

SECTION 11

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SECTION 11

ASPHALTIC CONCRETE PAVINGSPECIFICATIONS11.1 SCOPE

This specification governs the production, placing and compaction of hot mix, hot laid asphalt concrete for pavement construction and other uses.

11.2 SPECIAL MIXES

For special purposes, such as patching, the paving of shoulders, boulevards, walkways and sidewalks, and the construction of curb, gutter or combination curb and gutter, the requirements of this specification, particularly in respect to the mix design aggregate requirements and the level of testing, shall be subject to amendment by the Engineer.

11.3 AGGREGATE

11.3.1 Aggregate for asphaltic concrete shall be composed of hard, angular, durable, crushed gravel free from silt or clay lumps, cementation, organic material, frozen material and other deleterious materials.

11.3.2 The aggregate gradation shall fall within the following limits when tested in accordance with ASTM C136 and ASTM C117.

Gradation Limits (% Passing by Weight)

<u>Size</u>		<u>19 mm</u>	<u>12 mm</u>	<u>10 mm</u>
25	mm	100	100	100
19	mm	100	100	100
12.5	mm	70-100	90-100	100
9.5	mm	55-90	75-95	90-100
4.75	mm	35-70	45-75	55-85
2.35	mm	25-57	30-60	35-70
1.18	mm	18-45	20-45	25-55
0.60	mm	13-34	15-35	15-40
0.30	mm	8-26	6-20	8-25
0.15	mm	5-17	4-15	5-18
0.075	mm	2-8	2-10	2-10

- 11.3.3 All sample gradations shall fall within the limits, and any deviations between the samples and the project gradation curve, based on the mix design, shall not exceed the following limits:

<u>Sieve Size (mm)</u>	<u>Maximum Permissible Tolerance % by Weight Passing</u>
4.75 - 19.0	± 4.5
1.18 - 2.35	± 4.0
0.60	± 3.5
0.30	± 2.5
0.15	± 1.5
0.075	± 1.0

- 11.3.4 A minimum 70% of the material retained on a 4.75 sieve shall have at least 2 fractured faces. Percentages shall be determined by particle count.
- 11.3.5 Shale content by weight shall not exceed 3% in the lower course or 1-1/2% in the surface course.
- 11.3.6 Aggregate short of material passing the 0.075 mm sieve shall have approved mineral filler added. Mineral filler shall be only material passing the 0.075 mm sieve and shall be finely ground particles of limestone, hydrated lime, Portland cement or other approved non-plastic materials when tested in accordance with ASTM D423 and D424.
- 11.3.7 The moisture content of the aggregate after leaving the drier and before mixing shall not be more than 0.05% by weight.
- 11.3.8 The following tests may be required to conform the gravel source is suitable for use in the production of aggregate for asphaltic concrete:
- (a) Soundness of Aggregates to ASTM C88
- Maximum loss by mass after 5 cycles with MgSO₄:
Coarse aggregate = 15%
Fine aggregate = 18%
 - (b) Los Angeles Abrasion to ASTM C131
- Maximum loss by mass = 25%
 - (c) Sand Equivalent to ASTM D2419
- Minimum = 40
 - (d) Absorption of Aggregate to ASTM C127
- Maximum absorption by mass = 2%
 - (e) Petrographic Examination to ASTM C295.

11.4 **ASPHALT CEMENT**

11.4.1 Asphalt cement shall be prepared from the refining of petroleum oils and be homogenous, free from water and shall not foam when heated to 175 deg. C.

11.4.2 Asphalt cement shall be AC-8 grade and conform to the following specifications:

<u>Test Designation</u>	<u>Characteristics</u>	<u>Min.</u>	<u>Max.</u>	<u>Units</u>
ASTM D5	Penetration @ 25 deg. C (100 gm for 5 seconds)	80	100	(0.1 mm)
ASTM D2171	Absolute Viscosity @ 60 deg. C	550	750	(poise)
	Kinematic Viscosity @ 135 deg. C	170	-	(Centi-strokes)
ASTM D113	Ductility @ 25 deg. C	100	-	(cm)
ASTM D2042	Solubility in Trichloroethylene min. %	99.0	-	(%)
ASTM D92	Flash point, by Cleveland Open Cup	232	-	(deg. C)
DI754	Loss on heating	1.0	-	(%)
ASTM D5	Penetration @ 25 deg. C after loss on heating 100 gms for 5 secs.	55	-	% of original

11.4.3 The Contractor shall inform the Engineer of the name of his asphalt supplier and shall ensure that each load of asphalt is accompanied with a flow sheet showing compliance with the preceding requirements. Such flow sheets shall be submitted to the Engineer.

