

DIVISION 32

1 GENERAL

1.1 Related Requirements

- .1 Not used.

1.2 Measurement and Payment

- .1 Measure surface prepared and cleaned for receiving surfacing materials in square metres.

1.3 Action and Informational Submittals

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

2 PRODUCTS

2.1 Not Used

3 EXECUTION

3.1 Finishing and Compacting Subgrade

- .1 The excavated sections shall be ploughed to a depth of at least 150 mm below the surface of the subgrade and replaced and compacted to a minimum of ninety eight percent (98%) of Standard Proctor Density. The cut shall be left sufficiently high so that the surface after compaction can be trimmed to the final grade, and any loose material resulting from this operation removed. All depressions caused by the finishing rollers shall be removed during the final blading operation. Finished subgrade surfaces shall be within plus or minus 30 mm of established grade, but not uniformly high or low.

3.2 Excavation Below Subgrade

- .1 Unsuitable Materials: When topsoil, muskeg, or other soft areas are encountered below the finished subgrade, which in the opinion of the Departmental Representative require removal, the area shall be undercut and the unsuitable material excavated, loaded and disposed of outside of Park. These materials shall be replaced with granular sub-base course gravel.
- .2 Placing Fill: Fill material shall be placed in successive horizontal layers not exceeding 150 mm.
- .3 Compaction: The compaction will be sufficient to obtain a minimum density of 98% of maximum dry density in accordance with ASTM D698 (Method C or D), unless otherwise stated in the specifications. Where it is necessary to add or remove moisture from the soil to obtain the compaction, it shall be done as part of the requirements of this section.

3.3 The Following Tests Shall Be Employed To Establish Compaction Procedures

- .1 The maximum dry density of the soil shall be determined by ASTM procedure D-698 (Moisture Density Relationships of soils), to be determined for each soil type. The optimum moisture content of the soil shall be determined from the laboratory compaction curve established.
- .2 The field density of soils shall be determined by ASTM D-2922 – Determining density of soil and soil aggregate in place by nuclear methods (shallow depth).

3.4 Normal Compacted Thicknesses of Lifts

Equipment Type	Cohesive Soils	Non-Cohesive Soil
Vibratory Sheepsfoot Packer	300 mm	300 mm
Sheepsfoot Packer	200 mm	--
Pneumatic Tire	200 mm	200 mm
Vibratory Roller	150 mm	300 mm
Pneumatic Tamper (contact area < 130 sq cm)	100 mm	100 mm
Pneumatic Tamper (contact area > 130 sq cm)	100 mm	100 mm
Mechanical Tamper (diesel or gas – jumping jack)	100 mm	200 mm

- .1 Thickness of lifts for other equipment shall be determined by laboratory testing procedures during the construction process. The Departmental Representative may grant approval in writing to alter lift thicknesses upon evidence of satisfactory compaction at other lift thicknesses.

END OF SECTION

1 GENERAL

1.1 References

- .1 Not used.

1.2 Measurement Procedures

- .1 Refer to Section 01 29 00 - Payment Procedures.

1.3 Action and Informational Submittals

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

2 PRODUCTS

2.1 Samples

- .1 At least five days prior to commencing work, inform the Departmental Representative of proposed source of aggregates and provide access for sampling.

2.2 Materials Certification

- .1 Aggregates: At least five days prior to commencing work provide:
 - .1 Test data reports representing granular base and/or granular sub-base processed into stockpile. Submit one (1) complete aggregate gradation analysis report for every 1,000 tonnes of each material required for the project or one complete analysis for each production day when production is less than 1,000 tonnes. Include percentage of crushed coarse aggregate particles in granular base reports.
 - .2 Certification that the physical properties of the aggregates meet the requirements of this section.
 - .3 Reports and certification shall be provided by an independent testing consultant under the signature and professional seal of a qualified materials engineer.
- .2 At least five days prior to contemplated change in source of aggregates, provide written notification to the Departmental Representative and provide new materials certification in accordance with the requirements of this section.

2.3 Granular Base

- .1 Crushed stone or gravel consisting of hard, durable, angular particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials.
- .2 Physical properties of Aggregates:

% Fracture, by weight (2 faces)	60 min.
Los Angeles Abrasion, loss, %	50 max.
Liquid Limit, %	25 max.
Plasticity Index, %	6 max.
Lightweight Particles, %	5 max.
California Bearing Ratio, when compacted to 100% of ASTM D698	80 min.

- .3 Gradation to be within the following limits when tested to ASTM C-117 with sieve sizes to CAN/CGSBD 8-GP-2M rather than ASTM E11, and to have a smooth curve without sharp breaks when plotted on a semi-log grading chart.

<u>Sieve Size</u>	<u>Percent Passing by Weight</u>
20 000	100
16 000	84 - 94
10 000	63 - 86
5 000	40 - 67
1 250	20 - 43
315	9 - 26
160	5 - 18
80	2 - 10

2.4 Granular Subbase

- .1 Crushed stone or gravel consisting of hard, durable, angular particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials.
- .2 Physical properties of Aggregates:
- | | |
|--|---------|
| Los Angeles Abrasion, loss, % | 50 max. |
| Liquid Limit, % | 25 max. |
| Plasticity Index, % | 6 max. |
| Lightweight Particles, % | 5 max. |
| California Bearing Ratio, when
compacted to 100% of ASTM D698 | 20 min. |
| Crushed particles (1 face plus 5 000 sieve fraction), % | 25 min. |
- .3 Gradation to be within the following limits when tested to ASTM C-136 and ASTM C-117 with sieve sizes to CAN/CGSBD 8-GP-2M rather than ASTM E11, and to have a smooth curve without sharp breaks when plotted on a semi-log grading chart.

<u>Sieve Size</u>	<u>Percent Passing by Weight</u>
80 000	100
25 000	38 - 100
16 000	32 - 85
5 000	20 - 65
315	6 - 30
80	2 - 10

3 EXECUTION

3.1 Preparation

- .1 The Contractor shall maintain the subgrade to the specified section, free from ruts, waves and undulations until granular sub-base material is placed. The subgrade shall be in a firm dry condition and must be approved by the Departmental Representative before gravel is placed. The depositing of granular base or sub-base on a soft, muddy or rutted subgrade will not be permitted.

3.2 Placing

- .1 Place material on a clean unfrozen surface, properly shaped and compacted and free from snow and ice.
- .2 Place using methods which do not lead to segregation or degradation of aggregate. Use approved methods to create uniform windrow of material along a crown line or high side of a one-way slope.
- .3 Place material to full width in layers not exceeding 150 mm in compacted thickness.
- .4 Shape each layer to a smooth contour and compact to the specified density before succeeding layer is placed.
- .5 Remove and replace any portion of a layer in which material becomes segregated during compaction.

3.3 Compacting

- .1 Moisture condition of granular sub-base and base course materials to be within plus or minus 3 percent of the optimum moisture content of the material.
- .2 Compact to density not less than 98% of maximum dry density in accordance with ASTM D698 (Method C or D).
- .3 Shape and compact alternately to obtain a smooth, even and uniformly compacted base.
- .4 In areas not accessible to rolling equipment, compact to specified density with approved mechanical tampers.

