, spacers and nuts. Use two bolts for each delineator unit, centered and spaced at 150 mm.

.2 Fasten two reflective markers back to back to each steel post for delineator units installed on two-way roads. Attach single reflective marker to each post for delineator units installed on one-way roads.

3.3 INSTALLATION

.1 Do work in accordance with Manual of Uniform Traffic Control Devices for Canada (MUTCDC) except where specified otherwise.

.2 Install posts vertically and 0.6 m beyond shoulder of road and in no case more than 4.0 m nor less than 1.2 m from edge of pavement.

.3 Locate centre of reflective marker 1.2 m above elevation of outside edge of adjacent lane in accordance with MUTCDC and at right angles to road centreline.

.4 On straight alignment, space delineator units at 60 m.

.5 On curves, space delineator units as follows:

Radius of Curve in Metres	Spacing in Metres on Curve	Spacing in Metres in Advance and Beyond		
		First Space	Second Space	Third Space
1500	42	60	60	60
1000	35	60	60	60
500	24	45	60	60
350	20	38	60	60
250	17	32	52	60
200	15	29	46	60
150	13	25	40	60
100	11	20	33	60
75	9	18	28	57
60	8	16	25	51
40	7	13	21	42

.6 Five markers to be always visible to the right of the road on approaches to and throughout horizontal curves.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling] in accordance with Section 01 74 19 - Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

APPENDIX

Basic Impact Analysis
(BIA)

Mountain Avenue Traffic Improvements

August 2018

1. PROJECT TITLE & LOCATION

Mountain Avenue Traffic Improvements
Mountain Avenue, Banff, Alberta, Canada

2. PROPONENT INFORMATION

Laurie MacDonald (Project Manager)
Technical Services Coordinator II
Banff Field Unit, Parks Canada Agency
Government of Canada
Laurie.MacDonald@pc.gc.ca
Telephone: 403-431-2168

3. PROPOSED PROJECT DATES

Planned commencement:	2018-09-04
Planned completion:	2019-07-01

4. INTERNAL PROJECT FILE

BNP-1264

5. SITE DESCRIPTION

Mountain Avenue, located within Banff National Park, extends south from the Town of Banff along the eastern side of Sulphur Mountain. The project site includes the south terminus of Mountain Avenue and two parking lots (Upper and Lower), which service several popular visitor attractions in the area, including the Upper Hot Springs, Sulphur Mountain Gondola, Rimrock Resort Hotel, and various trails, lookouts and picnic areas.

Figure 1. Overview of Project site and surrounding area.

5.1. Ecosite

The Project area is located within the Panorama Ridge Ecosection (PR), specifically the PR1 ecosite, of Lower Subalpine Ecoregion of the Rocky Mountain Natural Subregion (Holland and Coen 1982). The PR Ecosection occurs on valley walls and floors and includes benchlands (Holland and Coen 1982).

A summary of the general features of the PR1 Ecosite are provided in Table 1.

Table 1: Summary of General Features Associated with the PR1 Ecosite

Ecosite	Surface Expression	Genetic Material Unit	Soils	Vegetation	Slope
PR1	Blanket over inclined bedrock.	Till C (calcareous, medium textured)	Eutric Brunisol > Gray Luvisol	Lodgepole Pine forest	7 (30-45%)

Source: Holland and Coen (1982)

Dominant vegetation of the surrounding forested area of the PR1 Ecosite, as described by Holland and Coen (1982), is dominated by the Lodgepole pine (Pinus contorta)/feathermoss (C11); Lodgepole pine/false azalea (Menziesia ferruginea)/grouseberry (Vaccinium scoparium)(C20) and lodegpole pine/Labrador tea (*Rhododendron groenlandicum*) (C29) vegetation community types.

5.2. Soils & Hydrology

The existing surface of Mountain Avenue and parking lots consists primarily of asphalt pavement with some gravel surface at the south end of the Upper parking lot. These surfaces are underlain by a granular subgrade structure. A geotechnical investigation completed by Amec Foster Wheeler in 2016 identified subsurface soils consisting of primarily silty sand or gravel to the maximum investigated depth of 3.5 m. Groundwater was not encountered in any of the advanced boreholes, and the soils are expected to be well drained with seasonal fluctuations in groundwater levels.

Surface water runoff on the site primarily collects in ditches and drains through infiltration or follows topography north along Mountain Ave, or through culverts to the east side of the Lower parking lot. Surface water bodies in proximity to the site include the Upper Hot Springs to the northwest, an unnamed ephemeral creek approximately 20 m behind the Gondola building to the south, and the Spray River which is located approximately 750 m east of the site.

5.3. Sulphur Mountain Wildlife Corridor

The project site lies within the Sulphur Mountain Wildlife Corridor, which provides important habitat and a travel route for wildlife movement around the Town of Banff. The Town of Banff lies within a naturally constricted portion of the lower Bow Valley, near the junction of several large valleys. A variety of species, including many ungulates, rely on such corridors for travel around the townsite to reach seasonal ranges.

6. PROJECT DESCRIPTION

The proposed project involves roadway upgrades to the south end of Mountain Avenue; specifically the lower and upper parking lots located at the south terminus, and the adjacent intersections. The design includes construction of two new roundabout intersections, an asphalt overlay of existing parking lots, a new gravel base and pavement at the unpaved gravel parking area at the end of the upper parking lot, a new bus stop (within upper lot), as well as concrete pathways, crosswalks and the installation of new signs. The new signs will include regulatory, way-finding as well as destination, ‘sense of arrival’ signage. They will be installed at both intersections and parking lots. In both parking lots, the layout aims to maximize use of existing disturbed footprint to provide wider driving aisles than the minimum required width – the aim being to improve traffic flow through the lots, accommodate for improperly parked vehicles and/or allow for vehicles to pass-by stopped vehicles waiting to park within the lots. Details on the upgrades to each area of the Project site are as follows:

Lower Roundabout Intersection

- Parking adjacent to the intersection will not be provided.
- The proposed roundabout configuration accommodates the movement of buses (tour buses and ROAM buses) and other large vehicles.
- Landscaping in the center of the new roundabout including small shrub plantings

Upper Roundabout Intersection

- Bus and passenger drop-off zone immediately adjacent to the proposed roundabout but separate from the through driving aisles. The configuration accommodates buses leaving the drop off area without having to enter the lot, including ROAM transit after leaving bus stop.
- A bypass lane provided for vehicles to exit the intersection around the circle without entering the lot if it is congested.
- The entrance to UHS has been reconfigured as a narrower road than is existing with a more intentional right turn which will reduce the number of vehicles unintentionally travelling up this roadway.
- Designated staff parking stalls
- Landscaping in the center of the new roundabout including small shrub plantings

Lower Parking Lot

- One-way aisles with angled parking, pedestrian pathways and way-finding signs.
- Designated tour bus parking and separate passenger drop-off area for shuttle buses
- Existing ROAM bus stop to remain.
- Possible addition of low level lighting at bus stop and along pathways.
- Asphalt overlay
- Concrete curbs where pathways are adjacent to lots – to mitigate vehicles blocking pathways
- Formalize parallel parking along the road to the lower lot on the uphill side only, not permitting parking on the downhill side
- Addition of low retaining wall to stabilize slope and allow for formalized walkway along the road to the lower lot on the uphill side

Upper Parking Lot

- One-way aisles with angled parking, designated RV parking section, pedestrian pathways and way-finding signs
- Asphalt overlay of existing lot, new gravel base and pavement at the unpaved gravel parking area at the rear of the lot.
- Concrete curbs where pathways are adjacent to lots – to mitigate vehicles blocking pathways
- Trailhead run-off remediation – details to be confirmed
- Wheeler Monument installation at pedestrian/ROAM drop-off sidewalk

Pathways and Crosswalks

- Provide new pathways/sidewalk connections between the attractions and the parking lots, bus stops/passenger drop-off areas to help provide separation between pedestrians and motor vehicles
- Provide formal and clearly marked crosswalks, separate from intersections
- Limiting the use of the area immediately in front of the gondola building to shuttle bus drop-off only, and not to be used for parking which will help to reduce safety concerns with respect to pedestrians travelling through this area from the parking lot

Signage

- Regulatory, way-finding and sense of arrival signs will be designed in coordination with Upper Hot Springs and Gondola Operation to ensure clear and comprehensive messaging

Figure 1. Overview of Project site and general roundabout and parking lot design.

6.1. Rationale

The objective of the project is to address significant issues that have been identified with regards to traffic congestion, delays and impacts to visitor safety at the south end of Mountain Avenue. The identified issues include high traffic volumes with a finite number of defined parking spots, unfamiliarity of drivers with their destination, and overflow parking of vehicles along the shoulders of Mountain Avenue resulting in reduced driving lane width and introducing pedestrians along the roadway.

To address these issues, five key components were considered and addressed within the project scope:

1. ***Traffic Flow*** – improvements to traffic flow within the area through enhancements to the upper and lower parking lot intersections as well as thorough considerations of traffic flow within the parking lots themselves.
2. ***Parking Adequacy / Efficiency*** – while the general footprint for the existing upper and lower parking lots will remain the same, improvements to parking adequacy, formalization of parking available along the access road to the lower lot and within the existing gravel area at the back of the upper lot. Parking efficiencies will also be found from the improvement in the ease of parking maneuvers and designated parking by vehicle type.
3. ***Safety*** – while safety improvements will be inherent in the design for the two problem components identified above, safety for the travelling public and pedestrians in other isolated respects from the traffic flow and parking considerations and within the project limits is a specific consideration within the project limits.
4. ***Way-finding*** – specific improvements to way-finding within the project limits for both drivers and pedestrians will help to improve traffic flow and safety concerns by directing both vehicles and pedestrians to the appropriate destinations along designated routes.

5. ***Project Footprint*** – the improvements will be limited to the existing disturbed area.

7. VALUED COMPONENTS LIKELY TO BE AFFECTED

Valued components that are likely to be affected by the proposed project include air quality, soil and landforms, aquatic resources, vegetation, wildlife, cultural resources, and visitor experience. These valued components will be carried forward in the effects analysis.

8. EFFECTS ANALYSIS AND MITIGATION MEASURES

Effects analysis considers the possible interactions between the project activities, and the valued components likely to be affected. Potential effects may be direct or indirect, and may cause positive or negative impact. Mitigation measures are the prescribed project requirements necessary to prevent significant adverse effects to valued components.

8.1. Air Quality

Potential Effects

Construction activities will require excavation, grading, paving, use of heavy machinery, and transportation of materials which may result in temporary increases in dust and vehicle emissions. No long term effects on air quality are expected beyond the period of construction.

Mitigation Measures

- Minimize idling of vehicles.
- Cover and contain fine particulate materials during transportation on and off site.
- Avoid site preparation during excessively dry and/or windy periods, and wet down exposed soils to prevent dust generation.

8.2. Soil and Landforms

Potential Effects

Excavation, grading, and removal of stabilizing vegetation may result in adverse effects to soil and landforms at the project site. Efforts have been made in the design to limit construction to within the existing roadway footprint and minimize the disturbance to native soil and vegetated areas surrounding the road and parking lots. Potential effects to soil and landforms during construction include the following:

- Soil compaction and rutting from equipment access and travel on site.
- Increased susceptibility to wind and water erosion of exposed soils and stockpiles
- Loss of topsoil and associated seed bank through erosion or admixing.
- Soil contamination from accidental spills or leaks of hazardous materials on the site.
- Discovery of subsurface contaminants, possibility of contamination from buried materials already present on site where the extent and type of contamination risk is unknown.

Potential effects to soils and landforms following construction include the following:

- Reduced slope stability and increased susceptibility to wind and water erosion of disturbed soils if not re-vegetated appropriately.
- Soil compaction and erosion due to altered or increased foot traffic in vegetated areas if signage and fencing is unsuccessful in directing pedestrians.
- Greater paved surface area could lead to increased storm water runoff volumes and velocity leading to erosion down-gradient of the project site.

Mitigation Measures

- Ensure machinery arrives on site in a clean condition and is maintained free of fluid leaks, invasive species, noxious weeds and soils from off-site.
- Use only hardened surfaces or areas within the disturbance footprint for laydown, staging, parking, access and travel within the site.
- Minimize area of exposed soil at any given time by phasing construction and retaining vegetation or asphalt cover until disturbance is necessary.
- Stabilize exposed soil and stockpiles as soon as possible; if a prolonged period of exposure is expected, protect exposed soils with temporary cover (e.g. geotextile, mulch, vegetative cover).
- Salvage topsoil using a two-lift excavation sequence, and store separately from subsoil.
- Schedule work for periods of low rainfall; halt activity on exposed soils during periods of high rainfall and runoff.
- Prepare a detailed ESC Plan outlining the requirements and implementation of erosion and sediment control measures on site (e.g. mulches, erosion blankets, check dams, sediment fencing).
- All outlets to culverts and drainage points must be armoured with rip rap or gabian mattress to prevent erosion.
- Prepare a detailed Spill Response Plan outlining the containment and storage, security, handling, use and disposal of deleterious products or wastes (e.g. fuel, oil, asphalt, concrete).
- Spill kits shall be provided at re-fuelling, lubrication, and repair locations that are capable of dealing with 110% of the largest potential spill and shall be maintained in good working order. Site staff shall be informed of the location of the spill response kit(s) and be trained in its use.
- Hazardous or toxic products shall be stored no closer than 100 metres from surface water bodies
- Timely and effective action shall be taken to stop, contain and clean-up all spills as long as the site is safe to enter. The ESO shall be notified immediately of any spill. In the event of a major spill, all other work shall be stopped and all personnel devoted to spill containment and clean-up.

- The costs involved in a spill incident (the control, clean up, disposal of contaminants and site remediation to pre-spill conditions), shall be the responsibility of the proponent. The site will be inspected to ensure completion to the expected standard and to the satisfaction of Parks Canada

8.3. Aquatic Resources

Potential Effects

Adverse effects to aquatic resources could occur if deleterious substances associated with construction activities are released into surface or ground water. Given the distance and direction of surface water bodies from the site, the potential for direct releases of sediment or hazardous materials to aquatic ecosystems is low. However, ineffective ESC or spill management during construction, as well as poor design or installation of culverts and catchbasins could lead to deterioration of water quality and have negative impacts on aquatic resources.

Mitigation Measures

- Prepare appropriate ESC and Spill Response plans (see Soil and Landform mitigations above). All sediment control measures must be in place before starting work.
- Surface water drainage design and construction must adhere to the Alberta Stormwater Management Guidelines (2013).
- Sanitary facilities, such as a portable container toilet, shall be provided and maintained in a clean condition.
- Undertake grading, paving and concrete works during periods of dry weather to allow for control of contaminated runoff and sediment.
- If site dewatering is required, a site-specific dewatering plan with specific details on how and where the water will be discharged is required be provided to the ESO for approval before commencing.
- If temporary concrete washout facilities are required onsite, they must be located a minimum of 30m from storm drain inlets, open drainage facilities, and surface watercourses. They must be plastic-lined pit or bermed areas constructed and maintained in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations.
-
-

8.4. Vegetation

Potential Effects

Excavation, grading and landscaping activities around the perimeter of the site may have adverse effects on vegetation in the surrounding areas. The project has been designed to stay within the existing disturbed footprint and not intrude into surveyed drip line of perimeter trees, however there remains the possibility that select perimeter vegetation may need to be cleared once construction is underway. Sensitive or rare vegetation species are not anticipated in the immediate project area.

Potential effects to vegetation include the following:

- Potential clearing of select trees to allow for new parking lot alignments and/or retaining walls once laid out.
- Extension of disturbance within the drip-line of perimeter vegetation.
- Proliferation of non-native vegetation (NNV) due to disturbance and spreading of existing plants, importing contaminated soils, or by using unsuitable seed for restoration.
- Increased wildfire risk due to unsuitable planting species or tree mortality.
- Poor survivability of replanted grass and shrubs due to increased or altered foot traffic following construction.

Mitigation Measures

- Maintain all construction activities within the defined project footprint; delineate construction areas, access routes and storage areas with flagging, staking or fencing to minimize vehicle/equipment disturbance to vegetation and avoid spread of NNV.
- Materials shall be placed at storage sites or on the grade without spillage outside the work limits. Any material inadvertently falling outside the work limits will be removed promptly in a manner that does not damage trees or vegetation.
- Avoid vegetation clearing or damage; if vegetation clearing is required, review and approval by Parks Canada Vegetation specialists is required.
- Avoid removing or working within the drip-line of existing trees
- Prepare a detailed Reclamation Plan for all disturbed areas around the parking lots and road edges with an approved seed mix and planting species as per the Banff National Park Approved Planting List.
- Herbicide application is required twice per growing season during the construction period to prevent NNV spread and establishment
- Prevent foot traffic over seeded areas to allow for vegetation to establish.
- In areas where insufficient topsoil exists for salvage, import topsoil from an approved source (e.g. NutriLoam).
- Any disturbed soil unsuitable for fill or reclamation on the site must be disposed of at an approved facility outside of Banff National Park, or undergo characterization and testing to the satisfaction of the Banff Field Unit Environmental Assessment Office before being transported elsewhere within the National Park.

8.5. Wildlife

Potential Effects

Short-term effects to wildlife are expected during the construction period due to sensory disturbances associated with project activities. Construction-related traffic, material storage and transport, excavation and paving may have adverse effects through noise generation and visual disturbance to wildlife moving through the area. Wildlife using the area have likely adapted their behaviour to the relatively high level of traffic and human activity that has historically occurred at these facilities, using adjacent habitat as travel corridors around and between the nodes of human activity in the project area.

Grizzly bears regularly use the Sulphur Mountain Wildlife Corridor in spring, summer and fall and their home ranges include the project area. Project activities occurring in June, September and October have the potential to disrupt bear activity during these sensitive times and could lead to human-wildlife conflicts. Bears as well as other wildlife species typically navigate through areas of high human use during crepuscular periods and at night.

Additional potential effects to Wildlife include the following:

- Wildlife movement could be impeded from equipment laydown or construction fencing.
- Disruption to nesting migratory birds as a result of potential vegetation clearing.
- Injury and/or mortality of small mammals if entering excavated areas during overnight or unattended hours.
- Attraction of wildlife to the site due to improper waste management or use of unsuitable landscaping plant species
- Ground squirrel burrows could be destroyed by excavation activities

Mitigation Measures

- Limit all construction-related activities, including foot and vehicle traffic, material storage and equipment laydown to the existing road and parking lot areas
- Avoid or terminate activities on site that attract or disturb wildlife. Vacate the area and stay away from the immediate location if wildlife display aggressive behaviour or persistent intrusion.
- Organize equipment, materials and hoarding on the site such that it does not significantly restrict wildlife movement through the area
- Ensure all food waste, garbage or other potential wildlife attractants (e.g. petroleum products) are securely stored and disposed of in a manner that prevents wildlife access.
- Schedule project activities to occur during daylight hours and avoid working during crepuscular periods or at night. If night work is required, review and approval from Parks Canada Wildlife specialists is required.
- Notify the ESO immediately about dens, litters, nests, carcasses (road kills), wildlife activity or encounters on or around the site or crew accommodation. Other wildlife-related encounters are to be reported to ESO within 24 hours.
- Schedule potentially disruptive construction activities to avoid the most sensitive seasonal time periods (June, September & October) for grizzly and black bears
- If vegetation removal required, do not clear trees during the migratory bird nesting bird window of April 15 to August 31; if tree removal is necessary within this period, a qualified biologist must complete an inspection for nests within seven days prior to tree removal.
- If a nest is found during the pre-work surveys, the vegetated area will be left intact with a suitable sized buffer around it until the young have fledged and left the nest. Size of buffer is species dependent, to be determined in consultation with qualified biologist and PCA ecologist.
- If tree removal is required within the bat roosting window (April 1 – October 1) for large diameter trees (>25cm DBH), a qualified biologist must complete an inspection for bat presence within two weeks prior to tree removal.
- Use approved seed mix and planting species with low palatability to wildlife species.

- Fence or cover all excavations while unattended to prevent wildlife entrapment.

8.6. Cultural Resources

Potential Effects

The project will occur in proximity to known cultural resource sites and ground disturbance activities may reveal previously undocumented archeological resources. Significant cultural resources that could occur include, but are not limited to, historic structural features, concentrations of artifacts, and artifacts directly associated with known sites in the area.

Mitigation Measures

- The 'Accidental Finds' protocol must be adhered to during all project activities: There may be cultural resources present in the project area that have not yet been discovered (even after an archaeological assessment has been carried out or no assessment was deemed necessary for the project). If staff observe any significant cultural resources while working, they must stop work in the immediate area, and contact the ESO, or a Parks Canada Archaeologist or Cultural Resource Management Advisor, to discuss any protective measures that might be needed.
- Significant resources that could be considered grounds for work stoppage include, but are not limited to, human remains, unique or diagnostic artifacts, and/or artifacts directly associated with known sites and/or unidentified sites in the area. In all cases, cultural resource managers must be made aware of the finds, and these finds must be communicated back to Parks Canada archaeologists.
- Any changes or refinements to the scope and/or design of the project must be reviewed by Parks Canada archeologists as it may have an effect on requirements.

8.7. Visitor Experience

Potential Effects

Project activities have the potential to affect visitor experience as it will involve disturbance and alterations to an area heavily visited and associated with main attractions such as the Sulphur Mountain Gondola, Rimrock Resort Hotel, Upper Hot Springs, and multiple trailheads. Potential effects to visitor experience in the project area include:

- Construction activities will temporarily disrupt traffic and pedestrian flow patterns.
- Disruption of access to the trails, attractions and facilities served from Mountain Avenue.
- Short term hazards to motorists and pedestrians may increase during construction, as there will be open excavation, exposed slopes, un-even areas, exposed soils and construction equipment and materials.

- Increased noise and temporary alteration to the aesthetics of the site may affect visitor experience and viewscapes during construction.
- Following construction, the long term effects of the project is an anticipated improvement in visitor experience and safety.

Mitigation Measures

- Evaluate site layout, access routes and construction activities to minimize their visual impact.
- Limit noise-producing activities to daylight hours.
- Outline traffic control measures and assess the need for flagging personnel.
- Store materials within the confines of the work site.
- Phase construction sequence to allow for access and parking throughout the duration of the project.
- Plan construction activities to commence before and after the high season of tourist traffic to ease traffic control and minimize disturbance to visitor access and viewscapes.

9. ENVIRONMENTAL PROTECTION PLAN

Before initiation of construction, the Contractor must prepare an Environmental Protection Plan (EPP) prepared and certified by a Qualified Environmental Professional (QEP). Prior to work beginning, the EPP must also be approved by the Banff Field Unit. The EPP must explain how the mitigation measures outlined within this document and attached Best Management Practices will be implemented, and include an Erosion and Sediment Control (ESC) Management Plan, a Spill Response Plan, an Emergency Response Plan, and a Fire Prevention Plan.

All employees must attend a briefing with the ESO before beginning work at the site to review and explain the EPP and mitigations that are conditions of the project approvals.

10. OTHER CONSIDERATIONS

Check all that apply

☐ Public/stakeholder engagement
☐ Aboriginal engagement or consultation
☒ Surveillance
☒ Follow-up monitoring, required to evaluate effectiveness of mitigation measures and/or assess restoration success
☐ Follow-up monitoring, required by legislation or policy (indicate basis of requirement e.g. required by the *Species at Risk Act)*
☐ SARA Notification

11. RESIDUAL EFFECTS

This project is expected to provide a net benefit to visitor experience in the area by facilitating more efficient travel, safer conditions, and less traffic congestion at peak times.

Following mitigation there are expected to be no significant net negative impacts to any of the valued components listed above.