11.5 **ASPHALTIC CONCRETE MIX DESIGN CRITERIA**

11.5.1 If requested by the Engineer, the Contractor shall supply an asphaltic concrete mix design conforming to the following specifications as based on the Marshall method of design (ASTM D1559) for approval:

- (a) Number of blows each face of test specimen 75

(b)	Minimum % voids in mineral VMA aggregate, based on Bulk SG	
	19 mm Aggregate	14
	12 mm Aggregate	15
	10 mm Aggregate	16
(c)	% air voids in compacted mixture, surface and lower course	3-5
(d)	Minimum modified Marshall load, N @ 60 deg. C	4500
(e)	Flow index, units of 0.25 mm	8-18
(f)	Minimum index of retained stability after immersion in water @ 60 deg. C for 24 hours	80%
(g)	Asphalt content in the mix shall be as specified in the mix design $\pm 0.25\%$.	

11.6 **JOB MIX AND PLANT CALIBRATION**

11.6.1 If requested by the Engineer, a job mix formula shall be provided by the Contractor and shall contain the following information:

- (a) Sieve analysis of combined aggregate in mix.
- (b) Aggregate size range in each bin separation to be used.
- (c) Weight of aggregate to be used from each bin for one batch of mix.
- (d) Weight of asphalt cement to be used for one batch of mix.
- (e) Optimum mixing and compacting temperatures.

11.6.2 If requested by the Engineer, a plant calibration for continuous mix plants shall be provided by the Contractor.

11.7 **TACK COAT**

Bituminous tack coat shall be Grade SS-1 or SS-1h asphalt emulsion, or as approved. Manufacturer's laboratory analysis of each tack coat shipment shall be submitted to the Engineer for approval.

INSTALLATION**11.20 RESPONSIBILITY FOR BASE**

11.20.1 The base, existing surface, or tack coat shall be approved by the Engineer prior to commencement of the paving operation.

11.20.2 The Contractor shall examine the approved base, existing surface or tack coat prior to commencing paving operations and satisfy himself that it is properly prepared for the placement of asphaltic concrete and shall notify the Engineer of any observed deficiencies prior to paving. His responsibility for pavement failures shall include those caused by base failure.

11.20.3 Prior to delivery of the asphaltic concrete to the job site, the prepared base shall be cleaned of all loose or foreign material.

11.21 TRAFFIC CONTROL

11.21.1 The Contractor shall be responsible for traffic control during all operations and shall not unduly disrupt normal traffic movement.

11.21.2 Traffic shall not be permitted on the finished pavement until it has cooled to atmospheric temperature.

11.22 CUTTING AND REMOVAL OF EXISTING PAVEMENT

The Contractor shall cut, remove and dispose of existing pavement as directed by the Engineer. Pavement cutting shall be in accordance with Section 3.8.1.

11.23 ADJUSTMENT OF SERVICES

The Contractor shall adjust manholes, catchbasins, valves, etc., to the proper finished grade at the time of paving. Covers shall be recessed 0 -6 mm below finished pavement grade. Covers shall not protrude above the finished pavement. Unless approved by the Engineer, the use of the steel riser rings shall not be allowed within the travelled portion of the road. Raised iron should be grouted and any damage to the road structure resulting from raising of the iron shall be repaired to the Engineer's satisfaction.

11.24 TACK COAT

11.24.1 The existing asphaltic concrete surface shall be thoroughly cleaned by a power-driven sweeper immediately prior to applying the tack coat.

11.24.2 Tack coat shall be applied to all existing asphaltic concrete that is to be overlaid and to the edge of existing asphaltic concrete, curbs and structures where these surfaces will be in contact with the new asphaltic concrete pavement.

11.24.3 Tack coat shall be applied only when the surface is dry and clean, and the air temperature is over 10 deg. C.

- 11.24.4 Tack coat shall be uniformly applied with an approved pressure distributor at a rate of 0.25 litres per square metre. The temperature of the material shall be maintained between 32 deg. C and 38 deg. C.
- 11.24.5 Traffic shall, where possible, be kept off tack coat areas. Where traffic has been allowed on the tack coat, these areas shall be thoroughly cleaned by a power-driven sweeper immediately prior to laying asphaltic concrete.
- 11.24.6 No hot mix shall be placed upon the tack coat until it has dried to a proper condition of tackiness, as determined by the Engineer.
- 11.24.7 Work shall be planned so that no more tack coat than is necessary for the days operation is placed on the surface.