3.4 Finish Tolerances

- .1 Finished sub-base and base surfaces shall be within plus or minus 10 mm of established grade, but not uniformly high or low.
- .2 Correct surface irregularities by loosening and adding or removing materials until surface is within the specified tolerances.

3.5 Maintenance

- .1 Maintain finished base in a condition conforming to this section until succeeding material is applied or until acceptance.

END OF SECTION

1 GENERAL

1.1 Action and Informational Submittals

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

1.2 Definitions

- .1 End Product Specification (EPS) – A specification whereby the methods of construction are not defined. Under EPS the Departmental Representative will monitor the Contractor's control of the process that produces the items of construction and will accept or reject the end product according to a specified acceptance plan. The Contractor is responsible for quality control. End product acceptance, including quality acceptance is the responsibility of the Departmental Representative.
- 2 Lot – A Lot is a portion of the Work being considered for acceptance, and is defined as the following:
 - .1 The entire project quantity for each mix type.
 - .2 At the Departmental Representative's discretion, any portion of the Work may be deemed a Lot.
 - .3 In the specifications, Mix Type designation shall have these meanings:
 - .1 Mix Type 1 – Alberta Transportation (AT) Mix Type equivalent L1 with PG 52-34 (200/300A) binder.
 - .2 City of Edmonton mix type equivalent ACR will also be acceptable.

2 PRODUCTS

2.1 Materials

- .1 Asphalt cement:
 - .1 Asphalt cement shall be prepared by the refining of petroleum and shall not foam when heated to 177 C.
 - .2 The tolerance allowed by ASTM for testing precision will be applied for acceptance of asphalt cement.
- .2 Asphalt cement shall meet the following requirements for 200/300A:

Table 2.1.2

REQUIREMENTS	ASTM TEST METHOD	VALUES
Kinematic Viscosity at 135 C, mm ² /sec	D2170	200-300
Absolute Viscosity at 60 C, 300 mm, hg Vacuum, Pa.S	D2170	60-100

Penetration at 0 C, 200g, 60 sec; dmm	D5	30 min
Flash Point (Cleveland Open Cup) , C	D92	201 min.
Thin Film Oven Test. Penetration after test at 25 C, 100g, 5sec.; % of Original	D5	50 min
Ductility at 25 C and. 5 cm/min.; cm	D113	100 min
Solubility in Trichlorethylene, % by Mass	D2042	99.5 min.

.3 Aggregates:

- .1 Coarse aggregate is aggregate retained of the 5,000 µm sieve; fine aggregate is aggregate passing the 5,000 µm sieve.
- .2 Aggregate material shall be crushed stone or gravel consisting of hard, durable, angular particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials.
- .3 Gradation to be within limits specified, when tested to ASTM C-136 and ASTM C 117 with sieve sizes to CAN/CGSB 8-GP-2M rather than ASTM E11.

.4 Aggregate shall be processed to meet the following requirements:

- .1 Natural fines shall be pre-screened and stockpiled with not more than 10% of material retained in the 5,000 µm sieve and 100% passing the 10,000 µm sieve.
- .2 Fine fraction or manufactured sand to contain no more than 20% of material retained on the 5,000 µm sieve.

.5 Physical properties of aggregates to meet the requirements in Table 2.1.3.5

Table 2.1.3.5

Aggregate Physical Property Requirements

REQUIREMENT	TEST STANDARD	MIX TYPE I
Los Angeles Abrasion, Grading B (% loss)	C131	32.0 max.
Magnesium Sulphate Soundness (% loss)	C88	
Coarse Aggregate:		12.0 max.

Fine Aggregate:		12.0 max.
Lightweight Particles (%)	C123	1.5 max.

.6 Blend sand:

- .1 To consist of natural or manufactured sand passing the 5,000 µm sieve.
- .2 Stockpile volumes shall be maintained to ensure a minimum of 5 000 tonne of plant mix production at all times.

.7 Blended Aggregate Requirements:

- .1 Aggregate Gradation Requirements, including RAP, to meet the requirements of the following table.

Table 2.1.3.7.1

Blended Aggregate Gradation Requirements

SIEVE SIZE (µm)	Percent Passing	
	Type I	
	Max.	Min.
25,000	-	-
20,000	-	-
16,000	-	-
12,500	100	100
10,000	92	83
5,000	70	55
1,250	45	26
630	38	18
315	30	12
160	20	8
80	10.0	4.0

- .2 Coarse Aggregate Fracture: On coarse fraction (retained on 5,000 µm sieve size) the percentage of particles with two (2) or more fractured faces shall be by mass:

Mix Type I – 60% minimum

- .3 Flat and Elongated Particles: Of coarse fraction (retained on the 5,000 µm sieve size) the percentage of flat and elongated particles greater than a 5:1 ratio shall be by mass less than 10%.
- .4 Manufactured Sand: Of total fine fraction (passing 5,000 µm sieve size), manufactured sand shall be by mass:
 - .1 Mix Type I – 60% minimum
- .5 For mixes incorporating RAP, 50% of the RAP sand portion shall be considered manufactured sand.
- .6 The sand equivalent value (ASTM D2419, mechanical method) determined for the fine aggregate portion shall be:
 - .1 Mix Type I – 45% minimum
- .7 Of total aggregate, the maximum RAP portion shall be by mass:
 - .1 Mix Type I – 30% maximum
- .8 Delivery and Storage
 - .1 Aggregates: Stockpile minimum of 50% of total amount of aggregate required before commencing trial mix designs.
 - .2 Reclaimed Asphalt Pavement (RAP): Stockpile minimum of 100% of total amount of RAP required before commencing trail mix designs.

2.2 Mix Design

- .1 An asphalt mix design must be prepared and submitted to the Departmental Representative for review and approval at least seven days prior to the work. The Contractor shall use qualified engineering and testing services licensed to practice in the Province of Alberta.
- .2 The mix design shall follow the Marshall method of mix design as outlined in the latest edition of the Asphalt Institute Manual Series No. 2 (MS-2), and shall include five separate trial values of asphalt content.
- .3 Design of mix:
 - .1 Mix Type I – 50 blows on each face of test specimens.
- .4 Include the following data with mix design submission:
 - .1 Aggregate specific gravity and asphalt absorption.
 - .2 Sand equivalent, coarse aggregate fracture, flat and elongated particles, and percent manufactured sand values.
 - .3 Asphalt cement supplier/refinery, specific gravity and mixing and compaction temperatures, based on temperature-viscosity properties of asphalt cement.
 - .4 Job mix formula including aggregate gradation and blending proportions, and design asphalt content.

