

**PAVEMENT OF RUNWAY 07-25 , TAXIWAY
BRAVO AND APRON AT KUUIJUAQ AIRPORT,
KUUIJUAQ, QUÉBEC**

Project PWSGC: R. 087646.001

SPECIFICATIONS FOR TENDER

13th April 2018



Transports
Canada

Transport
Canada

Civil engineering :

DOCUMENT SIGNÉ NUMÉRIQUEMENT



2018-04-17

Gilles Marcotte, Eng.
Civil infrastructure



Martin Samson, Eng.
Civil Infrastructures

DOCUMENT SIGNÉ NUMÉRIQUEMENT



2018-04-17

André Levesque, Eng.
Civil infrastructure

Electrical engineering :



2018-04-17

Martin Hotton, Eng.
Electricity



2018-04-17

Mohamed Ouazzani, Eng.
Electricity

END OF SECTION

PAVEMENT OF RUNWAY 07-25, TAXIWAY
BRAVO AND APRON AT KUUIJUAQ AIRPORT,
KUUIJUAQ, QUÉBEC
April 2018

TABLE OF CONTENTS

SPECIFICATIONS

Division 00 – Procuring and contracting requirements

00 01 07 – Seals page	1
01 01 10 – Index of tender documents, specifications and list of drawings	2

Division 1 – General requirements

01 11 11 – General informations	5
01 15 50 – Weigh scales	2
01 21 00 – Allowances	1
01 29 83 – Testing laboratories – Quality Controls	2
01 31 19 – Project meetings	2
01 32 16.16 – Construction progress schedule – Critical Path Method (CPM)	10
01 33 00 – Submittal Procedures	4
01 35 00.06 – Special Project Procedures Traffic Control	3
01 35 13.13 – Special project procedures for airports facilities	5
01 35 29.06 – Health and Safety Requirements	4
01 35 43 – Environmental Procedures	4
01 45 00 – Quality control	13
01 52 00 – Construction facilities	5
01 61 00 – Common Product requirements	4
01 71 00 – Examination and preparation	2
01 74 11 – Cleaning	3
01 74 21 – Construction/demolition waste management and disposal	3
01 78 00 – Closeout submittals	6

Division 2 – Existing conditions

02 41 13.13 – Paving removal	5
------------------------------------	---

PAVEMENT OF RUNWAY 07-25, TAXIWAY
BRAVO AND APRON AT KUUIJUAQ AIRPORT,
KUUIJUAQ, QUÉBEC
April 2018

Division 26 – Electrical

26 05 00– Common work results for electrical	5
26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings	3
26 05 43.01 – Installation of Cables in Trenches and in Ducts	4

Division 31 – Earthwork

31 00 00.01 – Topographic joint survey	2
31 00 00.03 – Earthwork for surface drainage	4
31 05 10 – Corrected maximum dry density	1
31 05 16 – Aggregate materials	5
31 22 16.13 – Preparation of the granular surface before recharging	2
31 23 33.01 – Excavating, trenching and backfilling	5
31 32 19.01– Geotextile	3
31 37 00 –Rip-rap	2

Division 32 - Exterior improvements

32 01 11.01 – Pavement cleaning and marking removal	2
32 01 11.02 – Pavement crack cleaning and filling	3
32 01 16.13 – Reshaping asphalt pavement	3
32 11 23 – Aggregate base courses	4
32 12 13.16 – Asphalt tack coats	3
32 12 16 – Asphalt paving	25
32 17 23 – Pavement markings	4

Division 34 – Transportation

34 43 05 – Common Work Results for Airfield Lighting	10
34 43 13.17 – Airfield Elevated Edge Lighting	5

Division 49 - Various

49 00 00 – Geodetic marker	2
----------------------------------	---

PAVEMENT OF RUNWAY 07-25, TAXIWAY
BRAVO AND APRON AT KUUIJUAQ AIRPORT,
KUUIJUAQ, QUÉBEC
April 2018

Appendix A

Contractor quality control program 6

Appendix B

Advisory Circular (AC) N 302-023..... 15

LIST OF DRAWINGS

Civil drawings

Q121Q612C052	PLANS DE LOCALISATION ET LISTE DES PLANS / LOCALISATION PLAN AND DRAWING LIST
Q121Q612C053	LÉGENDE / LEGEND
Q121Q612C054	PISTE – PLAN D’ENSEMBLE – ÉTAT DES LIEUX / RUNWAY GENERAL VIEW – EXISTING SITUATION
Q121Q612C055	VOIE DE CIRCULATION ET AIRE DE TRAFIC – PLAN D’ENSEMBLE – ÉTAT DES LIEUX / TAXIWAY AND APRON – GENERAL VIEW – EXISTING SITUATION
Q121Q612C056	PISTE / RUNWAY LOCALISATION ET IDENTIFICATION DES TRAVAUX / LOCATION AND IDENTIFICATION OF WORKS
Q121Q612C057	VOIE DE CIRCULATION ET AIRE DE TRAFIC / RUNWAY AND APRON LOCALISATION ET IDENTIFICATION DES TRAVAUX / LOCATION AND IDENTIFICATION OF WORKS
Q121Q612C058	PISTE / RUNWAY CH. 5+000/5+450 TRAVAUX DE PLANAGE ET RÉPARATION DES FISSURES / RESHAPING PAVEMENT AND REPAIRS OF CRACKS

PAVEMENT OF RUNWAY 07-25, TAXIWAY
BRAVO AND APRON AT KUUIJUAQ AIRPORT,
KUUIJUAQ, QUÉBEC
April 2018

Q121Q612C059	PISTE / RUNWAY CH. 5+450/5+900 TRAVAUX DE PLANAGE ET RÉPARATION DES FISSURES / RESHAPING PAVEMENT AND REPAIRS OF CRACKS
Q121Q612C060	PISTE / RUNWAY CH.5+900/6+360 TRAVAUX DE PLANAGE ET RÉPARATION DES FISSURES / RESHAPING PAVEMENT AND REPAIRS OF CRACKS
Q121Q612C061	PISTE / RUNWAY CH. 6+360/6+830 TRAVAUX DE PLANAGE ET RÉPARATION DES FISSURES / RESHAPING PAVEMENT AND REPAIRS OF CRACKS
Q121Q612C062	VOIE DE CIRCULATION ET AIRE DE TRAFIC TAXIWAY AND APRON / TRAVAUX DE PLANAGE ET RÉPARATION DE FISSURES / RESHAPING PAVEMENT AND REPAIRS OF CRACKS
Q121Q612C063	PISTE / RUNWAY PLAN DE PHASAGE D'EXÉCUTION / EXECUTION PHASING PLAN
Q121Q612C064	VOIE DE CIRCULATION ET AIRE DE TRAFIC TAXIWAY AND APRON PLAN DE PHASAGE D'EXÉCUTION EXECUTION PHASING PLAN
Q121Q612C065	PISTE /RUNWAY – CH. 5+000/5+280 SECTIONS TRANSVERSALES / CROSS SECTIONS
Q121Q612C066	PISTE / RUNWAY – CH. 5+300/5+640 SECTIONS TRANSVERSALES / CROSS SECTIONS
Q121Q612C067	PISTE / RUNWAY – CH. 5+660/6+000 SECTIONS TRANSVERSALES / CROSS SECTIONS
Q121Q612C068	PISTE / RUNWAY – CH. 6+020/6+360 SECTIONS TRANSVERSALES / CROSS SECTIONS

PAVEMENT OF RUNWAY 07-25, TAXIWAY
BRAVO AND APRON AT KUUIJUAQ AIRPORT,
KUUIJUAQ, QUÉBEC
April 2018

Q121Q612C069	PISTE / RUNWAY – CH. 6+380/6+720 SECTIONS TRANSVERSALES / CROSS SECTIONS
Q121Q612C070	PISTE / RUNWAY – CH. 6+740/6+820 SECTIONS TRANSVERSALES / CROSS SECTIONS
Q121Q612C071	VOIE DE CIRCULATION / TAXIWAY SECTIONS TRANSVERSALES / CROSS SECTIONS
Q121Q612C072	AIRE DE TRAFIC / APRON SECTIONS TRANSVERSALES / CROSS SECTIONS
Q121Q612C073	TRAVAUX DE DRAINAGE / DRAINAGE WORKS
Q121Q612C074	COUPES TYPES ET DÉTAILS / CROSS SECTIONS AND DETAILS
Q121Q612C075	COUPES TYPES ET DETAILS / CROSS SECTIONS AND DETAILS
Q121Q612C076	MARQUAGE DE LA CHAUSSÉE TEMPORAIRE POUR LA PISTE 07-25 / PAVEMENT TEMPORARY MARKING FOR RUNWAY 07-25
Q121Q612C077	MARQUAGE DE LA CHAUSSÉE POUR LA PISTE 07- 25 / PAVEMENT MARKING FOR RUNWAY 07-25

Electrical drawings

Q121Q631P023_0	PLAN DE PRÉSENTATION ET LISTE DES DESSINS / PRESENTATION PLAN AND DRAWING LIST
Q121Q631P023_1	PLAN D'AMÉNAGEMENT POUR LA PISTE 07-25 (1 DE 4) / CONSTRUCTION LAYOUT FOR RUNWAY 07-25 (1 DE4)
Q121Q631P023_2	PLAN D'AMÉNAGEMENT POUR LA PISTE 07-25 (2 DE 4) / CONSTRUCTION LAYOUT FOR RUNWAY 07-25 (2 DE4)
Q121Q631P023_3	PLAN D'AMÉNAGEMENT POUR LA PISTE 07-25 (3 DE 4) / CONSTRUCTION LAYOUT FOR RUNWAY 07-25 (3 DE4)

PAVEMENT OF RUNWAY 07-25, TAXIWAY
BRAVO AND APRON AT KUUIJUAQ AIRPORT,
KUUIJUAQ, QUÉBEC
April 2018

Q121Q631P023_4	PLAN D'AMÉNAGEMENT POUR LA PISTE 07-25 (4 DE 4) / CONSTRUCTION LAYOUT FOR RUNWAY 07-25 (4 DE4)
Q121Q631P024	DÉTAILS TYPIQUE DE REHAUSSEMENT DE FEUX / TYPICAL LIGHT RAISING DETAILS
Q121Q631P025	DÉTAILS TYPIQUE DE REHAUSSEMENT DE FEUX / TYPICAL LIGHT RAISING DETAILS

END OF SECTION

Part 1 General

Remuneration of the following overhead expenses includes but is not limited to:

- .1 Mobilization and demobilization
 - .1 The costs associated with the mobilization and demobilization of equipment, machinery, materials, labour, etc.
- .2 Site organization
 - .1 The costs associated with room and board the workers, project management and all expenses incurred by the Contractor to satisfy the requirements of the various sections of the specifications.

1.2 WORKS COVERED BY DOCUMENTS TENDER

- .1 Work under this Contract cover the standardization of the runway 07-25. Work includes granular recharging of the runway 07-25 and apron BRAVO at Kuujuaq airport and the complete replacement of the lighting of the runway. The normalisation of the adjacent surfaces are also included in the project and all related electrical works and pavement marking.

1.3 RESTRICTIONS ABOUT WORKS

- .1 Runway 07-25 and the BRAVO lane will be in service throughout the period when the work is being done. There will be a partial closing period with an hourly schedule as follows:
 - .1 Phase 2018 – Period July 15th to September 5th
 - .1 Monday to Sunday: 19:00 PM to 10:00 AM (season 2018).
 - .2 Phase 2019 – Period July 15th to September 5th
 - .1 Monday to Sunday: 17:00 PM to 10:00 AM (season 2019 and 2020).
 - .3 Phase 2020 – Period July 5th to September 5th
 - .1 Monday to Sunday: 17:00 PM to 10:00 AM (season 2019 and 2020).
- .2 Co-ordinate Progress Schedule in with the departmental representative.
- .3 Construct Work in stages according to the execution phases.
- .4 Maintain fire access/control.
- .5 The Contractor must make all necessary arrangements for the availability of equipment and manpower in order to meet the mandatory requirements of the daily schedule and the schedule of works for each year.

1.4 CONTRACTOR USE OF PREMISES

- .1 Limit use of premises to necessary areas not exceeding 100 metres at the ends of each of the phases for works execution, at the exception of access road for heavy vehicles and end of runway.

- .2 Co-ordinate use of premises under direction of Departmental Representative.
- .3 At completion of operations condition of existing work each day: the restoration to service of the work done and equal to or better than that which existed before new work started.
- .4 The surveying tasks and technical surveys must be executed within the period when the runway is closed.

1.5 OCCUPANCY BY THE DEPARTMENTAL REPRESENTATIVE

- .1 The airport operator will occupy premises during entire construction period for execution of normal operations on the other runway.
- .2 Co-operate with the Departmental Representative in scheduling operations to minimize conflict and to facilitate the Departmental Representative usage.

1.6 EXISTING UTILITY SERVICES

- .1 The contractor shall protect the existing conduit with crosses runway 13-31 during the work by limiting the compaction, the movement of trucks over the runway shoulders and the excavation if required.
- .2 Notify Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .3 Where Work involves breaking into or connecting to existing services, give Departmental Representative 48 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 governing authorities with minimum disturbance to airports activity.
- .4 Establish location and extent of service lines in area of work before starting Work. Notify Departmental Representative of findings.
- .5 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
- .6 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
- .7 Record locations of maintained, re-routed and abandoned service lines.

1.7 REQUIRED DOCUMENTS

- .1 Maintain at job site, one copy each document as follows:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Reviewed Shop Drawings.
 - .5 List of Outstanding Shop Drawings.
 - .6 Change Orders.
 - .7 Other Modifications to Contract.

- .8 Field Test Reports.
- .9 Copy of Approved Work Schedule.
- .10 Health and Safety Plan and Other Safety Related Documents.
- .11 Other documents as specified.

1.8 TYPE OF CONTRACT

- .1 All expenses incurred to meet the requirements of the present contract and non-covered by item of payment must be included in the « Overheads » item of the tender form.
- .2 While the drawings and specifications indicate the general nature of the work to be performed, it must be distinctly understood that the Department reserves the right to alter the alignment grades or the extent of the work as may be found desirable without in any way invalidating the conditions of the contract.

1.9 CODES

- .1 The works must be executed in a manner to satisfy at all exigencies:
 - .1 Of contractual documents.
 - .2 Regulations and specified Codes and all other document referred to.
 - .3 Local authority.
- .2 In any case of conflict or discrepancy, the more stringent requirements shall apply.

1.10 WORK SCHEDULE

- .1 Provide within 10 working days after Contract award, a schedule showing anticipated progress stages and final completion of work within time period required by Contract documents as describe in 1.15 of this section.
- .2 Interim reviews of real work progress based on work schedule will be done as required by the departmental representative. Schedule updates will be carried out by the Contractor with the collaboration and approval of the Departmental representative.
- .3 The approval of the revised schedule by the Departmental representative does not free the Contractor from his responsibility relative to all consequences resulting from a non-respect of the original calendar requirements.

1.11 REGULATED ZONE

- .1 The work of the present contract is situated at the interior of a regulated zone of the airport. Please refer to the requirements of section 01 35 13.13 – Airports in Use, for information regarding the requirements in terms of safety and security at airports.

1.12 ADDITIONAL DRAWINGS

- .1 The departmental representative may furnish additional drawings for clarification. These additional drawings have same meaning and intent as if they were included with the plans referred to in Contract documents.

1.13 SCHEDULE TO COMPLETE ALL WORKS

- | | | | |
|-----|--|---|-----------------------|
| .1 | Year 2018 | | |
| .1 | Mobilization of crushing equipment and preparation of quarry | : | July 2018 |
| .2 | Aggregates production partial | : | July - November 2018 |
| .3 | Drainage works | : | August 2018 |
| .4 | Site preparation of storage of equipment and machinery | : | September 2018 |
| .2 | Year 2019 | | |
| .1 | Aggregates production | : | June – August 2019 |
| .2 | Mobilization of paving equipment and execution | : | July 2019 |
| .3 | Testing of quality production of paving | : | July 2019 |
| .4 | Works cracks repairs type A, B, C & D | : | July – August 2019 |
| .5 | Reshaping of existing pavement, taxiway and apron, phases 1, 2, 3 and 4 | : | July – August 2019 |
| .6 | Reshaping and paving of central area 30.0 metres | : | July – August 2019 |
| .7 | Micro-reshaping the lateral area of 7.5 metres on either side of the section power plant | : | August 2019 |
| .8 | Construction of access road for heavy trucks | : | July – August 2019 |
| .9 | Backfill of safety area at the end of runway | : | July – August 2019 |
| .10 | Connection with lateral strip and central strip of pavement | : | July – August 2019 |
| .11 | Temporary pavement marking conjointly | : | July – August 2019 |
| .12 | Permanent pavement marking | : | September 2019 |
| .13 | Demobilization of equipment (not required) | : | September 2019 |
| .3 | Year 2020 | | |
| .1 | Preparation of surfaces including works cracks repairs type E | : | July – August 2020 |
| .2 | Paving works of runway | : | July – August 2020 |
| .3 | Electricity works | : | July – August 2020 |
| .4 | Connection between runway and taxiway | : | July 2020 |
| .5 | Backfilling and levelling of shoulders conjointly | : | July – August 2020 |
| .6 | Backfilling and levelling of extremity of runway | : | September 2020 |
| .7 | Permanent pavement marking | : | September 2020 |
| .8 | Demobilization | : | End of September 2020 |

Part 2 Products

2.1 Not used.

Part 3 Execution

3.1 PRODUCTION OF AGGREGATES

.1 To refer at the specifications Aggregate materials and Testing laboratories – Quality Control.

3.2 PAVEMENT

.1 To refer at the specifications of plans & specifications for the lateral and longitudinal transitions and temporary connexion of existing pavement.

.2 The contractor shall be conform to specifications standard TP312 and requirements indicated on plans and specifications.

3.3 COORDINATION OF WORKS

.1 The contractor will be define a responsible of the team for the specials procedures and coordination of works, as indicated at the section 01 35 13.13.

END OF SECTION

Part 1 General

1.1 REGULATORY REQUIREMENTS

- .1 Prior to use, have weigh scales certified as meeting requirements of Statutes of Canada, Chapter 36, Weights and Measures Act 1970-71-72 and subsequent amendments. Display certificate in prominent position. The certificate must not exceed 12 months.

1.2 MEASUREMENT PROCEDURES

- .1 Include cost of certification, installation, maintenance and removal of scales or use of local commercial scales in items of work to be measured by mass.

1.3 EQUIPMENT

- .1 Weigh scale: truck scale of sufficient capacity to weigh loaded vehicles in single operation.
- .2 Certified commercial scales may be utilized.
- .3 Scale house: to enclose mass indicator and provide workspace for Engineer's use.
 - .1 Weatherproof and have minimum 750 lx of illumination, one sliding window facing scale platform, one other window for cross ventilation, shelf desk at least 0,6 x 1,8 m and heat to maintain inside temperature at 20°C. Entrance door not to face onto scale platform.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 INSTALLATION

- .1 Provide, install and maintain scale, scale house and ramps, convenient to project site, at location approved by Engineer.

3.2 OPERATION

- .1 Ensure the operation and the exploitation of weigh scales.
- .2 Ensure to the departmental representative the free access to the weigh scale. Allow the engineer to do verification of weighing of materials.
- .3 Provide sufficient number of weigh tickets, in triplicate, with consecutive serial numbers. Obtain departmental representative approval of design.

3.3 MAINTENANCE

- .1 Maintain scale platform and scale mechanism clean and free from gravel, asphalt, snow, ice and debris.
- .2 Maintain approach and exit ramps free from sags and ruts.
- .3 Have scales recertified if requested by Engineer.

3.4 REMOVAL

- .1 Remove scale and scale house when no longer required by Engineer.
- .2 Level approach and exit ramps and reshape to approval of Engineer.

END OF SECTION

Part 1 General

1.1 CASH ALLOWANCES

- .1 Cash allowances, unless otherwise specified, cover net cost to Contractor of services, products, construction machinery and equipment, freight, handling, unloading, storage [installation] and other authorized expenses incurred in performing Work.
- .2 Contract Price, and not cash allowance, includes Contractor's overhead and profit in connection with such cash allowance.
- .3 Contract Price will be adjusted by written order to provide for excess or deficit to each cash allowance.
- .4 Where costs under a cash allowance exceed amount of allowance, Contractor will be compensated for excess incurred and substantiated plus allowance for overhead and profit as set out in Contract Documents.
- .5 Include progress payments on accounts of work authorized under cash allowances in Consultant's monthly certificate for payment.
- .6 Amount of each allowance, for Work specified in respective specification Sections is as follows:
 - .1 An allowance of \$120 000 is specified at the section 01 35 13.13 – Submittal procedures – Airport installation.
 - .2 An allowance of \$25 000 is specified at the section 01 35 13.13 – Submittal procedures for the expenses opening of runway for the losses of productivity during the execution period of works, for medical emergency.
 - .3 An allowance of \$40 000 is included at the tender document for the works executed by airport personal at the approval by Departmental representative.
- .7 The production of the aggregate will be paid \$40/metric tonnes, not exceeding the quantities at the tender form. In execution of works, these amounts will be subtracted at the concerned works.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

- .1 Particular requirements of contractor for inspection and testing to be carried out by testing laboratory designated Quality Control are specified under section 01 45 00.
- .2 Section 31 05 16 – Aggregate materials.
- .3 Section 31 23 33.01 – Excavating, trenching and backfilling.
- .4 Section 32 11 23 – Aggregate base courses.
- .5 Section 32 12 16 – Asphalt paving.
- .6 Section 32 17 23 – Pavement Marking.
- .7 Refer to certified testing laboratory indicated at appendix A.

1.2 APPOINTMENT AND PAYMENT

- .1 The Contractor will appoint and pay for services of testing laboratory and accept all expenses and fees. These costs are included at concerned works.
- .2 The Department representative will choose an second laboratory for the quality control.
- .3 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, pay costs for additional tests or inspections as required by Departmental Representative to verify acceptability of corrected work.

1.3 CONTRACTOR'S/DESIGN-BUILDER'S RESPONSIBILITIES

- .1 Provide labour, equipment and facilities to:
 - .1 Provide access to Work for inspection and testing.
 - .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.
- .2 Notify Departmental Representative sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.
- .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 approved by Departmental Representative
- .5 Provide the attestations of conformity of granular materials according to the requirements of the CCDG before starting the installation of the new granular materials.
- .6 Provide the attestations of conformity of granular material to each 3,000 metric tonnes of new granular materials, all according to the requirements of the CCDG.

- .7 Perform the required testing board and provide attestations of conformity according to the requirements of the CCDG.

1.4 REFERENCES

- .1 Ministère des Transports, de la Mobilité durable et de l'Électrification des transports.
 - .1 CCDG, Cahier des charges et devis généraux, Construction et Réparation, Édition 2017.

1.5 MEASUREMENT FOR PAYMENT

- .1 All costs for this section, including rental fees, if necessary, will be included in different tender items.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 NOT USED

- .1 Not used.

END OF SECTION

Part 1 General

1.1 PRECONSTRUCTION MEETING

- .1 Within 10 days after award of Contract, the departmental representative will organise a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 Departmental Representative, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.
- .3 The departmental representative will establish time and location of meeting and notify parties concerned minimum 5 days before meeting.
- .4 The departmental representative will write the verbal process of these meetings and will distribute to participants and to missing involved concerned parties in the 3 following meeting days
- .5 Agenda to include:
 - .1 Appointment of official representative of participants in the Work.
 - .2 Schedule of Work, Construction Progress Schedules.
 - .3 Review of the particular conditions of section 01 35 13.13 – Special procedures for airport facilities.
 - .4 Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .5 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.
 - .6 Delivery schedule of materials.
 - .7 Site security.
 - .8 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
 - .9 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .10 Monthly progress claims, administrative procedures, photographs, hold backs.
 - .11 Appointment of inspection and testing agencies or firms.
 - .12 Insurances, transcript of policies.

1.2 PROGRESS MEETINGS

- .1 The departmental representative will establish a calendar for periodic meetings during the work progress.
- .2 Contractor, major Subcontractors involved in Work Departmental Representative are to be in attendance.
- .3 The departmental representative will notify parties minimum 5 days prior to meetings.

- .4 Departmental representative will record minutes of meetings and circulate to attending parties and affected parties not in attendance within 3 days after meeting.
- .5 Agenda to include the following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review of Work progress since previous meeting.
 - .3 Field observations, problems, conflicts.
 - .4 Problems which impede construction schedule.
 - .5 Review of off-site fabrication delivery schedules.
 - .6 Corrective measures and procedures to regain projected schedule.
 - .7 Revision to construction schedule.
 - .8 Progress schedule, during succeeding work period.
 - .9 Review submittal schedules: expedite as required.
 - .10 Maintenance of quality standards.
 - .11 Review proposed changes for affect on construction schedule and on completion date.
 - .12 Review of non-conformity of works.
 - .13 Health and Safety program.
 - .14 Environmental requirements.

Part 2 Products

2.1 Not used.

Part 3 Execution

3.1 Not used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 11 11 – General Informations.

1.2 REFERENCE STANDARDS

- .1 Project Management Institute (PMI Standards)
 - .1 A Guide to the Project Management Body of Knowledge (PMBOK Guide) - Fifth Edition.
 - .2 Practice Standard for Scheduling - 2011.

1.3 DEFINITIONS

- .1 Activity: Distinct, scheduled portion of work performed during course of a project.
- .2 Activity Duration: time in calendar units between start and finish of a scheduled activity. See also Duration.
- .3 Assumption: factor in planning process that is considered true, real, or certain without proof or demonstration.
- .4 Bar Chart (Gantt Chart): graphic display of schedule-related information.
 - .1 In typical bar chart, schedule activities or work breakdown structure components are listed down left side of chart, dates are shown across the top, and activity durations are shown as date-placed horizontal bars.
- .5 Baseline: approved version of a work product that can be changed only through formal change control procedures and is used as a basis for comparison.
- .6 Budget: approved estimate for a project or work breakdown structure component or schedule activity.
- .7 Cash Flow: projection of progress payment requests based on cash loaded construction schedule.
- .8 Change Control: process whereby modifications to documents, deliverables, or baselines associated with a project are identified, documented, approved, or rejected.
- .9 Completion Milestones: they are firstly Substantial Completion, Interim Certificate and secondly Final Certificate.
- .10 Constraint: scheduled limiting factor that effects execution of a project, program, portfolio, or process.
- .11 Contract: mutually binding agreement that obligates a seller to provide a specified product or service or result and obligates a buyer to pay for it.
- .12 Control: comparing actual performance with planned performance, analyzing variance, assessing trends, to effect process improvements, evaluating possible alternatives, and recommending appropriate corrective action as needed.

- .13 Corrective Action: intentional activity that realigns performance of project work with project management plan.
- .14 Critical Path: sequence of activities that represents longest path through a project, which determines shortest possible duration.
- .15 Critical Path Activity: activity on critical path in a project schedule.
- .16 Critical Path Method (CPM): method used to estimate minimum project duration and determine amount of scheduling flexibility on logical network of paths within schedule model.
- .17 Data Date: point in time when the status of the project is recorded.
- .18 Decomposition: technique used for dividing and subdividing project scope and project deliverables into smaller, more manageable parts.
- .19 Deliverable: unique and verifiable product, result, or capability to perform a service that is required to be produced to complete a process, phase, or project.
- .20 Duration: total number of work periods (not including holidays or other non-working periods) required to complete a schedule activity or work breakdown structure component.
 - .1 Usually expressed as workdays or work weeks.
- .21 Early Finish Date (EF): in Critical Path Method, earliest possible point in time when uncompleted portions of schedule activity can finish based on schedule network logic, data date, and schedule constraints.
 - .1 Early finish dates can change as Project progresses and changes are made to Project plan.
- .22 Early Start Date (ES): in Critical Path Method, earliest possible point in time when uncompleted portions of a schedule activity can start based on schedule network logic, data date, and schedule constraints.
 - .1 Early start dates can change as Project progresses and changes are made to Project Plan.
- .23 Execute: directing, managing, performing, and accomplishing project work; providing deliverables, and providing work performance information.
- .24 Finish Date: point in time associated with a schedule activity's completion.
 - .1 Usually qualified by one of following: actual, planned, estimated, scheduled, early, late, baseline, target, or current.
- .25 Float: (also known as slack) amount of time a schedule activity can be delayed without delaying early start date of a successor or violating a schedule constraint.
 - .1 This resource is available to both PWGSC and Contractor.
- .26 Forecast: estimate or prediction of conditions and events in project future based on information and knowledge available at time of forecast.

- .1 Information is based on projects past performance and expected future performance, and includes information that could impact project in future, a such as estimate at completion and estimate to complete.
- .27 Gantt Chart: see Bar Chart.
- .28 Impact Analysis: schedule analysis technique that adds a modeled delay to an accepted construction schedule to determined possible outcome of that delay on project completion.
- .29 Imposed Date: a fixed date imposed on a schedule activity or schedule milestone, usually in form of a “start no earlier than” and “finish no later than” date.
- .30 Lag: amount of time whereby a successor activity is required to be delayed with respect to a predecessor activity.
- .31 Late Finish Date (LF): in critical path method, latest possible point in time when uncompleted portions of a schedule activity can finish based on schedule network logic, project completion date, and schedule constraints.
- .32 Late Start Date (LS): in critical path method, latest possible point in time when uncompleted portions of a schedule activity can start based on schedule network logic, project completion date, and schedule constraints.
- .33 Lead: amount of time whereby a successor activity can be advanced with respect to a predecessor activity.
- .34 Logic Diagram: see Project network diagram.
- .35 Logical Relationship: dependency between two activities or between an activity and a milestone.
- .36 Master Schedule: summary-level schedule that identifies major deliverable; work breakdowns structure components, and key schedule milestones.
- .37 Milestone: significant point or event in a project, program, or portfolio.
- .38 Monitor: collect project performance data with respect to a plan, procedure performance measures, and report and disseminate performance.
- .39 Network: see Project Schedule Network Diagram.
- .40 Non-Critical Activities: activities which when delayed, do not affect specified Contract duration.
- .41 Project Control System: fully computerized system utilizing commercially available software packages.
- .42 Project Management: application of knowledge, skills, tools, and techniques, to project activities to meet project requirements.
- .43 Project Management Plan: approved document that describes how project will be executed, monitored, and controlled.
 - .1 Primary uses of Project management plan are to document planning assumptions and decisions, facilitate communication among stakeholders, and document approved scope, cost, and schedule baselines.
 - .2 Project management plan may be summary or detailed.

- .44 Project Management Planning: development and maintenance of Project Management Plan.
- .45 Project Management Planning, Monitoring and Control System: overall system operated to enable monitoring of Project Work in relation to established milestones.
- .46 Project Schedule: planned dates for performing activities and planned dates for meeting milestones.
- .47 Project Schedule Network Diagram: graphical representation of logical relationships among project schedule activities.
 - .1 Always drawn from left to right to reflect Project chronology.
- .48 Project Scope: work performed to deliver a product, service, or result with specified features and functions.
- .49 Quantified days duration: working days based on 5 day work week, discounting statutory holidays.
- .50 Risk: uncertain event or condition that, if it occurs, has positive or negative effect on one or more project objectives.
- .51 Schedule: see Project Schedule.
- .52 Schedule Data: collection of information for describing and controlling schedule.
- .53 Scope: see Project Scope.
- .54 Start Date: point in time associated with activity's start, usually qualified by one of following: actual, planned, estimated, scheduled, early, late, target, baseline, or current.
- .55 Work Breakdown Structure (WBS): hierarchical decomposition of total scope of work to be carried out by project team to accomplish project objectives and create the required deliverables.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Project Meeting:
 - .1 Meet with Departmental Representative within.
 - .2 Participate in regular project progress meetings with Departmental Representative specifically intended to discuss update of detailed schedule and contract changes.
- .2 Scheduling:
 - .1 Ensure that planning process is iterative and results in generally top-down processing with more detail being developed as planning progresses, and decisions concerning options and alternatives are made.
 - .2 Ensure project schedule efficiencies through monitoring of project in detail to ensure integrity of Critical Path, by comparing actual completions of individual activities with their scheduled completions, and review progress of activities that has started but are not yet completed.
 - .3 Monitor sufficiently often so that causes of delays can immediately be identified and mitigated.

- .3 Project monitoring and reporting:
 - .1 Keep team aware of changes to schedule, and potential consequences as project progresses.
 - .2 Use narrative reports to provide advice on seriousness of challenges and measures to overcome them.
 - .3 Begin narrative reporting with statement on general status of project followed by summarization of delays, potential problems, corrective measures and project status criticality.
- .4 Critical Path Method (CPM) Requirements:
 - .1 Ensure Master Plan and Detail Schedule are practical and remain within specified contract duration.
 - .2 Revise Master Schedule and Detail Schedule deemed impractical by Departmental Representative and resubmit for approval.
 - .3 Change to Contract Duration:
 - .1 Acceptance of Master Schedule and Detail Schedule showing scheduled Contract duration shorter than specified Contract duration does not constitute change to Contract.
 - .2 Duration of Contract may only be changed through bilateral Agreement.
 - .4 Consider Master Schedule and Detail Schedule deemed practical by Departmental Representative, showing Work completed in less than specified Contract duration, to have float.
 - .5 First Milestone on Master Schedule and Detail Schedule will identify start Milestone with an Early Start, "ES", constraint date equal to Award of Contract date.
 - .6 Calculate dates for completion of milestones from Plan and Schedule using specified time periods for Contract.
 - .7 Substantial Completion Interim Certificate with Late Finish, "LF", constraint equal to calculated date.
 - .8 Calculations on updates such that if early finish of Interim Certificate falls later than specified Contract duration then float calculation to reflect negative float.
 - .9 Delays to non-critical activities with float may not be basis for time extension.
 - .10 Do not use float suppression techniques such as software constraints, special lead/lag logic restraints, preferential sequencing, imposed dates other than required by Contract extended activity times.
 - .11 Allow for adverse weather conditions normally anticipated and show in Master Plan and Detail Schedule.
 - .1 Specified Contract duration has been predicated assuming normal amount of adverse weather conditions.
 - .12 Provide necessary crews and manpower to meet schedule requirements for performing Work within specified Contract duration.
 - .1 Simultaneous use of multiple crews on multiple fronts on multiple critical paths may be required.

- .13 Arrange participation on and off site of subcontractors and suppliers, as required by Departmental Representative, for purpose of network planning, scheduling, updating and progress monitoring.
 - .1 Approvals by Departmental Representative of original networks and revisions do not relieve Contractor from duties and responsibilities required by Contract.
- .14 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.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to Departmental Representative Project Control System for planning, scheduling, monitoring and reporting of project progress.
- .3 Submit Project Control System to Departmental Representative for approval.
 - .1 Failure to comply with each required submission, may result in progress payment being withheld in accordance with Federal Government's GC 5 Terms of Payment.
- .4 Include costs for execution, preparation and reproduction of schedule submittals in bid documents.
- .5 Submit letter ensuring that schedule has been prepared in co-ordination with major sub-contractors.
- .6 Refer to article "PROGRESS MONITORING AND REPORTING" of this specification Section for frequency of Project control system submittals.
- .7 Submit impact analysis of schedule for changes that result in extension of contract duration.
 - .1 Include draft schedule update and report as outlined in article "PROGRESS MONITORING AND REPORTING".
- .8 Submit Project planning, monitoring and control system data as part of initial schedule submission and monthly status reporting as required by Departmental Representative in following form.
 - .1 USB Drive files in original scheduling software
 - .2 Master Schedule Bar Chart.
 - .3 Construction Detail Schedule Bar Chart.
 - .4 Listing of project activities including milestones and logical connectors, networks (sub-networks) from Project start to end. Sort activities by activity identification number and accompany with descriptions. List early and late start and finish dates together with durations, codes and float.
 - .5 Criticality report listing activities and milestones with up to 5 days total float used as first sort for ready identification of critical near critical paths through entire project. List early and late starts and finishes dates, together with durations, codes and float for critical activities.