12. EXPERTS CONSULTED

Department/Agency/Institution: Parks Canada Agency	Date of Request: 2018-05-30
Expert's Name & Contact Information: Matt Rance, matt.rance@pc.gc.ca 403-762-1493	Title: Resource Management Officer, Fire & Vegetation, Banff Field Unit
Expertise Requested: Vegetation effects, landscaping & reclamation planning.	
Department/Agency/Institution: Parks Canada Agency	Date of Request: 2018-02-05
Expert's Name & Contact Information: Stephanie Koroscil, stephanie.koroscil@pc.gc.ca	Title: Resource Management Officer, Fire & Vegetation, Banff Field Unit
Expertise Requested: Vegetation effects, landscaping & reclamation planning.	
Department/Agency/Institution: Parks Canada Agency	Date of Request: 2018-07-18
Expert's Name & Contact Information: Laura Rance, laura.rance@pc.gc.ca 403-431-0020	Title: Resource Management Officer, Wildlife, Banff Field Unit
Expertise Requested: Wildlife impacts, species specific concerns and mitigations.	
Department/Agency/Institution: Parks Canada Agency	Date of Request: 2018-06-04
Expert's Name & Contact Information: Steve Malins, steve.malins@pc.gc.ca 403-762-1467	Title: Cultural Resource Management Advisor, Banff Field Unit
Expertise Requested: Cultural resource effects and mitigations	

13. DECISION

Taking into account implementation of mitigation measures outlined in the analysis, the project is:

☒ not likely to cause significant adverse environmental effects.

☐ likely to cause significant adverse environmental effects.

NOTE: If the project is identified as likely to cause significant adverse effects, CEAA 2012 prohibits approval of the project unless the Governor in Council (Cabinet) determines that the effects are justified in the circumstances. A finding of significant effects therefore means the project CANNOT go ahead as proposed.

FOR SARA REQUIREMENTS:

☒ There are no residual adverse effects to species at risk and therefore the SARA-Compliant Authorization Decision Tool was not required

OR, the SARA-Compliant Authorization Decision Tool () was used and determined:

☐ There is no contravention of SARA prohibitions

☐ Project activities contravene a SARA prohibition and CAN be authorized under SARA

☐ Project activities contravene a SARA prohibition and CANNOT be authorized

14. RECOMMENDATION AND APPROVAL

(Add additional blocks as required)

Prepared by: EIA author (name & position): Tim Coles, Environmental Assessment Scientist, Parks Canada	Date:
Recommended by: Functional manager of the project (name):	Date:
Approval signature: Name & position (*Field Unit Superintendent, Director of a Waterway)*:	Date:

15. ATTACHMENTS

15.1. BMPS

Town of Banff Model Class Screening– Sub Class 3 Roads
PCA Roadway, Highway, Parkway and Related Infrastructure Best Management Practices
Banff National Park Approved Planting List

15.2. Other (e.g., project area diagrams, sensitive area maps, project execution plan, previous analysis)

Site Plans and Construction Drawings

16. NATIONAL IMPACT ASSESSMENT TRACKING SYSTEM

☒ Project registered in tracking system
☐ Not yet registered *(CEAA 2012 requires PCA submit a report to Parliament annually. EIAs must be entered in the tracking system **by the end of April** to enable reporting*.

*****Ensure that all required mitigation measures and conditions (e.g. follow-up monitoring requirements) are included in project permits and authorizations*****

Appendix 1 : Effects Identification Matrix (optional)

Section A *focuses on direct effects of the project and* ***Section B*** *on indirect effects that are caused by changes to the environment.*

A. Direct Effects										
	You may wish to change the components listed under the headings to specify the natural or cultural resources that are priority considerations for your PCA site or for the specific project being reviewed.		**Valued components potentially directly affected by the proposed project**							
			Natural Resources					Cultural Resources		
			Air	Soil & landforms	Water (surface, ground, crossings, etc.)	Flora (specify, including SAR)	Fauna (specify, including SAR)	Insert heritage values	Insert heritage values
	Phase	Examples of Associated Activities							
Project Components	Preparation / Construction / Operation / Decommissioning	Supply and storage of materials	☐	☐	☐	☒	☐	☐	☐
		Burning	☐	☐	☐	☐	☐	☐	☐
		Clearing	☐	☐	☐	☒	☒	☐	☐
		Demolition	☐	☐	☐	☐	☐	☐	☐
		Disposal of waste	☐	☐	☐	☐	☐	☐	☐
		Blasting/ Drilling	☐	☐	☐	☐	☐	☐	☐
		Dredging	☐	☐	☐	☐	☐	☐	☐
		Drainage	☐	☐	☒	☒	☒	☐	☐
		Excavation	☐	☒	☐	☐	☒	☐	☐
		Grading	☐	☒	☐	☐	☐	☐	☐
		Backfilling	☐	☒	☐	☐	☐	☐	☐
		Use of machinery	☒	☐	☐	☐	☒	☐	☐
		Transport of materials/ equipment	☒	☒	☐	☒	☐	☐	☐
		Building of fire breaks	☐	☐	☐	☐	☐	☐	☐
		Use of Chemicals	☐	☐	☒	☐	☐	☐	☐
		Set up of temporary facilities	☐	☐	☐	☐	☐	☐	☐
		Other…	☐	☐	☐	☐	☐	☐	☐

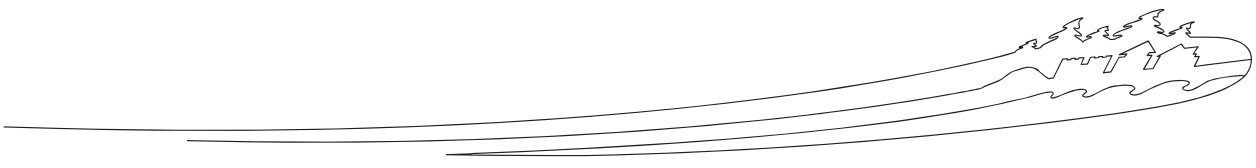
A. Direct effects continued

			Valued components potentially affected by the proposed project						
	You may wish to change the components listed under the headings to specify the natural or cultural resources that are priority considerations for your PCA site or for the specific project being reviewed.		Natural Resources					Cultural Resources	
			Air	Soil & landforms	Water (surface, ground, crossings, etc.)	Flora (specify, including SAR)	Fauna (specify, including SAR)	Insert heritage values	Insert heritage values
	Phase	**Examples of Associated Activities**							
Project Components	Preparation / Construction / Operation / Decommissioning	Waste disposal	☐	☐	☐	☐	☐	☐	☐
		Wastewater disposal	☐	☐	☐	☐	☐	☐	☐
		Maintenance	☐	☐	☐	☐	☐	☐	☐
		Use	☐	☐	☐	☒	☒	☐	☐
		Use/Removal of temporary facilities	☐	☐	☐	☐	☐	☐	☐
		Use of Chemicals	☐	☐	☐	☐	☐	☐	☐
		Active fire stage	☐	☐	☐	☐	☐	☐	☐
		Prescribed burn cleanup	☐	☐	☐	☐	☐	☐	☐
		Planting	☐	☐	☐	☒	☐	☐	☐
		Culling	☐	☐	☐	☐	☐	☐	☐
		Vehicle Traffic	☐	☐	☐	☐	☐	☐	☐
		Other…	☐	☐	☐	☐	☐	☐	☐

Section B *of the matrix should be used to identify potential indirect effects that may result from impacts of the project to components of the environment you have identified on the preceding pages (see Section A - direct effects to natural resources). Consideration of indirect effects is required under CEAA 2012 Sections 5(1)(c) and 5(2)(b), and by the PCA mandate. For example:*

- *if the proposed project could lead to adverse effects to water quality and quantity, could this then effect the quantity and quality of water resources (e.g. potable water) used by an Aboriginal community?*
- *could there also be adverse socio-economic effects to a community that relies on recreational fishing tourism?*
- *could changes to the environment (e.g. digging, clearing) affect visitor access, opportunities, or safety?*

B. Indirect Effects (all phases)							
You may wish to change the components listed under the headings to specify the natural or resources that are priority considerations for your PCA site or for the specific project being reviewed.		**Impacts as a result of changes to the environment**					
		With respect to non-Aboriginal peoples:	With respect to Aboriginal peoples:		With respect to visitor experience		
		Health and socio-economic conditions	Health & socio-economic conditions	Current use of lands and resources for traditional purposes	Access & services	Recreation & accommod'n opportunities	Safety
Phase	**Natural resource components affected by the project**						
Preparation /construction operation/implementation/decommissioning	Could impacts to <u>air</u> lead to adverse effects on…	☐	☐	☐	☐	☐	☐
	Could impacts to <u>soils and landforms</u> lead to adverse effects on…	☐	☐	☐	☒	☒	☒
	Could impacts to <u>water</u> (e.g. surface, ground water and water crossings) lead to adverse effects on…	☐	☐	☐	☒	☐	☐
	Could impacts to <u>flora</u> (including SAR) lead to adverse effects on…	☐	☐	☐	☐	☐	☐
	Could impacts to <u>fauna</u> (including SAR) lead to adverse effects on…	☐	☐	☐	☐	☐	☐
	Other…	☐	☐	☐	☐	☐	☐



Pavement Surfacing Assessment and Strategy

Mountain Avenue Improvements
Banff National Park of Canada

Submitted to: Parks Canada Agency Date: October 2017

PCA Standing Offer Agreement No.: 5P301-15-0002-006

PCA Call-Up No.: 45366885

Amec Foster Wheeler Job No.: CT164101

Executive Summary

Amec Foster Wheeler Environment & Infrastructure, a division of Amec Foster Wheeler Americas Limited (Amec Foster Wheeler) has been commissioned by Parks Canada Agency (PCA) to provide engineering services, namely surfacing assessments and strategy, related to improvements on Mountain Avenue and within the parking lots in the immediate vicinity of the Rimrock Resort Hotel, Banff Gondola and Upper Hot Springs, within Banff National Park.

Per the original scope of work, the surfacing assessment focused on assessing the current condition of the paved and gravel surfaces and provided recommendations based on the traffic loadings for various maintenance, repair and / or rehabilitation strategies with a life-cycle cost analysis and comparison. Regarding the treatment alternatives, this report mainly focused on asphalt concrete overly. Included with the Detailed Design Phase of the Mountain Avenue Improvements Project, the recommendations for concrete surface designs and associated costs targeted to specific areas (i.e. ROAM bus stops, tour bus drop-off / pick-up areas, roundabouts) will be incorporated, as required.

This report serves to summarize the site-specific field assessment, geotechnical assessment and pavement assessment efforts undertaken for this assignment, presents the findings of these assessments and studies, and introduces conclusions and recommendations pertaining to life cycle cost analysis for various treatments.

Field assessment, geotechnical assessment and pavement assessment were completed to gain a better understanding of the extent and severity of the surface distress associated with the existing pavement structures; to obtain targeted information about the subgrade soil, pavement structure and moisture conditions; and Life Cycle Cost Analysis was completed to better evaluate alternative treatments.

The following areas comprise the study area road network:

- **Area 1** – consists of the Lower Parking Lot, the Upper Parking Lot and the roadways leading into each of these parking lots from Mountain Avenue; and,
- **Area 2** – consists of the road leading from the Upper Parking Lot to the Upper Hot Springs.

Field Assessment

To observe the existing pavement condition within the study area, a visual pavement surface condition assessment was performed.

The collected information indicated that the overall condition of the pavement surface was good. The road leading from the Upper Parking Lot to the Upper Hot Springs showed the most signs of distress with transverse cracking and isolated pavement failures. Information in regards to the age of the existing pavement surfaces or quality testing from construction were not available for review. Considering the field review of the study area only, it was estimated that the existing asphalt pavements were constructed within a timeframe of approximately 10 years, with very little service life remaining without undertaking an extensive maintenance program within the next 5 years.

The following key findings pertaining to field reconnaissance are presented and discussed further within this report:

- **Transverse cracks –** generally moderate, few, majority on access road to Hot Springs with intermittent transverse cracking throughout the Upper and Lower Parking Lots;
- **Longitudinal cracks –** generally moderate, few;
- **Ruts –** generally moderate, at south end of Lower Parking Lot (buses turning);

- **Surface patches –** few, in fair to good condition; and,
- **Surface raveling –** generally slight to moderate at access to Hot Springs, and at pavement edges of the Lower Intersection and Lower Parking Lot access road.

Geotechnical Assessment

Following completion of the visual pavement assessment, the geotechnical investigation was performed. Generally, the geotechnical investigation provides information about the subsurface stratigraphy and thicknesses of the existing pavement which are presented and discussed further within this report. The geotechnical assessment scope of work generally consisted of:

- Borehole drilling:
  - Twelve (12) boreholes were advanced along the roadway alignments and the parking lots, in both the paved and non-paved areas.
- Soil classification:
  - Paved Areas:
    - Asphalt concrete pavement (ACP), depth: 70 - 130 mm
    - Gravel / Silt - Sand
  - Non-Paved Areas
    - Top soil
    - Gravel – Sand
    - Clay
    - Silt and Sand
- Observed groundwater conditions:
  - No water seepage and/or water accumulation was observed.
  - Seasonal fluctuations in water levels in response to meteorological cycles should be anticipated.
- Laboratory testing program, included:
  - moisture content determination;
  - fine soil particle distribution tests;
  - Atterberg limit test; and,
  - Moisture Density Relationship test.

Non-Destructive Falling Weight Deflectometer Testing

To assess the structural requirements for the existing paved structures and determine the thickness of an asphalt overlay, Amec Foster Wheeler used in-house non-intrusive Falling Weight Deflectometer (FWD) equipment. The FWD Testing was conducted on the existing paved areas, including sections of Mountain Avenue (access to Upper and Lower parking lots and Upper Hot Springs) and the Upper and Lower parking lots.

The data analysis estimated the future condition of parking lots and the access roads under different traffic loads. An additional benefit from the data collected was the compilation of preliminary maintenance, repair, and rehabilitation strategies.

Pavement Assessment

Amec Foster Wheeler conducted a traffic study in the project area in July / August 2016 to determine the existing traffic volumes and the traffic volumes projected for a period of twenty years. The traffic study provided an estimate for the heavy loads (buses and trucks) as a percentage of the peak traffic volume. Based on the aforementioned study, a three percent (3%) growth per annum was considered to be representative of the future traffic growth. The data derived from the traffic study and borehole logs, are presented within this report. This includes, but is not limited to, traffic volumes, growth rates, vehicle loading, CBR and underlying soil characteristics.

From the information presented regarding traffic volumes, field reconnaissance, geotechnical assessments, and soil classifications as well as from the results of the FWD testing, it was understood that the existing ACP thickness varied between 70 mm and 130 mm. An average existing ACP thickness of 80 mm was utilized in the subsequent asphalt concrete overlay design.

The analysis was based on FWD testing (Amec Foster Wheeler, 2016) and the AASHTO flexible pavement design methodology. The following recommended overlay thickness for each structure is estimated to provide a service life of approximately 20 years:

- Access to Lower Parking Lot and Lower Parking Lot: 120 mm
- Access to Upper Parking Lot: 120 mm
- Upper Parking Lot: 120 mm
- Access to Upper Hot Springs: 100 mm

The Upper Parking lot asphalt pavement surface was proposed to be extended towards the south. It would be cost effective to construct the extension at the same time when asphalt concrete overlay construction is scheduled. The pavement structure required is as follows:

- Granular Sub Base Course (GSBC): 400 mm
- Asphalt Concrete Pavement (ACP): 190 mm

Treatment Alternatives and Life Cycle Cost Analysis

When the overlay requirement is greater than 80 mm, the overlay construction is generally the most cost effective treatment, compared to other alternative short term treatments. If the recommended overlay pavement construction is to be delayed, preventive maintenance treatments, such as chip seal coat may provide short term preservation of the existing pavement surface. Using the field data from the visual and geotechnical investigation, FWD, and layer thickness data combined with traffic estimates, the following treatment alternatives were established and further evaluated for comparison purposes in this report:

- Alternative 1: Overlay at year 0;
- Alternative 2: Delay overlay to year 10;
- Alternative 3: No overlay, repair as required at 5 year intervals; and
- Alternative 4: Thin lift overlays.

Although the collected information from visual and geotechnical investigation indicated that the overall condition of the pavement surface was good, through previous conversations and discussions with PCA as well as from on-site observations within the project limits, PCA requested that Amec Foster Wheeler complete the Life Cycle Cost Analysis (LCCA) for the four aforementioned treatment alternatives.

Amec Foster Wheeler estimated costs for construction and maintenance based on Alberta Transportation published 2016 unit price averages report (UPA). The expected maintenance and rehabilitation over the design life were then determined and incorporated into a single, inflation-adjusted cost – Net Present Value (NPV), in order to evaluate and compare the different options in a fair and consistent manner.

From the LCCA, the following adjusted NPVs were calculated for each alternative:

- Alternative 1: $2,040,677;
- Alternative 2: $1,387,326;
- Alternative 3: $6,008,290; and
- Alternative 4: $1,546,355.

Alternative 1, Alternative 2, and Alternative 4 are bound by and aim to minimize the long term cost of maintenance and construction. Based on the cost difference between these three options (less than 10%), pavement serviceability and engineering judgement, Alternative 1 (Overlay at year 0) is considered the most effective treatment since this option will provide the least amount of disruption to the user for a small price premium over the analysis period.

Table of Contents

List of Appendices

Amec Foster Wheeler Environment & Infrastructure, a division of Amec Foster Wheeler Americas Limited – Third Party Disclaimer

1.0 Introduction

1.1 Background Information

Amec Foster Wheeler Environment & Infrastructure, a division of Amec Foster Wheeler Americas Limited (Amec Foster Wheeler) was retained by Parks Canada Agency (PCA), to provide engineering services related to a pavement surface assessment. This included conducting a limited geotechnical assessment and Falling Weight Deflectometer (FWD) testing, as well as preparing a surfacing strategy for the proposed upgrading of Mountain Avenue, the Upper Parking Lot and the Lower Parking Lot within the project limits on Sulphur Mountain. The area is located immediately adjacent to the Banff Gondola and Upper Hot Springs, and includes construction of an additional paved parking surface by extending the Upper Parking Lot to the south.

The project limits are comprised of two areas to be assessed:

- Area 1 – consists of the Lower Parking Lot (approximately 7,200 m² of pavement), the Upper Parking Lot (approximately 4,100 m² of pavement and 2,100 m² of gravel) and the roadways leading into each of these parking lots from Mountain Avenue (approximately 370 m of paved roadway or 3000 m² of pavement); and,
- Area 2 – consists of the road leading from the Upper Parking Lot to the Upper Hot Springs (approximately 200 m of paved roadway or 1600 m² of pavement).

Figure 1-1 illustrates these two areas.

Mountain Avenue, located within Banff National Park, is currently under the jurisdiction of and is operated by PCA. The south end of Mountain Avenue leads to the parking lots that service visitors to the Upper Hot Springs to the west and the Sulphur Mountain Gondola to the south.

The existing surface of Mountain Avenue and parking lots considered in this project consists primarily of asphalt concrete pavement (ACP) underlain by a granular subgrade structure. The existing section at the south end of the Upper Parking Lot is gravel surfaced.

In addition to the existing pavement surfaces, PCA is also considering an upgrade of the existing gravel surface within the Upper Lot to a fully paved surface. This will allow for an extension of the Upper Lot to the south and increase the number of marked parking stalls for passenger vehicles and RVs.

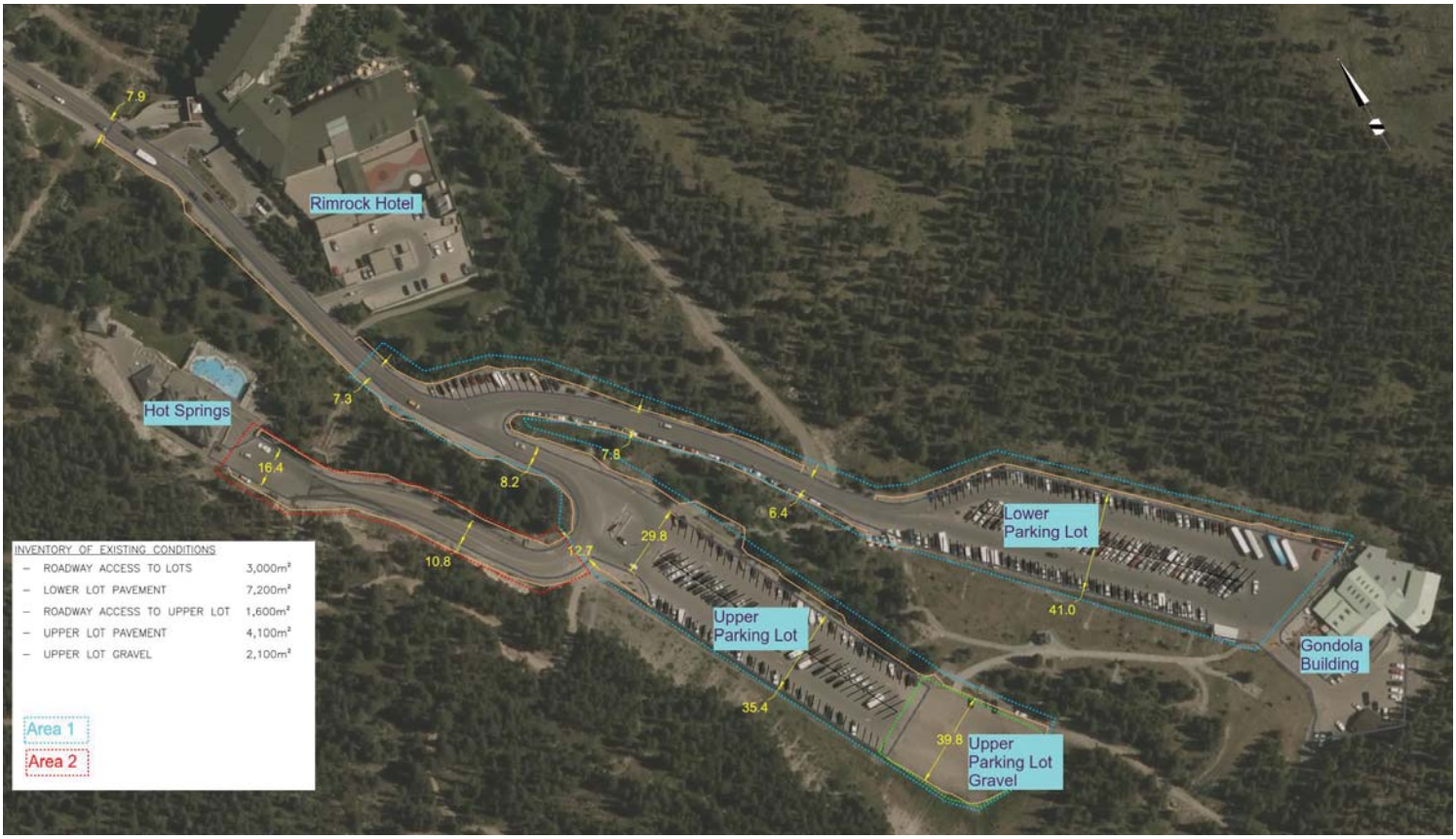


Figure 1-1: Project Site Plan

1.2 Scope of Work

The following summarizes Amec Foster Wheeler's scope of work for this assignment:

- Review and assess the current condition of the roadway and parking lot surfaces within the project limits;
- Undertake a geotechnical assessment to assess and understand the subsurface stratigraphy and structural properties of the subgrade conditions;
- Complete non-destructive testing to assess the structural capacity of the existing paved roadway and parking lot structures;
- Estimate the remaining service life of the existing roadways and parking lot surfaces;
- Generate, compare and assess potential maintenance, repair and rehabilitation strategies;
- Evaluate the long-term viability of the strategies through a life-cycle cost analysis; and,
- Provide recommendations based on the assessment and evaluation results.

