# SPECIFICATIONS FOR

## New Taxiway C

## Project No. 704-TRN.AIRP03972-01

## ISSUED FOR TENDER
## April 2026

## NORTHWEST REGIONAL AIRPORT TERRACE-KITIMAT

## PART 1 - GENERAL

### 1. AUTHENTICATIONS

| Disciplines | Seals | Permits to Practice |
|---|---|---|
| Civil | PROFESSIONAL ENGINEER<br>PROVINCE OF BRITISH COLUMBIA<br>A. M. EVANS<br># 35042<br>2020-04-20 | PERMIT TO PRACTICE<br>TETRA TECH CANADA INC.<br>PERMIT NUMBER: 1001972 |
| | | |

**END OF SECTION**

## Index to Specifications

**END OF SECTION**

## PART 1 - GENERAL

### 1. RELATED SECTIONS

.1 Section 01 35 13.13 – Special Procedures: Airport in Use

**.2** Appendix A – Plan of Construction Operations

**.3** Section 26 05 00 – Common Work Results for Electrical.

### 2. WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract is comprised of the construction of a new Taxiway C. Work to be undertaken includes, but is not limited to the following:

.1 Supply and install temporary relocated threshold markings as specified and remove when required. Markers to remain with the owner upon completion and removal.

.2 Install of low profile barricades.

.3 Sawcut existing asphalt edges and cold mill butt joint.

.4 Common excavation for new taxiway and shoulder construction.

.5 Supply and install granular subbase and granular base course material.

.6 Decommissioning of existing septic system.

.7 Removal of existing septic system piping encountered during excavation.

.8 Concrete encasement of utility crossings below new taxiway construction.

.9 New permanent line markings.

.10

.11 Supply and install new edge light system, signage and pull pits where noted.

.12 Supply and install new electrical conduits in new trench and concrete encase duct bank crossing Taxiway C.

.13 Supply and install asphalt tie-ins and asphalt for the new Taxiway C.

.14 Supply and install granular material for taxiway shoulders.

.15 Supply and install of culvert.

.16 Supply and install of dry well c/w catch basin and PVC piping.

.17 Survey layout, quantity surveys, and as-built survey;

.18 Quality control testing.

.19 PROVISIONAL: Paint markings.

.20 PROVISIONAL: Geotextile and geogrid.

.21 PROVISIONAL: Supply and install granular fill and native material for septic system decommissioning.

## 3. CONTRACT METHOD

.1 Construct Work under Unit Price Contract.

## 4. WORK SEQUENCE

.1 Construct Work in stages as shown on the drawings to provide for continuous airport usage. Do not close off public usage of facilities until use of one stage of Work will provide alternate usage.

.2 Maintain fire access/control.

## 5. OWNER OCCUPANCY

.1 Co-operate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.

## 6. OWNER FURNISHED ITEMS

.1 Temporary plastic low profile barricades fillable with water to provide resistance to movement by jet blast.

## 7. EXISTING SERVICES

.1 Notify the Owner and utility companies of intended interruption of services and obtain required permission.

.2 Where Work involves breaking into or connecting to existing services, give the Owner 72 hours' notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by Owner with minimum disturbance to operation.

.3 Submit schedule to and obtain approval from Owner for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.

.4 Where unknown services are encountered, immediately advise Consultant and confirm findings in writing.

.5 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.

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

1. **DOCUMENTS REQUIRED**

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

.1 Contract Drawings;

.2 Specifications;

.3 Addenda;

.4 Approved Plan of Construction Operations (PCO);

.5 Reviewed Shop Drawings and Submittals;

.6 List of Outstanding Shop Drawings;

.7 Change Orders;

.8 Other Modifications to Contract;

.9 Field Test Reports;

.10 Copy of Approved Work Schedule;

.11 Health and Safety Plan and Other Safety Related Documents;

.12 Other documents as specified.

**END OF SECTION**

## PART 1 - GENERAL

### 1. RELATED SECTIONS

.1 Section 01 32 16.07 – Construction Progress Schedules – Bar (GANTT) Chart

.2 Section 01 35 13.13 – Special Project Procedures: Airport in Use

**.3** Plan of Construction Operations

### 2. ACCESS AND EGRESS

.1 Maintain temporary “access to” and egress from” work areas, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.

### 3. USE OF SITE AND FACILITIES

.1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Owner to facilitate work as stated.

.2 Maintain existing services to building and provide for personnel and vehicle access.

.3 Use of site shall be limited to the designated areas by work and storage.

.4 Where security is reduced by work provide temporary means to maintain security.

.5 Closures: protect work temporarily until permanent enclosures are completed.

### 4. EXISTING SERVICES

.1 Notify, the Owner and utility companies of intended interruption of services and obtain required permission.

.1 Where Work involves breaking into or connecting to existing services, give Owner 72 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum. Carry out interruptions after normal working hours of occupants, preferably on weekends.

.2 Provide for personnel pedestrian and vehicular traffic.

.3 Construct barriers in accordance with the Plan of Construction Operations (PCO).

### 5. SPECIAL REQUIREMENTS

.1 Submit schedule in accordance with Section 01 32 16.07 – Construction Progress Schedules - Bar (GANTT) Chart.

.1 Ensure that Contractor personnel employed on site become familiar with and obey regulations including the PCO, safety, fire, traffic, and security regulations.

.2 Keep within limits of work and avenues of ingress and egress.

.3 Ingress and egress of Contractor vehicles at site is limited to those indicated by the Plan of Construction Operations and may only be allowed under security escort.

## 6. AIRSIDE VEHICLE SECURITY ESCORT (AVOP)

.1 Personnel employed on this project must be escorted for all (and access into and out of) work in airside areas. Personnel must be escorted in all areas after normal working hours.

.1 The Airport will provide an airside escort with vehicle for the times the contractor's personnel are airside at no cost to the contractor.

.2 See the Plan of Construction Operations document for further details.

## 7. NON-SMOKING ENVIRONMENT

.1 Comply with smoking restrictions. Smoking and vaping is not allowed anywhere on the airside of the airport.

# PART 2 - PRODUCTS

## 1. NOT USED

# PART 3 - EXECUTION

## 1. NOT USED

**END OF SECTION**

## PART 1 - GENERAL

### 1. DESCRIPTION

.1 This section specified requirements for project meetings including the pre-construction, progress and safety meetings as required by the Contract Documents or as required by the Consultant or Owner.

### 2. ADMINISTRATIVE

.1 The Consultant shall schedule and administer project and safety meetings throughout the progress of the work.

.2 Provide physical space and make arrangements for meetings.

.3 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.

.4 Reproduce and distribute copies of minutes within three days after meetings and transmit to meeting participants and affected parties not in attendance.

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

### 3. PRECONSTRUCTION MEETING

.1 Immediately upon issuance of “Issued for Construction” drawings, the Consultant will schedule a meeting of parties in the contract to discuss and resolve administrative procedures and responsibilities.

.2 Senior representatives of the Owner, the Consultant, Contractor, major Subcontractors, field inspectors, supervisors, and others as required will be in attendance.

.3 Meeting will be held within five days of issuance of “Issued for Construction” drawings.

.4 Establish time and location of meeting and notify parties concerned minimum five days before meeting.

.5 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.

.6 Agenda to include:

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

.2 Schedule of Work and progress scheduling;

.3 Discussion of safety;

.4 Discussion of Plan of Construction Operations and work restrictions;

.5 Schedule of submission of shop drawings, samples. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures;

.6 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities;

.7 Delivery schedule of specified equipment;

.8 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, and administrative requirements;

.9 Record drawings in accordance with Section 01 33 00 - Submittal Procedures;

.10 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals;

.11 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals;

.12 Monthly progress claims, administrative procedures, photographs, and hold backs;

.13 Appointment of inspection and testing agencies or firms;

.14 Insurances, transcript of policies;

.15 Record drawings.

## 4. PROGRESS MEETINGS

.1 During course of Work, the Consultant will schedule progress/safety meetings weekly.

.2 Contractor, major Subcontractors involved in Work, the Consultant and/or representative(s) and affected airport users are to be in attendance.

.3 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within three days after meeting.

.4 Agenda to include the following:

.1 Review, and approval of minutes of previous meeting;

.2 Review of Work progress since previous meeting;

.3 Review safety concerns;

.4 Field observations, problems, conflicts;

.5 Problems which impede construction schedule;

.6 Review of off-site fabrication delivery schedules;

.7 Corrective measures and procedures to regain projected schedule;

.8 Revision to construction schedule;

.9 Progress schedule, during succeeding work period;

.10 Review submittal schedules: expedite as required;

.11 Maintenance of quality standards;

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

.13 Other business.

**END OF SECTION**

## PART 1 - GENERAL

### 1. RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

### 2. 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 accepted plan (for project, work package, or activity), plus or minus accepted 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 Consultant to enable monitoring of project work in relation to established milestones.

### 3. 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 Ensure that it is understood that 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.

## 4. SUBMITTALS

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

.2 Submit to Consultant within 5 working days of Award of Contract, Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.

## 5. PROJECT MILESTONES

.1 Project milestones form interim targets for Project Schedule.

## 6. PROJECT SCHEDULE

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

.1 Award;

.2 Shop Drawings, Samples;

.3 Permits;

.4 Mobilization;

.5 Removals;

.6 Earthworks;

.7 Granular;

.8 Asphalt Paving;

.9 Edge Light Installation;

.10 Signage Installation;

.11 Line Painting;

.12 Storm/Sewer/Watermain Utility Tie Ins;

.13 Testing and Commissioning;

.14 Supplied item required dates.

## 7. PROJECT SCHEDULE REPORTING

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

.2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

## 8. PROJECT MEETINGS

.1 Discuss Project Schedule at regular site 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 accepted dates shown on baseline schedule.

.2 Weather related delays with their remedial measures will be discussed and negotiated.

# PART 2 - PRODUCTS

## 1. NOT USED

# PART 3 - EXECUTION

## 1. NOT USED

**END OF SECTION**

## PART 1 - GENERAL

### 1. DESCRIPTION

.1 This section specifies general requirements and procedures for Contractor's submissions of shop drawings, product data, samples and mock-ups to the Consultant for review.

### 2. ADMINISTRATIVE

.1 Submit to the Consultant 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 To avoid confusion, Contractor shall take care in organizing submittals under a unique filename while submitting to the Consultant for review. Keep in consideration:

.1 Each submittal shall only contain documentation pertaining to one subject matter. For example: Asphalt and Concrete mix designs shall be two separate submittals.

.2 Submittal filename and title shall begin with *"SUBMITTAL"* followed by its submission number *"01"* and ends with a brief description of the documentation such as *"Asphalt Paving Plan"* or *"Glass Bead Data Sheet"* or *"Storm Pressure Grouting Plan"*. For example: *"SUBMITTAL 01 – Asphalt Paving Plan".*

.3 If further revisions are required to an existing submittal document, the filename shall be updated to include *"REV 1"* or *"REV 2"* based on the iteration. For example: *"SUBMITTAL 08 – Project Schedule REV 3".*

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

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

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

.6 Review submittals prior to submission to the Consultant. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated 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.

.7 Submittals shall be in a reproducible or electronic form acceptable to the Consultant. Facsimile versions of submittals are not acceptable

.8 Notify the Consultant, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.9 Verify field measurements and affected adjacent Work are coordinated.

.10 Contractor's responsibility for errors and omissions in submission is not relieved by the Consultant's review of submittals.

.11 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by the Consultant review.

.12 Keep one copy of each submission, reviewed and accepted, on site.

## 3. 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 Submit shop drawings bearing stamp and signature of qualified professional engineer registered or licensed in Province of British Columbia, Canada.

.3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.4 Allow eight days for the Consultant's review of each submission.

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

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

.7 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.

.8 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 Fabrication;

.2 Layout, showing dimensions, including identified field dimensions, and clearances;

.3 Setting or erection details;

.4 Capacities;

.5 Performance characteristics;

.6 Standards;

.7 Operating weight;

.8 Wiring diagrams;

.9 Single line and schematic diagrams;

.10 Relationship to adjacent work.

.9 After the Consultant's review, distribute copies.

.10 Submit electronic copy of shop drawings for each requirement requested in specification sections and as the Consultant may reasonably request.

.11 Submit electronic copy of product data sheets or brochures for requirements requested in specification sections and as requested by the Consultant where shop drawings will not be prepared due to standardized manufacture of product.

.12 Submit electronic copy of test reports for requirements requested in specification Sections and as requested by the Consultant.

.1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.

.2 Testing must have been within three years of date of contract award for project.

.13 Submit electronic copy of certificates for requirements requested in specification Sections and as requested by the Consultant.

.1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.

.2 Certificates must be dated after award of project contract complete with project name.

.14 Submit electronic copy of manufacturers' instructions for requirements requested in specification Sections and as requested by the Consultant.

.1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

.15 Submit electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by the Consultant.

.1 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

.16 Submit electronic copy of Operation and Maintenance Data for requirements requested in specification Sections and as requested by the Consultant.

.17 Delete information not applicable to project.

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

.19 If upon review by the Consultant, no errors or omissions are discovered or if only minor corrections are made, copy 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.

## 4. SAMPLES

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

.2 Deliver samples prepaid to the Consultant's site office.

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

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

.5 Make changes in samples, which the Consultant may require, consistent with Contract Documents.

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

## 5. MOCK-UPS

**.1 NOT USED.**

## 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.

**END OF SECTION**

## PART 1 - GENERAL

### 1. SUMMARY

.1 Section Includes:

.1 Movement of equipment and other special procedures that must be considered when construction is being carried out while the airport facility is in use.

### 2. RELATED SECTIONS

.1 Section 01 52 00 – Construction Facilities

.2 Section 01 56 00 – Temporary Barriers and Enclosures

.3 Appendix A – Plan of Construction Operations.

### 3. REFERENCES

.1 Transport Canada Aerodrome Standards and Recommended Practices, TP 312E, 5th Edition.

### 4. MEASUREMENT FOR PAYMENT

.1 Mobilization and Demobilization shall be measured per lump sum.

.1 Payment will be made at the Contract lump sum price for item “Mobilization / Demobilization / Permits / Bonding / Insurance / Maintain Low-Profile Barricades & Red Lights / Temporary Threshold Relocation Marking / Closure Markers / Temporary Fencing / Temporary Granular Ramp / Quality Control”. This price shall be full compensation for furnishing all labour, materials, tools, equipment, transportation, and incidentals necessary to complete this item as accepted by the Consultant.

.2 The item shall consist of the following:

.1 Mobilization and removal of all necessary equipment and facilities to the project site in preparation for the work to be done under the Contract.

.2 All necessary permits, bonding, and insurance required for the successful completion of the Contract.

.3 Low profile barricades complete with red lights will be provided by the Owner. The Contractor must install, maintain, supply additional batteries when required, relocate as required and remove at project completion.

.4 Temporary threshold relocation marking complete with lights to be provided by the Contractor. The Contractor must install, maintain, relocate as required and remove at project completion. Temporary

marking to be provided to the airport at the end of the project. Closure marking as shown in the drawings.

.5 The Contractor is to provide, install and remove temporary fencing and placed so that the new Taxiway C construction area is not airside. Refer to PCO for details on fencing placement.

.6 The Contractor is to provide and install granular material for temporary ramps along the runway edge as outlined in the Plan of Construction Operations.

.7 Contractor to provide quality control material testing and survey as required in Section 01 45 00 – Quality Control and Section 01 71 00 – Examination and Preparation.

.3 Partial payment for this item will be made once per month as work progresses. The partial payments will be made as follows:

.1 When 50 percent of the original contract amount is earned, 50 percent of the amount bid for this item will be paid.

.2 When 100 percent of the original contract amount is earned, 100 percent of the amount bid for this item will be paid.

## 1. GENERAL PROTECTION

.1 Do not disrupt airport business except as permitted by Consultant and stated in the approved Plan of Construction Operations.

.2 Provide temporary protection for safe handling of public, personnel, pedestrians and vehicular traffic: to Section 01 56 00 - Temporary Barriers and Enclosures.

.3 Provide barricades and lights where directed.

## 2. MOVEMENT OF EQUIPMENT AND PERSONNEL

.1 In areas of airport not closed to aircraft traffic:

.1 Obtain Consultant's approval on scheduling of Work.

.2 Control movements of equipment and personnel as directed by the Airside Security Escort.

.3 Obey directions from the Airside Security Escort instantly.

.4 All construction activity is monitored by the Airside Security Escort.

.5 All instructions from the Airside Secuirty Escort regarding airport rules, safety and conduct while on airside are to be obeyed immediately.

.6 All work must be planned and executed in conformance with the approved Plan of Construction Operations.

3. **UNSERVICEABLE AREAS**

.1 Mark off areas made unserviceable for aircraft by Work of this Contract by providing plainly visible danger markings by day and red lights by night.

.2 Open flames and inflammable fuels are not permitted.

.3 Mark with steady burning red lights as directed by Consultant and as indicated in the Plan of Construction Operations.

.4 The Contractor shall supply the temporary threshold relocation marking. The Contractor shall place and maintain the temporary threshold relocation marking as indicated in the Plan of Construction Operations.

4. **TRENCHING**

.1 Conduct Work in accordance with Section 31 23 33.01 Excavating, Trenching and Backfilling.

5. **AIRPORT FACILITIES**

.1 Coordinate with the Owner for permits and procedures to locate and / or disclose the underground facilities such as cables, pipes and ducts.

## PART 2 - PRODUCTS

**1. NOT USED**

## PART 3 - EXECUTION

1. **APPLICATION**

.1 Low profile barricades with steady burning red lights must be of standard dimensions and placed in accordance with the Plan of Construction Operations and TP 312E, 5th Edition.

.2 Temporary threshold relocation markings must be of standard dimensions and placed in accordance with the Plan of Construction Operations and TP 312E, 5th Edition.

.3 Prevent closure markers and steady red lights from moving due to wind and jet blast. Secure using sand bags if required.

**END OF SECTION**

## PART 1 - GENERAL

### 1. DESCRIPTION

.1 This section specifies the requirements for protection of the environment during the execution of the Work.

### 2. REFERENCES

.1 Definitions:

.1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade environment aesthetically, culturally and/or historically.

.2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

.2 Reference Standards:

.1 All references to this Specifications, Standards, or Methods shall be understood to refer to the latest adopted revision, including all amendments.

.2 Canadian Construction Documents Committee (CCDC 18)

.3 Canadian Environmental Assessment Act (CEAA 2012).

### 3. MEASUREMENT FOR PAYMENT

**.1** No separate payment will be made under this section. Work in this section is considered incidental to the project.

### 4. ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Prior to commencing construction activities or delivery of materials to site, provide Environmental Protection Plan for review and approval by Consultant.

.3 Ensure Environmental Protection Plan includes comprehensive overview of known or potential environmental issues to be addressed during construction.

.4 Address topics at level of detail commensurate with environmental issue and required construction task(s).

## 5. FIRES

.1 Fires and burning of rubbish on site is not permitted.

## 6. DRAINAGE

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

.2 Ensure pumped water into waterways, sewer or drainage systems is free of suspended materials.

.3 The Contractor shall ensure that water does not collect in excavations from rainfalls during working hours or after hours when the Contractor is not onsite.

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

## 7. WORK ADJACENT TO WATERWAYS

.1 Construction equipment to be operated on land only.

.2 Do not use waterway beds for borrow material.

.3 Waterways to be free of excavated fill, waste material and debris.

.4 Design and construct temporary crossings to minimize erosion to waterways.

.5 Do not skid logs or construction materials across waterways.

.6 Avoid indicated spawning beds when constructing temporary crossings of waterways.

## 8. POLLUTION CONTROL

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

.2 Control emissions from equipment and plant to local authorities' emission requirements.

.3 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area.

.1 Provide temporary enclosures where indicated and as directed by Consultant.

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

.5 All spills of any nature must be reported to the Owner and cleaned up immediately to the satisfaction of the Owner.

## 9. 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.

## 10. NOTIFICATION

.1 Consultant 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 Consultant of proposed corrective action and take such action for approval by Consultant.

.1 Do not take action until after receipt of written approval by Consultant.

.3 Consultant 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

## 1. NOT USED

# PART 3 - EXECUTION

## 1. CLEANING

.1 Conduct cleaning Work in accordance with Section 01 74 00 - Cleaning.

.2 Burial of rubbish and waste materials on site are not permitted.

.3 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.

**END OF SECTION**

# PART 1 - GENERAL

## 1. DESCRIPTION

.1 This section specifies the requirements for testing laboratory services to be provided by the Contractor during the execution of the work.

## 2. RELATED REQUIREMENTS SPECIFIED ELSEWHERE

.1 Particular requirements for inspection and testing designated by the Consultant to be carried out by testing laboratory are specified under various sections of the specifications.

## 3. REFERENCES

.1 All references to this Specifications, Standards, or Methods shall be understood to refer to the latest adopted revision, including all amendments.

## 4. MEASUREMENT FOR PAYMENT

.1 No separate payment will be made for quality control and/or testing laboratory services. Unit rates and lump sum price bid shall include all labour, materials, tools, equipment, etc. as required by the Contractor to complete the quality control testing as specified under the various sections.

.2 Where tests or inspections by designated testing laboratory reveal work not in accordance with contract requirements, the Contractor shall pay costs for additional tests or inspections as the Consultant may require verifying acceptability of corrected work.

## 5. CONTRACTOR'S RESPONSIBILITIES

.1 Quality control testing and testing laboratory services shall consist of but not limited to the following:

.1 Soil and aggregates sieve analysis, proctor, density and moisture content testing.

.2 Density/compaction testing.

.3 Portland Cement Concrete quality control and product acceptance testing.

.4 Hot mix asphalt concrete quality control and product acceptance testing.

.5 All testing as specified under the various sections of the specifications.

.2 Furnish labour and facilities to:

.1 Provide access to work to be inspected and tested.

.2 Facilitate inspections and tests.

.3 Make good work disturbed by inspection and test.

.4 Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.

.3 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.

.4 Pay costs for uncovering and making good work that is covered before required inspection or testing is completed and accepted by the Consultant.

## 6. INSPECTION

.1 Allow the Consultant 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 acceptance by the Consultant instructions, or law of Place of Work.

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

.4 Consultant 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.

## 7. INDEPENDENT QUALITY ASSURANCE INSPECTION AGENCIES

.1 Independent Quality Assurance Inspection/Testing Agencies will be engaged by the Consultant 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 Quality Assurance 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 the Consultant at no cost to the Owner. Pay costs for re-testing and re-inspection.

## 8. ACCESS TO WORK

.1 Allow Quality Assurance inspection/testing agencies access to Work, off site manufacturing and fabrication plants.

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

## 9. PROCEDURES

.1 Notify appropriate agency and the Consultant 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.

## 10. 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 the Consultant 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 the opinion of the Consultant it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner will deduct from Contract Price the difference in value between Work performed and that called for by Contract Documents, this amount of which will be determined by the Consultant.

## 11. REPORTS

.1 Submit one copy of inspection and test reports to Consultant, coincidental with the timing the Contractor receives same or as accepted by the Consultant.

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

## 12. 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 the Contract Documents or beyond those required by law of Place of Work will be appraised by the Consultant and may be authorized as recoverable.

## 13. MILL TESTS

.1 Submit mill test certificates as required of specification sections.

**END OF SECTION**

## PART 1 - GENERAL

### 1. DESCRIPTION

.1 This section specifies the requirements for temporary construction facilities during the execution of the Work.

### 2. REFERENCES

.1 Section 01 35 43 – Environmental Procedures.

.2 All references to this Specifications, Standards, or Methods shall be understood to refer to the latest adopted revision, including all amendments.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 1.189 - 2000, Exterior Alkyd Primer for Wood.

.2 CGSB 1.59 - 97, Alkyd Exterior Gloss Enamel.

.4 Canadian Standards Association (CSA International)

.1 CSA-A23.1/A23.2:24, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CSA-O121:17 (R2022), Douglas Fir Plywood.

.3 CAN/CSA-S269.2-16 (R2021), Access Scaffolding for Construction Purposes.

.4 CAN/CSA-Z321-96 (R2006), Signs and Symbols for the Occupational Environment.

.5 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions 'C', In Effect as of: May 14, 2004.

### 3. MEASUREMENT FOR PAYMENT

.1 Payment for construction facilities described herein shall be paid for under Section 01 35 13.13 – Special Procedures: Airports in Use.

### 4. SUBMITTALS

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

## 5. INSTALLATION AND REMOVAL

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

.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 after use.

.6 Provide and maintain adequate access to project sites.

.7 In the event of snowfall, the Contractor shall provide snow removal as required during the period of work.

.8 Clean roads, runways, taxiways and apron areas where used by the Contractor's equipment and as directed by the Consultant.

## 6. SITE STORAGE/LOADING

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

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

## 7. CONSTRUCTION PARKING

.1 Designated parking space will be made available on site. Maintain and administer these spaces as directed.

.2 Provide and maintain adequate access to project site.

## 8. SECURITY

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

## 9. 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.

.3 Provide adequate weather tight sheds with raised floors, for storage of materials, tools and equipment which are subject to damage by weather.

## 10. 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.

## 11. CONSTRUCTION SIGNAGE

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

## 12. 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 the Consultant.

.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 The 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: responsible for repair of damage to roads caused by construction operations.

.7 Construct access and haul roads necessary.

.8 Haul roads: constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided.

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

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

.11 Location, grade, width, and alignment of construction and hauling roads: subject to acceptance by the Consultant.

.12 Lighting: to assure full and clear visibility for full width of haul road and work areas during night work operations as accepted by the Consultant.

.13 Provide snow removal during period of the Work.

.14 Remove, upon completion of work, haul roads designated by the Consultant.

**13. 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 Stack stored new or salvaged material not in construction facilities.

**14. WATER SUPPLY**

.1 Arrange, pay for and maintain temporary water supply in accordance with governing regulations and ordinances.

**15. POWER**

.1 Arrange, pay for and maintain temporary electrical power supply in accordance with governing regulations and ordinances.

.2 Install temporary facilities for power such as pole lines and underground cables to approval of local power supply authority.

## PART 2 - PRODUCTS

**1. NOT USED**

## PART 3 - EXECUTION

**1. TEMPORARY EROSION AND SEDIMENTATION CONTROL**

.1 Refer to Section 01 35 43 – Environmental Procedures for details on temporary erosion and sedimentation control requirements.

**END OF SECTION**

## PART 1 - GENERAL

### 1. REFERENCES

.1 Section 01 35 13.13 – Special Airport Procedures – Airports in Use

.2 All references to this Specifications, Standards, or Methods shall be understood to refer to the latest adopted revision, including all amendments.

.3 Canadian General Standards Board (CGSB)

.1 CGSB 1.59, Alkyd Exterior Gloss Enamel.

.2 CAN/CGSB 1.189 - 2000, Exterior Alkyd Primer for Wood.

.4 Canadian Standards Association (CSA International)

.1 CSA-O121:17 (R2022), Douglas Fir Plywood.

.5 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions 'C', In Effect as Of: May 14, 2004.

### 2. INSTALLATION AND REMOVAL

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

.2 Remove from site all such work after use.

.3 Provide as required by the Plan of Construction Operations and the Owner.

### 3. GUARD RAILS AND BARRICADES

.1 Provide secure, rigid guard rails and barricades around deep excavations.

.2 Provide as required by governing authorities or as indicated.

### 4. ACCESS TO SITE

.1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work. Work closely with any other Contractor affected by site access.

### 5. PUBLIC TRAFFIC FLOW

.1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect public.

## 6. FIRE ROUTES

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

## 7. PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

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

.2 Be responsible for damage incurred.

## PART 2 - PRODUCTS

## 1. NOT USED

## PART 3 - EXECUTION

## 1. NOT USED

**END OF SECTION**

## PART 1 - GENERAL

### 1. DESCRIPTION

.1 This section specifies the general requirements for Material and Equipment that are to be installed as part of the Work by the Contractor.

### 2. REFERENCES

.1 Articles of Agreement and General Conditions of Construction Contracts.

.2 Within text of each specifications section, reference may be made to reference standards.

.3 Conform to these reference standards, in whole or in part as specifically requested in the specifications.

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

.5 The cost for such testing will be borne by the Contractor in event of non-conformance.

### 3. QUALITY

.1 Products, materials, equipment and articles incorporated in the Work shall be new, not damaged or defective, and of the best quality for the 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 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 the Engineer based upon requirements of the Contract Documents.

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

.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.

## 4. AVAILABILITY

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

.2 In event of failure to notify the Engineer at commencement of the Work and should it subsequently appear that the Work may be delayed for such reason, the Engineer reserves right to substitute more readily available products of similar character, at no increase in the Contract Price or Contract Time.

## 5. STORAGE, HANDLING AND PROTECTION

.1 Deliver, handle, and store products in a manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable. Immediately remove rejected material and equipment from site.

.2 Store packaged or bundled products in their original and undamaged condition with the manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in the 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, lumber on flat, solid supports and keep clear of the 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 the Engineer.

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

.10 Deliver, store, and maintain packaged materials and equipment with manufacturer’s seals and labels intact.

.11 Prevent damage, adulteration, and soiling of material and equipment during deliver, handling, and storage. Immediately remove rejected material and equipment from site.

.12 Store material and equipment in accordance with the supplier's instructions.

## 6. TRANSPORTATION

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

## 7. MANUFACTURER'S INSTRUCTIONS

.1 Unless otherwise indicated in specifications install or erect products in accordance with the manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from the manufacturers.

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

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

## 8. QUALITY OF WORK

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

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

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

## 9. SUBSTITUTION

.1 No substitutions will be permitted without prior written approval of the Engineer.

.2 Proposals for substitution may only be submitted after award of the contract. Such request must include statements of the respective costs of items originally specified and the proposed substitution.

.3 Proposals will be considered by the Engineer if:

.1 Materials selected by tenderer from those specified, are not available.

.2 Delivery date of materials selected from those materials specified would unduly delay completion of the contract; or

.3 Alternative material to those specified which are brought to the attention of and considered by the Engineer as equivalent to the material specified and will result in a credit to the Contract amount.

.4 Should a proposed substitution be accepted either in part or in whole, the contractor shall assume full responsibility and costs when the substitution affects other work on the project. The Contractor shall pay for design or drawing changes required as result of the substitution.

.5 Amounts of all credits arising from the approval of a substitutions will be determined by the Engineer and the Contract Price will be reduced accordingly.

## 10. CO-ORDINATION

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

.2 Be responsible for the coordination and placement of openings, sleeves and accessories.

## 11. REMEDIAL WORK

.1 Perform remedial work required to repair or replace parts or portions of the 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 the Work.

## 12. FASTENINGS

.1 Provide metal fastenings and accessories of the same texture, colour and finish as adjacent materials, unless otherwise indicated.

.2 Prevent electrolytic action between dissimilar metals and materials.