- .6 Progress report in early start sequence, listing for each trade, activities or finished due to start, underway, within 2 months from monthly update date. List activity identification number, description and duration. Provide columns for entry of actual start and finish dates, duration remaining and remarks concerning action required.

1.6 QUALITY ASSURANCE

- .1 Use experienced personnel, fully qualified in planning and scheduling to provide services from start of construction to Final Certificate, including Commissioning.

1.7 WORK BREAKDOWN STRUCTURE (WBS)

- .1 Prepare construction Work Breakdown Structure (WBS) within 3 weeks after the allowance of the contract.
 - .1 Develop WBS through at least five levels: project, stage, element, sub-element and work package.

1.8 PROJECT MILESTONES

- .1 Mandatory and recommended project milestones form targets for both Master Schedule and Detail Schedule of CPM construction network system, as indicated at article 1.13, section 01 11 11.

1.9 MASTER SCHEDULE

- .1 Structure and base CPM construction networks system on WBS coding in order to ensure consistency throughout Project.
- .2 Prepare comprehensive construction Master Schedule (CPM logic diagram) and dependent Cash Flow Projection within 2 weeks after the allowance of the contract.
 - .1 Master Schedule will be used as baseline.
 - .1 Revise baseline as conditions dictate and as required by Departmental Representative.
 - .2 Departmental Representative as Project progresses will review and return revised baseline within 3 days.
- .3 Reconcile revisions to Master Schedule and Cash Flow Projections with previous baseline to provide continuous audit trail.
- .4 Initial and subsequent Master Schedule will include:
 - .1 USB Drive containing schedule and cash flow information, clearly labelled with data date, specific update, and person responsible for update.
 - .2 Bar chart identifying coding, activity durations, early/late and start/finish dates, total float, completion as percentile, current status and budget amounts.
 - .3 Network diagram showing coding, activity sequencing (logic), total float, early/late dates, current status and durations.
 - .4 Actual/projected monthly cash flow: expressed annually monthly and shown in both graphical and numerical form.

1.10 DETAIL SCHEDULE

- .1 Provide detailed project schedule (CPM logic diagram) within 3 weeks after the allowance of the contract.
- .2 Detail CPM schedule to cover in detail minimum period of 2018, 2019 and 2020 year.
 - .1 Show remaining activities for CPM construction network system up to Final Certificate and develop complete detail as project progresses.
 - .2 Detail activities completely and comprehensively throughout duration of project.
- .3 Relate Detail Schedule activities to basic activities and milestones developed and approved in Master Schedule.
- .4 Clearly show sequence and interdependence of construction activities and indicate:
 - .1 Start and completion of all items of Work, their major components, and interim milestone completion dates.
 - .2 Activities for procurement, delivery, installation and completion of each major piece of equipment, materials and other supplies, including:
 - .1 Time for submittals, resubmittals and review.
 - .2 Time for fabrication and delivery of manufactured products for Work.
 - .3 Interdependence of procurement and construction activities.
 - .3 Include sufficient detail to assure adequate planning and execution of Work. Activities generally range in duration from 3 to 15 workdays each.
- .5 Provide level of detail for project activities such that sequence and interdependency of Contract tasks are demonstrated and allow co-ordination and control of project activities. Show continuous flow from left to right.
- .6 Ensure activities with no float are calculated and clearly indicated on logical CPM construction network system as being, whenever possible, continuous series of activities throughout length of Project to form "Critical Path". Increased number of critical activities is seen as indication of increased risk.
- .7 Insert Change Orders in appropriate and logical location of Detail Schedule. After analysis, clearly state and report to Departmental Representative for review effects created by insertion of new Change Order.

1.11 REVIEW OF CONSTRUCTION DETAIL SCHEDULE

- .1 Allow minimum 5 work days for review by Departmental Representative of proposed construction Detail Schedule unless otherwise specified.
- .2 Upon receipt of reviewed Detail Schedule make necessary revisions and resubmit to Departmental Representative for review within maximum 5 work days unless otherwise specified.
- .3 Promptly provide additional information to validate practicability of Detail Schedule as required by Departmental Representative.
- .4 Submittal of Detail Schedule indicates that it meets Contract requirements and will be executed generally in sequence.

1.12 COMPLIANCE WITH DETAIL SCHEDULE

- .1 Comply with reviewed Detail Schedule.
- .2 Proceed with significant changes and deviations from scheduled sequence of activities that cause delay, only after written receipt of approval by Departmental Representative.
- .3 Identify activities that are behind schedule and causing delay. Provide measures to regain slippage.
 - .1 Corrective measures may include:
 - .1 Increase of personnel with more experience/qualifications on site for effected activities or work package.
 - .2 Increase in materials equipment.
 - .3 Overtime work Additional work shifts.
- .4 Submit to Departmental Representative, justification, project schedule data and supporting evidence for approval of extension to Contract completion date or interim milestone date when required. As part of supporting evidence, include:
 - .1 Written submission of proof of delay based on revised activity logic, duration and costs, showing time impact analysis illustrating influence of each change or delay relative to approved contract schedule.
 - .2 Prepared schedule indicating how change will be incorporated into overall logic diagram. Demonstrate perceived impact based on date of occurrence of change and include status of construction at that time.
 - .3 Other supporting evidence requested by Departmental Representative.
 - .4 Do not assume approval of Contract extension prior to receipt of written approval from Departmental Representative.
- .5 In event of Contract extension, display in Detail Schedule that scheduled float time available for work involved has been used in full without jeopardizing earned float.
 - .1 Departmental Representative will determine and advise Contractor number of allowable days for extension of Contract based on project schedule updates for period in question, and other factual information.
 - .2 Construction delays affecting project schedule will not constitute justification for extension of contract completion date.

1.13 PROGRESS AND REPORTING

- .1 On an ongoing basis, Detail Schedule on job site to show "Progress to Date". Arrange participation on and off site of subcontractors and suppliers, as, and when necessary, for purpose of network planning, scheduling, updating and progress monitoring. Inspect Work with Departmental Representative at least once monthly to establish progress on each current activity shown on applicable networks.
- .2 Update and reissue project Work Breakdown Structure and relevant coding structures as project develops and changes.
- .3 Perform Detail Schedule update monthly with status dated (Data Date) on last working day of month. Update to reflect activities completed to date, activities in progress, logic and duration changes.

- .4 Do not automatically update actual start and finish dates by using default mechanisms found in project management software.
- .5 Submit to Departmental Representative copies of updated Detail Schedule.
- .6 Requirements for monthly progress monitoring and reporting are basis for progress payment request.
- .7 Submit monthly written report based on Detail Schedule, showing Work to date performed, comparing Work progress to planned, and presenting current forecasts. Report summarize progress, defining problem areas and anticipated delays with respect to Work schedule, and critical paths. Explain alternatives for possible schedule recovery to mitigate potential delay. Include in report:
 - .1 Description of progress made.
 - .2 Pending items and status of: possible time extensions, shop drawings, permits, change orders, etc.
 - .3 Status of Contract completion date and milestones.
 - .4 Current and anticipated problem areas, potential delays and corrective measures.
 - .5 Review of progress and status of Critical Path activities.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 NOT USED

- .1 Not used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Contractor shall provide Departmental Representative with certificates, certificates of conformity and data sheets for the materials required for the execution of the Work.

1.2 REFERENCES

- .1 Not used.

1.3 ADMINISTRATIVE

- .1 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Works are co-ordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
- .10 Keep one reviewed copy of each submission on site.

1.4 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 drawings stamped and signed by professional engineer registered or licensed in Québec Province of 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 co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

- .4 Allow 10 days for Departmental Representative's review of each submission.
- .5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
- .7 Accompany submissions with transmittal letter, in duplicate, 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 Standards;
 - .5 Operating weight.
- .9 After Departmental Representative's review, distribute copies.

- .10 Submit six (6) print copies or one (1) electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
- .11 Submit six (6) print copies or one (1) electronic copy of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
- .12 Submit six (6) print copies or one (1) electronic copy of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .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 3 years of date of contract award for project.
- .13 Submit six (6) print copies or one (1) electronic copy of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
 - .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 six (6) print copies or one (1) electronic copy of manufacturer's instructions for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets and safety precautions.
- .15 Delete information not applicable to project.
- .16 Supplement standard information to provide details applicable to project.
- .17 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, [transparency] [copies] will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .18 The review of shop drawings by Public Works and Government Services Canada (PWGSC) is for sole purpose of ascertaining conformance with general concept.
 - .1 This review shall not mean that PWGSC approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

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

1.5 CERTIFICATES AND TRANSCRIPTS

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

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 NOT USED

- .1 Not used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Not used.

1.2 REFERENCES

- .1 Tome 5 des Normes - Ouvrages routiers du MTQ.

1.3 PUBLIC TRAFFIC PROTECTION

- .1 Comply with the requirements of the applicable laws, regulations and bylaws and orders governing traffic and the use of roads on which it is necessary to perform work or transport materials and equipment.
- .2 When the works are done on a road in use, you must do the following.
 - .1 Arrange the equipment in way that causes the least inconvenience and risk to users.
 - .2 To the extent possible, consolidate the equipment on the same side of the road.
 - .3 Do not leave equipment on the roadway overnight.
- .3 No traffic lane outside the security and/or municipal area may be closed without the authorization of the airport authorities.
- .4 The Contract must not take any action that can affect the traffic lanes, runways and airport activities.
- .5 Keep the roadway clean without impeding the airport activities. The road must be wide enough to allow adequate use.
- .6 Install an access road as specified in the plans.

1.4 INFORMATION AND WARNING

- .1 Provide and install warning signals and other similar signs to indicate the presence of a work zone or any other temporary situation resulting from the execution of the works and requiring a reaction or reflex response from the road user, and ensure that they are maintained.
- .2 Provide and install the signals, markers, barricades and other warning devices as provided in Volume 5 of the Standards – Road Works of the MTQ for traffic outside the regulated zone. For work within the regulated zone, refer to the phasing plans.
- .3 Place the signals and other warning devices at the locations recommended in Volume 5 of the Standards – Road Works of the MTQ for traffic outside the regulated zone. For work within the regulated zone, refer to the phasing plans.

Before the works begin, consult the MTQ representative to jointly prepare a list of signals and other warning devices necessary for the work. If the situation on the site changes, revise the list to the satisfaction of the MTQ representative.

- .4 The MTQ representative can request adjustments after the site is set up, despite any prior acceptance of the reference area.
- .5 Maintain all the signage devices as follows.
 - .1 Inspect them every day to ensure that they are legible, in good condition, in the right place and satisfy needs. Clean, repair or, as appropriate, replace the signals to ensure their clarity and reflectance.
 - .2 Remove or cover signs that do not apply to the existing situations, which can vary from day to day.
- .6 The remuneration for this work must be included in the article of the "Temporary security marking – Public road" tender form.

1.5 PUBLIC TRAFFIC CONTROL

- .1 Provide on-site services of competent flaggers whose training and equipment satisfy Québec regulations, for the following situations.
 - .1 When public traffic must avoid vehicles or equipment that partially or entirely block the road.
 - .2 When traffic is dense, approach speeds high and the signage system is out of service.
 - .3 When workers and equipment are at work on the road, beyond the summit of a slope, after a pronounced curve or at other locations where users cannot otherwise be effectively warned.
 - .4 When it is necessary to take temporary protection measures, during signage installation or removal.
 - .5 When emergency protective measures are necessary because of the impossibility of quickly obtaining signage devices.
 - .6 In all cases where the other signage devices do not ensure complete protection of workers, equipment and public traffic.

1.6 RESTRICTIONS TO TRAFFIC

- .1 Limit speed in air area is maximum 10 km/h.
- .2 Limit load on the runway, taxiway and apron is 25 metric tonnes.
- .3 Avoid doing abrupt turning with trucks on the existing new pavement.

Part 2 Products

- .1 Not used.

Project R.087646.001

Part 3 Execution

.1 Not used

END OF SECTION

Part 1 General

1.1 DEFINITIONS

- .1 Restricted or secured area; Any area on airport property to which access is restricted by sign and/or monitored is a secured or restricted area.
- .2 Movement area; Airport surfaces used for movement of aircrafts including apron, taxiways and runways.

1.2 CONTRACTOR'S RESPONSIBILITY

- .1 The Contractor shall familiarize himself with the airport security regulations, the « Airport Traffic Regulations» and with the specific to this Project Exploitation plan during Construction (PEC) and give appropriate instructions to his employees and sub-contractors.
- .2 The departmental representative will supply a copy of the Project Exploitation plan during Construction (PEC) approved by the competent authority.
- .3 Rules and regulations are available at the following address: <http://www.tc.gc.ca/eng/acts-regulations/acts-air.htm> under Government Property Traffic Act.
- .4 Be responsible for construction, personnel and vehicles employed and sub-contractors participating on the project and requiring access to restricted areas.
- .5 Supply to departmental representative a list of the responsible personal, including subcontractor and escort responsible who, in case of emergency, can be contacted after work shift.
- .6 Designate from among its employees, a person who will maintain constant contact with the airport escort. This person must have an Restricted Operator's Certificate and remain in constant contact with the flight service station to airport.

1.3 MEASUREMENTS FOR PAYMENTS

- .1 The contractor will have to pay the airport operator directly for the expenses associated with escort services. These services are subject to an allowance included in the contract price and will be reimbursed as described in section 21 00 00 – Allowances.
- .2 All others costs associated with meeting the requirements of this section of the specifications shall be included in the Contractor overhead and/or profit for the different items of the tender.

1.4 ESCORTS

- .1 The airport operator will provide the airport escort services. The airport operator will also supply the escort vehicles and the radio with the flight station services (FSS) frequency.
- .2 Every vehicle or person entering the restricted area must be escorted and every vehicle must be equipped with an amber rotary beacon.
- .3 The Contractor and his employees must instantly observe orders given by the escort.

- .4 The contractor will advise the airport operator at least 12 hours in advance of any schedule or program modifications approved by Departmental representative when escorts are required. This requirement is necessary to organize the escort's working schedules.
- .5 Contractor will supply radios needed for the communications between the contractor, departmental representative and the escort officer.

1.5 GENERAL PROTECTION

- .1 Do not disrupt airport business except as permitted by Departmental Representative.
- .2 Provide temporary protection for safe handling of public, personnel, pedestrians and vehicular traffic.

1.6 MOVEMENT OF EQUIPMENT AND PERSONNEL

- .1 In areas of airport not closed to aircraft traffic:
 - .1 Obtain Departmental Representative's approval on scheduling of Work.
 - .2 Control movements of equipment and personnel as directed by Departmental Representative.
 - .3 The Contractor and his employees must instantly observe orders given by the escort.
 - .4 Contractor will supply radios needed for the communications between the contractor, the departmental representative and the Transport Canada officer. See section 01 52 00 – Construction facilities.
 - .5 At the end of each shift, all equipment and materials must be moved outside the airport enclosure.

1.7 DAILY SECURITY

- .1 On the apron area, no torch work, fire or smoking will be tolerated under penalty of fine to the person infringing airport regulations. This is because of ever present motor-fuel conduits and vapour.
- .2 Ensure that the gate is properly locked and no breaches are present in the perimeter fence of the airport at each end of working days.
- .3 The Contractor will maintain the guarding security of access at the air area during all of the executive period of works. A building with lighting and heating will provide and install by the Contractor. These requirements are only for the 2019 and 2020 phases.

1.8 TEMPORARY MARKERS FOR CLOSED MOVEMENT AREAS

For the apron and taxiway:

- .1 The Contractor shall provide highly visible danger markers during the day and illuminate red lights at night in the locations indicated on the drawings. Beacons should be TR-V-7 or R-UT6600 Stinson, with light on the top.

- .2 The Contractor will supply, install, locate and relocate as per work progress, the temporary markers to indicate day and night closed to airport operation manoeuvre areas or parts of them.
- .3 Apron areas closed to aircraft operation will be delimited both end by lighted equipment's conform to exigencies of the article 5.3.33 of TP 312, 5th edition. This article is enclosed as part 4 of the present section.
- .4 The remuneration for this work is included in the article of the "Temporary security marking – restriction area" tender form.

1.9 WORK SCHEDULE

- .1 The contractor must take note and consider that work to granular gravelling will be carried out as per the following modality at article 1.3, section 01 11 11.

1.10 TRENCHING

- .1 Obtain the write approbation of departmental representative before proceeding of trenching excavation works.

1.11 UTILITY NETWORK OF PUBLICS SERVICES

- .1 The departmental representative will approximately indicate the location of public's underground utility services of the airport (cable, conduits, canalisation etc.). The contractor must identified on site, by exploratory hand digging if necessary, the exact location of buried utilities services.
- .2 Advise the departmental representative 48 hours in advance of the of the location of the works to be executed, that to allow the time to investigate the underground public's services.

1.12 SPECIAL DAILY PROCEDURES FOR COORDINATING THE WORKS

- .1 Verification of meteorological conditions
 - .1 The Contract must check the meteorological (Environnement Canada) conditions daily to learn the temperature variation during the overnight period (minimum temperature forecast) and the risks and intensity of any precipitation.
- .2 Suspension of works
 - .1 If the weather forecast is for 50% or more likelihood of precipitation, the work on the runway will be suspended.
The Contractor may carry out paving work on the apron or the traffic lanes, depending on the conditions and risks, further to the prior authorizations of the Departmental Representative and the Airport Director.
- .3 Verification of daily flight schedules
 - .1 The Contractor must coordinate with the Airport Director to obtain confirmation of the flight times (arrival and departure) at the Kuujuaq airport.

- .2 The work hours on the runway and the traffic lanes must be adjusted accordingly, if there are no expected variations from the normal period set out in the specification for the execution of the works.
- .4 Meeting of the Execution Committee
 - .1 An Execution Committee will be formed of Departmental representatives, the airport director, the contractor's project manager and the foreman. This committee must meet daily at least 3 hours before the time allotted for the execution of work to submit the work program and the analysis of the following elements:
 - .1 Notice of runway closing.
 - .2 Analysis of weather report (Forecast advisor precision expert).
 - .3 Compliance with PEC (Operation during Construction Plan) requirements.
 - .4 Signage plan.
 - .5 Closing of the Bravo traffic lane and the Alpha lane.
 - .6 Marking of the runway.
 - .7 Work intervention zone.
 - .8 Access control.
 - .9 Equipment storage area.
- .5 Reopening the runway
 - .1 Once the work is done, a joint inspection of the work will be carried out by the Departmental Representative, the Contractor's project manager and the airport director or his representative to check the quality of the work and the compliance of provisional temporary measures after each day.
 - .2 Any correction required must be made immediately by the Contractor.
 - .3 As soon as the compliance of the work has been validated by the committee, an official notice of the re-opening of the runway will be issued by the airport director.
- .6 Removal of equipment
 - .1 All equipment must be removed from the airport premises after each day of work, before official notice of re-opening the runway is given.
 - .2 The Contractor must obtain the required authorizations from the competent authorities (Land Holding) in order to arrange security including watching its equipment and materials storage site.
- .7 Daily works program
 - .1 The Contractor must submit the detailed program of works each day.

Part 2 Product
Not used.

Part 3 Execution
Not used.

Part 4 Article 5.3.33 - Lighted « X » Closed Area Marker

As indicated at the Guide TP312, edition 5, «Aerodrome Standards and recommended Practices Lighted “X” closed area marker, article 5.3.33.

- .1 The luminaire must be mounted on a mobile trailer with batteries and solar power LED lamps (9 units, 30W (60000 C) and variable intensity flashing control as manufactured by **Signal** or approved equivalent.
- .2 The Contractor will submit for approved an alternative solution, in case of a major breakdown of closed area marker.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Not used.

1.2 REFERENCES

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 Province of Quebec
 - .1 An Act Respecting Occupational Health and Safety, R.S.Q. 1997 (updated 26 July 2005).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
 - .1 Results of site specific safety hazard assessment.
 - .2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.
- .3 Submit 2 copies of Contractor's authorized representative's work site health and safety inspection reports to authority having jurisdiction, daily to Departmental Representative.
- .4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .5 Submit copies of incident and accident reports.
- .6 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 5 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 2 days after receipt of comments from Departmental Representative.
- .7 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .8 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Departmental Representative.
- .9 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

1.4 FILING OF NOTICE

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

1.5 SAFETY ASSESSMENT

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

1.6 MEETINGS

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

1.7 PROJECT/SITE CONDITIONS

- .1 Work at site will involve contact with:
 - .1 Section 01 35 000.06 - Special procedures for traffic control.
 - .2 Section 01 35 13.13 - Special procedures for airport facilities.

1.8 GENERAL REQUIREMENTS

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.
- .2 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.9 RESPONSIBILITY

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.10 COMPLIANCE REQUIREMENTS

- .1 Comply with Workers Compensation Act, B.C. Reg.
- .2 Comply with Occupational Health and Safety Act, Industrial and Commercial Establishments Regulation, R.R.Q.
- .3 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.11 UNFORSEEN HAZARDS

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

1.12 HEALTH AND SAFETY CO-ORDINATOR

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:
 - .1 Have site-related working experience specific to activities associated with works in Cree community.
 - .2 Have working knowledge of occupational safety and health regulations.
 - .3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
 - .4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
 - .5 Be on site during execution of Work and report directly to and be under direction of Registered Occupational Hygienist

1.13 POSTING OF DOCUMENTS

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

1.14 CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

1.15 WORK STOPPAGE

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

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 05 16 – Aggregate materials.

1.2 REFERENCES

- .1 Definitions
 - .1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humans; or degrade environment aesthetically, culturally and/or historically.
 - .2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction.
- .2 References
 - .1 Gouvernement du Québec
 - .1 Loi sur la qualité de l'environnement (R.L.R.Q., chapitre Q-2).
 - .2 Règlement sur les carrières et sablières (R.L.R.Q., chapitre Q-2, r. 7).
 - .3 Règlement sur le stockage et les centres de transfert de sols contaminés (R.L.R.Q., chapitre Q-2, r. 46).
 - .4 Politique québécoise de gestion des matières résiduelles (R.L.R.Q., chapitre Q-2, r. 35.1).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Before commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review and approval by Departmental Representative.
- .3 Environmental Protection Plan must include 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 tasks.
- .5 Include in Environmental Protection Plan:
 - .1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.
 - .2 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.
 - .3 Names and qualifications of persons responsible for training site personnel.

- .4 Erosion and sediment control plan identifying type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.
- .5 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use.
 - .1 Plan to include measures for marking limits of use areas and methods for protection of features to be preserved within authorized work areas.
- .6 Spill Control Plan to include procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
- .7 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris (Section 01 74 21).

1.4 FIRES

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

1.5 SITE CLEARING AND PLANT PROTECTION

- .1 Protect trees and plants on site and adjacent properties as indicated.
- .2 Protect trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m minimum.
- .3 Protect roots of designated trees to drip line during excavation and site grading to prevent disturbance or damage.
 - .1 Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .4 Minimize stripping of topsoil and vegetation.
- .5 Restrict tree removal to areas indicated and designated by Departmental Representative.

1.6 DRAINAGE

- .1 Develop and submit erosion and Sediment Control Plan (ESC) identifying type and location of erosion and sediment controls provided. Plan to include monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.
- .2 Provide temporary drainage and pumping required to keep excavations and site free from water.
- .3 Ensure pumped water into waterways, sewer or drainage systems is free of suspended materials.
- .4 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.7 WORK ADJACENT TO WATERWAYS

- .1 Construction equipment to be operated on land only.

- .2 Use waterway beds for borrow material only after written receipt of approval from Departmental Representative.
- .3 Waterways to be kept 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.
- .7 Blasting is allowed only above water and 100 m minimum from indicated spawning beds.

1.8 POLLUTION CONTROL

- .1 Maintain temporary erosion and pollution control features installed under this Contract.
- .2 Control emissions from equipment and plant in accordance with local authorities' emission requirements.
- .3 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

1.9 NOTIFICATION

- .1 Departmental Representative 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 Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative.
 - .1 Take action only after receipt of written approval by Departmental Representative.
- .3 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.
- .4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

1.10 CONTAMINATED SOIL

- .1 Contractor shall immediately inform the Departmental Representative when potentially contaminated soil is identified during excavation work.
- .2 The Departmental Representative will provide Contractor with directives regarding the continuation of the work.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
- .2 Waste Management: waste materials disposal in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .3 Bury rubbish and waste materials on site where directed after receipt of written approval from Departmental Representative.
- .4 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.

END OF SECTION

Part 1 General

1.1 OBJECTIVES

- .1 Provide information to enable the Contractor to establish and maintain the quality control on the construction site through a quality management plan (QMP) incorporating all the construction activities of the project.

1.2 DEFINITIONS

- .1 Quality Assurance (QA): All activities planned within a quality system to ensure that the quality requirements for a product or service are indeed controlled.
- .2 Quality Control (QC): A set of observations and activities required to meet quality requirements.

1.3 INTRODUCTION

- .1 The Contractor is responsible to perform the quality control (QC).
- .2 The Contractor is responsible to build in compliance with the quality criteria indicated in the plans, specifications, permits and industry standards.
- .3 The Contractor has the obligation to ensure that all of his work meets the quality requirements mentioned in the plans, specifications, permits and industry standards. The purpose of the Contractor's quality management plan (QMP) is to assist in the realization of this obligation and provide the Departmental Representative with a means of confirming that the specified quality level is reached.
- .4 The Contractor must ensure a uniform and high level of manufacturing quality in all phases of procurement, fabrication, construction, installation and implementation of the works.
- .5 The Departmental Representative is responsible for the quality assurance (QA). The QA activities of the Departmental Representative do not release the Contractor from its obligations and responsibilities under the quality control requirements of the contract.

1.4 SCOPE OF QUALITY MANAGEMENT PLAN (QMP)

- .1 Establish and maintain a QMP as described in the present section. The QMP is the key element in determining the quality level required under the conditions of this contract and is composed of the following:
 - .1 QC organization.
 - .2 QC procedures.
 - .3 Coordination Plan at the kick-off site meeting.
 - .4 QC meeting.
 - .5 The three (3) control phases (described in the present section).
 - .6 Proposal, review and approval.

- .7 Testing to be performed.
- .8 Inspections and certifications.
- .9 Checklist.
- .2 The QMP shall include without limitation: shop drawings, samples, testing and the different sections of the present specification.
- .3 The QMP must cover all work on and off-site and will be adapted to the sequence of the work.
- .4 The QMP must be approved by the Departmental Representative before beginning the work. The Departmental Representative reserves the right to require changes in the QMP if required.
- .5 The only activities allowed before the acceptance of the QMP are surveying and mobilization of site offices, equipment and materials.
- .6 Inform the Departmental Representative in writing of any changes proposed in the QMP or QC staff a minimum of ten (10) working days before the entry into force of the proposed amendment. The proposed changes are subject to the acceptance of the Departmental Representative.
- .7 The quality management plan (QMP) is separated into three control phases defined as follows:
 - .1 QMP Quality Planning.
 - .2 QMP Quality Control.
 - .3 QMP Quality Assurance.
- .8 Coordination of the three (3) control phases is the responsibility of the Contractor's QC manager.

1.5 QMP : PLANNING FOR QUALITY

- .1 Develop, organize and implement, if required, procedures and instructions to describe how the quality assurance will be performed.
- .2 Must meet all of the contractual specifications, the schedule and the applicable standards and codes requirements.
- .3 Maintain an effective system for the verification and validation of shop drawings.
- .4 Achieve the revised "As Built" drawings by ensuring that they meet the requirements of the contract.
- .5 Establish an inspection report system (in list form) that demonstrates and confirms that all items have been inspected. Compile the results accurately; join the test certificates and other required documents.
- .6 Provide specialized inspection by an independent firm for work with a high level of risk.
- .7 Maintain procedures and records that verify and confirm that the purchased materials meet the specified standards.

- .8 Develop a procedure for reporting deficiencies to identify nonconformities. The procedure should include a verification process to correct non-conformities and reactivate the inspection process. All non-compliance reports must be provided daily to the Contractor's superintendent and the Departmental Representative.
- .9 The QMP must be submitted to the Departmental Representative for review and comment prior to the commissioning and installation of each component of the work.
- .10 Prepare and submit reports on the overall progress in connection with the QMP on a weekly basis. QMP weekly report must cover all aspects of the plan and identify progress for the current week and plan activities for the next week. Send these reports to the Departmental Representative and the Contractor's superintendent.

1.6 QMP : QUALITY CONTROL

- .1 Quality control is the part of the QMP which focuses on the quality requirements of the project. The control consists in the process and procedures to ensure the quality of the work performed by the Contractor.
- .2 Once the QMP is prepared and approved for each segment of the work, complete and document the following:
 - .1 Verify that the materials and/or equipment comply with the shop drawings, technical specifications and approved samples.
 - .2 Verify that the equipment and manpower to do the work are suitable and qualified.
 - .3 Verify that the work has been prepared according to the rules of good practice, the manufacturers' recommendations/instructions and the contract documents.
 - .4 Initial verification of all materials/equipment must be performed by qualified personnel.
 - .5 At any point in the process, if there is a presence of non-compliance, stop the work and produce a deficiency report. Once the non-compliance is corrected, repeat the quality control process from the beginning.
 - .6 Once the report for all project components is completed, authenticate and transmit to the Departmental Representative.

1.7 QMP : QUALITY ASSURANCE

- .1 The quality assurance segment of the QMP focuses on verifying that the requirements for the quality control of the project and that the performance criteria have been achieved. It ensures that the processes and procedures to ensure product quality and workmanship are well established and understood by the Contractor.
- .2 The coordination between the quality assurance processes of the Departmental Representative is the responsibility of the QA specialist of the Contractor.

1.8 INSPECTION

- .1 The Departmental Representative must have access to the structures. If parts of the work or works are performed outside of the site, access to this location must also be assured for the duration of the work.
- .2 In case of works that must be subject to inspections, approvals or special testing ordered by the Departmental Representative or required under local regulations to the site, make the request within a reasonable time period.
- .3 If the Contractor has backfilled or allowed to backfill a structure before it was submitted to inspections, approvals or required special testing, he must excavate the structure in question, see to the performance of inspections or tests required to satisfy the competent authorities then put the structure in its original state.
- .4 The Departmental Representative may order the inspection of any part of the structure to which the conformity with the contract documents is in doubt. If, after review, the structure in question does not comply with the requirements of the contract documents, the Contractor shall take the necessary measures to ensure the structure conforms to the specified requirements, and cover the inspection and repair costs. If the structure in question is found to comply with the contract documents, the Departmental Representative will cover the costs of the inspection and rehabilitation so incurred.
- .5 The Departmental Representative reserves the right to audit the performance of the QMP and related documentation and facilities to verify the compliance of the work.

1.9 INDEPENDANT TESTING AND INSPECTION ORGANIZATIONS

- .1 The Departmental Representative will be responsible to retain the test organisms and independent inspection services. The cost of these services will be borne by the Departmental Representative.
- .2 Provide materials required by the bodies designated to carrying out the tests and inspections.
- .3 The use of testing and inspection bodies does not relieve the Contractor from its responsibility for the execution of works according to the requirements of the contract documents.
- .4 If defects are identified during testing and/or inspections, the designated agency will require further inspection and/or additional tests to accurately define the nature and extent of these defects. The Contractor shall correct the defects and imperfections according to the Departmental Representative's guidelines, at no additional cost to the Departmental Representative, and assume the cost of tests and inspections that should be performed after these corrections.
- .5 Testing organizations and independent inspection services will be responsible for carrying out the quality control tests. Tests will be carried out, without limitation, on the following elements:
 - .1 Crushed stones material;
 - .2 Pavement;
 - .3 Bitumen;

.4 Surface marking.

- .5 The Departmental Representative may choose to arrange and pay for quality assurance testing beyond the QMP activities of the Contractor and examine all work under this contract. The Contractor shall allow access to the site as necessary to permit these tests.

1.10 SITE ACCESS

- .1 Enable testing and inspection organizations to have access to the work site as well as the workshops for the manufacturing and shaping located outside the site.
- .2 Working with these organizations and take all reasonable measures so that they have the necessary means of access.

1.11 PROCEDURE

- .1 Notify at least forty eight (48) hours in advance the appropriate testing and inspection organizations and the Departmental Representative when tests are carry out so that all parties may be present.
- .2 Submit samples and/or materials/ necessary equipment for the testing according to the requirements of the specifications, within a reasonable time and in a predetermined order so as not to delay the execution of the work.
- .3 Provide the labor and the necessary facilities for the collecting and handling of specimens and materials/equipment on the site. Also provide the space required for the storage and curing of samples.
- .4 Assist the Departmental Representative for him to get the samples for the quality assurance purposes.

1.12 REPORTS

- .1 Provide two (2) copies of the tests and inspections reports to the Departmental Representative.
- .2 Provide copies of these reports to sub-contractors responsible for the inspected or tested structures.

1.13 TESTING AND DOSAGE FORMULA

- .1 Submit the required test reports and dosage formulas in accordance of Appendix A. The results of quality control will be sent in a maximum delay of 5 hours after the execution of the pavement.

1.14 SAMPLES OF WORKS

- .1 Prepare the samples of works specifically required in the specifications. The requirements of the present section apply to all sections of the specifications under which it is asked to provide samples of works.
- .2 Construct samples of works at locations approved by the Departmental Representative.
- .3 Prepare samples of works for the approval by the Departmental Representative within a reasonable time and in a predetermined order, so as not to delay the execution of the work.

- .4 A delay in the preparation of samples of works cannot constitute a sufficient reason for an extension of time for completion of the work and no such request will be accepted.
- .5 If necessary, the Departmental Representative will help the Contractor establish a timetable for the preparation samples of samples of work.
- .6 Remove samples at the completion of the work or when instructed by the Departmental Representative.

1.15 PLANT TRIALS

- .1 Submit the certificates of the factory performed tests that are prescribed in the various sections of the specifications.

1.16 MATERIALS, EQUIPMENTS AND SPECIAL DAILY INSPECTIONS

- .1 Submit the mechanical and electrical systems' balancing reports.
Crushing Unit
- .2 Before the work begins, the Contractor must retain the services of a specialized inspector to inspect the paving factory that will be used by the Contractor's supplier. The inspector will make a first joint visit with the Departmental Representative and review the entire paving manufacturing process to be used for this mandate. Following this first visit, the inspector appointed by the Contractor shall provide the Contractor and the Departmental Representative with a written report summarizing his observations on the status of the various components of the plant and the manufacturing operations, warehousing and weighing of the paving. The report will also contain the recommendations deemed necessary to ensure maximum consistency in the quality of the paving mixture and continuity in the production for the duration of the contract. Here is a list of checks that need to be made by the Inspector appointed by the contractor:
 - .1 Status of the bitumen and calibration pumps;
 - .2 Flange condition;
 - .3 Elevator condition;
 - .4 Burner system condition;
 - .5 Silos sealing;
 - .6 Thermometers' calibration;
 - .7 Results of the testing on samples taken during the 2015 and 2016 seasons;
 - .8 Plant compliance certificate;
 - .9 History maintenance and calibrations performed during the last two (2) years.
- .3 At the joint visit, the inspector shall conduct any verification deemed relevant by the Departmental Representative.
- .4 Following receipt of the report from the inspector, the Contractor shall proceed with the implementation of all the inspector's recommendations and must send a copy of the report to the Departmental Representative. The Contractor shall notify the Departmental Representative and his inspector when the upgrade of the plant is completed. A second

joint visit will take place at the plant to see the improvements that have been made and the test the results obtained on the mixtures, in the last two months. The Contractor shall demonstrate that its plant is in good condition and that all measures have been taken to manufacture a mix of consistent quality and the risk of breakage is minimized given the good condition of the plant. A maintenance plan must be prepared by the Contractor and submitted to the Departmental Representative.

Part 2 Products

- .1 Not used.