11.25 **TRANSPORTATION OF HOT PLANT MIX**

- 11.25.1 Trucks used for the transport of hot mix shall be equipped with tarpaulins and with insulated boxes where required. Trucks shall not leak fuel or lubrication oils.
- 11.25.2 Inside surfaces of truck boxes shall be free of all deleterious materials and lubricated with suitable thin oil or soap, but excessive use of lubricant will not be permitted.
- 11.25.3 Loads shall be delivered continuously in covered trucks to provide a uniform, non-stop paving operation.
- 11.25.4 Delivery of the mix shall be scheduled to permit completion of the paving operation in daylight hours unless otherwise approved by the Engineer.

11.26 **PLACEMENT**

- 11.26.1 Surfaces onto which asphaltic concrete pavement is placed shall be dry, above 5 deg. C, and cleaned of all loose and foreign materials. Mixtures shall normally not be laid when the atmospheric temperature is less than 5 deg. C and falling.
- 11.26.2 The mixture temperature at time of placing shall be not less than 120 deg. C or greater than 150-160 deg. C or as required by the mix design.
- 11.26.3 An approved, self-propelled mechanical paver shall be used to spread the mixture to the specified thickness. The paver speed shall be adjusted to correspond to the rate of delivery to provide a uniform, non-stop paving operation.
- 11.26.4 The Contractor may use such methods as approved by the Engineer in narrow areas, irregular sections, intersections, turnouts or driveways, where it is impractical to spread with a paver.
- 11.26.5 Minor inequalities in spreading and shaping the paved surface adjacent to existing structures such as manholes, catchbasins or valves shall be performed to a condition satisfactory to the Engineer.

11.27 **COMPACTION**11.27.1 **Equipment**

- (a) Unless otherwise directed by the Engineer, the Contractor shall furnish a minimum of two (2) self-propelled rollers to roll and compact the asphaltic concrete mixture. All rollers shall be in good condition and capable of reversing without backlash.
- (b) One roller shall be an approved self-propelled smooth steel wheeled type capable of exerting a compression on the main roll of at least 4000 kg per metre of width.
- (c) The other roller shall be an approved self-propelled pneumatic tired type weighing not less than 10 tones. The wheels of the pneumatic tired roller shall be so constructed that the contact pressure can be made uniform for all wheels and the tire pressure of the several tires shall not vary by more than 20 kPa.

11.27.2 **General**

- (a) Compaction shall commence immediately after the bearing capacity of the course is adequate to support compaction equipment without undesirable displacement or cracking.
- (b) Maximum speed for initial rolling shall not exceed 5 km/h, and subsequent rolling, 8 km/h. Speeds shall be maintained at all times such that displacement of asphaltic concrete does not occur.
- (c) During the rolling operation, roller wheels shall be kept moist with only enough water to avoid picking up material. Fuel oil, lubricating oil, or kerosene shall not be permitted as lubricants for the surface of the roller wheels.
- (d) The line of rolling shall not be suddenly changed nor the direction of rolling suddenly reversed. Pronounced changes in direction shall be made on stable material.
- (e) Heavy equipment including rollers shall not be permitted to stand on the finished surface before it has been compacted and thoroughly cooled.
- (f) Where rolling causes displacement of material, loosen affected areas immediately with lutes or shovels and restore to original grade of loose material before re-rolling.
- (g) Should the testing results or the Contractor's quality control indicate compaction requirements are not being met, the Contractor shall immediately modify his compaction procedure to satisfy the compaction requirements.

11.27.3 **Breakdown Rolling**

Breakdown rolling shall immediately follow the rolling of transverse and longitudinal joint and

edges. Rollers shall be operated as close to the paver as necessary to obtain adequate density without causing undue displacement. Initial rolling shall be performed by steel wheel rollers with the drive roll or wheel forward in the direction of paving. Rolling shall commence on the low side of the mat and progress to the high side.

11.27.4 Secondary Rolling

Secondary rolling shall be performed by pneumatic tired rollers, shall follow the initial rolling as closely as possible, and shall be continuous until the mix has been thoroughly compacted.

11.27.5 Finish Rolling

Finish rolling shall be by steel wheel roller to remove all marks left by pneumatic rolling. Finish rolling shall be accomplished with the minimum number of passes required to produce a satisfactory surface.

11.28 JOINTS

11.28.1 General

- (a) All transverse and longitudinal joints shall be painted with a thin tack coat immediately prior to paving. Application of tack coat to longitudinal joints may be omitted if the previously laid pavement has not cooled to less than 50 deg. C.
- (b) Transverse joints in succeeding courses shall be offset a minimum of 600 mm. In adjacent lanes they shall be offset a minimum of 3 m.
- (c) Longitudinal joints in succeeding courses shall be offset 150 - 200 mm.
- (d) Wherever possible, longitudinal joints shall be located under future traffic markings (paint lines).