.3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected Specification Section.

.4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.

.5 Keep exposed fastenings to a minimum, space evenly and install neatly.

.6 Fastenings which cause spalling or cracking of the material to which the anchorage is made are not acceptable.

.7 Obtain the Engineer's approval before using explosive actuated fastening devices. If approval is obtained comply with CSA Z166-1975.

## 13. FASTENINGS - EQUIPMENT

.1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.

.2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.

.3 Bolts may not project more than one diameter beyond nuts.

.4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

## 14. CONSTRUCTION EQUIPMENT AND PLANT

.1 On request, prove to the satisfaction of the Engineer that the construction equipment and plant are adequate to manufacture, transport, place and finish work to the quality and at the production rates specified. If inadequate, replace or provide additional equipment or plant as directed.

.2 Maintain construction equipment and plant in good operating order.

.3 Plant must provide adequate capacity in order to replace any material removed during one shift as well as enough material to provide transitions from the new mat to existing surface to allow re-opening of the runway for safe operations of aircraft after the work shift.

.4 Plant must be available for production twenty four (24) hrs. a day for night and day paving.

.5 Plant must have appropriate permitting to produce asphalt for delivery and use on airport property.

.6 Plant must meet emissions standards of the authority having jurisdiction.

## 15. PROTECTION OF WORK IN PROGRESS

.1 Prevent overloading of parts of the Work. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written acceptance of the Engineer.

## 16. EXISTING UTILITIES

.1 When breaking into or connecting to existing services or utilities, execute the Work at times directed by the local governing authorities, with minimum of disturbance to the Work.

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

## PART 2 - PRODUCTS

### 1. NOT USED

## PART 3 - EXECUTION

### 1. NOT USED

**END OF SECTION**

## PART 1 - GENERAL

### 1. REFERENCES

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

.2 Section 01 33 00 - Submittal Procedures

.3 Section 01 78 00 – Closeout Submittals

### 2. MEASUREMENT FOR PAYMENT

.1 Payment for construction layout, quantity measurements and as-built surveys will be made at the contract lump sum price for “Construction & As-builts Surveys, Operations & Maintenance Manuals”. This price shall be full compensation for furnishing all labour, materials, tools, equipment, transportation and incidentals necessary to complete this item as described in the Contract Documents and shall include construction surveys (including paint markings), quantity surveys, as-built survey, and final submission of As-builts in AutoCad format as required by the Consultant, all as-built red-lines, and all operations & maintenance manuals noted in the specifications.

### 3. QUALIFICATIONS OF SURVEYOR

.1 The Contractor shall supply a competent fully equipped survey crew to carry out work as listed below. Unsuitable or unqualified personnel shall be removed from the project and replaced immediately with qualified personnel.

### 4. 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 the Consultant.

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

.5 Costs to replace geodetic bench marks or legal survey pins as a result of Contractor negligence will be deducted from the Contractor’s payment. In particular, legal pins shall be laid out by a competent registered Canada Land Surveyor.

### 5. GENERAL REQUIREMENTS

.1 All layout of the Work shall be the responsibility of the Contractor.

.2 The Contractor shall set all Work stakes and/or marks necessary to complete the work and be responsible for the preservation of all stakes and marks. The layout of the Work shall be as required to ensure tolerances are achieved.

.3 The Consultant will furnish the Contractor with a complete set of construction drawings. The Contractor shall provide the Consultant with a copy of all vertical control grades as established from the information provided. Should the Contractor's survey utilize a control points network, the Contractor shall provide to the Consultant a copy of coordinates and elevations of the control points.

.4 If at any time during the progress of the Work any error shall appear or arise in the position, levels, dimensions or alignment of any part of the Work, the Contractor shall stop working on that portion of the Work and notify the Consultant. If the Contractor proceeds with the Work after a discrepancy is discovered, he does so at his own risk. The Contractor shall make allowances in his work schedule for delays of this nature and shall not claim or be paid for stand by or shut down.

## 6. CONSTRUCTION SURVEY LAYOUT

.1 The Contractor shall provide stakes and/or marks required to properly identify critical changes in transverse/ longitudinal slopes or grade breaks in addition to the intervals specified below for each material layer. **Nails are not permitted, felt pen/paint to be used on hard surfaces, 300mm long rebar to be used in soft surfaces.**

.1 The Contractor shall provide subgrade, granular subbase course, granular base course, asphalt and milling grades referenced to finished pavement elevations. The Contractor shall be responsible for establishing grades for cold milling, subgrade, granular subbase, granular base, and intermediate asphalt lifts as required. The interval for setting grades shall be 10 metres in the longitudinal direction of paving and 5 metres in the transverse direction and at each change in transverse slope and/or the width of the paving mat as agreed to by the Contractor and the Consultant. Tighter grades may be required in specific variable depth milling area.

.2 Table 1 consists of survey layout for miscellaneous items to be provided by the Contractor. Layout requirements may be changed as mutually agreed upon with the Contractor and the Consultant.

| Table 1 – Survey Layout Provisions | | | | |
|---|---|---|---|---|
| ITEM | LOCATION LAYOUT | OFFSET LAYOUT | ELEVATION | COMMENTS |
| Temporary Threshold Relocation Marking | √ | √ | | Location of threshold marking for 1000ft temporary threshold displacement. |
| Asphalt Mat Thickness Layout | √ | √ | Thickness | Paint marks on the asphalt |
| Edge Lights | | √ | | Mark on edge of pavement |
| Pullpits | | √ | | Location stake |
| Signs | √ | √ | √ | Sign base location and offset stakes. Elevation to top of concrete base. |
| Underground Pipes, Culverts and Utilities | √ | √ | √ | Offset stakes with grades referenced to pipe inverts |
| Paint Markings | √ | | | Marks at 10 m intervals on tangent lines. Marks at 5 m intervals on curves. Marks to center or edge of numbers and letters. |

## 7. CONTRACTOR'S RESPONSIBILITIES

.1 The Contractor must satisfy themselves before commencing any work as to the meaning and intent of all marks and stakes. Should the Contractor discover or suspect any apparent error or omission in the Drawings, Specifications, stakes, marks, engineering tests, or other measurements done or provided by the Consultant, the Contractor shall immediately bring such apparent error or omission to the attention of the Consultant. The Consultant will make corrections and interpretations as may be necessary for the fulfillment of the intent of the Drawings and Specifications.

.2 The Contractor shall be responsible for transferring the information from the Drawings, Specifications, or other measurements provided by the Consultant for performance of the Work in accordance with the Contract Documents.

## 8. EXISTING SERVICES

.1 Before commencing work, coordinate with the Owner to establish location and extent of service lines in area of the Work.

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

## 9. RECORDS

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

.2 Record locations/elevations of maintained, re-routed, and abandoned service lines.

## 10. SUBMITTALS

.1 Submit name and address of the Surveyor to the Consultant.

.2 Throughout the duration of the project, the Contractor shall submit progress estimate quantities and as-built survey information to the Consultant for review. In addition, upon completion of the project, the Contractor shall submit a complete set of markup drawings to the Consultant. All survey data to be complete and in format acceptable to the Consultant.

.3 On request of the Consultant, submit documentation to verify accuracy of field engineering work.

.4 Survey data submittals for progress estimate quantities shall be in ACAD Civil 3D with break lines and surfaces or other format acceptable to the Consultant with each Tender Line Item provided as a separate file/surface. For example, a surveyed surface of the existing compacted subgrade may be named “Item 3.03 Top of Subgrade” and subsequent survey surface of compacted supplied / installed base gravels may be named “Item 3.04 Installed Gravel”. CSV file and feature code file showing descriptions of points to accompany data.

## 11. SUBSURFACE CONDITIONS

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

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

**END OF SECTION**

## PART 1 - GENERAL

### 1. DESCRIPTION

.1 This Section specifies the requirements for the cleaning of the project site and the completed work during the time of the Work and at the completion of the work.

### 2. REFERENCES

.1 All references to this Specifications, Standards, or Methods shall be understood to refer to the latest adopted revision, including all amendments.

### 3. MEASUREMENT PROCEDURES

.1 No separate payment will be made under this section. Include costs in the appropriate tender items.

### 4. GENERAL

.1 Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.

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

.3 Dust control shall be exercised as required and as directed by the Consultant. Contractors shall supply the necessary water truck(s) as required for dust control purposes.

### 5. PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including other than that caused by the Owner or other Contractors.

.2 Clear soil, snow and ice and remove from site.

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

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

.5 Provide and use marked separate bins for recycling.

.6 Dispose of waste materials and debris off site.

.7 For work on or around airside pavements including airside access route, provide continuous cleaning of dust and debris as necessary to prevent damage to aircraft.

.8 Prevent materials and rubbish from blowing onto aircraft maneuvering areas and becoming a hazard to aircraft operations.

.9 The Contractor must demonstrate that they have sufficient equipment (pressure sprayers, vacuums, brushes, sweepers, trucks) and workforce to clean the asphalt and concrete and debris and slurry during sawcutting operations. The Contractor must also contain the slurry from flowing out of the specific site area during work operations.

.10 Clean areas prior to start of finishing/paint markings work and maintain areas free of dust and other contaminants during finishing/painting operations.

.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.

## 6. FINAL CLEANING

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

.2 Remove waste products and debris, and leave the Work area clean.

.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 the Consultant. Do not burn waste materials on site.

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

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

.7 Remove dirt and other disfiguration from exterior surfaces.

.8 Sweep and wash clean paved areas.

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

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

.11 Remove snow and ice.

.12 Underground drainage structures.

.1 All underground pipes shall be flushed with water in the presence of the Consultant to remove any construction debris from the pipes.

.13 Manholes, Catch basins and Electrical Vaults.

.1 All debris and water shall be removed from the underground structure with a hydrovac unit at the completion of the project.

.14 Pavement Surfaces

.1 All pavements shall be cleaned of mud, cement slurry or other deleterious materials prior to final inspection.

.15 Landscaped Surfaces

.1 Rake surface to remove debris except in newly planted areas where debris shall be handpicked.

## 7. WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with governing agencies.

**END OF SECTION**

## PART 1 - GENERAL

### 1. DESCRIPTION

.1 This Section specifies the requirements for the preparation of Project Record Documents by the Contractor for submission to the Consultant at the completion of the Work.

### 2. REFERENCES

.1 Section 01 33 00 - Submittal Procedures

.2 Section 01 71 00 – Examination and Preparation

### 3. MEASUREMENT FOR PAYMENT

.1 No separate payment will be made under this section. Include costs in the appropriate tender items.

### 4. ADMINISTRATIVE REQUIREMENTS

.1 Pre-warranty Meeting:

.1 Convene meeting one week prior to contract completion with the contractor's representative and the Consultant to:

.1 Verify project requirements.

.2 Review manufacturer's installation instructions and warranty requirements.

.2 The Consultant is 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.

### 5. ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Two weeks prior to Substantial Performance of the Work, submit to the Consultant, four 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 the Work.

.4 Provide evidence, if requested, for type, source and quality of products supplied.

## 6. 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 by systems, under Section numbers and sequence of Table of Contents.

.6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.7 Text: manufacturer's printed data, or typewritten data.

.8 Drawings: provide with reinforced punched binder tab.

.1 Bind in with text; fold larger drawings to size of text pages.

.9 Provide as-built survey CAD files in *.dwg format or Civil 3D format as requested by the Consultant. Survey data shall have all break lines/surfaces tied to survey monument data.

## 7. CONTENTS - PROJECT RECORD DOCUMENTS

.1 Table of Contents for Each Volume: provide title of project;

.1 Date of submission, names.

.2 Addresses, and telephone numbers of Contractor with name of responsible parties.

.3 Schedule of products and systems, indexed to content of volume.

.2 For each product or system:

.1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.

.4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.5 Typewritten Text: as required to supplement product data.

.1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.

## 8. AS-BUILT DOCUMENTS AND SAMPLES

.1 The Consultant will provide one set of white prints for record drawing purposes.

.2 Maintain, in addition to requirements in General Conditions, at site for the Consultant 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.

.3 Store record documents and samples in field office apart from documents used for construction.

.1 Provide files, racks, and secure storage.

.4 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.

.5 Maintain record documents in clean, dry and legible condition.

.1 Do not use record documents for construction purposes.

.6 Keep record documents and samples available for inspection by the Consultant.

## 9. RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

.1 Maintain project record drawings and record accurately deviations from Contract documents.

.2 Record changes in red and submit set of prints to the Consultant at completion of the project.

.3 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.

.4 Record information concurrently with construction progress.

.1 Do not conceal Work until required information is recorded.

.5 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 Location of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of structure.

.3 Field changes of dimension and detail.

.4 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.5 Field changes of dimension and detail.

.6 Changes made by change orders or field order.

.7 Details not on original Contract Drawings.

.8 References to related shop drawings and modifications.

.6 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.

.7 Other Documents: maintain the manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

.8 Provide digital photos, if requested, for site records.

## 10. FINAL SURVEY

.1 Submit final site survey drawings, certifying that elevations and locations of completed Work are in conformance, or non-conformance with the Contract Documents. Survey data to be in ACAD Civil 3D with break lines or other format acceptable to the Consultant with CSV file and feature code file showing descriptions of points to accompany data.

.2 Final survey for asphalt construction on the new Taxiway C shall have the taxiway centerline and approx. 6m offsets increments from CL, and 20m grid shots, edges of rehabilitation, granular shoulders, dry well, stormwater piping and appurtenances, drainage swale, edge light, signage and pull pit locations, as well as any ground changes or features outside the asphalt areas.

## 11. EQUIPMENT AND SYSTEMS

.1 **NOT USED**.

## 12. DELIVERY, STORAGE AND HANDLING

.1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.

.2 Store in original and undamaged condition with manufacturer's seal and labels intact.

.3 Store components subject to damage from weather in weatherproof enclosures.

.4 Store paints and freezable materials in a heated and ventilated room.

.5 Remove and replace damaged products at own expense and for review by the Consultant.

**END OF SECTION**

## PART 1 - GENERAL

### 1. DESCRIPTION

.1 This section specifies requirements for sawcutting, removal, disposal, and salvage of site work indicated by the Contract Documents or as directed by the Consultant.

### 2. SUMMARY

.1 Section Includes.

.1 Methods and procedures for demolishing, salvaging, recycling, and removing site work items designated to be removed in whole or in part, and for backfilling resulting trenches and excavations.

.2 Related Sections.

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 45 00 - Quality Control.

.3 Section 01 35 43 - Environmental Procedures.

.4 Section 31 23 33.01 - Excavating, Trenching and Backfilling.

### 3. MEASUREMENT FOR PAYMENT

.1 Refer to Section 02 41 13.14 – Asphalt Paving Removal for asphalt removal & sawcutting measurement for payment details.

### 4. REFERENCES

.1 All references to the Specifications, Standards, or Methods shall be understood to refer to the latest adopted revision, including all amendments.

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

.1 Material Safety Data Sheets (MSDS).

.4 Transport Canada (TC).

.1 Transportation of Dangerous Goods Act, 1992 (TDGA), c. 34.

## 5. DEFINITIONS

.1 Demolition: rapid destruction of pavements following removal of hazardous materials.

.2 Hazardous Materials: dangerous substances, dangerous goods, hazardous commodities, and hazardous products, may include 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.

## 6. SUBMITTALS

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

.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets.

.3 Shop drawings.

.1 Submit for acceptance drawings, diagrams or details showing sequence of demolition work, and supporting structures and underpinning where required by authorities having jurisdiction.

.2 Submit drawings stamped and signed by qualified professional engineer registered or licensed in Province of British Columbia, Canada.

.4 Hazardous Materials: provide description of Hazardous Materials and Notification of Filing with proper authorities prior to beginning of the Work, as required.

## 7. QUALITY ASSURANCE

.1 Regulatory Requirements: ensure Work is performed in compliance with applicable Provincial/Territorial regulations.

.2 Site Meetings.

.1 Convene pre-installation meeting one week prior to beginning work of this Section.

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other construction sub trades.

.2 Arrange for site visit with the Consultant to examine existing site conditions adjacent to demolition work, prior to start of the Work.

.3 Hold project meetings every week.

.4 Ensure key personnel, site supervisor, project manager, and subcontractor representatives attend.

## 8. DELIVERY, STORAGE AND HANDLING

.1 Perform Work in accordance with Section 01 35 43 - Environmental Procedures.

.2 Storage and Protection.

.1 Protect in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Protect existing items designated to remain and items designated for salvage. In event of damage to such items, immediately replace or make repairs to acceptance of the Consultant and at no cost to the Owner.

.3 Remove and store materials to be salvaged, in manner to prevent damage.

.4 Store and protect in accordance with requirements for maximum preservation of material.

.5 Handle salvaged materials as new materials.

.6 Existing buried utilities and structures:

.1 Size, depth, and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.

.2 Prior to commencing any excavation work, notify the applicable owner or authorities, confirm location and state of use of buried utilities and structures. Clearly mark such locations to prevent disturbance during work.

.3 Confirm locations of buried utilities by careful test excavations.

.4 Maintain and protect from damage, water, sewer, gas, fuel, electric, telephone, and other utilities and structures encountered. Obtain direction from the Consultant before moving or otherwise disturbing utilities or structures.

.5 Record as-built locations of maintained, re-routed and abandoned underground lines on Drawings.

.3 Waste Management and Disposal.

.1 Divert excess materials from landfill to site accepted by the Consultant.

.2 Separate for reuse and recycling and place in designated containers for Steel, Metal, and Plastic waste.

.3 Place materials defined as hazardous or toxic in designated containers.

.4 Handle and dispose of hazardous materials in accordance with Regional and Municipal, regulations.

.5 Label location of salvaged material's storage areas and provide barriers and security devices.

.6 Ensure emptied containers are sealed and stored safely.

.7 Source separate for recycling materials that cannot be salvaged for reuse including wood, metal, concrete and asphalt, and gypsum.

.8 Remove materials that cannot be salvaged for reuse or recycling and dispose of in accordance with applicable codes at licensed facilities.

.9 All materials suitable for re-use, other than that which is designated for re-use in work shall be transported and stockpiled at locations indicated or as directed by the Consultant.

.10 The Contractor shall be responsible for obtaining all necessary permits.

## 9. SITE CONDITIONS

.1 Site Environmental Requirements.

.1 Perform work in accordance with Section 01 35 43 - Environmental Procedures.

.2 Ensure that selective demolition work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.

.3 Do not dispose 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.

.1 Ensure proper disposal procedures are maintained throughout the project.

.4 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers or onto adjacent properties.

.5 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authorities or as directed by the Consultant.

.6 Protect trees, plants, and foliage on site and adjacent properties where indicated.

## PART 2 - PRODUCTS

### 1. EQUIPMENT

.1 Leave machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.

## PART 3 - EXECUTION

### 1. PREPARATION

.1 Inspect site with the Consultant and verify extent and location of items designated 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 Notify and obtain approval of utility companies before starting demolition.

### 2. REMOVAL OF HAZARDOUS WASTES

.1 Remove contaminated or dangerous materials defined by authorities having jurisdiction, relating to environmental protection, from site and dispose of in safe manner to minimize danger at site or during disposal.

### 3. REMOVAL OPERATIONS

.1 Remove items as indicated on the drawings and as noted elsewhere in the specifications.

.2 Do not disturb items designated to remain in place.

.3 Removal of items shall be staged in accordance with the operations plan to ensure the continued operation of the airport.

.4 Removal of Pavements, Curbs, and Gutters:

.1 Perform sawcuts to lines indicated on drawings or as directed by the Consultant.

.2 Square up adjacent surfaces to remain in place by saw cutting or other method accepted by the Consultant.

.3 Protect adjacent joints and load transfer devices.

.4 Protect underlying and adjacent granular materials.

.5 Prevent contamination of removed asphalt pavement by topsoil, underlying gravel or other materials.

.6 Excavate at least 300 mm below pipe invert, when removing pipes under existing or future pavement area.

.7 Use equipment and methods of removal and hauling which do not tear, gouge, break or otherwise damage or disturb adjacent pavement or underlying granular material.

.8 Provide for suppression of dust generated by removal process.

.9 Salvage.

.1 Carefully dismantle items containing materials for salvage. Reuse items as indicated on drawings. Stockpile salvaged materials not designated for re-use in work at locations indicated or as directed by the Consultant.

.10 Disposal of Material.

.1 Dispose of materials not designated for salvage or reuse.

.2 All materials suitable for re-use, other than that which is designated for re-use in work shall be transported and stockpiled at locations indicated or as directed by the Consultant.

.3 All excavated material is to be separated and disposed of on site at locations specified by the Consultant. Topsoil and excavated material are to be stockpiled separately.

.4 Contractor shall be responsible for obtaining all necessary permits.

.5 Trim disposal areas to acceptance of the Consultant.

.11 Backfill.

.1 Backfill in areas as indicated and in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

## 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.

## 5. REMOVAL FROM SITE

.1 Remove stockpiled material as directed by the Consultant, when it interferes with operations of project.

.2 Remove stockpiles of like materials by alternate disposal option once collection of materials is complete.

.3 Transport material designated for alternate disposal using accepted facilities in accordance with the applicable regulations.

.4 Dispose of materials not designated for alternate disposal in accordance with the applicable regulations.

## 6. RESTORATION

.1 Restore areas and existing works outside areas of demolition to conditions that existed prior to beginning of the 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.

## 7. CLEANING

.1 Remove debris, trim surfaces and leave work site clean, upon completion of the Work.

.2 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.

.3 Ensure all haul routes are free from debris and dirt during and after construction activities, to the satisfaction of the Consultant.

**END OF SECTION**

## PART 1 - GENERAL

### 1. SECTION INCLUDES

.1 Methods for removal of existing asphalt pavement.

### 2. RELATED SECTIONS

.1 Section 01 74 00 - Cleaning.

### 3. MEASUREMENT FOR PAYMENT

.1 Measure asphalt concrete pavement by cold milling, for butt joints or rehabilitation, in square meters to depth specified. Payment under this item will include equipment and operations involved in milling, loading, hauling, cleaning, sweeping and stockpiling and/or disposal on-site as directed by the Consultant.

.2 Measure saw cutting of existing asphalt pavement in lineal meters to depth specified including cleaning, loading, hauling and disposal of asphalt and asphalt laitance, disposal on-site, tipping fees. Saw cutting for this item is for any existing full depth asphalt and for butt joint sawcuts only, as shown on the drawings. Any saw cutting required to complete staggered construction of new asphalt pavement is considered incidental to paving.

### 4. WASTE MANAGEMENT AND DISPOSAL

.1 Divert unused asphalt materials from landfill to local facility as accepted by Consultant.

.2 Separate waste materials for reuse and recycling in accordance with governing agencies.

## PART 2 - PRODUCTS

### 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.

.2 Use mechanical saw cutting machine capable of following a straight line to provide a straight, clean vertical surface.

## PART 3 - EXECUTION

### 1. PREPARATION

.1 Prior to beginning removal, sawcutting and milling operation, inspect, and verify with Consultant areas, depths and lines of asphalt pavement to be milled or removed.

### 2. PROTECTION

.1 Protect existing pavement not designated for removal or milling, light units and structures from damage. In event of damage, immediately replace or make repairs to acceptance of Consultant at no additional cost.

.2 Protect appurtenances (manhole castings, valve covers, trench drains, light units and structures) from damage. If there is any damage, immediately replace or complete repairs to acceptance of the Consultant at no additional cost.

.3 Protect existing storm catch basins and inlets from slurry/debris entering the systems. In event of damage, immediately replace or make repair to acceptance of Consultant at no additional cost.

.4 Protect existing aircraft tie down anchors which are to remain from disturbance during cold milling. In event of damage, immediately replace or make repair to acceptance of Consultant at no additional cost.

### 3. REMOVAL

.1 Remove existing asphalt pavement to lines, depths and grades as indicated or established by Consultant.

.2 Use equipment and methods of removal and hauling which do not damage or disturb underlying pavement.

.3 Prevent contamination of removed asphalt pavement by topsoil, underlying gravel or other materials.

.4 Provide for suppression of dust generated by removal process.

### 4. DISPOSAL

.1 Dispose of millings by stockpiling in location designated by the Consultant. No windrow permitted along aprons and taxiways.

### 5. FINISH TOLERANCES

.1 Finished surfaces in areas where asphalt pavement has been removed to be within +/- 5 mm of grade specified but not uniformly high or low.

## 6. SWEEPING

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

**END OF SECTION**

# PART 1 - GENERAL

## 1. DESCRIPTION

.1 This section specifies the requirements for the supply and construction of formwork for Cast-In-Place and Concrete Paving concrete items as indicated by the Contract Documents or as directed by the Consultant.

## 2. RELATED SECTIONS

.1 Section 03 20 00 – Concrete Reinforcing

.2 Section 03 30 00 - Cast-in-place Concrete.

## 3. REFERENCES

.1 All references to this Specifications, Standards, or Methods shall be understood to refer to the latest adopted revision, including all amendments.

.2 Canadian Standards Association (CSA International)

.3 All references to this Specifications, Standards, or Methods shall be understood to refer to the latest adopted revision, including all amendments.

.4 Canadian Standards Association (CSA International)

.5 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.6 CSA O86S1, Supplement No. 1 to CAN/CSA-O86-01, Engineering Design in Wood.

.7 CSA-O121, Douglas Fir Plywood.

.8 CSA-O151, Canadian Softwood Plywood.

.9 CSA-O153, Poplar Plywood.

.10 CAN/CSA-O325.0, Construction Sheathing.

.11 CSA-O437 Series, Standards for OSB and Waferboard.

.12 CAN/CSA S269.3, Concrete Formwork, National Standard of Canada

.13 Underwriters' Laboratories of Canada (ULC)

.14 CAN/ULC-S701, Standard for Thermal Insulation, Polystyrene, Boards, and Pipe Covering.

## 4. MEASUREMENT FOR PAYMENT

.1 No measurement shall be made under this section. Include costs in items of work for which concrete formwork is required.

## 5. SUBMITTALS

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

.2 Submit shop drawings for formwork.

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia, Canada.

.3 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CAN/CSA-S269.3 for formwork drawings.

.4 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.

.5 Indicate sequence of erection and removal of formwork for review by the Consultant.

.6 When slip forming and flying forms are used, submit details of equipment and procedures for review by the Consultant.

## 6. DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with regulatory agencies.

.2 Place materials defined as hazardous or toxic in designated containers.

.3 Divert wood materials from landfill to a recycling facility as accepted by the Consultant.

.4 Divert plastic materials from landfill to a recycling facility as accepted by the Consultant.

.5 Divert unused form release material from landfill to an official hazardous material collections site as accepted by the Consultant.

## PART 2 - PRODUCTS

### 1. GENERAL

.1 Products shall meet the standards set out in the referenced standards and requirements of this section.

### 2. MATERIALS

.1 Formwork materials:

.1 For concrete without special architectural features, use wood and wood product formwork materials to CSA O121 CAN/CSA O86 CSA O437 Series CSA O153.

.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 Formwork shall be G1S exterior grade Douglas Fir Plywood, steel or other suitable form grade material. Forms shall not have patches, broken edges, or joint widths greater than 1.5 mm.

.5 Pan forms: permanent as indicated.

.6 Pan forms: permanent as indicated.

.2 Form ties:

.1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.

.2 For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs.

.3 Form liner:

.1 Plywood: Douglas Fir to CSA-O121, grade.

.2 Waferboard: to CAN/CSA-O325.

.4 Form release agent

.1 Non-staining chemical type form release agent.

.5 Form stripping agent: colourless mineral oil, biodegradable, free of kerosene, with viscosity between 70 and 110 seconds Saybolt Universal, 15 to 24 $mm^2/s$ at 40 ºC, flashpoint minimum 150 ºC, open cup.

## PART 3 - EXECUTION

### 1. FABRICATION AND ERECTION

.1 The Contractor shall assume full responsibility for the structural adequacy of the forms to withstand all concrete and construction loads.

.2 Verify lines, levels and centres before proceeding with formwork and ensure dimensions agree with drawings.

.3 Obtain the Consultant's acceptance for use of earth forms framing openings not indicated on drawings.

.4 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.

.5 Forms shall be constructed that the finished concrete will conform to the shape, dimensions and tolerances as specified.

.6 Refer to architectural drawings for concrete members requiring architectural exposed finishes.

.7 Do not place shores and mud sills on frozen ground.

.8 Provide site drainage to prevent washout of soil supporting mud sills and shores.

.9 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.

.10 Align form joints and make watertight.

.1 Keep form joints to minimum.

.11 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.

.12 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

.13 Construct forms for architectural concrete, and place ties as indicated.

.1 Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.

.14 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

.15 When slip forming is used, submit details as indicated in Part 1 Section 5 - Submittals.

## 2. REMOVAL AND RESHORING

.1 Forms shall not be removed until concrete has attained sufficient strength that no damage to strength or continuity of concrete will occur when forms are removed. Obtain acceptance from the Consultant prior to removing formwork.

.2 Remove forms in a manner to prevent damage to concrete. Use only wooden edges to wedge between the form and the concrete.

.3 Re-use formwork subject to requirements of CSA-A23.1/A23.2.

**END OF SECTION**

# PART 1 - GENERAL

## 1. DESCRIPTION

.1 This section specifies the requirements for the supply and installation of reinforcing steel for the partial depth concrete top repair of a manhole as indicated by the Contract documents or as directed by the Consultant.

## 2. RELATED SECTIONS

.1 Section 03 10 00 – Concrete Forming and Accessories.

.2 Section 03 30 00 – Cast-in-Place Concrete

## 3. MEASUREMENT FOR PAYMENT

.1 No measurement will be made under this Section.

.1 Include costs in items of work for which reinforcing steel is required.

## 4. REFERENCES

.1 All references to this Specifications, Standards, or Methods shall be understood to refer to the latest adopted revision, including all amendments.

.2 American Concrete Institute (ACI)

.1 SP-66, ACI Detailing Manual 2004.

.1 ACI 315, Details and Detailing of Concrete Reinforcement.

.2 ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.

.3 American Society for Testing and Materials International (ASTM)

.1 ASTM A143/A143M, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.

.2 ASTM A185/A185M, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

.3 ASTM A497/A497M, Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.

.4 ASTM A775/A775M, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.

.4 Canadian Standards Association (CSA International)

.1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA-A23.3, Design of Concrete Structures.

.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.

.5 CAN/CSA-G164-M92 (2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.6 CSA-W186-M1990 (R2012), Welding of Reinforcing Bars in Reinforced Concrete Construction.

.5 Reinforcing Steel Institute of Canada (RSIC)

.1 RSIC, Reinforcing Steel Manual of Standard Practice 2004.

## 5. SUBMITTALS

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

.2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and ACI 315.

.3 At least four weeks prior to commencing work provide to the Consultant.

.1 A certified copy of mill test report of reinforcing steel, showing physical and chemical analysis.