Part 3 Execution

3.1 QUALITY CONTROL ORGANIZATION

- .1 Quality control manager (QM)
 - .1 The QM will implement and manage the Contractor's QMP. No construction work or testing may be performed unless the QM is present on the work site.
 - .2 The QM is required to attend project kick off meetings, QMP Meetings, Coordination and Mutual Understanding Meeting, conduct the QMP Meetings, perform the three phases of control, perform submittal review and approval, confirm testing is performed and provide QC certifications and documentation required in this Contract. The QM is responsible for managing and coordinating the three phases of control and documentation performed by the QC Specialists, testing laboratory personnel and any other inspection and testing personnel required by this Contract. The QM is the manager of all QC activities.
 - .3 The individual must be familiar with the requirements and have experience in the areas of hazard identification and safety compliance.
 - .4 The QM is responsible to collect, coordinate and compile the elements of the QMP that will be executed by the Contractor and his sub-contractors.
 - .5 The QM is responsible to manage the performance of the sub-contractors and ensure adherence to the QMP. In addition, the QM will perform quality audits on those portions of the QMP that are executed by sub-contractors and report on their compliance as part of the QMP Reporting to the Departmental Representative.

3.2 QUALITY MANAGEMENT PLAN (QMP)

- .1 Provide, for acceptance by the Departmental Representative, a Construction QMP submitted in a three-ring binder that includes a table of contents, with major sections identified with tables, with pages numbered sequentially, and that documents the proposed method and responsibilities for accomplishing commissioning activities during the construction of the project: The QMP shall include the following :
 - .1 QC Organization: A chart showing the QC organizational structure.

- .2 Duties, Responsibility and Authority of QMP Personnel: Duties, responsibilities, and authorities of each person in the QC organization.
- .3 Outside Organizations: A listing of outside organizations, such as consulting engineering firms, QC testing firms and laboratories which will be employed by the Contractor and a description of the services these firms will provide.
- .4 Appointment Letters: Letters signed by an officer of the firm appointing the QM and stating that they are responsible for implementing and managing the QC Program as described in the Contract. Include in letters the responsibilities of the QM to implement and manage the three phases of control, and their authority to stop Work which is not in compliance with the Contract. Letters of direction are to be issued by the QM to all other QC Specialists outlining their duties, authorities, and responsibilities. Include copies of the letters in the QC Plan.
- .5 Submittal Procedures and Initial Submittal Register: Procedures for reviewing, approving and managing submittals. Provide the name(s) of the person(s) in the QC organization authorized to review and certify submittals prior to approval.
- .6 Testing Laboratory Information: Testing laboratory certification and description of investigative responsibilities to be implemented.
- .7 Testing Plan and Log: A testing plan and log that includes the tests required, referenced by the specification paragraph number requiring the test, the frequency, and the person responsible for each test.
- .8 Procedures to Complete Rework Items: Procedures to identify, record, track, and complete rework items.
- .9 Documentation Procedures:
 - .1 List of Definable Activities: A definable activity (DA) is a task that is separate and distinct from other tasks and has control requirements and work crews unique to that task. A DA is identified by different trades or disciplines and is an item or activity on the construction schedule. Include in the list of DAs, but not be limited to, all critical path activities. Include all activities for which this specification required QC specialists or specialty inspection personnel.
 - .2 Procedures for Performing the Three Phases of Control: Identify procedures used to ensure the three phases of control to manage the quality on this project. For each DA, a Preparatory and Initial Phase checklist will be filled out during the Preparatory and Initial Phase meetings. Conduct the Preparatory and Initial Phases and meetings with a view toward obtaining quality construction by planning ahead and identifying potential problems for each DA.
 - .3 Checklists: Checklists must be created for each DA. The input for the checklists must be extracted from the contract documents, and the industry and DND standards referenced therein. These checklists will form the backbone of the QMP documentation.

3.3 COORDINATION AND MUTUAL UNDERSTANDING MEETING

- .1 Prior to submission of the QMP, the QM will meet with the Departmental Representative to discuss the QMP requirements of this Contract. The purpose of this meeting is to develop a mutual understanding of the QMP requirements prior to plan development and submission.
- .2 The purpose of this meeting is to develop a mutual understanding of the QMP details, including documentation, administration for on-site and off-site work, design intent, environmental requirements and procedures, coordination of activities to be performed, and the coordination of the Contractor's management, production and QMP personnel. At the meeting, the QM will be required to explain in detail how three phases of control will be implemented for each DA.
- .3 The QM will coordinate activities included in various sections to assure efficient and orderly installation of each component. Coordinate operations included under different sections that are dependent on each other for proper installation and operation.
- .4 As a minimum, the Contractor's personnel required to attend include the Project Manager, Project Superintendent, QM, and subcontractor representatives. Each Subcontractor who will be assigned QC responsibilities must have an authorized representative of the firm at the meeting. Minutes of the meeting will be prepared by the QM and signed by the Contractor and the Departmental Representative. Provide a copy of the signed minutes to all attendees and include in the QMP.
- .5 If a new QM is appointed, the Coordination and Mutual Understanding Meeting will be repeated.

3.4 PROGRESS REPORT OF THE QMP

- .1 After the start of construction, conduct weekly QMP progress report in conjunction with Departmental Representative Construction Progress Meeting. The Contractor QM will prepare the minutes of the progress report and provide a copy to the Departmental Representative within two (2) working days to include into the minutes of the Construction Progress meeting. As a minimum, accomplish the following at each meeting:
 - .1 Review the minutes of the previous reports.
 - .2 Review the schedule and the status of work and rework.
 - .3 Review the status of submittals.
 - .4 Review the Work to be accomplished in the next two (2) weeks and the related documentation required.
 - .5 Resolve QC and construction problems.
 - .6 Address the items that may require revising the QMP.

3.5 THREE PHASES OF CONTROL

- .1 The Three Phases of Control are: Quality Planning, Quality Control and Quality Assurance. The Quality Planning Phase is intended to ensure that the Contractor reviews, verifies and is effectively prepared to execute the work.

The Quality Control Phase is intended to ensure that the Contractor initiates and executes the work in accordance with the Contract requirements. The Quality Assurance Phase is intended to ensure that all work, testing and documentation are complete and compliant. QM will cover both on-site and off-site work with the Three Phases of Control.

- .2 Quality Planning Phase: QMP progress report will be conducted by the QM and attended by the subcontractor QC personnel, the Project Superintendents and the CM. When a DA is performed by a subcontractor, that subcontractor's foreman shall attend the planning phase meeting. Document the results of the planning phase actions in the daily contractor QMP report and in the Planning Phase checklist. Perform the following prior to beginning Work on each DA:
 - .1 Review each paragraph of the applicable specification sections and extract metrics from the technical specifications and the referenced standards.
 - .2 Assemble the metrics into comprehensive checklists for use for each time a DA is executed.
 - .3 Review the Contract drawings.
 - .4 Ensure that field measurements are as indicated on construction and/or shop drawings before confirming product orders.
 - .5 Ensure that appropriate shop drawings and submittals for material and equipment have been submitted and approved. Verify receipt of approved factory test results, when required.
 - .6 Review the testing plan and ensure that provisions have been made to provide the required QC testing.
 - .7 Examine the work area to ensure that the required preliminary work has been completed.
 - .8 Coordinate the schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
 - .9 Arrange for the return of shipping/packaging materials, such as wood pallets, where economically feasible.
 - .10 Ensure that the required materials, equipment and sample work are on hand and conform to the approved shop drawings and submitted data.
 - .11 Discuss specific controls and construction methods used, construction tolerance, workmanship standards, and the approach that will be used to provide quality construction by planning ahead and identifying potential problems for each DA.
 - .12 Review and verify that applicable safety requirements are met, and that required Material Safety Data Sheets (MSDS) are submitted.
 - .13 Complete applicable compliance checklists.
- .3 Quality Control Phase: QM will notify the Departmental Representative at least two (2) work days in advance of each quality control phase. When construction crews are ready to start work on a DA, conduct the quality control phase with (the QC specialists) the project Superintendent, and the foreman responsible for that DA.

Observe the initial segment of the DA to ensure that the work complies with the Contract requirements. Document the results of the initial phase in the weekly QC Report and in the quality control phase checklists. Repeat the quality control phase for each new crew to work on-site, or when acceptable levels of specified quality are not being met. Perform the following for each DA:

- .1 Establish the quality of workmanship required.
 - .2 Resolve conflicts.
 - .3 Confirm testing is performed by the approved laboratory.
 - .4 Check to confirm all applicable safety requirements are met.
 - .5 Provide complete applicable checklists for each DA.
- .4 Quality Assurance Phase: QM will verify with the Departmental Representative that QA has correlated QC results as frequently as necessary, until the completion of each DA and document in the daily QMP Report:
- .1 Confirm work is in compliance with Contract requirements.
 - .2 Maintain the quality of workmanship required.
 - .3 Confirm testing is performed by the approved laboratory.
 - .4 Confirm rework items are being corrected, if required.
 - .5 Confirm the manufacturers' representatives have performed the necessary inspections on products delivered and to ensure safety.
 - .6 Confirm that the quality checklists for each DA is completed and filed.
- .5 Continuous Improvement: QM will conduct additional quality planning and quality control phases on the same DA if the quality of on-going work is unacceptable, if there are changes in the applicable QC organization, if there are changes in the on-site production supervision or work crew, if the Work on a DA is resumed after substantial period of inactivity, or if other problems develop.
- .6 Incorporate any 'lessons learned' or modifications into the QMP identified as a result of the Continuous Improvement as part of the Quality Assurance Phase.

3.6 QC TESTING

- .1 Except as stated otherwise in the specification sections, perform sampling and testing under this Contract.
- .2 Construction materials testing must be provided by an accredited laboratory and will be required to submit a copy of the Certification of Accreditation and Scope of Accreditation. The policy applies to the specific laboratory performing the actual testing, not just the Corporate office.
- .3 The Departmental Representative retains the right to check laboratory equipment in the proposed laboratory and the laboratory technician's testing procedures, techniques, and other items pertinent to testing, for compliance with the standards set forth in the contract.

- .4 QM will cite applicable Contract requirements, tests or analytical procedures used. Provide actual results and include a statement that the item tested or analyzed conforms or fails to conform to specified requirements. If the item fails to conform, notify the Departmental Representative immediately.
 - .1 Conspicuously stamp the cover sheet for each report in large red letters.
 - .2 Provide the Departmental Representative with a proposed remedial action plan to correct failure instances within twenty four (24) hours.
- .5 The QM will provide the signed reports and certifications of field tests at the end of each work day to the Departmental Representative. Attach a copy of the summary report summarizing submissions to the weekly Contractor QMP report.

3.7 DOCUMENTATION

- .1 The QM will maintain current and complete records of on-site and off-site QMP operations and activities.
- .2 The reports are required for each day that Work is performed and must be attached to the QMP weekly report. Account for each calendar day throughout the life of the contract. Every space on the forms must be filled in. Use N/A if nothing can be reported in one of the spaces. The Project Superintendent and the QM must prepare and sign the QMP Reports which are to be submitted weekly. The reporting of Work must be identified by terminology consistent with the construction schedule. Include in the reports pertinent information such as directions received, problems encountered during construction, work progress, conflicts or errors in the drawings or specifications, field changes, safety hazards encountered, instruction given and corrective actions taken, delays encountered and a record of visitors to the work site, quality control problem areas, deviations from the QMP, construction deficiencies encountered, meetings held. For each entry in the report(s), identify the schedule DA that is associated with the entered remark.
- .3 The QM will establish and maintain the following in a series of three ring binders. Divide and tab the binders as shown below. These binders must be readily available to the Departmental Representative during all business hours and must contain the following:
 - .1 All completed Quality Planning, Control and Assurance Phase Checklists, arranged by specification section.
 - .2 All milestone inspections, arranged by the DA.
 - .3 An up-to-date copy of the Testing Plan and Log with supporting field test reports, arranged by specification section.
 - .4 Copies of all contract modifications, arranged in numerical order. Also include documentation that modified work was accomplished.
 - .5 An up-to-date copy of the Rework Items List.
- .4 Reports are required for each day that work is performed in their area of responsibility. QC Specialist or subcontractor reports must include the same documentation requirements as the QMP Report for their area of responsibility. These reports are to be prepared, signed and dated by the QC Specialists or subcontractor and attached to the weekly QMP report.

- .5 As tests are performed on site the QM will report and record on their results.
- .6 The QM must maintain a list of work that does not comply with the Contract, identifying what items need to be reworked, the date the non-compliance of the item was originally discovered, the date the item will be corrected by, and the date the item was corrected. There is no requirement to report a rework item that is corrected the same day it is discovered. Attach an updated copy of the list to the weekly QMP Report.
- .7 The QM is required to ensure that « as-built » drawings are kept current on a daily basis.

END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

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

1.2 INSTALLATION AND REMOVAL

- .1 Prepare a site plan showing the proposed location and dimensions of the area which must be fenced and used by the Contractor, the number of required construction trailers, the access routes to the fenced area and details of Installation of the fence.
- .2 Identify areas that need to be covered with gravel to prevent sludge deposits.
- .3 Indicate any additional zone or transit zone.
- .4 Supply, implement or develop the construction of facilities necessary for the performance of work in the shortest time.
- .5 Remove from site all such work after use.

1.3 SITE STORAGE/LOADING

- .1 Confine work and operations inside limits indicated in Contract Documents. Do not unreasonably encumber the site with material and equipment.
- .2 Do not load or permit to load any part of Work with a weight or force that will endanger the Work.

1.4 CONSTRUCTION ACCESS ROADS

- .1 Provide and maintain adequate access roads to project site.
- .2 If authorized to use existing roads for access to project site, maintain such roads in good condition for duration of Contract. Repair damage resulting from Contractors' use of roads.
- .3 Clean runways and taxi areas used by Contractor's equipment.

1.5 SECURITY

- .1 If necessary, provide and pay for recognized security personnel to guard site and contents of site after working hours and during holidays.
- .2 The contractor will provide a permanent security personnel for the access control in the air central area.

1.6 COMMUNICATION

- .1 Supply to Departmental Representative 2 cellular phones for the duration of the works and charger to the escort personal for communication between contractor, the escort and the Departmental Representative. Provide an internet line and photocopy.

1.7 OFFICE OF THE DEPARTMENTAL REPRESENTATIVE

- .1 The office will be installed in air area, as indicated by Transports Canada.
- .2 Set up an office that is ventilated, heated to 22 degrees Celsius, equipped with fixtures allowing a lighting level of 750 lux and sufficiently large for holding site meetings, and including a table for spreading out drawings.
- .3 Provide a complete and well-marked first-aid kit and store it in an easily accessible location.
- .4 If necessary, the sub-contractors must install their own office. Indicate to them where they can locate it.
- .5 Office of the Departmental Representative:
 - .1 Arrange a temporary office for the Departmental Representative that is separated from the Contractor's office;
 - .2 The office must measure inside at least 5 m long x 3 m wide x 2.4 m high, and contain a floor located 0.3 m above the ground, 4 windows that open 50% and a door that locks.
 - .3 The office must be well insulated and equipped with a heating system ensuring an ambient temperature of 22 degrees Celsius.
 - .4 The walls and ceiling must be fitted with plywood panels, hardboard panels or drywall plates, then painted according to the colours selected. The floor must be covered with plywood panels 19 mm thick.
 - .5 The office must be equipped with an electrical lighting system providing a light level of 750 lux, the fixtures used must be of the commercial type, with direct lighting and 10% of the light directed above, flush mounted and fitted with a reflector.
 - .6 Install a private toilet near the office with either a chemical or flush toilet, a sink and a mirror and a supply of paper towels and toilet paper.
 - .7 Furnish the office with a table 1 m x 2 m, 4 chairs, three chairs, three 1 m x 2 m desks, shelves 300 mm wide, for a total length of 6 m, a three-drawer filing cabinet, a drawing stand and a coat rack, with a shelf.
 - .8 All costs of supply, installation, maintenance and demobilization will be included in the item of the schedule.
- .5 Trailer of the Departmental Laboratory:
 - .1 Provide and / or develop a site laboratory no later than one (1) week after contract award, at the location designated by the Departmental Representative.
 - .1 Install a 3.0 m x 8.0 m trailer on blocks of wood or concrete.
 - .2 Power the trailer of electricity (115/230 volts) necessary.
 - .3 Power the trailer with drinking water (minimum reservoir of 400 litres) with sink and counter.

- .4 Construct a concrete base 0.6 m x 0.6 m variable height from 1.2 m to 1.8 m where indicated.
- .5 Provide the trailer with a staircase.
- .6 Install a telephone in the trailer and pay for it (except long distance calls).
- .7 Disconnect all these services at the end of the project and clean the premises.
- .8 All costs of providing installation, maintenance and dismantling will be included in the item of the schedule.
- .9 Conference room for 10 persons.
- .10 Protection of windows with metallic grating.

1.8 VEHICLES FOR USE BY DEPARTMENTAL REPRESENTATIVES

- .1 The Contractor shall provide and maintain for the exclusive use of the Departmental Representative and the escort of 2 vehicles in 2018 and 3 vehicles in 2019-2020, pick-up or SUV vehicles in good condition for the duration of the works.
- .2 The Contractor shall assume all costs associated with the mechanical maintenance of vehicles, supply of gasoline, cleaning, etc.

1.9 EQUIPMENT, TOOL AND MATERIALS STORAGE

- .1 Provide and maintain, in a 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 a manner to cause least interference with work activities.

1.10 SANITARY FACILITIES

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
- .2 Post notices and take such precautions as required by local health authorities. Keep area and premises in good sanitary condition.

1.11 POWER

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

1.12 WATER SUPPLY

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

1.13 SIGN FOR RESTRICTED AREAS

- .1 Conform to section 01 35 13.13 – Airports in Use, concerning temporary signs during construction.

1.14 TEMPORARY LIGHTNING

- .1 For works executed in night, supply the lightning equipment's in sufficient number and quality to permit the realization of the works and in security. The main equipments as pavers, compactor, VTM vehicle will have a lighting ball with Del lamps.
- .2 Lighting tours will be installed at the crusher and asphalt plant.

1.15 CLEANING

- .1 Evacuate daily of the work, debris, garbage and wrapping materials.
- .2 Remove mud and dust off the pavement.
- .3 Store materials recuperated from demolition.
- .4 Do not store on site new or recuperated materials.

1.16 PROJECT PANEL OF WORKS

- .1 The contractor will provide and installation of a project panel of works at a site determined by the director of airport. This panel will be the dimensions 1200 x 2400 x 19 mm.
- .2 Transport Canada will provide the sticky layer film.

1.17 MESUREMENT FOR PAYMENT

- .1 All costs for this section are included in different tender items.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 TEMPORARY MEANS OF MEANS OF EROSION AND SEDIMENT

- .1 Establish temporary means to fight against erosion as erosion barriers arranged transversely in rivers and foot slope.
- .2 If necessary, arrange upstream sedimentation basins of rivers to intercept airborne particles entrained by runoff surfaces.
- .3 Protect with tarpaulins or other device acceptable to the ministry representative, granular materials deposits exposed to erosion by wind.
- .4 The use of blind calcium chloride-based dust is not allowed.
- .5 Inspect control methods implemented in the maintenance and repair as required until permanent vegetation has established.

- .6 Remove the means to fight at the right time and restore and stabilize areas disturbed during the work.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 - Common Work Results - Electrical
- .2 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings
- .3 Section 26 05 43.01 - Installation of Cables in Trenches and in Ducts
- .4 Section 34 43 05 - Common Work Results for Airfield Lighting
- .5 Section 34 43 13.13 - Runway Identification Lights
- .6 Section 34 43 13.15 - Airfield Illuminated Guidance Signs
- .7 Section 34 43 13.17 - Elevated Edge Lighting for Airport Runways

1.2 REFERENCE STANDARDS

- .1 Within text of each specifications section, reference may be made to reference standards.
- .2 Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .3 If there is question as to whether products or systems are in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.
- .4 Cost for such testing will be borne by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.3 QUALITY

- .1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.
- .3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .4 Should disputes arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.
- .5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.

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

1.4 AVAILABILITY

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- .2 In event of failure to notify Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Departmental Representative reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.5 STORAGE, HANDLING AND PROTECTION

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .6 Store sheet materials, lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .8 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.
- .9 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.6 TRANSPORTATION

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

1.7 MANUFACTURER'S INSTRUCTIONS

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

- .2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative will establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.

1.8 QUALITY OF WORK

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately Departmental Representative if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.

1.9 CO-ORDINATION

- .1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.10 REMEDIAL WORK

- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.
- .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.11 LOCATION OF FIXTURES

- .1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.
- .2 Inform Departmental Representative of conflicting installation. Install as directed.

1.12 FASTENINGS

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
- .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 material to which anchorage is made are not acceptable.

1.13 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.

1.14 EXISTING UTILITIES

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work and airport operation.
- .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 NOT USED

- .1 Not used.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

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

1.2 SURVEY REFERENCE POINTS

- .1 Existing base horizontal and vertical control points are designated on drawings.
- .2 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.
- .3 Make no changes or relocations without prior written notice to Departmental Representative.
- .4 Report to Departmental Representative when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
- .5 Require surveyor to replace control points in accordance with original survey control.

1.3 SURVEY REQUIREMENTS

- .1 Establish lines and levels, locate and lay out, by instrumentation.
- .2 Establish lines and levels for mechanical and electrical work.

1.4 EXISTING SERVICES

- .1 Before commencing work, establish location and extent of service lines in area of Work and notify Departmental Representative of findings.
- .2 Remove abandoned service lines within 2m of structures. Cap or otherwise seal lines at cut-off points as directed by Departmental Representative.

1.5 LOCATION OF EQUIPMENT AND FIXTURES

- .1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.
- .2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.
- .3 Inform Departmental Representative of impending installation and obtain approval for actual location.
- .4 Submit all drawings of location, including the proposed networks, as indicated by DCC representative.
- .5 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

1.6 RECORDS

- .1 Maintain a complete, accurate log of control and survey work as it progresses.
- .2 On completion of foundations and major site improvements, prepare a certified survey showing dimensions, locations, angles and elevations of Work.
- .3 Record locations of maintained, re-routed and abandoned service lines.

1.7 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit name and address of Surveyor to Departmental Representative.
- .2 On request of Departmental Representative, submit documentation to verify accuracy of field engineering work.
- .3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform [and do not conform]with Contract Documents.

1.8 SUBSURFACE CONDITIONS

- .1 Promptly notify Consultant in writing if subsurface conditions at Place of Work differ materially from those indicated in Contract Documents, or a reasonable assumption of probable conditions based thereon.
- .2 After prompt investigation, should Consultant determine that conditions do differ materially; instructions will be issued for changes in Work as provided in Changes and Change Orders.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

1.2 REFERENCES

- .1 Not Used.

1.3 PROJECT CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Owner or other Contractors.
- .2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
- .3 Clear snow and ice from work areas, bank/pile snow in designated areas only.
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5 Dispose of waste materials and debris authorised at designated dumping areas.
- .6 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .7 Provide on-site containers for collection of waste materials and debris.
- .8 Remove waste material and debris from site at end of each working day.
- .9 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .10 Provide and use marked separate bins for recycling. Refer to Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .11 Runway and taxiway used by Contractor must be cleaned. Cleaning operations must be done in continuous for areas used by aircrafts and once a day for others areas.

1.4 FINAL CLEANING

- .1 At the end of each day, remove surplus products, tools, construction machinery and equipment disposed in the air area.
- .2 Prior to final review remove surplus products, tools, construction machinery and equipment.
- .3 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris in compliance with applicable laws and regulations and subject to approval from the band council.
- .5 Clean lighting reflectors, lenses, and other lighting surfaces.

- .6 If construction vehicles are allowed to use movement area, Contractor will keep on site all cleaning equipments needed to maintain movement area cleaned to the departmental representative's satisfaction.
- .7 Daily and before re opening movement areas, an inspection will be done with Transport Canada escort .If needed, Contractor will do more cleaning to Transport Canada satisfaction.
- .8 Clean tracks, lanes and aprons that have been used by the Contractor's vehicles. The cleaning must be continuous for the areas used by the aircraft and daily for the others, as well as the removal of the dust.

A joint inspection will be conducted with the Departmental Representative, the Contractor and the airport operator on a daily basis prior to the reopening of the facilities to airport operations.

The Contractor shall immediately carry out all the cleaning and restoration operations required.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Disposal of waste in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.6 FINAL CONSTRUCTION SITE CLEANUP AND LEVELLING

- .1 Final levelling includes the touch-ups required to ensure that the profiles fully conform to shoulder of runway and taxiway and the work required to clean and restore the sites.
- .2 Shape the flare points on each shoulder of the runway. The flare points shall be perfectly straight and parallel to the runway centreline and shall comply with the theoretical dimensions indicated on the plans.

1.7 PAYMENT METHOD

- .1 Cleaning
 - .1 Cleaning costs are included in tender unit prices.
- .2 Waste management and disposal
 - .1 Waste management and disposal costs are included in overheads.
- .3 Final construction site cleanup and levelling
 - .1 The prices indicated are global prices. A global payment will be made once all the work has been approved by the Departmental Representative
 - .2 When supporting materials are required to fill depressions as directed by the Departmental Representative, these materials are paid as per contract unit prices provided they do not replace excavated, moved or contaminated materials as part of the execution of the Work.

Part 2 Products

2.1 EQUIPMENTS

- .1 Refer to sections 32 01 16.13 and 32 12 16.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

The Contractor must make the evacuation out of the community by sea transport to a site recognized and approved by the Ministry of Environment of all surplus materials, such as barrels for the transport of bitumen and the containers of clogging product residues, paint or other materials.

Also, all the equipment must be demobilized after the execution of the works.

1.1 WASTE MANAGEMENT GOALS

- .1 Prior to start of Work conduct meeting with Departmental Representative to review and discuss PWGSC's Waste Management Plan and Goals.
- .2 Accomplish maximum control of solid construction waste.
- .3 Preserve environment and prevent pollution and environment damage.

1.2 RELATED REQUIREMENTS

- .1 All quote sections whose work is likely of generated waste.

1.3 DEFINITIONS

- .1 Class III: non-hazardous waste - construction renovation and demolition waste.
- .2 Cost/Revenue Analysis Workplan (CRAW): based on information from WRW, and intended as financial tracking tool for determining economic status of waste management practices.
- .3 Demolition Waste Audit (DWA): relates to actual waste generated from project.
- .4 Inert Fill: inert waste - exclusively asphalt and concrete.
- .5 Materials Source Separation Program (MSSP): consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.
- .6 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.
- .7 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .8 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- .9 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:
 - .1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
 - .2 Returning reusable items including pallets or unused products to vendors.

- .10 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .11 Separate Condition: refers to waste sorted into individual types.
- .12 Source Separation: acts of keeping different types of waste materials separate beginning from first time they became waste.
- .13 Waste Audit (WA): detailed inventory of materials in building. Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project. Indicates quantities of reuse, recycling and landfill. Refer to Schedule A.
- .14 Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.
- .15 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. Refer to Schedule B. WRW is based on information acquired from WA (Schedule A).

1.4 DOCUMENTS

- .1 Maintain at job site, one copy of the following document:
 - .1 Construction demolition waste management and disposal plan.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit non-hazardous waste management and disposal plan identifying methods and sites for disposal of solid waste and clearing debris (Section 35 42 60) and the disposal of existing culverts to be replaced (Section 33 42 13).

1.6 DISPOSAL OF WASTES

- .1 Do not bury rubbish or waste materials.
- .2 Do not dispose of waste, volatile materials, mineral spirits, oil, paint thinner into waterways, storm, or sanitary sewers.
- .3 Keep records of construction waste including:
 - .1 Number and size of bins;
 - .2 Waste type of each bin;
 - .3 Total tonnage generated.
- .4 Remove materials from deconstruction as deconstruction/disassembly Work progresses.
- .5 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in pre-demolition material audit.
- .6 Dispose waste at an authorized site.

1.7 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises.

1.8 SCHEDULING

- .1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 APPLICATION

- .1 Execute work in compliance with plans and specifications and the waste disposal and management plan.
- .2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

3.2 CLEANING

- .1 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.
- .2 Clean-up work area as work progresses.

3.3 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT

- .1 Ministère de l'Environnement et de la Faune, siège social 150, boul. René-Lévesque Est, Québec (Québec) G1R 3P4.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 45 00 - Quality Control
- .2 Section 26 05 00 - Common Work Results – Electrical
- .3 Section 31 00 00.01 - Topographic Joint Survey
- .4 Section 31 05 16 - Aggregate Materials
- .5 Section 32 12 16 - Asphalt Paving
- .6 Section 34 43 05 - Common Work Results for Airfield Lighting
- .7 Section 34 43 13.17 - Airfield Elevated Edge Lighting

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-warranty Meeting:
 - .1 Convene meeting one week prior to contract completion with Departmental Representative, in accordance with Section 01 31 19- Project Meetings to:
 - .1 Verify Project requirements.
 - .2 Review warranty requirements and manufacturer's installation instructions.
 - .2 Departmental Representative to establish communication procedures for:
 - .1 Notifying construction warranty defects.
 - .2 Determine priorities for type of defects.
 - .3 Determine reasonable response time.
 - .3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.
 - .4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, four final copies of operating and maintenance manuals. Electronic and prints.
- .3 Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.
- .4 Provide evidence, if requested, for type, source and quality of products supplied.

1.4 FORMAT

- .1 Organize data as instructional manual and an electronic version in PFD format of all required documents.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279mm 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 CAD files in dwg format on electronic support.

1.5 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.

1.6 AS -BUILT DOCUMENTS AND SAMPLES

- .1 Maintain, in addition to requirements in General Conditions, 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.
- .9 Maintenance and operation manual.
- .2 Store record documents and samples in field office apart from documents used for construction.
 - .1 Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.
 - .1 Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition.
 - .1 Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Departmental Representative.

1.7 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

- .1 Record information on set of opaque drawings.
- .2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress.
 - .1 Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: mark each item to record actual construction, including:
 - .1 Measured depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Changes made by change orders.
 - .6 Details not on original Contract Drawings.
 - .7 Referenced Standards to related shop drawings and modifications.

- .5 Specifications: mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.
- .6 Other Documents: maintain inspection certifications, field test records, manufacturer's certifications, required by individual specifications sections.
- .7 Provide digital photos, if requested, for site records.

1.8 FINAL SURVEY

- .1 Submit final site survey certificate in accordance with Section 01 71 00- Examination and Preparation, certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

1.9 EQUIPMENT AND SYSTEMS

- .1 For each item of equipment and each system include description of unit or system, and component parts.
 - .1 Give function, normal operation characteristics and limiting conditions.
 - .2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.
 - .1 Include regulation, control, stopping, shut-down, and emergency instructions.
 - .2 Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing schedule.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's co-ordination drawings, with installed colour coded diagrams.
- .12 Provide charts tag numbers, with location and function of each equipment, keyed to flow and control diagrams.

- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports as specified in Section 01 45 00- Quality Control.
- .15 Additional requirements: as specified in individual specification sections.
- .16 At the end of the Work, a specific document must be submitted detailing the maintenance tasks to be carried out on the newly installed equipment.

1.10 MAINTENANCE MATERIALS

- .1 Spare Parts:
 - .1 Provide spare parts, in quantities specified in sections 34 43 05 and 34 43 13.17. Provide spare parts to replace those damaged during dismantling. Use a replacement rate of 30%. Spare parts not required to replace damaged parts will be delivered to the Departmental Representative.
 - .2 Provide items of same manufacture and quality as items in Work.
 - .3 Deliver to site; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.
 - .5 Obtain receipt for delivered products and submit prior to final payment.
- .2 Special Tools:
 - .1 Provide special tools, in quantities specified in individual specification section.
 - .2 Provide items with tags identifying their associated function and equipment.
 - .3 Deliver to site; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.

1.11 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 Remove and replace damaged products at own expense and for review by Departmental Representative.

1.12 WARRANTIES AND BONDS

- .1 Develop warranty management plan to contain information relevant to Warranties.

- .2 Submit warranty management plan, 30days before planned pre-warranty conference, to Departmental Representative approval.
- .3 Warranty management plan to include required actions and documents to assure that Departmental Representative receives warranties to which it is entitled.
- .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
- .5 Assemble approved information in binder, submit upon acceptance of work.
- .6 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.
- .7 Respond in timely manner to oral or written notification of required construction warranty repair work.
- .8 Written verification to follow oral instructions.
 - .1 Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section includes descriptions for demolishing, salvaging, recycling and removing of asphalt paving identified in whole or in part, and for backfilling trenches and excavations resulting from site demolition activities a required by scope of work.

1.2 RELATED REQUIREMENTS

- .1 Section 01 74 11 – Cleaning.
- .2 Section 01 74 21 – Construction/Demolition waste management and disposal.
- .3 Section 32 11 23 – Aggregate base courses.

1.3 PRICE AND PAYMENT

- .1 Removal of existing asphalt pavement will be measured in square metres of surface actually removed regardless of depth removed, regardless of number of operations required .
- .2 Payment under this item will include operations involved in removing, hauling and stockpiling designated pavement and cleaning of remaining pavement surface.
- .3 The removal of existing asphalt will be measured as the thickness follows:
 - .1 Reshaping asphalt pavement, thickness 10-70 mm.
 - .2 Reshaping asphalt pavement, thickness variable 5-40 mm.

1.4 REFERENCE STANDARDS

- .1 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
 - .2 Canadian Environmental Protection Act, 1999 (CEPA), c. 33.
- .2 U.S. Environmental Protection Agency (EPA) / Office of Water
 - .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.5 DEFINITIONS

- .1 Demolish: Detach items from existing construction and legally dispose of them off site, unless indicated to be removed and salvaged or removed and reinstalled.
- .2 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed, removed and salvaged, or removed and reinstalled
- .3 Draft Construction Waste Management Plan (Draft CWM Plan): Detailed inventory of materials in building indicating estimated quantities of reuse, recycling and landfill, prepared in accordance with Section 01 74 21 - Construction Waste Management and Disposal and as follows:

- .1 Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project.
- .4 Waste Management Coordinator (WMC): Contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.
- .5 Construction Waste Management Report (CWM Report): Written report identifying actual materials that formed CWM Plan for reduction, reuse, or recycling of materials prepared in accordance with Section 01 74 21- Construction Waste Management and Disposal.

1.6 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate requirements for Waste Management and Disposal for materials being re used or recycled.
 - .1 Separate materials identified for recycling place in identified areas in accordance with Waste Management Plan
 - .2 Label location of salvaged material's storage areas and provide barriers and security devices
 - .3 Remove materials that cannot be salvaged for re use or recycling and dispose of in accordance with applicable codes at licensed facilities
- .2 Pre Construction Meeting: Arrange a pre construction meeting in accordance with Section 01 31 19– Project Meetings; attended by Representative Contractor's key personnel and Consultant to discuss the following:
 - .1 Verify project requirements
 - .2 Review site conditions
 - .3 Coordination with other Subcontractor's affected by work of this Section
 - .4 Examine existing site conditions adjacent to demolition work, prior to start of Work
 - .5 Waste reporting requirements

1.7 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Action Submittals: Provide the following submittals before starting any work of this Section:
 - .1 Shop Drawings: Submit shop drawings indicating diagrams or details showing sequence of demolition work.
- .2 Informational Submittals: Provide the following submittals during the course of the work:
 - .1 Certificates: Submit copies of certified weigh bills, bills of lading or receipts from authorized disposal sites and re use and recycling facilities for material removed from site on weekly basis.
- .3 Sustainable Design Submittals:
 - .1 Erosion and Sedimentation Control: submit copy of erosion and sedimentation control plan in accordance with [Section 01 35 43 – Environmental Procedures.

- .2 Construction Waste Management: Submit project CWM Plan highlighting recycling and salvage requirements in accordance with Section 01 74 21- Construction Waste Management and Disposal.

1.8 QUALITY ASSURANCE

- .1 Regulatory Requirements: ensure Work is performed in compliance with CEAA, applicable Provincial/Territorial regulations.
- .2 Comply with hauling and disposal regulations of Authority Having Jurisdiction.