- .5 Maximum relative density at each trial asphalt content.
- .6 Where reclaimed asphalt pavement (RAP) is to be incorporated into the mix, supply RAP gradation, RAP asphalt cement content, design recycle percentage and rheology testing results.
- .7 Data to satisfy the requirements of the following:

Table 2.2.4.7

Mixture Physical Property Requirements

PROPERTY	REQUIREMENTS
	Mix Type I
Marshall Stability (kN)	5.3 min.
Marshall Flow (0.25 mm units)	8 – 16
Marshall Immersion Index of Retained Stability (%)	75 min.
Air Voids (%)	3.5 – 4.0
Voids in Mineral Aggregate (VMA) (%)	13.5 – 14.0
Voids Filled With Asphalt (VFA) (%)	65 – 78
Film Thickness (µm)	6.5 – 6.7

2.3 Job Mix Formula (JMF)

- .1 Subject to approval by the Departmental Representative, the aggregate proportioning (including RAP), target gradation, asphalt content and air void content from the Mix Design will become the Job Mix Formula (JMF) for the supply of hot mix asphalt.
- .2 Once established, no alterations to the JMF will be permitted unless the Contractor submits a new JMF and approved by the Departmental Representative.
- .3 If the sum of any alterations to the JMF is in excess of any one of the following limits, a new Mix Design is required.
 - ± 5% passing the 5,000 µm sieve size
 - ± 1% passing the 80µm sieve size
 - ± 0.30% asphalt content

- .4 Any alteration to the JMF shall not result in properties which do not meet the requirements of this Specification.

2.4 Production Tolerances

- .1 All mixtures shall be supplied to the JMF within the range of tolerances specified.
- .2 Asphalt cement content: $\pm 0.30\%$ of JMF value.
- .3 Temperature: Mix temperature at point of plant discharge shall not vary from that specified in the JMF by more than $\pm 10^\circ\text{C}$.
- .4 Aggregate Gradation:

Table 2.4.4

AGGREGATE PASSING SIEVE SIZE (μm)	TOLERANCE (% BY MASS)
Max. Size to 5,000	± 5.0
2,500 & 1,250	± 4.0
630 & 315	± 3.0
160	± 2.0
80	± 1.0

- .5 Air Voids: $\pm 1.0\%$ of the JMF value.
- .6 Mixture Properties: Marshall Stability, Marshall Flow, Voids Filled with Asphalt, Voids in Mineral Aggregate, and Film Thickness as per requirements identified in Table 2.2.4.7.
- .7 Moisture in Mix: Maximum permissible moisture, at point of plant discharge, is 0.2% by mass of mix.
- .8 Asphalt cement recovered from freshly produced hot mix by the Abson Method, ASTM D1856 and subsequently tested in accordance with ASTM D5, shall retain a minimum value of 50% of its original penetration value.

3 SAMPLING AND TESTING

3.1 General

- .1 The Departmental Representative shall have access to all production processes and materials used for the work to monitor material quantity as often as deemed necessary.
- Such inspection and testing shall not relieve the Contractor of the responsibility for meeting the requirements of this specification.
- .2 At least five days prior to commencing work, inform the Departmental Representative of the proposed source of aggregates and provide access for sampling, and provide samples of asphalt cement.

3.2 Quality Control

- .1 Quality Control is the responsibility of the Contractor throughout every stage of the work from aggregate processing to the final accepted product. Tests performed by the Departmental Representative will not be considered as Quality Control tests.
- .2 The Contractor shall be totally responsible for production of materials and construction that meets all specified requirements.
- .3 All quality control shall be conducted by qualified personnel. The Contractor shall bear the cost of all quality control testing and consulting services.
- .4 Pre-Production testing and sampling and minimum frequencies are described in the following table:

Table 3.2.4

Pre-Production Quality Control Requirements

Quality Control Requirement	Test Standard	Minimum Frequency
Asphalt Cement Certification	-	Once per year or for change in supplier.
Aggregate Physical Properties Table 2.1.3.5	Table 2.1.3.5	Once per year, or for change in source.
Crushed Coarse Aggregate Gradation Analysis and Fracture Content	ASTM C 136 ASTM D 5821	One for every 1,000 tonnes of each class of material processed into stockpile, or one analysis for each material, every production day when production rate is less than 1,000 tonnes.
Manufactured Sand Aggregate Gradation	ASTM C 117 ASTM C 126	
Natural Fine Aggregate Gradation	ASTM C 117 ASTM C 126	
Blend Sand Aggregate Gradation	ASTM C 117 ASTM C 126	
Reclaimed Asphalt Pavement (RAP) Asphalt Content and Extracted Aggregate Gradation	ASTM D 2172 ASTM C117 ASTM C 136	One for each 500 tonnes delivered to stockpile, or one for each location when delivery rate is less than 500 tonnes.
Penetration of Asphalt Cement Recovered from RAP by Abson Method	ASTM D 1856 ASTM D 5	One for each 2,000 tonnes delivered to stockpile.
Trial Mix Design by Marshall Method Section 2.2	Asphalt Institute MS-2	One per mix type every 3 years, or as required for a change in asphalt cement supply, aggregate gradation or

		aggregate source. See Note 1.
Marshall Immersion Test for Bitumen	AASHTO T245-97-UL [2004]	Minimum frequency not specified.
Plant Calibration	-	As required.

Note 1: A laboratory/plant JMF verification is required each year when a trial mix design is not conducted.

- .5 Post-Production testing and sampling and minimum frequencies are described in the following table:

Table 3.2.5

Post-Production Quality Control Requirements

Quality Control Requirement	Test Standard	Minimum Frequency
Hot Mix Asphalt Analysis (including Asphalt Content, Aggregate Gradation, Marshall Density and Void Properties)	ASTM D 6307 ASTM C117 ASTM C 136 ASTM D 3203	One for every 500 tonnes of each mix type supplied under this specification. See note 1.
Quality Control Charts (including 3 test running average for Binder Content, Aggregate Gradation, Marshall Density and Void Properties)	-	For each hot mix analysis. Test results and updated 3 test running average to be submitted to the Departmental Representative as they become available.
Marshall Immersion Test for Bitumen	AASHTO T245-97-UL [2004]	Minimum frequency not specified.
Hot Mix Asphalt Temperature	-	Minimum frequency not specified.
Cold Feed Aggregate Analysis	ASTM C 117 ASTM C 1236	Minimum frequency not specified.
Maximum Relative Density of Hot Mix Asphalt	ASTM D 2041	Minimum frequency not specified.
Compaction Monitoring (Core or Nuclear Density)	ASTM D 2726 ASTM D 2950	Minimum frequency not specified. See note 2.

Note 1: Where an individual test indicates non-compliance, another test shall be initiated immediately.

Note 2: Coring is subject to approval by the Departmental Representative.

- .6 Pre-Production Quality Control test data shall be reported to the Departmental Representative five days prior to commencing the project, or as requested.
- .7 Post-Production Quality Control test data shall be reported to the Departmental Representative daily as the work proceeds.

3.3 Quality Control Compliance With Specified Tolerances

- .1 Asphalt Content, Aggregate Gradation and Mixture Properties
 - .1 The test data derived by Post-Production Quality Control mix testing, described in Section 3.2, shall be compared to the tolerances set forth in Section 2.4 of this specification. The Contractor shall document, and make available to the Departmental Representative, any adjustments made to correct non-compliance with the specified tolerances.
 - .2 The Contractor shall suspend mix production when the 3 test running average for any property is outside of the specified tolerance limits for three consecutive tests. Supply shall not commence again until it is demonstrated that corrective action has been taken.
- .2 Hot Mix Asphalt Temperature
 - .1 Plant mix that does not meet temperature requirements of Section 2.4.3, at the point of plant discharge shall be subject to rejection at the discretion of the Departmental Representative.