.2 Proposed source of material to be supplied.

.4 Submit shop drawings including placing of reinforcement and indicate:

.1 Bar bending details.

.2 Lists.

.3 Quantities of reinforcement.

.4 Indicate sizes, spacings, locations of chairs, spacers, and hangers.

.5 Detail lap lengths and bar development lengths to CSA-A23.3, unless otherwise indicated.

.1 Provide type A, B, C tension lap splices where indicated.

.6 When Chromate solution is used as replacement for galvanizing non-prestressed reinforcement, provide product description for review and acceptance by the Consultant prior to its use.

.7 Quality Assurance: in accordance with Section 01 45 00 – Quality Control and as described in Part 2, Section 3 – Source Quality Control.

.1 Mill Test Report: provide the Consultant with certified copy of mill test report of reinforcing steel, minimum four weeks prior to beginning reinforcing work.

.2 Submit in writing to the Consultant proposed source of reinforcement material to be supplied.

## 6. DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with governing agencies..

.2 Place materials defined as hazardous or toxic in designated containers.

# PART 2 - PRODUCTS

## 1. MATERIALS

.1 Reinforcing steel: billet steel, grade 400, deformed bars to CAN/CSA-G30.18-09, unless indicated otherwise.

.2 Reinforcing steel: weldable low alloy steel deformed bars to CAN/CSA-G30.18-09.

.3 Deformed steel wire for concrete reinforcement: to
– ASTM A1064/A1064M

.4 Welded steel wire fabric: to ASTM A1064/A1064M –

.1 Provide in flat sheets only.

.5 Welded deformed steel wire fabric: to ASTM A1064/A1064M.

.1 Provide in flat sheets only.

.6 Epoxy Coating of non-prestressed reinforcement: to ASTM A775/A775M.

.7 Galvanizing of non-prestressed reinforcement: to included in A23.3-04 (R2010), minimum zinc coating 610 g/m$^2$.

.8 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.

.9 Mechanical splices: subject to acceptance by the Consultant.

.10 Plain round bars: to CSA-G40.20/G40.21-13.

## 2. FABRICATION

.1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2, ACI 315 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.1 ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures unless indicated otherwise.

.2 Obtain Consultant's acceptance for locations of reinforcement splices other than those shown on placing drawings.

.3 Upon acceptance by the Consultant, weld reinforcement in accordance with CSA-W186-1990 (R2012).

.4 Welding shall be performed by a company certified by the Canadian Welding Bureau in accordance with CSA-W47.1-09 (R2014).

.5 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

.1 Ship epoxy coated bars in accordance with ASTM A775A/A775M.

## 3. SOURCE QUALITY CONTROL

.1 Provide the Consultant with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum four weeks prior to beginning reinforcing work.

.2 Inform the Consultant of proposed source of material to be supplied.

# PART 3 - EXECUTION

## 1. PREPARATION

.1 Galvanizing to include chromate treatment.

.2 Conduct bending tests to verify galvanized bar fragility in accordance with ASTM A143/A143M.

## 2. PLACING REINFORCEMENT

.1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1/A23.2.

.2 Reinforcing steel shall not be spliced unless indicated by the Contract documents or accepted by the Consultant.

.3 Reinforcement of size and layout indicated by the Contract documents shall be accurately placed and aligned. Place all dowels accurately.

.4 Reinforcing steel shall be adequately supported by proper chairs, spacers, hangers, and ties to prevent movement during placement of concrete.

.5 Reinforcing steel shall be placed to meet standard tolerances.

.6 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 When paint is dry, apply thick even film of mineral lubricating grease.

.7 Prior to placing concrete, obtain the Consultant's acceptance of reinforcing material and placement.

.8 Ensure cover to reinforcement is maintained during concrete pour.

.9 Protect epoxy coated portions of bars with covering during transportation and handling.

## 3. FIELD TOUCH-UP

.1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcing steel with compatible finish to provide continuous coating.

**END OF SECTION**

## PART 1 - GENERAL

### 1. DESCRIPTION

.1 This section specifies the requirements for cast-in-place concrete for the construction of manholes and catch basins, concrete works associated with the installation of water mains, sewers and electrical work and similar works incidental to site services as indicated by the Contract Documents or as directed by the Consultant.

.2 This section is not applicable for structural facilities or airfield Portland Cement Concrete (PCC) panels.

### 2. RELATED SECTIONS

.1 Section 03 10 00 - Concrete Forms and Accessories.

.2 Section 03 20 00 - Reinforcing Steel.

### 3. MEASUREMENT FOR PAYMENT

.1 No separate payment will be made under this section.

### 4. REFERENCES

.1 All references to this Specifications, Standards, or Methods shall be understood to refer to the latest adopted revision, including all amendments.

.2 American Concrete Institute (ACI)

.1 ACI 306 R-88 Cold Weather Concreting

.2 ACI 305 R-99 Hot Weather Concreting

.3 American Society for Testing and Materials International (ASTM)

.1 ASTM C260, Standard Specification for Air-Entraining Admixtures for Concrete.

.2 ASTM C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.3 ASTM C330, Standard Specification for Lightweight Aggregates for Structural Concrete.

.4 ASTM C494/C494M, Standard Specification for Chemical Admixtures for Concrete.

.5 ASTM C1017/C1017M, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

.6 ASTM D412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.

.7 ASTM D624, Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.

.8 ASTM D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).

.9 ASTM D1752, Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-37.2, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.

.2 CAN/CGSB-51.34, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.5 Canadian Standards Association (CSA International)

.1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA-A283, Qualification Code for Concrete Testing Laboratories.

.3 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.1 CSA-A3001, Cementitious Materials for Use in Concrete.

## 5. ACRONYMS AND TYPES

.1 Cement: hydraulic cement or blended hydraulic cement (XXb - where b denotes blended).

.1 Type GU or GUb - General use cement.

.2 Type MS or MSb - Moderate sulphate-resistant cement.

.3 Type MH or MHb - Moderate heat of hydration cement.

.4 Type HE or HEb - High early-strength cement.

.5 Type LH or LHb - Low heat of hydration cement.

.6 Type HS or HSb - High sulphate-resistant cement.

.2 Fly ash:

.1 Type F - with CaO content less than 8 %.

.2 Type CI - with CaO content ranging from 8 to 20 %.

.3 Type CH - with CaO greater than 20 %.

.3 GGBFS - Ground, granulated blast-furnace slag.

## 6. DESIGN REQUIREMENTS

.1 Alternative 1 – Performance: in accordance with CSA-A23.1/A23.2 and described in MIXES of PART 2 - Products.

## 7. SUBMITTALS

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

.2 At least 4 weeks prior to beginning Work, submit to the Consultant samples of following materials proposed for use:

.3 Aggregates

.1 At least two weeks prior to commencing work, inform the Consultant of the proposed source and provide access for sampling.

.4 Mix Design

.1 At least two weeks prior to commencing work provide the mix design for each specified concrete.

.2 Provide certification that the mix proportions will produce concrete of specified quality and yield and that strength will comply with CSA-A23.1.

.5 Joints

.1 Submit to the Consultant the manufacturer's test data and certification that the products supplied meet the requirements of this section.

.2 Submit samples of joint sealant and foam backer rod if requested by the Consultant.

.6 Miscellaneous

.1 5 L of curing compound.

.2 2 m length of each type of joint filler.

.3 2 m length of each type of waterstops.

.7 Concrete pours: submit accurate records of poured concrete items indicating date/time and location of pour, quality, air temperature and test samples taken as described in PART 3 - FIELD QUALITY CONTROL.

.8 Concrete hauling time: submit for review by the Consultant deviations exceeding maximum allowable time of 90 minutes for concrete to be delivered to site of Work and discharged after batching.

## 8. QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 Site Meetings: in accordance with Section 01 32 16.07 - Construction Progress Schedules – Bar (GANTT) Chart, convene pre-installation meeting one week prior to beginning concrete works.

.1 Ensure key personnel, site supervisor, Consultant, speciality contractor - finishing, forming and testing laboratories attend.

.2 Verify project requirements.

.3 Submit to the Consultant, minimum 4 weeks prior to starting concrete work, valid and recognized certificate from plant delivering concrete.

.1 When plant does not hold valid certification, provide test data and certification by qualified independent inspection and testing laboratory that materials used in concrete mixture will meet specified requirements.

.4 Minimum 4 weeks prior to starting concrete work, submit proposed quality control procedures for review by the Consultant on following items:

.1 Hot weather concrete.

.2 Cold weather concrete.

.3 Finishing/Texturing

.4 Curing.

.5 Sawcutting.

.6 Joints Sealing

.5 Quality Control Plan: submit written report, as described in PART 3 - VERIFICATION, to Consultant verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.

## 9. DELIVERY, STORAGE AND HANDLING

.1 Concrete hauling time: maximum allowable time for concrete to be delivered to site of Work and discharged not to exceed 90 minutes after batching.

.1 Modifications to maximum time limit must be agreed to Consultant and concrete producer as described in CSA-A23.1/A23.2.

.2 Deviations to be submitted for review by Consultant.

.2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA-A23.1/A23.2.

.3 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 02 41 13 – Selective Site Demolition and governing agencies.

.2 Divert unused concrete materials from landfill to local facility approved by the Consultant.

.3 Provide an appropriate area on the job site where concrete trucks can be safely washed.

.4 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by the Consultant.

.5 Unused admixtures and additive materials must not be disposed of into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.

.6 Prevent admixtures and additive materials from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with inert, non-combustible material and remove for disposal. Dispose of waste in accordance with applicable local, Provincial/Territorial and National regulations.

## PART 2 - PRODUCTS

### 1. MATERIALS

.1 Hydraulic Cement: to CAN/CSA-A23.1-04, Table 6 and CAN/CSA-A300-03. Type: GU.

.2 Fly ash: Type F.

.3 Supplementary cementing materials: to CAN/CSA-A23.1, Table 8 and CAN/CSA-A3000.

.4 Water: to CSA-A23.1.

.5 Aggregates: to CAN/CSA-A23.1 and Section 31 05 16 - Aggregate Materials

.1 Coarse aggregates: nominal maximum size 20 mm or large maximum 40 mm.
Each size fraction > 5 % retained.

.2 On 5, 10, 14, 20 and 28 mm sieves to contain at least 50 % two face crushed particles.

.3 The contractor shall submit aggregate test data indicating conformance with
CSA-A23.1-09 Clause 4.2.3.2.2.

.6 Admixtures:

.1 Air entraining admixture: to ASTM C260.

.2 Chemical admixture: to ASTM C494. Consultant to approve accelerating or set retarding admixtures during cold and hot weather placing.

.3 Monomolecular film (Evaporation reducer) – Confilm by Master Builders Technologies, or approved equal. Application in accordance with the manufacturer's recommendations.

.7 Curing compound low VOC: to CSA-A23.1/A23.2 white and ASTM C309, Type 2.

.8 Premoulded joint fillers:

.1 Bituminous impregnated fiber board: to ASTM D1751.

.2 Sponge rubber: to ASTM D1752, Type I, firm grade.

.9 Dowels and tie-bars: to CSA-G30.18.

.1 Dowels: clean, straight and free from flattened or burred ends, plain round bars of grade 300 or better conforming to CSA-G40.21 and be epoxy-coated
to ASTM A775/A775M.

.2 Tie-Bars: deformed steel bars in compliance with CSA-G30.18 and be epoxy-coated to ASTM A775/A775M.

### 2. MIXES

.1 Alternative 1 - Performance Method for specifying concrete: to meet the Consultant's performance criteria in accordance with CAN/CSA-A23.1/A23.2.

.1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as described in PART 3 - VERIFICATION.

.2 Concrete mixes to be designed to prevent excessive expansion due to alkali aggregate reactivity.

.3 Provide concrete mix to meet following hard state requirements:

.1 Durability and class of exposure: F-1.

.2 Minimum compressive strength at 28 days: 30 MPa or as noted on drawings and other specifications.

.3 Minimum flexural strength (MR) of 4.2 Mpa.

.4 Minimum cementing material content: 310 Kg/m3

.5 Maximum fly ash replacement 10 %.

.6 Surface texture: broom / brush finish.

.4 Provide quality management plan to ensure verification of concrete quality to specified performance.

.5 Mix design to be approved by the Consultant prior to commencement of concrete work onsite.

.6 Mix design to be proportioned in accordance with Table 1 and the specified mix as per the Contract Documents.

.7 Use of chemical admixtures will be approved only when specified mix requirements or workability cannot be achieved by proportioning of aggregates, water, cement and air entraining admixtures.

.8 Do not change concrete mix design without prior approval to the Consultant.

.9 Do not change material source without prior approval of the Consultant.

.10 Concrete supplier's certification to include documentation confirming concrete materials and concrete production conform to CSA-A23.1.

**TABLE 1**

| | |
|---|---|
| Cement Type | GU |
| Class of Exposure | F-1 |
| Compressive Strength (minimum 28-day average MPa) | 30 |
| Slump (Maximum mm) | 80 |
| Air Content (%) | 5 – 8 |
| Minimum Portland Cement ($kg/m^3$) | 335 |
| Maximum Water/Cement Ratio | 0.50 |
| Nominal Maximum Size of Coarse Aggregate (mm) | 20 |

## PART 3 - EXECUTION

### 1. PREPARATION

.1 Obtain the Consultant's approval before placing concrete.

.1 Provide 24 hours notice prior to placing of concrete.

.2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.

.3 Do cast-in-place work in accordance with CSA-A23.1.

.4 During concreting operations:

.1 Development of cold joints not allowed.

.2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.

.5 Pumping of concrete permitted after approval of equipment and design by the Consultant.

.1 Provide 48 hours notice to the Consultant prior to placing concrete by pumping.

.6 Ensure reinforcement and inserts are not disturbed during concrete placement.

.7 Prior to concrete being placed, obtain approval from the Consultant for the proposed method to protect concrete, place and cured, in adverse weather conditions.

.8 Protect previous Work from staining.

.9 Clean and remove stains prior to application for concrete finishes.

.10 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

.11 In locations where new concrete is dowelled to existing work, drill holes in existing concrete.

.1 Place steel dowels of deformed steel reinforcing bars and pack solidly with epoxy grout to anchor and hold dowels in positions as indicated.

.12 Do not place load upon new concrete until authorized by the Consultant.

.13 Contractor shall supply and place all necessary barricades and delineation devices to keep people, animals and vehicles off of the work for a minimum period of five days.

### 2. CONSTRUCTION

.1 Do cast-in-place concrete work in accordance with CSA-A23.1/A23.2.

.2 Insert tie bars as indicated.

.3 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 the Consultant.

.2 Where approved by the 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, must be reviewed by the Consultant.

.4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from the Consultant before placing of concrete.

.5 Check locations and sizes of sleeves and openings shown on drawings.

.6 Set special inserts for strength testing as indicated and as required by on-destructive method of testing concrete.

.4 Anchor Bolts

.1 Set bolts, ties and other inserts and openings as indicated or specified elsewhere.

.2 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from the Consultant before placing of concrete.

.3 Check locations and sizes of anchor bolts and openings shown on drawings. Place anchor bolts to templates under supervision of trade supplying anchors prior to placing concrete. Tie anchor bolts at bottom together and align spacing and vertically accurately. Maximum allowable tolerance in spacing is ± 2.0 mm.

.5 Finishing and curing:

.1 Finish concrete in accordance with CSA-A23.1/A23.2.

.2 Use procedures as reviewed by the Consultant or those noted in CSA-A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.

.3 Use curing compounds compatible with applied finish on concrete surfaces. Applied finish on concrete: Provide written declaration that compounds used are compatible.

.4 Rub exposed sharp edges of concrete with a carborundum stove to produce a 3 mm radius edge unless indicated otherwise.

.5 Trowel smooth top surfaces of exposed concrete.

.6 Joint fillers:

.1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by the Consultant.

.2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.

.3 Locate and form isolation, expansion joints as indicated.

.4 Install joint filler.

.5 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.

## 3. JOINTS

.1 General:

.1 Construct joints plumb, straight and square to details indicated.

.2 Transverse joints to coincide with those in adjacent pavement unless indicated or directed otherwise.

.3 Install preformed joint filler at locations and to details indicated.

.4 Install isolation joints around structures and features that project through, into or against pavement.

.2 For sawn joints.

.1 Ensure joints are sawn straight. Install end stakes to ensure straight joint alignment across paved area. Mark joint alignment with chalk line or other suitable guide to approval of the Consultant.

.2 Saw joints using approved equipment and methods to produce joint dimensions indicated.

.3 Restrict speed of saw cutting to ensure proper joint alignment and to avoid damage to concrete.

.4 Supply sufficient workers and equipment including standby equipment, to maintain satisfactory sawing schedule.

.5 Schedule sawing operations on 24 hours basis and consistent with concrete placing.

.6 Make initial saw cuts in progressive manner and as soon as concrete surface has hardened sufficiently to resist ravelling as cut is made and before shrinkage cracks occurs.

.7 If cracking occurs ahead of saw cut, stop sawing immediately. Move ahead several joints and cut one or more joints before returning to saw intermediate joints. Where cracking persists, make 1 m saw cut from one edge and complete sawing from opposite edge. Adjust sawing schedule accordingly.

.8 If uncontrolled cracking or other surface damage results from inadequate or improper sawing techniques suspend further concrete operations until situation
is corrected and immediately remove and replace damaged slabs.

.9 Immediately on completion of sawing, flush joints with water to remove laitance.

## 4. SPECIAL REQUIREMENTS

.1 Hot Weather

.1 When the ambient air temperature is or forecasted to be 23 °C or greater than the following requirements shall be followed:

.1 Concrete temperature at time of placing shall not exceed 20 °C.

.2 Retarding admixtures may be used subject to approval of the Consultant.

.2 Cold Weather

.1 When the air temperature is at or below 5 °C or when there is a probability of it falling below 5 °C within 24 hours of placing.

.2 The aggregate and mixing water shall have a temperature of not less than 5 °C and be entirely free of frozen materials.

## 5. SURFACE TOLERANCE

.1 Concrete tolerance in accordance with CSA-A23.1/A23.2 straightedge method to tolerance schedule as indicated.

## 6. FIELD QUALITY CONTROL

.1 Site tests: conduct following test in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.

.1 Concrete pours.

.2 Slump tests.

.3 Air content test.

.2 Inspection and testing of concrete and concrete materials will be carried out by Contractor's independant testing laboratory in accordance with CSA-A23.1/A23.2.

.1 Ensure testing laboratory is certified in accordance with CSA-A283.

.3 Ensure test results are distributed for discussion at pre-pouring concrete meeting between testing laboratory and the Consultant.

.4 Consultant may request additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.

.5 Non-Destructive Methods for Testing Concrete: in accordance with CSA-A23.1/A23.2.

.6 Inspection or independent testing by the Consultant will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

## 7. DEFECTIVE CONCRETE

.1 Concrete is defective when:

.1 It contains: honeycombing, embedded debris, uncontrolled shrinkage, cracking, or other surface defects.

.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 less than 80 % of specified minimum 28 day strength.

## 8. REPAIR/RESTORATION

.1 Repair of defective concrete work:

.1 Repair defective areas while concrete is still plastic, otherwise wait until curing is completed. Use repair methods approved by the Consultant.

.2 Remove and replace defective concrete where directed by the Consultant.

.1 Replace with new concrete to this specification.

.2 Construct contraction joint at boundary between sawn face of existing concrete
and new concrete.

.3 Install new tie bars between old and new concrete as directed by the Consultant.

## 9. VERIFICATION

.1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established in PART 2 - Products, by Consultant and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

**END OF SECTION**

# PART 1 - GENERAL

## 1. DESCRIPTION

.1 This specification covers the general and specific requirements for aggregates incorporated in various portions of the work.

## 2. RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 32 11 16.01 – Granular Sub-base

.3 Section 32 11 23 – Aggregate Base Coarse

.4 Section 32 12 16 – Asphalt Paving

.5 Section 33 41 00 – Storm Utility Drainage Piping

## 3. REFERENCES

.1 All references to this Specifications, Standards, or Methods shall be understood to refer to the latest adopted revision, including all amendments.

.2 American Society for Testing and Materials (ASTM)

.1 ASTM D4791, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

.2 ASTM C117, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.

.3 ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.4 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.5 ASTM D422, Standard Test Method for Particle-Size Analysis of Soils.

.6 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3)(600 kN-m/m3).

.7 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3)(2,700 kN-m/m3).

.8 ASTM D1883, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.

.9 ASTM D2321, Standard Practice for Underground Installation of Thermal Plastic Pipe For Sewers and Other Gravity Flow Applications.

.10 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.

.4 CSA Group (CSA)

.1 CSA-A23.2-1A Sampling aggregates for use in concrete

.2 CSA-A23.2-12A Relative density and absorption of coarse aggregate.

.3 CSA-A23.2-6A Relative density and absorption of fine aggregate.

.4 CSA-A23.2-16A/17A Resistance to degradation of small-size coarse aggregate by abrasion and impact in the Los Angeles machine.

.5 CSA-A23.2-9A Soundness of aggregate by use of magnesium sulphate

.6 CSA-A23.2-2A Sieve analysis of fine and coarse aggregate.

.7 CSA-A23.2-5A Amount of material finer than 80 µm in aggregate.

## 4. MEASUREMENT FOR PAYMENT

.1 No measurement to be made under this section. Include costs in appropriate tender items.

## 5. GRANULAR SOURCE

.1 The Contractor has the option to produce the granular materials using on site source materials. If the Contractor would like to proceed with an off-site granular source, the granular source is to be accepted by the Consultant. Refer to the following Section (Granular Source Approval) below.

## 6. GRANULAR SOURCE APPROVAL

.1 Inform the Consultant of proposed source of aggregates and provide current satisfactory test data on proposed source of aggregates at least four weeks prior to delivery of aggregate to the site.

.2 If, in the opinion of the Consultant, materials from proposed source(s) do not meet, or cannot reasonably be processed to meet specified requirements, procure alternative source.

.3 Should change of material source be proposed during work, advise the Consultant and provide current satisfactory test data on proposed aggregate source at least two weeks prior to delivery of aggregate to the site.

.4 Acceptance of material at source does not preclude future rejection if it is subsequently found to lack uniformity, or if it fails to conform to requirements specified when incorporated into work.

## 7. SAMPLES

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

.2 Allow continual sampling by the Consultant during production.

.3 Provide the Consultant with access to source and processed material for sampling.

.4 Install sampling facilities at discharge end of production conveyor, to allow the Consultant to obtain representative samples of items being produced. Stop conveyor belt when requested by the Consultant to permit full cross section sampling.

.5 Pay cost of sampling and testing of aggregates which fail to meet specified requirements if so required.

.6 Provide water, electric power and propane to the Consultant's laboratory trailer at production site. (Not Required).

.7 For existing stockpiles of material submit results of Quality Control testing to Consultant at least two weeks prior to delivery of aggregate to the site.

.8 For material produced during the course of the work, submit the results of Quality Control testing within 24 hours of completion of the test.

.9 Submit samples of aggregates (minimum 50 kg) as requested by the Consultant for Quality Assurance testing. Provide the Consultant with access to aggregate sources if requested.

## 8. WASTE MANAGEMENT AND DISPOSAL

.1 Divert unused granular materials from landfill to local recycling facility.

## 9. TEST METHODS

.1 The latest edition of the test methods in Table 1 will be used to determine material characteristics unless otherwise specified.

TABLE 1

| | Name of Test | CSA/ASTM Designation for PCC Pavement | ASTM Designation for HMAC Pavement |
|---|---|---|---|
| **1** | Sampling Aggregates for Use in Concrete | CSA - A23.2 - 1A | |
| .2 | Relative Density and Absorption of Coarse Aggregate | CSA - A23.2 - 12A | ASTM C127-09 |
| .3 | Relative Density and Absorption of Fine Aggregate | CSA - A23.2 - 6A | ASTM D854 - 06 |
| .4 | Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine | CSA - A23.2 - 16A | ASTM C131 - 06 |
| .5 | Soundness of Aggregate by Use of Magnesium Sulphate | CSA - A23.2 - 9A | ASTM C88 - 05 |
| .6 | Sieve Analysis of Fine and Coarse Aggregate | CSA - A23.2 - 2A | ASTM C136 - 06 |
| .7 | Amount of Material Finer than 80 μm in Aggregate | CSA - A23.2 - 5A | ASTM C117- 04 |
| .8 | Sieve Analysis of Mineral Filler for Road and Paving Materials | ASTM D546 | ASTM D546 |
| .9 | Sand Equivalent Value of Soils and Fine Aggregate | ASTM D2419 | ASTM D2419 |
| .10 | Plasticity Index of Soils | ASTM D4318 | ASTM D4318 |
| .11 | Liquid Limit of Soils | ASTM D4318 | ASTM D4318 |

## 10. QUALITY ASSURANCE TESTING

.1 The Consultant will undertake a Quality Assurance program of aggregates testing as material is delivered on site and/or as it is produced and placed in stockpile at the aggregate source. The location of sampling will be at the Consultant's discretion.

.2 Testing by the Consultant will not relieve the Contractor of the responsibility to supply aggregate in accordance with the Contract Documents.

.3 Provide access and assistance to the Consultant to sample aggregates as required for Quality Assurance testing.

.4 Contractor to bear cost of sampling and testing of aggregates which fail to meet specified requirements.

.5 Quality Assurance testing by the Consultant does not relieve the contractor of the responsibility to supply and bear costs for quality control testing and reporting.

## PART 2 - PRODUCTS

### 1. GENERAL

.1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, or other substances that would act in deleterious manner for use intended.

.2 Flat and elongated particles of coarse aggregate: to ASTM D4791.

.1 Greatest dimension to exceed five times least dimension.

.3 Particles having at least two freshly fractured face are considered as crushed fragments.

.4 Fine Aggregates for purposes of standard CSA tests, shall be all mineral matter passing the 5 mm sieve including mineral fillers.

.5 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:

.1 Natural sand.

.2 Manufactured sand.

.3 Screenings produced in crushing of quarried rock, boulders, gravel or slag.

.6 Coarse Aggregates for the purposes of standard CSA tests, shall be all mineral material retained on the 5 mm sieve.

.7 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. MATERIALS

.1 Aggregates shall satisfy all the requirements of this specification and unless specified otherwise shall be:

.1 Crushed Aggregate

.1 Crushed rock composed of hard, uncoated fragments, products from rock formations or boulders of uniform quality.

.2 Crushed gravel composed of hard, durable, uncoated particles, produced from naturally formed deposits.

.2 Screened Aggregate

.1 Aggregates shall be composed of clean, hard, durable uncoated particles and shall satisfy all requirements for the material required.

.2 Unless otherwise directed by the Consultant in consultation with the Design Manager, specifications for various aggregate types are as follows:

.1 Gravel shall conform to the following:

| | % Passing by Weight (Nominal Gravel Size) | |
|---|---|---|
| Metric Sieve Sizes | 75 mm (Screened) | 19 mm (Crushed) |
| 75 mm | 100 | |
| 50 mm | – | |
| 40 mm | – | |
| 25 mm | 50 – 90 | |
| 19 mm | – | 100 |
| 10 mm | – | – |
| 4.75 mm | – | 40 – 80 |
| 2.36 mm | – | 27 – 65 |
| 1.18 mm | – | 18 – 50 |
| 0.600 mm | – | 12 – 35 |
| 0.300 mm | 0 – 15 | 8 – 25 |
| 0.150 mm | – | 4 – 17 |
| 0.075 mm | 0 – 6 | 2 – 8 |

.1 75 mm Screened Gravel:

.1 To be well-graded granular material, substantially free from clay lumps, organic matter and other extraneous material,

screened to remove all stones in excess of maximum diameter specified in material description.

.2 19 mm Crushed Gravel:

.1 Minimum percent fractured shall be 60%. (2 Face)

.2 Maximum 45% loss when tested in accordance with CSA-A23.2–16A and CSA-A23.2–17A.

.2 Crushed or graded gravel for pipe bedding shall conform to the following:

| | % Passing by Weight (Nominal Gravel Size) | |
|---|---|---|
| Sieve Sizes | Type 1 (% Passing) | Type 2 (% Passing) |
| 25.0 mm | 100 | 100 |
| 19.0 mm | 90 – 100 | 90 – 100 |
| 12.5 mm | 65 – 85 | 70 – 100 |
| 9.5 mm | 50 – 75 | |
| 4.75 mm | 25 – 50 | 40 – 70 |
| 2.36 mm | 10 – 35 | |
| 0.85 mm | 5 – 20 | 8 – 30 |
| 0.425 mm | 0 – 15 | |
| 0.300 mm | | 3 – 20 |
| 0.180 mm | 0 – 8 | |
| 0.075 mm | 0 – 5 | 0 – 8 |

Type 1: Standard gradation.
Type 2: To be used only in dry trench conditions and with the Consultants prior approval

.3 Coarse gravel for bedding and drainage shall conform to the following:

| | % Passing by Weight (Nominal Gravel Size) | |
|---|---|---|
| Metric Sieve Sizes | 50 mm | 40 mm |
| 50 mm | | 100 |
| 40 mm | 90 – 100 | 100 |
| 25 mm | – | 95 – 100 |
| 20 mm | 35 – 70 | – |
| 16 mm | – | 25 – 60 |
| 10 mm | 10 – 30 | – |
| 5 mm | 0 – 5 | 0 – 10 |
| 2.5 mm | – | 0 – 5 |

.4 Coarse sand for bedding and drainage shall conform to the following **(NOT USED):**

| Metric Sieve Sizes | % Passing by Weight |
|---|---|
| 10 mm | 100 |
| 5 mm | 95 – 100 |
| 2.5 mm | 80 – 100 |
| 1.25 mm | 50 – 85 |
| 0.630 mm | 25 – 60 |
| 0.160 mm | 10 – 30 |
| 0.080 mm | 2 – 10 |

.5 For Coarse Gravel and Sand for bedding and drainage **(NOT USED):**

.1 Coarse aggregate retained on the 5 mm sieve shall consist of durable particles of crushed stone, gravel or slag capable of withstanding the effects of handling, spreading and compacting without degradation which produces deleterious fines. Of the particles retained on the plus 5 mm sieves at least 50% shall have two or more fractured faces.

.2 Fine aggregate shall consist of fines from crushing and natural sands.

.6 PVC Pipe Bedding:

.1 In accordance with Local Sewer Construction Standard Specifications, bedding materials shall conform to the embedment materials so noted within ASTM D2321 standard. ASTM D2321 requires Class I, II or III materials to be used. General descriptions of these materials are as follows:

.1 Class I: Angular 6 to 40 mm graded stone.

.2 Class II: Coarse sands and gravels with maximum particle size passing the 40 mm sieve. Soil types GW, GP, SW, and SP are included in this class.

.3 Class III: Fine sand and clayey gravels, including fine sands, sand-clay mixtures, and gravel-clay mixtures.