The scope of work included a geotechnical field drilling program, a non-destructive (FWD) testing program, laboratory testing and compilation of borehole logs, engineering assessment and the preparation of this report.

1.3 Project Objectives and Deliverables

The main objective of the study was to provide results from the pavement analysis for use by PCA to better understand the current condition of the paved roadway and paved/gravel parking lot surfaces within the project limits. This report includes potential surfacing strategies, estimated construction costs and life cycle analysis for various surface treatments and a recommended approach for resurfacing based on PCA's financial constraints and priorities. The main focus for the surfacing strategies was asphalt concrete overly. For specific areas with different traffic patterns and loadings (i.e. ROAM bus stops, tour bus drop-off / pick-up areas, roundabouts), the recommendations for concrete surface designs and associated costs will be incorporated in the Detailed Design Phase of the Mountain Avenue Improvements Project.

The deliverables for this pavement surface assessment and strategy work were to:

- Determine the thickness of existing pavement structure;
- Identify the soils and groundwater conditions at the time of borehole drilling;
- Determine the adequacy of the existing pavement structures, by FWD testing;
- Analyse the geotechnical and pavement strength data;
- Provide recommendations for pavement preservation and / or rehabilitation;
- Provide recommendations for new construction; and
- Provide life cycle cost analysis for various pavement preservation and / or rehabilitation treatments.

1.4 Study Methodology

Two basic properties of a road or parking pavement surface can be quantified and should be evaluated to provide an overall pavement assessment:

- Surface conditions – indicate the current quality of a pavement; and
- Structural strength – indicates a pavement's ability to carry heavy traffic.

These two properties combined can be used to predict a pavement's performance under various circumstances.

Amec Foster Wheeler's proposed methodology to complete the surface assessment and prepare a comprehensive surfacing strategy involved various levels of field investigation (visual assessment, geotechnical investigation, FWD testing), a comprehensive review of the estimated remaining service life for the existing surfaces, and a complete evaluation of the potential maintenance, repair and rehabilitation strategies as well as their associated life-cycle costs / benefits to provide recommendations for surface improvements within the project limits. Additional details pertaining to the specifics of each component of this study are discussed in the sections below.

2.0 Project Team Structure

The Project Team for this assignment consists of members from PCA and Amec Foster Wheeler as identified below.

Parks Canada Agency Team Members

- Laurie McDonald, CET, LEED AP ID+C, Technical Services Coordinator II – Project Manager
- Greg Danchuk, Visitor Experience Manager

Amec Foster Wheeler Team Members

- Steve Wopnford, P.Eng. – Project Manager
- Jena Kurtenbach, P.Eng. – Project Engineer
- Jasmine Ahmadzadegan, EIT – Jr. Engineer
- Sultan Butt, P.Eng. – Senior Pavement Engineer
- Doug Cox, P.Eng. – Senior Pavement Review Engineer
- Additional field, traffic analysis and general engineering support

3.0 Field Assessment – Pavement Condition Survey

Pavement performance is highly variable due to many factors, such as pavement structural design, materials, subgrade, construction quality, climate, and traffic. These factors contribute to changes in pavement behavior that are reflected in the results of a pavement condition survey. Minimizing the impact of variability on pavement condition data helps ensure that survey results reflect real changes in pavement performance rather than variations in data due to poor data quality. The following briefly describes the primary methods for collecting pavement condition data:

- **Manual surveys** – Manual surveys are conducted by walking or traveling at slow speed and noting the existing surface distress. Manual surveys may be limited to selected segments or span the entire roadway length. Rut depth and/or faulting are typically estimated by taking manual spot measurements.
- **Automated surveys** – Automated surveys typically incorporate the use of vans fitted with equipment (e.g., lasers, high-speed cameras, and computers) specifically designed for collecting pavement and roadway features. Digital images of the transverse and longitudinal profiles of the roadway surface are captured at highway speeds for use in assessing pavement condition.

The standard set of condition data typically collected includes:

- **Asphalt**
  - Roughness
  - Rut depth
  - Transverse cracking
  - Alligator cracking
  - Block cracking
  - Longitudinal cracking
  - Blow-ups
  - Shoving or distortion
  - Potholes and/or patching
  - Bleeding
  - Raveling
  - Polishing

- **Gravel**
  - Potholes
  - Wash boarding
  - Loose aggregate or dust

Amec Foster Wheeler personnel conducted field reconnaissance of the parking lots and roads within the project limits at various times in 2016, to observe the extent and severity of the surface distresses associated with the existing pavement structures.

The field assessment was quantified by performing a visual pavement surface condition assessment in accordance with the Distress Identification Manual for the Long-Term Pavement Performance Studies, prepared by the Strategic Highway Research Program (SHRP) of the Federal Highway Administration (FHWA).

Information in regards to the age of the existing pavement surfaces, records of drawings, specifications or quality testing from construction were not available to review. From the field assessment, it was estimated that the existing asphalt pavements were constructed within a timeframe of 10 years, with very little service life remaining without undertaking an extensive maintenance program within the next 5 years.

The overall surface condition of the asphalt pavement structures were considered good with few surface distresses notable from the field review. Upper and Lower Parking Lots, and roadways leading into each of these parking lots from Mountain Avenue were in good condition with some minor surface distresses evident such as transverse cracking and ravelling at the edges of the Upper and Lower access roads. The road leading from the Upper Parking Lot to the Upper Hot Springs showed the most signs of distress with transverse cracking and isolated pavement failures that appeared to be the result of moisture infiltration, causing subgrade failure that was reflecting through to the asphalt pavement surface.

Through this field assessment, the observations were as follows:

- **Transverse cracks, generally moderate, few, majority on access road to Hot Springs with intermittent transverse cracking throughout the Upper and Lower Parking Lots**;
  - Transverse cracking is an unconnected crack that runs across a paved road, perpendicular to the direction of travel along the road. Transverse cracking may be the result of any one or more of the following:

- Main reason for transverse cracks are thermal cracks due to freeze – thaw cycles (i.e. hardening of the binder);
- The reflection of a crack or joint in an underlying pavement layer;
- A construction joint or shrinkage crack (due to low temperature or bitumen hardening) in an asphalt surface – majority of the transverse cracks are a result of this factor; or
- The structural failure of a base course.

- The recommended repair for this type of cracking is to patch/fill the cracks when they are first noticed, to prevent them from spreading into tertiary cracks and permitting the infiltration of moisture into the base course and subgrade.
- These types of cracks can lead to further weather-related damages, such as freeze-thaw expansion that results in wider failures beyond the crack and into full blown surface failures requiring full depth repairs.

- **Longitudinal cracks, generally moderate, few, majority on access road to Hot Springs**;
  - Longitudinal cracks occur parallel to the centerline of the pavement. They may be caused by any one or more of the following:
    - Poorly constructed joint;
    - Shrinkage of the asphalt layer;
    - Cracks reflecting up from an underlying layer;
    - Failure of subgrade or base course layers, or
    - Longitudinal segregation due to improper paver operation.
  - Fatigue cracks due to continuous directional loading (i.e. cyclical loading) is another type of longitudinal cracks.
  - The suggested maintenance is to seal the crack and fill with asphalt emulsion slurry or light grade of asphalt mixed with fine sand.

- **Ruts, generally slight, at south end of Lower Parking Lot (buses turning)**;
  - Ruts are longitudinal depressions in the pavement wheel paths created by repeated repetitions of heavy traffic and may be caused by:
    - The densification of pavement layers and the subgrade under the traffic loads;
    - The deformation and shoving of the asphalt concrete layers under heavy traffic;
    - Unstable granular and subgrade material, asphalt mixes or shoulder material;
    - Insufficient pavement thickness;
    - Lack of compaction;
    - Weaknesses in the pavement layers due to moisture infiltration; or
    - Weak asphalt mixtures.
  - Rutting may be accompanied by longitudinal cracking in the wheel paths.
  - Rutting may be considered as both structural distress and a safety issue.
  - In Alberta, rut measurements are carried out for the purposes of pavement evaluation and maintenance activities, however the rutting encountered on site is considered moderate and was not measured. There were however some minor visual signs of rutting that may indicate potential for future problematic rutting if traffic continues to grow and pavement is allowed to continue to deteriorate.
  - Ruts in asphalt pavement can be filled with asphalt, then overlaid with another layer of asphalt but better results can usually be achieved by milling off the surface to remove the affected asphalt and to restore the proper cross slope, then resurfacing.
  - The suggested maintenance is cold mill and overlay or thin surface patching.
  - If the ruts are formed due to deformation of the subbase below the pavement, the only long-term repair is generally full-depth reconstruction of the road.

- **Surface patch / utility cut, few, at access to Hot Springs, in fair to good condition**;
  - Surface patches are portions of pavement surface, greater than 0.1 m^2, that have been replaced or additional material applied to the pavement after original construction.
  - Patch failure may be caused by:
    - Poor installation techniques, such as inadequate compaction, inferior or improper materials; or
    - Failure of the surrounding or underlying pavement.
  - The suggested maintenance is to replace patch with deep or full-depth patch.

- **Surface raveling, generally slight to moderate, at access to Hot Springs**;
  - Surface ravelling is the wearing away of the pavement surface and may be caused by:
    - The dislodging of aggregate particles and loss of asphalt binder;
    - Excessive hardening of the asphalt binder; or
    - Poor-quality asphalt mixture.
  - Raveling ranges from loss of fines to loss of some coarse aggregate and ultimately to a very rough and pitted surface with obvious loss of aggregate.
  - The presence of raveling indicates potential mixture related performance problems.
  - Any surface treatment or thin overlay can usually fix the problem.

- There was very little visual evidence of surface failure of the existing asphalt surfaces in the Upper and Lower Parking Lot pavements. Most distresses were noted in the Upper Hot Springs Road related to transverse cracking with some indication of subgrade failure in localized small areas.

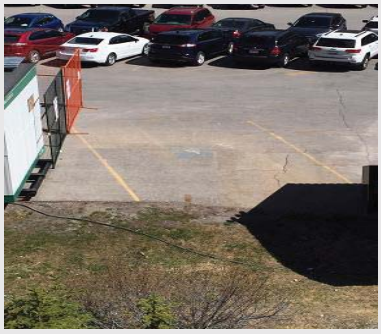
A few select examples of the observations noted above are summarized in Table 3-1.

Table 3-1: Field Assessment Observations

Field Assessment Observations

		
► Upper Hot Springs Access ► Longitudinal crack (localized)	► Upper Hot Springs Access ► Longitudinal crack (localized)	► Lower Parking Lot Access ► Longitudinal crack (localized)
		
► Upper Hot Springs Access ► Transverse crack (localized)	► Upper Hot Springs Access ► Transverse crack (localized)	► Lower Parking Lot Access ► Transverse crack (localized)

Field Assessment Observations



- Lower Parking Lot
  - Typical transverse crack

- Upper Parking Lot
  - Typical transverse crack

- Lower Parking Lot Access
  - Typical transverse and longitudinal crack

- Upper Intersection
  - Typical transverse crack

- Upper Intersection
  - Typical transverse crack

- Upper Hot Springs Road
  - Typical transverse and longitudinal crack

Field Assessment Observations

- Upper Parking Lot Gravel Area
  - Evidence of rutting and surface failures

- Upper Parking Lot Gravel Area
  - Evidence of rutting and surface failures

- Upper Parking Lot Gravel Area
  - Evidence of rutting and surface failures

- Upper Hot Springs Road
  - Subgrade failure

- Lower Parking Lot Access
  - Typical transverse and longitudinal crack
  - Shoulder edge ravelling / deterioration

- Lower Intersection
  - Typical transverse crack
  - Shoulder edge ravelling / deterioration

Field Assessment Observations

- Lower Intersection
  - Shoulder edge ravelling / deterioration

- Lower Parking Lot
  - Shoulder edge ravelling / deterioration

4.0 Geotechnical Assessment

The geotechnical investigation was performed following completion of the visual pavement assessment. The test hole locations were strategically selected to obtain targeted information about the subgrade soil, pavement structure and moisture conditions. The geotechnical investigation provides information about the subsurface stratigraphy and thicknesses of the existing pavement layers and includes laboratory testing to provide subgrade strength data.

The geotechnical assessment scope of work consisted of borehole drilling, classification of the soils encountered in the field, in-situ soil testing, observation of groundwater conditions and a laboratory testing program:

- Twelve (12) boreholes were advanced to depths between 1 m and 3 m:
  - Figure 4-1 identifies the proposed borehole locations.
- Amec Foster Wheeler coordinated the underground clearances through a private locator and Alberta 1 Call and included a site visit to mark the borehole locations and obtain private sweeps:
  - Geotechnical personnel supervised the private locate while on site coordinating the Alberta 1 Call locate.
- Amec Foster Wheeler used a geotechnical drilling subcontractor to advance the proposed boreholes:
  - A health and safety assessment, along with a tool box safety meeting, were completed prior to completion of the drilling;
  - Each borehole was logged on a continuous basis by an Amec Foster Wheeler representative according to the Modified Unified Soil Classification System (MUSCS);
  - Samples were retained at regular intervals and returned to Amec Foster Wheeler's Calgary laboratory to verify soil classification and for engineering analysis;
  - Auger cuttings were back spun into the boreholes or scattered along the fringe of the gravel parking area in the upper parking lot;
  - Cold asphalt mix patch was used to patch the road and parking lot surfaces where the boreholes were drilled into the pavement.
- Amec Foster Wheeler conducted several soil tests on the collected samples in the Calgary laboratory. The extent of laboratory testing, and the specific tests conducted depends on the types of soils encountered, however they generally include:
  - Moisture Content;
  - California Bearing Ratio;
  - Atterberg Limits;
  - Grain Size Analysis on granular materials.
- A summary of the subsurface conditions encountered at the borehole locations were provided along with the results of the field and laboratory soil testing programs.

A traffic accommodation strategy (TAS) was developed and reviewed with PCA prior to initiating the geotechnical investigation. The TAS included any necessary traffic signing or flag persons that were required to conduct the investigation safely while also protecting the travelling public or pedestrians within the work area. Work locations and proposed signings are included in Appendix A.

Figure 4-1: Borehole Locations

4.1 Borehole Drilling

Prior to commencement of the field work, Amec Foster Wheeler arranged for the services of Alberta First Call to establish clearances of buried utilities and pipelines within the project area. In addition, the services of an on-site private locator were also procured to sweep the individual borehole locations for clearance.

The borehole drilling was conducted on 25 October 2016. Twelve (12) boreholes, designated as BH16-01 to BH16-12, were advanced along the roadway alignments and the parking lots, in both the paved and non-paved areas. The boreholes were advanced to depths, ranging between 2.0 m and 3.5 m below existing grades. The borehole locations were selected in the field by Amec Foster Wheeler personnel and are illustrated in Figure 4-1. The field investigation was performed under the direction of Amec Foster Wheeler personnel and included drilling and logging of boreholes, in-situ testing and collection of soil samples. The soil sampling and testing sequences are shown on the borehole logs and were generally as follows:

- Soils encountered during drilling were classified in the field in accordance with the Modified Unified Soil Classification System (MUSCS), which is described in the 'Explanation of Terms and Symbols' in Appendix B.
- Disturbed soil samples were generally obtained from within the uppermost 1 m and at approximately 1 m depth intervals thereafter for moisture content determinations.
- Standard Penetration Tests (SPT) were conducted at select depths.
- Drill cuttings were used to backfill the boreholes. In paved areas the uppermost 0.3 m was backfilled with cold asphalt mix.

4.2 Laboratory Testing

The laboratory testing program consisted of moisture content determination, fine soil particle distribution tests, Atterberg limit test, California Bearing Ratio tests, and Moisture Density Relationship test, on a select number of samples. The results of the laboratory tests are presented on borehole logs, and the reports are attached in Appendix C.

4.3 Subsurface Soil Conditions

Detailed descriptions of soil conditions are presented on the borehole logs included in Appendix C. The soil conditions are summarized in the following sections. Variations in the thicknesses and conditions of the soils from that observed in the boreholes could be encountered between boreholes and in areas of the site not investigated.

4.3.1 Paved Areas

Boreholes BH16-01 to BH16-04, and boreholes BH16-08 to BH16-10 were advanced in areas with asphalt concrete pavement surface along Mountain Avenue and the Upper and the Lower Parking Lots. The generalized soil stratigraphy at the boreholes is presented in Table 4-1.

Table 4-1: Soil Stratigraphy at Boreholes (Paved Areas)

Borehole No.	Borehole Location		Soil Description: Depth	Borehole Termination Depth (m)	Water Conditions
	Northing	Easting			
BH16-01	5667288.09	601016.96	ACP: to 0.120 m Silt/Sand: to 0.8 m Gravel: to 3.3 m	3.3	No accumulation of water or sloughing at borehole completion
BH 16-02	5667319.92	600978.48	ACP: to 0.070 m Gravel: to 1.8 m	1.8	No accumulation of water or sloughing at borehole completion
BH16-03	5667388.53	600931.59	ACP: to 0.090 m Gravel: to 2.0 m	2.0	No accumulation of water or sloughing at borehole completion
BH16-04	5667387.53	600886.27	ACP: to 0.090 m Gravel: to 2.4 m	2.4	No accumulation of water or sloughing at borehole completion
BH16-08	5667450.41	600785.96	ACP: to 0.120 m Gravel: to 3.5 m	3.5	No accumulation of water or sloughing at borehole completion
BH16-09	5667395.71	600826.77	ACP: to 0.130 m Gravel: to 3.5 m	3.5	No accumulation of water or sloughing at borehole completion
BH16-10	5667314.4	600833.13	ACP: to 0.080 m Silt/Sand: to 1.5 m Gravel: to 3.0 m	3.0	No accumulation of water or sloughing at borehole completion

ACP: Asphalt Concrete Pavement

4.3.1.1 Asphalt Concrete Pavement (ACP)

Asphalt concrete pavement was encountered at the surface in all the boreholes. The thickness of ACP ranged between 70 mm and 130 mm. The ACP surface was considered to be in good condition.

4.3.1.2 Gravel / Silt - Sand

A layer of gravel was encountered, below the ACP layer, in all boreholes, except in BH16-01 located at the far end of the Lower Parking Lot, where silt and sand mixture was encountered below the ACP layer, underlain by gravel. The gravel was observed to the termination depth at each borehole.

The gravel encountered was classified as sandy/silty, with some cobbles, trace of clay, moist and dense in consistency.

The silt/sand mixture in BH16-01 was classified as fine grained, with some gravel, trace of clay, damp, and very stiff to hard in consistency.

4.3.2 Non-Paved Areas

Boreholes BH16-05 to BH16-07 were advanced in areas with no asphalt concrete pavement surface at locations immediately adjacent to Mountain Avenue, the Upper and Lower Parking Lots and the access road to the Upper Hot Springs. Boreholes BH16-11 and BH16-12 were advanced in the gravel area of the Upper Parking Lot. The generalized soil stratigraphy at the boreholes is presented in Table 4-2.

Table 4-2: Soil Stratigraphy at Boreholes (Non-Paved Areas)

Borehole No.	Borehole Location		Soil Description: Depth	Borehole Termination Depth (m)	Water Conditions
	Northing	Easting			
BH16-05	5667445.56	600839.23	Topsoil: to 0.050 m Sand/Gravel: to 0.7 m Clay: to.2.0 m	2.0	No accumulation of water or sloughing at borehole completion
BH 16-06	5667510.54	600760.16	Topsoil: to 0.050 m Silt – Sand: to 2.2 m Sand – Gravel: to 2.6 m	2.6	No accumulation of water or sloughing at borehole completion
BH16-07	5667447.28	600744.95	Topsoil: to 0.050 m Silt – Sand: to 2.1 m Sand – Gravel: to 3.0 m	3.0	No accumulation of water or sloughing at borehole completion
BH16-11	5667311.14	600848.65	Gravel: to 2.1 m Sand: to 3.0 m	3.0	No accumulation of water or sloughing at borehole completion
BH16-12	5667284.36	600878.42	Silt – Sand: to 2.0 m	3.5	No accumulation of water or sloughing at borehole completion

4.3.2.1 Top Soil

An organic layer of topsoil, approximately 50 mm in thickness, was encountered in boreholes BH16-05 to BH16-07.

4.3.2.2 Gravel – Sand

A layer of gravel was encountered, below the topsoil in BH16-05, below sand layer in BH16-06 and BH16-07 and from the existing surface to a depth of approximately 2.1 m in BH16-11.

The gravel encountered was classified as sandy/silty, with trace of clay, moist and very dense in consistency.

4.3.2.3 Clay

Clay soil was encountered underlying the topsoil and gravel in Borehole BH16-05, to the borehole termination depth of 2.0 m. The clay soil was classified as silty/sandy, low plastic, with trace amounts of gravel. The clay soil was considered to be stiff to hard in consistency.

The results of the Atterberg Limit test showed a Liquid Limit of 16 percent and a corresponding Plastic Limit of 10 percent, indicative of low plastic silty clay. The moisture content from a sample of the clay fill was approximately 9 percent. Based on a comparison between the in-situ moisture content and the plastic limit, the clay fill soils are considered to be near the estimated optimum moisture content (OMC).

4.3.2.4 Silt and Sand

Silt and sand mixture was encountered, below the top soil in borehole BH16-06, BH16-07 and below gravel in BH16-11 and from the surface to the borehole termination depth in BH16-12. The sandy mix was classified as fine grained with traces of gravel, moist, compact to dense in consistency.

4.4 Groundwater Conditions

Groundwater conditions were monitored during and at the completion of drilling. At the completion of drilling, no water seepage and/or water accumulation was observed. Seasonal fluctuations in water levels in response to meteorological cycles should be anticipated. Typically, higher water levels prevail following spring thaw and periods of prolonged rainfall.

4.5 Falling Weight Deflectometer Testing

To determine the existing pavement strength, Amec Foster Wheeler used in-house Falling Weight Deflectometer (FWD) equipment. The FWD is a non-destructive testing and non-intrusive device which is used to achieve a

rapid and repeatable in-situ characterization of the pavement layer stiffness of flexible and rigid pavements. The FWD applies dynamic loads simulating the magnitude and duration of a single heavy moving wheel load. The pavement responses (deflections) at various distances from the loading plate are measured by a series of geophone sensors. By applying FWD test data, pavement analysis and design are carried out in a more rational and accurate manner that leads to selecting optimum pavement maintenance and rehabilitation strategies that translate to construction cost savings.

Amec Foster Wheeler utilized the 2015 Dynatest model 8002 FWD. A TAS was developed that included a flagger to conduct the FWD testing safely. The FWD testing unit was pulled by a vehicle with onboard lighting which made the unit highly visible to other drivers on the roadway or parking areas.

The purpose of the FWD testing was to assess the structural requirements for the existing paved structures and determine the thickness of an asphalt overlay, if required. The FWD testing was conducted on the existing paved areas, including sections of Mountain Avenue (access to Upper and Lower parking lots and Upper Hot Springs) and the Upper and Lower parking lots, on 19 October 2016.

The testing was conducted in both lanes of Mountain Avenue (access roads) and in the travel lanes between the parking stalls in the parking lots. The testing was conducted at an approximate interval of 40 m.

5.0 Pavement Surfacing Assessment

5.1 Flexible Pavement

The flexible pavement overlay structural design, for the access roadways to the parking lots and to the Upper Hot Springs, and the Upper and Lower parking lots is based on the American Association of State Highway and Transportation Officials (AASHTO) methodologies – Appendix D, that takes into account the cumulative number of equivalent single axle loads (ESALs) the roadway will be subjected to within a specific design period.