3.4 Acceptance Sampling and Testing

- .1 Within this specification, certain requirements, limits and tolerances are specified regarding supplied materials and workmanship. Compliance with these requirements shall be determined from acceptance testing as described in this section.
- .2 Acceptance testing is the responsibility of the Departmental Representative.
- .3 Initial acceptance testing will be undertaken free of cost to the Contractor.
- .4 Asphalt concrete pavement for pathways will be subject to acceptance testing at the Departmental Representative's discretion.
- .5 Sampling and acceptance testing is described in the following table:

Table 3.4.4

Acceptance Testing Requirements

Acceptance Testing	Test Standard	Minimum Frequency
Hot Mix Asphalt Analysis (including Binder Content, Aggregate Gradation, Marshall Density, Maximum Relative Density, Void Properties, Marshall Stability and Flow)	ASTM D 6307 ASTM C 117 ASTM C 136 ASTM D 2041 ASTM D 3203	For each mix type, one test for each 3,500 sq.m. of placement, or three tests per Lot, whichever is greater. See note 1.

Marshall Immersion Test for Bitumen	AASHTO T245-97-UL [2004]	Minimum frequency not specified.
Compaction Testing (Core Density) and Thickness Determination	ASTM D 2726 ASTM D 3549	For each mix type, one test for each 2,000 sq.m. of placement, or three tests per Lot, whichever is greater.
Hot Mix Asphalt Temperature	-	Minimum frequency not specified.

Note 1: The Departmental Representative may, at their discretion, acquire the minimum number of mix samples, but reduce the number of tests to a minimum of one (1). Should non-compliance be indicated by the sample(s) tested, the Departmental Representative reserves the option to test the remaining samples.

.6 Acceptance Sampling Procedures:

- .1 Loose mix samples shall be acquired from the Work site in accordance with Alberta Transportation Test (ATT) procedure ATT-37. Auger samples may be used if approved by both the Departmental Representative and the Contractor.
- .2 The timing of mix sampling shall be stratified, with each sample representing a similar production quantity.
- .3 Core locations will be selected using stratified random sampling procedures. The Lot will be divided into segments meeting or exceeding the minimum specified frequency and of approximately equal area. In each segment a test site will be located using random numbers to determine the longitudinal and transverse coordinates.
- .4 Areas within 3 metres of transverse joints or 0.3 metres of a mat edge are excluded from compaction acceptance sampling and testing.

.7 Reporting Protocols:

- .1 Test reporting accuracy shall be as stipulated in the referenced test procedures, including:
 - .1 Gradation to the nearest whole number, except the percent passing the 80 µm sieve, which shall be reported to the nearest 0.1%.
 - .2 Binder content to the nearest 0.01%.
 - .3 Air voids and compaction to the nearest 0.1%.
 - .4 Thickness to the nearest whole millimeter (mm).
- .2 Lot averages shall be reported to the same accuracy as test results.

4 EXECUTION

4.1 Continuity of Production

- .1 During the time period that work is in progress on any project for which this specification is in effect, and at the Departmental Representative's discretion, the plant may be limited to producing only the mix type required for that project.

4.2 Mix Production

.1 Preparation of Mineral Aggregate

- .1 The Mineral aggregates shall be at as low a temperature as is consistent with proper mixing and lay down and in no case to exceed 165°C.

.2 Composition of Mixture

- .1 The mineral aggregate, reclaimed asphalt pavement (where applicable) and asphalt cement shall be mixed in a manner to produce a homogeneous mixture in which all particles of the mineral aggregate are uniformly coated.
- .2 Incorporate RAP such that it does not come in direct contact with the burner flame.
- .3 Plant emissions shall not exceed the limits set by Alberta Environment.

4.3 Preparation for Paving

- .1 The Contractor shall provide the Departmental Representative a minimum of six hours notice of the intention to commence paving over any previously approved primed or tacked surface.
- .2 The hot asphalt mixture shall be laid upon a dry firm surface, true to grade and cross-section and free from all loose or foreign material. No hot mix shall be placed when the surface is wet or when other conditions prevent proper spreading, finishing or compaction.
- .3 If undercutting, and subsequent backfill with asphalt concrete is done, the backfill operation shall be performed sufficiently far ahead of the paving operation to allow the asphalt concrete time to cool down enough to support equipment.

4.4 Hot Mix Asphalt Placing Temperature

- .1 No hot mix asphalt shall be dispatched to the field unless the temperature, as issued by Environment Canada, is rising and meets the following minimum temperature requirements.
 - .1 Thickness less than or equal to 50 mm: 7°C
 - .2 Thickness greater than 50 mm: 2°C
 - .2 A tolerance will be permitted for plant start-up.
 - .3 No surface lift asphalt shall be placed regardless of temperature until the road surface is 5°C or higher.

4.5 Hours of Operation

- .1 No loads of hot mix asphalt shall be dispatched from the plant after sunset or during hours of darkness unless loads can be placed and compacted in accordance with these specifications, and suitable artificial illumination is provided, all subject to the Departmental Representative's approval.

4.6 Transportation of Hot Mix Asphalt

- .1 Trucks shall be equipped with tarpaulins of sufficient weights and size to cover the entire open area of the truck box. Regardless of weather conditions, tarpaulins shall be used.
- .2 Vehicles used for the transportation of hot mix asphalt from the plant to the site of work shall have tight metal boxes previously cleaned of all foreign matter. The inside surface may be lightly lubricated with a soap solution just before loading. Excess lubrication will not be permitted.
- .3 For purposes of checking asphalt mixture temperatures, trucks shall have an accessible 13 mm diameter hole drilled into the driver's side of the truck box, at a distance of 0.3 metres from the bottom of the box and 150 mm clear of the reinforcing ribs.
- .4 The speed and weight of hauling trucks shall be regulated so that, in the opinion of the Departmental Representative, no damage will occur to any portion of the work underway. The Contractor at their own expense shall repair any damage to the tack coat, prime coat or the existing surface caused by the Contractor's equipment.

4.7 Hot Mix Asphalt Spreaders

- .1 The spreading machine shall be self-propelled and capable of placing a uniform layer of asphalt mix to the depth and grades as shown on the plans or as indicated by the Departmental Representative.
- .2 The screed shall include a tamping bar or vibratory strike-off device for use when required. The screed shall strike-off the mix to the depth and cross-section specified and produces a finished surface of uniform texture.
- .3 Control of the screed shall be by automatic sensing devices. Longitudinal control shall be accomplished by a sensor, which follows a string line, ski, or other reference. The grade sensor shall be movable and mounts provided so that grade control can be established on either side of the paver. A slope control sensor shall also be provided to maintain the proper transverse slope of the screed. Use automatic grade control or GPS control for paving operations.

4.8 Hand Tools

- .1 Only lutes shall be used during the spreading operation and when the asphalt is worked by hand in areas in which the paver cannot reach.
- .2 Tamping irons may be used to consolidate the material along structures inaccessible to the rollers. Mechanical compaction equipment, satisfactory to the Departmental Representative, may be used instead of tamping irons.
- .3 For purposes of checking the finished surface, the Contractor must provide and carry on each paving machine a 3 metre straight edge and slope measuring level.