.2 Refer to ASTM. D2321, Table 1 and 2 for details of Class I, II, and III materials.

.7 Drain Rock for Dry Well:

.1 100 – 200mm Rounded Drain Rock (Cobbles)

.8 Riprap:

.1 10kg to BC MOTI Riprap Installation Guide.

.9 Angular Rock

.1 150mm to 200mm.

## 3. SOURCE QUALITY CONTROL

.1 General

.1 Quality Control shall be the responsibility of the Contractor. Quality Assurance tests performed by the Consultant shall not be considered Quality Control tests.

.2 The Contractor shall use professional engineering services and a CSA certified testing laboratory licensed to practice in the Province of British Columbia to assess and where necessary, modify the aggregate materials being produced to ensure their end use meets all specification requirements.

.3 Advise the Consultant 2 weeks in advance of proposed change of material source.

.4 Inspection or testing by the Consultant shall not in any way relieve the Contractor of the responsibility for providing aggregates that meet the specification in all respects.

.2 Testing Frequency

The Contractor shall provide current aggregate test results as per Table 3.

**TABLE 3**

| Test | Standard | Minimum Frequency |
|---|---|---|
| SIEVE ANALYSIS:<br>Crushed or Screened Aggregate or Sand | ASTM C136 | One per 1000 tonnes of aggregate produced |
| SIEVE ANALYSIS:<br>Pit-run Aggregate or Sand | ASTM C136 | One per 1000 tonnes of aggregate produced |
| PERCENT FRACTURE | See Note 1 | One per 5000 tonnes of aggregate produced |

| | | |
|---|---|---|
| L.A. ABRASION | ASTM C131 | One per 10,000 tonnes of aggregate produced |

Note 1: The percentage (%) of fractured material will be determined by examining the fraction retained on the 5 mm sieve and dividing the mass of the fractured particles having two or more fractured faces by the total mass retained on the 5 mm sieve.

## PART 3 - EXECUTION

### 1. PREPARATION

.1 Handling

.1 Handle and transport aggregates to avoid segregation, contamination and degradation.

.2 Stockpiling

.1 Stockpile aggregates on site in locations as indicated unless directed otherwise by the Consultant. Do not stockpile on completed pavement surfaces.

.2 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.

.3 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.

.4 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by the Consultant within 24 hours of rejection.

.5 Stockpile materials in uniform layers of thickness as follows:

.1 Max 1.5 m for coarse aggregate and base coarse materials.

.2 Max 1.5 m for fine aggregate and sub-base materials.

.3 Max 1.5 m for other materials.

.6 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.

.7 Do not cone piles or spill material over edges of piles.

### 2. CLEANING

.1 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.

.2 Leave any unused aggregates in neat compact stockpiles as directed by the Consultant.

**.3** For temporary or permanent abandonment of aggregate source, restore source to condition meeting requirements of authority having jurisdiction.

**END OF SECTION**

## PART 1 - GENERAL

### 1. DESCRIPTION

.1 This section specifies the requirements for the removal and stockpiling of topsoil indicated by the Contract Documents or as directed by the Consultant.

### 2. RELATED SECTIONS

.1 Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Section 32 91 19.13 - Topsoil Placement and Grading.

### 3. REFERENCES

.1 All references to this Specifications, Standards, or Methods shall be understood to refer to the latest adopted revision, including all amendments.

### 4. MEASUREMENT FOR PAYMENT

.1 Payment for topsoil stripping, hauling, and stockpiling will be paid by actual number of cubic meters stripped and stockpiled on site. Existing topsoil has an approximate depth of 100mm but will need to be confirmed in the field. Survey is to be provided to the Consultant to confirm stripped area. Material is to be stockpiled on site as indicated on the drawings or as directed by the Consultant. No measurement will be made of excavated material in stockpiles. No measurement will be made of stripping beyond limits in Contract Documents or as agreed to with the Consultant. Payment at the unit price bid shall be full compensation for all work required to excavate, load, haul, place, level, cleanup, and other work incidental to this section.

### 5. DEFINITIONS

.1 Topsoil: The top layer of soil composed of a mixture of mineral particulates, micro-organisms, and organic matter that provides a suitable medium for supporting plant growth. The depth of topsoil shall be equivalent to 100 - 300 mm below the original ground surface unless indicated otherwise.

.2 Unsuitable: Materials containing vegetable or organic materials such as muck, peat, organic silt or sod and/or very weak, and compressible materials.

## PART 2 - EXECUTION

### 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.

## 2. STRIPPING OF TOPSOIL

.1 Ensure that procedures are conducted in accordance with applicable Provincial and Municipal requirements, the Contractor's Environmental Protection Plan, and Section 01 35 43 - Environmental Procedures.

.2 Remove topsoil before construction procedures commence to avoid compaction of topsoil.

.3 Handle topsoil only when it is dry and warm.

.4 Remove vegetation from targeted areas by non-chemical means and dispose of stripped vegetation by alternative disposal.

.5 Remove brush from targeted area by non-chemical means and dispose of through alternative disposal.

.6 Strip topsoil to required depths as indicated or as directed by the Consultant.

.1 Avoid mixing topsoil with subsoil.

.7 Haul, place, and level topsoil to the location indicated on the Contract Drawings or as indicated by the Consultant.

## 3. PREPARATION OF GRADE

.1 Verify that grades are correct. Notify the Consultant if discrepancies occur do not begin work until instructed by the Consultant.

.1 Grade area only when soil is dry to lessen soil compaction.

.2 Grade soil establishing contours as per the Contract Drawings and Documents, and eliminating uneven areas and low spots, ensuring positive drainage.

## 4. PLACING OF TOPSOIL

.1 Place and level topsoil in accordance with Section 32 91 19.13 – Topsoil Placement and Grading.

## 5. CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

.2 Leave areas stripped of topsoil trimmed and leveled suitable for next phase of work.

.3 Leave site in tidy and well drained conditions free of standing water once placing and leveling of the topsoil is competed.

.4 Remove material that has spilled onto pavement surfaces or haul routes.

.5 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, and equipment.

**END OF SECTION**

**NOT USED**

## PART 1 - GENERAL

### 1. DESCRIPTION

.1 This section specifies the requirements for excavation, disposal of material, construction of common fill areas, and preparation of pavement subgrade in accordance with the specifications and conforming to lines, grades, dimensions and typical cross sections indicated by the Contract Documents or as established by the Consultant.

### 2. MEASUREMENT FOR PAYMENT

.1 Measurement for Payment for Airfield Grading / excavation items shall be at the unit price bid per cubic meter of actual material excavated and stockpiled and/or utilized on site, as measured in its original position by survey and as accepted by the Consultant. Airfield Grading also includes the ditch work/ Also includes material reuse for areas where the granular shoulder structure is to be built that have an existing subgrade elevation below design. Payment shall be full compensation for furnishing all labour, materials, tools, equipment, transportation, disposal on-site or utilization on site, dust control, measurements, survey, loading, hauling, cleaning, drainage and dewatering during construction, maintenance of the work area, grading, watering and compacting and incidentals necessary to complete this item. Measurements for payment shall not include the quantity of materials excavated without authorisation beyond the neat lines staked in the field, or the quantity of material used for purposes other than those directed by the Consultant. Initial surveys shall be taken by the Contractor immediately prior to placement of material.

.2 Measurement for subgrade preparation shall be measured in square metres and shall include all finish grading of subgrade, corresponding survey, removal of surplus materials, adjustment of moisture content and compaction as specified. No additional payment will be made for removal and correction of soft or unstable material put in place by the Contractor. Measurements for payment shall not include the quantity of materials excavated without authorisation beyond the neat lines staked in the field.

.3 Excavation and disposal of unsuitable material (subcuts) not put in place by the Contractor shall be measured and pro-rated as common excavation to on-site. Subcuts also includes any additional excavation required for the septic system areas.

.4 Replacement of subcuts will be paid granular subbase.

.5 For areas below the taxiway pavement structure where the existing subgrade elevation is below grade, granular subbase material is to be provided to bring the ground up to subgrade elevation. Compaction requirements and measurement for payment shall be as outlined in Section 32 11 16.01 – Granular Sub-base. Initial surveys shall be taken by the Contractor immediately prior to placement of

material. This is a provisional item for the excavation required for the septic field decommissioning works.

.6 Measurement for payment for common excavation / disposal off site and supply / install of GSBC for fill material up to subgrade (blow asphalt structure) for septic system decommissioning) shall be in actual cubic meters and be the actual amount of material installed. Payment shall be full compensation for furnishing all labour, materials, tools, equipment, transportation, disposal costs, dust control, measurements, survey, supply and install of material, loading, hauling, cleaning, drainage and dewatering during construction, maintenance of the work area, grading, watering and compacting and incidentals necessary to complete this item. Compaction requirements shall be as outlined in Section 32 11 16.01 – Granular Sub-base. Measurements for payment shall not include the quantity of materials installed without authorisation beyond the neat lines staked in the field, or the quantity of material used for purposes other than those directed by the Consultant. Initial surveys shall be taken by the Contractor immediately prior to placement of material. This is a provisional item.

.7 Measurement for payment for the removal, disposal and decommissioning of the existing septic system equipment will be measured in lump sum. This will include the removal and offsite disposal of any existing septic piping that is encountered during excavation for the new taxiway and the details outlined in the decommissioning part of this specification section. Excavation of native and granular material shall be included in measurement for payment items 1.2.6 and 1.2.8 of this specification section. Work encompasses both the abandoned and the septic field that is to be decommissioned. Payment for this item shall be full compensation for supplying all labour, material, tools, equipment, transportation, cleaning, and incidentals necessary to complete this item.

.8 Measurement for payment for the common excavation / disposal off site and install of native material to bring the ground up to grade following septic system decommissioning (areas not below asphalt) shall be in actual cubic meters and be the actual amount of material installed. Payment shall be full compensation for furnishing all labour, materials, tools, equipment, transportation, disposal costs, dust control, measurements, survey, loading, hauling, cleaning, drainage and dewatering during construction, maintenance of the work area, grading, watering and compacting and incidentals necessary to complete this item. Measurements for payment shall not include the quantity of materials installed without authorisation beyond the neat lines staked in the field, or the quantity of material used for purposes other than those directed by the Consultant. Initial surveys shall be taken by the Contractor immediately prior to placement of material. This is a provisional item.

.9 No separate payment will be made for:

.1 Ripping of common material.

.2 Construction of embankments

.3 Dust control.

.4 Maintenance of the work area and haul roads.

.5 Watering, drying and compacting.

.6 Haul of excavated material.

.7 Drainage and dewatering during construction.

## 3. REFERENCES

.1 All references to this Specifications, Standards, or Methods shall be understood to refer to the latest adopted revision, including all amendments.

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM C117, Test Method for Materials Finer Than 75-Φm (No. 200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136, Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D422, Method for Particle-Size Analysis of Soils.

.4 ASTM D4318, Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

.3 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.

## 4. DEFINITIONS

.1 Excavation shall include the following:

.1 Excavation and disposal of muck or other unsuitable materials.

.2 Excavation for the preparation and construction of the subgrade of roadways, runways, taxiways and aprons.

.3 Excavation for subcuts.

.4 Excavation for the backfill of subcuts.

.5 Excavation for the construction of drainage ditches.

.6 Excavation of material for ditch blocks and ditch checks.

.7 Excavation for construction of approaches, entrances and parking areas for vehicles and aircraft.

.8 Excavation for the general grading of areas adjacent to roadways, runways, taxiways and aprons.

.9 Excavation for the backfill of holes or false grading to correct surface irregularities.

.10 The trimming and cleanup of all materials or excavation areas.

.11 Trimming and rounding of slopes.

.12 Free haul distance: distance that excavated material is to be hauled without compensation. Free haul distance to be 1000m.

.13 The construction of detours or other suitable provision to accommodate traffic, either pedestrian, vehicular or aircraft over or around any part of the work being performed.

.14 Maintaining the work in a finished condition until it has been accepted as completed by the Consultant.

.2 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.

.1 Rock Excavation: excavation of material from solid masses of igneous, sedimentary or metamorphic rock which, prior to its removal, was integral with its parent mass, and boulders or rock fragments having individual volume in excess of 1 $m^3$.

.2 Common Excavation: excavation of materials of whatever nature, which are not included under definition of rock excavation, including dense tills, hardpan and frozen materials and partially cemented materials which can be ripped and excavated with heavy construction equipment.

.3 Unclassified excavation: excavation of deposits of whatever character encountered in work.

.3 Compaction classes: two classes of soil are recognized for compaction purposes; cohesionless and cohesive soil:

.1 Cohesionless soil:

.1 Soils which have less than 20% passing 0.075 mm sieve, when tested to ASTM C117, regardless of plasticity of fines.

.2 Soils containing between 20% to 50% passing 0.075 mm sieve and having liquid limit less than 25 and plasticity index less than 6 when tested to ASTM D4318.

.2 Cohesive soil: soil not having properties to be classified as cohesionless.

.4 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

.5 Waste material: excavated material unsuitable for use in work or surplus to requirements to be disposed as directed.

.6 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of work.

.7 Pavement structure: combination of layers of unbound or stabilized granular sub-base, base, and asphalt or concrete surfacing.

.8 Subgrade elevation: Elevation immediately below base or subbase, whichever is lower.

.9 Subcut: Excavation within or below the subgrade to length, width, and depth established by the Consultant.

.10 Common Fill: Material derived from usable excavation and placed above original ground or stripped surface up to subgrade elevation.

.11 Subgrade: In fills, the material confined between subgrade elevation and original ground, and between sideslopes; in cuts, the material below subgrade elevation confined between sideslopes.

.12 Stripping: Material composed of organic, unsuitable for common fill regardless of moisture content.

.13 Unsuitable materials:

.1 Weak and compressible materials under pavement areas.

.2 Frost susceptible materials under pavement areas.

## 5. WASTE MANAGEMENT AND DISPOSAL

.1 Dispose of excavated waste materials off-site.

# PART 2 - PRODUCTS

## 1. MATERIALS

.1 Materials: to acceptance of the Consultant.

.2 Material used for common fill not to contain more than 3% organic matter by mass.

## PART 3 - EXECUTION

### 1. EXCAVATING

.1 General:

.1 Advise the Consultant at least 7 days in advance of excavation operations for initial cross sections to be taken.

.2 Excavate to lines, grades, elevations and dimensions as indicated or as directed by the Consultant.

.3 Ensure drainage of excavated areas and maintain crowns and cross slopes to provide surface drainage. Do not allow standing water to occur on the excavated or fill surface at any time.

.4 Provide ditches as the work progresses to provide drainage.

.5 All deposits of frost susceptible and unsuitable materials shall be removed below subgrade to the length, widths and depths as directed by the Consultant, and such unsuitable materials shall be replaced with acceptable backfill material and compacted in place. Notify the Consultant when unsuitable materials are uncovered.

.1 The Consultant will require timely placement of backfill material, if such action is deemed essential to minimize deterioration or degradation of exposed materials.

.6 Treat ground slopes at grade points, where subgrade is on transition from excavation to embankment or earth to rock, as indicated or as directed by the Consultant.

.7 Dispose of waste material as specified in the Contractor's Waste Reduction Work Plan.

.2 Do not disturb foundation materials of adjacent pavements or structures which are to remain in place.

.3 Side Ditches:

.1 Construct side ditches to depths and widths indicated in contract documents or as directed by the Consultant, to permit ready flow of surface water.

.2 Ditches in airfield cuts will be constructed as soon as possible to provide drainage in the cut to prevent softening of the subgrade.

.3 Maintain and keep ditches open and free from debris at all times.

.4 Provide drainage control devices in ditches to minimize flow rates and prevent erosion.

.4 Unsuitable or surplus material:

.1 Disposal of unsuitable or excess material shall be at locations as indicated in the Contract Documents or as directed by the Consultant.

.5 General Airfield Grading:

.1 For areas outside of the granular shoulder and below the taxiway, project excavated material is to be utilized for grading. Topsoil to be placed overtop of the graded area to Section 32 92 19.13 – Topsoil Placement and Grading.

.6 Contractor Supplied Gravels:

.1 Consultant to designate location and extent of gravel stockpiles.

.2 Contractor is responsible for maintenance of all haul roads. No separate payment will be made.

.3 Contractor is responsible for providing gravel materials for the project.

.7 Borrow Excavation:

.1 Completely use in embankment suitable materials removed from work area excavations before taking material from borrow areas.

.2 Obtain from designated borrow areas, fill material required in excess of quantities available from cut areas.

.3 Engineer to designate location and extent of borrow areas and allowable depth of cutting.

.4 Contractor is responsible for construction and maintenance of all haul roads to pits. Location of pits and haul roads subject to the Engineer's and Owner's acceptance. Cost of constructing and maintaining haul roads to be considered part of cost of producing material and no separate payment made.

.5 Strips borrows topsoil and stockpile outside the work area. Stripped topsoil shall be removed from the areas to be excavated and stockpiled so as not to be contaminated by deleterious material.

.6 Remove materials unsuitable for embankment as designated by the Engineer.

.7 Shape edges of borrow areas on slopes of 2:1 and provide drainage as directed by the Engineer.

.8 Trim and leave borrow pits in suitable condition as directed by the Engineer.

.9 The stripped topsoil stockpiled from the Contractor's pit operations shall be spread uniformly over the entire trimmed and graded surfaces in a condition suitable for seeding by others. The Contractor shall not be required to place topsoil in areas which in the opinion of the Engineer may remain open for future pit operations, but shall trim off and dress slopes of topsoil material and leave site in neat condition.

.10 During course of construction, the Engineer may order additional borrow investigation, using the Contractor's equipment.

.11 Borrow pits may be deleted or added.

.8 Decommissioning of Active Septic System

.1 Decommissioning of Tanks and Sewer Pipe

.1 Remove all existing sludge and liquids from the septic tank, siphon chamber, and distribution box using a septage hauler. The interiors are to be rinsed and residual sludge is to be removed if present.

.2 Excavate and remove all PVC sewer lines between the septic tank, siphon chamber, and distribution box. Dispose at approved landfill.

.3 Excavate, remove and dispose of concrete tanks at an approved landfill.

.4 For excavated areas below the taxiway asphalt, backfill using granular subbase material. Compaction requirements shall be as outlined in Section 32 11 16.01 – Granular Sub-base. Initial surveys shall be taken by the Contractor immediately prior to placement of material.

.5 For excavated areas outside of the new taxiway asphalt, backfill is to be common fill material. Placement and compaction are to be as outlined in this specification section.

.2 Decommissioning of Septic Field

.1 Locate entire drainfield including all trenches, inspection ports, header piping, and lateral piping.

.2 Remove all PVC pipes and other infrastructure.

.3 Remove the trench structure, including drain rock, biomat layer, organic materials, non-native, or disturbed soils.

.4 Excavate to competent native soil.

.5 Dispose of excavated material at approved landfill.

.6 For excavated areas below the taxiway asphalt, backfill using granular subbase material. Compaction requirements shall be as outlined in Section 32 11 16.01 – Granular Sub-base. Initial surveys shall be taken by the Contractor immediately prior to placement of material.

.7 For excavated areas outside of the new taxiway asphalt, backfill is to be common fill material. Placement and compaction are to be as outlined in this specification section.

## 2. PLACING FILL

.1 Before taking material from borrow areas, completely use, in fill areas outside of the taxiway pavement structure, suitable materials removed from excavation.

.2 Do not place material which is frozen nor place material on frozen surfaces.

.3 Maintain crowned surface during construction to ensure run-off of surface water. Do not place material in free standing water. Drain low areas, before placing material.

.4 Blade surface regularly to eliminate rutting.

.5 Begin common fill construction full width. Spread material in horizontal layers over the length of the fill area to prevent pockets of materials with different properties being placed side by side in the fill area.

.6 When directed, scarify or bench existing slopes in side hill or sloping sections to ensure proper bond between new materials and existing surfaces. Method used to be subject to prior acceptance by the Engineer.

.7 Break up or scarify existing surface prior to placing common fill material.

.8 The Contractor shall have sufficient graders, water trucks, and rollers onsite to meet the specified spreading and compaction requirements for the amount of material hauled in each lift. The Engineer reserves the right to order the discontinuance of use of any equipment or method which, in his opinion, fails to produce satisfactory results.

.9 When common fills are to be placed over swampy or saturated ground, the Contractor may be permitted to end dump an initial lift of accepted material of sufficient depth to support hauling equipment.

.10 Do not place stones and boulders exceeding 50 mm maximum dimension within 100 mm of finished surface in graded areas.

## 3. COMPACTION

.1 General:

.1 Shape and roll alternately to obtain smooth, even and uniform compacted layers.

.2 When necessary apply water during compaction to obtain specified density. If material is excessively moist, aerate by scarifying with suitable equipment until moisture content is corrected.

.3 Any soft, weak, or otherwise unsuitable material discovered at any stage of the work shall be excavated to the depth and extent designated by the Consultant. The material shall be replaced by suitable material.

.4 Quality assurance testing of materials will be carried out by the testing laboratory designated by the Consultant. Quality control testing of materials will be carried out by the testing laboratory designated by the Contractor, at a higher frequency.

.5 Should the surface become rutted or disturbed for any reason prior to or during the placing of the next layer, the Contractor shall re-grade and re-compact the subgrade at their own expense.

.6 Place and compact to full width in layers not exceeding 200 mm loose thickness. The Consultant may authorize thicker lifts if specified compaction can be achieved and if material contains more than 25% by volume stone or rock fragments larger than 100 mm.

.7 Break soil down to a size suitable for compaction and mix for uniform moisture and soil conditions to full depth of layer.

.8 Compact each layer to at least a minimum of 98% Modified Proctor Maximum Dry Density ASTM D1557. Refer to Section 32 11 16.01 – Granular Subbase and Section 32 11 23 – Granular Base Course for granular compaction requirements.

.9 During performance of the work, sufficient water shall be added or the soil shall be aerated to bring the moisture content to within ± 2% of optimum required for compaction.

.10 The moisture content shall be maintained at ± 2% of the optimum moisture content as defined by ASTM D1557 until the next layer is placed.

## 4. FINISHING AND TOLERANCES

.1 Ditches:

.1 Blade finished ditch subgrade surfaces in cut and fill areas free from ruts, depressions, rock in excess of 75 mm and debris. Hand finish areas that cannot be finished satisfactorily by machine.

.2 Finished ditch subgrade to be within 30 mm of design elevations, but not uniformly high or low.

.2 Pavement and Shoulder Subgrade:

.1 Fine grade finished subgrade to be free from ruts, depressions, rock in excess of 75 mm, and debris and attain a tight dense surface.

.2 Following fine grading, static rolling subgrade surface using a smooth drum type roller can be done (if needed), to help attain a tight dense condition.

.3 Finished subgrade to be within 30 mm of design elevations, but not uniformly high or low.

.4 Finished subgrade surfaces to be free from depressions exceeding 30 mm in 5 m.

## 5. PROOF ROLLING

.1 For proof rolling, use fully loaded dual axle dump truck with an effective single axle load of 18,000 lbs (80 kN).

.2 The Consultant may authorize use of other acceptable proof rolling equipment.

.3 Proof roll top of subgrade upon completion of compaction, fine grading work, and density testing to verify compliance with density and moisture specification.

.4 Make sufficient passes of proof roller to subject every point on the surface to three separate passes of loaded tire.

.5 Where proof rolling reveals areas of unstable subgrade, proceed as follows:

.1 Investigate material in unstable area to a depth of about 600 to 750 mm below subgrade elevation, or as directed by the Consultant. If the material below the subgrade surface is deemed to be suitable, redo subgrade preparation to a depth necessary to achieve requirements of this section. After completion of rework, proof roll subgrade again.

.2 If the investigation reveals unsuitable material, remove such material to the depth and extent as directed by the Consultant. Use of geotextile and geogrid in the bottom of the excavation shall be at the discretion of the Consultant.

.3 Backfill area of excavation with common material in compliance with the compaction and moisture content requirements of this section. Proof roll subgrade again.

.4 The use of Geotextile and Geogrid as a means to help correct areas of unstable subgrade shall be at the discretion of the Consultant and shall only be used after all methods noted in this section have been attempted. Unauthorized use of geotextile and geogrid shall be at the Contractors' expense.

## 6. MAINTENANCE

.1 Maintain finished surfaces in a condition in accordance with this Section until succeeding material is applied.

.2 Acceptance of finished subgrade by the Consultant does not relieve the Contractor of their responsibility to provide a subgrade meeting the requirements of this Section until succeeding material is applied.

.3 Maintain work area such that dust does not create a safety hazard to the airport.

**END OF SECTION**

# PART 1 - GENERAL

## 1. DESCRIPTION

.1 This section specifies the requirements for excavating, trenching, and backfilling of underground utility installations and related structures.

.2 The section is not applicable to excavation and backfill below, above or adjacent to structural assemblies.

## 2. RELATED SECTIONS

.1 Section 33 41 00 – Storm Utility Drainage Piping

## 3. MEASUREMENT FOR PAYMENT

.1 No separate payment shall be made for excavating, trenching, and backfilling. Include costs for work performed under this section in the appropriate tender items.

.2 No separate payment shall be made for drainage and dewatering during construction.

## 4. REFERENCES

.1 All references to this Specifications, Standards, or Methods shall be understood to refer to the latest adopted revision, including all amendments.

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM C117, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D422-63, Standard Test Method for Particle-Size Analysis of Soils.

.4 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft) (600 kN-m/m).

.5 ASTM D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft) (2,700 kN-m/m).

.3 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils. Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.

.4 Canadian Green Building Council (CaGBC)

.1 LEED Canada-NC Version 1.0, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for New Construction and Major Renovations.

.5 Canadian Standards Association (CSA International)

.1 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.1 CSA-A3001, Cementitious Materials for Use in Concrete.

.2 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.6 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.

## 5. DEFINITIONS

.1 Class 1 Backfill.

.1 Class 1 backfill shall consist of backfilling the trench with sand or gravel material compacted in even layers not exceeding 200 mm in depth.

.2 Class 2 Backfill.

.1 Class 2 backfill shall consist of backfilling the trench with excavated material in even layers not exceeding 200 mm in depth.

.3 Class 3 Backfill.

.1 Class 3 backfill shall consist of backfilling the trench with excavated material in even layers not exceeding 300 mm in depth.

.4 Waste material: excavated material unsuitable for use in Work or surplus to requirements.

.5 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.

.6 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.

.7 Unsuitable materials:

.1 Weak, chemically unstable, and compressible materials.

.2 Frost susceptible materials:

.1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422 and ASTM C136: Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.

.2 Coarse grained soils containing more than 20% by mass passing 0.075 mm sieve.

.8 Unshrinkable fill: very weak mixture of cement, concrete aggregates, and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

## 6. SUBMITTALS

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

.2 Quality Control in accordance with Section 01 45 00 - Quality Control:

.1 Submit condition survey of existing conditions as described in Part 1 Section 9 Existing Condition

.2 Submit for review by the Consultant dewatering and heave prevention methods as described in Part 3 Section 7.

.3 Submit to the Consultant written notice at least seven days prior to excavation work, to ensure cross sections are taken.

.4 Submit to the Consultant testing/inspection results and report as described in Part 3.

.3 Preconstruction Submittals:

.1 Submit construction equipment list for major equipment to be used in this section prior to start of Work.

.2 Submit records of underground utility locates, indicating: location plan of existing utilities as found in field, clearance record from utility authority and location plan of relocated and abandoned services, as required.

.4 Samples:

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

.2 Inform the Consultant at least four weeks prior to beginning Work, of proposed source of fill/unshrinkable fill materials and provide access for sampling.

.3 Contractor shall provide sieve analysis and source location of material that may be imported to the site for work performed under this section.

.4 Imported materials shall be accepted by the Consultant prior to use by the Contractor.

.5 If requested by the Consultant, submit 70 kg samples of type of fill/unshrinkable fill specified including representative samples of excavated material.

.6 Ship samples prepaid to the Consultant, in tightly closed containers to prevent contamination and exposure to elements.

## 7. QUALITY ASSURANCE

.1 Engage services of qualified Professional Engineer who is registered or licensed in Province of British Columbia, Canada in which Work is to be carried out to design and inspect cofferdams, shoring, bracing and underpinning required for the Work.

.2 Do not use soil material until written report of soil test results are reviewed and accepted by the Engineer.

## 8. WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with the Contract Documents.

.2 Divert excess aggregate materials from landfill to local facility for reuse as specified in the Contract Documents (excess aggregate material should stay at pit location).

## 9. EXISTING CONDITIONS

.1 Examine soil report.

.2 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 authorities having jurisdiction establish location and state of use of buried utilities and structures. Authorities having jurisdiction to clearly mark such locations to prevent disturbance during the 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 as indicated. Obtain acceptance from the Consultant before moving or otherwise disturbing utilities or structures.

.7 Where utility lines or structures exist in area of excavation, obtain direction of the Consultant before removing/re-routing.

.8 Record location of maintained, re-routed, and abandoned underground lines.

.9 Confirm locations of recent excavations adjacent to area of excavation.

.3 Existing buildings and surface features:

.1 Conduct, with the Consultant, 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 the Consultant.

.3 Where required for excavation, cut roots or branches as directed by the Consultant.

## PART 2 - PRODUCTS

### 1. MATERIALS

.1 General excavation fill and bedding material shall be as shown on the drawings.

.1 Geogrid: to Section 31 32 19.13 – Geogrid Soil Stabilization.

.2 Geotextile: to Section 31 32 19.16 – Geotextile Soil Stabilization.

## PART 3 - EXECUTION

### 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 Section 01 35 43 - Environmental Procedures.

.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.

## 2. SITE PREPARATION

.1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

.2 Remove all brush, weeds, grasses, and accumulated debris from the site.

.3 Remove existing pavements to limits indicated or as directed by the Consultant. Work shall be performed in accordance with Section 02 41 13 - Selective Site Demolition.

.4 Strip and stockpile topsoil as indicated or as directed by the Consultant. Work shall be performed in accordance with Section 31 14 13 - Soil Stripping and Stockpiling.

## 3. PREPARATION/PROTECTION

.1 Record as-built location of maintained, re-routed, and abandoned underground lines on Contract Drawings.

.2 Protect existing features in accordance with applicable local regulations.

.3 Keep excavations clean, free of standing water, and loose soil.

.4 Where soil is subject to significant volume change due to change in moisture content, cover, and protect in a manner acceptable to the Consultant.

.5 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.

.6 Protect buried services that are required to remain undisturbed.

## 4. STRIPPING OF TOPSOIL

.1 Complete work in accordance with Section 31 14 13 - Soil Stripping and Stockpiling.

## 5. STOCKPILING

.1 Complete work in accordance with Section 31 14 13 - Soil Stripping and Stockpiling.

## 6. COFFERDAMS, SHORING, BRACING AND UNDERPINNING

.1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Occupational Health and Safety Regulation for the Province of British Columbia.

