

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 This section specifies the requirements for construction of all roadwork and asphalt patching required under this contract.

1.2 MEASUREMENT PROCEDURES

- .1 Measure asphalt concrete paving in tonnes of asphalt concrete actually incorporated into Work.

1.3 REFERENCES

- .1 American Association of State Highway and Transportation Officials (AASHTO)
 - .1 AASHTO M320 - Current Edition, Standard Specification for Performance Graded Asphalt Binder.
 - .2 AASHTO R29- Current Edition, Standard Specification for Grading or Verifying the Performance Graded of an Asphalt Binder.
 - .3 AASHTO T245- Current Edition, Resistance to Plastic flow of Bituminous Mixtures Using Marshall Apparatus.
- .2 Asphalt Institute (AI)
 - .1 AI MS2- Current Edition Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.
- .3 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM C123- Current Edition, Standard Test Method for Lightweight Particles in Aggregate.
 - .2 ASTM C127- Current Edition, Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.
 - .3 ASTM C128- Current Edition, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.
 - .4 ASTM C131- Current Edition, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .5 ASTM C136- Current Edition, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .6 ASTM D3203- Current Edition, Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
 - .7 ASTM D4791- Current Edition, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.2- Current Edition, Sieves Testing, Woven Wire, Metric.

.2 CAN/CGSB-16.3- Current Edition, Asphalt Cements for Road Purposes.

1.4 PRODUCT DATA

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 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 at least 4 weeks prior to beginning Work.
- .3 Submit manufacturer's test data and certification that asphalt cement meets requirements of this Section.
- .4 The Contractor shall submit to the Departmental Representative, at least 7 working days prior to the commencement of field paving, a proposed job mix formula in writing for the asphalt mixture to be supplied.
- .5 The job mix formula so submitted shall list the following information:
 - .1 The sieve analysis of the combined aggregate in the mix.
 - .2 The sieve analysis of aggregate in each bin separation to be used.
 - .3 The weight of the material to be used from each bin for one batch of mix.
 - .4 The weight of asphalt to be used in each batch.
 - .5 The mixing temperature of the asphalt as determined from the temperature-viscosity relationship for the asphalt.
- .6 The formula shall be posted in a conspicuous place within sight of the plant operator. Any subsequent changes must be approved by the Departmental Representative in writing.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Handle all aggregate in a manner that will prevent segregation and intrusion of foreign materials.
- .2 Submit to Departmental Representative copies of freight and waybills for asphalt cement as shipments are received. Departmental Representative reserves right to check weights as material is received.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Divert unused asphalt to facility capable of recycling materials.

1.7 REGULATIONS

- .1 Abide by the bylaws and regulations of the Province of Alberta or Municipality in which the work is located.

- .2 Obtain permission from the Local or Highway Authority for haul routes and abide by the regulations with respect to their maintenance.

1.8 QUALITY ASSURANCE

- .1 Refer to Section 01 45 00 - Quality Control.

1.9 SITE EXAMINATION

- .1 Examine all existing structures and protect them from damage during paving operations.
- .2 Ascertain that the base course is properly compacted and prepared for placement of the surface course.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Asphalt Cement
 - .1 Asphalt cement: to CAN/CGSB-16.3, Grade 150/200, Group: A.

<u>Property</u>	<u>CGSB Specification</u>	<u>Test Method</u>
Flash Point (C.O.C.), °C	205 Minimum	ASTM D 92
Penetration at 25°C, 100 g/5 s, 0.1 mm	150 Minimum, 200 Maximum	ASTM D 5
Viscosity at 60°C, Pa.s	50 minimum	ASTM D 2171
Viscosity at 135°C, cSt	185 minimum	ASTM D 2170
Solubility in Trichloroethylene, % by Mass	99.0 minimum	ASTM D 2042
Ductility at 25°C, 5 cm/min, cm (4)	100 minimum	ASTM D 113
Thin Film Oven Test:		ASTM D 1754
% Loss in Mass	1.3 maximum	
% of Original Penetration at 25°C	40 minimum	
Ratio of Absolute Viscosity of residue to Original	4.0 maximum	

- .2 Asphalt shall be prepared by the refining of petroleum.
- .3 Asphalt shall be uniform in character and shall not foam when heated to 177°C.
- .4 Delivery temperature shall be between 135°C and 177°C.
- .2 Aggregates: in accordance with Section 31 05 16 - Aggregate Materials and the following requirements:
 - .1 25mm Road Crush Gravel.

- .2 Gradations: within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.2.