4.9 Pre-levelling for Asphalt Concrete

- .1 Pre-levelling of uneven surfaces over which asphalt concrete is to be placed shall be accomplished by the use of asphalt concrete placed with a grader, paver, by hand or by a combination of these methods as directed by the Departmental Representative.
- .2 After placement, the asphalt concrete used for pre-levelling shall be compacted thoroughly with pneumatic tired rollers.

4.10 Paving Operations

- .1 The asphalt concrete shall be placed to the design thickness as shown on the contract drawings. On new construction where an established reference is lacking, a string-line reference will be required. Adjacent mats on the same lift are to be controlled by use of the grade sensor. No relaxation of the above procedure will be permitted without written approval of the Departmental Representative.
- .2 The spreader shall be operated in such a manner as to distribute the asphalt concrete mix to proper cross section, width and thickness without causing segregation of the mix. Segregated areas, which may occur, shall be corrected immediately. The forward motion of the spreader shall be controlled so that no irregularities in the pavement surface are caused by excessive speed. The rate of placement of the mixture shall be uniform, and shall be coordinated with the production rate of the asphalt plant without intermittent operation of the spreader.
- .3 Any failure of the machine or operation to produce a smooth, uniformly dense mat, free from irregularities, shall be corrected immediately to the satisfaction of the Departmental Representative.

4.11 Areas Inaccessible to the Paving Machine

- .1 Areas that are inaccessible to the paving machine may be paved by other methods, as approved by the Departmental Representative.
- .2 In small areas or where the use of mechanical equipment is not practical, the mix may be spread and finished by hand. The asphalt mixture shall be dumped on the area and immediately thereafter distributed into place by shovels and spread with lutes in a loose uniform layer, uniform density and correct depth. Material must be handled so as to avoid segregation.

4.12 Compaction

- .1 The Contractor shall supply sufficient compaction equipment to:
 - .1 Provide a compaction rate that will equal or exceed the placing rate of the spreader.
 - .2 Ensure the specified compaction is attained before the temperature of the mat falls below 80°C.

4.13 Longitudinal and Transverse Joints

- .1 Longitudinal and transverse joints shall be made in a manner consistent with industry standards. Coarse aggregate removed from the hot mix during joint preparation shall not be broadcast onto the mat.

- .2 Paving joints shall not be placed in the same vertical plane. Longitudinal joints shall be offset at least 150 mm and transverse joints shall be offset at least 2 metres.
- .3 Longitudinal joints shall not be located within travel lanes, unless approved by the Departmental Representative.
- .4 Edges where additional pavement is to be placed shall be vertically formed to true line. A lute shall be used immediately behind the paver when required to obtain a true line and vertical edge.
- .5 The exposed edges of all cold asphalt joints and the face of concrete curb and gutter shall be cleaned and painted with a thin coat of asphalt tack.
- .6 At the end of each day's paving of the surface course and upper lift of the base course mix, the uncompleted paving mats shall be provided with vertically cut transverse joints. Joints between old and new pavements or between successive days' work shall be carefully made in such a manner as to ensure a thorough and continuous bond between the old and new surfaces.

4.14 Opening to Traffic

- .1 Prior to any application of traffic, paving mats shall be sufficiently cool to resist and deformation or surface scuffing.
- .2 The Departmental Representative may, at their discretion, require means of cooling (e.g. application of water) completed pavements prior to opening to traffic.
- .3 At their discretion, the Departmental Representative may prohibit traffic from travelling on newly paved surfaces for any length of time deemed necessary.

Part 5 END PRODUCT ACCEPTANCE

5.1 General

- .1 The Contractor shall provide an end product conforming to the quantity and tolerance requirements of this specification. Where no tolerances are specified, the standard of workmanship shall be in accordance with accepted industry standards.
- .2 Acceptance of any Lot will occur if there are no obvious defects and the Lot mean results for asphalt content, pavement density, air voids and thickness meet or exceed the specified tolerances.

5.2 Asphalt Content

- .1 The Asphalt Content must be within $\pm 0.30\%$ of the approved JMF value, as specified in Section 2.4.

5.3 Pavement Compaction

- .1 Lot Mean Pavement Compaction must be equal to or greater than 94% of the Lot Mean Maximum Relative Density (MRD).
- .2 Deficient Density: If the average core density is below specified, the represented area of mat may be accepted subject to a pay factor according to Table 5.3.2 to be applied to the price of the quantity of ACP hot-mix in that mat area.

TABLE 5.3.2 ASPHALT DENSITY PAY FACTORS

Percentage of MRD 94%MRD Required	Pay Factor(%)
94.0	100.0
93.9	99.9
93.8	99.8
93.7	99.6
93.6	99.4
93.5	99.1
93.4	98.7
93.3	98.3
93.2	97.8
93.1	97.2
93.0	96.5
92.9	95.8
92.8	95.0
92.7	94.2
92.6	93.3
92.5	92.3
92.4	91.1
<u>92.3</u>	<u>89.8</u>
92.2	88.5
92.1	87.1
92.0	85.5
91.9	83.8
91.8	82.0
91.7	80.0
91.6	77.7
Less than 91.5	Grind and Resurface

5.4 Air Void Content

- .1 The Air Voids must be within $\pm 1.0\%$ of the JMF value, as specified in Section 2.4.

5.5 Thickness

- .1 Pavement of any type found to be deficient in thickness by more than 13.0 mm shall be removed and replaced by pavement of specified thickness, at the Contractor's expense.
- .2 The Lot Mean Thickness for any Lot will be determined on the basis of the acceptance cores described in Table 3.4.4. Core thickness shall be determined in accordance with ASTM D 3549.
- .3 If the deficiency of any individual core exceeds 13 mm, additional cores may be extracted in the proximity to the location of the core of excessive deficiency, to identify the extremities of the pavement area subject to be removed and replaced. The Contractor shall pay for such additional coring.
- .4 For payment, the Lot Mean Thickness must be equal to, or greater than, the specified thickness.

5.6 Smoothness

- .1 The completed asphalt concrete surface shall be true to the dimensional and tolerance requirements of the specifications and drawings. Unless detailed otherwise in the contract documents, the tolerances in both profile and crown are:
 - .1 Base Course: 10 mm in 3 m
 - .2 Surface Course: 5 mm in 3 m
- .2 When deviations in excess of the above tolerances are found, the pavement surface shall be corrected by methods satisfactory to the Departmental Representative. Correction of defects shall be carried out until there are no deviations anywhere greater than the allowable tolerances.

5.7 Segregation

- .1 The finished surface shall have a uniform texture and be free of segregated areas. A segregated area is defined as an area of the pavement where the texture differs visually from the texture of the surrounding pavement.
- .2 All segregation will be evaluated by the Departmental Representative to determine repair requirements.
- .3 The severity of segregation will be rated as follows:
 - .1 Slight: The matrix of asphalt cement and fine aggregates is in place between the coarse aggregate particles, however there is more stone in comparison to the surrounding acceptable mix.
 - .2 Moderate: Significantly more stone than the surrounding mix, and exhibit a lack of surrounding matrix.
 - .3 Severe: Appears as an area of very stony mix, stone against stone, with very little or no matrix.
 - .4 Segregated areas shall be repaired by the Contractor as directed by the Departmental Representative. The following methods of repair are identified.
 - .1 Slight: Squeegee asphalt to completely fill the surface voids.
 - .2 Moderate: Slurry seal for full mat width.
 - .3 Severe: Removal and replacement or overlay.
 - .5 All repairs shall be regular in shape and finished using good workmanship practices to provide an appearance suitable to the Departmental Representative.
 - .6 Any other methods of repair proposed by the Contractor will be subject to the approval of the Departmental Representative.
 - .7 Repairs will be carried out by the Contractor at their expense.