.2 Obtain permit from authority having jurisdiction for temporary diversion of water course.

.3 Construct temporary Works to depths, heights, and locations as indicated or directed by the Consultant.

.4 When close sheeting is required, it shall be so driven as to prevent adjacent soil from entering the trench either below or through such sheeting. The Consultant reserves the right to order the sheeting driven to the full depth of the trench or to such additional depths as may be required for the protection of the Work.

.5 Trench bracing may be removed when the backfilling has reached the respective level of such bracing. Sheeting shall be removed as the backfilling proceeds. Backfilling of holes left by sheeting below the trench bottom shall be carefully compacted, and thereafter backfilling and withdrawal of sheeting shall proceed together. No voids shall be left in the backfill by the withdrawal of the sheeting.

.6 When a cage or shield is used in the trench instead of shoring, special care shall be taken to ensure that there is no lateral or longitudinal movement of the pipe when the cage is moved. The cage shall be raised vertically so that the bottom member is clear of the crown of the pipe before the cage is pulled forward in the trench.

.7 During backfill operation:

.1 Unless otherwise indicated or directed by the Consultant, remove sheeting and shoring from excavations.

.2 Do not remove bracing until backfilling has reached respective levels of such bracing.

.3 Pull sheeting in increments that will ensure compacted backfill is maintained at elevation at least 500 mm above toe of sheeting.

.8 When sheeting is required to remain in place, cut off tops at elevations as indicated.

.9 Upon completion of substructure construction:

.1 Remove cofferdams, shoring, and bracing.

.2 Remove excess materials from site and restore watercourses as indicated and as directed by the Consultant.

## 7. DEWATERING AND HEAVE PREVENTION

.1 Keep excavations free of water while Work is in progress.

.2 Provide for the Consultant's acceptance details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.

.3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.

.1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.

.4 Protect open excavations against flooding and damage due to surface run-off.

.5 Gutters and natural drainage channels shall not be obstructed. Satisfactory provisions shall be made for alternate drainage where this is impractical.

.6 The trench shall be drained so that the workers may work safety and effectively. All water encountered in trenches shall be pumped or bailed out, and in no case shall the pipe be used as a drain for such water. It is essential that the discharge of the trench dewatering pumps be conducted away from the site of the work and into natural drainage channels, drains or storm sewers. Ensure pumped water is free of suspended materials prior to release into native drainage channels, drains or storm sewers.

.7 Dispose of water in accordance with Section 01 35 43 - Environmental Procedures to approved runoff areas in manner not detrimental to public and private property, or portion of Work completed or under construction.

.1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.

## 8. EXCAVATION

.1 Advise the Consultant at least seven days in advance of excavation operations for initial cross sections to be taken.

.2 Excavate to lines, grades, elevations, and dimensions as indicated or as directed by the Consultant.

.3 Where excavated material will be used as backfill, stockpile material onsite or as directed by the Consultant. If material is surplus to backfill requirements stockpile material as indicated as directed by the Consultant.

.4 Where excavated material is unsuitable as backfill, stockpile material as indicated or as directed by the Consultant.

.5 Material that is suspected of contamination shall be stockpiled as directed by the Consultant. The Consultant will test the material to determine the extent of contamination and then direct the Contractor as to method of disposal or reuse.

.6 Trenching

.1 The minimum trench width below the crown of the pipe shall be not less than the nominal diameter of the pipe plus 400 mm. The maximum width of the trench below the crown of the pipe including shoring shall be not more than the nominal diameter of the pipe plus 600 mm or not more than a total width of 900 mm, whichever is the greatest. Where the maximum trench width is exceeded, the Contractor shall, at his own expense, provide special bedding or take other precautions as directed by the Consultant. Where more than one pipe is laid in the same trench, the minimum and maximum widths shall be as directed by the Consultant.

.2 The Contractor shall confine his activities to the immediate area of the trench. All activities outside trench boundaries shall be performed so as not to damage other existing features. The Contractor shall generally have the option of using either vertical shored trenches or Vee trenches. Every effort shall be made to restrict the trench widths to minimize the area disturbed.

.3 All excavated material shall be piled at least 1.0 m clear of the trench tip to prevent material from falling back into the excavation. The material shall be piled in such a manner that it will not endanger the work, or obstruct other work or rights-of-way, or affect the safety and operation of aircraft. Sufficient clear space must be left on one side of the trench to accommodate the work stakes.

.4 The trench shall be excavated so that the pipe can be laid to the alignment, grade and depth required, or the pipe can be removed as required.

.5 The subgrade shall provide a uniform and continuous support for the pipe and fittings on solid undisturbed ground. Any over excavation by the Contractor below the required grade shall be backfilled at their expense with material acceptable to the Consultant.

.7 Do not disturb soil within branch spread of trees or shrubs that are to remain.

.1 If excavating through roots, excavate by hand and cut roots with sharp axe or saw.

.8 For trench excavation, unless otherwise authorized by the Consultant in writing, do not excavate more than 30 m of trench in advance of installation operations and no trenches shall be left open at the end of day's operation.

.9 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by the Consultant, and the contents of this specification and requirements of the British Columbia OH&S.

.10 Restrict vehicle operations directly adjacent to open trenches.

.11 Dispose of surplus and unsuitable excavated material as indicated or as directed by the Consultant off site.

.12 Do not obstruct flow of surface drainage or natural watercourses.

.13 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.14 Notify the Consultant when bottom of excavation is reached.

.15 Obtain the Consultant acceptance of completed excavation.

.16 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by the Consultant.

.1 Replace material with suitable material acceptable to the Consultant.

.17 Correct unauthorized over-excavation as follows:

.1 Fill under bearing surfaces and footings with Type 2 fill compacted to not less than 100% of corrected Standard Proctor maximum dry density.

.2 Unauthorized excavation and replacement with suitable materials shall be at the Contractor’s expense.

.18 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.

.2 Where required for electrical trenches, clean out rock seams and fill with concrete mortar or grout to acceptance of the Consultant.

.19 Trench Subgrade

.1 Trim and remove loose material and debris from excavation prior to installing bedding and pipe.

.2 If the Trench subgrade is disturbed, compact foundation soil to density at least equal to undisturbed soil.

.20 Install geogrid in accordance with Section 31 32 19.13 – Geogrid Soil Stabilization.

.21 Install geotextiles in accordance with Section 31 32 19.16 – Geotextile Soil Stabilization.

## 9. UTILITY INSTALLATION

.1 Place and compact bedding materials as specified by the appropriate section.

.2 Install the required pipe or duct as specified by the corresponding section.

.3 Place the remaining bedding and surround materials as specified by the Contract Drawings.

## 10. FILL TYPES AND COMPACTION

.1 Compact materials specified in this section as follows:

.1 Cohesive soils compacted to a minimum of 98% of Standard Proctor Maximum Dry Density (ASTM D698). Cohesionless soils compacted to a minimum of 100% of Standard Proctor Maximum Dry Density (ASTM D698).The type of compaction equipment shall be chosen with regard to minimizing the vibration effect on nearby structures and utilities. The Consultant shall have the right to request the Contractor to replace any equipment causing unacceptable vibrations. The Contractor is responsible for any damage caused due to construction.

.2 Place unshrinkable fill in areas as indicated.

## 11. BEDDING AND SURROUND OF UNDERGROUND SERVICES

.1 Place and compact granular material for bedding and surround of underground services as indicated and as specified in Section 33 41 00 - Storm Utility Drainage Piping.

.2 Place bedding and surround material in unfrozen condition.

## 12. BACKFILLING

.1 Do not proceed with backfilling operations until completion of following:

.1 The Consultant has inspected and accepted installations.

.2 The Consultant has inspected and accepted construction below finish grade.

.3 Inspection, testing, acceptance, and recording location of underground utilities.

.4 Removal of concrete formwork.

.5 Removal of shoring and bracing; backfilling of voids with satisfactory soil material.

.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.

.4 Place backfill material in uniform layers not exceeding 200 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

.5 Backfilling around installations:

.1 Place bedding and surround material as specified elsewhere.

.2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.

.3 Place layers simultaneously on both sides of installed Work to equalize loading. Difference not to exceed 0.5 m.

.4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:

.1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and acceptance obtained from the Consultant.

.2 If accepted by the Consultant, erect bracing or shoring to counteract unbalance, and leave in place until removal is accepted by the Consultant.

.5 Place material by hand under, around, and over installations until 600 mm of cover is provided. Dumping material directly on installation will not be permitted.

.6 Place unshrinkable fill in areas as indicated.

.7 Consolidate and level unshrinkable fill with internal vibrators.

.8 Install drainage filter system in backfill as indicated or as directed by the Consultant.

## 13. RESTORATION

.1 Upon completion of Work, remove waste materials and debris in accordance to Contract Documents, trim slopes, and correct defects as directed by the Consultant.

.2 Replace topsoil as indicated or as directed by the Consultant.

.3 Reinstate lawns to elevation which existed before excavation.

.4 Reinstate pavements disturbed by excavation to thickness, structure, and elevation which existed before excavation.

.5 Clean and reinstate areas affected by Work as directed by the Consultant.

.6 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.

.7 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

**END OF SECTION**

# PART 1 - GENERAL

## 1. DESCRIPTION

.1 This section specified requirements for supply and installing geogrid as indicated by the Contract Documents or as directed by the Consultant.

## 2. SECTION INCLUDES

.1 Materials and installation of polymeric geogrids used in embankments and roadbeds as reinforcement to provide tensile strength to soil mass.

## 3. RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 19 - Waste Management And Disposal.

.3 Section 31 22 14 – Airfield Grading

.4 Section 31 23 33.01 - Excavating, Trenching And Backfilling.

## 4. MEASUREMENT PROCEDURES

.1 Supply and installation of the biaxial geogrid shall be measured in square meters of finished sloped surface area. Payment at the unit price bid shall be full compensation for furnishing all materials, preparation, delivery, storage, laying the geogrid and for all labour, equipment, tools and other work incidental to this section. Overlap of geogrid shall be considered incidental to surface area covered. No separate payment for repairs to damaged geogrid. No separate payment for surface preparation. This item is provisional.

## 5. REFERENCES

.1 All references to this Specifications, Standards, or Methods shall be understood to refer to the latest adopted revision, including all amendments.

.2 American Society for Testing and Materials International, (ASTM)

.1 ASTM D1248, Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.

.2 ASTM D4101, Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials.

.3 ASTM D4218, Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique.

.4 ASTM D5262, Standard Test Method for Determining the Unconfined Tension Creep and Creep Rupture Behavior of Planar Geosynthetics Used for Reinforcement Purposes.

.5 ASTM D6637, Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-Rib Tensile Method.

.3 Drexel University - Geosynthetic Research Institute (GRI)

.1 GRI GG2, Geogrid Junction Strength.

## 6. SUBMITTALS

.1 Obtain written acceptance from the Consultant for geogrid before installation of material in work.

.2 Each roll of geogrid shall be marked with a permanently legible tag, or similar identification label showing the product number of the geogrid material, date of manufacture, and a batch number.

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

.4 Submit to the Consultant copies of mill test data and certificate, at least two weeks prior to start of Work and in accordance with Section 01 33 00 - Submittal Procedures.

.5 The Contractor shall submit to the Consultant two weeks prior to delivery onsite, a mill certificate or affidavit signed by an authorized official of the company manufacturing the geogrid.

.6 The mill certificate or affidavit shall attest that the typical physical properties of the geogrid meet the minimum chemical, physical and manufacturing requirements stated in this specification.

.7 The mill certificate shall identify all roll and batch numbers and shall correspond to rolls delivered to the site.

## 7. DELIVERY, STORAGE AND HANDLING

.1 During delivery and storage, protect geogrids from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris, and rodents.

.2 Contractor to supply and deliver all geogrid to the site in sufficient quantities to cover the area designated in the Contract documents and as requested by the Consultant.

.3 Geogrid shall be stored on the site at locations accepted by the Consultant.

.4 Geogrid shall be covered at all times during storage by an opaque tarp, regardless of the nature of covering supplied by the manufacturer.

.5 Geogrid shall be placed on dunnage during storage.

.6 Geogrid materials brought from the storage site to the placement site shall be used immediately or protected with an opaque tarp.

## 8. WASTE MANAGEMENT AND DISPOSAL

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

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling.

.4 Fold up metal banding, flatten and place in designated area for recycling.

# PART 2 - PRODUCTS

## 1. MATERIAL

.1 Geogrid shall be Tensar BX1100, Mirafi BXG110, or accepted equivalent.

# PART 3 - EXECUTION

## 1. INSTALLATION

.1 Place geogrid material by unrolling onto graded surface in manner and locations indicated and retain in position in accordance with manufacturer's written recommendations.

.2 Geogrid shall be unrolled onto the geotextile previously placed.

.3 Place geogrid on sloping surfaces in one continuous length from toe of slope to upper extent of geogrid.

.4 For the first layer of geogrid, overlap each successive strip of geogrid 900mm over previously laid strip.

.5 For the second layer of geogrid, overlap each successive strip of geogrid 600mm over previously laid strip or as recommended by the manufacturer.

.6 Geogrid to be secured using nail spikes.

.7 Join successive strips of geogrid as indicated by manufacturer.

.8 Protect geogrid from displacement, damage or deterioration before and during placement of overlay soil layers.

.9 After installation, cover with overlay layer within four hours of placement.

.10 Replace damaged or deteriorated geogrid to acceptance of the Consultant.

.11 Where structures penetrate the geogrid, ensure that the integrity of the geogrid is maintained

.12 Remove and replace damaged or deteriorated material. The damaged area shall be overlain with new geogrid with a minimum one metre overlap. Secure overlap as in Part 3, Section 1.6.

.13 Place and compact soil layers in accordance with Section 31 23 33.01 – Excavating, Trenching and Backfilling, and granular sub-base to section 32 11 16.01.

.14 Cover material shall be end dumped on the ground adjacent to the geogrid and carefully pushed or spread on to the geogrid by a dozer or other tracked machinery.

.15 A minimum depth of 200 mm shall be maintained at all times between the geogrid and the construction equipment.

.16 Cover material shall be spread in the direction of the geogrid overlap.

.17 Cover material placement shall be placed immediately on geogrid exposed to ultraviolet radiation. No more than 8.0 m of geogrid is to be left uncovered at any one time.

.18 On unprotected geogrid, stones weighting more than 45 kg shall not be allowed to roll down slope.

.19 For protected and unprotected geogrid, height of drop for stones less than 115 kg shall be less than 1 m and stones greater than 115 kg shall be placed with no free fall. If stones greater than 115 kg must be dropped, field trails shall be performed to determine the maximum height of safe drop without damaging the geogrid.

## 2. CLEANING

.1 Remove construction debris from Project site and dispose of debris in an environmentally responsible and legal manner.

## 3. PROTECTION

.1 Vehicular traffic or equipment are not permitted directly on geogrid.

**END OF SECTION**

## PART 1 - GENERAL

### 1. DESCRIPTION

.1 This section specified requirements for supply and installing geotextile as indicated by the Contract Documents or as directed by the Consultant.

### 2. SECTION INCLUDES

.1 Materials and installation of polymeric geotextiles used in drainage structures and roadbeds purpose of which is to:

.1 Separate and prevent mixing of granular materials of different grading.

.2 Act as hydraulic filters permitting passage of water while retaining soil strength of granular structure.

### 3. RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 02 41 13 – Selective Site Demolition.

.3 Section 31 22 14 - Airfield Grading.

.4 Section 31 23 33.01 – Excavating, Trenching, and Backfilling.

### 4. MEASUREMENT PROCEDURES

.1 Supply and installation of geotextile fabric will be measured and paid by square metres of finished surface area covered by geotextile fabric including supply, loading, hauling, installation, protection, as per manufacturer's specifications, including spikes/washers or whatever method of fabric securing is recommended by the manufacturer. Payment for overlap of fabric will not be paid for. This item is provisional.

.1 No separate payment for repairs to damaged geotextile.

.2 No separate payment for surface preparation.

.3 This payment item is for provisional use only. The use of geotextile in the construction of the drywell shall be included in the drywell payment item.

.2 Measure of the supply and install of angular rock shall be in cubic meters in place to specified thickness as accepted by Consultant. No payment for overbuild of angular rock beyond neat lines shown on cross sections. Payment at the tendered unit price shall be full compensation for the production, supply, processing, stockpiling, loading, hauling, placing, moisture conditioning, compacting, grading, maintaining, cleanup and other work incidental to this section.

### 5. REFERENCES

.1 All references to this Specifications, Standards, or Methods shall be understood to refer to the latest adopted revision, including all amendments.

.2 American Society for Testing and Materials International, (ASTM)

.1 ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM D4491, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.

.3 ASTM D4595, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.

.4 ASTM D4716, Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.

.5 ASTM D4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-4.2 No. 11.2, 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, Methods of Testing Geosynthetics - Mass per Unit Area.

.2 No.3, Methods of Testing Geosynthetics – Thickness of Geotextiles.

.3 No.6.1, Methods of Testing Geotextiles and Geomembranes - Bursting Strength of Geotextiles Under No Compressive Load.

.4 No.7.3, Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles.

.5 No. 10, Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size.

.3 Canadian Standards Association (CSA International)

.1 CAN/CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.

## 6. SUBMITTALS

.1 Obtain written acceptance from the Consultant for geotextile before installation of material in work.

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

.2 Submit to the Consultant copies of mill test data and certificate at least two weeks prior to start of Work, and in accordance with Section 01 33 00 - Submittal Procedures.

.3 The Contractor shall submit to the Consultant two weeks prior to delivery on site, a mill certificate or affidavit signed by an authorized official of the company manufacturing the fabric.

.4 The mill certificate or affidavit shall attest that the typical physical properties of the fabric meet the minimum chemical, physical and manufacturing requirements stated in this specification.

.5 The mill certificate shall identify all roll and batch numbers and shall correspond to rolls delivered to the site.

.6 Each roll of geotextile shall be marked with a permanently legible tag, or similar identification label showing the product number of the geotextile material, date of manufacture, and a batch number

## 7. DELIVERY, STORAGE, AND HANDLING

.1 During delivery and storage, protect geotextiles from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris and rodents.

.2 Contractor to supply and deliver all geotextile to the site in sufficient quantities to cover the area designated in the Contract Documents and as requested by the Consultant.

.3 Geotextile shall be stored on the site at locations accepted by the Consultant.

.4 Geotextile shall be placed on dunnage during storage.

.5 Geotextile shall be covered at all times during storage by an opaque tarp, regardless of the nature of covering supplied by the manufacturer.

.6 Geotextile materials brought from the storage site to the placement site shall be used immediately, or protected with an opaque tarp

## 8. WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with local jurisdictions.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Reduction Workplan.

.4 Fold up metal banding, flatten and place in designated area for recycling.

## PART 2 - PRODUCTS

### 1. MATERIAL

.1 Geotextile fabric shall be Mirafi HP570 or accepted equivalent. Fabric shall be non-woven construction, supplied in rolls.

.2 Geotextile fabric shall consist of polymeric filament or yarns such as polypropylene, polyethylene, polyester, or other polymers excluding polyamides, formed into a stable network such that the filaments or yarns retain their relative position to each other. The geotextile shall be inert to commonly encountered chemicals, resistant to ultraviolet light and heat exposure, and shall be indestructible by micro-organisms and insects.

.3 Where sections of geotextile are joined, seam strength shall meet the minimum tensile strength requirements for the class of geotextile, unless otherwise specified in the Contract Documents.

.4 Seams of the geotextile shall be sewn with thread of the material meeting the material requirements for the geotextile.

.5 Geotextile rolls shall be supplied with an opaque protective covering by the manufacturer or supplier.

.6 Factory seams: sewn in accordance with manufacturer's recommendations.

.7 Thread for sewn seams: equal or better resistance to chemical and biological degradation than geotextile.

## PART 3 - EXECUTION

### 1. INSTALLATION

.1 Where geotextile is to be placed on natural ground, prepare surface by removing debris which would interfere with placement of geotextile. Remove all boulders and sharp objects.

.2 In areas with soft subgrade, subexcavate to depth as directed by the Consultant and then place the geotextile.

.3 Place geotextile material by unrolling onto graded surface in orientation, manner and locations indicated and retain in position with weight and/or manufacturer’s specifications.

.4 Place geotextile material smooth and free of tension stress, folds, wrinkles and creases.

.5 When using pegged seams on sloping surfaces, place geotextile in one continuous length from toe of slope to upper extent of geotextile to avoid horizontal seams.

.6 Successive strips of geotextile shall be overlapped at all transverse and longitudinal seams in accordance with the manufacturer’s specifications.

.7 Pin successive strips of geotextile with securing pins as indicated or in accordance with the manufacturer's specifications.

.8 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.

.9 Remove and replace damaged or deteriorated material. The damaged area shall be overlain with new geotextile with a minimum one metre overlap. Secure overlap as per this section.

.10 After installation, cover with overlying layer within 4 hours of placement.

.11 Replace damaged or deteriorated geotextile to acceptance of the Consultant.

.12 Protect geotextile from displacement or damage until and during placement of overlaid material layers.

.13 Where structures penetrate the geotextile, ensure that the integrity of the geotextile is maintained.

.14 Place and compact soil layers in accordance with Section 31 22 14 - Airfield Grading and Section 31 23 33.01 – Excavating, Trenching, and Backfilling.

## 2. PLACEMENT OF COVER MATERIAL

.1 Cover material shall be 150mm to 200mm angular rock compacted with a minimum of six passes of the static roller to achieve equivalent of 98% Modified Proctor Maximum Dry Density. If elevation is below subgrade, place and compact GSBC up to subgrade elevation.

.2 Cover material shall be end dumped on the ground adjacent to the geotextile and carefully pushed or spread on to the geotextile by a dozer or other tracked machinery.

.3 A minimum depth of 200 mm shall be maintained at all times between the geotextile and the construction equipment.

.4 Cover material shall be spread in the direction of the geotextile overlap.

.5 Cover material placement shall be place immediately on geotextile exposed to ultraviolet radiation. No more than eight metres of geotextile is to be left uncovered at any one time.

.6 On unprotected geotextile, stones weighting more than 45 kg shall not be allowed to roll down slope.

.7 For protected and unprotected geotextile, height of drop for stones less than 115 kg shall be less than one metre and stones greater than 115 kg shall be placed with no free fall. If stones greater than 115 kg must be dropped, field trials shall be performed to determine the maximum height of safe drop without damaging the geotextile.

## 3. CLEANING

.1 Remove construction debris from Project site and dispose of debris in an environmentally responsible and legal manner.

## 4. PROTECTION

.1 Vehicular traffic not permitted directly on geotextile.

## 5. ADDITIONAL STABILIZATION

.1 In the event the geotextile does not provide enough stabilization, install geogrid as directed by the Consultant.

**END OF SECTION**

## PART 1 - GENERAL

### 1. DESCRIPTION

.1 This section specifies the requirements for cleaning of pavement surfaces and/or the removal of existing paint markings prior to painting new paint markings as shown in the Contract Documents or as directed by the Consultant.

### 2. RELATED SECTIONS

.1 Section 32 17 23 - Pavement Markings.

### 3. MEASUREMENT FOR PAYMENT

.1 No separate payment for pavement cleaning prior to painting will be made. Include cost in the line item for paint marking.

### 4. WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.2 Place materials defined as hazardous or toxic in designated containers.

.3 Do not dispose of unused solvent materials into landfill. Divert materials to municipal hazardous materials depot as per governing agencies.

## PART 2 - PRODUCTS

### 1. MATERIALS

.1 Abrasives and solvents used for removal of paint, oil, grease, rubber deposits, proprietary products specially designed for pavement cleaning, subject to acceptance by Consultant.

## PART 3 - EXECUTION

### 1. REMOVING PAVEMENT MARKINGS

.1 Remove rubber tire deposits and paint markings, in areas designated by Consultant, by water or shot blasting or other method acceptable to the Consultant.

.2 Exercise care to avoid dislodging of coarse aggregate particles, excessive removal of fines, damage to bituminous binder or damage to joint and crack sealers.

.3 Do not heat pavement surfaces above 120°C, when using heater planning equipment.

.4 Upon request of the Consultant perform demonstration of proposed method on a test section prior to commencing work. Modify procedures as directed by the Consultant if the pavement surface is damaged.

.5 Remove and dispose of debris created by the removal process.

## 2. PAVEMENT SURFACE CLEANING

.1 Remove sealing compound which has protruded excessively, where directed by Consultant. Dispose of removed material as directed by Consultant.

.2 Remove dust, contaminants, loose and foreign materials, oil and grease, in areas designated and by method acceptable to the Consultant.

.3 Methods of cleaning include using high pressure water, sand blasting and shot blasting.

.4 Obtain acceptance of the Consultant for proposed method prior to commencing work.

.5 Upon request of the Consultant perform a demonstration of proposed method on a test section prior to commencing work. Modify procedures as directed by the Consultant if the pavement surface is damaged.

.6 Remove and dispose of cleaning agents as directed by the Consultant.

.7 Do not allow debris or cleaning agents to enter drainage courses or storm sewer systems.

.8 Use rotary power brooms, vacuum sweepers supplemented by hand brooming.

**END OF SECTION**

## PART 1 - GENERAL

### 1. DESCRIPTION

.1 This section specifies the requirements for loading, hauling, placing, and compacting gravel as Granular Sub-base Course to lines, grades, and cross sections indicated by the Contract Documents or as established by the Consultant.

### 2. RELATED SECTIONS

.1 Section 31 22 14 - Airfield Grading.

.2 Section 31 05 16 - Granular Materials and Aggregates.

.3 Section 32 11 23 – Aggregate Base Courses.

### 3. MEASUREMENT FOR PAYMENT

.1 Measure granular sub-base course in compacted cubic meters in place to specified thickness as accepted by Consultant. No payment for overbuild of Granular Sub-base Course beyond neat lines shown on cross sections. Payment at the tendered unit price shall be full compensation for the production, supply, processing, stockpiling, loading, hauling, placing, moisture conditioning, compacting, grading, maintaining, cleanup and other work incidental to this section.

### 4. REFERENCES

.1 As set out in Section 31 05 16 - Aggregate Materials.

### 5. WASTE MANAGEMENT AND DISPOSAL

.1 Divert unused granular material from landfill to local facility as accepted by the Consultant.

## PART 2 - PRODUCTS

### 1. MATERIALS

.1 Granular sub-base material: in accordance with Section 31 05 16 - Aggregate Materials and following requirements:

.1 80 mm Crushed Gravel.

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1, CAN/CGSB-8.2.

.3 Other Properties as follows:

.1 Liquid Limit: to ASTM D4318, Maximum 25.

.2 Plasticity Index: to ASTM D4318, Maximum 6.

.3 Los Angeles degradation: to ASTM C131.
Max% Loss by mass: 45.

.2 Fill material for taxiway pavement areas that are below subgrade before the start of excavation shall be granular sub-base course. Compaction requirements outlined in this specification section apply. This is not applicable to below the granular shoulders.

## PART 3 - EXECUTION

### 1. SEQUENCE OF OPERATION

.1 Place granular sub-base after subgrade is inspected and accepted by the Consultant.

.2 Placing

.1 Construct granular sub-base to depth and grade in areas as indicated.

.1 No frozen material is permitted to be placed.

.2 Place material only on clean, unfrozen surface, properly shaped and compacted and free from ice and snow.

.3 Begin spreading sub-base material on crown line or high side of one-way slope.

.4 Place granular sub-base materials using methods which do not lead to segregation or degradation.

.5 Have sufficient graders, water trucks, and rollers onsite to meet the specified spreading and compaction requirements for the amount of material hauled in each shift.

.6 Organize equipment such that the material hauled in one day is spread and compacted that same day.

.7 Do not leave windrows unspread overnight.

.8 Do not commence spreading and compacting granular sub-base material until the hauled material is bladed into a uniform continuous windrow.

.9 Place material to full width in uniform layers not exceeding 200 mm compacted thickness. The Consultant may authorize thicker lifts (layers) if specified compaction can be achieved.

.10 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.

.11 Segregation of aggregates shall be avoided and the material as spread shall be free from pockets of large or fine material. Segregated materials shall be remixed until uniform.

.12 Remove and replace or remix portion of layer in which material has become segregated during spreading as directed by the Consultant.

.3 Compaction

.1 Compaction equipment to be capable of obtaining required material densities.

.2 Compact to density not less than 98% Modified Proctor Maximum Dry Density in accordance with ASTM D1557.

.3 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.

.4 When necessary apply water during compaction to obtain specified density. If material is excessively moist, aerate by scarifying with suitable equipment until moisture content is corrected.

.5 When it is impracticable with larger types of compaction equipment to obtain the required degree of compaction in areas where working space is limited, the Contractor shall provide and use mechanical hand compaction equipment in order to achieve the require density.

.6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

.7 The moisture content shall be maintained within the specified moisture content range as defined by ASTM D1557 until the next layer is placed.

## 2. PROOF ROLLING

.1 For proof rolling use a legally loaded dual axle truck with an effective single axle load of 18,000 lbs (or 80 kN).

.2 Obtain acceptance from the Consultant to use non-standard proof rolling equipment.

.3 Proof roll at level in granular sub-base course as indicated. If non-standard proof rolling equipment is approved, Consultant to determine level of proof rolling.

.4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.

.5 Where proof rolling reveals areas of defective or softened granular sub-base:

.1 Remove granular sub-base and subgrade material as required to depth and extent as directed by the Consultant.

.2 Backfill excavated subgrade as directed by the Consultant.

.3 Replace granular sub-base material and compact.

.4 Supply and install Geogrid reinforcement as directed by the Consultant.

## 3. SITE TOLERANCES

.1 Finished Granular Sub-base Course to be within ± 20 mm of established grade and cross section, but not uniformly high or low.

.2 Correct surface irregularities greater than ± 20 mm by adding or removing material until surface is within specified tolerances.

## 4. PROTECTION

.1 Maintain finished granular sub-base in condition conforming to this section until succeeding base course is constructed, or until granular sub-base is accepted by the Consultant.

.2 Acceptance of finished Granular Sub-base Course by the Consultant does not relieve the Contractor of his responsibility to provide a finished Granular Sub-base Course meeting the requirements of this section until succeeding material is applied.

**END OF SECTION**

## PART 1 - GENERAL

### 1. RELATED SECTIONS

.1 Section 31 05 16 - Aggregate Materials.

.2 Section 32 11 16.01 – Granular Sub-base.

.3 Section 31 22 14 - Airfield Grading.

### 2. MEASUREMENT FOR PAYMENT

.1 Measure granular base course in compacted cubic meters in place to specified thickness as accepted by Consultant. Payment at the tendered unit price shall be full compensation for the production, supply, processing, stockpiling, loading, hauling, placing, grading, moisture conditioning, compacting, maintaining, cleanup and other work incidental to this section. No payment shall be made for overbuild of Granular Base Course beyond neat lines shown on the drawings. Granular material to be compacted to requirements outlined in this project specification.