1.9 SITE CONDITIONS

- .1 Protect existing site features to remain or identified for salvage or re use; make repairs and restore to a similar condition to existing where damage to these items occurs as directed by the Consultant and at no cost to Owner:
 - .1 Remove and store salvaged materials to prevent contamination.
 - .2 Store and protect salvaged materials as required for maximum preservation of material.
 - .3 Handle salvaged materials the same as new materials.
- .2 Perform pavement removal work to prevent adverse effects to adjacent watercourses, groundwater and wildlife, and to prevent excess air and noise pollution:
 - .1 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers or onto adjacent properties.
 - .2 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with Authorities Having Jurisdiction.
- .3 Protect existing site features and structures, trees, plants and foliage on site and adjacent properties.

Part 2 Products

2.1 EQUIPMENT

- .1 Use cold milling, planning or grinding equipment with automatic grade controls capable of operating from stringline, and capable of removing part of pavement surface to depths or grades indicated.

Part 3 Execution

3.1 PREPARATION

- .1 Verify extent and location of asphalt identified for removal, disposal, alternative disposal, recycling, salvage and items to remain.
- .2 Locate and protect utilities, preserve active utilities traversing site in operating condition.

- .3 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction sediment and erosion control drawings.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
 - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- .4 Prior to beginning removal operation, inspect and verify with DCC Representative areas, depths and lines of asphalt pavement to be removed.
- .5 Protection: protect existing pavement not designated for removal, light units and structures from damage. In event of damage, immediately replace or make repairs to approval of DCC Representative at no additional cost.

3.2 REMOVAL

- .1 Remove existing asphalt pavement to lines and grades as indicated established by DCC Representative on site.
- .2 Demolition of pavements, curbs and gutters:
 - .1 Square up adjacent surfaces to remain in place by saw cutting or other method acceptable to the Representative on site.
 - .2 Protect adjacent joints and load transfer devices.
 - .3 Protect underlying and adjacent granular materials where they are exposed and identified to remain.
 - .4 Prevent contamination with base course aggregates, when removing asphalt pavement for subsequent incorporation into hot mix asphalt concrete paving.
- .3 Use equipment and methods of removal and hauling which do not damage or disturb underlying pavement.
- .4 Prevent contamination of removed asphalt pavement by topsoil, underlying gravel or other materials.
- .5 Suppress dust generated by removal process.

3.3 FINISH TOLERANCES

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

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.

- .3 Sweep remaining asphalt pavement surfaces clean of debris resulting from removal operations using rotary power brooms and hand brooming as required.
- .4 Waste Management: separate waste materials for [reuse] [recycling] in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
 - .2 Removed asphalt pavement which is to be recycled in hot mix asphalt concrete under this contract may be stockpiled at designated asphalt plant site.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 43.01 - Installation of Cables in Trenches and in Ducts.
- .2 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.2 REFERENCE STANDARDS

- .1 CSA Group
 - .1 CSA C22.1-15, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.
- .2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
 - .1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

1.3 DEFINITIONS

- .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets.
- .3 Shop drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Quebec, Canada.
 - .2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.
 - .3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
 - .4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
 - .5 If changes are required, notify Departmental Representative of these changes before they are made.
- .4 Certificates:
 - .1 Provide CSA certified material and equipment.

- .2 Where CSA certified equipment and material is not available, submit such material and equipment to inspection authorities for approval before delivery to site.
- .3 Submit test results of installed electrical systems and instrumentation.
- .4 Permits and fees: in accordance with General Conditions of contract.
- .5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.
- .5 Field Reports: submit to Departmental Representative manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.
- .6 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

1.5 CLOSEOUT SUBMITTALS

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

1.6 DELIVERY, DISMANTLING, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Dismantling
 - .1 Dismantle equipment so that it is not damaged and can be relocated.
 - .2 Provide equipment to replace those damaged during dismantling.
 - .3 Replace defective or damaged materials with new.
- .4 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect to avoid nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .5 Packaging Waste Management: remove for reuse as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 DESIGN REQUIREMENTS

- .1 Operating voltages: to CAN3-C235.
- .2 Control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
 - .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

2.2 MATERIALS AND EQUIPMENT

- .1 Provide material and equipment in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Equipment and material to be CSA certified.

2.3 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, coloured plastic tapes numbered, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.1.

2.4 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Colours: 25mm wide prime colour and 20mm wide auxiliary colour.

Type	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

2.5 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: Before decommissioning, installation or relocation of equipment, verify that conditions of items previously installed under other Sections or Contracts are acceptable
 - .1 Visually inspect items in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CAN/CSA-C22.3 No.1 except where specified otherwise.

3.3 FIELD QUALITY CONTROL

- .1 Conduct following tests in accordance with Section 01 45 00 - Quality Control.
 - .1 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
 - .3 Megger 600-5000 V circuits, feeders and equipment with a 5000 V instrument.
 - .4 Check resistance to ground before energizing.
- .2 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

3.4 SYSTEM STARTUP

- .1 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.

- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for recycling or reuse in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 - Common Work Results for Electrical.
- .2 Section 34 43 05 - Common Work Results for Airfield Lighting.

1.2 REFERENCE STANDARDS

- .1 Canadian Standards Association (CSA International)
- .1 CAN/CSA C22.2 No. 18-98(R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
- .2 CSA C22.2 No. 45-M1981(R2003), Rigid Metal Conduit.
- .3 CSA C22.2 No. 56-04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
- .4 CSA C22.2 No. 83-M1985(R2003), Electrical Metallic Tubing.
- .5 CSA C22.2 No. 211.2-M1984(R2003), Rigid PVC (Unplasticized) Conduit.
- .6 CAN/CSA C22.2 No. 227.3-05, Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product data: submit manufacturer's printed product literature, specifications and datasheets.
 - .1 Submit cable, conduits, conduit fastenings and conduit fittings manufacturing data.
- .3 Quality assurance submittals:
 - .1 Test reports: submit certified test reports.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling and reuse in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.

Part 2 Products

2.1 CABLES AND REELS

- .1 Provide cables on reels.

- .1 Mark or tag each cable and outside of each reel, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.
- .2 Each reel of cable to contain only one continuous cable without splices.
- .3 Identify cables for exclusively dc applications.
- .4 Reel and mark shielded cables rated 2,001 volts and above.

2.2 CONDUITS

- .1 Rigid PVC conduit: to CSA C22.2 No. 211.2.

2.3 CONDUIT FITTINGS

- .1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.
- .2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

- .1 Polypropylene.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 GENERAL

- .1 Existing ducts to remain.
- .2 Identify, locate and protect electrical conduits during work.

3.3 INSTALLATION

- .1 Use rigid PVC conduit underground.
- .2 Bend conduit cold:
 - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .3 Mechanically bend steel conduit over 19 mm diameter.
- .4 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

- .5 Install fish cord in empty conduits.
- .6 Remove and replace blocked conduit sections.
 - .1 Do not use liquids to clean out conduits.
- .7 Dry conduits out before installing wire.

3.4 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.

3.5 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 - Common Work Results for Electrical.
- .2 Section 31 23 33.01 - Excavating, Trenching and Backfilling.

1.2 REFERENCE STANDARDS

- .1 Insulated Cable Engineers Association, Inc. (ICEA)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for cables and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Construction Waste Management:
 - .1 Submit project Waste Reduction Work plan highlighting recycling and salvage requirements.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors, off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect cables from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 CABLE PROTECTION

- .1 Pressure treated 38 mm x 140 mm planks with water repellent preservative.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: Before decommissioning, installation or relocation of cables, verify that conditions of items previously installed under other Sections or Contracts are acceptable for cable installation.
 - .1 Visually inspect items in presence of Departmental Representative.
 - .2 Locate the cables to be retained and the cables to be relocated.
 - .3 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .4 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 DIRECT BURIAL OF CABLES

- .1 After sand bed in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling, is in place, lay cables maintaining 75mm clearance from each side of trench to nearest cable.
 - .1 Do not pull cable into trench.
- .2 Include offsets for thermal action and minor earth movements.
 - .1 Offset cables 150mm minimum for each 60m run, maintaining minimum cable separation and bending radius requirements.
- .3 Make termination and splice only as indicated leaving 0.6m minimum of surplus cable in each direction.
 - .1 Make splices and terminations in accordance with manufacturer's written recommendations using approved splicing kits.
- .4 Underground cable splices not acceptable.
- .5 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable or in accordance with manufacturer's written recommendations; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.
- .6 Cable separation:
 - .1 Maintain 75mm minimum separation between cables of different circuits.
 - .2 Maintain 300mm minimum horizontal separation between low and high voltage cables.
 - .3 When low voltage cables cross high voltage cables maintain 300mm vertical separation with low voltage cables in upper position.
 - .4 At crossover, maintain 75mm minimum vertical separation between low voltage cables and 150mm between high voltage cables.

- .5 Maintain 300mm minimum lateral and vertical separation for fire alarm and control cables when crossing other cables, with fire alarm and control cables in upper position.
- .6 Install treated planks on lower cables 0.6m minimum in each direction at crossings.
- .7 After sand protective cover specified in Section 31 23 33.01- Excavating, Trenching and Backfilling, is in place, install continuous row of indicating tape as indicated to cover length of run.

3.3 CABLE INSTALLATION IN DUCTS

- .1 Install cables as indicated in ducts. In accordance with Section 31 23 33.01- Excavating, Trenching and Backfilling.
- .2 Do not pull spliced cables inside ducts.
- .3 Install multiple cables in duct simultaneously.
- .4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.
- .5 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.
- .6 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.
- .7 After sand protective cover specified in Section 31 23 33.01 - Excavating, Trenching and Backfilling, is in place, install continuous row of indicating tape as indicated to cover length of run.
- .8 After installation of cables, seal duct ends with duct sealing compound.

3.4 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform tests using qualified personnel.
 - .1 Include necessary instruments and equipment.
- .3 Check phase rotation and identify each phase conductor of each feeder.
- .4 Check each feeder for continuity, short circuits and grounds.
 - .1 Ensure resistance to ground of circuits is not less than 50 megohms.
- .5 Pre-acceptance tests:
 - .1 After installing cable but before splicing and terminating, perform insulation resistance test with megger on each phase conductor.
 - .2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

- .6 Acceptance Tests:
 - .1 Ensure that terminations and accessory equipment are disconnected.
 - .2 Ground shields, ground wires, metallic armour and conductors not under test.
 - .3 High Potential (Hipot) Testing.
 - .1 Conduct hipot testing.
 - .4 Leakage Current Testing:
 - .1 Raise voltage in steps from zero to maximum values as specified by manufacturer for type of cable being tested.
 - .2 Hold maximum voltage for specified time period by manufacturer.
 - .3 Record leakage current at each step.
- .7 Provide Departmental Representative with list of test results showing location at which each test was made, circuit tested and result of each test.
- .8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 PROTECTION

- .1 Repair damage to adjacent materials caused by cables installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Not used

1.2 WORK COVERED BY THE PRESENT SECTION

- .1 The contractor must conduct a topographic joint survey with the departmental Representative, three (3) weeks before the start of the work.
- .2 The purpose of the topographic joint survey is to modify, if necessary, the final profiles of the runway and taxiway to the quantities of the tender form. These were optimized with the survey used in the design in September 2017. The Departmental Representative will make the adjustments deemed necessary to the elevations of the longitudinal profile as the work progresses, with updated records for each phases.

The objective is to adjust the design according to the variations caused by the thawing of the various work areas (execution phase).

1.3 REFERENCES

- .1 Ministère des Transports, de la Mobilité durable et de l'Électrification des transports du Québec
 - .1 CCDG 2017, Cahier des charges et devis généraux.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 All costs and fees relating to topographic joint survey should be included in the item of tender form titled " Construction site organization.

Part 2 Products

2.1 MATERIALS

- .1 Not used

Part 3 Execution

3.1 EXECUTION OF WORK

- .1 Evaluation and Assessment:
 - .1 Conduct a survey of meticulous joint survey of the runaway including his shoulders and taxiway.
 - .2 Use appropriate surveying equipment to achieve a precision of 1 sec in all axes.

- .3 Achieve a density of survey points sufficient to obtain a precise field model of the runaway and the taxiway (minimum grid of 10 m x 10 m for surface and 5 m x 5 m for junctions with taxiway and apron and side strips of 7.5 meter runway).

3.2 GEODESIC REFERENCE POINTS

- .1 The departmental Representative of the Department will provide to the contractor the location and coordinates of two geodetic reference markers.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Dispose of cleared and grubbed material off site daily.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse or disposal in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Sections affected by this section:
 - .1 Section 31 37 00 - Waterproof stone protective revetment - Rip-rap
 - .2 Section 32 11 16.01- Granular sub-base
 - .3 Section 31 22 16.13 – Preparation of the granular surface before recharging
- .2 The contractor must have completed the following work before beginning work covered by this section
 - .1 Section 31 00 00.01 – Topographic joint survey

1.2 WORK COVERED BY THIS SECTION

- .1 The contractor must shape, backfill, level and compact the surface of safety areas between the edge of the track and the top of lateral ditch or gutter in order to ensure surface drainage of the runoff from the runaway to the lateral ditches without accumulation of water on the surface.
- .2 Surplus and unsuitable materials must be removed to an authorized site.
- .3 The depressions must be filled by materials in place.
- .4 The contractor must borrowed granular materials form the airport reserve in the embankments of the earthwork of the safety area earthwork.

If required, the contractor must sort borrowed granular materials in order to obtain a material with an adequate granulometry for the thickness of embankments to be filled.
- .5 As shown on the plans or at the request of the departmental representative, the contractor must install a aggregate base courses layer of MG 20 b materials on the shoulders of the runway.

1.3 MEASUREMENTS AND PAYMENT

- .1 Levelling of the surface for drainage

The drainage works are paid per linear meter of pipes of that is the subject of work. Without limitation, the unit price includes surveying, pipes and setting up of landmarks, the shaping of the surface, excavation, transport, geotextile, rip-rap net, moving materials to fill depressions, the levelling of the surface, compaction and includes any incidental expenses.
- .2 Disposal of surplus and unsuitable material

The disposal of surplus and unsuitable materials for surface drainage is paid per linear meter. Without limitation, price includes loading, transport and the disposal at an authorized site, and it includes any incidental expenses.

- .3 Borrowed granular materials:
The borrowed granular materials are paid according to the specifications of the 32 11 16.01 – Borrowed granular materials. These costs are included in linear meters of drainage pipe installed.
- .4 Aggregate base courses MG 20b modified:
Aggregate base courses MG 20 material is paid per tonne of incorporated materials. Without limitation the price includes supply, loading, transport, set up, leveling, compaction, surveying, royalties and includes any incidental expenses.
- .5 Aggregate crushed stone:
Aggregate crushed stone material is paid in linear meter of drainage trench.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Co-ordination: arrange with authority having jurisdiction for relocation of buried infrastructure and conduct that interfere with execution of work.
 - .1 Pay costs of relocating services.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Erosion and Sedimentation Control: submit erosion and sedimentation control plan in accordance with section 01 35 43 – Environmental Procedures.
- .2 Construction Waste Management:
 - .1 Submit project Waste Management Plan according to section 01 35 43 – Environmental Procedures

Part 2 Products

2.1 MATERIALS

- .3 Unless otherwise indicated by departmental representative, excavated materials from section 31 23 33.00, must be disposed at the outside of security area.

Part 3 Execution

3.1 EXAMINATION

- .1 Make a joint visit with the departmental representative of the delimited areas between the edges of the runaway shoulders the top of the lateral ditches.
- .2 Identify areas where which need important work of cut and fill.
- .3 Inform the departmental representative of any problem concerning the execution of the work.

3.2 PREPARATION

- .1 Temporary erosion and sedimentation control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff according to the erosion and sediment control plan.
 - .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 Removal:
 - .1 Remove trees, stumps, logs, brush, shrubs, bushes, vines, undergrowth, rotten wood, dead plant material, exposed boulders and debris within areas designated on drawings.
 - .2 Remove stumps and tree roots below footings, slabs, and paving, and to 600 mm below finished grade elsewhere.
 - .3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.

3.2 EXECUTION

- .1 Do a topographic survey of the work zones if it has not been done in the topographic joint survey.
- .2 Install guide markers along the lateral ditches in order to ensure that the minimum slopes of the surface of the soil in the area between the edge of the runaway shoulder and the top of the lateral ditch will not fall below 1% unless otherwise indicated by the departmental representative.
- .3 In work zones excavate and have unsuitable materials such as excess soils, non-compactable soils, rocks, roots, etc.
- .4 Perform a preliminary shaping of the surface of the ground, including the cutting of the mounds and the filling the depressions.
- .5 Remove any block or rock whose diameter exceeds 100 mm from the surface of work areas and dispose of it in an authorized site.
- .6 Perform the leveling of the ground surface of the work areas using appropriate equipment approved by the departmental representative.
- .7 Fill the depressions through backfilling borrowed granular materials from the airport stock pile, level.
- .8 Compact the surface of work zones
- .9 If there is presence of depression that can lead to accumulations of water, fill these depressions with the backfilling borrowed granular materials.

- .10 The contractor must in priority use borrowed granular materials from airport reserve and the cuttings material provided in side to fill the embankments and depressions in the safety area.

3.3 BACKFILLING

- .1 Remove snow, ice, construction debris, organic soil and standing water from spaces to be filled.
- .2 Placing:
 - .1 Place backfill, fill and base course material in 150 mm lifts: add water as required to achieve specified density.
- .3 Compaction: compact each layer of material to following densities:
 - .1 To underside of base courses: 95%.
 - .2 Base courses: 95%.
 - .3 Elsewhere: 90%.

3.4 GRADING

- .1 Grade so that water will drain to lateral ditches.
 - .1 Grade to be gradual between finished spot elevations shown on drawings.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Dispose of cleared and grubbed material off site daily.
- .2 Daily Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: dispose waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 This section covers the calculation parameters to use for correcting maximum density in order to take into account aggregates with dimensions greater than 20 mm.

1.2 RELATED REQUIREMENTS

- .1 Section 31 05 16 - Aggregate materials
- .2 Section 31 23 33.01 - Excavating, trenching and backfilling
- .3 Section 32 11 23 - Aggregate base courses

1.3 REFERENCES

Most recent edition of these documents:

- .1 Bureau de normalisation de Québec (BNQ)
 - .1 CAN/BNQ 2501-062: Soils – Determination of minimum and maximum densities and Density Index of Cohesionless Soils – Vibrating Table Test.
 - .2 CAN/BNQ 2501-255: Soils – Determination of the water-density relationship – Modified Compacting Energy Test (2700 kN.m/m³).
- .2 Ministère des Transports, de la Mobilité durable et de l'Électrification des transports du Québec (MTMDET) - Recueil des méthodes d'essai LC, Section 1 – Granulats
 - .1 LC 21-067 Détermination de la densité et de l'absorption du gros granulat
- .3 International Standards Organization
 - .1 ISO 3310-1 Test Sieves – Technical requirements and testing – Part 1: Test sieves of metal wire cloth.

1.4 DEFINITIONS

- .1 The corrected maximum density is defined by the following equation:
 - .1 $M = (F1 \times M1) + (0.9 \times M2 \times F2)$
 - .2 Equation in which:
 - .1 M = corrected maximum density expressed in kg/m³.
 - .2 $F1$ = decimal fraction of the complete sample (taken on the site) that passes the 20 mm sieve.
 - .3 $F2$ = decimal fraction of the complete sample (taken on the site) that is held in the 20 mm sieve (equal to 1.00 - $F1$).

- .4 M1 = maximum density expressed in kg/m^3 , of materials passing through the 20 mm sieve and determined according to the method in Standard BNQ 2501-255.
- .5 M2 = apparent density expressed in kg/m^3 , of materials caught in the 19 mm screen, equal to 1000D, D representing the apparent density (when dry) of materials subjected to a test according to standard LC 21-067.

Part 2 Products

2.1 NOT USED

- .1 Not used

Part 3 Execution

3.1 NOT USED

- .1 Not used

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 31 37 00 – Rip-rap
- .2 Section 32 11 23 – Aggregate base courses
- .3 Section 32 12 16 – Asphalt paving

1.2 SUPPLY OF MATERIALS

- .1 The contractor must pay to the local authority (land holding) all royalties for the supply of granular materials, fragmented rocks and rip-rap.

1.3 PRODUCTION DES GRANULATS

- .1 To produce various types of aggregates needed for making asphalt concrete, refilling road shoulders and safety areas and for supplying clean crushed stone in drainage trenches, the contractor must consider the following options:

- .1 Option 1 – Supplying of rock at the existing quarry

- .1 The community of Kuujjuaq has a crusher at the quarry located about 10 km south of the runway.

- If this option is chosen by the contractor, he will have to evaluate the existing crusher to ensure that it satisfies all the grain-size distribution requirements contained in the specifications for the various types of materials.

- Likewise, he must verify its output in order to allow production of the volumes required for execution of the works on schedule.

- If the unit does not allow meeting all specification requirements, the contractor must plan modification required or to mobilize a supplementary crusher unit and integrate it for compliant and effective production.

- .2 Option 2 – Opening of a new source of supply and mobilization of a crusher

- .1 This option implies obtaining prior authorizations from the relevant authorities for permits to operate a quarry and install a crusher.

- All requirements relative to the intrinsic quality of the raw materials must be confirmed by a certified laboratory.

- The contract must also arrange an agreement with the municipality to obtain the permits and relevant fees.

1.4 REFERENCES

The most recent edition of the following documents:

- .1 Bureau de normalisation du Québec
 - .1 Norme NQ 2560-114 « Travaux de génie civil – Granulats ».

- .2 Ministère des Transports, de la Mobilité durable et de l'Électrification des transports du Québec (MTMDET)
 - .1 Recueil des méthodes d'essai LC, Section 1 – Granulats.
- .3 Organisation internationale de normalisation
 - .1 ISO 3310-1 Tamis de contrôle – Exigences techniques et vérifications – Partie 1 : Tamis de contrôle en tissus métalliques.
- .4 Loi sur la qualité de l'environnement (RLRQ, chapitre Q-2).
 - .1 Règlement sur les carrières et sablières (Q-2, r. 7)

1.5 MEASUREMENT FOR PAYMENT

- .1 Compensation for aggregates is included in each of the articles requiring the use of aggregates. For the production of aggregate, the quantity will be paid \$40/metric tonnes, if conform at the quality required. During the execution of works, these amounts will be subtracted of works executed.
- .2 The restoration of the aggregate supply source will be a lump sum payable on completion.

1.6 DOCUMENTS/SAMPLES TO SUBMIT FOR APPROVAL/INFORMATION

- .1 Submit documents and samples in accordance with Section 01 33 00 - Submission Procedures.
- .2 Specification sheets
 - .1 Submit the specification sheets required as well as the instructions and documentation of the producer with respect to the aggregates.

The specification sheets must indicate the aggregate characteristics, performance criteria, dimensions, limits and production variations.
- .3 Attestations of compliance
 - .1 The Contractor must present the departmental representative with an attestation of compliance per crushed aggregate stockpile. It attests that the materials in stockpile comply with the requirements stipulated in the plans and specifications. Any materials produced subsequent to the issue of the attestation of compliance must be in another stockpile and receive a new attestation of compliance.
 - .2 The tests must be performed by an accredited laboratory with a registration certificate that satisfies the ISO standard valid for the work.
 - .3 The minimum stockpile by type of aggregate is 5,000 tons or equal to the total output of this type of aggregate, if less than that amount.
 - .4 The attestation by the producer must include the following information:
 - .1 Proof that the laboratory is certified under ISO 9001, whose scope covers testing services;
 - .2 The complete results of grain size distribution analyses of the stockpiled materials by layer, accompanied by a production log with sketches showing the location of the stockpile and each sample;

- .3 The results of the tests of the intrinsic, fabrication and complementary characteristics.
- .4 Grain-size analyses of stockpiled materials
 - .1 The aggregates must be crushed specifically for the contract. The Contractor must perform, at its expense, a grain-size testing program compliant with standard LC 21-040 "Grain-size analysis", using a sample that complies with standard LC 21-010 "Sampling". The sampling and the tests are performed at the following minimum:
 - .1 Two (2) initial tests;
 - .2 One (1) test per shift, per day of production, if the daily output is less than 3,000 tons;
 - .3 One (1) supplementary test per shift, per 3,000-ton segment, if daily production is greater than 3,000 tons.
- .5 Intrinsic, production and complementary characteristics
 - .1 Each class of coarse and fine aggregates must be jointly characterized with the Department Representative for each of the hot mix characteristics.
 - .2 For the characterization results provided by the producer to be accepted, the gap between the average results obtained by the Department and the producer must not be greater than the reproducibility variance of two results between two laboratories, when specified by the test methods concerned. If the variance between the results is greater than the specified variance, the Department and the producer redo the tests.
 - .3 A minimum of two (2) tests per aggregate stockpile must be provided, except for the projected polishing value.
- .6 All results as well as the location of the samples must be submitted to the Department at least one (1) week before the works begin.
- .7 The departmental representative will perform the control tests on the materials during their production.
- .8 Samples
 - .1 Apply the measures necessary for continuous aggregate sampling by the producer and the departmental representative during production.
 - .2 Ensure that the departmental representative has access to the source of supply and the prepared materials for sampling purposes.
 - .3 Install the sampling stations at the output of the conveyor used for preparing the aggregates so that the Departmental representative can take representative samples there. Stop the conveyor, at the request of the departmental representative, so that he can take a sample all across the material being transported.
 - .4 Provide a front-end loader or other appropriate equipment and, as necessary, the services of an operator specialized in stockpile sampling.

Move the samples to a storage location as instructed by the Departmental representative.

- .5 Provide sampling bags or new and clean rigid containers that are suitable for storing aggregate samples.
- .6 In case of non-compliance with requirements, aggregate sampling and testing fees are charged to the contractor.
- .7 Provide, at the production sites, sufficient water, electricity and propane gas for the departmental representative's mobile laboratory.

1.7 TRANSPORT, STOCKPILE AND HANDLING

- .1 Transport and handling: the aggregate materials must be transported and handled in a manner to prevent segregation, contamination and degradation.
- .2 Stockpile: the washed or excavated under water materials shall be piled in a manner to let the water runoff of the materials and to uniform the water content of the pile at least 24 hours.

Partie 2 Products

2.1 MATERIALS

- .1 Aggregate characteristics: good quality, strong, resistant, without flat and elongated, soft or layered particles, organic material, lumps of clay, minerals, adherent films, harmful quantities of disintegrated pieces or other harmful substances.
- .2 Fine aggregates meeting the requirements of the relevant section must be composed of one of the following materials or a mixture of them.
 - .1 Screenings from the crushing of quarry blocks, rocks or gravel.
- .3 Coarse aggregates meeting the requirements of the relevant section must be composed of the one of the following materials or a mixture of them.
 - .1 Crushed stone.
 - .2 Crushed gravel consisting of natural stone particles.
- .4 The stones must be fractured, inert and not be potentially acid-generating.

2.2 SOURCE QUALITY CONTROL

- .1 Inform departmental representative of proposed source of aggregates and provide access for sampling at least 4 weeks prior to commencing production.
- .2 If the materials from the proposed source of supply do not satisfy the prescribed requirements or cannot reasonably be prepared to meet them, find another source of supply or demonstrate that the materials from the source of supply concerned can be prepared in such a way as to satisfy the specified requirements.
- .3 Advise departmental representative 4 weeks in advance of proposed change of material source.
- .4 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

- .5 The documents presented must identify the level of operation and the sector of the quarry where the proposed material is from.

Partie 3 Execution

3.1 EXAMINATION

- .1 Conditions verification: insure that the condition was acceptable to remove the vegetal materials.
 - .1 Visually inspect surfaces and supports with the departmental representative.
 - .2 Immediately inform the departmental representative of any unacceptable condition founded.
 - .3 Begin to remove the vegetal materials only after making corrections of unacceptable condition and obtain the departmental representative approval.

3.2 PREPARATION

- .1 Processing with vegetal materials removal
 - .1 The vegetal materials should not be manipulated when the materials are wet or frozen nor in any manner that could alter the soil structure.
 - .2 Remove the vegetal materials to the depth indicated by the departmental representative. Avoid mixing vegetal materials with subsequent layer materials.
 - .3 Stockpile or install vegetal materials at the location indicated by the departmental representative. The height of pile do not exceed 2 meters.
 - .4 Keep the vegetal materials for re-use in the re-naturalization of the supply source.
- .2 Preparation of the source of supply
 - .1 Before undertaking the excavation work for producing the aggregates, clear and remove stumps from the excavation zone and clear the surface of unsuitable materials. Evacuate the clearing debris, stumps and unsuitable materials in a way approved by the competent authority.
 - .2 Once the excavation work is done, arrange the edges of the excavation at a nominal slope of 1.5:1 and, if necessary, dig drainage channels or ditches to prevent the accumulation of runoff water in the excavation zone.
 - .3 Adjust the slopes of the piles of waste material and leave a worksite that is clean and orderly.
 - .4 Provide an anti-erosion fence or some other way of preventing contamination of watercourses or existing natural wetlands.
- .3 Aggregate preparation
 - .1 Prepare the aggregates in a uniform way, using methods that prevent their contamination, segregation and degradation.
 - .2 If necessary, a mixture of aggregates that includes recovered materials that satisfy the physical requirements of the specification is allowed in order to

- provide the grain-size distribution, particle form or percentage of crushed particles prescribed.
- .4 In the presence of stratified deposits, use equipment and excavation methods that make it possible to obtain aggregates that are homogeneous and have uniform grain-size distributions.
 - .5 If necessary, screen, crush, wash, sort and treat the aggregates with appropriate equipment that complies with requirements.
 - .6 Stockpiling
 - .1 Unless otherwise instructed by the departmental representative, stack the aggregates on the jobsite at the locations indicated. Do not pile aggregates on paved surfaces.
 - .2 Stockpile enough aggregate material to be able to respect the work schedule.
 - .3 The aggregates must be placed in piles on flat and well-drained lots that have sufficient bearing capacity and stability to support the stacked material and the handling equipment.
 - .4 Unless the materials are piled on an acceptably stabilized surface, the bottom of the pile must consist of a layer of compacted sand that is at least 300 mm thick in order to prevent aggregate contamination. This layer must not be incorporated in the stockpiled materials.
 - .5 It is prohibited to use mixed or contaminated materials. Remove and dispose of any rejected materials within 48 hours of their rejection, as instructed by the department representative.
 - .6 To avoid aggregate mixtures, space the piles of different aggregates sufficiently far apart or separate them using robust, full-height fences.
 - .7 Pile up the materials by making uniform and flat layers whose thickness complies with the following prescriptions.
 - .1 In the case of coarse aggregates: not more than 1.5 m.
 - .2 In the case of fine aggregates and foundation layer materials: not more than 2 m;
 - .3 For all other materials: not more than 1.5 m.
 - .8 Finish spreading each layer of aggregate materials being piled up throughout the storage area before starting to spread the next layer.
 - .9 Unload aggregates brought to the pile by truck in uniform heaps and arrange the piles according to the prescriptions.
 - .10 It is prohibited to make piles in cone shapes or to cause materials to slide down the sides of piles.
 - .11 Do not use conveyor stackers.
 - .12 During work done in winter, keep ice and snow from mixing with the materials being piled up or removed from the pile.

3.3 CLEANING

- .1 Progress Cleaning: made them clean in accordance with Section 01 74 11 – Cleaning.
 - .1 Leave Work area clean at the end of each working day
- .2 Final Cleaning: upon completion remove materials / surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning
- .3 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.
- .4 Leave any unused aggregates in neat compact stockpiles as directed by departmental representative.
- .5 Waste Management: separate waste materials for reuse / re-use and recycling in accordance with Section 01 74 21 - Construction-demolition waste management and disposal.

3.4 RESTORATION OF THE SUPPLY SOURCE

- .1 At works completion, restore supply source to condition meeting requirements of authority having jurisdiction.
- .2 At works completion, provide the Departmental Representative a letter from the local authorities certifying that the supply source or part thereof exploited to the project requirements was restored to the satisfaction of these.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 32 11 23 – Aggregate base courses.

1.2 DEFINITION

- .1 The goal of the preparation of the granular surface of shoulder of runway and taxiway before recharging is the looseness of the base granular material of the runway to allow the reshaping of the base granular material layer before recharging and the optimal cohesion with new materials of recharging.

1.3 WORK COVERT BY THE PRESENT SECTION

- .1 The contractor must perform the preparation of the granular before recharging on the shoulder runway surface including as well as on the surface of the shoulders of taxiway and apron on which is scheduled for the work of paving.

1.4 MEASUREMENT AND PAYMENT

- .1 Pay the preparation of the granular surface preparation before recharging per square meter (m²) of surface that are the subject of work.
- .2 Unit price includes scarification, decohesion of blocks, the removal and disposal of material unfit as well as the shaping of base granular material layer, including shoulders, and the taxiway and it includes any incidental expenses.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify the conditions of existing roadway base courses.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with works only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 SCARIFYING AND RESHAPING

- .1 The contractor must perform scarification and reshaping of the base granular surface of the runway and taxiway before the recharging the surface with new granular materials.
- .2 At the end each day, or on special request of the departmental Representative, the contractor must perform completely recharging the portion of runaway or taxiway that has been the subject of scarification.
- .3 The contractor must use graders equipped with electronic equipment that allows a precise automated leveling.
- .4 The contractor should scarify to a maximum of 50 mm depth, across the width of the runaway, including his shoulders, and the taxiway.
- .5 The contractor shall proceed to the decohesion of the blocks larger than 50 mm.
- .6 The contractor must extract and to dispose all unsuitable material or whose dimensions exceed 55 mm.
- .7 The contractor must then proceed to reshaping (including reprofiling) before recharging of the runway, including his shoulders, and the taxiway. The contractor must respect the minimum slope granular material for the runway and its shoulders as indicated on the plans.
- .8 The contractor shall protect the existing runaway lighting during the execution of the work.
- .9 Do not pulverize a surface more than the superficies can be profiled and compacted within one work shift.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each working day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

3.4 PROTECTION

- .1 Protect and maintain reshaped surface in condition conforming to this Section until succeeding material is applied.
- .2 Protect the runaway lighting.
- .3 Fill any surface and adjacent surface before reopening the runway.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section related to this section:
 - .1 Section 26 45 .03.01- Installation of cables in trenches and in ducts
 - .2 Section 31 00 00.03 - Drainage
 - .3 Section 31 37 00 - Rip-rap
- Any other section of specifications requiring excavation and backfilling of granular or other material.

1.2 SCOPE OF WORK

- .1 In addition work described in the sections referred to in the previous paragraph, this section aims all excavation and backfilling work which, among other things, earthworks for soils removal on each side of the runaway required for the obstacle clearance. Unless otherwise indicated by Departmental Representative, these cut materials must be use to fill embankments in the safety area.
- .2 Unless authorized by the Departmental Representative in writing, it is prohibited to dig more than 20 meters of trench before proceeding with the installation of the landfill.

Prior to each operating period described in Section 01 11 11 - General Construction Information, all trenches shall be backfilled, leveled and compacted.

No leveling or piling of materials will be tolerated near the runway during the operating period.

1.3 MEASUREMENT PROCEDURES

- .1 The cost for common excavation is included in the tender or lump sum unit prices.
- .2 The cost for backfilling with MG 20b modified or other materials is included in the tender or lump sum unit prices.

1.4 REFERENCES

- .1 Bureau de la normalisation du Québec
 - .1 Norme NQ 2560-114 – Travaux de génie civil – Granulats.

1.5 DEFINITIONS

- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.
 - .1 Rock: solid material in excess of 1.00 m³ and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m³ bucket.
 - Frozen material not classified as rock.