A traffic study in the project area was undertaken in July, August and September 2016, by Amec Foster Wheeler and the Traffic Assessment Report has been prepared. The purpose of the study, among other things was to determine the existing traffic volumes and the traffic volumes projected for a period of twenty years. The data collected during the traffic assessment study was compiled, compared and reviewed. Ultimately, August long weekend had the highest recorded traffic volumes on 31 July 2016 and 1 August 2016. These a.m. and p.m. peak volumes were then used for existing (2016) peak conditions. The traffic study also provided an estimate for the heavy loads (buses and trucks) as a percentage of the peak traffic volume. The peak hourly traffic volume was considered to be equivalent to ten percent of the daily traffic volumes.

Based on the aforementioned study, a three percent (3%) growth per annum was considered to be representative of the future traffic growth. The approximate values, derived from the traffic study and borehole logs, are presented in Table 5-1.

Table 5-1: Flexible Pavement – Existing Values

Structure	Existing Pavement Structure (mm)		Estimated Traffic Volumes (vehicles per a.m. / p.m. peak hour)	Weighted % Heavy Loading (bus + truck)
	ACP	Subgrade		
Access to Lower Parking Lot and Lower Parking Lot	70-120	Granular	219 (p.m.)	8
Access to Upper Parking Lot and Upper Hot Springs	80-120	Granular	216 (p.m.)	6
Upper Parking Lot	80-130	Granular	171 (p.m.)	6
Access to Upper Hot Springs	80 (assumed)	Granular	45	6

Note: a.m. Peak = p.m. Peak = 10% of Daily Traffic. The higher of the estimated values of a.m. and p.m. peak, from traffic data, were selected for design purposes.

The following design input parameters were utilized in the formulation of the pavement structural design for the access roadways and parking lots:

- ESAL/day/direction: as per Table 5-2
- Traffic growth: 3%
- Design period: 20 years
- Cumulative design ESAL: as per Table 5-2
- Subgrade resilient modulus (for new construction): 30 MPa (40 MPa if silty sand)
- Initial serviceability: 4.2
- Terminal serviceability: 2.5
- Overall standard deviation: 0.45
- Reliability: 50% (for rehabilitation)
- Reliability: 85% (for new construction)
- Structural coefficient for ACP: 0.4
- Structural Coefficient for GBC (crushed gravel): 0.14
- Structural Coefficient for GSBC (granular fill): 0.10
- Climatic Zone for mix type: Zone 2 (as per Alberta Transportation)
- Asphalt concrete mix type: H2, PG 58-28 (As per Alberta Transportation) or equivalent

The existing ACP thickness varied between 70 mm and 130 mm within the project limits. An ACP thickness of 80 mm was utilized in the subsequent asphalt concrete overlay design.

Table 5-2: Flexible Pavement – Design Values

Structure	Daily Traffic (VPD)	Heavy Loads (%)	ESALs per Day per Direction	Cumulative 20 Year Design ESALs (at 3%/Annum growth)
Access to Lower Parking Lot and Lower Parking Lot	2190	8	525	5.1×10^6
Access to Upper Parking Lot and Upper Hot Springs	2160	6	389	3.8×10^6
Upper Parking Lot	1710	6	308	3.0×10^6
Access to Upper Hot Springs	450	6	81	0.8×10^6

Note: VPD: vehicles per day = (a.m. peak or p.m. peak) / 0.10
ESAL: Equivalent Single Axle Load
Majority of the heavy loads consisted of loaded buses.
Heavy Load ESAL Factor (loaded bus) = 3 ESAL per Heavy Load (utilized in design for all heavy loads)
Cumulative 20 Year Design ESALs are based on a 3 percent per annum growth rate.

5.2 Flexible Pavement Assessment and Design

The single point FWD analysis was carried out to determine the structural adequacy of the existing pavement. The analysis was based on FWD testing (Amec Foster Wheeler, 2016) and the AASHTO flexible pavement design methodology – Appendix D. The structural requirements were determined for access roads and parking lots, based on the 20 year cumulative design ESALs. The asphalt concrete overlay plots are attached in the Appendix E. A summary of the analysis is presented in Table 5-3 below. The recommended overlay thickness for each structure is estimated to provide a service life of approximately 18 years.

Table 5-3: Recommended Overlay Thickness

Structure	Lane (Location)	Structural Requirements – Overlay (mm)			Recommended AC Overlay Thickness (mm)
		Minimum	Maximum	Average	
Access to Lower Parking Lot and Lower Parking Lot	West	40	147	94	120
	East	31	141	92	
Access to Upper Parking Lot	West	83	133	103	120
	East	75	95	88	
Upper Parking Lot	West	11	110	72	120

Structure	Lane (Location)	Structural Requirements – Overlay (mm)			Recommended AC Overlay Thickness (mm)
		Minimum	Maximum	Average	
	East	20	65	40	
Access to Upper Hot Springs	West	0	120	38	100
	East	27	82	50	

5.3 Parking Lot Extension (New Construction)

The Upper Parking Lot asphalt pavement surface is proposed to be extended towards the south. Borehole BH16-11, in the current gravel surface area (south of the paved area), indicated a granular fill layer to a depth of approximately 2 m, underlain by silty sand. Borehole BH16-12, located south of BH16-11, indicated presence of silty sand fill, to the borehole termination depth of 2.0 m. It would be prudent and cost effective to construct the extension at the same time when asphalt concrete overlay construction is scheduled.

Based on AASHTO flexible pavement specified layered design, the minimum requirements, based on three million ($3x10^6$) cumulative design ESALs and an estimated design subgrade resilient modulus value of 30 MPa for the fill gravel/sand, are presented below in Table 5-4.

Table 5-4: New Construction Recommended Values

Structure	Cumulative Design ESAL	Structural No (SN) required	Structural Design		
			GSBC	ACP	Design SN
Upper Parking Lot Extension	3×10^6	116	400	190	116

GSBC: Granular Sub Base Course (fill) ACP: Asphalt Concrete Pavement

6.0 Treatment Alternatives

Typically, the data collected as part of the pavement and geotechnical investigations are used to identify the preliminary maintenance, repair, and rehabilitation strategies, which may include alternatives such as:

- Crack seal;
- Slurry seal;
- Deep patching;
- Overlay;
- Full depth reclamation;
- Cold in-place recycling;

- Hot in-place recycling;
- Mill and inlay to prescribed depths;
- Partial reconstruction; and
- Full reconstruction.

A summary of typical maintenance alternatives / actions is presented in Table 6-1 below.

Table 6-1: Typical Maintenance Alternatives

Action Type	Flexible Pavement Surface	Gravel Surface
Routine Maintenance	▶ Pothole Repair ▶ Shallow Patching ▶ Spray Patching ▶ Drainage Improvement	▶ Local Grading ▶ Dust Control ▶ Drainage Improvement
Preservation	▶ Crack Sealing ▶ Spray Patching ▶ Full-Depth Patching ▶ Thin Asphalt Overlay ▶ Milling and Inlay ▶ Slurry Sealing ▶ Seal Coat ▶ Micro surfacing	▶ Grading and Drainage Improvement
Rehabilitation	▶ Resurfacing – Structural ▶ Milling and Resurfacing – Structural ▶ Hot In-Place Recycling ▶ Cold In-Place Recycling ▶ Full-Depth Reclamation	▶ Re-Graveling ▶ Scarification and Grading ▶ Stabilization

As illustrated in Figure 6-1, pavement preservation treatments are proactive, consisting of well-timed and executed activities to prevent premature distresses and to slow the rate of deterioration. They would normally occur earlier in the service life of the pavement before it has reached a limit of serviceability. Rehabilitation consists of structural enhancements that renew the service life of an existing pavement and improve its load carrying capacity.

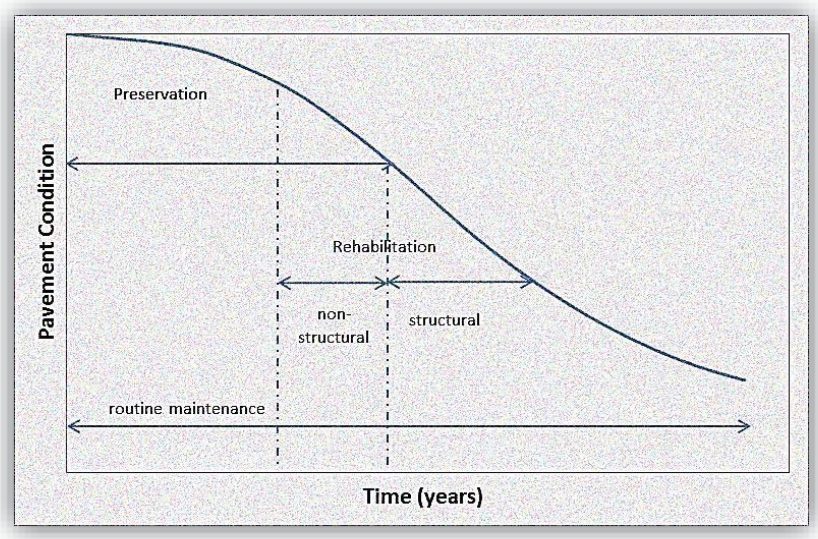


Figure 6-1: Timing of Treatments (Transportation Association of Canada, Pavement Design and Management Guide)

Generally, when the overlay requirement is greater than 80 mm, overlay construction is the most cost effective treatment, compared to alternative short term treatments, such as a thin overlay with an estimated approximate service life of 5 - 6 years.

Based on the condition of the existing pavement surface with minimal structural distresses, other alternatives, such as deep patching, mill and inlay, full depth reclamation, partial re-construction, full re-construction and hot in-place or cold-in-place recycling, are neither required nor would they enhance the structural capacity to meet the requirements, listed in Table 5-3 of this report.

Notwithstanding the above, generally moderate fatigue cracks were observed at the south end of the Lower Parking Lot, at or near the bus terminal. The plastic deformation in the asphalt concrete pavement (rutting) occurs generally in warmer temperatures, and under the action of repeated channelized heavy loadings. Plastic movement can occur either in the subgrade or in the asphalt concrete. Majority of the rutting is classified as instability rutting that takes place due to slow movements, stoppages, acceleration and deceleration of heavy loads, such as buses. These factors induce a combined effect of horizontal and vertical stresses and accompanying strains, such as rutting and shoving. Generally rutting is present within the uppermost layer(s) of asphalt concrete pavement.

To mitigate rutting, generally, the upper layer(s) of the existing asphalt pavement are milled to a specified depth and inlayed with asphalt mix, prior to the construction of an overlay.

If the recommended overlay pavement construction is to be delayed, preventive maintenance treatments, such as crack repairs, fog coat, chip seal coat, slurry seal and/or micro surfacing will provide short term preservation of the existing pavement surface, without providing additional structural strengthening to the existing pavement structures.

Four treatment alternatives were developed for consideration, comparison and evaluation. These alternatives range from options that focus on immediate overlay to delaying overlays with increased levels of maintenance. The alternatives are as follows:

- Alternative 1: Overlay at year 0 (2017) includes:
  - 2017:
    - Overlay 120 mm (paved area)
    - New construction (gravel area)
    - Full depth repair (10% of the total area)

- 2027:
  - Seal coat
  - Minor crack filling (1000 m)
  - Full depth repair (10% of the total area)
- 2037:
  - Overlay 120 mm (paved area)
  - Overlay 120 mm (gravel area)
- 2047:
  - Seal coat
  - Full depth repair (10% of the total area)

- Alternative 2: Delay overlay includes:
  - 2017:
    - Seal coat
    - Minor crack filling (1000 m)
    - Full depth repair (10% of the paved area)
    - New construction (gravel area)
  - 2027:
    - Overlay 120 mm (paved area)
    - Seal coat (gravel area)
  - 2037:
    - Seal coat
    - Full depth repair (10% of the paved area)
    - Minor crack filling (1000 m)
    - Overlay 120 mm (gravel area)
  - 2047:
    - Overlay 120 mm (paved area)
    - Seal coat (gravel area)

- Alternative 3: No overlay includes:
  - 2017:
    - Seal coat
    - Full depth repair (10% of the paved area)
    - New construction (gravel area)
  - 2022:
    - Full depth repair (15% of the paved area + 5% of the gravel area)
  - 2027:
    - Full depth repair (20% of the paved area + 10% of the gravel area)
    - Seal coat
  - 2032:
    - Full depth repair (25% of the paved area + 15% of the gravel area)
  - 2037:
    - Full depth repair (30% of the paved area + 20% of the gravel area)
    - Seal coat

- 2042:
  - Full depth repair (35% of the paved area + 25% of the gravel area)
- 2047:
  - Full depth repair (40% of the paved area + 30% of the gravel area)
  - Seal coat

- Alternative 4: Thin lift overlays includes:
  - 2017:
    - Seal coat
    - Minor crack filling (1000 m)
    - Full depth repair (10% of the paved area)
    - New construction (gravel area)
  - 2022:
    - 40 mm Overlay (paved area)
    - Milling
  - 2027:
    - 40 mm Overlay (paved area)
    - Milling
  - 2032:
    - 40 mm Overlay (the total area)
    - Milling
  - 2037:
    - 40 mm Overlay (the total area)
    - Milling
  - 2042:
    - 40 mm Overlay (the total area)
    - Milling
  - 2047:
    - 40 mm Overlay (the total area)
    - Milling

Table 6-2 below summarizes these alternatives and provides details regarding recommended actions for each alternative over a 30 year duration, which will be used as part of the life cycle cost analysis in the following section.

Table 6-2: Treatment Alternatives

Year	0	5	10	15	20	25	30
Alt. 1	Overlay 120 mm (existing paved area) + New construction (existing gravel area) + Full depth repair (10% of the total area)		Seal coat w/ minor crack filling (1000 m) + Full depth repair (10% of the total area)		Overlay 120 mm (existing paved area) + Overlay 120 mm (existing gravel area)		Seal coat + Full depth repair (10% of the total area)
Alt. 2	Seal coat w/ crack filling (minor - 1000 m) + Full depth repair (10% of the existing paved area) + New construction (existing gravel area)		Overlay 120 mm (existing paved area) + Seal coat (existing gravel area)		Seal coat + Full depth repair (10% of the existing paved area) + Crack filling (1000 m) + Overlay 120 mm (existing gravel area)		Overlay 120 mm (existing paved area) + Seal coat (existing gravel area)
Alt. 3	Seal coat + Full depth repair (10% of the existing paved area) + New construction (existing gravel area)	Full depth repair (15% of the existing paved area + 5% of the existing gravel area)	Full depth repair (20% of the existing paved area + 10% of the existing gravel area) + Seal coat	Full depth repair (25% of the existing paved area + 15% of the existing gravel area)	Full depth repair (30% of the existing paved area + 20% of the existing gravel area) + Seal coat	Full depth repair (35% of the existing paved area + 25% of the existing gravel area)	Full depth repair (40% of the existing paved area + 30% of the existing gravel area) + Seal coat
Alt. 4	Seal coat w/ crack filling (minor - 1000 m) + Full depth repair (10% of the existing paved area) + New construction (existing gravel area)	40 mm Overlay (existing paved area) + Milling	40 mm Overlay (existing paved area) + Milling	40 mm Overlay (the total area) + Milling	40 mm Overlay (the total area) + Milling	40 mm Overlay (the total area) + Milling	40 mm Overlay (the total area) + Milling

7.0 Life-Cycle Cost Analysis

When selecting pavement alternatives it is important to understand the expected pavement performance and costs for the entire life-cycle of the pavement. The overall costs and value need to be determined over many years to effectively consider the different options in terms of pavement type, design life, and future rehabilitation. Life-cycle cost analysis (LCCA) has been used for many years to assist in making decisions regarding pavement type as well as selecting pavement preservation options.

In a typical LCCA, alternatives are available for an initial pavement design or surface treatment. Based on the initial pavement designs, the expected maintenance and rehabilitation over the design life are then determined and incorporated into a single, inflation-adjusted cost in order to evaluate and compare the different options in a fair and consistent manner. An analysis period of 30 to 40 years can be considered typical for such an analysis. In Alberta, the standard analysis period is generally 30 years.

Overall the LCCA incorporates initial and discounted future costs that PCA would incur to maintain an acceptable level of service with these surfaced areas. Identifying these costs associated with each alternative over its service life helps to evaluate which alternative(s) provides the best value and lowest long term cost while satisfying the objectives of PCA for the investment expenditures being considered.

The steps were taken to complete the LCCA can be summarized as follows:

- Establish alternative pavement design strategies for the analysis period (four alternative strategies have been identified for comparison purposes);
- Determine performance periods and timing for maintenance and rehabilitation;
- Estimate costs for construction and maintenance – costs have been estimated using Alberta Transportation historical prices based on the published 2016 unit price averages report (UPA) – Appendix F;
- Compute Net Present Value (NPV);
- Analyze results; and
- Review design strategies.

7.1 Life-Cycle Cost Analysis Results

The following assumptions have been made in order to complete the LCCA:

- Discount Rate: 2%;
- User Costs: 0;
- Remaining life on existing pavement: 10 years;
- Seal coat required after 10 years of service;
- After 10 years with no construction, full depth repair area increases 10%;
- ACP: 2.33 t/m^3;
- GBC: 2.10 t/m^3;
- Costs estimates based on the published Alberta Transportation 2016 UPA;
- Design period: 20 years;
- Total paved area: 16000 m^2; and
- Gravel area: 2100 m^2.

Table 7-1 presents the summary of the LCCA. A preliminary Class 'C' Estimate for the four treatment alternatives is included in Appendix G.

Table 7-1: Life Cycle Cost Analysis

	Alt. 1: Overlay at year 0		Alt. 2: Delay overlay		Alt. 3: No overlay		Alt. 4: Thin lift overlays	
Year	**Capital ($)**	**NPV ($)**	**Capital ($)**	**NPV ($)**	**Capital ($)**	**NPV ($)**	**Capital ($)**	**NPV ($)**
0	1,075,510	1,075,510	798,150	798,150	788,150	788,150	798,150	798,150
5	0	0	0	0	626,250	567,214	213,120	193,029
10	643,500	527,894	468,360	384,218	1,033,500	847,830	213,120	174,833
15	0	0	0	0	1,078,750	801,527	241,092	179,135
20	506,076	340,575	628,716	423,108	1,486,000	1,000,035	241,092	162,248
25	0	0	0	0	1,531,250	933,344	241,092	146,953
30	633,500	349,737	468,360	258,568	1,938,500	1,070,189	241,092	133,100
Salvage Value ($)	253,038		476,718		0		241,092	
Adjusted NPV ($)	2,040,677		1,387,326		6,008,290		1,546,355	

The following key points can be taken from the results of the LCCA:

- Delaying the overlay to year 10 (Alternative 2) while implementing immediate repairs results in the lowest cost. However, user impact due to disruption from construction and repairs prior to year 10 needs to be considered when selecting treatment options. This option is feasible if PCA accepts the existing pavement condition and considers short term maintenance.
- The highest cost alternative is no overlay with continuous repairs. This will be very disruptive to the user and as the surface deteriorates the risk of incurring greater repair cost increases annually. This option is not recommended.
- Applying thin lift overlay is similar to delaying the overlay in alternative 2. However, this option results in more disruption to the user due to the higher frequency of construction activities. Due to the level of disruption to the user, this alternative is not recommended.
- While alternative 1 has a higher cost than alternatives 2 and 4, it results in less user disruption for a small cost increase over the 30 year analysis period.

In conclusion, based on the cost difference between the four alternatives, Alternative 1 (Overlay at year 0) is considered the most efficient and least disruptive option, however, if the recommended overlay pavement construction is to be delayed, it will be necessary to provide short term preservation of the existing pavement surface.

8.0 Conclusions and Recommendations

As mentioned earlier herein, this report mainly focused on asphalt concrete overlay as the potential surfacing treatment. The recommendations for concrete surface designs for specific areas (i.e. ROAM bus stops, tour bus drop-off / pick-up areas, roundabouts) will be included with the Detailed Design Phase of the Mountain Avenue Improvements Project.

Based on the review of the above information, the site reconnaissance observations, the design inputs, and the pavement structural analysis based on AASHTO methodologies, the following recommendations are presented.

It is recommended that prior to the construction of asphalt concrete overlay, all moderate to severe cracks should be sealed or spray patched.

- **Lower Parking Lot and Access to Lower Parking Lot**

ACP Overlay	**120 mm**	**Two Lifts**	**60 mm top lift**
			60 mm bottom lift

- **Upper Parking Lot and Access to Upper Parking Lot**

ACP Overlay	**120 mm**	**Two Lifts**	**60 mm top lift**
			60 mm bottom lift

- **Access to Upper Hot Springs**

ACP Overlay	**100 mm**	**Two Lifts**	**50 mm top lift**
			50 mm bottom lift

Based on the geographic location and the design traffic volumes, an Alberta Transportation Mix Type H2, with a PG 58-28 binder, is recommended for both lifts.

- **Upper Parking Lot Extension**

It is recommended that the existing gravelled section and non-gravelled section to the south should be excavated to an elevation, 590 mm below the design top-of-asphalt elevation that would provide a level surface with the rest of the parking areas, after the recommended overlay construction.

Prior to the construction of granular sub base course, the base of the excavation should be compacted to the project specifications and proof rolled to identify any weak (yielding) areas. If weak areas are present, the section should be excavated to an additional 300 mm, backfilled with granular sub base course materials, and compacted to the project specifications. Subsequent to an adequate subgrade preparation, a granular sub base course, followed by the asphalt concrete pavement should be constructed.

ACP	**190 mm**	**Three Lifts**	**50 mm top lift** **60 mm middle lift** **80 mm bottom lift**
GSBC	**400 mm**	**Two lifts of equal thickness**	**Locally available gravel, maximum 100 mm aggregate size**
Subgrade			**Prepared to Project Specifications**

Based on the geographic location and the design traffic volumes, an Alberta Transportation Mix Type H2 for 50 mm and 60 mm lifts, and Type S3 for the 80 mm lift, with a PG 58-28 binder is recommended for this portion of the project.

- **Short Term Pavement Preservation Treatments**

If the construction of the recommended overlays is programmed beyond 2020, the short term preservation treatments, such as fog coat, crack sealing, crack spray patching, slurry coat and/or micro surfacing may be considered. The short term treatments are designed to retard the surface deterioration, but do not add to the existing structural capacity of the existing pavement.

9.0 Closure

The findings and recommendations are based on Amec Foster Wheeler field drilling program and the results of the 12 boreholes combined with an interpolation of soil conditions between borehole locations.

This report has been prepared for the exclusive use of Parks Canada Agency for the project described herein and has been prepared in accordance with generally accepted engineering practices. Any use that a third party makes of this report, or any reliance or decisions based on this report are the sole responsibility of those parties.