### 3. REFERENCES

.1 As set out in Section 31 05 16 - Aggregate Materials.

### 4. DELIVERY, STORAGE, AND HANDLING

.1 Deliver and stockpile aggregates in accordance with Section 31 05 16 - Aggregate Materials. Stockpile sufficient aggregate required prior to beginning operation.

## PART 2 - PRODUCTS

### 1. MATERIALS

.1 Granular base: material in accordance with Section 31 05 16 - Aggregate Materials and following requirements:

.1 19 mm Crushed Gravel.

.1 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.2, CAN.

.2 25 mm Crushed Gravel.

.1 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.2, CAN.

## PART 3 - EXECUTION

### 1. SEQUENCE OF OPERATION

.1 Place granular base after granular sub-base or subgrade surface is inspected and accepted by the Consultant.

.2 Placing

.1 Compact existing underlying subgrade gravels (granular subbase) to a minimum of 98% Modified Proctor Maximum Dry Density ASTM D1557.

.2 Construct granular base to depth and grade in areas indicated.

.3 No frozen material is permitted to be placed.

.4 Place material only on clean unfrozen surface, free from snow and ice.

.5 Have sufficient graders, water trucks, and rollers on site to meet the specified spreading and compaction requirements for the amount of material hauled in each shift.

.6 Organize equipment such that the material hauled in one day is spread and compacted that day.

.7 Do not leave windrows unspread overnight.

.8 Do not commence spreading and compacting crushed material until the hauled material is bladed into a uniform continuous windrow.

.9 Begin spreading base material on crown line or on high side of one-way slope.

.10 Place material using methods which do not lead to segregation or degradation of aggregate.

.11 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. Consultant may accept thicker lifts (layers) if specified compaction can be achieved.

.12 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.

.13 Remove and replace or remix that portion of layer in which material becomes segregated during spreading as directed by the Consultant.

.14 Segregation of aggregates shall be avoided and the material as spread shall be free from pockets of large or fine material. Segregated materials shall be remixed until uniform.

.3 Compacting

.1 For **granular sections below new pavement structures**, compact to density not less than 100% Modified Proctor Maximum Dry Density in accordance with ASTM D1557.

.2 For **granular shoulders,** compact density not less than 100% Standard Proctor Maximum Dry Density in accordance with ASTM D698.

.3 Shape and roll alternately to obtain smooth, even and uniformly compacted base.

.4 Apply water as necessary during compacting to obtain specified density.

.5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers accepted by Consultant.

.6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

.7 The moisture content shall be maintained at the optimum moisture content as defined by ASTM D1557 and ASTM D698 until the next layer is placed.

## 2. PROOF ROLLING

.1 For proof rolling use a legally loaded dual axle truck with an effective single axle load of 18,000 lbs (or 80 kN).

.2 Obtain acceptance from the Consultant to use non-standard proof rolling equipment.

.3 Proof roll at level in aggregate base course as indicated. If non-standard proof rolling equipment is accepted, Consultant to determine level of proof rolling.

.4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.

.5 Where proof rolling reveals areas of defective aggregate base:

.1 Remove base, sub-base and subgrade material to depth and extent as directed by Consultant.

.2 Backfill excavated subgrade with acceptable common material and compact.

.3 Replace sub-base material and compact as per Section 32 11 16.01 – Granular Sub-Base.

.4 Replace base material and compact in accordance with this Section.

.6 Where proof rolling reveals defective base or sub-base, remove defective materials to depth and extent as directed by Consultant and replace with new materials in accordance with this section and as directed by Consultant.

.7 Supply and install geotextile and/or geogrid reinforcement as directed by the Consultant.

## 3. SITE TOLERANCES

.1 Finished granular base surface to be within ±10 mm of established grade and cross section but not uniformly high or low.

.2 Correct surface irregularities greater than ±10 mm by adding or removing material until surface is within specified tolerances.

.3 Provide confirmation to Consultant that design grades have been achieved by survey and other field checks as acceptable to the Consultant.

## 4. PROTECTION

.1 Maintain finished base in condition conforming to this Section until succeeding material is applied or until acceptance by Consultant.

.2 Acceptance of finished Aggregate Base Course by the Consultant does not relieve the Contractor of their responsibility to provide a finished Aggregate Base Course meeting the requirements of this Section until succeeding material is applied.

**END OF SECTION**

# PART 1 - GENERAL

## 1. DESCRIPTION

.1 This section specifies the requirements for the supply and application of asphalt tack coat as indicated by the Contract Documents or as directed by the Consultant.

## 2. SECTION INCLUDES

.1 Materials and application of asphalt tack coat to an existing asphalt or concrete surface prior to asphalt paving.

## 3. RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 32 12 16 - Asphalt Paving.

## 4. MEASUREMENT FOR PAYMENT

.1 Asphalt tack coat shall be measured in square metres of plan area of surface treated per asphalt lift including vertical edges as specified and accepted by the Consultant. Payment at the tendered unit price shall be full compensation for supply, heating and placing asphalt tack coat and all work incidental to this section. No additional payment for reapplication of asphalt tack coat that fails to cure.

## 5. REFERENCES

.1 All references to this Specifications, Standards, or Methods shall be understood to refer to the latest adopted revision, including all amendments.

.2 American Society for Testing and Materials International, (ASTM)

.1 ASTM D140, Standard Practice for Sampling Bituminous Materials.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-16.2, Emulsified Asphalts, Anionic Type, for Road Purposes.

## 6. SUBMITTALS

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

.2 Sample asphalt tack coat material to: ASTM D140.

.3 Provide access on tank truck for Consultant to sample asphalt material to be incorporated into Work, in accordance with ASTM D140.

.4 Provide one 4 litre sample of asphalt emulsion per 5,000 litres of asphalt emulsion delivered, if requested by Consultant.

## 7. QUALITY ASSURANCE

.1 Upon request by the Consultant, submit manufacturer's test data and certification that asphalt tack coat material meets requirements of this section.

## 8. DELIVERY, STORAGE AND HANDLING

.1 Deliver, store, and handle materials in accordance with ASTM D140.

.2 Provide, maintain, and restore asphalt storage area.

## 9. WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with governing agencies.

.2 Divert unused asphalt from landfill to facility capable of recycling materials.

# PART 2 - PRODUCTS

## 1. MATERIALS

.1 Anionic emulsified asphalt: to CAN/CGSB-16.2, grade: SS-1.

.2 Water: clean, potable, free from foreign matter.

## 2. EQUIPMENT

.1 Pressure distributor to be:

.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 0.5 L/$m^2$ with uniform pressure, and with an 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 metres of travel 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 an easily read, accurate and sensitive device which registers temperature of liquid in reservoir.

.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.

.8 Cleaned if previously used with incompatible asphalt material.

## PART 3 - EXECUTION

### 1. APPLICATION

.1 Obtain the Consultant's acceptance of surface before applying asphalt tack coat.

.2 Apply asphalt tack coat only on clean and dry surface.

.3 Dilute asphalt emulsion with water at 1:1 ratio for application. Mix thoroughly by pumping or other method accepted by the Consultant.

.4 Apply asphalt tack coat evenly to pavement surface at rate as directed by the Consultant, between 0.2 and 0.5 L/$m^2$ but not to exceed 0.6 L/$m^2$.

.5 Paint contact surfaces of curbs, gutters, headers, manholes and like structures with thin, uniform coat of asphalt tack coat material.

.6 Do not apply asphalt tack coat when air temperature is less than 10°C or when rain is forecast within two hours of application.

.7 Apply asphalt tack coat only to surfaces that are expected to be overlaid on same day.

.8 Apply asphalt tack coat only on unfrozen surface.

.9 Evenly distribute localized excessive deposits of tack coat by brooming as directed by the Consultant.

.10 Where traffic is to be maintained, treat no more than one half of width of surface in one application.

.11 Keep traffic off tacked areas until asphalt tack coat has set.

.12 Re-tack contaminated or disturbed areas as directed by the Consultant.

.13 Permit asphalt tack coat to set before placing asphalt pavement.

**END OF SECTION**

# PART 1 - GENERAL

## 1. DESCRIPTION

.1 This section specifies the requirements for producing and placing hot mix asphalt concrete to the lines, grades and dimensions shown in the Contract Documents or as directed by the Consultant.

## 2. SECTION INCLUDES

.1 Materials and installation for asphalt concrete paving for airport taxiways, apron, and roads.

## 3. RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 31 05 16 – Aggregate Materials.

.3 Section 32 12 13.16 – Asphalt Tack Coats.

## 4. MEASUREMENT PROCEDURES

.1 Hot Mix Asphalt Concrete Paving shall be measured in square metres of hot mix asphalt concrete actually incorporated into the work at the compacted thickness shown on the drawings, based on final surface measured by Contractor's survey and accepted by the Consultant. No payment shall be made for overbuild of Hot Mix Asphalt Concrete Paving beyond neat lines shown on the drawings.

.1 Payment at the tendered unit price for Hot Mix Asphalt Concrete Paving shall be full compensation for the mix design, production and supply of aggregates, supply of Performance Graded Asphalt Binder (PGAB), supply and incorporation of anti-stripping agent into the mix as required by mix design, production and transportation of hot mix asphaltic concrete mix, preparation of the surface to be paved including tack on vertical surfaces, saw cutting required for staggered paving areas, temporary paving ramps if required, placement and compaction of the mixture, finishing, quality control plan and testing, supply of marshall samples and cores for quality assurance, cleanup, and all other work, equipment and materials incidental to complete the work as specified.

## 5. REFERENCES

.1 All references to this Specifications, Standards, or Methods shall be understood to refer to the latest adopted revision, including all amendments.

.2 American Association of State Highway and Transportation Officials (AASHTO)

.1 AASHTO M320, Standard Specification for Performance Graded Asphalt Binder.

.2 AASHTO R29, Standard Specification for Grading or Verifying the Performance Graded of an Asphalt Binder.

.3 AASHTO T245, Resistance to Plastic flow of Bituminous Mixtures Using Marshall Apparatus.

.4 AASHTO T283, Resistance of Compacted Asphalt Mixtures to Moisture-Induced Damage.

.3 Asphalt Institute (AI)

.1 AI MS2, Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.

.4 American Society for Testing and Materials International, (ASTM)

.1 ASTM C117, Standard Test Method for Material Finer Than 0.075mm (No.200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C127, Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.

.3 ASTM C128, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.

.4 ASTM C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

.5 ASTM C1252, Standard Method for Un-compacted Void Content.

.6 ASTM C207, Standard Specification for Hydrated Lime for Masonry Purposes.

.7 ASTM D995, Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.

.8 ASTM D2419, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

.9 ASTM D2041, Test Method for Theoretical Maximum Specific Gravity of Bituminous Paving Mixtures.

.10 ASTM D2726, Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens.

.11 ASTM D3203, Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.

.12 ASTM D4791, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

.13 ASTM D6927, Standard Test Method for Marshall Stability and Flow of Bituminous Mixtures.

.14 ASTM D 6928 Standard Test Method for Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus.

.15 ASTM D7428 Standard Test Method for Resistance of Fine Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus.

.5 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.2, Sieves Testing, Woven Wire, Metric.

.2 CAN/CGSB-16.3, Asphalt Cements for Road Purposes.

## 6. PRODUCT DATA

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

.2 Submit asphalt concrete mix design and trial mix test results reviewed and signed by a BC Registered Professional Engineer to the Consultant for review at least two (2) weeks prior to beginning Work. Prove optimum asphalt cement content with a minimum of five (5) points of curves relating asphalt cement content to density, stability, air voids, flow, voids in mineral aggregate (VMA), and voids filled with asphalt (VFA) versus asphalt cement content (% by weight of total mix).

## 7. SAMPLES

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

.2 Submit the following to the Consultant at least two (2) weeks prior to commencing paving operations.

.1 Mix Design

.1 Mix Design by Marshall method, as outlined in the latest edition of the Asphalt Institute Manual (MS-2), including all laboratory testing results. Mix formulas only are not acceptable. A qualified and independent testing laboratory engaged by the Contractor shall be employed to prepare a mix design and job mix formulae.

.2 Asphalt Cement

.1 Viscosity – temperature chart for asphalt cement to be supplied showing Kinematic Viscosity in centistokes ($mm^2/s$), temperature range 105 to 175°C.

.2 Proposed source of asphalt cement and manufacturers test data.

.3 Submit one (1) – 1 L containers of asphalt cement, if requested by the Consultant.

.3 Aggregates

.1 Proposed source of aggregates.

.2 Submit 10 kg samples of coarse and fine aggregates, if requested by the Consultant.

.3 Submit aggregate processing Quality Control test results.

.4 Plant Scale Certificate

.1 Submit a copy of the plant scale certificate(s).

.5 During paving operations submit the following samples as specified.

.1 Asphalt cement: One (1) – 1 litre container of asphalt cement per 2000 tonnes of asphalt placed, if requested by the Consultant.

.2 The Manufacture's test data and certification that the asphalt cement meets the requirements of this specification.

.3 Printed temperature record of asphalt mix produced on a daily basis.

.4 Scale tickets recording mass of asphalt delivered and incorporated into the work on a daily basis.

## 8. PAVING PLAN

.1 The Contractor shall submit a paving plan at least two weeks prior to commencing paving operations.

.2 This plan shall detail:

.1 Proposed paving equipment.

.2 Outline planned equipment access and egress routes for each specified work areas.

.3 A plan illustrating the sequence of pavement lane construction including mat width, mat edge offset, locations of transverse joints, joint construction and other information requested by the Consultant.

.4 Contingency plans to deal with the interruption in asphalt concrete supply, breakdown in equipment and inclement weather during paving operations.

.5 Modifications to the production and paving operation to accommodate production rates lower than the recommended minimum contained in this specification.

.3 Acceptance of the plan by the Consultant will not relieve the Contractor of any responsibility in attaining a defect free product.

## 9. QUALITY CONTROL PLAN

.1 Quality Control (QC) and all QC testing is the responsibility of the Contractor.

.2 QC is defined as the sum total of activities performed by the HMAC producer and/or the Contractor to make sure that the HMAC product meets specification requirements. This includes materials handling and construction procedures, calibration and maintenance of equipment, production process control and any sampling, testing, and inspection that is done for these purposes.

.3 The Contractor's QC Plan shall contain appropriate information regarding the sampling and testing that will be performed by the Contractor's personnel. The sampling and testing plan should contain testing information which will be used by the Contractor to maintain control of the production and placement of the asphalt concrete and to ensure a product that complies with the specifications.

.4 The Contractor's QC Plan shall contain a detailed testing plan outlining the characteristic or quality to be inspected, the test method to be used, the frequency, the sampling location, and designation of responsibility. Every quality shall define the tolerances that are allowed or specified. A sample of a "Quality Control Sampling and Testing Plan" is included in Part 2, Section 4 – Sampling and Testing.

.5 Quality Control reports shall be submitted daily to the Consultant.

## 10. DELIVERY, STORAGE AND HANDLING

.1 Deliver and stockpile aggregates in accordance with Section 31 05 16 – Aggregate Materials. Stockpile minimum 100% of total amount of aggregate required before beginning asphalt mixing operation.

.2 When necessary to blend aggregates from one or more sources to produce required gradation, do not blend in stockpiles.

.3 Stockpile fine aggregate separately from coarse aggregate, although separate stockpiles for more than two mix components are permitted.

.4 Provide approved storage, heating tanks and pumping facilities for asphalt cement.

## PART 2 - PRODUCTS

### 1. MATERIALS

.1 Asphalt cement: to AASHTO M320 – PG 64-25.

.2 Aggregates:

.1 Materials

.1 Aggregate shall satisfy all requirements of Tables 1 and 2 of this specification and unless otherwise specified shall be:

.1 Crushed rock composed of hard, uncoated, cubical fragments, produced from rock formations or boulders of uniform quality;

Or

.2 Crushed gravel composed of hard, durable, uncoated particles, produced from naturally formed deposits.

.2 Fine aggregates shall consist of natural sand and/or manufactured material derived from crushing stone, or gravel. All particles shall be clean, durable, moderately sharp and free from coatings of clay, silt or other deleterious materials and shall contain no organic matter.

.3 Natural sand and/or blend sand shall be limited to 15% maximum of the aggregate blend.

.2 Physical Requirements

.1 Physical requirements of aggregates shall be within limits shown on Table 2.

.2 Do not use aggregates having known polishing characteristics in mixtures for surface courses.

.3 Irrespective of compliance with the physical requirements, aggregates may be accepted or rejected based on past field performance.

.3 Gradation

.1 Gradation of aggregates blended to job mix formula to be within the limits shown in Table 1 when tested to ASTM C117 and ASTM C136 and giving smooth curve without sharp breaks when plotted on semi-log grading chart.

.2 Coarse aggregate is aggregate retained on 5 mm sieve and fine aggregate is aggregate passing 5 mm sieve.

.3 Process aggregate and stockpile fine aggregate separately from coarse aggregate.

.4 Mineral Filler

.1 Finely ground particles of limestone, hydrated lime, Portland cement or other approved non-plastic mineral matter, thoroughly dry and free from lumps.

.2 Add mineral filler when necessary to meet job mix aggregate gradation or as directed to improve mix properties.

.3 Mineral filler to be dry and free flowing when added to aggregate.

.5 Blend Sand

Shall be a blend of the following:

.1 Screenings produced in crushing of quarried rock, boulders or gravel.

.2 Add blend sand when necessary to meet job mix aggregate gradation or as directed, to improve mix properties.

.3 Blend sand to be sufficiently dry to be free flowing when added to aggregate.

| Table 1<br>Percent Passing Designated Sieve | | | |
|---|---|---|---|
| **Sieve Size (mm)** | | **New Limits** | |
| Metric | Imperial | ~~Base~~ | Surface |
| 20 | 19 | ~~100~~ | |
| 16 | 16 | ~~80-95~~ | 100 |
| 12.5 | 12.5 | ~~67-85~~ | 82-95 |
| 10 | 9.5 | ~~58-78~~ | 70-85 |
| 5 | 4.75 | ~~40-60~~ | 50-65 |
| 2.5 | 2.36 | ~~27-47~~ | 35-50 |
| 1.25 | 1.18 | ~~18-37~~ | 23-40 |
| 0.630 | 0.600 | ~~12-30~~ | 15-30 |
| 0.315 | 0.300 | ~~8-23~~ | 10-23 |
| 0.160 | 0.150 | ~~5-15~~ | 6-16 |
| 0.080 | 0.075 | ~~3-8~~ | 3-8 |

| Table 2<br>Physical Tests for Hot Mix Aggregate | | | |
|---|---|---|---|
| **Physical Test** | **Fine Aggregate** | **Coarse Aggregate** | **Notes** |
| Percent Crushed Minimum * (Minimum 2 fractured faces) | ---- | 80 | For Surface Course |
| | ---- | 70 | For Base Course |
| Sand Equivalent ASTM D2419 Minimum | 50 | ---- | |
| Micro Deval ASTM D7428, % Loss | 18 | 16 | |
| Absorption ASTM C127 Max % by Mass | ---- | 1.75 | |
| Loss by Washing ASTM C117 Max % Passing Sieve | ---- | 1.5 | For Surface Course Only |
| | | 2.0 | For Base Course Only |
| Flat & Elongated Particles Ratio greater than 5:1 Max % by Mass | ---- | 15 | |
| Fine Aggregate Angularity (Uncompacted Void Content), Min. % | 45 | ---- | For Surface Course Only |
| Liquid Limit ASTM D4318 (maximum) | 25 | ---- | |
| Plasticity Index ASTM D4318 (maximum) | 0 | ---- | |

* The percent of crushed material will be determined by examining the fraction retained on the 5 mm sieve and dividing the mass of the crushed particles by the total mass retained on the 5 mm sieve.

## 2. EQUIPMENT

.1 Pavers: automatic grade-controlled self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated. Provide two pavers for echelon paving and one back-up paver of equal capability.

.2 Rollers: sufficient number, minimum of three per paver of type and weight to obtain specified density of compacted mix.

.3 Vibratory rollers:

.1 Minimum drum diameter: 1200 mm.

.4 Haul trucks: sufficient number and of adequate size, speed and condition to ensure orderly and continuous operation and as follows:

.1 Boxes with tight metal bottoms.

.2 Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.

.3 In cool weather or for long hauls, insulate entire contact area of each truck box.

.4 Use only trucks which can be weighed in single operation on scales supplied.

.5 Hand tools:

.1 Lutes or rakes with covered teeth for spreading and finishing operations.

.2 Tamping irons having mass not less than 12 kg and bearing area not exceeding 310 $cm^2$ for compacting material along curbs, gutters and other structures inaccessible to roller. Mechanical compaction equipment, when approved by the Consultant, may be used instead of tamping irons.

.3 Straight edges, 4.5 m in length, to test finished surface.

## 3. MIX DESIGN

.1 Mix design to be provided by contractor and approved by the Consultant.

.2 Mix design to be developed by testing laboratory approved by the Consultant.

.3 Design of mix by Marshall Method as outlined in the latest edition of the Asphalt Institute Manual (MS-2), to the following requirements.

.1 Compaction blows on each face of test specimens: 50.

.2 Mix physical requirements.

| Marshall Method Mix Criteria | Base Course | Surface Course |
|---|---|---|
| Stability ASTM D6927 (kN @ 60°C) Minimum | 8 | 10 |
| Flow ASTM D6927 (mm) | 2 – 4 | 2 – 4 |
| Air Voids ASTM D3203 (%) | 4.0 - 4.5 | 3.5 – 4.0 |
| Voids in Mineral Aggregates (%, Minimum) | 13 | 14 |
| Voids Filled with Asphalt (%) | 65 - 78 | 65 – 78 |
| Tensile Strength Ratio (%, Minimum) AASHTO T283 | 70 | 75 |

.3 Notes:

.1 Percent voids in mineral aggregate to be calculated on the basis of the ASTM bulk specific gravity for the aggregate.

.2 The portion of asphalt cement lost by absorption into the aggregate particles must be allowed for when calculating percent air voids.

.3 For AASHTO T 283, include the freeze cycle.

.4 Do not change job mix without prior acceptance of the Consultant. When change in material source proposed, new job-mix formula to be accepted by the Consultant.

## 4. SAMPLING AND TESTING

.1 During the progress of the work tests will be carried out on materials and workmanship in order to ensure compliance with the requirements of the specifications. Quality Assurance testing shall be done by the Consultant. Quality Control testing shall be done by the Contractor.

.2 Quality Control Testing

.1 The Contractor shall use Professional Engineering Services and a qualified testing laboratory, licensed to practise in the Province, for Quality Control testing. The Contractor shall provide and maintain equipment and qualified personnel to perform all field testing necessary to determine and monitor the characteristics of the materials produced and incorporated into the work. The Contractor shall bear the cost of all Quality Control sampling and testing services.

.2 The frequencies of Quality Control testing are to be indicated on a Quality Control Sampling and Testing Plan. Results of all Quality Control tests shall be made available to the Consultant at any time, and two (2) copies of the tests shall be given to the Consultant at the end of each day.

.3 The following is a sample of a blank “Quality Control Sampling and Testing Plan” for production and placement of asphalt concrete pavement.

| *- SAMPLE-* | | | | | |
|---|---|---|---|---|---|
| QUALITY CONTROL SAMPLING AND TESTING PLAN | | | | | |
| Characteristic | Test Method | Frequency | Sample Location | Responsibility | Tolerance |
| Asphalt Content | | | | | |
| Aggregate Gradation | | | | | |
| Relative Compaction | | | | | |
| Asphalt Temperature | | | | | |
| Mix Temperature | | | | | |
| Mix Moisture | | | | | |

.3 Quality Assurance Testing

.1 Quality Assurance testing for compliance with the specifications will be carried out by the testing agency designated by the Consultant.

## PART 3 - EXECUTION

### 1. PLANT AND MIXING REQUIREMENTS

.1 Batch and continuous mixing plants:

.1 To ASTM D995.

.2 Feed aggregates from individual stockpiles through separate bins to cold elevator feeders. Do not load frozen materials into bins.

.3 Feed cold aggregates to plant in proportions to ensure continuous operations.

.4 Calibrate bin gate openings and conveyor speeds to ensure mix proportions are achieved.

.5 Before mixing, dry aggregates to moisture content not greater than 0.5% by mass or to lesser moisture content if required to meet mix design requirements.

.6 Immediately after drying, screen aggregates into hot storage bins in sizes to permit recombining into gradation meeting job-mix requirements.

.7 Store hot screened aggregates in manner to minimize segregation and temperature loss.

.8 Heat asphalt cement and aggregate to mixing temperature directed by Consultant. Do not heat asphalt cement above 160°C, maximum temperature indicated on temperature-viscosity chart.

.9 Make available current asphalt cement viscosity data at plant. With information relative to viscosity of asphalt being used, the Consultant to approve temperature of completed mix at plant and at paver after considering hauling and placing conditions.

.10 Maintain temperature of materials within 5°C of specified mix temperature during mixing.

.11 Mixing time:

.1 In batch plants, both dry and wet mixing times for not less than 10 seconds. Continue wet mixing as long as necessary to obtain thoroughly blended mix but not less than 30 s or more than 75 s.

.2 In continuous mixing plants, mixing time as directed by the Consultant but not less than 45 s.

.3 Do not alter mixing time unless directed by the Consultant.

.2 Dryer drum mixing plant:

.1 To ASTM D995.

.2 Load aggregates from individual stockpiles to separate cold feed bins. Do not load frozen materials into bins.

.3 Feed aggregates to burner end of dryer drum by means of multi-bin cold feed unit and blend to meet job-mix requirements by adjustments of variable speed feed belts and gates on each bin.

.4 Meter total flow of aggregate by an electronic weigh belt system with indicator that can be monitored by plant operator and which is interlocked with asphalt pump so that proportions of aggregate and asphalt entering mixer remain constant.

.5 Provide for easy calibration of weighing systems for aggregates without having material enter mixer.

.6 Calibrate bin gate openings and conveyor speeds to ensure mix proportions are achieved. Calibrate weigh bridge on charging conveyor by weighing amount of aggregate passing over weigh bridge in set amount of time. Difference between this value and amount shown by plant computer system to differ by not more than plus or minus 2%.

.7 Make provision for conveniently sampling full flow of materials from cold feed.

.8 Provide screens or other suitable devices to reject oversize particles or lumps of aggregate from cold feed prior to entering drum.

.9 Provide system interlock stop on feed components if either asphalt or aggregate from bin stops flowing.

.10 Accomplish heating and mixing of asphalt mix in approved parallel flow dryer-mixer in which aggregate enters drum at burner end and travels parallel to flame and exhaust gas stream. Control heating to prevent fracture of aggregate or excessive oxidation of asphalt. Equip system with automatic burner controls and provide for continuous temperature sensing of asphalt mixture at discharge, with printing recorder that can be monitored by plant operator. Submit printed record of mix temperatures at end of each day to the Consultant.

.11 Mixing period and temperature to produce uniform mixture in which particles are thoroughly coated, and moisture content of material as it leaves mixer to be less than 1%.

.3 Temporary storage of hot mix:

.1 Provide mix storage of sufficient capacity to permit continuous operation and designed to prevent segregation.

.2 Do not store asphalt mix in storage bins in excess of 3 hours.

.4 While producing asphalt mix for this Project, do not produce mix for other users unless separate storage and pumping facilities are provided for materials supplied to this project.

.5 Mixing tolerances:

.1 Permissible variation in aggregate gradation from job mix (percent of total mass):

| Sieve Designation | | % Passing by Mass | |
|---|---|---|---|
| Metric (mm) Imperial (mm) | | Individual Sample | Average of Last 5 Samples |
| >5 | | ± 5.0 | ± 3.0 |
| 5 | 4.75 | ± 5.0 | ± 3.0 |
| 2.5 | 2.36 | ± 4.0 | ± 2.5 |
| 0.63 | 0.60 | ± 3.0 | ± 2.0 |
| 0.315 | 0.300 | ± 3.0 | ± 2.0 |
| 0.160 | 0.150 | ± 2.0 | ± 1.5 |
| 0.080 | 0.075 | ± 1.5 | ± 1.0 |

.2 Asphalt Content Tolerance: Allowable variation from accepted design asphalt content shall be ± 0.3 % by mass of mix.

.3 Air Void Content Tolerance: Allowable variation from accepted design air void content shall be ± 1.0 %.

.4 Mixing Temperature Tolerance: Allowable variation from design mixing temperature shall be ± 5°C.

.6 Addition of anti-stripping agent:

.1 If required, only liquid anti-strip additive accepted by the Consultant will be allowed.

## 2. PREPARATION

.1 When paving over existing asphalt surface, clean pavement surface. When levelling course is not required, patch and correct depressions and other irregularities to approval of the Consultant before beginning paving operations.

.2 Apply prime coat and tack coat in accordance with Section 32 12 13.23 – Asphalt Prime and Section 32 12 13.16 – Asphalt Tack Coat prior to paving.

.3 Prior to laying mix, clean surfaces of loose and foreign material.

## 3. TRANSPORTATION OF MIX

.1 Transport mix to job site in vehicles cleaned of foreign material.

.2 Paint or spray truck beds with limewater, soap or detergent solution, or non-petroleum based commercial product, at least daily or as required. Elevate truck bed and thoroughly drain. No excess solution to remain in truck bed.

.3 Schedule delivery of material for placing in daylight, unless the Consultant approves artificial lighting for paving.

.4 Deposit mix from surge or storage silo to trucks in multiple drops to reduce segregation. Do not dribble mix into trucks.

.5 Deliver material to paver at uniform rate and in an amount within capacity of paving and compacting equipment.

.6 Deliver loads continuously in covered vehicles and immediately spread and compact. Deliver and place mixes at temperature within range as directed by Consultant, but not less than 135°C.

## 4. TEST STRIP

.1 Construct and test strip to approval of the Consultant.

.2 For airfield pavement, construct test strip in non-critical area to resolve anticipated problems with equipment, mix behaviour or compaction, prior to starting paving operation.

.3 Establish optimum rolling pattern by taking nuclear densometer readings and observations to:

.1 Determine sequence and number of passes.

.2 Determine correct operating characteristics of vibratory rollers.

.3 Determine maximum density of asphalt mix.

.4 Ensure smooth surface finish.

.5 Establish actual density achieved by coring in order to determine if additional or other rolling equipment is required to achieve density of not less than 94% of density obtained with specimens prepared from samples of mix being used.

## 5. PLACING

.1 Obtain the Consultant's approval of existing surface and tack coat or prime coat prior to placing asphalt.

.2 Place asphalt concrete to thicknesses, grades and lines as specified on Contract Drawings or as directed by the Consultant.

.3 Placing conditions:

.1 Place asphalt mixtures only when air temperature is above 5°C.