- .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
- .2 Unclassified excavation: excavation of deposits of whatever character encountered in Work.
- .3 Topsoil:
 - .1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
 - .2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than [25 millimeters] [1 inch] in any dimension.
- .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 ASTM C136: Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.
 - .2 Table:

Sieve Designation	% Passing
2.00 mm	100
0.10 mm	45 – 100
0.02 mm	10 - 80
0.005 mm	0 - 45
 - .3 Coarse grained soils containing more than 20 % by mass passing 0.075 mm sieve.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Submit certificates of conformity for MG 20b materials.
 - .2 Submit certificates of conformity for geotextiles.
 - .3 Submit certificates of conformity for rip-rap.
- .2 Submit erosion and sediment control plan in compliance with Section 01 35 43 – Environmental Procedures.
- .3 Submit waste and debris disposal plan in compliance with Section 01 74 21 – Construction Waste Management and Disposal.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Waste materials disposal in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.8 EXISTING CONDITIONS

- .1 Buried services and electrical cables:
 - .1 Confirm locations of buried utilities and electrical cables by careful test excavations.
 - .2 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered as indicated.
 - .3 Record location of maintained, re-routed and abandoned underground lines.
 - .4 Confirm locations of recent excavations adjacent to area of excavation.

Part 2 Products

2.1 MATERIALS

- .1 MG 20b modified and granular materials: properties to Section 31 05 16 – Aggregate Materials and the following requirements:
 - .1 Gradations according to Norm NQ 2560-114 – Travaux de génie civil – Granulats.
 - .2 Geotextiles: According with Section 31 32 19.01 - Geotextiles.
 - .3 Bedding and surrounding: granular material CG-14 according to Norm NQ 2560-114 – Travaux de génie civil – Granulats.
 - .1 Sub-base material according to section 32 11 23 – Aggregate Base Courses - Gradations according to Norm NQ 2560-114 – Travaux de génie civil – Granulats.
 - .4 Sub-base material according to section 32 11 16.01 – Sub-base.
 - .1 Gradations according to Norm NQ 2560-114 – Travaux de génie civil – Granulats.
 - .5 Backfill material CG-14 – Backfilling electricity trenches for bedding and covering ducts.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion, according to sediment and erosion control plan, specific to site, 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.

3.2 SITE PREPARATION

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

3.3 PREPARATION/PROTECTION

- .1 Keep excavations clean, free of standing water, and loose soil.
- .2 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.
- .3 Protect buried services that are required to remain undisturbed.

3.4 DEWATERING AND HEAVE PREVENTION

- .1 Keep excavations free of water while Work is in progress.
- .2 Provide for Departmental Representative review 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.
- .4 Protect open excavations against flooding and damage due to surface run-off.
- .5 Dispose of water in accordance with Section 01 35 43 - Environmental Procedures and in manner not detrimental to environment.
 - .1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.
- .6 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, watercourses or drainage areas.

3.5 EXCAVATION

- .1 Excavate to lines, grades, elevations and dimensions as indicated Departmental Representative.
- .2 For trench excavation, unless otherwise authorized by Departmental Representative in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.
- .3 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by Departmental Representative.
- .4 Restrict vehicle operations directly adjacent to open trenches.

- .5 Dispose of surplus and unsuitable excavated material off site.
- .6 Do not obstruct flow of surface drainage or natural watercourses.
- .7 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .8 Notify Departmental Representative when bottom of excavation is reached.
- .9 Obtain Departmental Representative approval of completed excavation.
- .10 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.
- .11 Hand trim, make firm and remove loose material and debris from excavations.
- .12 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.
- .13 Install geotextiles in accordance with Section 31 32 19.01 - Geotextiles.

3.6 BACKFILL AND COMPACTING MATERIALS

- .1 Use compacting equipment approved by the Departmental Representative.
- .2 Do not start backfilling until the following authorizations have been obtained:
 - .1 Approval of the excavations by the Departmental Representative.
 - .2 Inspection, density testing, positioning of materials and equipment.
- .3 Do not backfill with debris containing ice or snow or frozen soil.

3.7 BEDDING AND COVERING MATERIALS FOR UNDERGROUND PIPELINES

- .1 Deposit CG-14 granulate materials provided for laying and covering buried underground utility pipelines and electrical conduits and compact them according to the instructions in the relevant sections of the specifications for these structures.
- .2 The bedding and covering must not be frozen.

3.8 BACKFILL

- .1 Use backfill and compacting equipment approved by the Departmental Representative.
- .2 Do not start backfilling before:
 - .1 Inspection and approval of the installations by the Departmental Representative.
 - .2 Inspection, testing, approval of the underground utility networks and documentation of their location.
- .3 The areas to be backfilled must be free of debris, snow, ice, water and frozen dirt.
- .4 Use of backfill that is frozen or contains snow, ice or debris is prohibited
- .5 Spread the backfill in uniform layers no more than 150 mm thick after compacting, to the levels indicated. Compact each layer before spreading the next one.
- .6 Filling around the structures

- .1 Place the bedding and covering materials as provided in the specifications formulated elsewhere.
- .2 Do not fill around or above concrete structures cast in place within 24 hours of when the concrete was cast.
- .3 Apply the layers of fill simultaneously on either side of the installed structures, to balance the loads deposited. The difference in height between the fills must not exceed 150 mm.

3.9 RESTORATION OF THE SITES

- .1 Once the work is done, remove the waste materials and debris as provided in section 01 74 21 – Management and disposal of construction/demolition waste, treat the slopes and correct faults according to the instructions of the Departmental Representative.
- .2 Replace the topsoil as instructed by the Departmental Representative.
- .3 Clean and restore the areas affected by the work daily according to the instructions of the Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Not Used.

1.2 SCOPE OF WORK

- .1 Contractor shall install geotextile under the quarry stone rip-rap as indicated on plans and specifications in Section 31 37 00 Rip-rap.

1.3 MEASUREMENT AND PAYMENT

- .1 Geotextiles under rip-rap are paid as part of the unit price for drainage pipes

1.4 REFERENCES

- .1 ASTM International
 - .1 ASTM A123/A123M-09, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .2 ASTM D4595-09, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
 - .3 ASTM D4355, Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-148.1, Methods of Testing Geotextiles and Complete Geomembranes.
 - .1 No.1-94, Methods of Testing Geosynthetics – Sampling and Preparation of Test Specimens.
 - .2 No.2-M85, Methods of Testing Geosynthetics - Mass per Unit Area.
 - .3 No.3-M85, Methods of Testing Geosynthetics - Thickness of Geotextiles.
 - .4 No.4-94, Methods of Testing Geosynthetics – Permeability to Water in a normal way without compression.
 - .5 No.6.1-93, Methods of Testing Geotextiles and Geomembranes - Bursting Strength of Geotextiles Under No Compressive Load.
 - .6 No.7.3-92, Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles.
 - .7 No. 10-94, Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for geotextiles and include product characteristics, performance criteria, physical size, finish and limitations.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect geotextiles from direct sunlight and UV rays.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIAL

- .1 Geotextile: woven synthetic fibre fabric, supplied in rolls.
 - .1 Width: 3.5 m minimum.
 - .2 Length: 100 m minimum.
 - .3 Composed of: minimum 85% by mass of polypropylene or polyester with inhibitors added to base plastic to resist deterioration by ultra-violet and heat exposure for 60 days.
- .2 Physical properties:
 - .1 Thickness: to CAN/CGSB-148.1, No.3, minimum 2.0 mm.
 - .2 Mass per unit area: to CAN/CGSB-148.1, No.2, minimum 250 g/m².
- .3 Hydraulic properties:
 - .1 Filtration opening size (FOS): to CAN/CGSB-148.1 No.10, OPSS 1860: 53-93 micrometres.
 - .2 Permittivity: 0.7 pers.
- .4 Securing pins and washers: to CSA G40.21, Grade 300W, hot-dipped galvanized with minimum zinc coating of 600 g/m² to ASTM A123/A123M.
- .5 Factory seams: sewn in accordance with manufacturer's recommendations.
- .6 Thread for sewn seams: equal or better resistance to chemical and biological degradation than geotextile.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for geotextile material installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Place geotextile material by unrolling onto graded surface in orientation, manner and locations indicated and retain in position with pins and washers as requested by the Departmental Representative.
- .2 Place geotextile material smooth and free of tension stress, folds, wrinkles and creases.
- .3 Place geotextile material on sloping surfaces in one continuous length from toe of slope to upper extent of geotextile.
- .4 Overlap each successive strip of geotextile 600 mm over previously laid strip.
- .5 Pin successive strips of geotextile as indicated by Departmental Representative with securing pins at 1 000 mm interval at midpoint of lap.
- .6 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.
- .7 After installation, cover with overlying layer within 4 hours of placement.
- .8 Replace damaged or deteriorated geotextile to approval of Departmental Representative.
- .9 Place rip-rap according to section 31 37 00.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.4 PROTECTION

- .1 Vehicular traffic not permitted directly on geotextile.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Not used.

1.2 SCOPE OF WORK

- .1 Contractor must install rip-rap as indicated in the plans and specifications or the Departmental Representative.
- .2 Rip-rap is installed on geotextile in compliance with Section 31 32 19.01 and waterproof stone protective revetment.

1.3 MEASUREMENT PROCEDURES

- .1 Rip-rap is paid as per linear metre of drainage pipes installed and measured on-site. The price includes excavation, disposal of excavated material, shaping of the walls and bottom, compaction, geotextiles and overlays, supply and installation of rip-rap, and all incidental expenses.

1.4 REFERENCES

- .1 Bureau de la normalisation du Québec
 - .1 NQ 2560-114 “Travaux de génie civil – Granulat”.

1.5 SUBMITTALS FOR APPROVAL

- .1 Submit required documents and samples in compliance with Section 01 33 00 – Submittal Procedures.
- .2 Data sheets (certificates of conformity by accredited laboratory)
 - .1 Submit required data sheets and manufacturer’s instructions and documentation for rip-rap. Data sheets shall indicate product characteristics, performance criteria, dimensions, limitations and finish.
 - .2 Rip-rap shall be inert and non acid-generating.

Part 2 Products**2.1 STONE**

- .1 Hard, dense with relative density (formally specific gravity) not less than 2.65, durable quarry stone, free from seams, cracks or other structural defects, to meet plans and specifications requirements.
- .2 Meet the requirements of « Bureau de normalisation du Québec, norme NQ 2560-114, Travaux de génie civil – Granulats ».
- .3 Inerte, non-potentially acid generator and fractured stones.

2.2 GEOTEXTILE

- .1 Geotextile: in accordance with Section 31 32 19.01 - Geotextiles.

Part 3 Execution**3.1 PLACING**

- .1 Where rip-rap is to be placed on slopes, excavate trench at toe of slope to dimensions as indicated.
- .2 Fine grade area to be rip-rapped to uniform, even surface. Fill depressions with suitable material and compact to provide firm bed.
- .3 Place geotextile on prepared surface in accordance with Section 31 32 19.01- Geotextiles and as indicated. Avoid puncturing geotextile or geomembrane. Vehicular traffic over geotextile not permitted.
- .4 Place rip-rap to thickness and details as indicated.
- .5 Place stones in manner approved by Departmental Representative to secure surface and create a stable mass. Place larger stones at bottom of slopes.
- .6 Hand placing:
 - .1 Use larger stones for lower courses and as headers for subsequent courses.
 - .2 Stagger vertical joints and fill voids with rock spalls or cobbles.
 - .3 Finish surface evenly, free of large openings and neat in appearance.

END OF SECTION

Part 1 General

1.1 MEASUREMENT AND PAYMENT

- .1 Measure removal of pavement markings by lump sum including the existing pavement marking and temporary pavement marking. The works are included the overall price listed on the tender form.
- .2 The withdrawal of existing marking and temporary marking will be paid by lump sum.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for each type of abrasives and solvent used on project.
 - .2 Submit of WHMIS MSDS in accordance with Section 01 33 00 – Submittal Procedures. The contractor will conserve in file an example of manufacturing instructions.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Develop Construction Waste Management Plan related to Work of this Section.

Part 2 Products

2.1 MATERIALS

- .1 Abrasives for removal of paint, oil, grease, rubber deposits: proprietary products specially designed for pavement cleaning, subject to approval by DCC Representative. Approved methods are pressurized water jet and brushing.

Part 3 Execution

3.1 REMOVING PAVEMENT MARKINGS

- .1 Remove paint markings, in areas as directed by DCC Representative, by pressurized water jet and brushing or other method approved in writing by DCC Representative.
- .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 degrees C, when using heater planning equipment.

3.2 PAVEMENT SURFACE CLEANING

- .1 Remove dust, contaminants, loose and foreign materials, oil and grease, in areas as directed by and by method approved in writing by Representative DCC Representative.
- .2 After the withdrawal of marking, use rotary power brooms supplemented by hand brooming.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Daily final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 32 12 16 – Asphalt paving.
- .2 Section 32 12 13.16 – Asphalt tack coats.
- .3 Section 32 17 13 – Pavement marking.

1.2 MEASUREMENT PROCEDURES

- .1 Measure pavement crack filling in linear metres of asphalt paving pouring in site, as the type of material. The unit price includes the sawing of existing pavement each side of the crack, removal existing pavement, supplying and pouring of asphalt tack coats, granular material crushed stone MG 20b modified, asphalt paving, as indicated with description of works, article 3.1 «Repairs of cracks», asphalt paving for coat corrective.

1.3 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM C117-13, Standard Test Method for Material Finer Than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136-M14, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D2419-14, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric.
 - .3 CAN/CGSB-16.1-M89, Cutback Asphalts for Road Purposes.
 - .4 CAN/CGSB-16.2-M89, Emulsified Asphalts, Anionic Type, for Road Purposes.
 - .5 CAN/CGSB-16.4-M89, Emulsified Asphalts, Cationic Type, for Road Purposes.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for cleaning and filling materials and include product characteristics, performance criteria, physical size, finish and limitations.

1.5 CERTIFICATES

- .1 Submit manufacturer's test data and certification that materials meet requirements of this Section 2 weeks before beginning Work.

1.6 SUSTAINABLE DESIGN SUBMITTALS

- .1 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements as section 01 74 21.
 - .2 There is forbidden to unload watertightness product to repair the crack of the pavement in the sewer main network, river, lake or on the ground, implicated a risk of the health and environment.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00- Common Product Requirements with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

Part 2 Products

2.1 MATERIALS

- .1 Pavement: as indicated at the section 32 12 16 – Asphalt paving.
- .2 Emulsified asphalt: as indicated at the section 32 12 13.16 – Asphalt tack coat.

Part 3 Execution

3.1 CRACK REPAIRS

- .1 Five (5) different types of crack repairs are possible:
 - .1 Type A: Major cracks (greater than 50 mm). These repairs require removing 2 layers of paving, depending on the cross-section. Cracks of this type are identified by plan view.

Remuneration is based on the linear metre.

 - Width: 2,000 mm
 - Depth: 100 mm
 - .2 Type B: Major cracks (less than 50 mm).

Remuneration is based on the linear metre.

 - Width: 2,000 mm
 - Depth: 50 mm

Cracks of this type are identified by plan view.
 - .3 Type C: Major cracks presenting a subsidence of less than 15 to 20 mm.

This type of crack is not shown on the plans and will be identified by the site supervisor.

Remuneration is based on the linear metre.

 - Width: 1,000 mm

- Depth: 50 mm
- .4 Type D: Minor cracks with no subsidence, whose width varies from 100 to 300 mm.
Remuneration is based on the linear metre.
This type of fissure is not shown on the plans and will be identified by the site supervisor.
 - Width: 300 mm
 - Depth: 50 mm
- .5 Type E: Minor cracks, having sealing product to remove and plug with a corrective asphalt concrete mixture.
Remuneration is based on the linear metre.
This type of crack is not shown on the plans and will be identified by the site supervisor during the execution of works.
 - Width: ± 40 mm
 - Depth: ± 40 mm
- .2 Repair the cracks indicated by DCC representative. The DCC representative provides the type of reparations.
- .3 The execution of repair's cracks will be realized as follows:
 - .1 Execute removal existing paving at the depth indicated.
 - .2 Remove all pavement block and dispose.
 - .3 Remove all particles of pavement with a mechanical vacuum broom.
 - .4 Before to apply asphalt lack coat to obtain the approval of works by DCC representative.
 - .5 Apply asphalt lack coat at the rate 0,30 L/m² on the vertical surface of the repair and removed surface.
 - .6 Put the asphalt paving at the level of the pavement surface, with equipment or manual operation.
 - .7 Densify at 95% the pavement.
 - .8 Execute a new pavement marking at the section of repair of cracks.
- .4 In order to allow the runway to be put back into service before the prescribed time each day, the Contractor must coordinate its work so that all the planar areas are entirely covered with new asphalt concrete at the end of its service shift.
- .5 The Contractor must provide a work plan demonstrating that the productivity of leveling and surface preparation is consistent with the paving capacity of the repairs in accordance with the schedule provided in Section 01 35 13.13.

END OF SECTION

Part 1 General

The reshaping of existing bituminous pavements involves the following activities:

- .1 Levelling

Plan the surfaces of the runway, taxiway and apron according to the thicknesses described in the plans and typical cuts, includes the reshaping, connexion and withdrawal of lateral and longitudinal transition.
- .2 Micro-Levelling

Micro-planning of the 7.5-meter-wide area between the 30.0-meter-wide planar center surface and the runway edge to standardize the surface to a minimum thickness of 50 mm of asphalt concrete and to ensure the free flow of drainage. The micro-planning will be required the withdrawal of bosses between the existing pavement and new pavement.

1.1 RELATED REQUIREMENTS

- .1 Section 01 74 11 – Cleaning.
- .2 Section 01 74 21 – Construction/Demolition waste management and disposal.
- .3 Section 02 41 13.13 – Paving removal.

1.2 MEASUREMENT PROCEDURES

- .1 Pulverizing and reshaping existing asphalt pavement will be measured in square metres. The unit price includes the reshaping an attaching as thickness indicated plans and specifications, remove of material, mechanical broom of the surface and remove of fragments. The fragments of micro-reshaping will be disposed out of the works in accordance of municipal rules.

1.3 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM C117-04, Standard Test Method for Material Finer Than 75 µm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C131-06, Standard Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³(600 kN-m/m^{3 - .5 ASTM D1557-09, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³(2700 kN-m/m^{3 - .6 ASTM D4318-10, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.}}

- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2 Samples:
 - .1 Submit six (6) samples
- .3 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
 - .2 Erosion and Sedimentation Control: submit copy of erosion and sedimentation control plan in accordance with authorities having jurisdiction.

Part 2 Products

2.1 MATERIALS

- .1 The material product by reshaping asphalt pavement will be reused for the works. All quantity should be transported and disposal to for the granular base of access road at the shoulder in north of the runway.

2.2 EQUIPMENT

- .1 To refer at the specifications section 32 12 16.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for reshaping asphalt pavement installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of DCC Representative.
 - .2 Inform DCC Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied written approval to proceed from DCC Representative.

3.2 RESHAPING

- .1 Reshaping must be done by micro-planning to the surfaces indicated on the plans.

3.3 COMPACTING

- .1 No object.

3.4 FINISH TOLERANCES

- .1 The depth of the micro-planning shall not exceed 5 to 40 mm. The minimum deviation of the profile must not exceed 5 mm of the transverse theoretical profile.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.
- .3 After the operation of mechanical broom, proceed to air compressed on all surface to eliminate the dust before the application of asphalt lack coat.

3.6 PROTECTION

- .1 Protect and maintain reshaped asphalt pavement surface in condition conforming to this section until succeeding material is applied or until after receipt of written acceptance from DCC Representative.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 31 05 10 – Corrected maximum dry density.
- .2 Section 31 05 16 - Aggregate Materials.

1.2 MEASUREMENT PROCEDURES

- .1 Measure aggregate base courses layer in metric tons of material compacted and measured in place, incorporated to the works and accepted by the departmental representative. The price must include supply, loading and transportation to the works, installation with robotic grader, water and compaction of the aggregate base courses material.

1.3 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM C117-13, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C131/C131M-14, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM C136/C136M-14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D698-12E2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
 - .5 ASTM D1557-12E1, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kN-m/m³).
 - .6 ASTM D1883-14, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
 - .7 ASTM D4318-10E1, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .2 Bureau de normalisation du Québec (BNQ).
 - .1 Norme NQ 2560-114-II/2002, Travaux de génie civil – Granulats – Partie II : Matériaux pour fondation, sous-fondation, couche de roulement et accotement.
- .3 Office des normes générales du Canada (CGSB).
 - .1 CAN/CGSB-8.1-88, Tamis de contrôle en toile métallique, non métrique.
- .4 CAN/CGSB-8.2-M88, Tamis de contrôle en toile métallique, métrique. U.S. Environmental Protection Agency (EPA) / Office of Water.
- .5 EPA 832-R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Delivering aggregates as and when they are needed in order to avoid creating piles on site.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Divert unused granular material as approved by the departmental representative.

Part 2 Products

2.1 MATERIALS

- .1 Granular base: material in accordance with Section 31 05 16 - Aggregate Materials and following requirements:
 - .1 Crushed stone or gravel.
 - .2 Gradations to be within limits specified when tested to NQ 2560-114. Gradation curve plotted on a semi-logarithmic diagram must be progressive and continue.

- .1 Gradation to:

Sieve Designation	% Passing MG 20b modified (quarry)
31,5 mm	100
20 mm	90 – 100
14 mm	68 – 93
5 mm	35 – 60
1,25 mm	19 – 38
0,315 mm	9 – 17
0,080 mm	5 – 11

- .3 Intrinsic characteristic to following test :
 - .1 * Methylene blue (LC 21-255) : $\leq 0,20$
 - .2 Los Angeles (LC 21-400) : ≤ 45
 - .3 Micro-Deval (LC 21-070) : ≤ 35
 - .4 Fragmentation crushed stone, minimum 60% with face fragmented

Part 3 Execution

3.1 SEQUENCE OF OPERATION

- .1 Place granular base after sub-base surface is inspected and approved by the departmental representative.
- .2 Placing
 - .1 Construct granular base to depth and grade in areas indicated. The contractor shall use a robotic grader able to follow a numeric land model.

- .2 Ensure no frozen material is placed.
- .3 Place material only on clean unfrozen surface, free from snow and ice.
- .4 Begin spreading base material on crown line or on high side of one-way slope.
- .5 Place material using methods which do not lead to segregation or degradation of aggregate.
- .6 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.
- .7 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .8 Remove and replace that portion of layer in which material becomes segregated during spreading.
- .3 Place the materials of the shoulder reloading layer and runway end areas with MG-20b after the asphalt has been laid.
- .4 Compaction Equipment
 - .1 Compaction equipment to be capable of obtaining required material densities.
- .5 Compacting
 - .1 Compact to density not less than 100% corrected maximum dry density in accordance with section 31 05 10 - Corrected Maximum Dry Density.
 - .2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
 - .3 Apply water as necessary during compacting to obtain specified density.
 - .4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by the departmental representative.
 - .5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.2 SITE TOLERANCES

- .1 Finished base surface to be within plus or minus 10 mm of established grade and cross section but not uniformly high or low.

3.3 CLEANING

- .1 Execute the cleaning of works as indicated at the section 01 74 11 – Cleaning.

3.4 PROTECTION

- .1 Maintain finished base in condition conforming to this Section.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 32 12 16 – Asphalt paving.
- .2 Section 32 01 11.02 – Pavement cleaning and marking removal.

1.2 MEASUREMENT PROCEDURES

- .1 Asphalt tack coat will be not measured for the repairs of cracks. The cost of asphalt tack coat is included in unit price of asphalt paving or repair of cracks, including supplying, transport, pouring and all related works.

1.3 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM D140 -09, Standard Practice for Sampling Bituminous Materials.
 - .2 Ministère des Transports, de la Mobilité durable et de l'Électrification des transports, tome VII – Material.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for asphalt tack coat and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Sample asphalt tack coat material to: ASTM D140.
 - .3 Provide access on tank truck for DCC Representative to sample asphalt material to be incorporated into Work to ASTM D140.
 - .4 Provide the certification of the conformity before the beginning of works.

1.5 QUALITY ASSURANCE

- .1 Upon request from DCC Representative, submit manufacturer's test data and certification that asphalt prime material meets requirements of this Section.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with ASTM D140.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Section 01 74 21- Construction/Demolition Waste Management And Disposal.

Part 2 Products

2.1 MATERIALS

- .1 Anionic emulsified asphalt: to standard ASTM D2397/D2397M.
- .2 Cationic emulsified asphalt: to standard ASTM D977.
- .3 Water: clean, potable, free from foreign matter.

2.2 EQUIPMENT

- .1 Pressure distributor:
 - .1 Designed, equipped, maintained and operated so that asphalt material can be:
 - .1 Maintained at even temperature.
 - .2 Applied uniformly on variable widths of surface up to 5m.
 - .3 Applied at readily determined and controlled rates from 0.2 to 0.4 L/m² with uniform pressure, and with allowable variation from any specified rate not exceeding 0.05 L/m².
 - .4 Distribute in uniform spray without atomization at temperature required.
 - .2 Equipped with meter, registering travel in metres per minute, visibly located to enable truck driver to maintain constant speed required for application at specified rate.
 - .3 Equipped with pump having flow metre graduated in units of 5 L or less per minute passing through nozzles and readily visible to operator. Pump power unit to be independent of truck power unit.
 - .4 Equipped with easily read, accurate and sensitive device which registers temperature of liquid in reservoir.
 - .5 Equipped with accurate volume measuring device or calibrated tank.
 - .6 Equipped with nozzles of same make and dimensions, adjustable for fan width and orientation.
 - .7 Equipped with nozzle spray bar, with operational height adjustment in increments of 0.6 metres and capable of being raised or lowered.

Part 3 Execution

3.1 APPLICATION

- .1 Obtain the approval by DCC representative before to apply the 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.
 - .1 Mix thoroughly by pumping or other method approved by DCC Representative.
- .4 Apply asphalt tack coat evenly to pavement surface at rate as directed by DCC Representative at the rate 0.20 L/m² for new pavement, 0.25 L/m² for existing pavement and 0.30 L/m² for pulverized pavement.

- .5 Paint contact surfaces of curbs, gutters, headers, manholes and like structures with thin, uniform coat of asphalt tack coat material.
- .6 Apply asphalt tack coat only when air temperature greater than 10 degrees C and when rain is not forecast within 2 hours minimum of application.
- .7 Apply asphalt tack coat only on unfrozen surface.
- .8 Evenly distribute localized excessive deposits of tack coat by brooming as directed by DCC Representative.
- .9 Where traffic is to be maintained, treat no more than one half of width of surface in one application.
- .10 Keep traffic off tacked areas until asphalt tack coat has set.
- .11 Re-tack contaminated or disturbed areas as directed by DCC Representative.
- .12 Permit asphalt tack coat to set break before placing asphalt pavement.

3.2 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section [01 74 11- Cleaning].
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 05 16 – Aggregate materials.
- .2 Section 32 01 11.02 – Pavement crack cleaning and filling.
- .3 Section 32 12 13.16 – Asphalt tack coat.
- .4 Section 32 17 23 – Pavement markings.

1.2 PRODUCTS SUPPLIED BUT NOT INSTALLED UNDER THIS SECTION

- .1 There is no product supplied by the client. The contractor provides all material for the aggregate measured to the production of asphalt paving, including transport and supply of bitumen.
- .2 Notify DCC Representative of proposed date for use of materials; order and schedule shipments to coincide with construction schedule.

1.3 MEASUREMENT AND PAYMENT

- .1 Measure asphalt concrete paving in tonnes of asphalt concrete actually incorporated into Work including the transition zones.

The base price for the purchase of bitumen at the supplier's plant is based on a unit price of \$700 per metric ton. For any variation (above or below) in this unit price, a monetary adjustment will be applied to the quantity actually incorporated in manufacturing the bituminous concrete.
- .2 The supply and incorporated bitumen are included at the unit price by tonnes of asphalt paving or repairs of cracks in linear metres.
- .3 The coated aggregates incorporated in the crack repairs are not measured but included in the linear price of crack repair costs.
- .4 Adjustment of existing water well observation.
- .5 Testing strip is paid by lump sum.

1.4 REFERENCE STANDARDS

- .1 American Association of State Highway and Transportation Officials (AASHTO)
 - .1 AASHTO M320-10, Standard Specification for Performance Graded Asphalt Binder.
 - .2 AASHTO R29-02, Standard Specification for Grading or Verifying the Performance Graded of an Asphalt Binder.
 - .3 AASHTO T245-97(2004), Standard Method of Test for Resistance to Plastic flow of Bituminous Mixtures Using Marshall Apparatus.

- .2 Asphalt Institute (AI)
 - .1 AI MS-2-Sixth Edition 1994, Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.
- .3 ASTM International
 - .1 ASTM C88-05, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
 - .2 ASTM C117-04, Standard Test Method for Material Finer Than 0.075mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .3 ASTM C123-04, Standard Test Method for Lightweight Particles in Aggregate.
 - .4 ASTM C127-07, Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.
 - .5 ASTM C128-07a, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.
 - .6 ASTM C131-06, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .7 ASTM C136-06, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .8 ASTM C207-2006, Standard Specification for Hydrated Lime for Masonry Purposes.
 - .9 ASTM D995-95b(2002), Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
 - .10 ASTM D2419-09, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
 - .11 ASTM D3203-94(2005), Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
 - .12 ASTM D4791-05e1, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
 - .13 ASTM E965, Standard Test Method for Measuring Pavement Macrottexture Depth Using a volumetric Technique
- .4 Organisation internationale de normalisation
 - .1 ISO 3310-1 Tamis de contrôle – Exigences techniques et vérifications – Partie 1 : Tamis de contrôle en tissus métalliques.
- .5 Bureau de la normalisation du Québec
 - .1 BNQ 2560-114, Travaux de génie civil- Granulats
- .6 Direction du laboratoire des chaussées et normes – Ouvrages routiers, du Ministère des Transports, de la Mobilité durable et de l'Électrification des transports du Québec (MTMDET)
 - .1 Recueil des méthodes d'essais LC, Section 1 – Granulats

- .2 Recueil des méthodes d'essais LC, Section 3 – Liants hydrocarbonés
- .3 Recueil des méthodes d'essais LC, Section 4 – Enrobés
- .4 Tome VII Matériaux – Norme 4101 : Bitumes
- .7 U.S. Environmental Protection Agency (EPA) / Office of Water
 - .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

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

Before the works begin, the Contractor must submit for the approval of the Departmental Representative a paving installation plan that includes the expected hourly production and expected position of the longitudinal and transverse joints.
- .2 Product Data:
 - .1 According to the requirements of this contract, submit manufacturer's instructions, printed product literature and data sheets for asphalt mixes and aggregate and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 According to the requirements of this contract, submit viscosity-temperature chart for asphalt cement to be supplied showing either Saybolt Furol viscosity in seconds or Kinematic Viscosity in centistokes, temperature range 105 to 175 degrees C 4weeks prior to beginning Work.
- .3 Samples:
 - .1 Inform DCC Representative of proposed source of aggregates and provide access for sampling 4weeks prior to beginning Work.
 - .2 Submit samples of following materials proposed for use 4weeks prior to beginning Work.
 - .1 One 5 L container of asphalt cement.
 - .2 One kg of mineral filler, if required.
- .4 Certificates, attestations of compliance and quality plan
 - .1 According to the requirements of this contract and within the stipulated time periods, provide the attestations of complete conformity of the bitumen, as specified in standard 4101 of Tome VII, Matériaux of the MTMDDET, for each of the batches planned for the structures before they are shipped to the site of the works, as well as the viscosity-temperature graph of the proposed bituminous binder, indicating either the Saybolt Furol viscosity in seconds or the kinematic viscosity in centistokes, for a temperature range of 105 to 175 degrees Celsius.
 - .2 According to the requirements of this contract and the stipulated time periods, provide proof that the manufacturer of the bitumen has a registration certificate attesting that the quality system satisfies the requirements of standard ISO 9001

- “Quality management system”. The certification must be valid for the period of the works.
- .3 According to the requirements of this contract and within the stipulated time periods, provide a copy of the ISO registration of the hot mix plant as well as the quality plan for production of the asphalt mix
 - .5 Test and Evaluation Reports:
 - .1 According to the requirements of this contract and within the stipulated time periods, submit to the Departmental Representative, for verification, the mix formula for each type of mix required and the results of the tests on each mix and its constituents. The results must come from tests performed during the current calendar year for all properties of the constituents and the mixtures.
 - .2 Submit printed record of mix temperatures at end of each day.
 - .3 Provide the calibration charts for each hot load and each cold load before the start of the works and at each inspection during production.
 - .6 Sustainable Design Submittals:
 - .1 Erosion and Sedimentation Control: submit copy of erosion and sedimentation control plan in accordance with EPA 832/R-92-2005.
 - .2 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
 - .7 Description of plant and mixing asphalt
 - .1 Model of plant and mixing asphalt and factored year.
 - .2 Maintenance program of last 3 years, as:
 - .1 Preventive maintenance.
 - .2 Type of mix and quantity executed.
 - .3 Quality report of asphalt paving mix.
 - .4 Hourly production and weekly production.
 - .5 Restraint operation.
 - .6 Inspection report by the manufacturer or qualified representant, including major modification, replacement of pieces and preventive maintenance as indicated at the section 01 45 00 – Quality control.
 - .7 The capacity of reservoir of bitumen.
 - .8 The Departmental Representative reserves the right to refuse a mix plant that is not considered to offer a history of the capacity and quality required in the context of an isolated location in northern regions.
 - .8 Description of the paving team
 - .1 The Contractor’s workforce must respond to the following minimum requirements:

- .1 One foreman and one paving team with relevant experience in laying airport paving. The foreman must be present on the site throughout the paving work.
- .2 Paver operators with relevant experience in laying airport paving.
- .3 Steamroller operators with relevant experience in laying airport paving.
- .4 A head mechanic able to quickly adjust and/or repair all equipment used on the site.
- .5 The Contractor must demonstrate at the site start-up meeting, with supporting resum, that the workers who will be doing the paving have relevant experience in laying airport paving.

1.6 **QUALITY ASSURANCE**

- .1 Asphalt mixes must be manufactured by a company operating a coating plant with a registration certificate attesting that the quality system meets the requirements of the ISO standard.
- .2 Bitumen used in the manufacture of asphalt must be produced by a manufacturer whose plant holds a certificate of registration attesting that the quality system meets the requirements of the ISO 9001 standard "Quality Management Systems".
- .3 The company responsible for warehousing and shipping must hold a registration certificate attesting that the quality system meets the requirements of ISO 9001 "Quality Management Systems".
- .4 For each delivery of bitumen, the Contractor must provide the supervisor with a certificate of compliance, as specified in MTMDDET Materials Vol VII.

1.7 **DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver and stockpile aggregates in accordance with Section 31 05 16- Aggregate Materials and erosion and sedimentation control plan. Stockpile minimum 50% of total amount of aggregate required before beginning asphalt mixing operation.
- .3 When necessary to blend aggregates from one or more sources to produce required gradation, do not blend in stockpiles.
- .4 Stockpile fine aggregate separately from coarse aggregate.
- .5 Provide approved storage, heating tanks and pumping facilities for asphalt cement.
- .6 Submit to DCC Representative copies of freight and waybills for asphalt cement as shipments are received.
 - .1 DCC Representative reserves right to check weights as material is received and the sample, to demonstrate that the properties have not deteriorated and still respect the requirements.
- .7 During transport, the following information must be added to the certificate of conformity:

- the contractor's name;
 - the transporter's name;
 - the loading date;
 - the quantity delivered.
- .8 The containers must be identified as follows:
- the bitumen type;
 - the batch number;
 - manufacturing date;
 - manufacturer's name;
 - distributor's name
- .9 Make separate piles of crushed recovered mix, as provided in section 31 05 16-Aggregates, at the places indicated by the Departmental Representative.
- .10 Prepare a construction waste management plan for the works that are covered by this section.
- .11 Packing waste management: recover the packing waste for reuse/recycling of the pallets and cushioning by their manufacturer and recover other packing materials, according to the instructions of the waste reduction plan, as provided in section 01 74 21-Construction/demolition waste management and disposal.