END OF SECTION

Part 1 GENERAL

1.1 Measurement Procedures

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

1.2 Action and Informational Submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Samples:
 - .1 Submit two - 1 L samples of asphalt tack coat material proposed for use in new, clean, airtight, sealed, wide mouth jars or bottles made with plastic to Departmental Representative, at least 5 days prior to beginning Work.
 - .2 Sample asphalt tack coat material to: ASTM D 140.
 - .3 Provide access on tank truck for Departmental Representative to sample asphalt material to be incorporated into Work to ASTM D 140.

1.3 Quality Assurance

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

1.4 Delivery, Storage and Handling

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labeled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect asphalt tack coats from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
 - .4 Deliver, store and handle materials in accordance with ASTM D 140.
 - .5 Provide, maintain and restore asphalt storage area.

Part 2 PRODUCTS

2.1 Materials

- .1 Anionic emulsified asphalt: to CAN/CGSB-16.2, grade SS-1h
- .2 Cut-back asphalt: to AASHTO M081-92-UL, grade RC-70 or RC-250.
- .3 Water: clean, potable, free from foreign matter.

2.2 Equipment

- .1 Equipment required for Work of this Section to be in satisfactory working condition and maintained for duration of Work.
- .2 Pressure distributor:
 - .1 Designed, equipped, maintained and operated so that asphalt material can be:
 - .1 Maintained at even temperature.
 - .2 Applied uniformly on variable widths of surface up to 5 m.
 - .3 Applied at readily determined and controlled rates from 0.2 to 5.4 L/m² with uniform pressure and with allowable variation from any specified rate not exceeding 0.1 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 meter graduated in units of 5 L or less per minute passing through nozzles and readily visible to operator. Pump power unit to be independent of truck power unit.
 - .4 Equipped with easily read, accurate and sensitive device which registers temperature of liquid in reservoir.
 - .1 Measure temperature to closest whole number.
 - .5 Equipped with accurate volume measuring device or calibrated tank.
 - .6 Equipped with nozzles of same make and dimensions, adjustable for fan width and orientation.
 - .7 Equipped with nozzle spray bar, with operational height adjustment in increments of 0.6 metres and capable of being raised or lowered.
 - .8 Cleaned if previously used with incompatible asphalt material.

Part 3 EXECUTION

3.1 Application

- .1 Apply asphalt tack coat only on clean and dry surface.
- .2 Dilute asphalt emulsion with water at 1:1 ratio for application.
 - .1 Mix thoroughly by pumping or other method approved by Departmental Representative.
- .3 Apply asphalt tack coat evenly to pavement surface at 0.5L/ m².
- .4 Paint contact surfaces of curbs, gutters, headers, manholes and like structures with thin, uniform coat of asphalt tack coat material.

- .5 Apply asphalt tack coat only when air temperature greater than 10 degrees C and when rain is not forecast within 2 hours minimum of application.
- .6 Apply asphalt tack coat only on unfrozen surface.
- .7 Evenly distribute localized excessive deposits of tack coat by brooming as directed by Departmental Representative.
- .8 Where traffic is to be maintained, treat no more than one half of width of surface in one application.
 - .1 Control traffic in accordance with Section 01 35 00 - Special Procedures for Traffic Control.
- .9 Keep traffic off tacked areas until asphalt tack coat has set.
- .10 Re-tack contaminated or disturbed areas as directed by Departmental Representative.
- .11 Permit asphalt tack coat to set before placing asphalt pavement.
- .12 Submit summary report within 3 days minimum of date of application and include information as follows:
 - .1 Total area tack coated.
 - .2 Quantity of tack coat used.
 - .3 Mean application rate.
 - .4 Actual product quantity used when using equipment on pressure distributors.
 - .5 Dipstick measurements or electronic printouts are acceptable.
- .13 Carry out measurements in presence of Departmental Representative upon request.
- .14 Inspect tack coat application to ensure uniformity.
 - .1 Re-spray areas of insufficient or non-uniform tack coat coverage as directed by Departmental Representative.
 - .2 Ensure tack coating performed using hand held devices is consistent in appearance with adjacent areas of machine applied material.

3.2 Cleaning

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

END OF SECTION

Part 1 GENERAL

1.1 Measurement Procedures

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

1.2 Action and Informational Submittals

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Samples:
 - .1 Submit two 1 L samples of asphalt prime proposed for use in new, clean, air tight sealed, wide mouth, jars or bottles made with plastic, to Departmental Representative, 5 days prior to commencing Work.
 - .2 Sample asphalt prime coat materials in accordance with ASTM D 140.
- .3 Provide access on tank truck for Departmental Representative to sample asphalt material to be incorporated into Work, in accordance with ASTM D 140.

1.3 Quality Assurance

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

1.4 Delivery, Storage and Handling

- .1 Storage and Handling Requirements:
 - .1 Deliver, store and handle materials to ASTM D 140.
 - .2 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .3 Store and protect asphalt prime coats from nicks, scratches, and blemishes.
 - .4 Replace defective or damaged materials with new.

Part 2 PRODUCTS

2.1 Material

- .1 Asphalt material: to CAN/CGSB-16.1, grade SS-1h.
- .2 Sand blotter: clean granular material passing 4.75 mm sieve and free from organic matter or other deleterious materials.

3. Water: clean, potable, free from foreign matter.

2.2 Equipment

.1 Pressure distributor:

- .1 Designed, equipped, maintained and operated so that asphalt material can be:
 - .1 Maintained at even temperature.
 - .2 Applied uniformly on variable widths of surface up to 5 m.
 - .3 Applied at controlled rates from 0.2 to 5.4 L/m² with uniform pressure, and allowable variation from any specified rate not exceeding 0.1 L/m².
 - .4 Distributed in uniform spray without atomization at temperature required.
- .2 Equipped with meter registering travel distance in metres per minute, visibly located to enable truck driver to maintain constant speed required for application at specified rate.
- .3 Equipped with pump having flow meter graduated in units of 5 L or less per minute passing through nozzles and readily visible to operator.
 - .1 Pump power unit to be independent of truck power unit.
- .4 Equipped with easily read, accurate and sensitive device which registers temperature of liquid in reservoir.
 - .1 Temperature to be measured to nearest whole number.
- .5 Equipped with accurate volume measuring device or calibrated tank.
- .6 Equipped with nozzles of same make and dimensions, adjustable for fan width and orientation.
- .7 Equipped with nozzle spray bar, with operational height adjustment in increments of 0.6 metres and capable of being raised or lowered.
- .8 Cleaned if previously used with incompatible asphalt material.

.2 Aggregate Spreader:

- .1 Apply blotter sand to primed surfaces using roll type spreader, or rotating disc sander capable of applying aggregate at variable widths and at variable rates.