- .3 Table

<u>Sieve Designation</u>	<u>% Passing</u>
25 mm	100
19 mm	95-100
12.5 mm	-
9.5 mm	60-80
4.75 mm	40-60
2.00 mm	25-45
0.425 mm	10-25
0.180 mm	-
0.075 mm	2-10]

- .4 For crushed aggregate not less than 60 percent of the material retained on the 4.75 mm sieve shall be crushed particles. The ratio of the percentage passing the 4.75 mm sieve to the ratio passing the 425 micro-m sieve shall not exceed two-thirds and preferably not less than one half.

2.2 MINIMUM QUALITY CONTROL TEST FREQUENCIES

- .1 The following frequencies of testing are the minimum required. The Contractor shall perform as many tests as are necessary to ensure that the Work conforms to the requirements of the Contract regardless of the minimum number specified.

- .1 Crushed Gravel

- .1 One sieve analysis for every 500 m³ of crushed gravel.
.2 One field density for every 2000 m² of compacted layers.

- .2 Asphalt

- .1 Submit a certified laboratory analysis to the Departmental Representative for each shipment of asphalt cement.
.2 Provide test data (re: the temperature viscosity relationship).
.3 Submit one copy of results of each of the following control tests, for each class of aggregate to be used:
.1 Los Angeles Abrasion Test - ASTM-C 131.
.2 Crushed Fragments.
.3 Specified Gravity and Absorption ASTM-C127 and ASTM C128.
.4 Material passing 75 micro-m sieve - ASTM-C117.
.4 Combined aggregate tests shall be taken prior to the aggregate being combined with asphalt.
.1 Sieve analysis (ASTM-C136) will be taken daily.
.2 Moisture contents of dried aggregates will be taken daily.

- .5 The testing agency shall sample asphalt mixtures daily and in accordance with ASTM-D1559 method. Subject the samples to a density, air voids and an asphalt content determination.
- .6 A stability value shall be established at least once in each five days of mixing.
- .7 Density determination and air void contents will shall be taken by the Contractor's Testing Agency at a rate of one test for each layer at each site; and at least one each day during placing operations.
- .8 Nuclear density determinations will be in accordance with ASTM D2950 and one test will be taken at each paving site at a minimum.
- .9 Cores will be measured and tested to provide the following information.
 - .1 Thickness
 - .2 Asphalt content
 - .3 Density
 - .4 Sieve analysis
 - .5 Percentage air voids: ASTM-D3203

2.3 MIX DESIGN

- .1 The Contractor shall pay for and submit duplicate copies of a design mix as recommended by a testing agency employed by the Contractor. The design mix shall satisfy the following criteria based on the Standard Marshall Test Procedure (ASTM-D1559).
 - .1 Compaction blows on each face of test specimens: 50.
 - .2 Marshall Stability Newtons at 60°C: 4450 min
 - .3 Flow Index (Units of 0.3mm): 8-14
 - .4 % Voids in Mineral Aggregate
 - .1 19mm Maximum Aggregate: 14 min
 - .2 13mm Maximum Aggregate: 15 min
 - .5 % Voids in Total Mix: 3 – 5
 - .6 % Asphalt Cement (by weight) of dry aggregate: 6.0 min
 - .7 % Moisture Content: 0.5
 - .8 Air voids: to ASTM D3203.
- .2 Do not change job-mix without prior approval of Departmental Representative. When change in material source proposed, new job-mix formula will be provided to Departmental Representative for review.

PART 3 EXECUTION

3.1 PREPARATION

- .1 Apply prime coat and tack coat in accordance with Section 32 12 13.23 - Asphalt Prime Coats and Section 32 12 13.16 - Asphalt Tack Coats prior to paving.
- .2 Prior to laying mix, clean surfaces of loose and foreign material.

3.2 TRANSPORTATION OF MIX

- .1 Transport mix to job site in vehicles cleaned of foreign material.
- .2 Paint or spray truck beds with limewater, soap or detergent solution, or non-petroleum based commercial product, at least daily or as required. Elevate truck bed and thoroughly drain. No excess solution to remain in truck bed.
- .3 Schedule delivery of material for placing in daylight, unless Departmental Representative approves artificial light.
- .4 Deposit mix from surge or storage silo to trucks in multiple drops to reduce segregation. Do not dribble mix into trucks.
- .5 Deliver material to paver at uniform rate and in an amount within capacity of paving and compacting equipment.
- .6 Deliver loads continuously in covered vehicles and immediately spread and compact. Deliver and place mixes at temperature within 10°C of the temperature specified by the Departmental Representative.