Part 2 Products

2.1 MATERIALS

- .1 Bitumen: PG52V-40 in accordance with 4101, Volume VII Materials, MTMDET.
- .2 Reclaimed asphalt
- .1 The use of recycled materials such as reclaimed asphalt pavement (RAP), post-manufacture (BPF) and post-consumption (BPC) asphalt shingles is prohibited for this contract.
- .3 Bitumen-aggregate affinity:
- .1 The adhesiveness of the binder to the aggregate used as input in the production of the hot mix must be verified according to the LC 25-009 test method. For this purpose, the bitumen must have a minimum residual coating of 95% with each of the aggregate sources used in formulation of the binder. The test results will determine whether the asphalt must be HRD type, if required these costs will be included at unit price of metric tonne of pavement.
- The results obtained must be sent immediately to the Departmental Representative to confirm the type of asphalt required to execute the works in 2019 and 2020. The Departmental Representative reserves the right to make verification tests.

- .4 Aggregates: compliant with section 31 05 16 – Aggregates and the following requirements.
- .1 Crushed stone consisting solely of hard, angular particles free of clay lumps, hydraulic, organic or frozen materials as well as any other deleterious substances. Limestone and other easily polished petrographic facies are prohibited
- .2 The grain size distribution of the reconstituted materials must remain within the following limits.

Screen designation	% passing	
	Base layer, surface layer and crack repairs	Micro-asphalt concrete
14 mm	100	
10 mm	85-100	100
5 mm	60-78	85-100
2,5 mm	42-65	80-95
1,25 mm	30-50	70-90
0,630 mm	20-38	55-80
0,315 mm	12-28	30-60
0,160 mm	5-18	10-35
0,080 mm	4,0-10,0	4-14,0

- .3 Aggregates must respect the following intrinsic properties, production characteristics and supplementary characteristics:

CHARACTERISTICS / STANDARD	REQUIREMENTS	
	FINE AGGREGATES	COARSE AGGREGATES
MgSO ₄ (%) CSA A23.2-9A	≤ 16%	≤ 12%
Micro-Deval MD (%) LC 21-400 Coarse aggregates LC 21-101 Fine aggregates	≤ 30%	≤ 15%
Los Angeles LA (%) LC 21-400	N.A.	≤ 25% surface layer ≤ 35% bottom layer
Micro-Deval + Los Angeles	N.A.	≤ 40% surface layer ≤ 50% bottom layer
Absorption (%) LC 21-067	N.A.	≤ 2.00%
Particles passing the 80 µm screen (%) CSA A23.2-5A	N.A.	≤ 1.0% (gravel pit) ≤ 1.5% (quarry)

CHARACTERISTICS / STANDARD	REQUIREMENTS	
	FINE AGGREGATES	FINE AGGREGATES
Flat particles (%) LC 21-265	N.A.	≤ 25%

Elongated particles (%) LC 21-265	N.A.	≤ 40%
Flat and elongated (%) ASTM D4791	N.A.	≤ 10%
Fractured particles (%) LC 21-100	N.A.	≥ 60%
Light particles % of particle mass of a density below 1.95 CSA A23.2-4A	≥ 1.5% surface layer ≥ 3.0% bottom layer and cracks	
Clay lump content (%) CSA A23.2-3A	≤ 2.0%	N.A.
Content of particles less than 5µm (%) /BNQ 2501-025	≤ 5.0%	N.A.
Flow rate LC 21-075	≥ 80	N.A.
Sand equivalent (%) ASTM D2419	≥ 50%	N.A.
Projection Polishing Rate (PPR) / LC 21-102	N.A.	0.48 surface layer 0.45 base layer

- .4 Coarse aggregate is what is retained on the 5 mm mesh screen and fine aggregate is what passes through the 5 mm mesh screen.
- .5 When a mix plant with a drum dryer or without a hot sorter/feeder is used, the fine aggregates must first pass through a 5 mm mesh screen and then be piled separately from the coarse aggregates.
- .6 The choice of blocks used in the production of aggregates must reflect the required specifications.
- .7 Small aggregates may be accepted or rejected in view of their prior performance on the site, even if they have the prescribed physical characteristics.
- .5 Mineral filler:
 - .1 Ensure finely ground particles of limestone, hydrated lime, Portland cement or non-plastic mineral matter approved by DCC Representative are thoroughly dry and free from lumps.
 - .2 Add mineral filler when necessary to meet job mix aggregate gradation or as directed by DCC Representative to improve mix properties.
 - .3 Ensure mineral filler is dry and free flowing when added to aggregate.
- .6 Water: to approval of DCC Representative.

2.2 EQUIPMENT

The Contractor must make available and leave at the site, for the exclusive use of the project, equipment in the numbers given in the following requirements:

- .1 Pavers: mechanical (2 units) self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.
- .2 VTM: vehicule transfert of material (1 unit), is required for the spreading mix on airstrip, taxiway and apron.

- .3 Vibrating compactors: at least three, at least two of which are steel tandem vibrating road rollers of a minimum of 20 T.
 - .1 Minimum width of the roller: 1800 mm for the bottom and surface layers and 900 mm for crack repairs.
 - .2 Maximum vibration amplitude (machine setting): 0.5 mm for layers less than 40 mm thick.
 - .3 Pneumatic compactor: at least one (1) pneumatic compactor roller of the type and weight appropriate for obtaining a compacted mix at the prescribed density.
- .4 Tack coat spreader truck: at least one (1) tack coat spreader truck equipped with a flow meter for controlling the application rate. One spare pump.
- .5 Reshaping asphalt equipment: (3 units) width 2.0 metre, 1.0 metre and 0.5 metre. Some 1.0 metre wide. For microplaning, the drum must have a minimum of 350 teeth, whose width does not exceed 6 mm. For conventional reshaping, width does not exceed 15 mm.
- .6 Mechanical broom: one unit truck mechanical broom.
- .7 Heater joint: (2 units), one mobile and one fixed at the paver for the longitudinal joint. The equipment will be of the "Poweray infrared or equivalent" infrared type.
- .8 Haul trucks: sufficient number (minimum 5 units) and of adequate size, speed and condition to ensure orderly and continuous operation and as follows:
 - .1 Heating 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.
- .9 Hand tools:
 - .1 Lutes or rakes with covered teeth for spreading and finishing operations.
 - .2 Tamping irons having mass 12 kg minimum and bearing area not exceeding 310 cm² for compacting material along curbs, gutters and other structures inaccessible to roller. Mechanical compaction equipment, when approved by, may be used instead of tamping irons. Cleaning equipment (blowers, brooms, brushes, etc.) for the joints and small, not extensive surfaces.
 - .3 Provide a 4.5 metre ruler equipped with a handle for the Departmental Representative.
- .2 One mobile repair unit used to repair and/or adjust all site equipment.
- .3 All equipment listed above must not have been in use for more than 5 years. The Contractor must certify the purchase and commissioning date for each piece of equipment. In case of a major upgrade of mechanical and other components, the equipment may have been in use for up to 8 years.

The Contractor must show the upgrade modifications, where any.

- .4 Equipment inspection
 - .1 The equipment will be inspected by the Departmental Representative after they are mobilized at the port, to confirm compliance with the above requirements.

Any equipment non-compliant with the specifications described will not be accepted and must be replaced by the Contractor.

2.3 MIX DESIGN

- .1 Mix design to be approved in writing by DCC Representative.
- .2 The Contractor must provide the Department Representative with the design curves of the Marshall mixes, illustrating the ratios of the asphalt content and each of the mix properties (density, stability, VMA, creep, voids, etc.) for at least five (5) different asphalt contents, with the difference between them not exceeding 0.5%. Select the highest asphalt content that still respects all the other requirements set out in the specifications. Adjustments to the grain size distribution, the 80-micron screen and the asphalt content may be required by the Department to respect the median voids.

The formulation exercise must allow a minimum sand height of 0.38mm to be reached upon commissioning. The test plank will allow confirmation that the proposed formulation (surface layer) satisfies this requirement.

If necessary, submit for approval a method for re-texturing and/or eliminating the superficial asphalt film. The method proposed must be gentle and demonstrate that the mixture and the aggregates have not been altered in any way.
- .3 The mix formula must be determined using the Marshall method and according to the requirements of volume MS-2 of the Asphalt Institute, to satisfy the following requirements.
 - .1 Number of hammer blows on each side of the samples: 50.
 - .2 Physical characteristics of the surface and correction mix:

Properties	Airport roads	Micro-asphalt concrete
Marshall stability at 60 degrees Celsius, in kN	≥ 9.0	≥ 5.0
Creep index (mm)	2.0 – 4.0	2.0 – 4.5
Percentage of voids in the mix (%)	2.0 – 4.0	2.0 – 4.0
Percentage of voids in the mineral aggregates VMA (%)	≥ 15.0 surface layer ≥ 13.0 bottom layer	≥ 16.0
Retained stability index (%)	≥ 75	N/A
Sand height (surface roughness) (mm)	≥ 0.4	N/A

- .3 Measure physical requirements as follows:
 - .1 Marshall load and flow value: to AASHTO T245.

- .2 Compute void properties on basis of bulk specific gravity of aggregate to ASTM C127 and ASTM C128. Make allowance for volume of asphalt absorbed into pores of aggregate.
- .3 Air voids: to ASTM D3203.
- .4 Voids in mineral aggregates: to AI MS2.
- .5 Retained stability index: according to standard ASTM D1075 or LC 26-001.
- .6 Sand height of 0.38 mm according to standard ASTM E965.
- .4 The composition of the mix must not be changed without the prior approval of the Departmental Representative. If a change of the source of supply of a material is proposed, a new mix dosage formula must be approved by the Departmental Representative.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for asphalt paving in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of DCC Representative.
 - .2 Inform DCC Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from DCC Representative.

3.2 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.
 - .1 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 1% by mass or to lesser moisture content if required to meet mix design requirements. Heat to temperature required to meet mixing temperature as directed by DCC Representative.
 - .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 DCC Representative. Do not heat asphalt cement above [maximum temperature indicated on temperature-viscosity chart 160 degrees C.
- .9 Make available current asphalt cement viscosity data at plant. With information relative to viscosity of asphalt being used, DCC Representative to approve temperature of completed mix at plant and at paver after considering hauling and placing conditions.
- .10 Maintain temperature of materials within 5 degrees C of specified mix temperature during mixing.
- .11 Mixing time:
 - .1 In batch plants, both dry and wet mixing times as directed by DCC Representative. Continue wet mixing as long as necessary to obtain thoroughly blended mix but not less than 30s or more than 75s.
 - .2 In continuous mixing plants, mixing time as directed by DCC Representative but not less than 45s.
 - .3 Mixing time as directed by DCC Representative.
- .12 Production capacity :
 - .1 Minimum 150 tonnes metric by hour.
- .2 Dryer drum mixing plant:
 - .1 The mixing plants must comply with standard AASHTO M156 Requirements for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures
 - .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 Where RAP is to be incorporated into mix, dryer drum mixer is to be designed to prevent direct contact of RAP with burner flame or with exhaust gases hotter than 180 degrees C.
 - .5 Feed RAP from separate cold feed bin designed to minimize reconsolidation of material.
 - .6 Adjust the opening of the hopper doors and the speed of the conveyor belts in a way to obtain the desired proportions for the mix.
 - .1 Calibrate the conveyor weighing mechanisms by determining the weight of the aggregates crossing the mechanisms during a defined period.
 - .2 The variance between the value obtained and the weight recorded by the computer of the mixing station must not be more than 2% more or less.

- .7 Allow for easy calibration of weighing systems for aggregates and RAP without having material enter mixer.
- .8 Provide and install screens, sieves or other appropriate devices that allow rejecting oversized materials or clumps of aggregates from the cold lifter before they enter the drum.
- .9 Equip the mixing station with a servo-mechanism that automatically stops the belts or lifters when the supply of asphalt or aggregates from any hopper is interrupted.
- .10 Ensure the heating and mixing of the asphalt mix in an approved drum dryer mixer of the parallel flow type, in which the aggregates enter the drum on the burner side and move in parallel to the flame and in the direction of the stream of the exhaust gases.
 - .1 Set the temperature of the drum dryer in a way to prevent the cracking of the aggregates and excessive oxidation of the asphalt.
 - .2 Provide the mixing station with an automatic control system for the burner with mix temperature sensor, at the discharge point, and a thermograph able to be monitored by the operator of the mixing station.
 - .3 At the end of the day, submit the mix temperature surveys for approval.
- .11 Make sure that the mixing time and temperature at which it occurs produce a uniform mix of perfectly coated aggregates with a humidity level, upon leaving the mixing plant, of no more than 2%.
- .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 4 hour.
- .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).

Screen with mesh of 5 mm and up	± 5.0
Screen with mesh of 2.5 mm	± 4.0
Screen with mesh of 0.315 mm to 1.25 mm	± 3.0
Screen with mesh of 0.160 mm	± 2.0
Screen with mesh of 0.080 mm	± 1.0
 - .2 Variance allowed between the quantity of binder provided in the formula and that contained in the mixture: 0.25%. However, the average percentage of asphalt in production must be the asphalt level of the approved formula (variance allowed ± 0.10%).
 - .3 Permissible variation of mix temperature at discharge from plant: 5 degrees C.

- .4 The characteristics of the mixture in production must comply with the specifications of article 2.3 "Mixing formulas" in this section.
- .6 Addition of anti-stripping agent:
 - .1 Plant to be equipped with pug mill to thoroughly mix aggregates and lime prior to entering the plant.
 - .2 Plant to be equipped with suitable conveyor systems capable of supplying aggregates and lime at constant rate.
 - .3 Plant to be equipped to control rate of lime incorporation to within 1/4%.
 - .4 Add water to aggregate prior to entering pug mill.

3.3 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to [sediment and erosion control plan, specific to site, or requirements of authorities having jurisdiction, whichever is more stringent sediment and erosion control drawings requirements of authorities having jurisdiction.

Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
 - .2 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- .2 Reshape asphalt pavement in accordance with Section 32 01 16.13- Reshaping Asphalt Pavement.
- .3 When paving over existing asphalt surface, clean pavement surface in accordance with Section 32 01 11.01- Pavement Cleaning and Marking Removal.
 - .1 When levelling course is not required, patch and correct depressions and other irregularities to approval of DCC Representative before beginning paving operations.
- .4 Apply tack coat in accordance with Section 32 12 13.16- Asphalt Tack Coats prior to paving.
- .5 Prior to laying mix, clean surfaces of loose and foreign material.

3.4 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.
 - .1 Raise truck bed and thoroughly drain, and ensure no excess solution remains in truck bed.

- .3 Schedule delivery of material for placing in daylight, unless DCC Representative approves artificial light for night placing.
- .4 Deposit mix from surge or storage silo to trucks in multiple drops to reduce segregation.
 - .1 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.
 - .1 Deliver and place mixes at temperature within range as directed by DCC Representative, but not less than 135degrees C.

3.5 TEST STRIP

- .1 Before the start of application of the asphalt paving, a test plank of at least 100 metric tons will be installed for each of the asphalt mixes, approved in advance by the Professional, must be carried out at the location specified by the Departmental Representative. The test planks must be executed over more than one adjacent lane, so that the finishing and compacting of the joints can be evaluated. The test plank will be applied on the apron area, phase 1.
- .2 The test planks must be executed with all the same laying and compacting equipment for the asphalt produced by the mixing plants approved in advance by the Professionals.
- .3 For each test plank, five (5) samples will be removed and analyzed by the Contractor and the Laboratory representing the Department.
- .4 The individual results must respect the requirements of the specifications and the average output must also comply with the specifications or the mix used for the test plank will be deemed defective and thus refused and unpaid and have to be replaced with conforming material.
- .5 The Contractor will not be authorized to continue the work until the test results are approved by the Departmental Representative. Any significant deviation from the specifications will result in a repetition of the test plank process.
- .6 During the construction of the test plank, the optimum method of compacting must be determined by taking readings using a nuclear densitometer and making various observations:
 - .1 Determine the number of passes to execute and the order in which they should be executed.
 - .2 Determine the appropriate operating characteristics of vibrating compactors.
 - .3 Check whether the paving surface is even and respects the surface roughness requirements.
 - .4 Determine the real density of the asphalt concrete using borings, to determine whether additional or different compacting equipment is required to obtain a density of at least 98% from the gross density of the Marshall test samples.

.7 Payment:

- .1 The test plank will be remunerated if it satisfies all the requirements described in the specifications.

3.6 PLACING

- .1 Obtain DCC Representative's approval of existing surface tack coat prior to placing asphalt.
- .2 Place asphalt concrete to thicknesses, grades and lines DCC Representative by as indicated. The Contractor must ensure the thermal homogeneity of the joints for laying the asphalt mix at the level of the longitudinal and transversal joints using the infrared camera.
- .3 A material transfer vehicle (MTV) must be used to install all surface asphalt concrete except on structures. Laying of micro-asphalt concrete and repairs do not require the use of an MTV.
- .4 The MTV is a unit specifically designed to take the mix from the trucks and transfer it to the finisher without depositing the mix on the road. The MTV must be self-propelled and independent of the finisher. The minimum capacity of the MTV must be 22 tons of asphalt mix.
- .5 Each finisher must be supplied by an MTV. One MTV cannot supply more than two finishers at once and can accept only one mixture with a unique formulation. Each finisher supplied by an MTV must be equipped with a supplemental hopper with a minimum capacity of 12 tons of mix. An MTV must be able to mix the asphalt concrete at the level of the device or supplementary loading hopper, so that it can deliver a uniform mix to the finisher. The MTV will not be used for transport between the mixing plant and the finisher. The speed at which the finishers and the MTV advance must be adjusted according to the mix production and supply rate to avoid having the finishers come to a halt. The finishers and MTV must also be positioned in a way to avoid contact with each other and avoid halting the finishers. Halting a finisher is tolerated only when there is a breakdown of the MTV. A breakdown is a mechanical, electrical or electronic problem preventing the MTV from working properly. In such a case, the mix already made at the time of the breakdown can be laid without using an MTV.
- .6 The MTV must be equipped with a system of sprinklers in order to spray all the tires with a soapy, anti-adhesive solution, to reduce sticking of the tack coat to the tires.
- .7 The Contractor must limit pulling off tack coat (cookies) from the tires of the MVT wheels and the paver so that tack coat does not become incorporated in the asphalt laid. If necessary, the Contractor must extract them manually at the exit from the paver before the asphalt is compacted.
- .8 Laying conditions.
 - .1 Lay the asphalt mixes only when the temperature of the ambient air is at least 5°C.
 - .2 When the temperature of the surface to be paved is less than 10 °C, supply the additional compactors necessary to compact the mixture to the prescribed degree of compactness before it cools down.

- .3 Do not lay hot mix when it is raining, if there are puddles of stagnant water on the surface to be paved or if that surface is damp.
- .4 The binder must be completed cured before the asphalt mix is laid
- .9 Apply the asphalt concrete in layers with the thickness, after compacting as indicated below.
 - .1 Base layer of the 30 metre central section, after planing, in the order of 50 mm thick, with a surface mix.
 - .2 Surface layer of the whole width of the runway, including lateral strips 7.5 metres on either side of the central 30.0 metre section and the section with an average thickness of 55 mm (varying from 50 to 65 mm).
 - .3 Corrective layer of the taxiway section with a surface mix, variable thickness, for slope correction.
 - .4 Surface layer of the taxiway and apron area, 55 mm thick.
- .10 Execute the levelling and tapering in the lower layers of material to the extent possible. Have the joints overlap for a width of at least 300 mm for the transition at the connection joint and the encased end.
- .11 Spread the asphalt mix in strips according to the lengths described in the phasing plan for each of the layers.
- .12 On aerodrome roads, traffic lanes, aprons and parking areas, begin spreading on the highest side of the pavement or from the crest of the road and make sure that the initial strip overlaps the axis of the curved roads.
- .13 Spread and cut the mix using an automotive mechanical spreader.
 - .1 Make the longitudinal joints and the edges of the paving according to the lines and markers identified.
 - .1 The Departmental Representative will specify what lines the spreader must follow parallel to the axis of the surface to be paved. Place and maneuver the spreader in a way to be able to follow the established lines closely.
 - .2 When the spreaders are used in a series, the first one must follow the lines or markers and the second one, the edge of the materials spread by the first one.
 - .1 Make sure that the spreaders follow each other as closely as possible and in no case are more than 30 m from each other.
 - .3 Maintain the quantity of mix contained in the spreader tank at a constant level while placing of the asphalt binder.
 - .4 If there is any sign of segregation, suspend the spreading work immediately until the cause has been identified and corrected.
 - .5 Correct the alignment variances left by the spreader immediately after its passage.
 - .6 Correct irregularities of the paved surface immediately after the passage of the spreader.
 - .1 Remove, using a shovel or rake, excess material forming bumps.

- .1 Fill the cavities with hot mix and smooth them.
 - .2 Scattering materials on surfaces to be repaired is prohibited.
- .7 Do not spread extra materials on surfaces that have just been trimmed.
- .14 Manual spreading.
 - .1 Use approved and firmly spread wood or steel frames to obtain the level and cross profile desired.
 - .1 Use measuring blocks and intermediate rods to obtain the desired cross profile.
 - .2 Distribute the materials uniformly without scattering them.
 - .3 While spreading, loosen the materials on the bottom and spread them uniformly using rakes or covered rollers with teeth.
 - .1 Reject material that has formed lumps that are hard to break apart.
 - .4 After spreading but before proceeding to rolling, check the surfaces using templates and rulers and correct any irregularities.
 - .5 Provide the heating equipment necessary to keep the hand tools free of binder.
 - .1 Adjust the temperature in a way to avoid burning the materials matériaux.
 - .2 The tools used must never be warmer than the materials installed.

3.7 COMPACTING

- .1 Roll the asphalt continuously using the rolling method adopted for the test plank, to at least 98% of the density obtained from the gross density of the Marshall tests of the hot mixed installed during the day, for each mix. The joints, correction joints, crack repairs and connection transition must be compacted at least 96% of the same density obtained for the mix laid during the day, for each mixture.
- .2 Do not change rolling pattern unless mix changes or lift thickness changes.
 - .1 Change rolling pattern only as directed by DCC Representative.
- .3 General:
 - .1 Provide at least 3 rollers and as many additional rollers as necessary to achieve specified pavement density. When more than 2 rollers are required, 1 roller must be pneumatic tired type.
 - .2 Start rolling operations as soon as placed mix can bear weight of roller without excess displacement of material or cracking of surface.
 - .3 Operate roller slowly initially to avoid displacement of material. Do not exceed 5 km/h for breakdown and intermediate rolling for static steel-wheeled and pneumatic tired rollers. Do not exceed 9 km/h for finish rolling.
 - .4 Use static compaction for levelling coarse less than 25 mm thick.
 - .5 For lifts 50 mm thick and greater, adjust speed and vibration frequency of vibratory rollers to produce minimum of 25 impacts per metre of travel. For lifts less than 50 mm thick, impact spacing not to exceed compacted lift thickness.

- .6 Overlap successive passes of roller by minimum of 200mm and vary pass lengths.
- .7 Keep wheels of roller slightly moistened with water to prevent pick-up of material but do not over-water.
- .8 Do not stop vibratory rollers on pavement that is being compacted with vibratory mechanism operating.
- .9 Do not permit heavy equipment or rollers to stand on finished surface before it has been compacted and has thoroughly cooled.
- .10 After traverse and longitudinal joints and outside edge have been compacted, start rolling longitudinally at low side and progress to high side.
 - .1 Ensure that all points across width of pavement receive essentially equal numbers of passes of compactors.
- .11 When paving in echelon, leave unrolled 50 to 75 mm of edge which second paver is following and roll when joint between lanes is rolled.
- .12 Where rolling causes displacement of material, loosen affected areas at once with lutes or shovels and restore to original grade of loose material before re-rolling.
- .4 Breakdown rolling:
 - .1 Begin breakdown rolling with static steel wheeled roller vibratory immediately following rolling of transverse and longitudinal joint and edges.
 - .2 Operate rollers as close to paver as necessary to obtain adequate density without causing undue displacement.
 - .3 Operate breakdown roller with drive roll or wheel nearest finishing machine. When working on steep slopes or super-elevated sections use operation approved by DCC Representative.
 - .4 Use only experienced roller operators.
- .5 Intermediate rolling:
 - .1 Use pneumatic-tired, steel wheel or vibratory rollers and follow breakdown rolling as closely as possible and while paving mix temperature allows maximum density from this operation.
 - .2 Rolling to be continuous after initial rolling until mix placed has been thoroughly compacted.
- .6 Finish rolling:
 - .1 Accomplish finish rolling with two-axle or three-axle tandem steel wheeled rollers while material is still warm enough for removal of roller marks.
 - .1 If necessary to obtain desired surface finish, use pneumatic-tired rollers as directed by DCC Representative.
 - .2 Conduct rolling operations in close sequence.

3.8 JOINTS

.1 General:

- .1 Remove surplus material from surface of previously laid strip.
 - .1 Do not deposit on surface of freshly laid strip.
 - .2 Remove the materials applied for the transition joints by planing the whole surface, in order to create a perfectly linear joint.
- .2 Before paving the adjacent surface, soak the contact surfaces of the existing works, such as the manholes, edges and gutters, with tack coating.
- .3 Before the hot mix is applied to the longitudinal and transverse cold joints whose temperature is below 90 °C, they must be heated with an infrared heating device mounted on the paver or using Bobcat type portable equipment.

The heating equipment must be installed on the spreader and designed for this type of work. The equipment must heat the joints to between 100 °C and 120 °C. The equipment must be accepted by the Departmental Representative.

.2 Transverse joints:

- .1 Offset transverse joint in succeeding lifts by at least 600 mm.
- .2 Cut back to full depth vertical face and tack face with thin coat of hot asphalt 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.
 - .1 When paving airport roads, avoid making a cold joint within the 30 m that form the central section of the pavement.
 - .2 When the cold joint cannot be avoided, saw-cut or plane the existing paving of the preceding lane for a width of at least 150 mm at its whole thickness to obtain a vertical face; soak this face with a thin layer of tack coating made of hot asphalt.
 - .3 The Contractor must supply the procedure for creating the various ramping zones, the method to be followed for removing the excess materials, the use of the 4.5 metre ruler to prepare the cutting plan for resumption, all under the responsibility of the Contractor.
- .2 Overlap previously laid strip with spreader by 25 to 50 mm.
- .3 Before rolling, carefully remove and discard coarse aggregate in material overlapping joint with lute or rake.
- .4 Roll longitudinal joints directly behind paving operation.
- .5 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 Construct feather joints so that thinner portion of joint contains fine graded material obtained by changed mix design or by raking out coarse aggregate in mix.
 - .1 Place and compact joint to ensure joint is smooth and without visible breaks in grade or less than 3 mm.
 - .2 Locate the encased joints in the existing paving.
- .5 Construct butt joints as indicated.

3.9 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 in the longitudinal and transverse axis of the runway, the taxiway and the apron.
- .3 Measurement of the evenness
 - .1 General information:

The Contractor must retain the specialized services of an independent firm to evaluate the evenness and this applies only to the surface layer placed on the runways and taxiway.
 - .2 Equipment and measurement unit

The evenness is measured using an inertial profilometer that meets the requirements of a Class 1 device according to standard ASTM E950 “Standard Test Method for Measuring the Longitudinal Profile of Traveled Surfaces with an Accelerometer Established Inertial Profiling Reference”.

The measurement unit for evenness is the IRI (International Roughness Index). The IRI is expressed in m/km and calculated according to standard ASTM E1926 “Standard Practice for Computing International Roughness Index of Roads from Longitudinal Profile Measurements”. The IRI is calculated in the axes in the centre and 10 metres to the left and right with a precision of one hundred of a m/km in segments of 10 and 100 m.

The IRI value adopted for a segment of 10 or 100 m is the truncated value, with a precision to the tenth of m/km, of the average of the IRI values of two wheel traces.
 - .3 Evaluation of surface evenness

The Department evaluates the surface evenness within 15 days after receipt of a written notice from the Contractor indicating that the asphalt paving work has been completed.

The Contractor may delegate at its expense an observer to ensure that the operations regarding the evaluation of the surface evenness comply with these specifications. Any comments concerning an operation that the Contractor deems incorrect must be reported immediately to the Supervisor.

.4 Contractor responsibilities

Throughout the time necessary for the Departmental Representative to evaluate the surface evenness, the Contractor is responsible for:

- .1 Keeping the surface clear of residue that could influence the evenness measurement;
- .2 Installing and maintaining signage according to the standards in effect to allow unobstructed passage of the inertial profilometer over the full width and whole length of the lanes subject to evenness requirements. The inertial profilometer must be able to travel at a constant speed of 50 to 80 km/h, depending on the posted speeds, on the lanes subject to the evenness requirements as well as for a distance of at least 100 m on either side of them;
- .3 Providing all assistance required by the supervisor for this evaluation.
- .4 Starting from the chaining at the start of the segmentation, the IRI values are calculated by consecutive segments of 10 and 100 m. The chaining at the end of the segmentation corresponds to 10 m before the paving end joint. The segment chainings must coincide on all the lanes of the same roadway.

.5 Surface evenness requirements

- .1 The surface evenness requirements apply to segments of 10 and 100 m according to two criteria.
- .2 For each of the 100 m segments subject to evenness requirements, the acceptance of surface evenness occurs as follows:
 - .1 A segment is accepted when the IRI value calculated for it is ≤ 1.7 m/km.
 - .2 A segment is rejected when the IRI value calculated for it is > 1.7 m/km.
- .3 For each of the 10 m segments subject to evenness requirements, the acceptance of surface evenness occurs as follows:
 - .1 A segment is accepted when the IRI value calculated for it is ≤ 4.0 m/km.
 - .2 A segment is rejected when the IRI value calculated for it is > 4.0 m/km.

.6 Corrective measures and evenness re-evaluation

- .1 For each 10 or 100 m segment rejected, the Contractor is required to apply the corrective measures necessary within a period of 28 days including the appeal deadline of the Contractor after the supervisor had informed him in writing of the results of the surface evenness evaluation. The exact nature of the corrective measures (planing or aggregate thickness, location, date of execution, etc.) must be approved by the supervisor before the corrective work is done.

- .2 After having made the corrective measures on all works, the Contractor is required to so notify the supervisor in writing. The Department then proceeds to re-evaluate the surface evenness, doing so with the same segmentation of lanes subject to evenness requirements. For each 10 and 100 m segment that has been corrected, including 10 m on either side, the result of the re-evaluation replaces the initial result.
- .3 To calculate the adjustment relative to surface evenness when corrective work has been done, it is necessary to replace the results of the initial evaluation with the results of the re-evaluation, but only for the segments that were corrected (including 10 m on either side).
- .4 All provisions and requirements relative to the surface evenness of the asphalt pavement apply to the corrective measures made by the Contractor as well as to the re-evaluation of the surface evenness of every corrected segment.
- .5 If the supervisor refuses the corrective measures, any rejected uncorrected segment is considered non-compliant and the calculations of adjustments determined in point .7 "Calculation of adjustment amounts for surface evenness" will be applied to each of the segments.
- .7 Calculation of adjustment amounts for surface evenness
 - .1 The adjustment amount related to surface evenness applicable to each of the 100 m segments accepted for each of the lanes subject to evenness requirements is shown in Table 2.

Adjustment amount related to surface evenness per 100 m segment

IRI value calculated for the accepted segment (m/km)	Adjustment amount related to surface evenness (\$)
≤ 1.2	0
1.3	- 10
1.4	- 20
1.5	- 100
1.6	- 500
1.7	- 1,000

- .2 The adjustment amounts of segments of each lane subject to evenness requirements are added for the whole contract and are the subject of a general deduction.

3.10 DEFECTIVE WORK

- .1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required.
 - .1 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.
- .3 Adjust roller operation and screed settings on paver to prevent further defects such as rippling and checking of pavement.

3.11 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

Part 4 Quality control

4.1 CONTROL BY THE CONTRACTOR

- .1 The Contractor must ensure quality control of the hot mix and its constituents during production.
- .2 He must supply the results for at least one sample per 500 tons of hot mix produced or a minimum of two (2) samples per day. A complete analysis must be performed for each sample. The briquettes will be created in the laboratory by applying 50 blows manually per side and respecting the temperature specified in Appendix A of standard LC 26-020. Each sample consists of 4 briquettes for the Marshall tests.
- .3 The frequency can be increased if production is not stable.
- .4 The Contractor, in the presence of the Departmental Representative and at the time the latter chooses, takes one sample of asphalt per 3,000 tons of hot mix laid with a minimum of three samples per year of work.
- .5 An asphalt sample consists of two collections of 1 litre each taken at the sampling tap located on the piping that links the tank to the asphalt incorporation device of the mixing system. The sample is placed in a clean metal container.
- .6 The compactness of the paving will be verified using a nuclear densitometer with a minimum of three tests per day. The compactness of the joints will be checked every 75 linear metres. In case of non-conformity, the compactness will be evaluated by taking cores at double the rate specified.
- .7 The Contractor must verify the homogeneity of the asphalt paving by thermography according to the requirements of these specifications.
- .8 The Contractor must provide each day detailed registers of the hot mix plant output, the grain size distribution of the aggregate from cold bins and hot bins, the mixing temperature of the chopped material, etc. It must demonstrate that transport, extraction from barrels and incorporation in the mix have not altered the properties of the asphalt.

- .9 The Contractor must proceed to make profile measurements continuously during the paving work by surveying and using a 4.5 metre ruler, in order to detect in real time any variance from the planned profiles and elevations. The Contractor must submit daily reports of these surveys of its quality control.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .3 Section 32 01 11.01 – Pavement Crack Cleaning and Filling.
- .4 Section 32 12 16 – Asphalt paving.

1.2 MEASUREMENT AND PAYMENT

- .1 Pavement marking: measured by lump sum.
- .2 Pavement marking: measured by lump sum including supply and install of paint, symbols, letters and removal of any existing paint.
- .3 Temporary pavement marking: measured by lump sum including supply and installation of paint as well as paint removal.
- .4 Contractor to provide survey layout for all required pavement markings. No separate payment will be made for survey layout.

1.3 REFERENCE STANDARDS

- .1 Environment Canada (EC)
 - .1 Volatile Organic Compound (VOC) Concentration Limits for Architectural Coatings Regulations, SOR/2009-264.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.5, Low Flash Petroleum Spirits Thinner;
 - .2 CAN/CGSB 1.74-2001 Alkyd Traffic Paint;
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .4 Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - édition courante.
 - .1 MPI #32 Traffic Markings Paint, Alkyd.
- .5 Minister of Transports of Quebec (MTQ), Pavement Laboratory (LC)
 - .1 LC 34-301, Paint – Determination of titanium dioxide.
 - .2 LC 34-505, Paint – Determination of consistency at 5°C.
 - .3 LC 34-506, Paint – Determination of the degree of sedimentation by the Patton method.
 - .4 LC 34-507, Paint – Determination of the lead chromate content.
 - .5 LC 34-508, Paint – Determination of the phthalic anhydride content.

- .6 MTQ standard 10201; Alkyd paint for road markings

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature and data sheets for pavement markings and include product characteristics, performance criteria, physical size, finish and limitations;
 - .2 Submit two (2) copies of WHMIS MSDS.
- .3 Construction Waste Management
 - .1 Submit the Construction Waste Management Plan for the project which must include the requirements for recycling and return of materials.
 - .2 Low emitting materials: Submit a list of paints and coatings used in pavement markings which must comply with the limits and restrictions with regards to their VOC content and chemical composition.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00- Closeout Submittals.
- .2 Operations and Maintenance Data: submit information on materials relative to work of this Section for inclusion in operations and maintenance manual and as follows:

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse by manufacturer and return of crates, pallets, padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

- .1 Paint and Markings:
 - .1 To MPI #32, Alkyd zone/traffic marking.