This report is respectfully submitted by:

Amec Foster Wheeler Environment & Infrastructure,
a division of Amec Foster Wheeler Americas Limited

Prepared By:

Jasmine Ahmadzadegan, EIT
Transportation Engineer-in-Training

Prepared By:

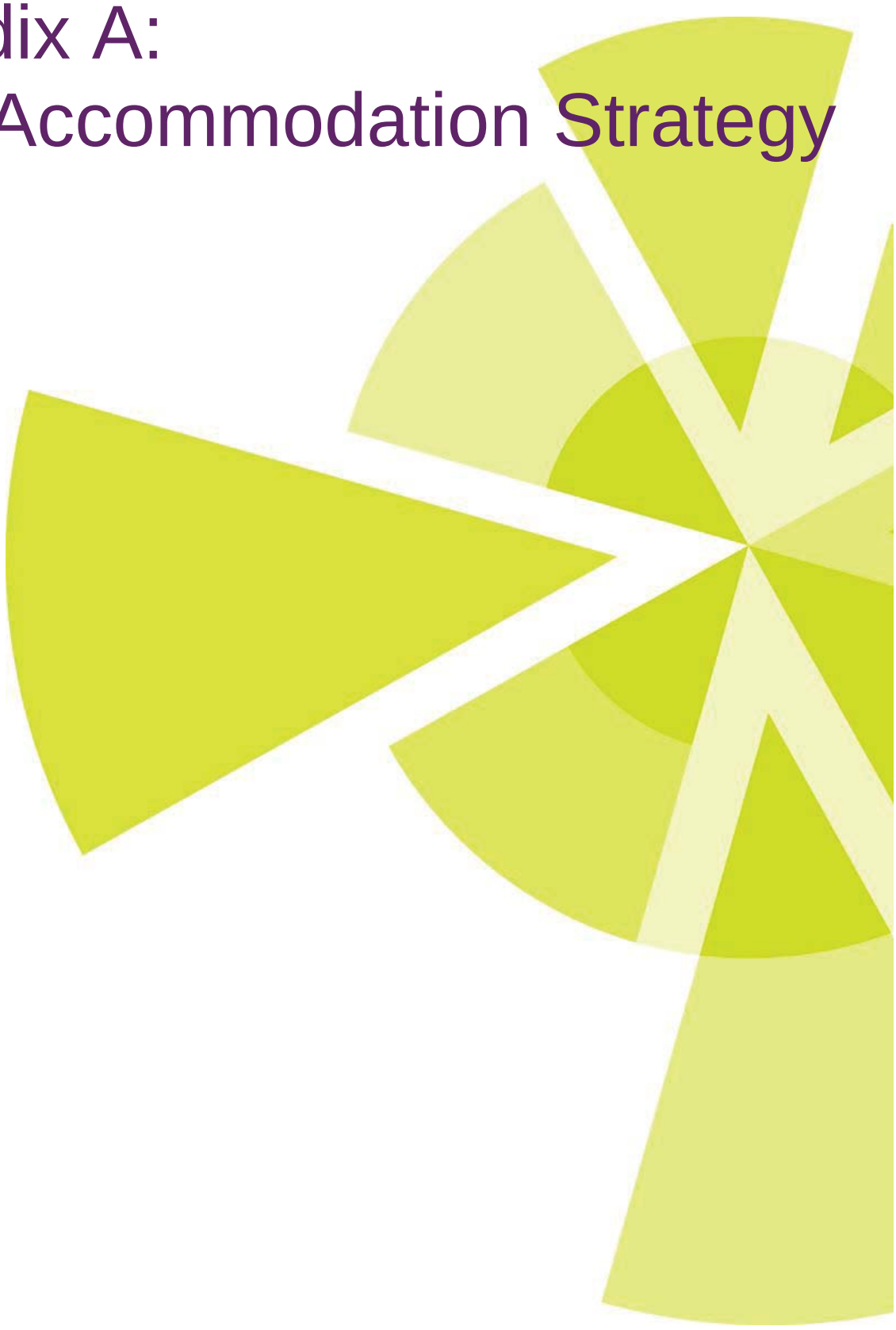
Sultan Butt, P.Eng.
Senior Pavement Engineer

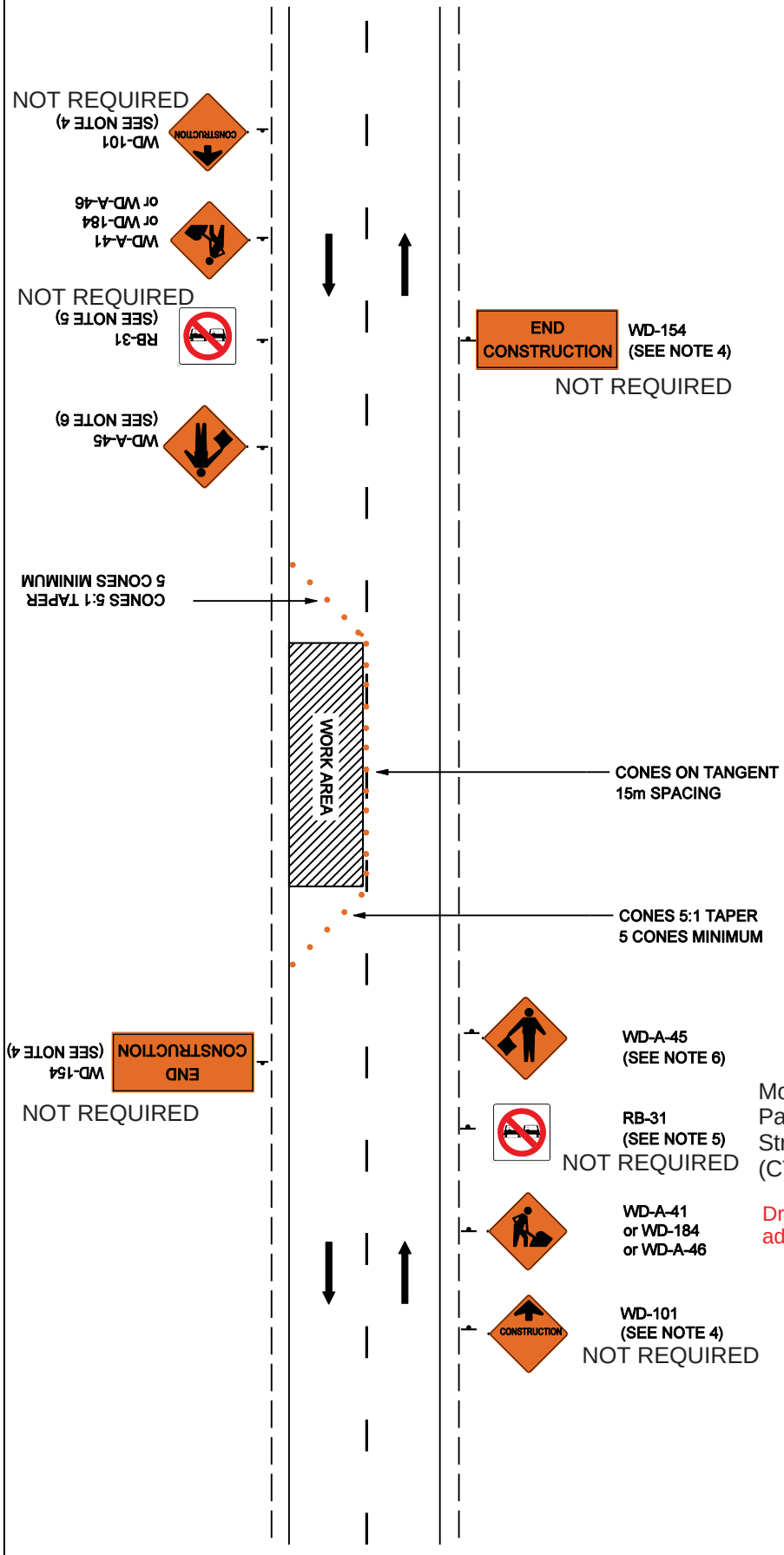
Reviewed By:

Steve Wopnford, P.Eng.
Project Manager

APEGA Permit Number: 04546

Appendix A:
Traffic Accommodation Strategy





NOTES:

1. Consideration must be given to traffic volume, sight distances, sign spacing, duration of work, night time conditions and other factors to ensure traffic control devices are adequate in each instance.

2. All sign spacing shall be 25m-100m unless otherwise indicated.

3. For mobile operation, cones may not be required.

4. WD-101 and WD-154 sign not required for short duration work.

5. RB-31 sign not required when existing solid yellow barrier line is in place.

6. WD-194 sign, together with RA-2 sign, may be used instead of WD-A-45 sign and flagperson if sight distance is adequate.

RA-2

WD-194

7. RB-5 and RB-1 signs will be used when a reduced speed zone is required. In this case gazetted speed to be posted after the work area.

RB-5

RB-1

8. Other hazard signs as shown in the schedule of signs may be used as required.

9.

WD-184

WD-A-46

Mountain Avenue Improvements - Pavement Surfacing Assessment and Strategy - FWD Testing (CT164101.0070)

Drawing published by Alberta Transportation, adopted by Amec Foster Wheeler

No.	REVISIONS	BY	DATE
⚠	Title block updated.	JM	Dec 31/07

Approved:

ORIGINAL SIGNED BY ALLAN KWAN

Executive Director, Technical Standards Branch

Date: MARCH, 2003

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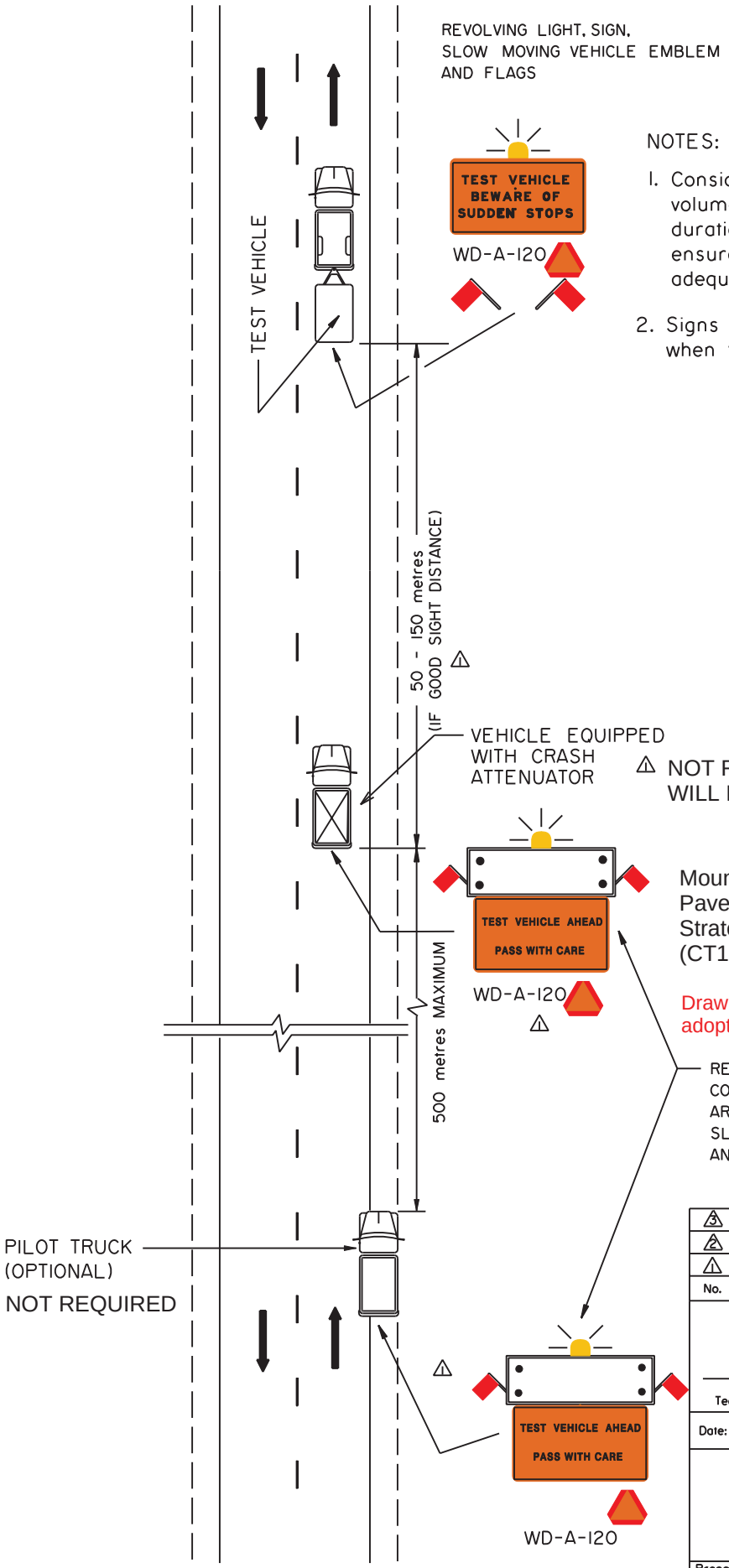
LOW SPEED/LOW VOLUME - SIGNING FOR URBAN AREAS
ONE LANE CLOSURE
(ONE LANE ALTERNATING TRAFFIC)
TWO LANE UNDIVIDED HIGHWAY ⚠

Prepared By: M.E.T.	Checked By: J.M.	Scale: N.T.S.	Dwg No.: TCS-B-7.IA



NOTES:

1. Consideration must be given to traffic volume, sight distances, sign spacing, duration of work and other factors to ensure traffic control devices are adequate in each instance.
2. Signs on trucks must be visible only when testing is in progress.

⚠ NOT REQUIRED - FLAG PERSON WILL FOLLOW TEST VEHICLE

Mountain Avenue Improvements - Pavement Surfacing Assessment and Strategy - FWD Testing (CT164101.0070)

Drawing published by Alberta Transportation, adopted by Amec Foster Wheeler

No.	REVISIONS	BY	DATE
3			
2			
1	Notes and sign deleted, crash attenuator and pilot vehicle added and Title Block updated.	JM	Dec 31/07

Approved:
Original signed by
Tim Hawnt
Executive Director,
Technical Standards Branch
Date: MARCH, 2001

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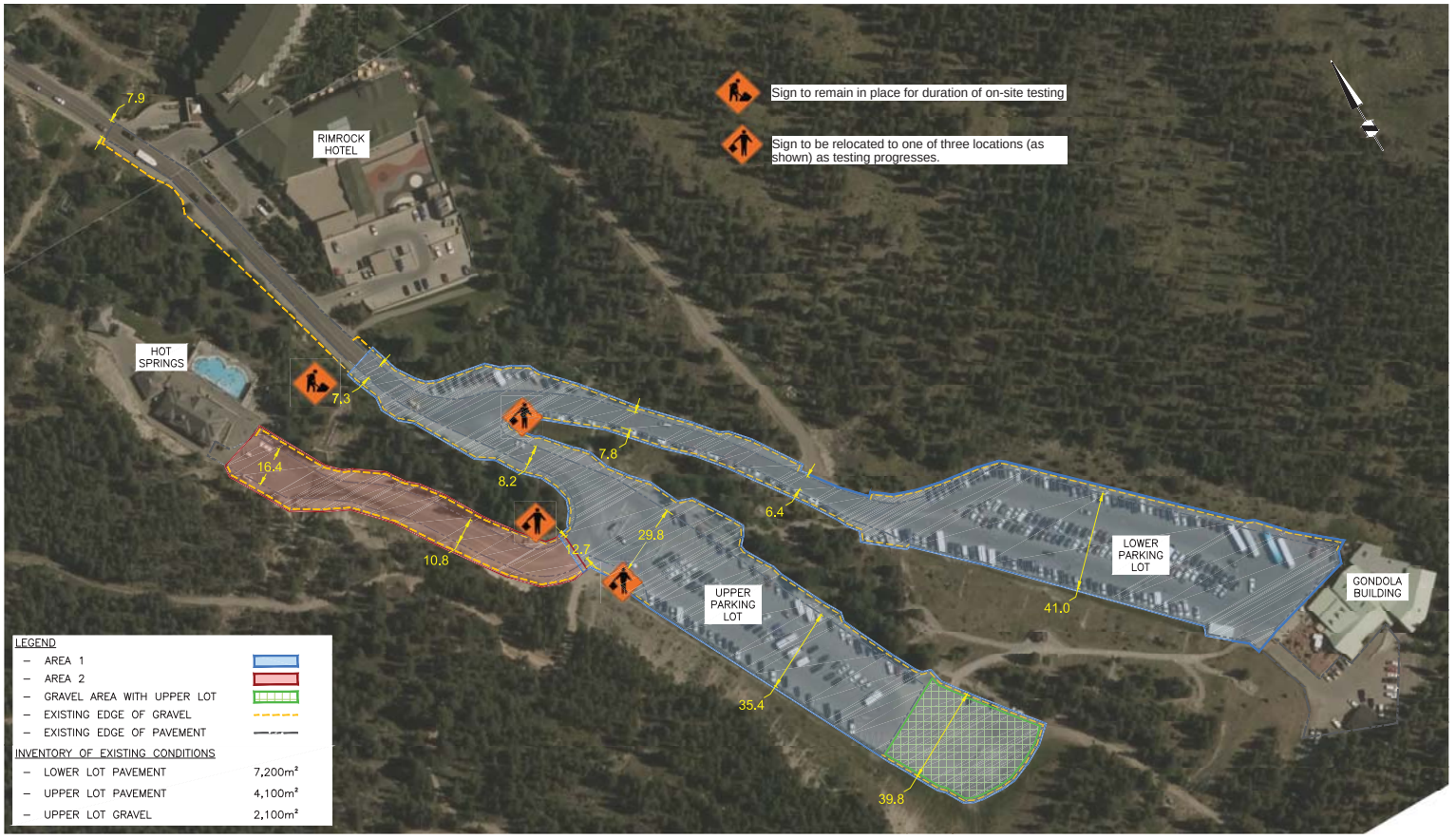
SHORT DURATION - SIGNING ⚠
MOBILE TESTING
TWO LANE UNDIVIDED HIGHWAY

Prepared By: G.E.C.	Checked By: P.H.	Scale: N.T.S.	Dwg No.: TCS-B-3.2A



SCALE : 1:750

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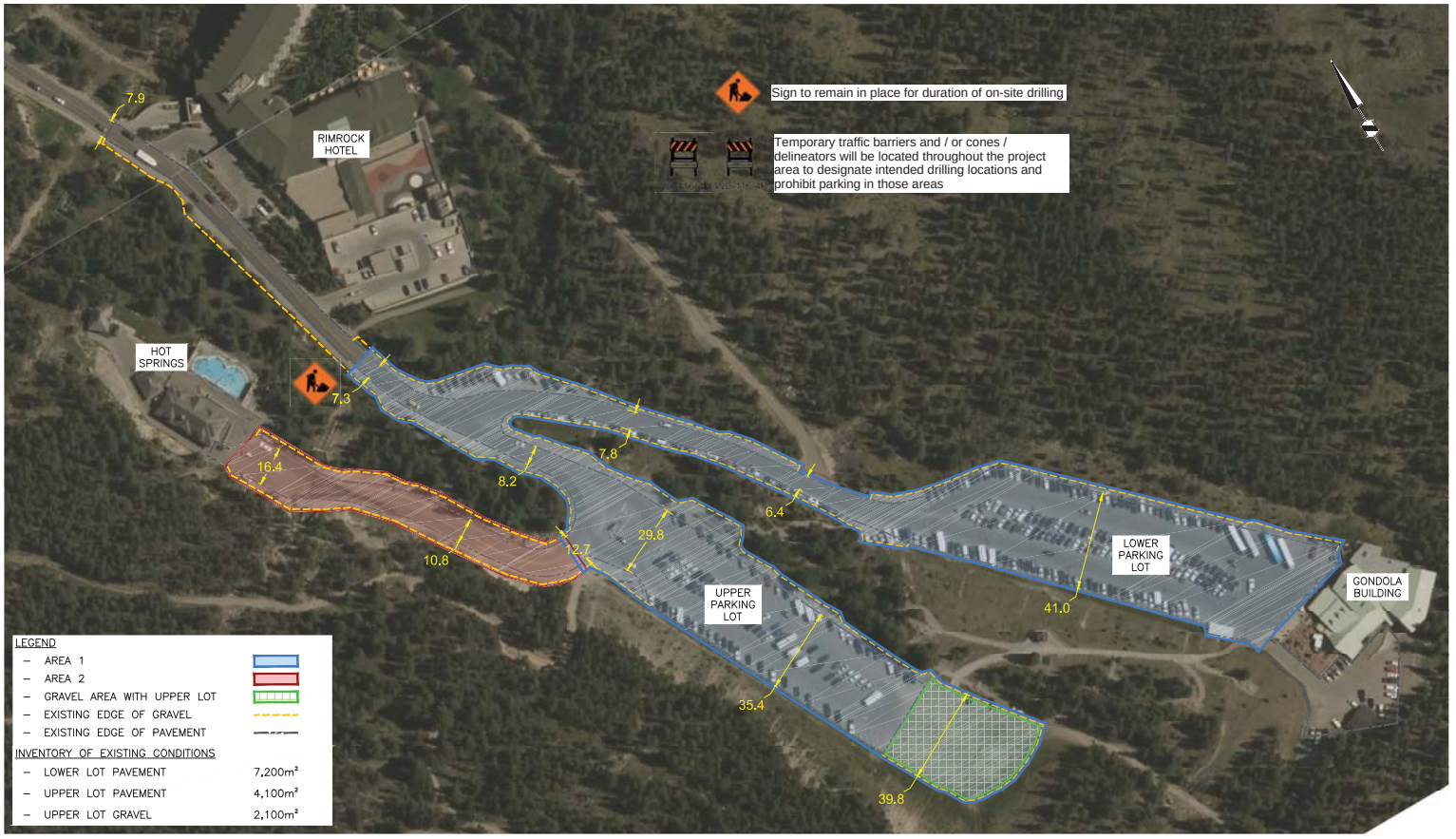
PARKS CANADA AGENCY

MOUNTAIN AVENUE IMPROVEMENTS

PAVEMENT SURFACING ASSESSMENT AND STRATEGY FIGURE 1

N/A



SCALE : 1:750

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PARKS CANADA AGENCY

MOUNTAIN AVENUE IMPROVEMENTS

PAVEMENT SURFACING ASSESSMENT AND STRATEGY
FIGURE 1

-

-

N/A

Appendix B: Explanation of Terms and Symbols

EXPLANATION OF TERMS AND SYMBOLS

The terms and symbols used on the borehole logs to summarize the results of field investigation and subsequent laboratory testing are described in these pages.

It should be noted that materials, boundaries and conditions have been established only at the borehole locations at the time of investigation and are not necessarily representative of subsurface conditions elsewhere across the site.

TEST DATA

Data obtained during the field investigation and from laboratory testing are shown at the appropriate depth interval.

Abbreviations, graphic symbols, and relevant test method designations are as follows:

*C	Consolidation Test	TV	Torvane shear strength
D_R	Relative Density	VS	Vane shear strength
*k	Permeability coefficient	w	Natural Moisture Content (ASTM D2216)
*MA	Mechanical grain size analysis and hydrometer test	wl	Liquid Limit (ASTM D 423)
		w_p	Plastic Limit (ASTM D 424)
N	Standard Penetration Test (CSA A119.1-60)	Ef	Unit strain at failure
		γ	Unit weight of soil or rock
N_d	Dynamic cone penetration test	γd	Dry unit weight of soil or rock
NP	Non plastic soil	ρ	Density of soil or rock
Pp	Pocket penetrometer strength	ρd	Dry Density of soil or rock
*q	Triaxial compression test	C_u	Undrained shear strength
q_u	Unconfined compressive strength	$\rightarrow$	Seepage
*SB	Shearbox test	$\underline{\blacktriangledown}$	Observed water level
SO_4	Concentration of water-soluble sulphate	$\underline{\nabla}$	Water level at completion of drilling

* The results of these tests are usually reported separately

Soils are classified and described according to their engineering properties and behaviour.

The soil of each stratum is described using the Unified Soil Classification System[1] modified slightly so that an inorganic clay of "medium plasticity" is recognized.

The modifying adjectives used to define the actual or estimated percentage range by weight of minor components are consistent with the Canadian Foundation Engineering Manual[2].

Relative Density and Consistency:

Cohensionless Soils		**Cohesive Soils**		
Relative Density	SPT (N) Value	Consistency	Undrained Shear Strength c_u (kPa)	**Approximate SPT (N) Value**
Very Loose	0-4	Very Soft	0-12	**0-2**
Loose	4-10	Soft	12-25	**2-4**
Compact	10-30	Firm	25-50	**4-8**
Dense	30-50	Stiff	50-100	**8-15**
Very Dense	>50	Very Stiff	100-200	**15-30**
		Hard	**>200**	**>30**

Standard Penetration Resistance ("N" value)
The number of blows by a 63.6kg hammer dropped 760mm to drive a 50 mm diameter open sampler attached to "A" drill rods for a distance of 300 mm after an initial penetration of 150 mm.