3.3 PLACING

- .1 Obtain Departmental Representative approval prior to placing asphalt.
- .2 Place asphalt concrete to thicknesses, grades and lines as indicated or as directed by Departmental Representative.
- .3 Placing conditions:
 - .1 Place asphalt mixtures only when air temperature is above 5 degrees C.
 - .2 When temperature of surface on which material is to be placed falls below 10 degrees C, provide extra rollers as necessary to obtain required compaction before cooling.
 - .3 Do not place hot-mix asphalt when pools of standing water exist on surface to be paved, during rain, or when surface is damp.
- .4 Place asphalt concrete in compacted lifts of thickness as indicated.
- .5 Where possible do tapering and levelling where required in lower lifts.
- .6 Spread and strike off mixture with self-propelled mechanical finisher.
 - .1 Construct longitudinal joints and edges true to line markings. Position and operate paver to follow established line closely.
 - .2 Maintain constant head of mix in auger chamber of paver during placing.
 - .3 If segregation occurs, immediately suspend spreading operation until cause is determined and corrected.
 - .4 Correct irregularities in alignment left by paver by trimming directly behind machine.

- .5 Correct irregularities in surface of pavement course directly behind paver. Remove by shovel or lute excess material forming high spots. Fill and smooth indented areas with hot mix. Do not broadcast material over such areas.
- .6 Do not throw surplus material on freshly screeded surfaces.
- .7 When hand spreading is used:
 - .1 In small areas where the use of mechanical finishing equipment is not practical, the mix may be spread and finished by hand, if so directed by the Departmental Representative.
 - .2 Use approved wood or steel forms, rigidly supported to assure correct grade and cross section. Use measuring blocks and intermediate strips to aid in obtaining required cross-section.
 - .3 Distribute material uniformly. Do not broadcast material.
 - .4 During spreading operation, thoroughly loosen and uniformly distribute material by lutes or covered rakes. Reject material that has formed into lumps and does not break down readily.
 - .5 After placing and before rolling, check surface with templates and straightedges and correct irregularities.
 - .6 Provide heating equipment to keep hand tools free from asphalt. Control temperature to avoid burning material. Do not use tools at higher temperature than temperature of mix being placed.

3.4 COMPACTING

- .1 General:
 - .1 Provide at least two rollers and as many additional rollers as necessary to achieve specified pavement density. When more than two rollers are required, one 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 course 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 200 mm 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. Ensure that all points

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- 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.
 - .2 Breakdown rolling:
 - .1 Begin breakdown rolling 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.
 - .4 Use only experienced roller operators.
 - .3 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.
 - .4 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. Conduct rolling operations in close sequence.
 - .5 Density
 - .1 Minimum in place densities after second rolling shall be:
 - .1 Prior to September 1 - 96% of the laboratory design density
 - .2 After September 1 - 98% of the laboratory design density.
 - .2 Mixes that tend to move unduly under a roller and show excessive cracking shall be modified to correct this problem.

3.5 JOINTS

- .1 General:
 - .1 Remove surplus material from surface of previously laid strip. Do not deposit on surface of freshly laid strip.
 - .2 Paint contact surfaces of existing structures such as manholes, curbs or gutters with bituminous material prior to placing adjacent pavement.
- .2 Transverse joints:
 - .1 Offset transverse joint in succeeding lifts by at least 600mm.
 - .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 150mm.
 - .2 Cold joint is defined as joint where asphalt mix is placed, compacted and left to cool below 100 degrees C prior to paving of adjacent lane.
 - .1 If cold joint cannot be avoided, cut back by saw cutting previously laid lane, by at least 150 mm, to full depth vertical face, and tack face with thin coat of hot asphalt of adjacent lane.
 - .3 Overlap previously laid strip with spreader by 25 to 50mm.
 - .4 Before rolling, carefully remove and discard coarse aggregate in material overlapping joint with lute or rake.
 - .5 Roll longitudinal joints directly behind paving operation.
 - .6 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.

3.6 FINISH TOLERANCES

- .1 Finish the surface smooth, uniform and true to the lines of the specified grade.
- .2 Finished asphalt surface to be within 5mm of design elevation but not uniformly high or low.
- .3 Finished asphalt surface not to have irregularities exceeding 5mm when checked with 4.5m straight edge placed in any direction.
- .4 Uneven surfaces shall be corrected by loosening the surface and adding new material or removing high areas.

3.7 SAMPLING AND TESTING FREQUENCY

- .1 A minimum of one test sample shall be taken at each road crossing requiring rehabilitation or as directed by the Departmental Representative.
- .2 Minimum Marshall Test sampling size is 10 Kg or as directed by the Departmental Representative.

3.8 THICKNESS TOLERANCE

- .1 Pavement found to be deficient in thickness by more than 13 mm shall be removed and replaced by pavement of sufficient thickness, at the Contractor's expense.

3.9 DEFECTIVE WORK

- .1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required. If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form true and even surface and compact immediately to specified density.

- .2 Repair areas showing checking, rippling, or segregation.
- .3 Adjust roller operation and screed settings on paver to prevent further defects such as rippling and checking of pavement.

END OF SECTION