Part 3 EXECUTION

3.1 Application

- .1 Proceed with application of asphalt prime coat only after receipt of written approval of granular base surface from Departmental Representative.
- .2 Cutback asphalt:
 - .1 Heat asphalt prime for pumping and spraying.

- .2 Apply asphalt prime to granular base at rate as directed by Departmental Representative.
- .3 Apply on dry surface unless otherwise directed by Departmental Representative.
- .3 Anionic emulsified asphalt:
 - .1 Dilute asphalt emulsion with clean water at 1:1 ratio for application.
 - .2 Mix thoroughly by pumping or other method approved by Departmental Representative.
 - .3 Apply diluted asphalt emulsion at 3.0L/m².
 - .4 Apply diluted asphalt emulsion on damp surface unless otherwise directed by Departmental Representative.
- .4 Apply asphalt prime only on unfrozen surface.
- .5 Apply asphalt prime coat only when air temperature is greater than 10 degrees C and when rain is not forecast within 2 hours minimum of application.
- .6 Paint contact surfaces of curbs, gutters, headers, manholes and like structures with thin, uniform coat of asphalt prime material.
- .7 Where traffic is to be maintained, treat no more than one-half width of surface in one application.
- .8 Prevent overlap at junction of applications.
- .9 Do not prime surfaces that will be visible when paving is complete.
- .10 Apply additional material to areas not sufficiently covered as directed by Departmental Representative.
- .11 Keep traffic off primed areas until asphalt prime has cured.
 - .1 Control traffic in accordance with Section 01 35 00 - Special Procedures for Traffic Control.
- .12 Permit prime to cure before placing asphalt paving.

3.2 Use of Sand Blotter

- .1 If asphalt prime fails to penetrate within 24 hours, spread sand blotter material in amounts required to absorb excess material.
- .2 Allow sufficient time for excess prime to be absorbed as directed by Departmental Representative.
- .3 Apply second application of sand blotter as required.
- .4 Do not roll blotter sand.
- .5 Sweep and remove excess blotter material.

3.3 Cleaning

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

END OF SECTION

Part 1 GENERAL

1.1 References

- .1 CAN/CGSB 1.5 M99, Low Flash Petroleum Spirits Thinner.
- .2 CGSB1 GP 12C 83, Standard Paint Colours.
- .3 CGSB1 GP 71 83, Method, of Testing Paints and Pigments.
- .4 CAN/CGSB 1.74-01, Alkyd Traffic Paint.
- .5 U.S. FED-STD-595B, 1989 - Colours Used in Government Procurement.
- .6 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.2 Action and Informational Submissions

- .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.
- .3 Samples:
 - .1 Submit to Departmental Representative following material sample quantities at least seven days prior to commencing work.
 - .1 Two 1 L samples of each type of paint.
 - .2 One 1 kg sample of glass beads.
 - .2 Mark samples with name of project and its location, paint manufacturer's name and address, name of paint, specification number and formulation number and batch number.

1.3 Delivery, Storage and Handling

- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2 Storage and Handling Requirements:
 - 1. Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - 2. Replace defective or damaged materials with new.

Part 2 PRODUCTS

2.1 Materials

- .1 Paint and Markings:
 - 1. To CGSB 1-GP-74M-79, Paint, Traffic, Alkyd.
- .2 Colour: to CGSB 1-GP-12C-68, yellow 505-308, white 513-301.
- .2 Thinner: to CAN/CGSB-1.5.
- .3 Glass reflective beads: type suitable for application to wet paint surface for light reflectance.

Part 3 EXECUTION

- .1 Tawayik Lake Access Road - painting of directional dividing line (single solid yellow centerline) and 2 edge lines (white shoulder lines for 3.5m lane width) on the roadways.
- .2 Tawayik Lake DUA Parking Lot – painting of parking lot markings (stalls and perimeter).

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 Departmental Representative instructions prior to pavement markings installation.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Pavement surface: dry, free from water, frost, ice, dust, oil, grease and other deleterious materials.
 - .3 Proceed with Work only after unacceptable conditions have been rectified.

3.2 Equipment Requirements

- .1 Paint applicator: approved pressure type mobile 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.
- 2. Distributor: capable of applying reflective glass beads as overlay on freshly applied paint.

3.3 Application

- .1 Pavement markings: laid out by Contractor.
- .2 Unless otherwise approved by Departmental Representative, apply paint only when air temperature is above 10 degrees C, wind speed is less than 60 km/h and no rain is forecast within next 4 hours.
- .3 Apply traffic paint evenly at rate of 3 m²/L.
- .4 Do not thin paint unless approved by Departmental Representative.
- .5 Paint lines of uniform colour and density with sharp edges.
- .6 Thoroughly clean distributor tank before refilling with paint of different colour.
- .7 Apply glass beads at rate of 200 g/m² of painted area immediately after application of paint.

3.4 Tolerance

- .1 Paint markings: within plus or minus 12 mm of dimensions indicated.
- .2 Remove incorrect markings to the satisfaction of the Departmental Representative.

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.

3.6 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 Measurement Procedures

- .1 Preparation of sub-grade for placing of topsoil will not be measured for payment.
- .2 Measure placing of topsoil in square metres, even if removed from stockpile.

1.2 Payment

- .1 Payment for Topsoil Placement will be made at the applicable unit price bid for Work measured and acceptably completed.

Part 2 PRODUCTS

2.1 Topsoil

- .1 Topsoil for seeded areas: mixture of particulates, microorganisms and organic matter that provides suitable medium for supporting intended plant growth.
 - .1 Native topsoil to be stripped from on-site sources, if available, as directed by the Departmental Representative.
- .2 Contain no toxic elements or growth inhibiting materials.
- .3 Finished surface free from:
 - .1 Debris and stones over 100 mm diameter.
- .4 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.

2.2 Source Quality Control

- .1 Advise Departmental Representative of sources of topsoil and manufactured topsoil to be utilized with sufficient lead time for testing. Sources shall be approved by the Departmental Representative.
- .2 Contractor is responsible for amendments to supply topsoil as specified.
- .3 Soil testing by recognized testing facility for PH, P and K, organic matter, noxious weeds, and prohibited weeds.
- .4 Topsoil testing will be carried out by testing laboratory designated by Departmental Representative.
 - .1 Soil sampling, testing and analysis to be in accordance with Provincial standards applicable to the place of the Work.
 - .2 Topsoil shall be certified to be free of noxious weeds and prohibited weeds as per Provincial and Federal Acts and Regulations applicable to the place of the Work.

Part 3 EXECUTION

3.1 Temporary Erosion and Sedimentation Control

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 Preparation of Existing Grade

- .1 Verify that grades are correct.
 - .1 If discrepancies occur, notify Departmental Representative and do not commence work until instructed by Departmental Representative.
 - .2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.
 - .3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials.
 - .1 Remove soil contaminated with calcium chloride, toxic materials and petroleum products.
 - .2 Remove debris which protrudes more than 75 mm above surface.
 - .3 Dispose of removed material off site.

3.3 Placing and Spreading of Topsoil

- .1 Place topsoil after Departmental Representative has accepted subgrade.
- .2 Spread topsoil in uniform layers not exceeding 100 mm.
- .3 For seeded areas spread topsoil to 100 mm minimum depth after settlement.
- .4 Manually spread topsoil around obstacles.