[1] "Unified Soil Classification System", Technical Memorandum 36-357 prepared by Waterways Experiment Station, Vicksburg, Mississippi, Corps Engineers of U.S. Army. Vol. 1 March 1953
[2] "Canadian Foundation Engineering Manual", 4th Edition, Canadian Geotechnical Society, 2006.

MODIFIED UNIFIED CLASSIFICATION SYSTEM FOR SOILS

MAJOR DIVISION			GROUP SYMBOL	GRAPH SYMBOL	COLOUR CODE	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA	
COARSE GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN 75µm)	GRAVELS MORE THAN HALF THE COARSE FRACTION LARGER THAN 4.75mm	CLEAN GRAVELS (LITTLE OR NO FINES)	GW		ORANGE	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	$C_U = \frac{D_{60}}{D_{10}} > 4$; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$	
			GP		ORANGE	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS	
		DIRTY GRAVELS (WITH SOME FINES)	GM		ORANGE	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	CONTENT OF FINES EXCEEDS 12 %	ATTERBERG LIMITS BELOW "A" LINE OR P.I. LESS THAN 4
			GC		ORANGE	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES		ATTERBERG LIMITS ABOVE "A" LINE P.I. MORE THAN 7
	SANDS MORE THAN HALF THE COARSE FRACTION SMALLER THAN 4.75mm	CLEAN SANDS (LITTLE OR NO FINES)	SW		YELLOW-BLACK	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	$C_U = \frac{D_{60}}{D_{10}} > 6$; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$	
			SP		YELLOW-BLACK	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS	
		DIRTY SANDS (WITH SOME FINES)	SM		YELLOW-BLACK	SILTY SANDS, SAND-SILT MIXTURES	CONTENT OF FINES EXCEEDS 12 %	ATTERBERG LIMITS BELOW "A" LINE OR P.I. LESS THAN 4
			SC		YELLOW-BLACK	CLAYEY SANDS, SAND-CLAY MIXTURES		ATTERBERG LIMITS ABOVE "A" LINE P.I. MORE THAN 7
FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT SMALLER THAN 75µm)	SILTS BELOW "A" LINE NEGLIGIBLE ORGANIC CONTENT	w_L < 50%	ML		GREEN	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT COMPRESSABILITY	CLASSIFICATION IS BASED UPON PLASTICITY CHART (SEE BELOW) $I_p = w_L - w_P$ $I_L = \frac{w - w_P}{w_L - w_P} = \frac{w - w_P}{I_P}$ I_P = PLASTICITY INDEX I_L = LIQUIDITY INDEX	
		w_L > 50%	MH		BLUE	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDS OR SILTY SOILS OF HIGH COMPRESSABILITY		
	CLAYS ABOVE "A" LINE NEGLIGIBLE ORGANIC CONTENT	w_L < 30%	CL		GREEN	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY OR SILTY CLAYS, LEAN CLAYS		
		30% < w_L < 50%	CI		GREEN-BLUE	INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS		
		w_L > 50%	CH		BLUE	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS		
	ORGANIC SILTS & CLAYS BELOW "A" LINE	w_L < 50%	OL		GREEN	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	WHENEVER THE NATURE OF THE FINES CONTENT HAS NOT BEEN DETERMINED, IT IS DESIGNATED BY THE LETTER "F", E.G. SF IS A MIXTURE OF SAND WITH SILT OR CLAY	
		w_L > 50%	OH		BLUE	ORGANIC CLAYS OF HIGH PLASTICITY		
HIGHLY ORGANIC SOILS			Pt		PURPLE	PEAT AND OTHER HIGHLY ORGANIC SOILS	STRONG COLOUR OR ODOUR, AND OFTEN FIBEROUS TEXTURE	

SPECIAL SYMBOLS

LIMESTONE		LEAN OIL SAND / RICH OIL SAND	
SANDSTONE		SHALE	
SILTSTONE		FILL (UNDIFFERENTIATED)	

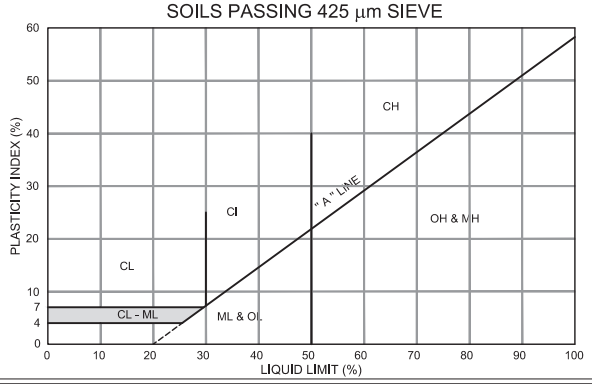
SOIL COMPONENTS

FRACTION	U.S. STANDARD SIEVE SIZE		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
GRAVEL	PASSING	RETAINED	PERCENT	DESCRIPTOR
COARSE	76mm	19mm	35-50	AND
FINE	19mm	4.75mm		
SAND			20-35	Y/EY
COARSE	4.75mm	2.00mm		
MEDIUM	2.00mm	425µm	10-20	SOME
FINE	425µm	75µm		
FINES (SILT OR CLAY BASED ON PLASTICITY)	75µm		1-10	TRACE

OVERSIZED MATERIAL

ROUNDED OR SUBROUNDED:	NOT ROUNDED:
COBBLES 76mm TO 200mm	ROCK FRAGMENTS > 76mm
BOULDERS > 200mm	ROCKS > 0.76 CUBIC METRE IN VOLUME

PLASTICITY CHART FOR SOILS PASSING 425 µm SIEVE



NOTES:

1. ALL SIEVE SIZES MENTIONED ON THIS CHART ARE U.S. STANDARD A.S.T.M. E.11
2. COARSE GRAIN SOILS WITH 5 TO 12% FINES GIVEN COMBINED GROUP SYMBOLS, E.G. GW-GC IS A WELL GRADED GRAVEL SAND MIXTURE WITH CLAY BINDER BETWEEN 5 AND 12% FINES.

Environment & Infrastructure
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Edmonton, Alberta, T6B 3P6

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Appendix C: Geotechnical Assessment Results

CLIENT: Parks Canada	PROJECT: Mountain Avenue Improvements	BOREHOLE NO.: **BH16-01**
DRILLER: All Service Drilling	SITE: Banff, AB	PROJECT NO.: CT164101
METHOD: Solid Stem Auger		ELEVATION:

SAMPLE TYPE: Shelby Tube; No Recovery; SPT Test (N); Grab Sample; Split-Pen; Core

BACKFILL TYPE: Bentonite; Pea Gravel; Slough; Grout; Drill Cuttings; Sand

◆ POCKET PEN (kPa) ◆ 100 200 300 400

■ BLOW COUNT (N) ■ 20 40 60 80

PLASTIC M.C. LIQUID 20 40 60 80

Depth (m)	SOIL SYMBOL	USCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	BACKFILL DETAILS	OTHER TESTS COMMENTS	Depth (m)
0		ASPH	**ASPHALT** - 12cm						0
		SM	**SILT and SAND** - fine grained, some gravel, trace clay, very stiff to hard, grey, damp		G1				
1	52/450		**SAND and GRAVEL** - silty, some cobbles, trace clay, very stiff to hard, grey, damp		S1	52/450			1
		GM	... damp to moist		G2				
2									2
3	92/350				S2	92/350			3
			END OF BOREHOLE at 3.3 m -Borehole backspun with drill cuttings and capped with cold patch near surface						
4									4
5									

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ENTERED BY: R.Mateff	COMPLETION DEPTH: 3.3 m
LOGGED BY: R.Mateff	COMPLETION DATE: 25/10/16
REVIEWED BY:	Page 1 of 1

CLIENT: Parks Canada	PROJECT: Mountain Avenue Improvements	BOREHOLE NO.: **BH16-02**
DRILLER: All Service Drilling	SITE: Banff, AB	PROJECT NO.: CT164101
METHOD: Solid Stem Auger		ELEVATION:

SAMPLE TYPE: Shelby Tube; No Recovery; SPT Test (N); Grab Sample; Split-Pen; Core

BACKFILL TYPE: Bentonite; Pea Gravel; Slough; Grout; Drill Cuttings; Sand

◆ POCKET PEN (kPa) ◆ 100 200 300 400

■ BLOW COUNT (N) ■ 20 40 60 80

PLASTIC M.C. LIQUID 20 40 60 80

Depth (m)	SOIL SYMBOL	USCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	BACKFILL DETAILS	OTHER TESTS COMMENTS	Depth (m)
0		ASPH	**ASPHALT** - 7cm						0
			SAND and GRAVEL - silty, trace clay, trace cobbles, very stiff, grey, damp		G1			Grain Size Analysis: Gravel: 32% Sand: 39% Silt: 21% Clay 8%	
1		GM			S1	21/450			1
	21/450		... increased sand content, firm to stiff		S2	17			
	17/300		... some cobbles, refusal on cobble		G2				
			END OF BOREHOLE at 1.8 m -Borehole backspun with drill cuttings and capped with cold patch near surface						
2									2
3									3
4									4
5									

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ENTERED BY: R.Mateff	COMPLETION DEPTH: 1.8 m
LOGGED BY: R.Mateff	COMPLETION DATE: 25/10/16
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CLIENT: Parks Canada	PROJECT: Mountain Avenue Improvements	BOREHOLE NO.: **BH16-03**
DRILLER: All Service Drilling	SITE: Banff, AB	PROJECT NO.: CT164101
METHOD: Solid Stem Auger		ELEVATION:

SAMPLE TYPE: Shelby Tube | No Recovery | SPT Test (N) | Grab Sample | Split-Pen | Core

BACKFILL TYPE: Bentonite | Pea Gravel | Slough | Grout | Drill Cuttings | Sand

◆ POCKET PEN (kPa) ◆ 100 200 300 400

■ BLOW COUNT (N) ■ 20 40 60 80

PLASTIC M.C. LIQUID 20 40 60 80

Depth (m)	SOIL SYMBOL	USCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	BACKFILL DETAILS	OTHER TESTS COMMENTS	Depth (m)
0		ASPH	**ASPHALT** - 9cm						0
			SAND and GRAVEL - fine to medium grained, silty, trace clay, trace cobbles, compact, brown, damp						
1		GM			B1				1
	21/450				S1	21/450			
	17/450				S2	17/450			
2			... increased cobble content, refusal on cobbles						2
			END OF BOREHOLE at 2.0 m						
			-Borehole backspun with drill cuttings and capped with cold patch near surface						
3									3
4									4
5									

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ENTERED BY: R.Mateff	COMPLETION DEPTH: 2 m
LOGGED BY: R.Mateff	COMPLETION DATE: 25/10/16
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CLIENT: Parks Canada	PROJECT: Mountain Avenue Improvements		BOREHOLE NO.: **BH16-04**
DRILLER: All Service Drilling	SITE: Banff, AB		PROJECT NO.: CT164101
METHOD: Solid Stem Auger			ELEVATION:

SAMPLE TYPE: Shelby Tube | No Recovery | SPT Test (N) | Grab Sample | Split-Pen | Core

BACKFILL TYPE: Bentonite | Pea Gravel | Slough | Grout | Drill Cuttings | Sand

Depth (m)	◆ POCKET PEN (kPa) ◆ 100 200 300 400 / ■ BLOW COUNT (N) ■ 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	SOIL SYMBOL	USCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	BACKFILL DETAILS	OTHER TESTS COMMENTS	Depth (m)
0			ASPH	**ASPHALT** - 9cm						0
				SAND and GRAVEL - some silt, trace clay, very dense, light brown, damp		G1				
1	84/450		GM			S1	84/450			1
				... silty						
	91/350					S2	91/350			
2				... higher gravel content, trace cobbles						2
						G2				
				END OF BOREHOLE at 2.4 m						
				-Borehole backspun with drill cuttings and capped with cold patch near surface						
3										3
4										4
5										

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ENTERED BY: R.Mateff	COMPLETION DEPTH: 2.4 m
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CLIENT: Parks Canada	PROJECT: Mountain Avenue Improvements	BOREHOLE NO.: **BH16-05**
DRILLER: All Service Drilling	SITE: Banff, AB	PROJECT NO.: CT164101
METHOD: Solid Stem Auger		ELEVATION:

SAMPLE TYPE: Shelby Tube; No Recovery; SPT Test (N); Grab Sample; Split-Pen; Core

BACKFILL TYPE: Bentonite; Pea Gravel; Slough; Grout; Drill Cuttings; Sand

Depth (m)	◆ POCKET PEN (kPa) ◆ 100 200 300 400 / ■ BLOW COUNT (N) ■ 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	SOIL SYMBOL	USCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	BACKFILL DETAILS	OTHER TESTS COMMENTS	Depth (m)
0			OR	**TOPSOIL**						0
			GM	**SAND and GRAVEL** - silty, some cobbles, some clay, compact, light brown to grey, moist		G1				
1				**CLAY** - silty, some gravel, trace sand, stiff, low plastic, light brown, moist		S1	59/450			1
	59/450			... gravely, some cobbles, some sand, hard						
			CL			S2	8/400			
2	8/400			END OF BOREHOLE at 2.0 m -Borehole backspun with drill cuttings						2
3										3
4										4
5										

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ENTERED BY: R.Mateff	COMPLETION DEPTH: 2 m
LOGGED BY: R.Mateff	COMPLETION DATE: 25/10/16
REVIEWED BY:	Page 1 of 1

CLIENT: Parks Canada	PROJECT: Mountain Avenue Improvements	BOREHOLE NO.: **BH16-06**
DRILLER: All Service Drilling	SITE: Banff, AB	PROJECT NO.: CT164101
METHOD: Solid Stem Auger		ELEVATION:

SAMPLE TYPE: Shelby Tube; No Recovery; SPT Test (N); Grab Sample; Split-Pen; Core

BACKFILL TYPE: Bentonite; Pea Gravel; Slough; Grout; Drill Cuttings; Sand

◆ POCKET PEN (kPa) ◆ 100 200 300 400

■ BLOW COUNT (N) ■ 20 40 60 80

PLASTIC M.C. LIQUID 20 40 60 80

Depth (m)	SOIL SYMBOL	USCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	BACKFILL DETAILS	OTHER TESTS COMMENTS	Depth (m)
0		OR	**TOPSOIL**						0
			SILT and SAND - gravely, trace cobbles, trace clay, loose to compact, light brown to grey, damp to moist		G1				
1	8/450	SM			S1	8/450			1
	10/450				S2	10/450			
2		GM	**SAND and GRAVEL** - silty, trace cobbles, trace clay, loose to compact, light brown to grey, damp to moist						2
			END OF BOREHOLE at 2.6 m -Borehole backspun with drill cuttings						
3									3
4									4
5									

R:\PROJECTS\CALGARY INFRASTRUCTURE\CT164101 - BANFF ROAD\200 - DATA\GINT\CT164101 - BANFF ROAD.GPJ 16/11/28 11:46 AM (BOREHOLE REPORT; 3210 (2015).GLB)

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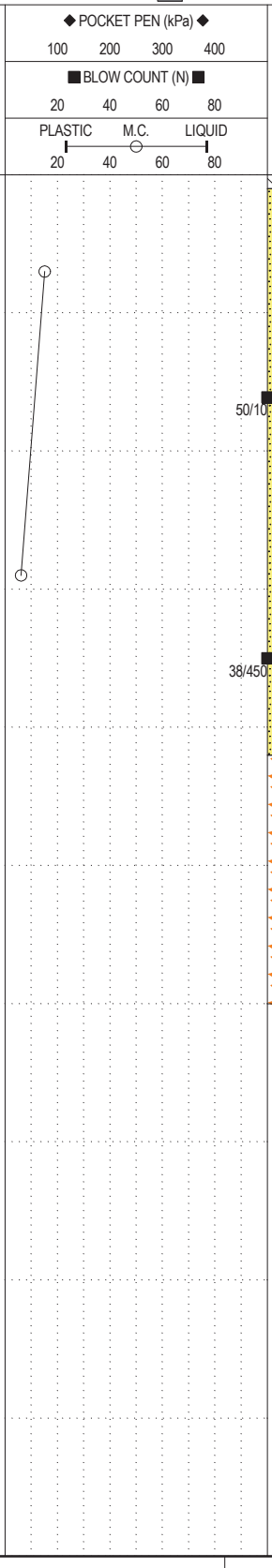
Environment & Infrastructure

ENTERED BY: R.Mateff	COMPLETION DEPTH: 2.6 m
LOGGED BY: R.Mateff	COMPLETION DATE: 25/10/16
REVIEWED BY:	Page 1 of 1

CLIENT: Parks Canada	PROJECT: Mountain Avenue Improvements	BOREHOLE NO.: **BH16-07**
DRILLER: All Service Drilling	SITE: Banff, AB	PROJECT NO.: CT164101
METHOD: Solid Stem Auger		ELEVATION:

SAMPLE TYPE: Shelby Tube | No Recovery | SPT Test (N) | Grab Sample | Split-Pen | Core

BACKFILL TYPE: Bentonite | Pea Gravel | Slough | Grout | Drill Cuttings | Sand



Depth (m)	USCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	BACKFILL DETAILS	OTHER TESTS COMMENTS	Depth (m)
0	OR	**TOPSOIL** **SILT and SAND** - gravely, trace clay, stiff to very stiff, light brown to grey, damp to moist		G1				0
1	SM			S1	50/10			1
2				G2				2
				S2	38/450			
3	GM	**SAND and GRAVEL** - silty, trace cobbles, trace clay, dense to very dense, grey, damp		G3				3
4		END OF BOREHOLE at 3.0 m -Borehole backspun with drill cuttings						4
5								

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ENTERED BY: R.Mateff	COMPLETION DEPTH: 3 m
LOGGED BY: R.Mateff	COMPLETION DATE: 25/10/16
REVIEWED BY:	Page 1 of 1

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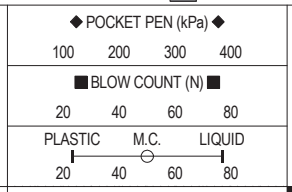
CLIENT: Parks Canada	PROJECT: Mountain Avenue Improvements	BOREHOLE NO.: **BH16-08**
DRILLER: All Service Drilling	SITE: Banff, AB	PROJECT NO.: CT164101
METHOD: Solid Stem Auger		ELEVATION:

SAMPLE TYPE: Shelby Tube; No Recovery; SPT Test (N); Grab Sample; Split-Pen; Core

BACKFILL TYPE: Bentonite; Pea Gravel; Slough; Grout; Drill Cuttings; Sand



Depth (m)	USCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	BACKFILL DETAILS	OTHER TESTS COMMENTS	Depth (m)
0	ASPH	**ASPHALT** - 12cm						0
		SAND and GRAVEL - silty, trace clay, compact, grey to brown, damp		G1				
1		28/450		S1	28/450			1
	GM	20/450		S2	20/450			
2		... some clay light brown						2
				G2				
3		16/450		S3	16/450			3
		END OF BOREHOLE at 3.5 m -Borehole backspun with drill cuttings and capped with cold patch near surface						
4								4
5								

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ENTERED BY: R.Mateff	COMPLETION DEPTH: 3.5 m
LOGGED BY: R.Mateff	COMPLETION DATE: 25/10/16
REVIEWED BY:	Page 1 of 1

CLIENT: Parks Canada	PROJECT: Mountain Avenue Improvements	BOREHOLE NO.: **BH16-09**
DRILLER: All Service Drilling	SITE: Banff, AB	PROJECT NO.: CT164101
METHOD: Solid Stem Auger		ELEVATION:

SAMPLE TYPE: Shelby Tube; No Recovery; SPT Test (N); Grab Sample; Split-Pen; Core

BACKFILL TYPE: Bentonite; Pea Gravel; Slough; Grout; Drill Cuttings; Sand

◆ POCKET PEN (kPa) ◆ 100 200 300 400

■ BLOW COUNT (N) ■ 20 40 60 80

PLASTIC M.C. LIQUID 20 40 60 80

Depth (m)	SOIL SYMBOL	USCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	BACKFILL DETAILS	OTHER TESTS COMMENTS	Depth (m)
0		ASPH	**ASPHALT** - 13cm						0
			SAND and GRAVEL - silty, dense, light brown to grey, damp		G1			Grain Size Analysis: Gravel: 54% Sand: 29% Silt: 13% Clay 4%	
1			... trace clay		S1	13/450			1
	13/450								
			... some clay, light brown		S2	11/450			
2	11/450	GM							2
					G2				
3					S3	17/450			3
	17/450								
4			END OF BOREHOLE at 3.5 m -Borehole backspun with drill cuttings and capped with cold patch near surface						4
5									

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ENTERED BY: R.Mateff	COMPLETION DEPTH: 3.5 m
LOGGED BY: R.Mateff	COMPLETION DATE: 25/10/16
REVIEWED BY:	Page 1 of 1

CLIENT: Parks Canada	PROJECT: Mountain Avenue Improvements	BOREHOLE NO.: **BH16-10**
DRILLER: All Service Drilling	SITE: Banff, AB	PROJECT NO.: CT164101
METHOD: Solid Stem Auger		ELEVATION:

SAMPLE TYPE: Shelby Tube; No Recovery; SPT Test (N); Grab Sample; Split-Pen; Core

BACKFILL TYPE: Bentonite; Pea Gravel; Slough; Grout; Drill Cuttings; Sand

◆ POCKET PEN (kPa) ◆ 100 200 300 400

■ BLOW COUNT (N) ■ 20 40 60 80

PLASTIC M.C. LIQUID 20 40 60 80

Depth (m)	SOIL SYMBOL	USCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	BACKFILL DETAILS	OTHER TESTS COMMENTS	Depth (m)
0		ASPH	**ASPHALT** - 8cm						0
			SILT and SAND - fine grained, some gravel, dense, light brown, damp		G1				
1		SM			S1	73/450			1
	73/450								
			SAND and GRAVEL - silty, dense, light brown, damp		S2	100/200			
2	100/200	GM							2
					G2				
3			END OF BOREHOLE at 3 m -Borehole backspun with drill cuttings and capped with cold patch near surface						3
4									4
5									

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ENTERED BY: R.Mateff	COMPLETION DEPTH: 3 m
LOGGED BY: R.Mateff	COMPLETION DATE: 25/10/16
REVIEWED BY:	Page 1 of 1

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CLIENT: Parks Canada	PROJECT: Mountain Avenue Improvements	BOREHOLE NO.: **BH16-11**
DRILLER: All Service Drilling	SITE: Banff, AB	PROJECT NO.: CT164101
METHOD: Solid Stem Auger		ELEVATION:

SAMPLE TYPE: Shelby Tube | No Recovery | SPT Test (N) | Grab Sample | Split-Pen | Core

BACKFILL TYPE: Bentonite | Pea Gravel | Slough | Grout | Drill Cuttings | Sand

◆ POCKET PEN (kPa) ◆ 100 200 300 400

■ BLOW COUNT (N) ■ 20 40 60 80

PLASTIC M.C. LIQUID 20 40 60 80

Depth (m)	SOIL SYMBOL	USCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	BACKFILL DETAILS	OTHER TESTS COMMENTS	Depth (m)
0			**GRAVEL** - sandy, silty, some cobbles, dense, light brown, damp						0
1	50/10	GM			S1	50/10		Grain Size Analysis: Gravel: 62% Sand: 26% Silt: 9% Clay 3%	1
					B1				
2		SM	**SAND** - silty, some gravel, dense, light brown, damp						2
3			END OF BOREHOLE at 3.0 m -Borehole backspun with drill cuttings						3
4									4
5									

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ENTERED BY: R.Mateff	COMPLETION DEPTH: 3 m
LOGGED BY: R.Mateff	COMPLETION DATE: 25/10/16
REVIEWED BY:	Page 1 of 1