- .2 Traffic Marking Coatings: maximum VOC limit 450g/L to SOR/2009-264
 - .3 Paints: in accordance with MPI recommendation for surface conditions.
 - .4 White colour paint: MTQ HOM 8010-201-08 Alkyd 462-742
 - .5 Yellow colour paint: MTQ HOM 8010-201-07 unleaded 462-784
 - .6 Upon request, DCC Representative will supply qualified product list of paints applicable to work. Qualified paints may be used but DCC Representative reserves right to perform further tests.
- .2 Thinner: to MPI listed manufacturer.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates and surfaces to receive pavement markings previously installed under other Sections or Contracts are acceptable for product installation in accordance with MPI instructions and Contract Documents prior to pavement markings installation.
 - .1 Visually inspect substrate in presence of DCC Representative.
- .2 Pavement surface: dry, free from water, frost, ice, dust, oil, grease and other deleterious materials.
- .3 Proceed with Work only after unacceptable conditions have been rectified.

3.2 EQUIPMENT REQUIREMENTS

- .1 Paint applicator: approved pressure type with positive shut-off distributor capable of applying paint in single, double and dashed lines and capable of applying marking components uniformly, at rates specified, and to dimensions as indicated.

3.3 APPLICATION

- .1 Pavement markings: Contractor to provide survey layout for all required pavement markings. No separate payment will be made for survey layout.
- .2 Unless otherwise approved by DCC Representative, apply paint only when air temperature is above 10degrees C, wind speed is less than 30 km/h and no rain is forecast within next 4hours.
- .3 Apply traffic paint evenly at rate of 3 m²/L.
- .4 Do not thin paint unless approved by DCC Representative.
- .5 Symbols and letters to dimensions indicated.
- .6 Paint lines: of uniform colour and density with sharp edges.
- .7 Thoroughly clean distributor tank before refilling with paint of different colour.

3.4 TOLERANCE

- .1 Paint markings: within plus or minus 5 mm of dimensions indicated.

- .2 Remove incorrect markings in accordance with Section 32 01 11.01- Pavement Cleaning and Marking Removal.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.
 - .1 Remove insulation material spilled during installation and leave work area ready for application of wall board.
- .3 Waste Management: separate waste materials for recycling reuse in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 PROTECTION

- .1 Protect pavement markings until dry.
- .2 Repair damage to adjacent materials caused by pavement marking application.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

- .1 This section provides the requirements for the supply and installation of a temporary fence including the gates (barriers) to the locations shown on the plans.
- .2 At the end of the work, the contractor must remove the temporary fence and gates and dispose of it in an authorized site

1.2 MEASUREMENT AND PAYMENT

- .1 The supply and installation of the temporary fence is paid per meter, based on the number of meter of fence installed, including barriers (gates).
- .2 The removal of the fence at the end of the work is paid to lump sum price in article of tender form entitled "dismantling of temporary works fence and signs of construction work. Without limitation, the cost includes the removal and disposal of material, supply and installation of materials, site restoration and it includes all incidental expenses.

1.3 REFERENCES

- .1 ASTM International
 1. ASTM A53/A53M-10, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 2. ASTM A90/A90M-09, Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
 3. ASTM A121-07, Standard Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.
 4. A653/A653M-10, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 5. ASTM C618-08a, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
 6. ASTM F1664-08, Standard Specification for Poly (Vinyl Chloride) (PVC)-Coated Steel Tension Wire Used with Chain-Link Fence.
 7. ASTM A123/A123M-09, Standard Specification for Zinc (Hot Dip Galvanized) coatings on Iron and Steel Products.
2. 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.

3. CSA International
 1. CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 2. CAN/CSA-A3000-08, Cementitious Materials Compendium.
4. Master Painters Institute (MPI)
 1. Architectural Painting Specification Manual - current edition

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for concrete mixes, fences, posts and gates and include product characteristics, performance criteria, physical size, finish and limitations.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Packing Waste Management: dispose in accordance with Section 01 74 21.

Part 2 Products

2.1 Materials

- .1 The temporary fence must have a height of 2.40 m as indicated on drawings.
- .2 The fence and barrier must be wire mesh for wildlife type as shown on drawings.
- .3 Fences must have a barrier or a gate of 2.40 m high at the taxiway. The width of the barrier must be 3.6 m.
- .4 The other physical characteristics of the elements of the fence are indicated on the drawings.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for fence and gate installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary Erosion and Sedimentation Control measures to prevent soil erosion and discharge of soil-bearing water runoff, according to sediment and erosion control plan.
 - .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 Grading:
 - .1 Remove debris and correct ground undulations along fence line to obtain smooth uniform gradient between posts.
 - .1 Provide clearance between bottom of fence and ground surface of 30 mm to 50 mm.

3.3 ERECTION OF FENCE

- .1 Build the fence along the route indicated to the plans or the instructions of the departmental representative.
- .2 Fix posts with anchorin, ground insertion, or ballasting devices according to the instructions of the manufacturer.
- .3 At the end of the work, remove the fence, its gates and restore the premises at the conditions prior to the work.

3.4 INSTALLATION OF GATES

- .1 Install gates in locations as indicated.
- .2 Level ground between gate posts and set gate bottom approximately 100 mm above ground surface.
- .3 Determine position of centre gate rest for double gate.
 - .1 Cast gate rest as directed by manufacturer.
 - .2 Dome concrete above ground level to shed water.
- .4 Install gate stops where indicated by manufacturer.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11.
 - .1 Leave Work area clean at end of each day.

- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.
- .3 Waste Management: dispose waste materials in accordance with Section 01 74 21.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 - Common Work Results for Electrical
- .2 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings
- .3 Section 26 05 43.01 - Installation of Cables in Trenches and in Ducts

1.2 REFERENCE STANDARDS

- .1 CSA Group
 - .1 CSA C22.1-15, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.
 - .2 CSA C22.2 No.179-09(R2014), Airport Series Lighting Cables.
 - .3 CSA C22.2 No.180-13, Series Isolating Transformers for Airport Lighting.
 - .4 CSA C22.2 No.198.2-M1986 - Underground Cable Splicing Kits.
- .2 Transport Canada/Air Navigation System Requirements Branch
 - .1 TP 312, Airfield Standards and Recommended Practices, 4th and 5th Edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide written confirmation of compliance with CSA standard: CSA C22.2 No.179, CSA C22.2 No.198.2 and CSA C22.2 No.180.
- .3 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for aeronautical ground lighting (AGL), including product functional and performance characteristics, physical size, finish and limitations.
 - .2 Submit evidence of conformation to TP-312 requirements for airfield lighting products.
- .4 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Management Plan.
 - .2 Erosion and Sedimentation Control: submit erosion and sedimentation control plan in accordance with authorities having jurisdiction.

1.4 CLOSEOUT SUBMITTALS

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

1.5 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit extra stock materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Supply extra material as follows:
 - .1 Several existing equipment will be raised. Dismantle equipment so that it is not damaged and can be reinstall.
 - .2 Provide spare parts to replace light unit ground anchor, breakable coupling, ground clamp and coupling damaged during dismantling.
 - .3 Replace damaged materials with new. These materials are at the expense of the contractor.

1.6 DELIVERY, DISMANTLING, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Dismantling
 - .1 Dismantle equipment so that it is not damaged and can be raised.
 - .2 Replace equipment damaged during dismantling.
 - .3 Replace defective or damaged materials with new. These materials are at the expense of the contractor.
- .4 Storage and Handling Requirements:
 - .1 Store materials indoors, off ground, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect airfield lighting from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new. These materials are at the expense of the contractor.
- .5 Packaging Waste Management: remove for reuse and return as specified in Construction Waste Management Plan in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 GENERAL

- .1 Waterproof and weatherproof – withstand exposure to sunlight, oil, gasoline, water de-icing fluids and acid/alkaline soils.
- .2 Complete electrical and mechanical isolation of the primary to secondary windings and ground for a 5 KV insulation rating.

- .3 Operate indefinitely with short or open circuit loads place on the secondary with the rated current and frequency input applied to the primary winding while immersed in water and or buried in ground.

2.2 SYSTEMS

- .1 Systems: according to the requirements of TP 312, 4th and 5th edition.
- .2 Description:
 - .1 High intensity airfield lighting:
 - .1 Runway lights 07-25.
 - .2 Threshold and Runway end lights.
 - .3 High intensity approach (SSALR) lights.
 - .2 Medium intensity lighting
 - .1 Bravo Taxiway lighting
 - .2 Traffic lights
 - .3 Runway turn pad lights

2.3 PRIMARY CABLES

- .1 Single conductor concentric stranded soft drawn copper, #8 AWG, 90deg C, 5000 V, type ASLC, combined cross linked polyethylene insulation and jacket: to CSA C22.2 No.179.

2.4 BREAKABLE COUPLING, TYPE 1

- .1 For mounting of elevated runway, taxiway and apron edge lighting fixtures.
- .2 Integral breakable coupling of the manufacturer's design, complying with international standards for frangibility requirements for elevated edge light fixtures.

2.5 BREAKABLE COUPLING, TYPE 2

- .1 For mounting of approach light fixtures installed at runway threshold where maximum specified mounting height to top of fixture allows.

2.6 BREAKABLE COUPLING, TYPE 3

- .1 For mounting of approach lighting on aluminum column for use with aluminum pipe columns.
- .2 Manufacturer supplied 60mm (2"NPT) to 60 mm OD slip fit breakable coupling for use with 60 mm (2" IPS) pipe columns.

2.7 PRIMARY PLUG RECEPTACLE CONNECTORS

- .1 Primary plug and receptacle connector kit, straight type, one male plug, one female plug, for use with isolating transformer or use for separable straight splice of #8 AWG primary cable.
- .2 Heat shrink tubing.

- .3 Primary cable extensions, appropriated length, terminated as required with factory moulded male or female plug.

2.8 PRIMARY CABLE KIT

- .1 Use compression splice: 5 kV rated inner heat shrink sleeve and a 600 V rated outer heat shrink sleeve for abrasion protection, and install per manufacturer's instructions.

2.9 SECONDARY PLUG AND RECEPTACLE CONNECTORS

- .1 Secondary plug connector kit: to field assemble secondary extension or terminate fixture lead, using 2 - #12AWG type SOW secondary cable.
- .2 Secondary receptacle connector kit: to field assemble secondary extension or repair transformer lead, using 2 - #12AWG type SOW secondary cable.
- .3 Factory assembled secondary extension, two conductor cable #12AWG, terminated with plug connector on one end and receptacle connector on other end, for long secondary runs between transformers and fixtures.

2.10 AGL SERIES ISOLATING TRANSFORMER

- .1 CSA C22.2 No.180, rated as indicated.
 - .1 Use for 5000 V, AGL series circuits.
 - .2 Completed with lay-in type lug for #8 AWG ground wire from manufacturer.
 - .3 Compatible with light monitoring systems.

2.11 TRANSFORMER HOUSING

- .1 Locking type construction with galvanized metal cover.
 - .1 450mm diameter, 450mm depth for single transformer.
 - .2 450mm diameter, 600mm depth, for multiple transformers and pulling cables.

2.12 LIGHT UNIT GROUND ANCHOR

- .1 Conduit anchor 50.8 mm diameter conduit, 1.5m long, galvanized steel, threaded one end, with conduit coupling and ground connector.

2.13 GROUND COUNTERPOISE WIRE

- .1 Single conductor #8 AWG, soft drawn copper wire:
 - .1 Solid bare for direct burial as counterpoise for airfield lighting circuits.
 - .2 Stranded with green TW insulation for placing in duct or conduit, as counterpoise for airfield lighting circuits buried beneath hard surfaces, and for power circuit insulated bonding conductors.

2.14 GROUND ROD AND GROUND CLAMP

- .1 Ground rod: Copper clad steel 19 mm x 3000 mm long complete with ground connector.
- .2 Ground clamp: Compatible with light unit ground anchor.

2.15 OTHER MATERIAL

- .1 Cable, secondary:
 - .1 Two conductor #12, copper, type SOW, Cab Tire.
- .2 Cable ties: nylon black length as required.
- .3 Number identification tags for light units.
- .4 Conductor markers: lamacoid tags 20mm diameter with width for 15mm high letters.
- .5 Conduit, rigid. In accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings:
 - .1 PVC: 41 or 53mm

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: Prior to airport lighting dismantling, relocation and installation, verify conditions of equipment previously installed under other Sections or Contracts are acceptable for installation.
 - .1 Visually inspect equipment in presence of Departmental Representative.
 - .2 Perform a ground resistance test for existing runway circuits for comparison with the test required in 3.11.1.2.4.
 - .3 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .4 Proceed with installation work only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 GENERAL

- .1 Identify, locate and protect equipment to be retained.
- .2 Identify and locate equipment to be raised. Dismantle them so as not to damage equipment to be retained or to be relocated. In particular, dig up by hand the secondary cable from the insulation transformer to the light, the counterpoise wire and the grounding flange before raising the anchor conduit.
- .3 Install Airport Lighting underground circuitry and equipment in accordance with Canadian Electrical Code, Part I, CSA C22.1.

3.3 INSTALLATION OF LIGHT UNIT ANCHORS

- .1 Protect adjacent equipment that is to be retained. Proceed by hand-digging. Disassemble the equipment so that it is not damaged and can be raised.
- .2 Provide equipment to replace those damaged during dismantling. Replace defective or damaged materials and equipment with new materials and equipment.

- .3 Proceed by hand-digging to locate existing underground infrastructure.
- .4 If damaged during enhancement, install 50mm diameter, light unit anchors, at locations indicated. Set plumb and vertical with top of conduit coupling at same elevation as adjacent ground surface:
 - .1 In common soil:
 - .1 Drive in conduit.
 - .2 Screw coupling on.
 - .2 In solid rock:
 - .1 Remove surface dirt.
 - .2 Drill hole 60 cm deep.
 - .3 Cut conduit to proper length.
 - .4 Cement grout in position.
 - .5 Screw coupling on.
 - .6 Backfill and compact to same level and density as adjacent ground.

3.4 INSTALLATION ISOLATING TRANSFORMERS

- .1 Isolation transformers is to be retained.
- .2 Dismantle equipment so as not to damage adjacent component to preserve. Proceed by hand-digging if required.
- .3 Provide equipment to replace those damaged during dismantling. Replace defective or damaged materials and equipment with new materials and equipment.
- .4 If damaged during enhancement, install isolating transformers at required locations:
 - .1 In transformer housings
 - .1 Place suitable transformer in housing.
 - .2 Make connections to:
 - .1 Primary cable.
 - .2 Edge light secondary cable.
 - .3 Ground counterpoise.
 - .3 After inspection by Departmental Representative, place back cover and lock, turning cover in clockwise rotation.

3.5 INSTALLATION OF TRANSFORMER HOUSINGS

- .1 Existing transformers housing is to be retained.
- .2 Provide equipment to replace those damaged during dismantling. Replace defective or damaged materials and equipment with new materials and equipment.
- .3 If damaged during works, install new transformer housings at required locations.

- .1 Excavate to size and depth indicated.
- .2 Cover bottom of excavation with 150mm layer of bedding material.
- .3 Place transformer housing so that cover is 75mm minimum below adjacent ground surface.
- .4 Make holes in transformer housing wall suitable for tubing used.
- .5 Install incoming and outgoing tubing and/or conduit.
- .6 Backfill with sand and common backfill material around transformer housing and compact to same level and density as adjacent ground as indicated.
- .7 After inspection by Departmental Representative, place cover on housing and lock, turning cover in clockwise rotation.

3.6 INSTALLATION OF AIRPORT LIGHTING PRIMARY U/G CABLES

- .1 The cables and conduits of circuits supplying PAPI and RIL and SSALR approach are to be remained and protected.
- .2 Primary cables for runway circuits to be remained and protected..
- .3 Dismantle equipment so as not to damage adjacent buried cables and conduits. Proceed by hand-digging to locate the installations and underground circuits.
- .4 Provide cables to replace damaged ones. Replace defective or damaged materials and equipment with new materials and equipment.
- .5 If damaged during enhancement, install new airport lighting primary underground cables, as indicated.
 - .1 Run cable in conduits as per Section 26 05 43.01- Installation of Cables in trenches and in Ducts.
- .6 Make connections using approved connectors as indicated.
 - .1 Leave 600 mm loop of loose cable at each connection, avoid mechanical tension on connector.
 - .2 Install connector in accordance with manufacturer's instructions.
- .7 Install markers on cable identifying circuit numbers in each transformer housing.

3.7 INSTALLATION OF PRIMARY AND SECONDARY MOLDED PLUG/ RECEPTACLE CONNECTORS

- .1 The connectors are to be remained.
- .2 Provide connectors to replace damaged ones. Replace defective or damaged materials and equipment with new materials and equipment.
- .3 If damaged during works, install plug and receptacle connector kit according to the manufacturer's instructions. The housing of the connector must be compatible with the size of the cable. Contact must lock permanently into the housing upon completion on the assembly so that the contact does not dislodge when pulling onto the housing.
- .4 Cover with heat shrink tubing when required.

3.8 INSTALLATION OF PRIMARY CABLE KIT

- .1 Airfield lighting cable splicer shall be qualified in making airport cable splices and terminations on cables rated at or above 5,000 V.
- .2 Connections of cable conductors shall be made using crimp connectors with a crimping tool designed to make a complete crimp before the tool can be removed.
- .3 The connectors are to be remained.
- .4 Provide connectors to replace damaged ones. Replace defective or damaged materials and equipment with new materials and equipment.
- .5 Cover with heat shrinks tubing when required.

3.9 INSTALLATION OF GROUND COUNTERPOISE

- .1 Ground counterpoise circuits shall be maintained as indicated.
- .2 Dismantle equipment so as not to damage adjacent component to preserve. Proceed by hand-digging if required.
- .3 Provide wires and fixings to replace damaged ones. Replace defective or damaged materials and equipment with new materials and equipment
- .4 Install with runs of series lighting primary cables, in trench, duct and/or tubing at locations as indicated:
 - .1 Use 1 conductor #8 SDBC wire with cables directly buried in trench or in protective tubing:
 - .1 Place counterpoise wire on top of additional 75 mm layer of bedding material above cables or tubing.
 - .2 Run counterpoise wire in straight line or in zig-zag pattern as per CSA C22.1.
- .5 Use 1 conductor #8 stranded with TW green insulation, with cables pulled in ducts and/or tubing under runway or taxi.
- .6 Use appropriate ground connector and connect counterpoise wire to:
 - .1 Power supply system common ground at field electrical centre/vault.
 - .2 Each light unit anchor and isolating transformer.
 - .3 Each ground rod.
 - .4 Other ground wires in same trench or nearby.
 - .5 Transformer housing cover.

3.10 INSTALLATION OF SECONDARY CABLES

- .1 Dismantle equipment so as not to damage buried secondary cables and adjacent equipment and be able to reuse them. Proceed by hand-digging to locate underground installations and circuits.
- .2 Provide cables and connectors to replace damaged ones. Replace defective or damaged materials and equipment with new materials and equipment.

- .3 Install as indicated:
 - .1 Bury cable directly in common soil.
 - .2 Place cable in tubing.
 - .3 Run cable in conduits.
- .4 Make connections using approved connectors as indicated.
 - .1 In series lighting circuits, connect to isolating transformer secondary outlet.
 - .2 Leave 600 mm loop of loose cable at connection to transformer and at connection to light.
 - .3 Install cable in trench as indicated and in accordance with Section 26 05 43.01 - Installation of Cables in Trenches and in Ducts
 - .4 Run loose cable end above ground to light unit location.
 - .5 Backfill as indicated and compact to same level and density as adjacent ground.
- .5 If required, extend secondary cables connecting insulation transformers to equipment using factory-assembled secondary extension cables terminated with a plug at one end and socket at the other.

3.11 FIELD QUALITY CONTROL

- .1 Testing requirements:
 - .1 Assign tests to qualified personnel only.
 - .2 Provide necessary instruments and equipment to demonstrate that:
 - .1 Circuits are continuous, free of short circuits and unspecified grounds.
 - .2 Circuits are connected according to applicable wiring diagrams.
 - .3 Circuits perform designated functions in sequence and manner intended.
 - .4 Resistance to ground of circuits, measured with 5 kV megger is not less than 1 Giga-ohms for existing cables
 - .5 Circuits are operable by:
 - .1 Energizing and operating each circuit at each brightness not less than 10 times.
 - .2 Energizing and operating each circuit at full load for continuous period of not less than eight (8) hours.
- .2 Provide Departmental Representative with list of test results indicating:
 - .1 Location at which test was made.
 - .2 Circuit number or designator of circuit tested.
 - .3 Individual test results.

3.12 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.

- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.
- .3 Waste Management: separate waste materials for reuse or recycling in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.13 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by airfield lighting system installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 34 43 05 - Common Work Results for Airfield Lighting

1.2 REFERENCE STANDARDS

- .1 Canadian Standards Association
 - .1 CSA C22.1-15, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.
- .2 Transport Canada
 - .1 TP 312, Aerodrome Standards and Recommended Practices, 4th and 5th Edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for airfield elevated edge lighting and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Test Reports: submit certified test reports from established third party testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
- .4 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

1.4 CLOSEOUT SUBMITTALS

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

1.5 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit extra stock materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Supply extra material as follows:
 - .1 Several existing equipment will be raised. Dismantle equipment so that it is not damaged and can be reinstalled.
 - .2 Provide spare parts to replace elevated light including lamps, globes, filters, cables and connectors damaged during dismantling.
 - .3 Replace defective or damaged materials during works with new. These materials are at the expense of the contractor.

1.6 DELIVERY, DISMANTLING, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Dismantling:
 - .1 Dismantle airfield elevated edge lighting so that they are not damaged and can be relocated.
 - .2 Replace equipment damaged during dismantling.
 - .3 Replace defective or damaged materials with new. These materials are at the expense of the contractor.
- .4 Storage and Handling Requirements:
 - .1 Store materials off ground and in accordance with manufacturer's recommendations. In a clean, dry, well-ventilated area.
 - .2 Store and protect airfield elevated edge lighting units from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .5 Packaging Waste Management: remove for reuse as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 ELEVATED TAXIWAY EDGE LIGHT - SERIES CIRCUIT

- .1 Light unit – apron or taxiway edge: to TP 312.
 - .1 6.6 A, incandescent, 45W series lamp as indicated.
 - .2 Blue symmetrical light distribution globes.
 - .3 Yellow symmetrical light distribution globes.
 - .4 External SOW cord assembly with male plug.
 - .5 Type 1, breakable coupling.
 - .6 Suitable for mounting on 50.8mm diameter threaded anchor stake coupling.
 - .7 Isolating transformer 6.6 A/6.6 A, 45W.
- .2 Runway turn pad lights: TP-312.
 - .1 LED lamps up to 6.6 A, for series mounting as indicated.
 - .2 Blue symmetrical light distribution globes.
 - .3 Internal connection cables type SOW, with male plug.

- .4 Type 1, breakable coupling.
- .5 Suitable for mounting on 50.8mm diameter threaded anchor stake coupling.
- .6 Isolation Transformers 6.6 A / 6.6 A, 10W.

2.2 HIGH INTENSITY RUNWAY EDGE ELEVATED LIGHT - SERIES CIRCUIT

- .1 Light unit - runway edge: to TP 312.
 - .1 6.6 A, halogen PK30d type, 150W series lamp as indicated.
 - .2 White symmetrical light distribution globes.
 - .3 External SOW cord assembly with male plug.
 - .4 Suitable for mounting on 50.8mm diameter threaded anchor stake coupling.
 - .5 Type 1, breakable coupling.
 - .6 Isolating transformer 6.6A/6.6A - 200W.
- .2 Light unit - runway threshold/end: to TP 312.
 - .1 150W PK30d halogen series lamp, green/red.
 - .2 External SOW cord assembly with male plug.
 - .3 Suitable for mounting on 50.8mm diameter threaded anchor stake coupling.
 - .4 Type 1, breakable coupling.
 - .5 Isolating transformer 6.6 A/6.6 A - 200W.
- .3 Fixed lights of the SSALR system: at TP-312.
 - .1 6.6 A, halogen PK30d type, 150W series lamp as indicated.
 - .2 Green symmetrical light distribution globes.
 - .3 External connection cables type SOW, with plug.
 - .4 Suitable for mounting on 50.8mm diameter threaded anchor stake coupling.
 - .5 Type 2, breakable coupling.
 - .6 Isolating transformer 6.6 A/6.6 A - 200W.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: Prior to equipment dismantling, relocation and installation verify conditions of airfield elevated edge lighting previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's written instructions prior to airfield elevated edge lighting installation.
 - .1 Visually inspect equipment in presence of Departmental Representative.

- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied Departmental Representative.

3.2 GENERAL

- .1 Identify, locate and protect equipment to be retained.
- .2 Identify and locate equipment to be raised. Dismantle them so as not to damage equipment to be retained or to be relocated.
- .3 Install Airport Lighting underground circuitry and equipment in accordance with Canadian Electrical Code, Part I, CSA C22.1.

3.3 LIGHT UNIT RAISING

- .1 Existing light units are to be raised and connected to existing series insulating transformers.
- .2 Enhancement of runway edge lights, taxiway lights, runway thresholds lights and fixed lights of the SSALR system:
 - .1 Work to be performed after civil works
 - .1 Dismantle the light unit, clean and retain for reinstallation
 - .2 Remove frangible fitting and retain for reinstallation
 - .3 Inspect the quality of the threaded connection and replace it, if necessary, with a new galvanized steel threaded connection compatible with the existing anchor conduit.
 - .4 Dig the ground by hand around the anchor conduit until you have enough clearance and access to the installation. In particular, dig up by hand the secondary cable from the insulation transformer to the light, the counterpoise wire and the grounding flange before raising the anchor conduit.
 - .5 Raised the anchor conduit to the indicated height
 - .6 Reinstall the frangible fitting
 - .7 Ensure break point of frangible fitting is 0 to 5 cm above the ground.
 - .8 Reinstall the fire.
 - .9 Level lights according to manufacturer's written instructions.
 - .10 Ensure that the maximum height of the lights above ground is less than 35 cm.
 - .11 If necessary, dig the ground by hand to reach the secondary cable and the transformer and raise them sufficiently to be able to reconnect the secondary cable to the new height of the fire.
 - .12 Reconnect secondary cable to fire and backfill trench with same materials as existing.
 - .13 Make sure to restore soil compaction level as existing.

3.4 LIGHT UNIT INSTALLATION

- .1 If the lights and/or anchor conduits damaged during works, install lights in accordance with Section 34 43 05 - Common Work Results for Airfield Lighting and as indicated:
 - .1 On conduit anchors.
- .2 Assemble in accordance with manufacturer's written installation instructions.
 - .1 Connect isolating transformer secondary lead to light unit cord assembly by means of secondary cables extension when required and male-female connectors.
- .3 Level in accordance with manufacturer's written instructions.
- .4 Make sure that the maximum height of above ground lights is less than 35 cm.
- .5 Make sure that the breaking point of the breakable coupling is 0 to 5 cm above the ground.
- .6 Install number identification tag.

3.5 FIELD QUALITY CONTROL

- .1 Perform field tests in accordance with Section 34 43 05 - Common Work Results for Airfield Lighting.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.
- .3 Waste Management: separate waste materials for reuse/recycling in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by airfield elevated edge lighting installation.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

- .1 Geodetic markers; mark engraved or sealed plate on a stable foundation, materializing a point and determined latitude, longitude and altitude.

1.2 WORK COVERED BY THE PRESENT SECTION

- .1 The Contractor must install two geodetic markers at each end of the runway. These markers must be implemented by a certified surveyor. The plans provide the construction details of the markers.

1.3 MEASUREMENT PROCEDURES

- .1 Geodetic marks minimum (2 units) B2 or C4 class will be measured and paid in the unit, will be taken into account only item effectively install and integrate into Geodec database of the Province of Quebec.

Part 2 Products

2.1 REFERENCES

- .1 Ministry of Natural Resources and Wildlife of Quebec; Instructions for the establishment of geodetic networks. (April 2012). Available online in French at the following link: http://mern.gouv.qc.ca/publications/territoire/instructions_etablissement_reseaux_geod.pdf
- .2 Department of Natural Resources and Wildlife of Quebec; Instructions for the materialization of geodetic point. (April 2012). Available online in French at the following link: http://mern.gouv.qc.ca/publications/territoire/instructions_materialisation.pdf

2.2 GEODETIC MARKERS

- .1 Marker frost proof composed of a double pipe as the TT2 model of Morasse company or equivalent.

Part 3 Execution

3.1 INSTALLATION

- .1 Follow the instructions and recommendations of the manufacturer about the installation of markers.
- .2 Follow the instructions outlined above in article 2.1.
- .3 All the required data to incorporate the new geodetic markers in the GEODEC database shall be send to the Department of Natural Resources and Wildlife of Quebec.

3.2 DATA SHEET

- .1 Provide to the departmental representative the preliminary datasheet for all new marker from the surveyor.

- .2 Provide to the departmental representative the final datasheets for each new marker from Department of Natural Resources and Wildlife of Quebec GEODEC database.

END OF SECTION

Appendix A

1 Contractor quality control program

1.1 Quality control

The Contractor must provide the qualified personnel necessary to conduct all the tests described below according to standards and minimum frequencies and in compliance with the standards of Public Works and Government Services Canada. Execution of the following tests will include all related tests provided in the standards applied.

1.1.1 Minimum testing requirements

Work phase	Test type	Minimum test frequency
Backfill	Liquid and plastic limit BNQ 2501-092	▪ One for each material
	Modified Proctor BNQ 2501-250, BNQ 2501-255	One for each material
	Relative density and absorption LC 21-065, 067	▪ One for each material
	Density as placed, compactness % and water content LC 22-002 and LC 22-003	▪ One per 2,000 m ² per layer or a minimum of five per layer
	Grain-size distribution with 80 µm screen washing LC 21-040	▪ Two for each material
Sub-foundation and granular foundation	Modified Proctor test BNQ 2501-250, BNQ 2501-255	▪ One for each material
	Grain-size distribution with 80 µm screen washing LC 21-040	▪ Three for acceptance plus two per day of production and one per day of laying
	Liquid and plastic limit BNQ 2501-092	▪ One for each material for acceptance
	Relative density and absorption LC 21-065, 067	▪ One for each material
	Percentage of crushed particles (granular foundation) LC 21-100	▪ One per grain-size distribution
	Tests of density as placed, compactness % and water content LC 22-002 and LC 22-003	▪ One per 2,000 m ² per layer or a minimum of five per layer
	Abrasion according to Los Angeles test LC 21-400	▪ Minimum of two tests for the acceptance of each material
Hot mix		
Stockpiling of aggregates	Grain-size distribution with washing LC 21-040	<ul style="list-style-type: none"> ▪ Two initial tests ▪ One test per shift per day of production, if daily production is less than 3,000 tons ▪ One additional test per shift, per 3,000 tons segment, if daily production is more 3,000 tons
	Relative density and absorption of coarse aggregates LC 21-067, LC 21-066	▪ Two tests for each stockpile
	Relative density and absorption of fine aggregates LC 21-065	▪ Two tests for each stockpile
Stockpiling of aggregates	Relative density and absorption of fine aggregate ASTM C128	▪ Two tests for each stockpile

Work phase	Test type	Minimum test frequency
	Percentage of crushed particles LC 21-100	<ul style="list-style-type: none"> Two tests for each material stockpile
	Micro-Deval test LC 21-101, LC 21-400	<ul style="list-style-type: none"> Two tests for each material stockpile
	Abrasion according to Los Angeles test LC 21-400	<ul style="list-style-type: none"> Two tests for each material stockpile
	Sand equivalent ASTM D2419	<ul style="list-style-type: none"> Two tests for each material stockpile
	Magnesium sulfate durability CSA A23.2-9A	<ul style="list-style-type: none"> Two tests for each material stockpile
	Light particles CSA A23.2-4A	<ul style="list-style-type: none"> Two tests for each material stockpile
	Flat and elongated particles ASTM D4791, LC 21-265	<ul style="list-style-type: none"> Two tests for each material stockpile
	Light particles CSA A23.2-4A	<ul style="list-style-type: none"> Two tests for each material stockpile
	Clay lump content CSA A23.2-3A	<ul style="list-style-type: none"> Two tests for each material stockpile
	Content of particles less than 5 µm BNQ 2501-025	<ul style="list-style-type: none"> Two tests for each material stockpile
	Flow rate LC 21-075	<ul style="list-style-type: none"> Two tests for each material stockpile
	Particles passing the 80 µm screen CSA A23.2-5A	<ul style="list-style-type: none"> Two tests for each material stockpile
	Projection polishing factor LC 21-102	<ul style="list-style-type: none"> One test per material
Making of mix and control of laying	Grain-size distribution with washing if required on cold bins LC 21-040	<ul style="list-style-type: none"> One per day per aggregate (if drum dryer plant – two tests per day per aggregate)
	Grain-size distribution with washing if required on hot bins LC 21-040	<ul style="list-style-type: none"> Two per day per bin (continuous or by weighting)
	Extraction (asphalt content with separation of filler and grain-size distribution) LC 26-100, LC 26-110 et LC 26-007	<ul style="list-style-type: none"> One test per 500 tons, minimum of two tests per day
	Correction factor for calculating asphalt content LC 26-150	<ul style="list-style-type: none"> One per mix
	Test plank: verification of physical characteristics of the asphalt mix presented by the Contractor with Marshall stability loss after immersion in water at 60°C for 24 hours	<ul style="list-style-type: none"> Once for each mix per year of works
	Marshal tests	<ul style="list-style-type: none"> Four briquettes per 500 tons, minimum 8 briquettes per day
	Stability, melt flow index Voids in the mix Voids in the mineral aggregates Gross density	<ul style="list-style-type: none"> On each briquette
	In place density tests % of compactness at the site (nuclear densitometer) in relation to the density of the mix produced daily, LC 26-500 and LC 26-510 Bores for concordance factor, density, thickness and compactness percentage in relation to the density of the mix produced	<ul style="list-style-type: none"> Six nuclear densitometer measurements per mix per day One concordance factor per mix
	Compactness tests on the joints at the site (nuclear densitometer) LC 26-510	<ul style="list-style-type: none"> One per 75 linear meters
	Measurements of the surface profile using the 4.5 m ruler at the joints and the spans	<ul style="list-style-type: none"> One per 100 m² daily All cross joints

Work phase	Test type	Minimum test frequency
	Verification of plant calibration	▪ One per mix
	Verification of calibration charts of the hot bins and cold bins	▪ One per mix ▪ Before the start of the works and for each verification during production
	Adhesiveness test of the asphalt with the aggregates LC 25-009	▪ Each year of works
	Macrotexture of the surface layer (sand height) ASTM E965	▪ Daily
	Homogeneity of the mix paving by thermography according to MTMDDET requirements	▪ Daily
Marshall Tests		
a) Moulding and compacting briquettes		
The briquettes are prepared according to method LC-26-020. The compacting effort is 50 blows per side. The mix must not be reheated before the briquettes are formed.		
b) Determination of the gross density of the volume weight of the hot compacted mix		
The gross density of the briquettes is determined according to test method LC 26-040.		
c) Maximum density, determination of voids and characteristics by calculation of various factors		
The maximum density of the mix, the percentage of voids and the characteristics of the mix calculated by calculating various factors are determined by the test methods, LC 26-045, LC 26-320 and LC 26-900.		
d) Marshall stability		
The Marshall stability and melt flow index are measured using the LC 26-060 test method.		
NOTE: All laboratory control tests on mix and those on the pavement at the site must be sent 24 hours after collection of the sample of the mix or the measurement made at the site (profile, compactness, roughness, homogeneity of laying ...)		

1.1.2 Sampling of manufactured products

Material	Source of samples	Frequency of samples	Receptacle	Quantity
Asphalt	Truck or tank-car	One per delivery. One per 3,000 tons of hot mix laid with a minimum of 3 per year of works	Metallic container	2 x 1 L
Bituminous emulsion	Truck or tank-car	One per delivery One per 5,000 tons of mix laid with a minim of 3 per year of works	Metallic container	2 x 1 L

The Contractor must keep a reference sample for each sampling of manufactured products for a period of one year after the end of the construction contract.