3.4 Finish Grading

- .1 Grade to eliminate rough spots and low areas and ensure positive drainage.
 - .1 Prepare loose friable bed by means of cultivation and subsequent raking.
 - .2 Consolidate topsoil to required bulk density using equipment approved by Departmental Representative.
 - .1 Leave surfaces smooth, uniform and firm against deep footprinting.

.2 Surface to match adjacent, existing surfaces.

3.5 Acceptance

.1 Departmental Representative will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading.

3.6 Surplus Material

.1 Dispose of materials except topsoil not required outside of Park.

3.7 Cleaning

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

.2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 Measurement and Payment

- .1 Payment for seeding will be made at unit price bid per metre of actual surface measurements taken. Areas of blending into existing turf grass will not be measured for payment.

1.2 General

- .1 This specification covers preparation of the area to be hydro-seeded, the supply and application of seed and fertilizer, and the finishing of hydro-seeded areas.
- .2 At the Departmental Representative's discretion, any area where established turf has been damaged or disturbed by the Contractor's operations, that area shall be surface prepped and hydro-seeded.

1.3 Action and Informational Submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Certificates of Analysis for each lot of seed supplied: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

1.4 Warranty

- .1 For seeding, 12 months warranty period is extended to 1 full growing season.
- .2 End-of-warranty inspection will be conducted by Departmental Representative.

Part 2 PRODUCTS

2.1 Supply of Materials

- .1 Materials for hydro-seeding, including grass seed mix, fertilizer, mulch and water shall be supplied by the Contractor.
- .2 Materials shall be stored dry and protected from direct sunlight and other detrimental conditions. Materials that have been subjected to detrimental conditions, as determined by the Departmental Representative, will not be accepted for use on the project.

2.1 Grass Seed

- .1 Canada "Certified" seed, "Canada No. 1 Ground Cover Mixture" in accordance with Government of Canada "Seeds Act" and "Seeds Regulations".
 - .1 Grass seed mixture.

- .1 35 % Awned Wheat Grass (*Elymus trachycaalus* spp. *subsecundus*)
 - .2 20 % Slender Wheat Grass (*Elymus trachycaulus*)
 - .3 20 % Western Wheat Grass (*Agropyron smithii*)
 - .4 10 % Northern Wheat Grass (*Elymus lanceolatus*)
 - .5 10 % Green Needle Grass (*Stipa viridula*)
 - .6 5 % June Grass (*Koeleria macrantha*)
- .2 The Contractor shall supply a grass seed mix that when established, will have a similar composition and appearance to the existing adjacent areas. The seed mix shall be subject to the Departmental Representative's approval, while meeting the requirements of the Grade Tables under the Canada Seeds Act & Regulations.
- .3 The seed shall be mixed by a conditioner and bulk storage facility approved by the Authority responsible for Canada Seeds Act & Regulations. All seed shall be tested by a Registered Seed Lab, and each bag shall be clearly marked with the name of the supplier and the mixture composition.
- .4 Prior to use on the project, the Contractor shall provide the Departmental Representative with a Certificate of Analysis for each lot of seed supplied. Test results from the Certificate of Analysis shall specify the germination, or for native seeds the Tetrazolium, and purity for each seed species of the mix, as well as the seed mix composition expressed as a percentage of each seed species by dry mass for each seed mix specified.

2.3 Hydro-mulch

- .1 Mulch material shall be cellulose fibre unless otherwise specified in the specifications. Mulch shall be clean and free of weeds and other foreign matter. Mulch shall be 100% biodegradable, compatible with the environment, and shall contain no germination-inhibiting components.

2.4 Tackifier

- .1 The binder must be capable of joining together the mulch particles to secure the mulch to the ground. The binder shall not form an impervious seal that will prevent the penetration of moisture to the underlying soil.

2.5 Water

- .1 Water supplied by the Contractor shall be free of any impurities that might inhibit germination of the seed.

2.6 Application Rate

- .1 The minimum application rate for hydro-seeding is 75-100 kg/ha.

Part 3 EXECUTION

3.1 Notification of Commencement of Work

- .1 The Contractor shall notify the Departmental Representative a minimum of 48 hours prior to any hydro-seeding work. Hydro-seeding operations shall not commence until all areas designated for hydro-seeding have been prepared to the satisfaction of the Departmental Representative.
- .2 Hydro-seeding operations shall not commence until the Departmental Representative has reviewed the Certificate of Analysis and verified the specified seed mixture supplied.

3.2 Surface Preparation

- .1 Grading or topsoil placement shall be completed to the satisfaction of the Departmental Representative prior to any surface preparation.
- .2 All eroded areas shall be corrected prior to surface preparation, as determined by the Departmental Representative.
- .3 Areas to be hydro-seeded shall be finished to a smooth and uniform surface, which is loosened to a depth of not less than 25 mm at the time of hydro-seeding. Where necessary, the surface shall be scarified and the Contractor shall dispose of stones, weeds, and other debris as determined by the Departmental Representative.
- .4 Hydro-seeding will not be permitted on hardened, crusted or rutted soil.
- .5 Do not perform Work under adverse field conditions such as frozen soil, excessively wet soil or soil covered with snow, ice, or standing water.

3.3 Weather Conditions

- .1 The Contractor shall not proceed with the Work when, in the opinion of the Departmental Representative, weather conditions are unsuitable. The Departmental Representative will not allow the Work to proceed when wind conditions are such that material is being carried beyond the designated work areas or that the material is not being uniformly applied.

3.4 Protection

- .1 The Contractor shall take reasonable care to prevent the contamination of structures, signs, guardrails, fences, utilities and other installations by hydro-seeding operations. Where such contamination occurs, the Contractor shall remove the offending material using methods acceptable to the Departmental Representative.
- .2 The Contractor shall ensure that hydro-seeding does not dislodge soil or cause erosion.
- .3 The Contractor shall be responsible for the protection of the Work and shall, at their own expense, repair all areas damaged by any cause, until the Work has been accepted by the Departmental Representative.

3.5 Acceptance and Reseeding

- .1 Hydro-seeded areas will be accepted by Departmental Representative provided that:
 - .1 Areas are uniformly established free of rutted, eroded, bare or dead spots and extent of weeds apparent in grass is acceptable.

- .2 Inspection of hydro-seeding will occur during the month of May of the calendar year following the year of initial seeding. The Contractor shall complete any required reseeding work prior to June 15 of that year. This date will be extended if, in the opinion of the Departmental Representative, the weather conditions prior to June 15 are not suitable for reseeding work.
- .3 At locations that fail to show a uniform stand of grass for any reason during the calendar year following the year of initial seeding, the Contractor shall repair the defective locations as determined by the Departmental Representative. A uniform stand of grass will be considered growth within an area measuring 1 square metre in size that shows no deterioration or bare spots, and provides a minimum of 80 percent ground cover as determined by the Departmental Representative.
- .4 Areas being reseeded shall receive the same seed mix as used for the original hydro-seeding.
- .5 The Contractor's method of reseeding shall be subject to the Departmental Representative's approval.
- .6 The Contractor shall supply all materials and equipment necessary for reseeding work and complete all reseeding work entirely at their own expense.
- .7 The Contractor will not be required to reseed any area more than once during the warranty period.

END OF SECTION