CLIENT: Parks Canada	PROJECT: Mountain Avenue Improvements	BOREHOLE NO.: **BH16-12**
DRILLER: All Service Drilling	SITE: Banff, AB	PROJECT NO.: CT164101
METHOD: Solid Stem Auger		ELEVATION:

SAMPLE TYPE: Shelby Tube | No Recovery | SPT Test (N) | Grab Sample | Split-Pen | Core

BACKFILL TYPE: Bentonite | Pea Gravel | Slough | Grout | Drill Cuttings | Sand

Depth (m)	◆ POCKET PEN (kPa) ◆ 100 200 300 400 / ■ BLOW COUNT (N) ■ 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	SOIL SYMBOL	USCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	BACKFILL DETAILS	OTHER TESTS COMMENTS	Depth (m)
0				**SILT and SAND** - some gravel, compact, black to brown, some organics, wood debris, damp		G1				0
1	81/230		SM	... light brown to grey, no more wood or organics, damp to moist		S1	81/230			1
2	64/180			... some cobbles ... refusal on cobbles		S2	64/180			2
				END OF BOREHOLE at 2.0 m -Borehole backspun with drill cuttings						
3										3
4										4
5										

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ENTERED BY: R.Mateff	COMPLETION DEPTH: 2 m
LOGGED BY: R.Mateff	COMPLETION DATE: 25/10/16
REVIEWED BY:	Page 1 of 1

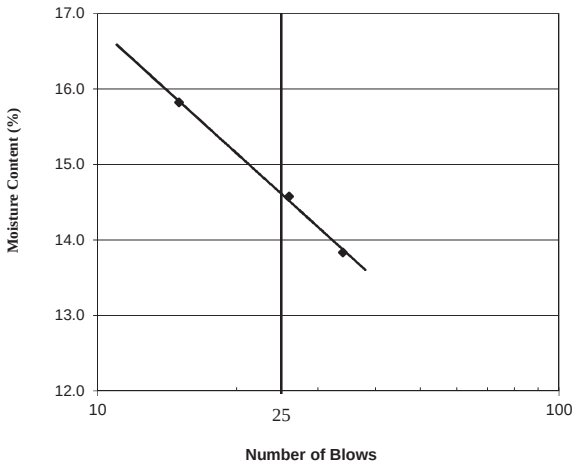
Atterberg Limits Test (ASTM D4318 - dry method)

Amec Foster Wheeler Environment & Infrastructure
a Division of Amec Foster Wheeler Americas Limited

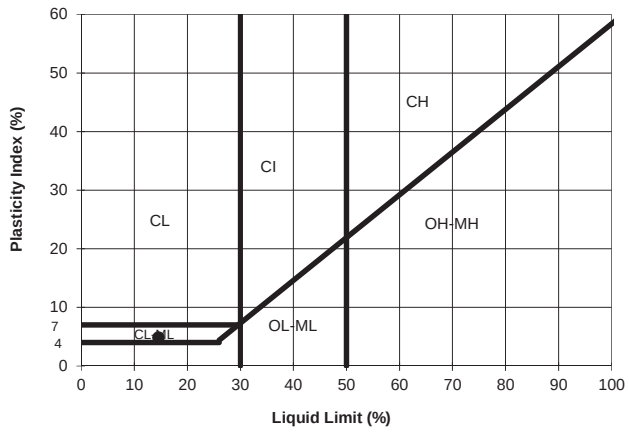
Client: Parks Canada
Project No: CT164101.0070.0003
Project: Banff Road
Sample ID: BH16-05 S1 @ 0.8-1.3m
Date: 16-Nov-16
Technician: KF

Liquid Limit Test				Plastic Limit Test		
# of Blows	15	26	34			
Tare #	BA	T81	6J	Tare #	6Z	T000
Wet Wt + Tare	30.78	31.08	29.74	Wet Wt + Tare	16.00	16.82
Dry Wt + Tare	27.72	28.21	27.15	Dry Wt + Tare	15.33	16.08
Wt of Tare	8.38	8.52	8.43	Wt of Tare	8.47	8.50
% Moisture	15.8	14.6	13.8	% Moisture	9.8	9.8

Liquid Limit Test



Plasticity chart for soil passing 425 um sieve



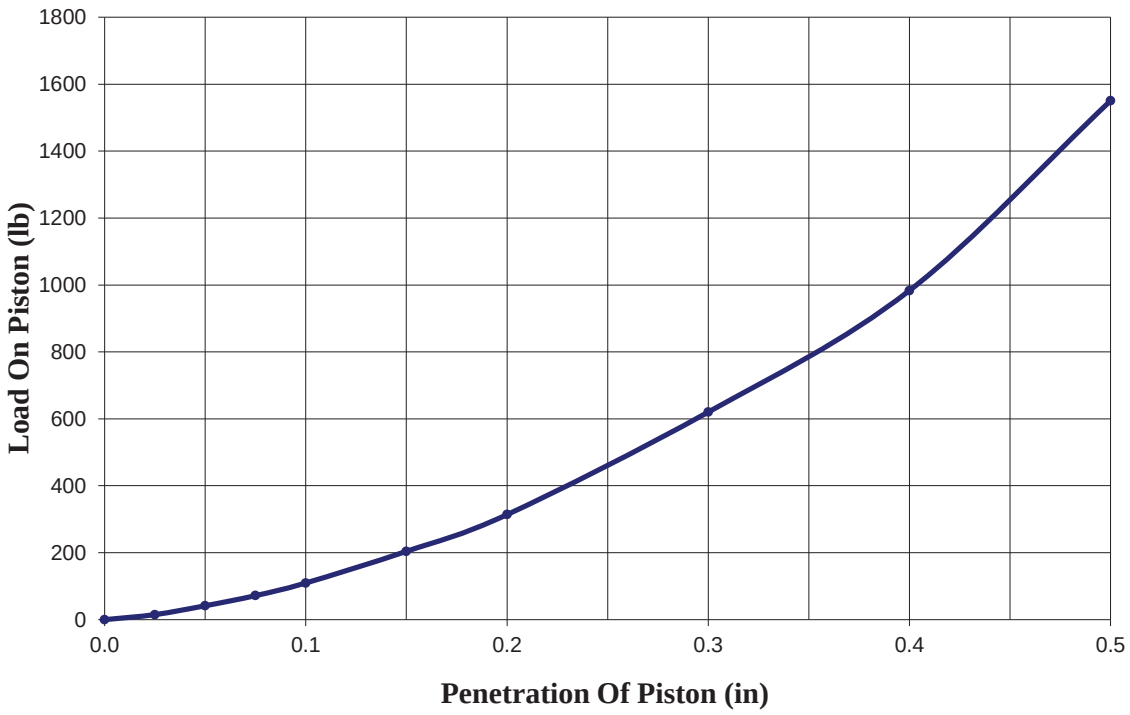
Liquid Limit : 14.6 **Plastic Limit :** 9.8 **Plasticity Index :** 4.8

Classification : CL-ML **Reviewed By :** JCS

California Bearing Ratio (ASTM D1883 - Soaking Method)

Amec Foster Wheeler
Environment & Infrastructure

Standard Proctor Maximum Dry Density	2266	(kg/m3)	Penetration (in.)	Standard Load	Soaked		
Standard Proctor Optimum Moisture Content	7.3	(%)		Crushed Stone	Load Reading	Corrected Reading	CBR
Type Of Preparation	STANDARD		0.025		15		
Mass of Surcharge	13.6	(kg)	0.050		42		
Compacted Dry Density	2264	(kg/m3)	0.075		72		
Compacted Moisture Content	6.0	(%)	0.100	3000	110	717	23.9
Percent Compaction of Standard Proctor Maximum Dry Density	99.9	(%)	0.150		204		
			0.200	4500	314	1134	25.2
Top 1 Inch Soaked Moisture	7.3	(%)	0.300		620		
Bottom 1 Inch Soaked Moisture	7.1	(%)	0.400		983		
Average Soaked Moisture	6.9	(%)	0.500		1550		



Client: Parks Canada
Project: Mountain Avenue Improvements
Project No: CT164101.0070.0003
Site Location: BH16-11 B1
Date: November 19, 2016
Request No: 1
Technologist: AA
Reviewed By: JCS

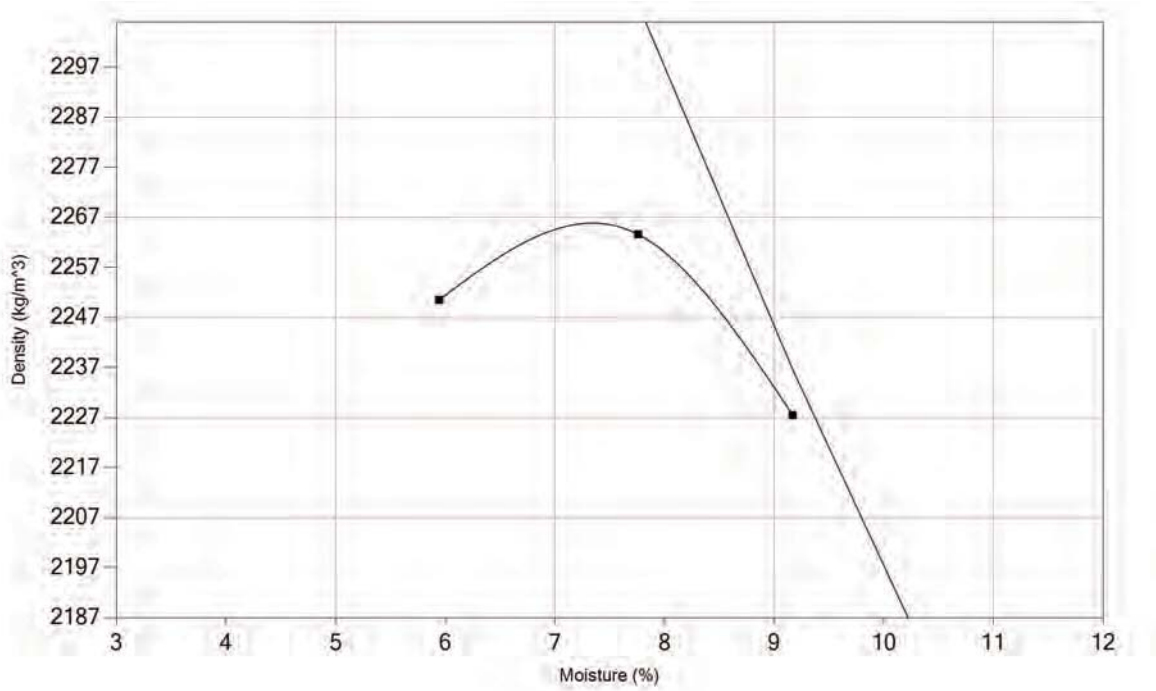
Soil Description: Gravelly some Clay

Liquid Limit - Plastic Limit - Plasticity Index - Swell 0.97%

Moisture / Density Relationship

Report Date: November 25, 2016 **Amend Date:** November 25, 2016

Client		Project	
Name:	Parks Canada Agency	**Name:**	(CT164101) Mountain Avenue Improvements
Address:	Box 900 Banff, AB T1L 1K2	**Address:**	Calgary, AB
Attention:	Jaison Van Tine	**Phase:**	**Task:**
PO Number:		**Manager:**	Tony Lai
Sample Date:	10/25/2016 by Ryan Mateff	**Lab/Ref. #:**	NS108387
Source:	BH16-11 B1	**Description:**	Gravelly some Clay



Moisture Density Relationship: (ASTM D698-12) Method: C

Preparation Method: Moist **Rammer Type:**Mechanical

Maximum Density (kg/m^3): 2266

Optimum Moisture (%): 7.3

Remarks: 16 % Oversize (19 mm)

Distribution:

Reviewed By: Jonathan Sanqui

Amec Foster Wheeler Environment & Infrastructure - 1003 53rd Avenue NE - Calgary, Alberta, Canada T2E 6X9

phone: (403) 235 8108 fax: (403) 569 0737

Particle Size Analysis (ASTM D422)

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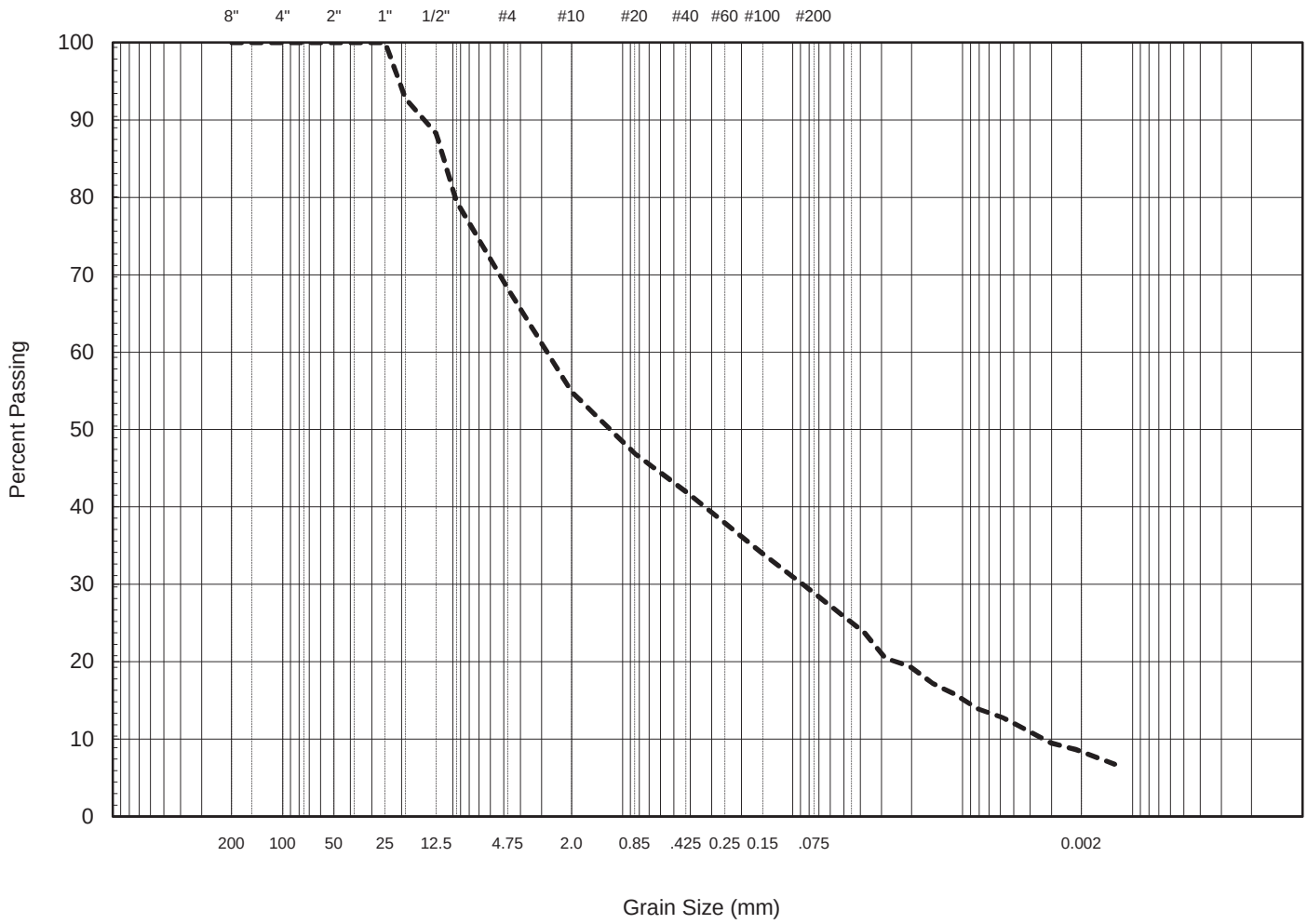
COBBLES	GRAVEL		SAND			SILT	CLAY
	Coarse	Fine	C	M	F		



Remarks:

Summary

D10 =	0.0034	mm	**Cobbles**	0	**%**
D20 =	0.0250	mm	**Gravel**	32	**%**
D30 =	0.0914	mm	**Sand**	39	**%**
D60 =	3.0553	mm	**Silt**	21	**%**
Cu =	903.37		**Clay**	8	**%**
Cc =	0.81				

Project No:	CT164101.0070.0003	**Project:**	Banff Road		
Borehole:	BH16-02	**Sample:**	G1	**Technician:**	AA
Depth (m):	0.3-0.4	**Date:**	November 15, 2016	**Reviewed by:**	JCS

C:\Users\sultan.butt\AppData\Local\Temp\Temp1_Lab Results.zip\Lab Results\Hydro BH16-02 G1.xls

Particle Size Analysis (ASTM D422)

Amec Foster Wheeler Environment & Infrastructure
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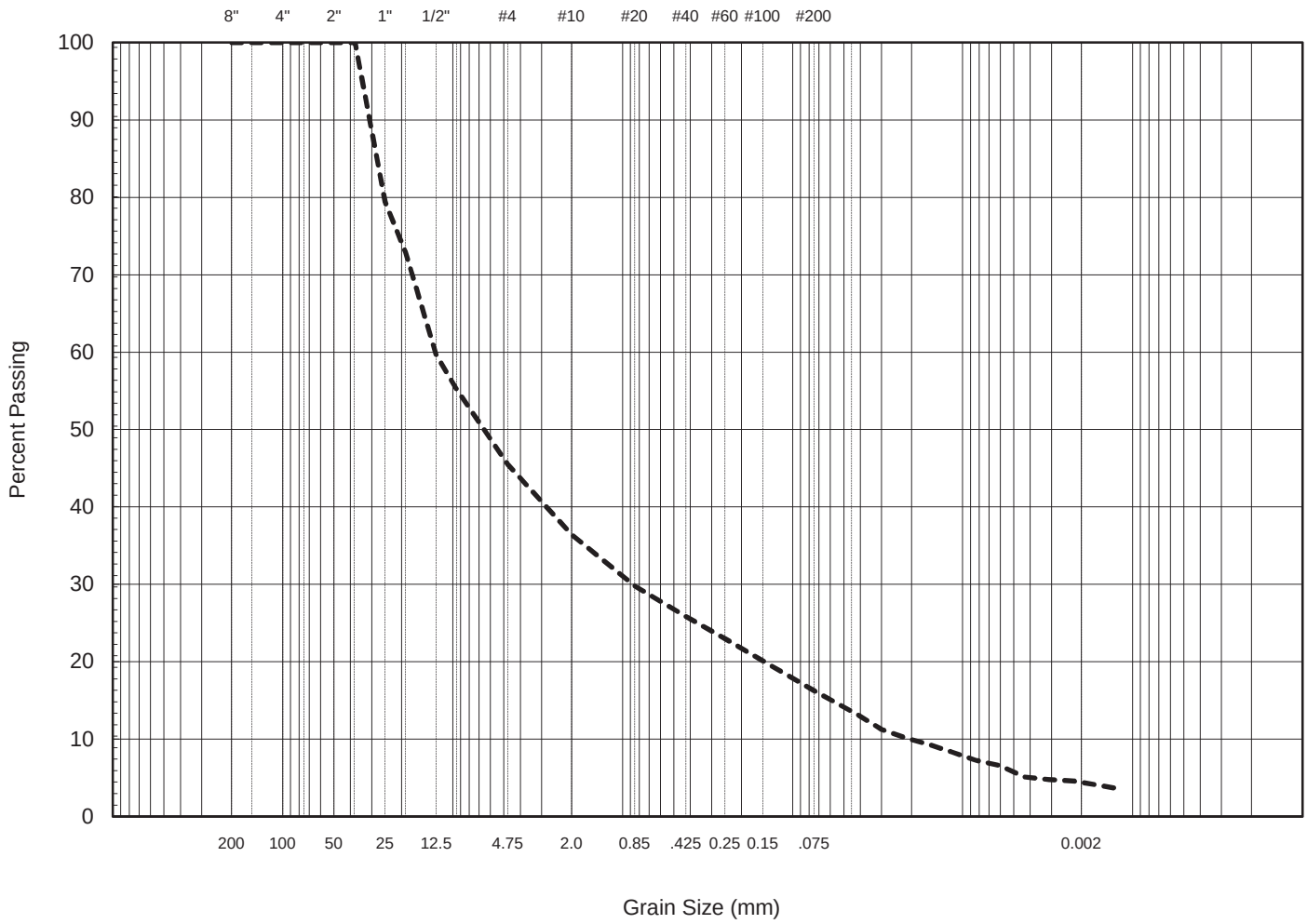
COBBLES	GRAVEL		SAND			SILT	CLAY
	Coarse	Fine	C	M	F		



Remarks:

Summary

D10 =	0.0206	mm	**Cobbles**	0	**%**
D20 =	0.1474	mm	**Gravel**	54	**%**
D30 =	0.8889	mm	**Sand**	29	**%**
D60 =	12.6551	mm	**Silt**	13	**%**
Cu =	615.43		**Clay**	4	**%**
Cc =	3.04				

Project No:	CT164101.0070.0003	**Project:**	Banff Road		
Borehole:	BH16-09	**Sample:**	G1	**Technician:**	AA
Depth (m):	0.3-0.4	**Date:**	November 15, 2016	**Reviewed by:**	JCS

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Particle Size Analysis (ASTM D422)

Amec Foster Wheeler Environment & Infrastructure
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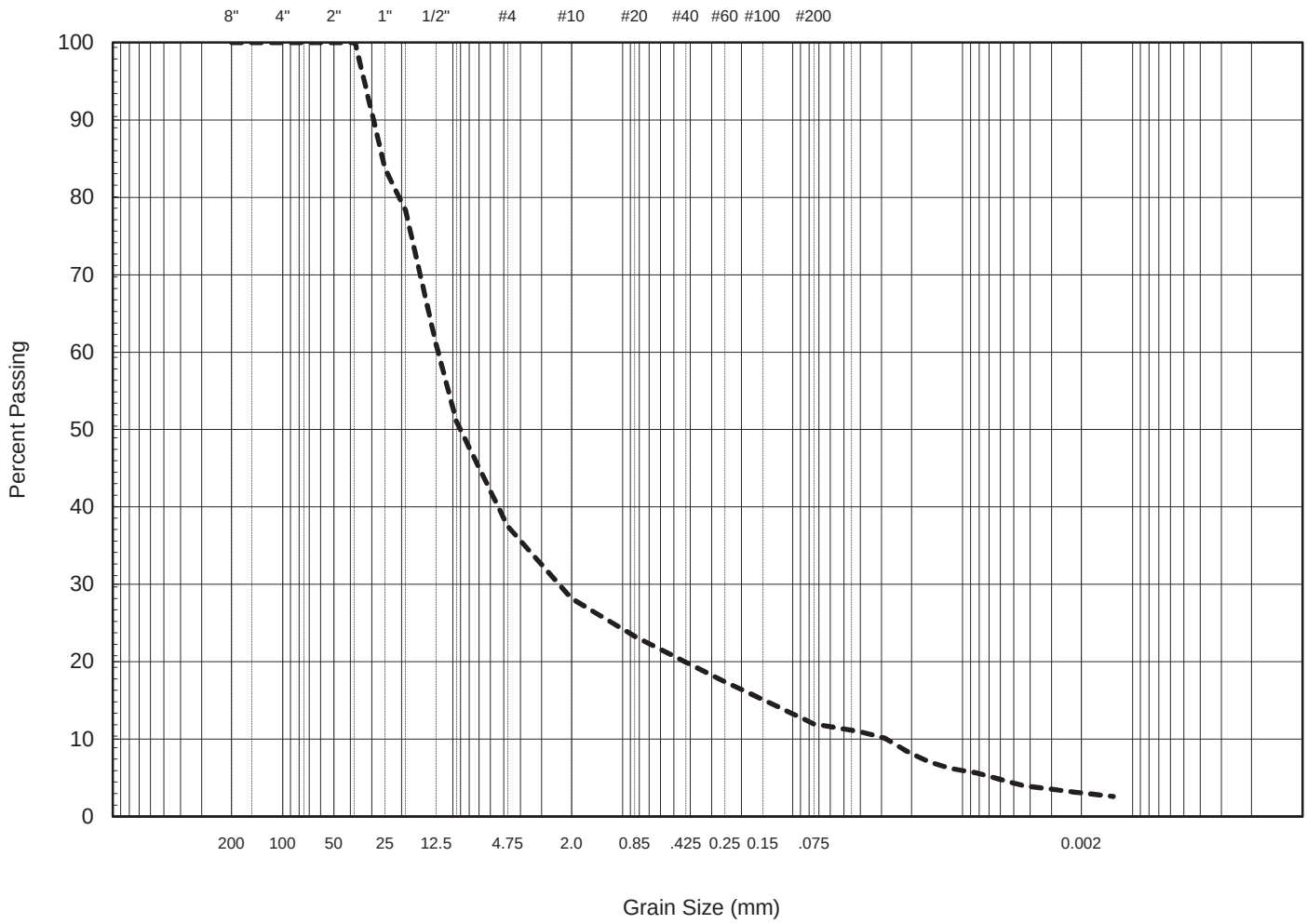
COBBLES	GRAVEL		SAND			SILT	CLAY
	Coarse	Fine	C	M	F		