.2 When temperature of surface on which material is to be placed falls below 10°C, provide extra rollers as necessary to obtain required compaction before cooling.

.3 Do not place hot-mix asphalt when pools of standing water exist on surface to be paved, during rain, or when surface is damp.

.4 Place individual strips no longer than 500 m.

.5 On airport runways and taxiways, aprons and parking lots commence spreading at high side of pavement or at crown and span crowned centerlines with initial strip.

.6 Place surface course using a minimum of two pavers in echelon. Alternatively submit, to the Consultant for approval, alternate method(s) of placing asphalt concrete paving.

.7 Spread and strike off mixture with self-propelled mechanical finisher.

.1 Construct longitudinal joints and edges true to line markings. The Contractor will establish lines for paver to follow parallel to centerline of proposed pavement. Position and operate paver to follow established line closely.

.2 When using pavers in echelon, have first paver follow marks or lines, and second paver follow edge of material placed by first paver. Work pavers as close together as possible and in no case permit them to be more than 30 m apart.

.3 Maintain constant head of mix in auger chamber of paver during placing.

.4 If segregation occurs, immediately suspend spreading operation until cause is determined and corrected.

.5 Correct irregularities in alignment left by paver by trimming directly behind machine.

.6 Correct irregularities in surface of pavement course directly behind paver. Remove by shovel or lute excess material forming high spots. Fill and smooth indented areas with hot mix. Do not broadcast material over such areas.

.7 Do not throw surplus material on freshly screeded surfaces.

.8 Do not re-use runoff/over build asphalt in the hopper

.9 Do not allow asphalt delivery trucks to clean on the prepared surface. Direct the trucks to clean excess material in designated area outside paving limits.

.10 When the paver hopper is almost empty, during the paving operation, do not fold the wings to incorporate residual asphalt into the mat

.11 Ensure the surface in front of the paver is clean of any deleterious material including accumulation of asphalt that would be deemed detrimental to placement of specified full thickness of the mat.

.8 When hand spreading is used:

.1 Use approved wood or steel forms, rigidly supported to assure correct grade and cross section. Use measuring blocks and intermediate strips to aid in obtaining required cross-section.

.2 Distribute material uniformly. Do not broadcast material.

.3 During spreading operation, thoroughly loosen and uniformly distribute material by lutes or covered rakes. Reject material that has formed into lumps and does not break down readily.

.4 After placing and before rolling, check surface with templates and straightedges and correct irregularities.

.5 Provide heating equipment to keep hand tools free from asphalt. Control temperature to avoid burning material. Do not use tools at higher temperature than temperature of mix being placed.

## 6. COMPACTING

.1 Compact HMAC to a density not less than 94% of the maximum theoretical density to ASTM D 2041.

## 7. JOINTS

.1 General:

.1 Remove surplus material from surface of previously laid strip. Do not deposit on surface of freshly laid strip.

.2 Construct joints between asphalt concrete pavement and Portland cement concrete pavement as indicated.

.3 Paint contact surfaces of existing structures such as manholes, curbs or gutters with bituminous material prior to placing adjacent pavement.

.2 Transverse joints:

.1 Offset transverse joint in succeeding lifts by at least 3 m.

.2 Sawcut back to full depth vertical face, clean all slurry and tack face with thin coat of hot asphalt tack prior to continuing paving.

.3 Compact transverse joints to provide smooth riding surface. Use methods to prevent rounding of compacted surface at joints.

.3 Longitudinal joints:

.1 Offset longitudinal joints in succeeding lifts by at least 150 mm.

.2 Cold joint is defined as joint where asphalt mix is placed, compacted and left to cool below 100°C prior to paving of adjacent lane.

.1 If cold joint cannot be avoided, cut back by saw cutting previously laid lane, by at least 150 mm, to full depth vertical face, clean to provide sludge-free edge and tack face with thin coat of hot asphalt tack of adjacent lane.

.3 When rolling with static or vibratory rollers, have most of drum width ride on newly placed lane with remaining 150 mm extending onto previously placed and compacted lane.

.4 Overlap previously laid strip with spreader by 50 mm.

.4 Construct butt joints as indicated.

## 8. FINISH TOLERANCES

.1 Finished asphalt surface to be within ±5 mm of design elevation but not uniformly high or low.

.2 Finished asphalt surface not to have irregularities exceeding 5 mm when checked with 4.5 m straight edge placed in any direction.

.3 Finish asphalt surface to provide positive drainage without ponding water.

## 9. DEFECTIVE WORK

.1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required. If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form true and even surface and compact immediately to specified density.

.2 Repair areas showing checking, rippling, or segregation. All repair methods to be submitted to the Consultant for acceptance.

.3 Adjust roller operation and screed settings on paver to prevent further defects such as rippling and checking of pavement.

.4 Asphalt pavement not meeting the specified compaction, thickness or finish tolerances shall be subject to removal and replacement, at the Contractor's expense, as directed by the Consultant.

.5 Skin patches or other thin layer repairs or surface treatments are not acceptable repair methods for final asphalt surfaces.

**END OF SECTION**

# PART 1 - GENERAL

## 1. DESCRIPTION

.1 This section specifies the requirements for the supply and application of paint lines and pavement markings indicated by the Contract Documents or as directed by the Consultant.

## 2. RELATED WORK

.1 Section 32 01 11.01 - Pavement Cleaning and Markings Removal.

## 3. REFERENCES

.1 All references to this Specifications, Standards, or Methods shall be understood to refer to the latest adopted revision, including all amendments.

.2 Federal Specification TT-P-1952F – Paint, Traffic and Airfield Marking, Waterborne

.3 Federal Specification TT-B-1325D – Beads (Glass Spheres) Retro-Reflective

.4 Federal Standard 595 – Colors Used in Government Procurement.

.5 CGSB1 GP 71, Method, of Testing Paints and Pigments.

## 4. SAMPLES

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

## 5. MEASUREMENT FOR PAYMENT

.1 Pavement markings are a provisional item. They will be measured in lump sum including cleaning, supply of stencils, supply and installation of two coats of paint, protection and clean-up. Survey is not included in this provisional item and should be included in the project scope as specified in Section 01 71 00 – Examination and Preparation.

# PART 2 - PRODUCTS

## 1. MATERIALS

.1 Paint (Permanent & Temporary):

.1 Low VOC waterborne traffic paint (VOC’s of 150 g/l or less).

.2 Use low temperature waterborne traffic paint between temperatures greater than 0°C and lower than 10°C.

.3 Use normal waterborne traffic paint when the temperature is greater than 10°C.

.4 Paint to meet requirements for Federal Specification TT-P-1952F Type I.

.5 Paint colour to be the following:

.1 Yellow: To FED-STD- 595 color number 33538.

.2 Black: To FED-STD- 595 color number 37038.

.3 White: To FED-STD- 595 color number 37925.

.4 Red: To FED-STD- 595 color number 31136.

.6 Upon request, the Consultant will supply a qualified product list of paints applicable to work. Qualified paints may be used but the Consultant reserves right to perform further tests.

.2 Any temporary paint shall be compatible with permanent paint.

.3 Colour as indicated.

.4 Methods of Testing Paints and Pigments to CAN/CGSB 1-GP-71.

.5 Glass beads: Not Used

.6 Durable markings shall be Poly Carb Mark 55.4 or Lafrentz System 400 Cold Plastic.

## PART 3 - EXECUTION

### 1. EQUIPMENT REQUIREMENTS

.1 Paint applicator to be an approved pressure type mobile distributor capable of applying paint in single, double and dashed lines. Applicator to be capable of applying marking components uniformly, at rates specified, and to dimensions as indicated, and to have positive shut-off.

.2 All equipment for use in the work shall be acceptable to the Consultant and shall include a mechanical marking machine and such auxiliary hand painting equipment as may be necessary to satisfactorily complete the work.

.3 The mechanical marker shall be an approved atomizing spray-type marking machine suitable for application of traffic paint. It shall produce an even and uniform film thickness at the required coverage and shall be designed so as to apply markings of uniform cross sections and clear cut edges without running or spattering.

.4 Suitable adjustments shall be provided on the sprayer(s) of a single machine or by furnishing additional equipment for painting the width required.

.5 Distributor to be capable of applying reflective glass beads as an overlay on freshly applied paint.

## 2. CONDITION OF SURFACES

.1 Pavement surface shall be clean and dry during application of paint. Areas to be painted shall be clean, free from curing compound, ponded water, frost, ice, dust, oil, grease, rubber tire deposits and other foreign matter.

.2 Pavement cleaning to Section 32 01 11.01 Pavement Cleaning and Marking Removal.

## 3. APPLICATION

.1 The Consultant shall provide points outlining the start and end points and radii for each paint markings. The Contractor shall be responsible for setting the marks required to complete the work.

.2 The Contractor shall use stencils, supplied by the Airport, for painting letters and numbers. Supply of stencils to be coordinated through the Airport Maintenance Department.

.3 All paint lines and pavement markings require two separate coats of paint.

.4 Unless otherwise accepted by the Consultant, apply paint only when air temperature is above 10°C, wind speed will not cause over-spray and no rain is forecast within next 4 h.

.5 Apply paint at a rate of not less than 0.37 L/$m^2$ per single coat of paint.

.6 Apply second coat of paint, after the first coat has dried or after a minimum of one hour.

.7 Apply paint to the locations and dimensions indicated in the Contract Documents or as directed by the Consultant.

.8 Do not thin paint unless accepted by the Consultant.

.9 Symbols and letters to conform to dimensions indicated.

.10 Paint lines to be of uniform colour and density with sharp edges.

.11 Thoroughly clean distributor tank before refilling with paint of different colour.

## 4. TOLERANCE

.1 Paint markings to be within plus or minus 10mm of dimensions indicated.

.2 Remove incorrect markings in accordance with Section 32 01 11.01 - Pavement Cleaning and Marking Removal.

.3 There shall be no overlap between the second and first coat. Both coats of paint shall be at the same width and alignment.

## 5. PROTECTION OF COMPLETED WORK

.1 Protect pavement markings until dry.

**END OF SECTION**

## PART 1 - GENERAL

### 1. SECTION INCLUDE

.1 Materials and installation for chain link fences and gates.

### 2. RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 03 30 00 - Cast-in-Place Concrete.

### 3. MEASUREMENT PROCEDURES

.1 The removal and off-site disposal of existing chain link fence shall be measured in lump sum. Payment to be the actual length measured in the field. Fencing to be removed as shown on drawings or as indicated by the Consultant in the field. This includes chain link, gates, barbed wire, posts, and any other items incidental to this section. Holes outside of the new taxiway area where posts have been removed are to be filled and compacted with gravel and topped with topsoil, which is to be included in this payment line item.

.2 Supply and installation of the new fencing is to be measured in lineal metres. Payment to be the actual length measured in the field. Fencing to be installed as shown on drawings or as directed by the Consultant in the field. Work in this area will include excavation, supply and install of posts, cast-in-place concrete bases, chain link, barbed wire, and all other materials outlined in the drawing and specifications.

.3 Supply and installation of the access gates are to be measured in each. Payment to be the actual length measured in the field. Fencing to be installed as shown on drawings or as directed by the Consultant in the field. Work in this area will include excavation, supply and install of posts, cast-in-place concrete bases, chain link, barbed wire, slide gate operator, roller, electrical conduits and all other materials outlined in the drawing and specifications. Electrical tie in for the gate is not to be included in the scope of work.

### 4. REFERENCES

.1 All references to this Specifications, Standards, or Methods shall be understood to refer to the latest adopted revision, including all amendments.

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM A53/A53M-[02], Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A90/A90M-[01], Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.

.3 ASTM A121-[99], Standard Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.

.4 A653/A653M-[03], Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.5 ASTM C618-[03], Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.

.6 ASTM F1664-[01], Standard Specification for Poly(Vinyl Chloride) (PVC)-Coated Steel Tension Wire Used with Chain-Link Fence.

.3 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-138.1-[96], Fabric for Chain Link Fence.

.2 CAN/CGSB-138.2-[96], Steel Framework for Chain Link Fence.

.3 CAN/CGSB-138.3-[96], Installation of Chain Link Fence.

.4 CAN/CGSB-138.4-[96], Gates for Chain Link Fence.

.5 CAN/CGSB-1.181-[99], Ready-Mixed Organic Zinc-Rich Coating.

.4 Canadian Standards Association (CSA International).

.1 CAN/CSA-A23.1/A23.2-[00(August 2001)], Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.

.2 CAN/CSA-G164-[M92(R2003)], Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CAN/CSA-A3000-[98(R2002)], Cementitious Materials Compendium. Includes:

.1 CAN/CSA-A23.5-[98], Supplementary Cementing Materials

.5 Department of Justice Canada (Jus).

.1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

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

.1 Material Safety Data Sheets (MSDS).

.7 The Master Painters Institute (MPI) - Architectural Painting Specification Manual - [March 1998].

.1 MPI # 18, Organic Zinc Rich Primer.

.8 Transport Canada (TC).

.1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

## 5. SUBMITTALS

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

## 6. WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Separate for reuse and recycling and place in designated containers Steel, Metal, Plastic waste in accordance with Waste Management Plan.

.5 Place materials defined as hazardous or toxic in designated containers.

.6 Handle and dispose of hazardous materials in accordance with Regional and Municipal regulations.

.7 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Consultant.

.8 Divert unused concrete materials from landfill to local facility as approved by Consultant.

.9 Unused paint or coating material must be disposed of at official hazardous material collections site as approved by Consultant.

.10 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.11 Fold up metal banding, flatten and place in designated area for recycling.

# PART 2 - PRODUCTS

## 1. MATERIALS

.1 Concrete mixes and materials: in accordance with Section 03 30 00 - Cast-in-Place Concrete CAN/CSA-A23.1.

.1 Nominal coarse aggregate size: 20-5.

.2 Compressive strength: 20 MPa minimum at 28 days.

.3 Additives: fly ash to CAN/CSA-A23.5, ASTM C618.

.2 Chain-link fence fabric: to CAN/CGSB-138.1.

.1 Fence wire shall be 4 mm (9 gauge) diameter steel, hot dip galvanized after weaving.

.2 The fence fabric shall be a uniform 50 mm diamond pattern chain link mesh closed at one edge by knuckling and the other edge by twisting to form a barb.

.3 Height of fabric: as indicated on the contract drawings.

.3 Posts, braces and rails: to CAN/CGSB-138.2, galvanized steel pipe. Dimensions as indicated on drawings.

.4 Top and bottom tension wire: to CAN/CGSB-138.2, single strand, galvanized steel wire.

.5 Tie wire fasteners: steel wire.

.6 Tension bar: to ASTM A653/A653M, 5 x 20 mm minimum galvanized steel.

.7 Gates: to CAN/CGSB-138.4.

.8 Gate frames: to ASTM A53/A53M, galvanized steel pipe, standard weight 45 mm outside diameter pipe for outside frame, 35 mm outside diameter pipe for interior bracing.

.1 Fabricate gates as indicated with electrically welded joints, and hot-dip galvanized after welding.

.2 Fasten fence fabric to gate with twisted selvage at top.

.3 Furnish gates with galvanized malleable iron hinges, latch and latch catch with provision for padlock which can be attached and operated from either side of installed gate.

.4 Furnish double gates with chain hook to hold gates open and centre rest with drop bolt for closed position.

.5 Fittings and hardware: to CAN/CGSB-138.2, galvanized steel.

.6 Tension bar bands: 3 x 20 mm minimum galvanized steel or 5 x 20 mm minimum aluminum.

.7 Post caps to provide waterproof fit, to fasten securely over posts and to carry top rail.

.8 Overhang tops to provide waterproof fit, to hold top rails and an outward and inward projection to hold barbed wire overhang.

.9 Provide projection with clips or recesses to hold 3 strands of barbed wire spaced 100 mm apart.

.10 Projection of approximately 300 mm long to project from fence at 45 degrees above horizontal.

.11 Turnbuckles to be drop forged.

.9 Organic zinc rich coating: to CAN/CGSB-1.181.

.10 Barbed wire: to ASTM A121 2 mm diameter galvanized steel wire 4 point barbs 125 mm spacing.

.11 Slide Gate Operator: Liftmaster SL585 or approved equivalent. Concrete mounting pad to be included with install.

## 2. FINISHES

.1 Galvanizing:

.1 For chain link fabric: to CAN/CGSB-138.1 Grade 2.

.2 For pipe: 550 g/$m^2$minimum to ASTM A90.

.3 For barbed wire: to ASTM A121, Class 2.

.4 For other fittings: to CAN/CSA-G164.

# PART 3 - EXECUTION

## 1. GRADING

.1 Remove debris and correct ground undulations along fence line to obtain smooth uniform gradient between posts.

.1 Extend fence fabric minimum 300mm below ground surface in landscaped areas.

## 2. ERECTION OF FENCE

.1 Erect fence along lines as indicated or as directed by Consultant and to CAN/CGSB-138.3.

.2 Excavate post holes to dimensions indicated or as directed by Consultant.

.3 Space line posts 3 m apart, measured parallel to ground surface.

.4 Space straining posts at equal intervals not to exceed 150 m if distance between end or corner posts on straight continuous lengths of fence over reasonably smooth grade, is greater than 150 m.

.5 Install additional straining posts at sharp changes in grade and where directed by Consultant.

.6 Install corner post where change in alignment exceeds 10 degrees.

.7 Install end posts at end of fence, tie-in to existing fence and at buildings.

.1 Install gate posts on both sides of gate openings.

.8 Place concrete in post holes then embed posts into concrete to depths indicated.

.1 Top of concrete to be 300mm below ground level.

.2 Brace to hold posts in plumb position and true to alignment and elevation until concrete has set.

.9 Do not install fence fabric until concrete has cured minimum of 5 days.

.10 Install brace between end and gate posts and nearest line post, placed in centre of panel and parallel to ground surface at inclination as indicated.

.1 Install braces on both sides of corner and straining posts in similar manner.

.11 Install overhang tops and caps.

.12 Install top rail between posts and fasten securely to posts and secure waterproof caps and overhang tops.

.13 Install bottom tension wire, stretch tightly and fasten securely to end, corner, gate and straining posts with turnbuckles and tension bar bands.

.14 Lay out fence fabric. Stretch tightly to tension recommended by manufacturer and fasten to end, corner, gate and straining posts with tension bar secured to post with tension bar bands spaced at 300 mm intervals.

.1 Knuckled selvedge at bottom.

.2 Twisted selvedge at top.

.15 Secure fabric to top rails, line posts and bottom tension wire with tie wires at 450 mm intervals.

.1 Give tie wires minimum two twists.

.16 Install barbed wire strands and clip securely to lugs of each projection.

.17 Install grounding rods as indicated.

## 3. INSTALLATION OF GATES

.1 Install gates in locations as indicated or as directed by Consultant.

.2 Level ground between gate posts and set gate bottom approximately 40 mm above ground surface.

.3 Determine position of centre gate rest for double gate.

.1 Cast gate rest in concrete as directed.

.2 Dome concrete above ground elevation to shed water.

.4 Install gate stops where indicated.

.5 Install Slide Gate Operator as per manufacturer's instructions and as outlined in the drawings.

.6 All electrical gate works to be included in the work, except for the final power tie in. Power tie in is not included in the project scope.

## 4. TOUCH UP

.1 Clean damaged surfaces with wire brush removing loose and cracked coatings. Apply two coats of organic zinc-rich paint to damaged areas as indicated or as directed by Consultant.

.1 Pre-treat damaged surfaces according to manufacturers' instructions for zinc-rich paint.

## 5. CLEANING

.1 Clean and trim areas disturbed by operations.

.1 Dispose of surplus material as directed by Consultant.

**END OF SECTION**

## Part 1 - GENERAL

### 1. DESCRIPTION

.1 This section specifies the requirements for supply and placement of topsoil and subsequent final grading to the lines, grades and cross section indicated by the Contract Documents or as directed by the Engineer.

### 2. RELATED SECTIONS

.1 Section 31 14 13 – Soil Stripping and Stockpiling

.2 Section 32 92 19-16 – Hydraulic Seeding.

### 3. MEASUREMENT PROCEDURES

.1 Topsoil placement and finish grading shall be measured in square metres to the depths specified. Payment at the unit price tendered shall be full compensation for surface preparation; placement of topsoil from stockpiled material; loading, hauling and spreading of topsoil along shoulders as required; finish grading, compaction, watering, clean-up and all work incidental to this section.

### 4. REFERENCES

.1 All references to this Specifications, Standards, or Methods shall be understood to refer to the latest adopted revision, including all amendments.

.2 Agriculture and Agri-Food Canada

.1 The Canadian System of Soil Classification, Third Edition, 1998.

.3 Canadian Council of Ministers of the Environment

.1 PN1340, Guidelines for Compost Quality.

### 5. SUBMITTALS

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

.2 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.

## 6. DEFINITIONS

.1 Compost:

.1 Mixture of soil and decomposing organic matter used as fertilizer, mulch, or soil conditioner.

.2 Compost is processed organic matter containing 40% or more organic matter as determined by Walkley-Black or Loss On Ignition (LOI) test.

.3 Product must be sufficiently decomposed (i.e. stable) so that any further decomposition does not adversely affect plant growth (C:N ratio below 25:50), and contain no toxic or growth inhibiting contaminates.

.4 Composed bio-solids to: CCME Guidelines for Compost Quality, Category A B.

## 7. QUALITY ASSURANCE

.1 Pre-installation meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements in accordance with Section 01 32 16.07 – Construction Progress Schedules – Bar (GANTT) Chart.

# Part 2 - PRODUCTS

## 1. TOPSOIL

.1 Stockpiled topsoil from topsoil stripping stockpile to be used.

.2 Topsoil for seeded areas : mixture of particulates, micro organisms and organic matter which provides suitable medium for supporting intended plant growth.

.1 Soil texture based on The Canadian System of Soil Classification, to consist of 20% to 70% sand, minimum 7% clay, and contain 2% to 10% organic matter by weight.

.2 Contain no toxic elements or growth inhibiting materials.

.3 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.

.4 Consistence: friable when moist.

## 2. SOIL AMENDMENTS

.1 Fertilizer:

.1 Fertility: major soil nutrients present in following amounts:

.2 Nitrogen (N): 20 to 40 micrograms of available N per gram of topsoil.

.3 Phosphorus (P): 40 to 50 micrograms of phosphate per gram of topsoil.

.4 Potassium (K): 75 to 110 micrograms of potassium per gram of topsoil.

.5 Calcium, magnesium, sulfur and micro-nutrients present in balanced ratios to support germination and/or establishment of intended vegetation.

.6 PH value: 6.5 to 8.0.

.2 Peatmoss:

.1 Derived from partially decomposed species of Sphagnum Mosses.

.2 Elastic and homogeneous, brown in colour.

.3 Free of wood and deleterious material which could prohibit growth.

.4 Shredded particle minimum size: 5 mm.

.3 Sand: washed coarse silica sand, medium to course textured.

.4 Organic matter: compost Category A, B in accordance with CCME PN1340, unprocessed organic matter, such as rotted manure, hay, straw, bark residue or sawdust, meeting the organic matter, stability and contaminant requirements.

.5 Use composts meeting Category B requirements for land fill reclamation and large scale industrial applications.

.6 Limestone:

.1 Ground agricultural limestone.

.2 Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.

.7 Fertilizer: industry accepted standard medium containing nitrogen, phosphorous, potassium and other micro-nutrients suitable to specific plant species or application or defined by soil test.

## 3. SOURCE QUALITY CONTROL

.1 Advise the Engineer of sources of topsoil and manufactured 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 the Engineer.

.1 Soil sampling, testing and analysis to be in accordance with Provincial Standards.

# Part 3 - EXECUTION

## 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.

## 2. PREPARATION OF EXISTING GRADE

.1 Verify that grades are correct.

.1 If discrepancies occur, notify the Engineer and do not commence work until instructed by the Engineer.

.2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.

.3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials.

.1 Remove soil contaminated with calcium chloride, toxic materials and petroleum products.

.2 Remove debris which protrudes more than 75 mm above surface.

.3 Dispose of removed material off site.

.4 Cultivate entire area which is to receive topsoil to minimum depth of 100 mm.

.1 Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

## 3. PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL

.1 Place topsoil after Engineer has accepted subgrade.

.2 Spread topsoil in uniform layers not exceeding 150 mm.

.3 Spread topsoil during dry weather.

.4 Spread topsoil over unfrozen subgrade free of standing water.

.5 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.

.6 Spread topsoil to following minimum depths after settlement.

.1 100 mm for seeded areas.

.7 Manually spread topsoil/planting soil around trees, shrubs and obstacles.

## 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 Engineer.

.1 Leave surfaces smooth, uniform and firm against deep footprinting.

.2 Compact to ensure the shoulders are capable of carrying traffic without footprinting.

## 5. ACCEPTANCE

.1 Engineer will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading.

## 6. SURPLUS MATERIAL

.1 Dispose of materials except topsoil not required where directed by Engineer Consultant.

## 7. CLEANING

.1 Proceed in accordance with Section 01 74 00 – Cleaning.

.2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

**END OF SECTION**

# PART 1 - GENERAL

## 1. DESCRIPTION

.1 This section specifies the requirements for supply and application of seed by hydraulic (hydroseeding) method in areas indicated by the Contract Documents or as directed by the Engineer.

## 2. RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 32 91 19.13 – Topsoil Placement and Grading.

## 3. MEASUREMENT PROCEDURES

.1 Hydroseeding shall be measured in square metres of plan area within limits as supplied by the Engineer. Payment at the tendered unit price shall be full compensation for supply and application of seed mixture or hydroseed mixture including seed and fertilizer, mulch, tackifier, water, cleanup and all other work incidental to this section. Payment shall be for the actual plan areas hydroseeded or design plan areas whichever is less. No additional payment shall be made for areas, which exceed the design quantity unless accepted by the Engineer.

## 4. SUBMITTALS

.1 Product Data.

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

.2 At least two weeks prior to commencing work submit to the Engineer product data and certification that the products meet the requirements for this section:

.1 Seed.

.2 Mulch.

.3 Tackifier.

.4 Fertilizer.

.3 Submit in writing to the Engineer ten days prior to commencing work:

.1 Volume capacity of hydraulic seeder in litres.

.2 Amount of material to be used per tank based on volume.

.3 Number of tank loads required per hectare to apply specified slurry mixture per hectare.

## 5. QUALITY ASSURANCE

.1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements. Comply with Section.

## 6. DELIVERY AND STORAGE

.1 Deliver and store grass seed in original containers showing:

.1 Analysis of seed mixture.

.2 Percentage of pure seed.

.3 Year of production.

.4 Net mass.

.5 Date when tagged and location.

.6 Name and address of distributor.

.2 Deliver wood fibre mulch and tackifier in moisture-proof containers indicating manufacturer, content and net air-dry mass.

.3 Supply fertilizer to the contract site in shrink wrapped or other suitable moisture proof containers, with guaranteed chemical analysis clearly shown on each container.

.4 Provide to the Engineer before and as a condition of use, a shipping bill issued by the supplier of the material, designating the supplier, the manufacturer, the type of material, and a certification of the net weight or volume of material in each container.

.5 Protect all materials as required during transportation and storage.

.6 Store the materials onsite only where and as directed and approved by the Engineer.

.7 Take precautions to prevent damage of stored materials by vandalism or weathering.

.8 Any material which has become wet or otherwise damaged during delivery or storage, or does not meet the requirements specified shall be rejected and the Contractor shall immediately remove rejected material from the project area.

## 7. SCHEDULING

.1 Schedule hydraulic seeding to coincide with preparation of soil surface.

## 8. WASTE MANAGEMENT AND DISPOSAL

.1 Divert unused fertilizer from landfill to official hazardous material collections site approved by the Engineer.

.2 Do not dispose of unused fertilizer into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

# PART 2 - PRODUCTS

## 1. MATERIALS

.1 Seed: "Canada pedigreed grade" in accordance with Government of Canada Seeds Act and Regulations.

.1 Grass mixture: "Certified", "Canada No. 1 Lawn Grass Mixture" in accordance with Government of Canada "Seeds Act" and "Seeds Regulations".

.1 Mixture composition:

.1 Kentucky Blue Grass 20%.

.2 Creeping Red Fescue 30%.

.3 Crested Wheat Grass 35%.

.4 Perennial Rye Grass 15%.

.2 Mulch: specially manufactured for use in hydraulic seeding equipment, non-toxic, water activated, green colouring, free of germination and growth inhibiting factors with following properties:

.1 Type I mulch:

.1 Made from wood cellulose fibre.

.2 Organic matter content: 99% - 100%.

.3 Value of pH: 4.8.

.4 Potential water absorption: 320%.

.5 The material used for mulching shall be a natural wood fibre specially prepared for use in hydroseeding equipment.

.6 Contain no growth or germination inhibiting properties.

.7 Capable of dispensing in water to form a homogeneous slurry.

.8 Capable of farming an absorptive mat ground cover allowing water percolation.

.3 Tackifier:

.1 The tackifier shall be one of:

.1 Free flowing non-corrosive biodegradable organic powder produced from a natural plant gum.

.2 Water dilatable liquid dispersion containing polyvinyl acetate polymer emulsion.

.3 Approved equivalent by the Engineer.

.4 Water: free of impurities that would inhibit germination and growth.

.5 Fertilizer:

.1 To Canada "Fertilizers Act" and "Fertilizers Regulations".

.2 Complete synthetic, slow release with 35% of nitrogen content in water-insoluble form.

.6 Inoculants: inoculant containers to be tagged with expiry date.

## PART 3 - EXECUTION

### 1. EQUIPMENT

.1 Cultivators: Capable of scarifying, discing or harrowing.

.2 Hydro Seeders: Capable of thoroughly mixing water, seed, fertilizer and pulverized wood fibre and of uniformly spraying the mix at designated rate.

.3 Rollers: Of suitable size and mass.

.4 Equipment for hydro seeding, mulch and fertilizing shall be capable of mixing the seed, fertilizer, mulch and tackifier as herein described, and evenly distributing the mixtures for efficient treatment of the selected areas.

.5 The equipment shall have a build-in agitation system with an operating capacity sufficient to agitate, suspend and homogeneously mix a slurry of materials in the amounts specified.

.6 The slurry tank shall have working capacity of at least 4500 L, and the pump shall be capable of maintaining a continuous, non-fluctuating stream of solution. Distribution lines shall be of large enough diameter to prevent blockage, and the discharge lines shall be equipped with appropriate nozzles.

.7 The equipment shall be capable of hydro seeding to the extremities of all areas designated for hydro seeding.

## 2. WORKMANSHIP

.1 Do not spray onto structures, signs, guide rails, fences, plant material, utilities and other than surfaces intended.

.2 Clean-up immediately, any material sprayed where not intended, to satisfaction of the Engineer.

.3 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.

.4 Protect seeded areas from trespass until plants are established.