1.1.3 Tests of manufactured products

▪ Asphalt tests according to standard 4101 Tome VII Matériaux, MTMDDET
▪ Binder, tests according to 4105 Tome VII Matériaux, MTMDDET

1.2 Inspection at the hot mix plant

Check the following elements:

- Observe the mix produced
- Check that the equipment is working properly
- Sample the aggregates and the bitumen
- Check the flow of the various bins
- Check the proportions of the mix
- Check the temperatures
- Enter all observations in a notebook: production times, interruptions, etc.

1.3 Inspection at the spreader (asphalt concrete)

Check the following elements:

- Check the laying equipment
- Check the sequence for rolling
- Take the temperatures
- Observe the appearance of the mix
- Check the thickness laid
- Monitor the appearance of the joints and the surface texture
- Take measures using the ruler (calibrated measurements)
- Enter all observations in a notebook

1.4 Daily reports

All test results must be sent daily to the representative of the Public Works and Government Services Canada daily.

1.5 Characteristics of the aggregates

1.5.1 Grain-size distribution of the hot mix

Screen designation	% passing	
	Bottom layer, surface layers and crack repairs	Micro-asphalt concrete
14 mm	100	
10 mm	85-100	100
5 mm	60-78	85-100
2,5 mm	42-65	80-95
1.25 mm	30-50	70-90
0.630 mm	20-38	55-80
0.315 mm	12-28	30-60
0.160 mm	5-18	10-35
0.080 mm	4.0-10.0	4-14.0

1.5.2 Characteristics of aggregates for asphalt concrete

Caractéristiques Norme	EXIGENCES	
	Granulats fins	Gros granulats
MgSO ₄ (%) CSA A23.2-9A	≤ 16 %	≤ 12 %
Micro-Deval MD (%) LC 21-400 Gros granulats LC 21-101 Granulats fins	≤ 30 %	≤ 15 %
Los Angeles LA (%) LC 21-400	S.O.	≤ 25% couche de surface ≤ 35% couche de fond
Micro-Deval + Los Angeles	S.O.	≤ 40% couche de surface ≤ 50% couche de fond
Absorption (%) LC 21-067	S.O.	≤ 2,00 %
Particules passant le tamis 80 µm (%) CSA A23.2-5A	S.O.	≤ 1,0 % (gravière) ≤ 1,5 % (carrière)
Particules plates (%) LC 21-265	S.O.	≤ 25 %
Particules allongées (%) LC 21-265	S.O.	≤ 40 %
Particules plates et allongées (%) ASTM D4791		≤ 10 %
Particules fracturés (%) LC 21-100	S.O.	≥ 60%
Particules légères, % en masse de particules de densité inférieure à 1,95 / CSA A23.2-4A	≥ 1,5 % couche de surface ≥ 3,0 % couche de fond et fissure	
Teneur en mottes d'argile (%) CSA A23.2-3A	≤ 2,0 %	S.O.
Teneur en particules inférieures à 5 µm (%) BNQ 2501-025	≤ 5,0 %	S.O.
Coefficient d'écoulement LC 21-075	≥ 80	S.O.
Équivalent de sable (%) ASTM D2419	≥ 50 %	S.O.
Coefficient de polissage par projection (CPP) LC 21-102	S.O.	0,48 couche de surface 0,45 couche de fond

1.6 Checking the homogeneity temperature of the asphalt concrete contractor during installation

In accordance with the requirements of the CCDG, edition 2018.

Appendix B



Advisory Circular

Subject: Measurement and Evaluation of Runway Roughness

Issuing Office:	Civil Aviation, Standards	Document No.:	AC 302-023
File Classification No.:	Z 5000-34	Issue No.:	02
RDIMS No.:	12150543-V2	Effective Date:	2016-12-16

TABLE OF CONTENTS

1.0	INTRODUCTION.....	3
1.1	Purpose	3
1.2	Applicability	3
1.3	Description of Changes.....	3
2.0	REFERENCES AND REQUIREMENTS	3
2.1	Reference Documents	3
2.2	Cancelled Documents	4
2.3	Definitions and Abbreviations	4
3.0	BACKGROUND.....	4
4.0	FACTORS IN EVALUATING PAVEMENT ROUGHNESS	5
4.1	What is Pavement Roughness.....	5
4.2	Causes of Pavement Roughness	5
4.3	Pavement Construction Specifications	5
4.4	Aircraft Response to Pavement Roughness	6
4.5	Types of Runway Pavement Roughness.....	6
5.0	PAVEMENT SURFACE PROFILE MEASUREMENT.....	6
5.1	Measurement Equipment.....	6
5.2	Survey Interval	7
5.3	Survey Location	7
6.0	PAVEMENT ROUGHNESS ANALYSIS METHODS	7
6.1	Profile “Bump Height/Length” Analysis (Boeing Bump Method)	7
6.2	Profile Indices (Average Runway Roughness)	10
6.3	Riding Comfort Index (RCI).....	11
6.4	Computerized Aircraft Roughness Simulation	12
7.0	CORRECTIVE ACTION TO RESTORE SMOOTHNESS	12
8.0	FREQUENCY AND TIMING OF ROUGHNESS MEASUREMENTS.....	13
9.0	SOFTWARE APPLICATIONS FOR PAVEMENT ROUGHNESS ANALYSIS	13
10.0	INFORMATION MANAGEMENT	14
11.0	DOCUMENT HISTORY	14
12.0	CONTACT OFFICE	14



Transport
Canada

Transports
Canada

List of Figures

Figure 1 – Runway Roughness Criteria for Isolated Bumps.....	9
Figure 2 – Bump Height Measurement.....	9

1.0 INTRODUCTION

- (1) This Advisory Circular (AC) is provided for information and guidance purposes. It describes an example of an acceptable means, but not the only means, of demonstrating compliance with regulations and standards. This AC on its own does not change, create, amend or permit deviations from regulatory requirements, nor does it establish minimum standards.

1.1 Purpose

- (1) The purpose of this document is to provide guidelines for the measurement and evaluation of runway pavement surface roughness.

1.2 Applicability

- (1) This document applies to Canadian airport operators and is also available to the aviation industry and aerodrome community for information purposes.

1.3 Description of Changes

- (1) Revisions to Section 6.1 (1), (4), (5), and (6). Principal changes include revised terminology and roughness category descriptions. Also included is a new Table 1 summarizing the roughness criteria in numeric format.

2.0 REFERENCES AND REQUIREMENTS

2.1 Reference Documents

- (1) It is intended that the following reference materials be used in conjunction with this document:
- (a) Part III, Subpart 2 of the *Canadian Aviation Regulations* (CARs) — *Airports*;
 - (b) Transport Canada Publication (TP) 312 5th Edition — *Aerodrome Standards and Recommended Practices*;
 - (c) Advisory Circular (AC) 302-016 — *Airport Pavement Management System*;
 - (d) TP 892 (Historical Reference Document AK-68-22-000) — *Pavement Construction: Methods and Inspection*. (A newer version of this document was published by Public Works and Government Services Canada (PWGSS), Architecture and Engineering Services, Airport Engineering, as ASG-20, September 1996 — *Pavement Construction: Methods and Inspection*);
 - (e) Federal Aviation Administration Advisory Circular (FAA AC) 150/5380-9, 2009-09-30 — *Guidelines and Procedures for Measuring Airfield Pavement Roughness*;
 - (f) International Civil Aviation Organization (ICAO) Annex 14 to the *Convention on International Civil Aviation* — *International Standards and Recommended Practices: Aerodromes* (Seventh Edition, July 2016); and
 - (g) Boeing Document No. D6-81746 — *Runway Roughness Measurement, Quantification, and Application – The Boeing Method*;
 - (h) ASTM E1364, 1995 (Reapproved 2012) — *Standard Test Method for Measuring Road Roughness by Static Level Method*; and
 - (i) ASTM E2133, 2003 (Reapproved 2013) — *Standard Test Method for Using a Rolling Inclinometer to Measure Longitudinal and Transverse Profiles of a Traveled Surface*.

2.2 Cancelled Documents

- (1) Not applicable.
- (2) By default, it is understood that the publication of a new issue of a document automatically renders any earlier issues of the same document null and void.

2.3 Definitions and Abbreviations

- (1) The following **definitions** are used in this document:
 - (a) **Macro-texture**: the coarse-scale roughness of the pavement surface as a whole, created by the hills and valleys formed by aggregate particles; and
 - (b) **Micro-texture**: the fine-scale roughness of individual aggregate particles, which may not be discernible to the eye but should be apparent to the touch.
- (2) The following **abbreviations** are used in this document:
 - (a) **AC**: Advisory Circular
 - (b) **FAA**: Federal Aviation Administration
 - (c) **ICAO**: International Civil Aviation Organization
 - (d) **IRI**: International Roughness Index
 - (e) **RCI**: Riding Comfort Index
 - (f) **RMSVA**: Root Mean Square Vertical Acceleration
 - (g) **TP**: Transport Canada Publication

3.0 BACKGROUND

- (1) TP 312 5th Edition *Aerodrome Standards and Recommended Practices*, section 3.1.3.1 states as a standard that “The pavement of the runway is without irregularities that would result in reduced friction characteristics or adversely affect aircraft operations. *Note 1: Surface irregularities may adversely affect the take-off or landing of an aircraft by causing excessive bouncing, pitching, vibration, or other control difficulties.*” In addition, section 3.5.1.6 of TP 312 states as a standard that “The surface of a taxiway is without irregularities that may cause damage to aircraft structures.”
- (2) Airport pavement surfaces should be free from any irregularities that could be detrimental to aircraft operations. Runway surface smoothness is very important for safe operation of aircraft during takeoff and landing runs. Surface irregularities and roughness can affect the safety of aircraft operations by:
 - (a) subjecting the aircraft to excessive pitch and roll motions that may interfere with aircraft operational performance and control;
 - (b) causing aircraft structural damage and component fatigue through repeated ground-air-ground cycles;
 - (c) causing the aircraft to become airborne;
 - (d) reducing aircraft tire/pavement contact which can affect feedback from aircraft anti-skid braking systems and degrade aircraft performance; and
 - (e) causing vibration problems that make on-board instruments difficult for pilots to read.
- (3) Excessive roughness may also cause discomfort and alarm for passengers. However, aircraft suspension is designed for landing and not for ride quality.

4.0 FACTORS IN EVALUATING PAVEMENT ROUGHNESS

4.1 What is Pavement Roughness

- (1) Pavement roughness (or lack of smoothness) exists when surface irregularities in the pavement profile are severe or extensive enough to interfere with the safe operation of aircraft, or cause damage or structural fatigue to an aircraft.
- (2) Pavement roughness, as discussed in this AC, is not the same as pavement texture, the fine-scale roughness of a pavement known as micro- and macro-texture that can be felt by running an open hand over the surface. Pavement texture and pavement grooving are not sources of roughness.

4.2 Causes of Pavement Roughness

- (1) There are a number of reasons why roughness occurs in airport pavements.
 - (a) Some minor roughness is usually built into new pavements because construction techniques are not perfect.
 - (b) Pavement surface roughness increases with time. As the pavement ages, cracks start to appear in the surface – especially thermal contraction cracks which will almost certainly occur in asphalt pavements during their first several winters of service. Surface cracking contributes to roughness.
 - (c) Differential movements within the pavement surface such as frost heave, settlements, and changes in subgrade soil conditions can result in surface roughness.
 - (d) As the pavement nears the end of its service life, roughness can increase rapidly as the surface begins to break down under traffic and maintenance patching becomes more extensive.

4.3 Pavement Construction Specifications

- (1) For acceptance of new pavement construction, roughness is typically measured with a straight edge.
- (2) Transport Canada historical specifications for acceptance testing of new pavement for surface irregularities are given in *ASG-20 Pavement Construction: Methods and Inspection* as follows:

“The surface of a finished (asphalt concrete or Portland cement concrete) pavement shall be within 5 mm of design grade, but not uniformly high or low, and shall have no irregularities exceeding 5 mm when checked with a 4.5 m straightedge placed in any direction.”
- (3) ICAO Annex 14, Attachment A, Section 5, gives the following recommended specifications for runway surface irregularities:

“ 5.1 In adopting tolerances for runway surface irregularities, the following standard of construction is achievable for short distances of 3 m and conforms to good engineering practice:

Except across the crown of a camber or across drainage channels, the finished surface of the wearing course is to be of such regularity that, when tested with a 3 m straight-edge placed anywhere in any direction on the surface, there is no deviation greater than 3 mm between the bottom of the straight-edge and the surface of the pavement anywhere along the straight-edge.

5.2 Caution should also be exercised when inserting runway lights or drainage grilles in runway surfaces to ensure that adequate smoothness of the surface is maintained.”
- (4) When designing and specifying tolerances to control runway surface irregularities, it is important to recognize that because surface roughness will increase with time as the pavement ages, the tolerances adopted for construction purposes should be more stringent than maintenance (aircraft operational) tolerances specified for roughness.

4.4 Aircraft Response to Pavement Roughness

- (1) Measuring and evaluating roughness is a complex problem due to differences in aircraft size and performance. Response to roughness is dependent on the type of aircraft including its method of operation, weight, amount of lift achieved, wheelbase length, landing gear dynamics and the speed at which it encounters a bump or depression.
- (2) Aircraft response is also dependent on the height and length of the bump or depression, its location in the profile, and whether there are multiple, successive bumps that amplify their individual roughness effects.
- (3) Minimizing roughness levels in runway surface profiles is of primary importance because of the “committed” nature of aircraft takeoff and landing operations. Unlike an automobile that encounters a rough section of road pavement, an aircraft once it has begun a takeoff or landing operation, cannot slow down to alleviate the effects of roughness or veer off course to avoid a rough area of runway.
- (4) Pilot complaints of pavement roughness are often the first indication that something may be wrong with the pavement profile and that further investigation is required.

4.5 Types of Runway Pavement Roughness

- (1) The measurement and analysis of runway pavement roughness should consider two types of roughness:
 - (a) Isolated bumps and depressions in the profile where an excessive change in elevation occurs in relation to the base length of the bump or depression. Short length bumps range from a practically a zero length bump such as occur with the abrupt elevation changes caused by concrete stepping up to about the wheelbase length of a typical passenger automobile. Long length bumps range up to about 60 metres and can have varying effects on an aircraft. Bump height/length analysis (Boeing Bump Method) can be used to identify isolated bumps and depressions.
 - (b) Average profile roughness levels for the entire runway (or subsections of the runway). Average profile roughness can be determined by analyzing a pavement profile to compute an average roughness index such as the International Roughness Index (IRI) or the Root Mean Square Vertical Acceleration (RMSVA)). An average roughness index can be included in an Airfield Pavement Management System (AC 302-016) as part of the non-destructive test data used in predicting future pavement conditions and the need for pavement rehabilitation.

5.0 PAVEMENT SURFACE PROFILE MEASUREMENT

- (1) Measurement of the pavement longitudinal surface profile can be used to both assess the severity of isolated bumps and to compute an average level of profile roughness using various indices.
- (2) When using profile techniques, it may not be necessary to profile the entire length of the runway but only the section known to be rough.

5.1 Measurement Equipment

- (1) Measuring runway profiles for runway roughness analysis requires the use of a “Class I” measuring device with a vertical resolution of 0.01 mm.
- (2) The conventional rod and level survey is usually the standard against which other types of profiling equipment are evaluated against. However, conventional rod and level methods are too slow other than for other than short profile lengths. ASTM E1364 gives a test method for

measuring the longitudinal profile of a pavement surface by static level for the purpose of obtaining a roughness index.

- (3) An inclinometer based profiler (“walking profiler”), is a hand operated device mounted on a rigid beam up to 0.305 m (1 foot) in length. The profile is created by measuring the beam inclination, which progresses along the length of the pavement section in steps that are equal to the length of the beam. Both the distance and the elevation are recorded at each step in order to create the profile. An inclinometer-based profiler is faster than a rod and level survey since it can be operated at speeds up to 4 km/hr. ASTM E2133 gives a test method for measuring longitudinal profiles on paved surfaces using a rolling inclinometer travelling at walking speed.
- (4) Inertial profilers (both “lightweight” and “highspeed”) are profiling devices utilizing a test vehicle mounted platform to carry a laser or acoustic equipment measuring the distance from the platform to the pavement surface, and an accelerometer tracking elevation of the platform. Inertial profilers typically include high pass filtering in the processing of the accelerometer signal to reduce errors from changing grades and from braking and accelerating the test vehicle. High pass filtering can have a significant effect on calculations using the Boeing Bump Method and on aircraft roughness simulations because of the relatively longer base lengths being evaluated. In addition, inertial profilers generate significant profile errors during braking and acceleration of the test vehicle. For these reasons, the use of inertial profilers with high pass filtering is not recommended for the measuring of runway profiles for the purpose of roughness analysis using the Boeing Bump Method or for aircraft roughness computer simulations.

5.2 Survey Interval

- (1) A full analysis of roughness characteristics requires a profile defined by elevations measured at an interval not exceeding 0.305 m (1 foot). The Federal Aviation Administration (FAA) software (PROFAA) described subsequently requires a profile survey interval of 0.25 m (0.82 ft) for evaluation of the Boeing Bump.
- (2) Profile measurements obtained by conventional rod and level survey at spacings not exceeding 3 metres can also be used to perform bump height/length analyses for bump lengths greater than twice the elevation interval spacing. However, rod and level surveys using 3 metre spacings are not acceptable for the computation of roughness indices such as RCI, IRI and RMSVA.

5.3 Survey Location

- (1) Runway surface profile measurements are normally made at 3.0 metre offsets right and left of the runway longitudinal centreline to approximate the wheel path of moderately sized aircraft. It may also be desirable to obtain measurements along the runway centreline to assess nose wheel roughness and at an offset of 5 to 6 metres (nominally 5.25 metres) of the runway centreline to approximate the outer gear wheel path of wide-bodied aircraft.

6.0 PAVEMENT ROUGHNESS ANALYSIS METHODS

6.1 Profile “Bump Height/Length” Analysis (Boeing Bump Method)

- (1) Guidance on evaluating a pavement surface profile to identify isolated bumps/depressions that may affect aircraft operations is given in Attachment A, Section 5. to ICAO Annex 14. The runway roughness criteria as given in Figure A-3 of ICAO Annex 14, is termed “bump height/length” analysis or “Boeing Bump” method. Figure 1 of this AC also gives the bump height/length criteria for isolated bumps (adapted from Figure A-3 of ICAO Annex 14). The runway roughness criteria is summarized in numeric format in Table 1.
- (2) The basis of the bump height/length analysis is to construct a virtual straightedge between two points on the elevation profile and measure the deviation from the straightedge to the pavement surface. The “bump height” is the maximum deviation (positive or negative) from the straightedge

- to the pavement surface and the “bump length” is the shortest distance from either end of the straightedge to the location where the bump is measured. The minimum straightedge length is twice the runway profile survey interval. The determination of bump height and bump length is illustrated in Figure 2.
- (3) The Boeing Bump method considers straightedge lengths (wavelengths) up to 120 metres. An isolated bump analysis involves computing all bump height/length combinations in the profile up to a bump length of approximately 60 metres and comparing the results of each combination against the criteria in Figure A-3 of ICAO Annex 14 (or Figure 1 of this AC). Because of the extensive number of bump height/length combinations, computer software is normally required for the performance of an isolated bump analysis.
 - (4) The guidelines below will assist in interpreting the effect that isolated bumps/depressions are likely to have on aircraft response and in determining the need for corrective action. The descriptive headings refer to the four regions defined by Figure A-3 of ICAO Annex 14.
 - (a) “Acceptable region” – Bump height/length combinations in this region should not adversely affect aircraft operations.
 - (b) “Tolerable region” – For bump height/length combinations in this region, corrective maintenance action should be planned. The runway may remain in service. This region is the start of possible passenger and pilot discomfort.
 - (c) “Excessive region” – For bump/height length combinations in this region, corrective maintenance should be taken immediately to restore the condition to within the acceptable limit region. The runway may remain in service but should be repaired within a reasonable period. This region could lead to the risk of possible aircraft structural damage due to a single event or fatigue failure over time.
 - (d) “Unacceptable region” – For bump height/length combinations in this region, the area of the runway where the roughness has been identified warrants closure. Repairs have to be made to restore the condition to within the acceptable limit region and the aircraft operators may be advised accordingly. This region runs the extreme risk of a structural failure and has to be addressed immediately,
 - (5) The maximum tolerable step type bump, such as that would exist between adjacent slabs, is simply the bump height corresponding to zero bump length at the upper end of the tolerable region of the roughness criteria of Figure 1. The bump height at this location is 1.75 cm.
 - (6) An isolated bump height/length analysis does not, however, account for the combined contributions to roughness of multiple or sequential bumps or for long wavelength harmonic effects.
 - (7) An isolated bump height/length analysis should be performed when pilot complaints of objectionable bumps/depressions in the runway pavement surface have been received.

Table 1 - Runway Roughness Criteria for Isolated Bumps

Surface irregularity (bump)	Length of irregularity (m)								
	3	6	9	12	15	20	30	45	60
Acceptable surface irregularity height (cm)	2.9	3.8	4.5	5	5.4	5.9	6.5	8.5	10
Tolerable surface irregularity height (cm)	3.9	5.5	6.8	7.8	8.6	9.6	11	13.6	16
Excessive surface irregularity height (cm)	5.8	7.6	9.1	10	10.8	11.9	13.9	17	20

Figure 1 – Runway Roughness Criteria for Isolated Bumps

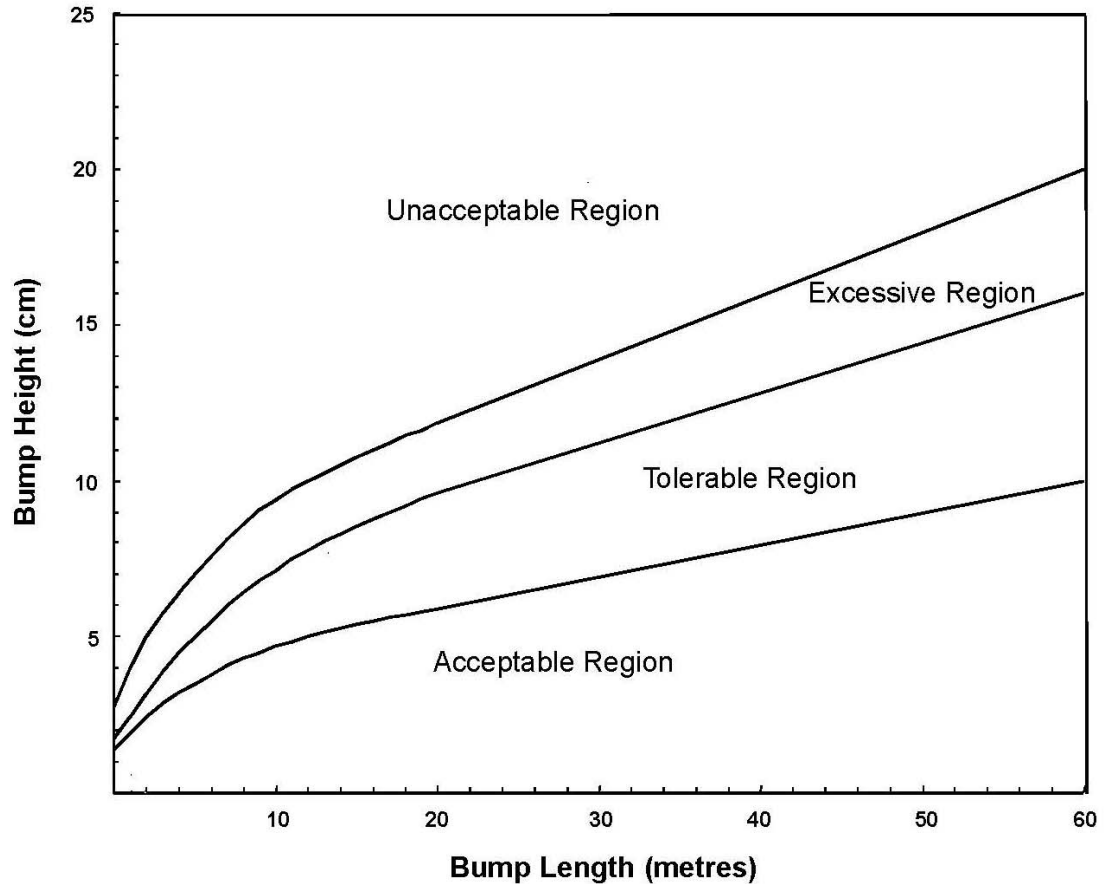
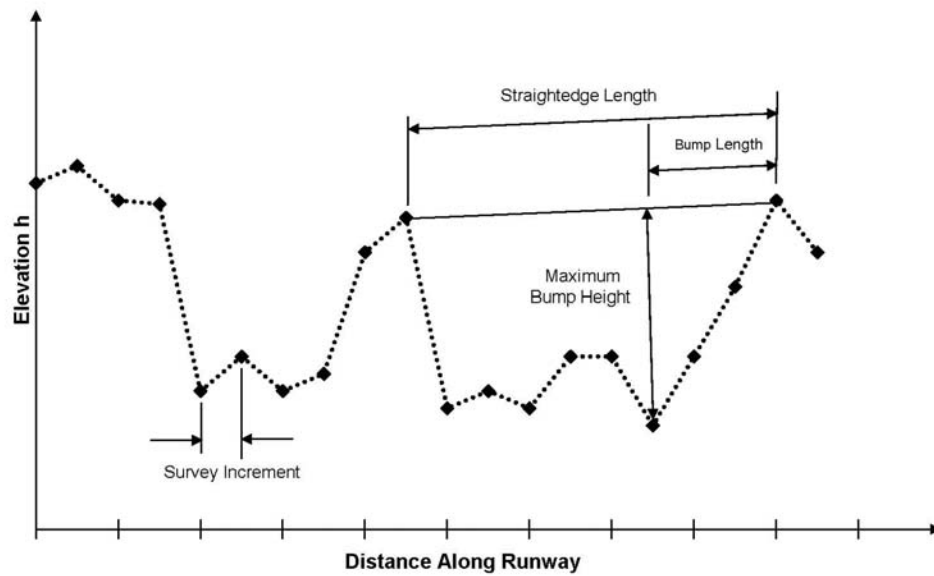


Figure 2 – Bump Height Measurement



6.2 Profile Indices (Average Runway Roughness)

- (1) The following roughness indices can be computed from a runway profile to express the average level of roughness.

(a) International Roughness Index (IRI)

The International Roughness Index (IRI) is a commonly used highway roughness index. The IRI can be computed for 100 metre sections to identify any portions of the runway profile that have higher roughness levels and for the entire runway profile. The IRI is computed in accordance with ASTM E1364.

(b) Root Mean Square Vertical Acceleration (RMSVA)

The Root Mean Square Vertical Acceleration (RMSVA) is another profile index that can be used to express an average level of roughness. The RMSVA can be computed for 100 meter sections to identify any portions of the runway that have high roughness levels and for the entire length of the runway. The RMSVA of a pavement profile is calculated using the following mathematical expression:

$$RMSVA_b = \sqrt{\frac{\sum_{i=k+1}^{i=n-k} VA(i)^2}{n-2k}}$$

where the Vertical Acceleration (VA) is defined as:

$$VA(i) = \frac{y(i+k) + y(i-k) - 2y(i)}{b^2}$$

and where:

$RMSVA_b$ = Root Mean Square Vertical Acceleration (mm/m²) calculated for a base length b

$VA(i)$ = vertical acceleration (mm/m²) at profile point “i”

n = number of profile elevations

i = index designating the i^{th} profile point

b = base length (m) used for $RMSVA_b$ calculation (1.5m preferred)

(Note: “ b ” is the distance between profile point “ $i - k$ ” and “ i ” and equally the distance between profile point “ i ” and “ $i + k$ ”)

dx = distance between profile points (m)

k = b / dx

$y(i)$ = elevation (mm) at profile point “i”

- (2) Due to the complexity of the calculations involved, the computation of IRI and RMSVA, roughness indices from a longitudinal surface profile make computer software an essential requirement.

6.3 Riding Comfort Index (RCI)

- (1) The historical Transport Canada method of assessing runway pavement roughness is called the Riding Comfort Index (RCI). The RCI is a subjective method of rating the roughness of a pavement on a scale of 0 to 10 while riding in an automobile, with a RCI of 0 representing a very poor ride quality and a RCI of 10 representing a very good ride quality. The RCI, however, does not indicate the presence of individual bumps of excessive magnitude as aircraft respond to profile irregularities of longer wavelength not affecting automobile ride.
- (2) Although the RCI represents a subjective measure of ride quality while riding in an automobile, the index gives a general indication of the average level of pavement roughness experienced by a pilot. For a runway receiving turbojet traffic, pilot complaints can be expected when the RCI falls below 5 and are almost certainly received if the RCI falls below 4. If pilot complaints of runway roughness are received and the RCI is at an acceptable level, then the runway profile should be evaluated for individual bumps of excessive magnitude.
- (3) Correlations have been established between the RCI and the profile roughness indices described above (IRI and RMSVA) and can be used to determine a corresponding RCI value as follows:
 - (a) The following equation can be used for determination of RCI values from IRI values:

$$\text{RCI} = 10 * e^{(-0.255 * \text{IRI})}$$
 where:
 RCI = Riding Comfort Index
 e = base of the natural logarithm (2.71828)
 IRI = International Roughness Index (mm/m) calculated from a measured profile
 - (b) The following equation can be used for determination of RCI values from RMSVA profile indices:

$$\text{RCI} = 10 * e^{(-0.366 * \text{RMSVA}_b)}$$
 where:
 RCI = Riding Comfort Index
 e = base of the natural logarithm (2.71828)
 RMSVA = Root Mean Square Vertical Acceleration (mm/m²) calculated from a measured profile using a base length “b” equal to 1.5 m
 - (c) If RMSVA is determined at a base length other than 1.5 metres, then the following equation can be used for the determination of RCI values from RMSVA profile indices:

$$\text{RCI} = 10 * e^{(c * \text{RMSVA}_b)}$$
 where:

$$c = (-0.355 * b) + 0.164$$
 and:
 b = The base length (metres) used for determination of the RMSVA_b profile index.
- (4) If RCI values are computed from both the IRI and the RMSVA, then two RCI values can be averaged to represent the average level of profile roughness.

- (5) The RCI can be computed for 100 metre sections to identify any sections of the runway profile that have higher roughness levels. However, roughness guidelines are based on the RCI average for the entire runway.
- (6) Table 1 gives historical Transport Canada runway roughness guidelines based on the average RCI for the entire length of the runway longitudinal profile.

Table 2 – Historical Runway Roughness Guidelines based on RCI

Historical Restoration Guidelines	Turbojet Traffic	Non-Turbojet Traffic
	When Runway Average “RCI” is Less Than	
Corrective Action Planned	5.0	4.0
Corrective Action Taken	4.0	3.0

6.4 Computerized Aircraft Roughness Simulation

- (1) When the longitudinal surface profile of a runway pavement has been measured, aircraft mathematical simulation techniques can also be used to assess the response of an aircraft to multiple event roughness present in the profile and to identify the severity and location of the roughness. Computer software is required to simulate the takeoff, landing or constant speed run of an aircraft over the length of the profile with aircraft ride quality being assessed in terms of the vertical acceleration of the landing gear.
- (2) Although standard criteria are not available for evaluating the results of aircraft roughness simulations, limiting the peak vertical acceleration experienced by aircraft landing gear to below 0.35 to 0.40 g's (acceleration due to gravity) is generally considered an achievable and acceptable objective.
- (3) Computer simulations of aircraft takeoff and landing runs over a surface profile give the closest representation of how an aircraft is likely to respond to both short and long wavelength roughness present in the profile. Many roughness cause/effect variables that are not considered in other techniques are factored into the simulation including multiple event roughness in the profile, aircraft landing gear dynamics, bump encounter speed, ground-borne aircraft mass, and airport site environmental and elevation influences.

7.0 CORRECTIVE ACTION TO RESTORE SMOOTHNESS

- (1) Section 2.5.1.1 of TP312 5th Edition indicates that “Information on the condition of the manoeuvring area and the operational status of related facilities is communicated to the appropriate aeronautical information service units, and similar information of operational significance to the air traffic services units, to enable those units to provide the necessary information to arriving and departing aircraft. The information is kept up to date and changes in conditions are reported without delay.”

Section 2.5.1.2 indicates that “The condition of the movement area and the operational status of related facilities are monitored and reports on matters of operational significance or affecting aircraft performance are communicated to AIS where provided, or the aircrew directly, in respect of the following: b) rough or broken surfaces on a runway...”
- (2) The decision on when and what type of corrective action is needed to restore surface smoothness will depend on the roughness analysis method used and on the type, location,

severity and extent of unacceptable roughness found in the surface – for example, localized versus general roughness found throughout the surface area. An excessive level of roughness is the justification for approximately 15 to 20 percent of airport pavement restoration projects.

- (3) When a runway surface profile is determined to contain a bump classified as “Excessive” as defined by Figure 1 (or Figure A-3 of ICAO Annex 14), corrective action should be taken immediately but the runway may remain in service.
- (4) When a runway surface profile is determined to contain a bump classified as “Unacceptable” as defined by Figure 1, the area of the runway where the bump is located warrants closure until such time as corrective action has been taken to restore surface smoothness.
- (5) Corrective measures (such as levelling and grinding) can be applied to a computerized pavement surface profile and the roughness analysis re-run to assess the effectiveness of the correction in alleviating the roughness problem.

8.0 FREQUENCY AND TIMING OF ROUGHNESS MEASUREMENTS

- (1) The frequency and timing of roughness measurements is established by the airport authority. Pilot complaints of pavement roughness are often the first indication that there may be something wrong with the pavement profile and that further investigation (roughness measurements) may be required. The roughness level of pavement surfaces will increase with time as the pavement ages and as various structural defects develop.
- (2) It is also desirable to measure the longitudinal surface profiles of new, reconstructed and resurfaced paved runways prior to or as soon as possible following the commissioning of the new surface. Measuring the surface profile of the runway surface will also serve as a check on the adequacy of construction as well as provide a reference or “benchmark” against which subsequent roughness measurement and deterioration can be assessed throughout the life of the pavement.

9.0 SOFTWARE APPLICATIONS FOR PAVEMENT ROUGHNESS ANALYSIS

- (1) The FAA has software available on their web site called “ProFAA” which provides the capability to simulate roughness evaluation procedures and calculate associated roughness indices as follows:
 - (a) Straight Edge
 - (b) Boeing Bump
 - (c) International Roughness Index (IRI)
 - (d) California Profilograph
 - (e) RMS BandpassIn addition, the software has the capability to simulate aircraft response for a library of representative aircraft and to calculate root mean square vertical accelerations and dynamic strut loads from the simulated responses.
- (2) Other proprietary software is available for the mathematical simulation of aircraft response to a runway profile. The types of analyses include aircraft takeoff and landing simulations to calculate “g” forces and aircraft constant velocity simulations to study the effects of speed on aircraft response to roughness in terms of the vertical acceleration of the landing gear.

10.0 INFORMATION MANAGEMENT

- (1) Not applicable.

11.0 DOCUMENT HISTORY

- (1) Advisory Circular (AC) 302-023 Issue 01, RDIMS 10840432 (E), 10840456 (F), dated 2015-09-16 – *Measurement and Evaluation of Runway Roughness*.

12.0 CONTACT OFFICE

For more information, please contact:

<http://www.tc.gc.ca/eng/regions.htm>

Suggestions for amendment to this document are invited, and should be submitted via:

TC.FlightStandards-Normsvol.TC@tc.gc.ca

[original signed by]

Robert Sincennes
Director, Standards
Civil Aviation