Remarks:

Summary

D10 =	0.0282	mm	**Cobbles**	0 **%**
D20 =	0.4316	mm	**Gravel**	62 **%**
D30 =	2.5439	mm	**Sand**	26 **%**
D60 =	12.2070	mm	**Silt**	9 **%**
Cu =	432.21		**Clay**	3 **%**
Cc =	18.77			

Project No:	CT164101.0070.0003	**Project:**	Banff Road		
Borehole:	BH16-11	**Sample:**	B1	**Technician:**	AA
Depth (m):	0.6-1.5	**Date:**	November 15, 2016	**Reviewed by:**	JCS

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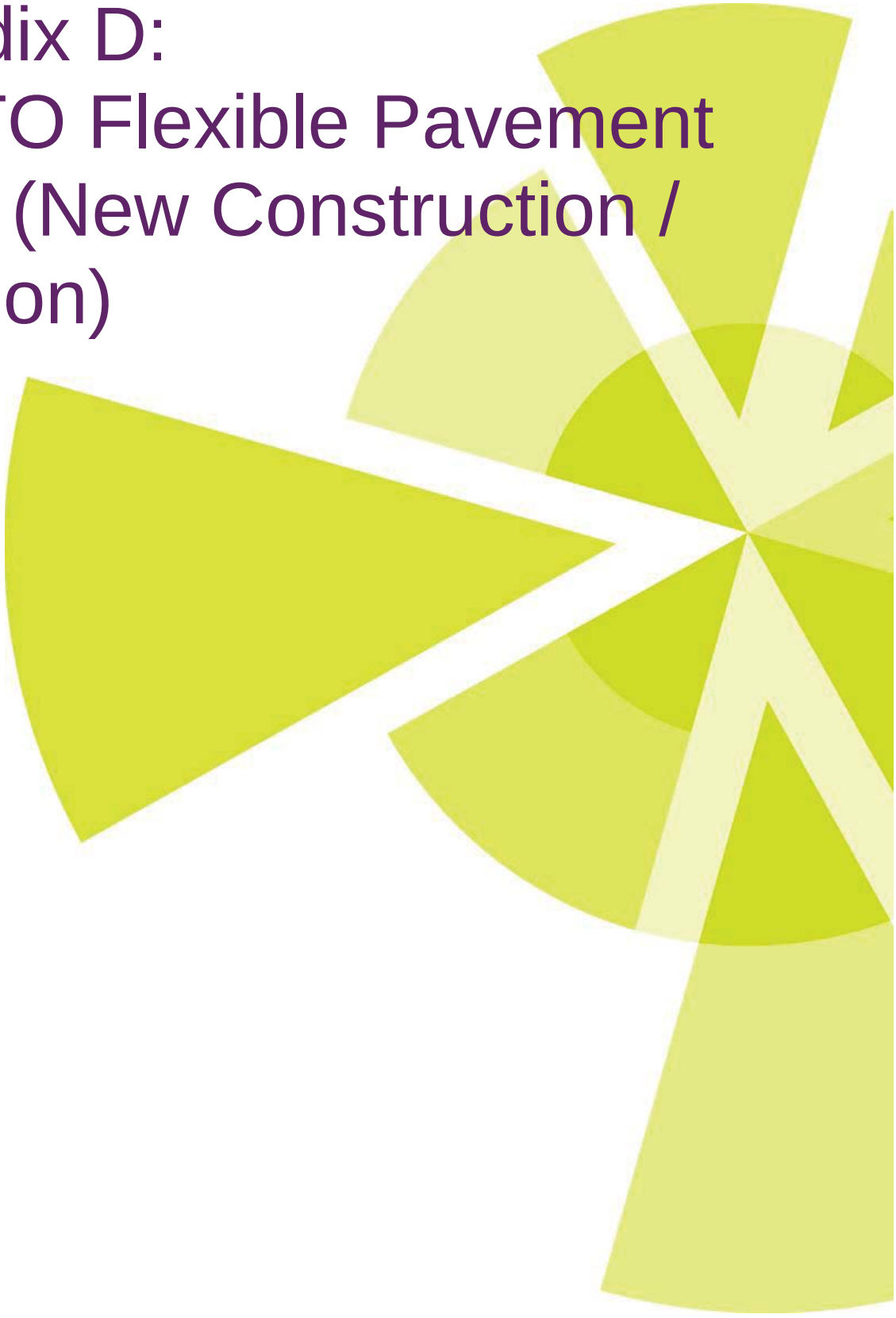
Appendix D: AASHTO Flexible Pavement Design (New Construction / Extension)



1997 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

A Proprietary AASHTOWare Computer Software Product

Amec Foster Wheeler
5671 70 St. NW
Edmonton, AB
Canada

Flexible Structural Design Module

Upper Parking Extension
Mountain Avenue Improvements

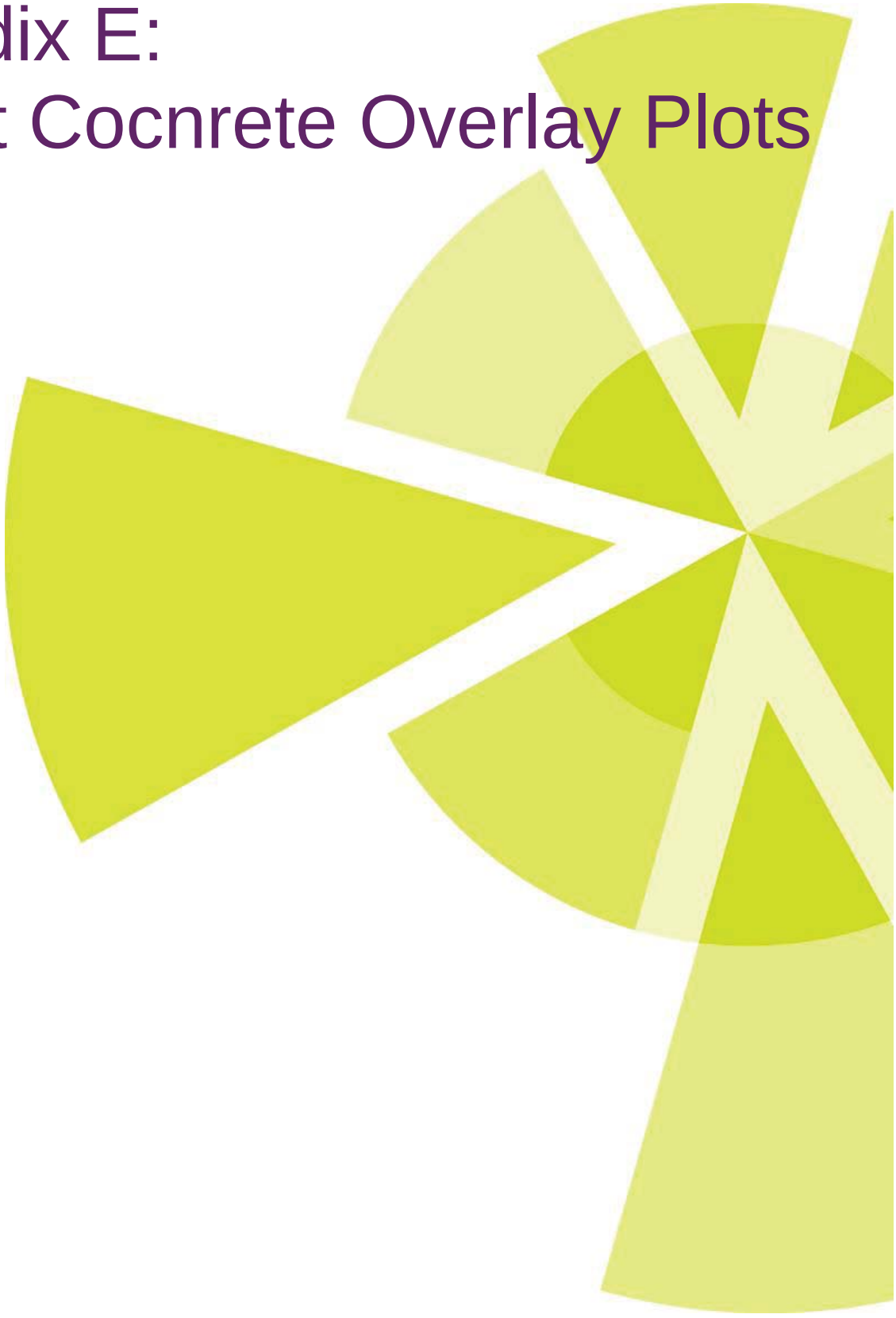
Flexible Structural Design

80-kN ESALs Over Initial Performance Period	3,000,000
Initial Serviceability	4.2
Terminal Serviceability	2.5
Reliability Level	85 %
Overall Standard Deviation	0.45
Roadbed Soil Resilient Modulus	35,000 kPa
Stage Construction	1
Calculated Design Structural Number	116 mm

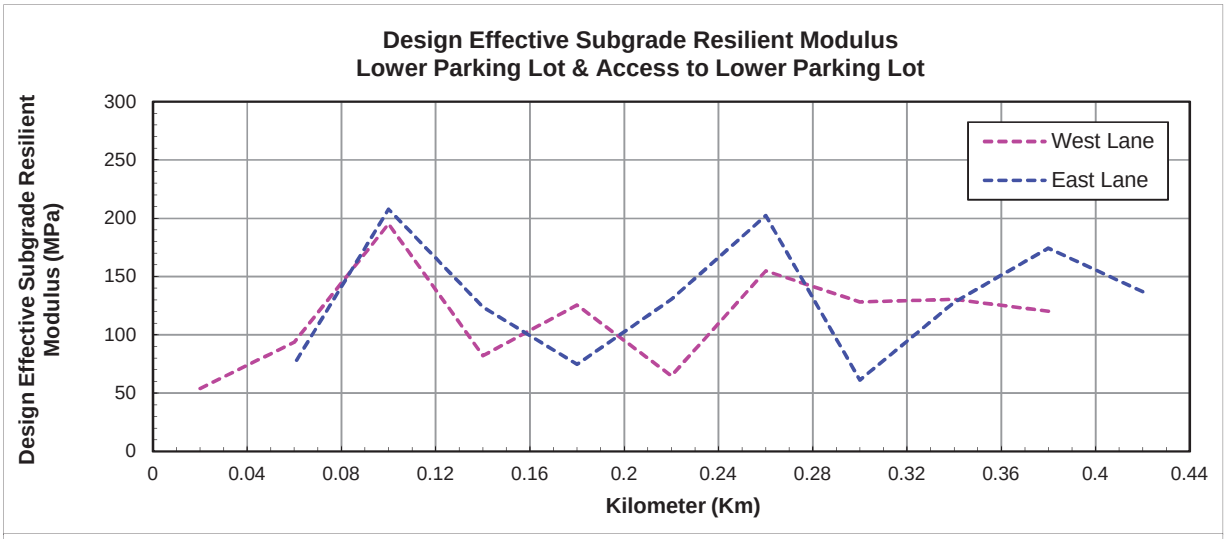
Specified Layer Design

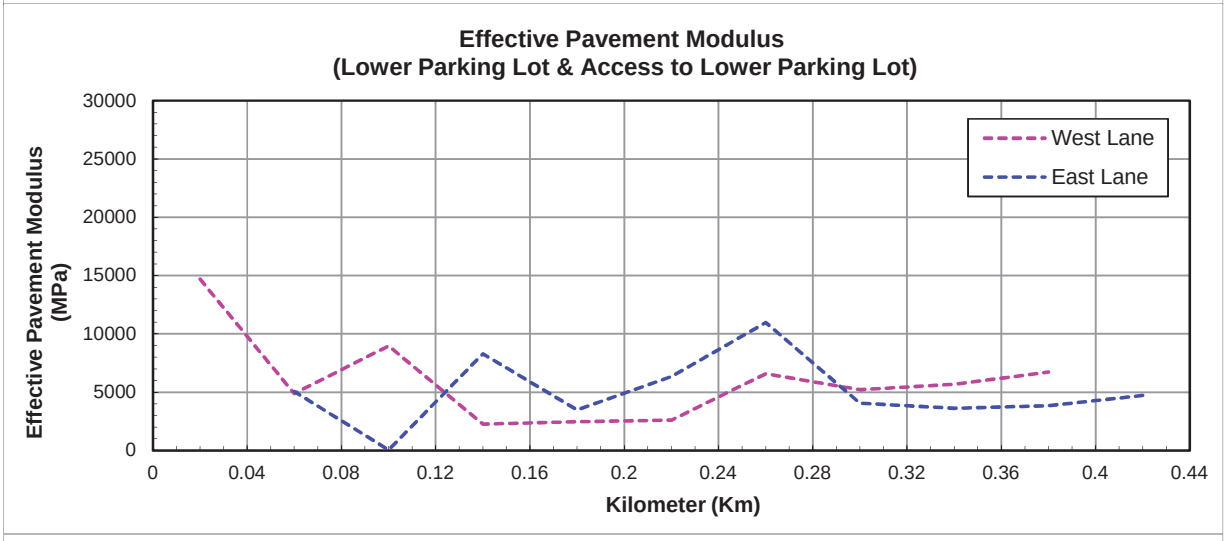
Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di)(mm)	Width (m)	Calculated SN (mm)
1	ACP	0.4	1	190	-	76
2	GSBC	0.1	1	400	-	40
Total	-	-	-	590	-	116

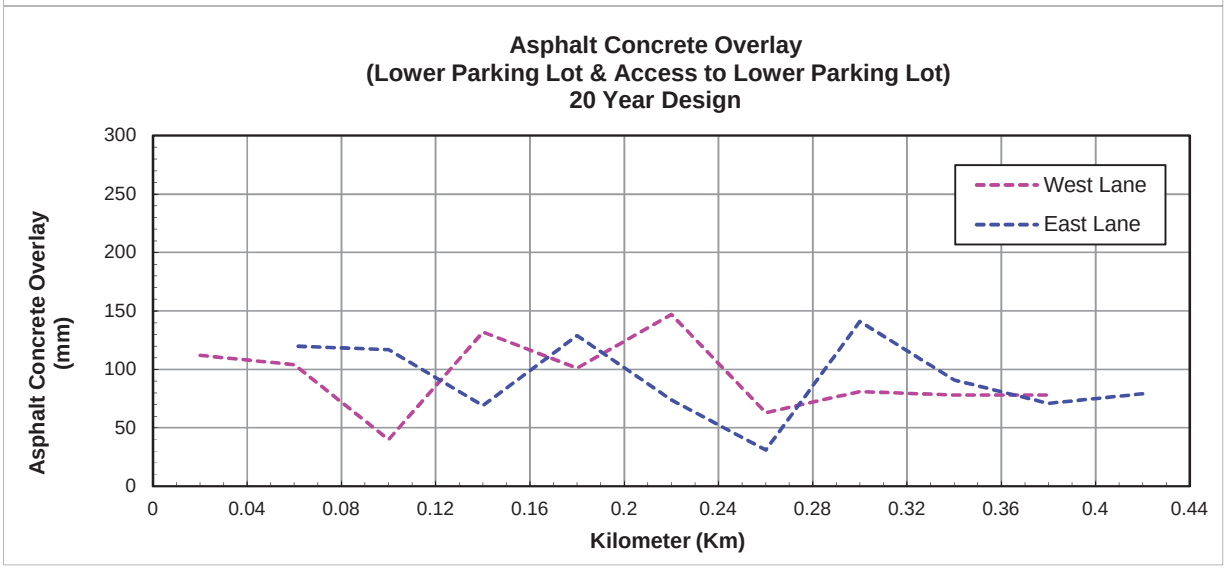
Appendix E:
Asphalt Cocnrete Overlay Plots



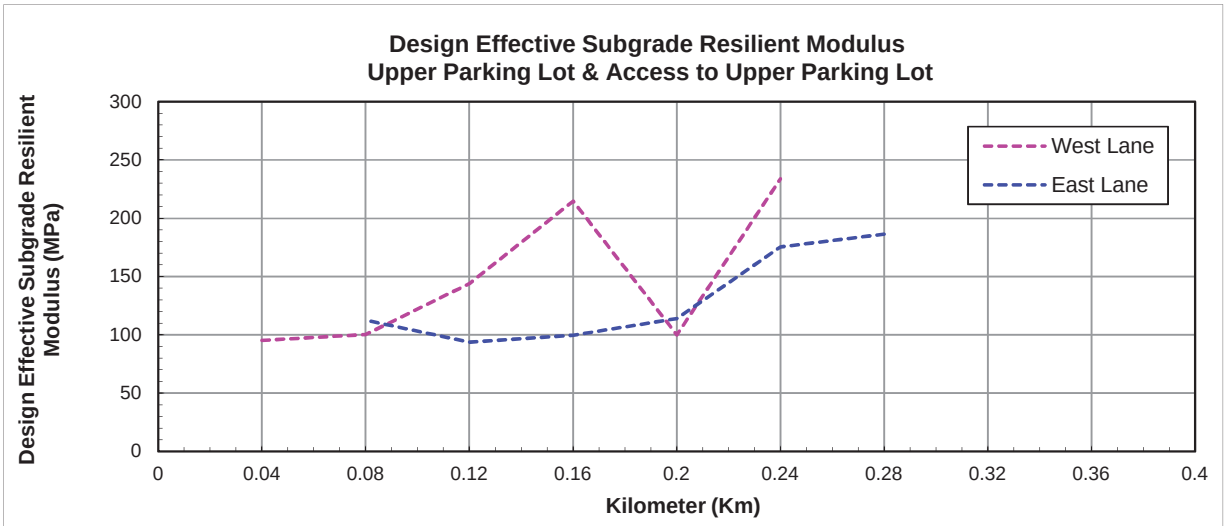
Reliability: 50%
Design 20 Year ESALs: 5.0 x 10^6

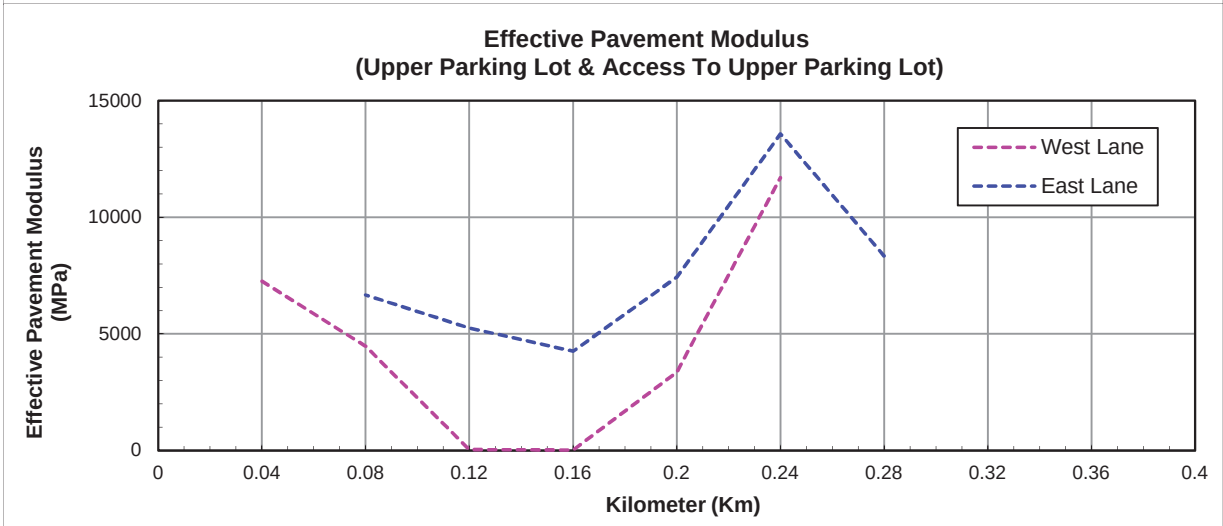


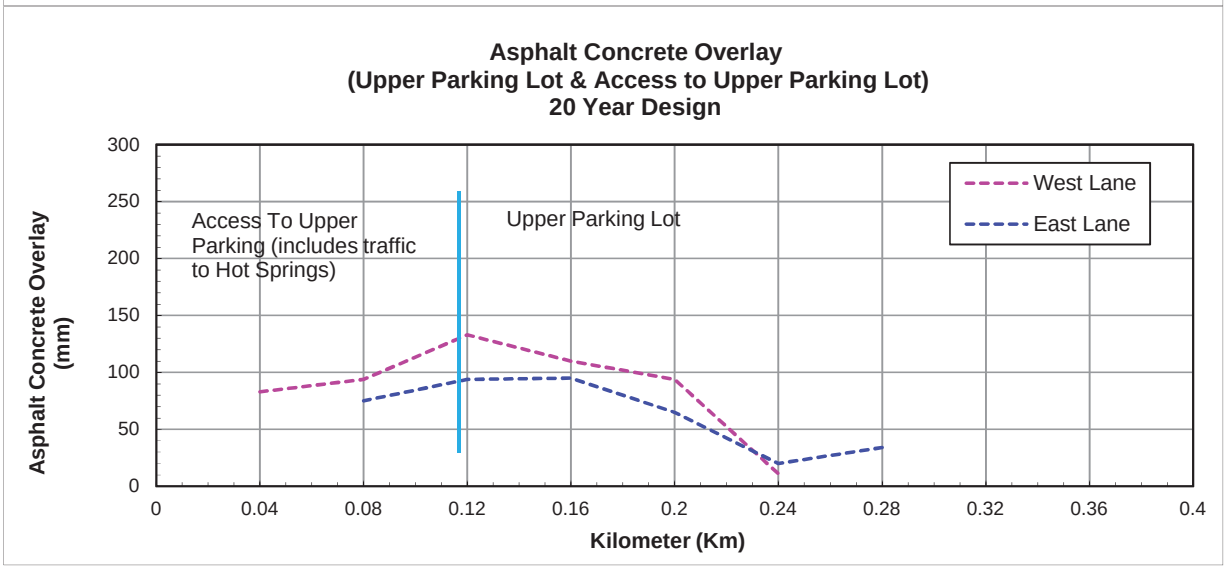




Reliability: 50%
Design 20 Year ESALs: 3.8 x 10^6 (Access Road)
Design 20 Year ESALs: 3.0 x 10^6 (Upper Parking Lot)







Reliability: 50%
Design 20 Year ESALs: 1.0 x 10^6