## 3. PREPARATION OF SURFACES

.1 Fine grade areas to be seeded free of humps and hollows. Ensure areas are free of deleterious and refuse materials.

.2 Cultivated areas identified as requiring cultivation to depth of 25 mm.

.3 Ensure areas to be seeded are moist to depth of 150 mm before seeding.

.4 Obtain the Engineer's approval of grade and topsoil depth before starting to seed.

## 4. PREPARATION OF SLURRY

.1 Measure quantities of materials by weight or weight-calibrated volume measurement satisfactory to the Engineer. Supply equipment required for this work.

.2 Charge required water into seeder. Add material into hydraulic seeder under agitation. Pulverize mulch and charge slowly into seeder.

.3 After all materials are in the seeder and well mixed, charge tackifier into seeder and mix thoroughly to complete slurry.

## 5. SLURRY APPLICATION

.1 Hydraulic seeding equipment:

.1 Slurry tank.

.2 Agitation system for slurry to be capable of operating during charging of tank and during seeding, consisting of recirculation of slurry and/or mechanical agitation method.

.3 Capable of seeding by 50 m hand operated hoses and appropriate nozzles.

.2 Slurry mixture applied per hectare.

.1 Seed: 300 kg.

.2 Mulch: 1,350 kg.

.3 Tackifier: 340 kg.

.4 Water: as required to form recommended slurry.

.5 Fertilizer: 275 kg.

.3 Apply slurry uniformly, at optimum angle of application for adherence to surfaces and germination of seed.

.1 Using correct nozzle for application.

.2 Using hoses for surfaces difficult to reach and to control application.

.4 Blend application 300 mm into adjacent grass areas or sodded areas to form uniform surfaces.

.5 Re-apply where application is not uniform.

.6 Remove slurry from items and areas not designated to be sprayed.

.7 Protect seeded areas from trespass satisfactory to the Engineer.

.8 Remove protection devices as directed by the Engineer.

.9 Hand broadcast seeding is unacceptable under any conditions except for isolated repair work.

.10 Sow the seed at the rate specified for the seed type, in two directions, 50% in one direction and remaining 50% of seed at right angles to first seeding pattern.

.11 Spread fertilizer evenly at rate specified.

.12 Thoroughly harrow the site after fertilizing, on areas flatter than 3 horizontal to 1 vertical.

.13 Protect all newly seeded areas as required.

.14 Thoroughly mix seed, fertilizer, mulch and tackifier and uniformly distribute the mixture with the hydroseeder over the area indicated or designated by the Engineer.

## 6. DAILY PROGRESS REPORTS

.1 Provide a daily report of the areas seeded. Include in the report:

.1 Approximate area seeded, itemized by station, left or right of centreline and approximate area.

.2 The amount of materials used for each area.

.3 The coverage in kg/ha for each area.

.4 Retain all empty containers of used materials for each days work until the Engineer's representative counts and marks the empty containers. Dispose all empty containers after they have been counted.

## 7. ACCEPTANCE

.1 Seeded areas will be accepted by the Engineer provided that:

.1 Seeded areas are free of rutted, eroded, bare or dead spots.

.2 Areas have been fertilized.

.2 Areas seeded in fall will achieve final acceptance in following spring, one month after start of growing season provided acceptance conditions are fulfilled.

## 8. CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

**END OF SECTION**

# PART 1 - GENERAL

## 1. DESCRIPTION

.1 This section specifies the requirements for the supply and installations of manholes, cleanouts, catch basins and related appurtenances to the lines, grades and dimensions shown in the Contract Documents or as directed by the Consultant.

## 2. RELATED SECTIONS

.1 Section 03 10 00 – Concrete Forming and Accessories.

.2 Section 03 20 00 – Concrete Reinforcing.

.3 Section 03 30 00 - Cast-In-Place Concrete.

.4 Section 31 05 16 - Aggregate Materials.

.5 Section 31 23 33.01 - Excavating, Trenching and Backfilling.

## 3. MEASUREMENT FOR PAYMENT

.1 Payment for the supply and install of the new Dry Well shall be paid for by lump sum. Payment for this item shall be full compensation for all excavation, removal and disposal of existing materials, preparation of subgrade, supply, install and compaction of granular material, supply and install of geotextile, dewatering, supply and install of dry well (including grates), reinforcement, pipe tie ins, cast-in-place concrete, cleaning, testing, surface restoration and all other work and materials necessary to complete the installation.

.2 Payment for the supply and install of the new catch basin shall be paid for by lump sum. Payment for this item shall be full compensation for all excavation, removal and disposal of existing materials, preparation of subgrade, supply, install and compaction of granular base and bedding, dewatering, supply and install of new catch basin, cast-in-place concrete, cleaning, testing, surface restoration and all other work and materials necessary to complete the installation.

.3 Payment for the raising of manhole shall be at the unit price bid for each manhole raised. Unit price bid shall also include cost for salvage and re-installation of manhole frame and grate. Manhole base to be protected in place. Riser materials to match the existing manhole type. Payment includes supply and install of all materials provided as necessary to raise the existing manhole to the required elevation.

## 4. REFERENCES

.1 All references to this Specifications, Standards, or Methods shall be understood to refer to the latest adopted revision, including all amendments.

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM A48/A48M, Standard Specification for Gray Iron Castings.

.2 ASTM C117, Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing.

.3 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM C139, Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.

.5 ASTM C478M, Standard Specification for Precast Reinforced Concrete Manhole Sections Metric.

.6 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft$^3$) (600 kN-m/m$^3$).

.3 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.

.4 Canadian Standards Association (CSA International)

.1 CAN/CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/ Methods of Test and Standard Practices for Concrete.

.2 CAN/CSA-A3000:23, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.1 CSA-A3001:23, Cementitious Materials for Use in Concrete.

.2 CSA-A3002:23, Masonry and Mortar Cement.

.3 CAN/CSA-A165 Series-04, CSA Standards on Concrete Masonry Units (Consists of A165.1, A165.2 and A165.3).

.4 CAN/CSA A257.4-09, Precast Reinforced Circular Concrete Manhole Sections, Catch Basins, and Fittings

.5 CAN/CSA-G30.18-M92(R2002), Billet Steel Bars for Concrete Reinforcement.

.6 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.5 Public Works Canada ASG-19 (Air Transportation) – Manual of Pavement Structural Design

## 5. SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures. Include method of installation of structure.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two copies WHMIS MSDS - Material Safety Data Sheets.

.3 At least four weeks prior to commencing work submit test data and certification that material incorporated into the work meets the requirements of this section.

.4 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.

.1 Submit manufacturer's test data and certification at least 4 weeks prior to beginning Work. Include manufacturer's drawings, information and shop drawings where pertinent.

.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

## 6. QUALITY ASSURANCE

.1 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section and on-site installation, with contractor's representative and the Consultant to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

## 7. DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

## 8. WASTE MANAGEMENT AND DISPOSAL:

.1 Separate waste materials for reuse and recycling in accordance with local regulations.

## PART 2 - PRODUCTS

.1 Cast-in-Place Concrete

.1 To Section 03 30 00 – Cast-in-Place Concrete. All concrete used in precast manholes shall use Type HS (Sulphate resistant) Portland Cement.

.2 Precast Units

.1 Precast unit for the dry well to meet the detail provided in the project drawings.

.2 Precast unit for catch basin tied to the dry well shall be to MMCD Standard Detail 11.

.3 Precast reinforced concrete manholes adjacent to and within runways, taxiways and aprons shall be an aircraft rated manhole with airport style top slab as indicated on the drawings. Concrete for the barrel to match top slab strength requirements.

.4 Refer to drawing for concrete mix design requirements.

.5 Precast reinforced concrete manhole sections shall confirm to ASTM C498.

.6 All concrete used in precast manholes shall use Type GU (General use cement) Portland cement.

.7 Reinforcing steel as indicated. Reinforcing steel to have 400 MPa minimum yield strength.

.8 Provide safety lift rings and matching female and male joints in the precast manhole and catch basin sections.

.9 Dimensions as indicated.

.10 All concrete structures shall meet the details shown on the drawings and specifications to meet aircraft loading requirements.

.11 All dimensioning and reinforcing steel as per strength requirements.

.3 Joints: made watertight using:

.1 Gasket

.1 Rubber Gasket

.2 Concrete Sewer Connection Tie In

.1 Concrete mix to meet Section 03 30 00 – Cast-in-Place Concrete requirements.

.4 Cement Mortar:

.1 Portland cement to CSA A3000-03, Type HS.

.2 Sand to CSA A82.56.

.3 Mortar mix: 1 part by volume of cement to 3 parts sand.

.4 Masonry Cement: to CAN/CSA-A3002.

.5 Ladder rungs: Aluminum conforming to CSA CAN3-S157.

.1 Rungs to be safety pattern (drop step type).

.2 Rungs to be in line with channel.

.3 Rungs to be installed as detailed on the drawing.

.6 Adjusting rings: to ASTM C478M.

.7 Concrete Brick: to CAN3-A165 Series.

.8 Galvanized iron sheet: approximately 2 mm thick.

.9 Steel gratings, I-beams and fasteners: as indicated.

.10 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.

.3 All steel members, frames, gratings and I beams to be hot dipped galvanized.

.2 Frames, grates and fastenings shall meet Transport Canada specifications and as shown on the contract drawings.

.3 Gray iron castings: to ASTM A48/A48M, strength Class 30B.

.4 Castings: sand blasted or cleaned and ground to eliminate surface imperfections.

.11 Granular bedding and backfill:

.1 Construct granular bedding where required in accordance with Section 31 05 16 - Aggregate Materials and the provided dry well detail.

.12 Unshrinkable fill: in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

## PART 3 - EXECUTION

### 1. MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

### 2. EXCAVATION AND BACKFILL

.1 Excavate and backfill in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling and as indicated.

.2 Contractor shall provide a shoring system to restrain the vertical face adjacent to the manhole or catch basin and the pavement structure. Removal of pavement on the runway or taxiway side of the manhole is prohibited.

.3 Obtain approval of the Consultant before installing outfall structures, manholes, catch basins or dry wells.

### 3. INSTALLATION

.1 Complete units as pipe laying progresses.

.1 Maximum of three units behind point of pipe laying will be allowed.

.2 Dewater excavation to approval of the Consultant and remove soft and foreign material before placing concrete base.

.3 Supply and install geotextile for dry well as indicated on the drawings and as to Section 31 32 19.16 – Geotextile Soil Stabilization.

.4 Pre-cast manhole bases shall be installed on a granular bedding compacted to a minimum of 98% Standard Proctor Maximum Dry Density (ASTM D698). The bedding shall be shaped to support the bottom of the base.

.5 Pre-cast dry well granular base to be drain rock as shown on the drawings.

.6 Precast units:

.1 Set bottom section of precast unit in bed of cement mortar and bond to concrete slab or base. For dry wells, place on the drain rock as indicated on the drawings.

.2 Make each successive joint watertight with the Consultant'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.

.5 Cast square top in place as shown on drawing details.

.7 For manholes and catch basins, place granular backfill a minimum of 300 mm around unit. Compact granular backfill to a minimum of 98 % of Modified Proctor Maximum Dry Density (ASTM D1557).

.8 For dry wells, place drain rock as surround.

.9 Place unshrinkable backfill in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.10 Installing units in existing systems:

.1 Where new unit is installed in existing run of pipe, ensure full support of existing pipe during installation, and carefully remove that portion of existing pipe to dimensions required and install new unit as specified.

.2 Make joints watertight between new unit and existing pipe.

.3 Where deemed expedient to maintain service around existing pipes and when systems constructed under this project are ready for operation, complete installation with appropriate break-outs, removals, redirection of flows, blocking unused pipes or other necessary work.

.11 Clean units of debris and foreign materials.

.1 Remove fins and sharp projections.

.2 Prevent debris from entering system.

.3 At completion of project flush manholes and catch basins with water and remove resultant debris.

.4 Remove all debris from area adjacent to manhole or catch basin.

.12 Install safety platforms in manholes having depth of 2 m or greater, as indicated.

.13 Finish Tolerances

.1 Manholes, catch basins and dry wells shall be set so that the top elevation of steel frame shall be between a minimum of 10 mm and a maximum of 25 mm below projected cross slope of adjacent pavement grades.

.2 The manhole, catch basin or dry well top shall be within ± 10 mm of vertical plumb.

.14 Pavement Restoration

.1 The pavement immediately adjacent to the manhole or catch basin shall be restored to the same condition as it previously existed prior to commencement of construction.

## 4. CONNECTION OF SUB-DRAIN, STORM, OR SEWER PIPE

.1 Openings for connection of pipes to the manhole, catch basin and dry well shall not be greater than the outer diameter of the pipe by more than 50 mm in any direction and shall be cored or cut.

.2 The pipe entering the manhole and dry well shall be made flush with the inside manhole barrel and the openings shall be mortared flush with the pipe and inside manhole wall.

.3 Storm sewer connections to drainage structure to follow the detail provided in the drawings.

## 5. 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 Remove fins and sharp objects.

.4 On completion of project, flush manholes and catch basins with water and remove resultant debris.

**END OF SECTION**

# PART 1 - GENERAL

## 1. DESCRIPTION

.1 This section specifies the requirements for the supply and installation of storm sewers, storm sewer connections and related appurtenances to the lines, grades and dimensions shown in the Contract Document or as directed by the Consultant.

## 2. SECTION INCLUDES

.1 Materials and installation for storm sewer.

## 3. RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.3 Section 31 05 16 - Aggregate Materials.

.4 Section 03 30 00 - Cast-in-Place Concrete.

## 4. MEASUREMENT OF PAYMENT

.1 Payment for the concrete culvert shall be measured in lineal meters and be the actual length of culvert installed. This item shall be full compensation for trench excavations, stockpiling of excavated material, dewatering, supply and installation of all pipe, caps/bends/fittings and related materials, supply and install of bedding material as specified, supply and install of backfill, supply and install of riprap, testing, all surface restoration including subgrade, disposal of waste or surplus materials, compaction as specified, cleaning and flushing, inspection by televising and other testing as required, and work and materials necessary to complete installation as shown on Contract drawings and specified under this section.

.2 Payment for storm piping shall be measured in lineal meters and be the actual length of stormwater pipe installed, measured from centre to centre between manholes or from centre of manhole to required termination point where applicable. This item shall be full compensation for trench excavations, stockpile of excavated material, dewatering, supply and installation of all pipe, caps/bends/fittings and related materials, supply and install of bedding material as specified, imported backfill, connection to new and existing manholes or pipes, testing, all surface restoration including subgrade, disposal of waste or surplus materials, compaction as specified, cleaning and flushing, inspection by televising and other testing as required, and work and materials necessary to complete installation as shown on Contract drawings and specified under this section.

.3 Supply and install of the 300mm concrete pipe shall be shall be measured in lineal meters and be the actual length of pipe installed, measured from centre to centre between the manholes or from the centre of the manhole to the required termination point where applicable. This item shall be full compensation for trench

excavations, stockpiling of excavated material, dewatering, supply and installation of all pipe, caps/bends/fittings and related materials, supply and install of bedding material as specified, supply and install of backfill, testing, all surface restoration including subgrade, disposal of waste or surplus materials, compaction as specified, cleaning and flushing, inspection by televising and other testing as required, and work and materials necessary to complete installation as shown on Contract drawings and specified under this section. This item is provisional.

## 5. REFERENCES

.1 All references to this Specifications, Standards, or Methods shall be understood to refer to the latest adopted revision, including all amendments.

.2 American Society for Testing and Materials International, (ASTM)

.1 ASTM C12, Standard Practice for Installing Vitrified Clay Pipe Lines.

.2 ASTM C14M, Standard Specification for Concrete Sewer, Storm Drain and Culvert Pipe (Metric).

.3 ASTM C76M, Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe (Metric).

.4 ASTM C117, Standard Test Method for Material Finer than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.

.5 ASTM C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

.6 ASTM C144-02, Standard Specification for Aggregate for Masonry Mortar.

.7 ASTM C425, Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings.

.8 ASTM C428, Standard Specification for Asbestos-Cement Nonpressure Sewer Pipe.

.9 ASTM C443M, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric).

.10 ASTM C506M, Standard Specification for Reinforced Concrete Arch Culvert, Storm Drain and Sewer Pipe.

.11 ASTM C507M, Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain and Sewer Pipe (Metric).

.12 ASTM C663, Standard Specification for Asbestos-Cement Storm Drain Pipe.

.13 ASTM C700, Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated.

.14 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft$^3$) (600 kN-m/m$^3$).

.15 ASTM D1056, Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.

.16 ASTM D1248-02, Standard Specification for Polyethylene Plastics Extrusion Materials For Wire and Cable.

.17 ASTM D1869, Standard Specification for Rubber Rings for Asbestos-Cement Pipe.

.18 ASTM D2680, Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.

.19 ASTM D3034, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

.20 ASTM F405, Standard Specification for Corrugated Polyethylene (PE) Tubing and Fittings.

.21 ASTM F667, Standard Specification for Large Diameter Corrugated Polyethylene Tubing and Fittings.

.22 ASTM F794, Standard Specification for Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

.3 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 CAN/CGSB-34.9, Asbestos-Cement Sewer Pipe.

.4 Canadian Standards Association (CSA International)

.1 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A5-98, A8-98, A23.5-98, A362-98, A363-98, A456.1-98, A456.2-98, A456.3-98).

.1 CAN/CSA-A5, Portland Cement.

.2 CAN/CSA-A257 Series-M92, Standards for Concrete Pipe.

.3 CSA B1800-02, Plastic Non-pressure Pipe Compendium - B1800 Series (Consists of B181.1, B181.2, B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.7, B182.8 and B182.11).

.1 CSA B182.2-02, PVC Sewer Pipe and Fittings (PSM Type).

.2 CSA B182.4-02, Profile PVC Sewer Pipe and Fittings.

.3 CSA B182.11-02, Recommended Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings.

.4 CSA-G401-01, Corrugated Steel Pipe Products.

.5 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act, 1999 (CEPA).

.6 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act, 1992 (TDGA)

## 6. DEFINITIONS

.1 Class A Bedding

.1 The pipe is set in non-reinforced concrete of suitable thickness under the lower part of the pipe extending upwards on each side of the pipe for a proportion of its height.

.2 Class B Bedding

.1 The pipe is encased in non-reinforced concrete of a minimum thickness of 150 mm.

.3 Class C Bedding

.1 The pipe is bedded in specified granular material for a specified depth above and below the pipe.

## 7. SUBMITTALS

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

.2 Shop drawings to indicate proposed method for installing carrier pipe for undercrossings.

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

.4 Inform the Consultant at least 4 weeks prior to beginning Work, of proposed source of bedding materials and provide access for sampling.

.5 Submit to the Consultant for testing, at least 2 weeks prior to beginning Work, following samples of materials proposed for use.

.6 Submit manufacturer's test data and certification that materials supplied meet the requirements of this section at least 2 weeks prior to beginning Work.

.7 Certification to be marked on pipe.

.8 Submit to the Consultant, two (2) copy of manufacturer's installation instructions.

## 8. WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 02 41 13 – Selective Site Demolition and governing agencies.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Separate for reuse and recycling and place in designated containers Steel, Metal and Plastic waste in accordance with Waste Management Plan.

.5 Divert unused metal materials from landfill to metal recycling facility for disposal approved by the Consultant.

.6 Place materials defined as hazardous or toxic in designated containers.

.7 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.8 Dispose of unused asbestos cement pipe in accordance with regulations governing the disposal of hazardous materials.

.9 Fold up metal banding, flatten and place in designated area for recycling.

## 9. 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.

## PART 2 - PRODUCTS

### 1. CONCRETE PIPE

.1 Reinforced Concrete Pipe to:

.1 ASTM C76M-15a, Class V

or

.2 CSA-A257.2-M, Class 140D

.2 Joints shall meet ASTM C443.

.3 Gaskets shall be nitrile gaskets unless indicated otherwise.

.4 Diameter as indicated.

.5 Lengths: nominal length 2.4 m.

.6 Lifting holes:

.1 Pipe 900 mm and less diameter: no lift holes.

.2 Pipe greater than 900 mm diameter: lift holes not to exceed two in piece of pipe.

.3 Provide pre-fabricated plugs to effectively seal lift holes after installation of pipe.

### 2. POLYVINYL CHLORIDE (PVC) PIPE

.1 Type PSM Poly Vinyl Chloride (PVC): to ASTM D3034 CSA B182.2.

.2 Standard Dimensional Ratio (SDR): 35

.3 Separate gasket and integral bell system.

.4 Diameter as indicated.

### 3. PIPE BEDDING AND SURROUND MATERIAL

.1 Granular material in accordance with Section 31 05 16 - Aggregate Materials and following requirements:

.1 Granular bedding and backfill shall be crushed or screened stone, gravel or sand unless specified otherwise.

.2 Bedding for pipe installed under Runway, apron, and Taxiway structures shall be Class A.

.3 Bedding for pipe installed between dry well and catch basin structures shall be Class C.

.2 Concrete mixes and materials for bedding, cradles, encasement, supports: in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.3 Concrete Bedding and encasement shall be Type HS (Sulphate Resistant) concrete mix as specified in Section 03 30 00 - Cast In-Place Concrete.

## 4. BACKFILL MATERIAL

.1 Backfill material shall be the surplus material excavated from the trench for the storm sewer unless indicated otherwise in the Contract Documents.

.2 If material from trench excavation is unsuitable, obtain suitable material as designated in Contract Documents.

.3 Obtain approval of the Consultant for material used for backfill.

.4 Unshrinkable fill: in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

## 5. JOINT MORTAR

.1 Portland cement: to CAN/CSA-A5, Type GU.

.2 Sand to CSA A82.56 and Section 31 05 16 - Aggregate Materials.

.3 Mortar: one part Portland cement to three parts clean sharp sand mixed with minimum amount of water to obtain optimum consistency for use intended. Do not use additives.

## 6. RIPRAP MATERIAL

.1 Riprap to be Class 10kg. Install to BC MOTI Rip Rap Installation Guide.

# PART 3 - EXECUTION

## 1. PREPARATION

.1 Clean pipes and fittings of debris and water before installation, and remove defective materials from site to approval of the Consultant.

.2 Obtain the Consultant’s approval of pipes and fittings prior to installation.

## 2. TRENCHING

.1 Do trenching Work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Do not allow contents of sewer or sewer connection to flow into trench.

.3 Make bottom of completed excavation firm for its full length and width. Where, in the opinion of the Consultant, soil bottom elevation is unsuitable for foundation of culverts, excavate to additional width and depth as directed and backfill such additional excavation with granular bedding material compacted to 98 % of Modified Proctor Maximum Dry Density.

.4 Trench alignment and depth to approval of the Consultant prior to placing bedding material and pipe.

.5 Water jetting of backfill under haunches of corrugated steel pipe may be permitted if recommended by manufacturer and approved by the Consultant.

## 3. CONCRETE BEDDING AND ENCASEMENT

.1 Do concrete Work in accordance with Section 03 30 00 - Cast-in-Place Concrete. Place concrete to details as indicated or as directed by the Consultant.

.2 Position pipe on concrete blocks to facilitate placing of concrete.

.1 When necessary, rigidly anchor or weight pipe to prevent flotation when concrete is placed.

.3 Do not backfill over concrete within 24 hour after placing.

## 4. GRANULAR BEDDING

.1 Place bedding in unfrozen condition.

.2 Place granular bedding material as accepted by the Consultant, in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.

.3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe. 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 98 % of Modified Proctor Maximum Dry Density to ASTM D1557.

.6 Fill excavation below bottom of specified bedding adjacent to manholes or catch basins with lean mix concrete or compacted bedding material as noted else where in the documents.

## 5. INSTALLATION

.1 Lay and join pipes to: ASTM C12.

.2 Lay and join pipe in accordance with manufacturer's recommendations and to approval of the Consultant.

.3 Handle pipe using methods approved by the Consultant.

.1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.

.4 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.

.5 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.

.6 Do not exceed maximum joint deflection recommended by pipe manufacturer.

.7 Do not allow water to flow through pipes during construction except as may be permitted by the Consultant.

.8 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.9 Install plastic pipe and fittings in accordance with CSA B182.11.

.10 Joints:

.1 Concrete cement pipe:

.1 Install gaskets as recommended by manufacturer.

.2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.3 Align pipes before joining.

.4 Maintain pipe joints free from mud, silt, gravel and other foreign material.

.5 Avoid displacing gasket or contaminating with dirt or other foreign material. Remove disturbed or dirty gaskets; clean, lubricate and replace before joining is attempted.

.6 Complete each joint before laying next length of pipe.

.7 Minimize joint deflection after joint has been made to avoid joint damage.

.8 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.

.9 At manholes, catch basins and inlet/outlet structures, install pipe joints not more than 1.2 m from side of structure as indicated.

.10 Mortared joints:

.1 Pipe interior: circular pipes 700 mm diameter and larger, and arch or elliptical pipe equivalent to 900 mm diameter or larger shall have interior gap between ends of adjacent pipes filled with mortar. Apply mortar minimum 7 days after backfilling has been completed to allow pipe settlement to occur. Finish interior surface of joints smooth.

.2 Pipe exterior: for bell and spigot pipe, use mortar to seal outside of joints. Press and bed mortar into place. Allow mortar to set minimum of 1 hour before backfilling.

.11 When any stoppage of Work occurs, restrain pipes as directed by the Consultant, to prevent "creep" during down time.

.12 Plug lifting holes with the Consultant approved prefabricated plugs, set in shrinkage compensating grout.

.13 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.

.14 Make watertight connections to manholes and catch basins.

.1 Use shrinkage compensating grout when suitable gaskets are not available.

.15 Use prefabricated saddles or approved field connections for connecting pipes to existing sewer pipes.

.1 Joint to be structurally sound and watertight.

.16 Temporarily plug open upstream ends of pipes with removable watertight concrete, steel or plastic bulkheads.

.17 Install inlet and outlet structures complete with rip-rap to ines, grades and dimensions indicated in Contract Documents.

## 6. PIPE SURROUND

.1 Place surround material in unfrozen condition.

.2 Upon completion of pipe laying, and after the Consultant 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.

.1 Do not dump material within 600 mm of pipe.

.4 Place layers uniformly and simultaneously on each side of pipe to minimum 300mm from edge of pipe or concrete bedding and minimum 500mm above crown of pipe.

.5 Compact each layer from pipe invert to mid height of pipe to at least 98 % of Modified Proctor Maximum Dry Density to ASTM D1557.

.6 Compact each layer from mid height of pipe to underside of backfill to at least 98 % of Modified Proctor Maximum Dry Density ASTM D1557.

.7 When field test results are acceptable to the Consultant, place surround material at pipe joints.

## 7. BACKFILL

.1 Place backfill material in unfrozen condition.

.2 Place backfill material, above pipe surround, in uniform layers not exceeding 200 mm compacted thickness up to grades as indicated.

.3 Compact each layer of backfill to at least 98 % of Modified Proctor Maximum Dry Density ASTM D1557.

.4 Place unshrinkable backfill in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

## 8. UNDERCROSSING

.1 Excavate working pit to dimensions indicated, outside right-of-way to be crossed.

.2 Excavate working pit to minimum of 0.5 m below lowest invert of encasing pipe.

.3 Dewater excavation.

.4 Dewater area of undercrossing.

.5 Install steel frame backstop.

.6 Place encasing pipe to exact line and grade as indicated.

.7 Install encasing pipe by jacking, boring or tunnelling as noted else where in the documents.

.8 Ensure encasing pipe is not in tension.

.9 Use welded type joints for encasing pipe.

.10 Place concrete grout levelling pad in encasing pipe. Carefully control level of grout during placing.

.11 Provide shop drawings showing proposed method of installation for storm sewer pipe.

.12 Insert storm sewer pipe into encasement pipe, in end with largest opening after placement of levelling pad.

.13 Use approved blocking method to guide storm sewer pipe in true alignment.

.14 Clearance between blocks and encasement pipe: maximum 12 mm when storm sewer pipe is in position.

.15 Join storm sewer pipe one length at time outside encasement pipe. Push storm sewer pipe into position. Couplings of storm sewer pipe: not to rest on levelling pad when carrier pipe is in position.

.16 Place 30 MPa concrete cradle around storm sewer pipe after it is positioned. Cradle to be minimum of 225 mm and maximum of 300 mm above levelling pad.

.17 Pressure grout remaining void with grout consisting of one part Portland cement and two parts clean washed sand with only sufficient amount of water added to allow placement.

.1 Do not install pressure grout until storm sewer pipe is secure against flotation.

.2 Do not use additives.

.18 Do field testing before placing concrete cradle and grouting.

## 9. FIELD TESTING

.1 Repair or replace pipe, pipe joint or bedding found defective.

.2 When directed by the Consultant, draw tapered wooden plug with diameter of 50 mm less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction.

.3 Remove foreign material from sewers and related appurtenances by flushing with water.

.4 At completion of the project flush sewers and related appurtenances with water and remove resultant debris.

## 10. VIDEO INSPECTION

.1 All storm sewers shall be inspected by TV camera after backfilling is to finished grade.

.2 The inspection shall be made by employing television scanning equipment which shall be provided by the Contractor. The Contractor shall employ a qualified closed circuit television contractor acceptable to the Consultant to carry out the inspection.

.3 All television inspection shall be carried out in the presence of the Consultant who shall be given at least 48 hours advance notice of any television inspection.

.4 Testing Equipment:

.1 The closed circuit television Contractor shall provide all equipment and materials necessary to conduct the inspection as specified herein.

.2 The television equipment shall be self-contained colour camera and monitoring unit connected by cable. It must be waterproof and be capable of lighting the entire pipe. Picture capabilities must be of a quality to show the entire pipe periphery. There must be capability of providing measurement within the line to an accuracy of one third of a metre per kilometre. Picture quality must be such to produce a continuous 600 line resolution picture showing the entire periphery of the pipe. The following capabilities and items must be available:

.1 a direct voice communication.

.2 a camera towing service.

.3 self-contained electrical power.

.4 proper safety equipment to protect employees and the general public.

.5 The cameral rate of progress shall be uniform during inspection and shall not exceed 6 m/minute.

.6 Report:

.1 A television log shall be maintained during the inspection showing location of lead, fault, open joint, break, crack, collapse, settlement, obstruction, infiltration, or any other defect affecting the overall performance of the storm sewer. The location of the defect shall be referenced from the starting catch basin of each run. A separate log shall be kept of service connections with comments of condition.

.2 Photographs shall be taken as directed by the Consultant or at the discretion of the television scanning operator. A minimum of one photo per defect is required.

.3 Catch basin identity shall be noted clearly as indicated on the drawings.

.4 A final typewritten report with corresponding photographs secured, and properly referenced to the test shall be submitted within two weeks after completion of inspection. A copy of the videotape log in DVD format shall also be included with report.

**END OF SECTION**