11.28.2 Transverse Joints

Transverse joints shall have a vertical face and shall be carefully constructed and thoroughly compacted to provide a smooth riding surface over the joint. Horizontal alignment of joints shall be straight-edged to ensure smoothness. Rolling of transverse joints shall be performed immediately after raking is completed.

11.28.3 Longitudinal Joints

Longitudinal joints shall have a vertical face and shall be rolled directly behind the paving operation.

Joints shall be rolled by passing the roller on the previously compacted lane letting one wheel project 100 mm to 150 mm on the new lane. A minimum of 2 passes shall be required to thoroughly compact this narrow strip down to and even with the existing lane.

11.28.4 Edges

Pavement edges shall be rolled concurrently with the longitudinal joints and shall not be exposed more than 15 minutes before rolling. After longitudinal joints and edges have been compacted, longitudinal rolling shall start at the edge and progress to the centre of the pavement, overlapping at least one-half the width of the roller with each successive pass. On super-elevated curves, rolling shall begin on the low side and progress to the high side.

11.29 CLEANING

The Contractor shall thoroughly remove from all culverts, catchbasins, curbs, gutters and other structures such contamination by asphaltic or other materials as may have occurred during the performance of the work.

11.30 TESTING

11.30.1 The Consulting Engineer will arrange for a testing firm to carry out tests to determine whether the applicable standards and specifications have been met. Where initial testing indicates non-compliance with the specifications, additional testing shall be required at the Contractor's expense.

11.30.2 The Contractor as directed by the Engineer shall supply specimens or samples for testing.

11.30.3 The test programs listed below are the minimum testing requirements. The Engineer shall determine if additional testing is required.

(a) Aggregates

- (i) One aggregate gradation test shall be carried out either for each 300 tonnes of production or a minimum of once per day (ASTM C136).
- (ii) Additional testing as outlined in Section 11.3 as required by the Engineer.

(b) Asphaltic Concrete

One Marshall test consisting of three briquettes for every 300 tonnes of production, or a minimum of one test per day shall be performed to determine the following: (ASTM D1559)

- (i) Marshall stability
- (ii) Specific gravity
- (iii) Air voids and voids in mineral aggregate (VMA)
- (iv) Flow index
- (v) Asphalt content extraction

(c) Compaction

- (i) Upon completion of the asphalt paving operation, one core from each 300 tonnes of pavement shall be obtained at allocations determined by the Engineer for the purpose of determining the asphaltic concrete density in accordance with ASTM D1559, and the asphaltic concrete thickness.
- (ii) Final compaction results shall be expressed as a percentage compacted density that is defined as follows:
Percentage compacted density $\frac{\text{Density of sample} \times 100}{\text{Laboratory design density}}$
- (iii) Test result data will be subjected to statistical analysis and the final compaction shall not be considered satisfactory unless the mean and the standard deviation of the test result data is in accordance with Section 11.31

- (d) Other testing as may be required to confirm conformance of materials and workmanship to the specifications.

11.30.4 The test programs outlined above are minimum requirements and may be modified by the Engineer. Full testing may be required during the first few days of paving to determine quality control and construction procedures. As paving progresses sufficient tests to maintain uniformity will be required.

11.30.5 Inspection and testing by the Engineer and Consulting Engineer shall not relieve the Contractor of his responsibility for quality control.

11.30.6 Asphaltic concrete found to be in non-compliance with the specifications shall be repaired or replaced by the Contractor at no additional cost to the Owner. The Contractor shall submit to the Engineer for approval his proposed method to correct the noted deficiencies, prior to commencing the work.

11.31 ACCEPTANCE REQUIREMENTS

11.31.1 The finished grade surface shall be free from bumps, depressions or other irregularities and shall be within 6 mm of the design grade and cross-section, but not uniformly high or low, when measured with a three (3) metre straight edge in any direction.

- 11.31.2 The finished elevation of the compacted asphaltic concrete shall be 0 - 6 mm above the finish elevation of structures, including but not limited to curbs, gutters, manhole lids, catchbasins, valve boxes and survey monuments.
- 11.31.3 The finished surface of the asphaltic concrete shall be homogenous, free from segregation and consistently uniform in surface texture.
- 11.31.4 Asphaltic concrete shall be compacted to 97% mean compacted density when tested in accordance with Section 11.30. Maximum acceptable standard deviation of test data shall be 1.5% with no individual test results less than 95% compacted density.
- 11.31.5 Asphaltic concrete thickness, as measured on all test cores, shall not be less than the specified thickness.