
ASPHALT CONCRETE PAVEMENT

PART 1 GENERAL

1.01 OTHER CONTRACT DOCUMENTS The General Conditions of the Contract, General Requirements, and Supplemental Conditions attached hereto shall apply to and be part of this Section.

1.02 DESCRIPTION OF WORK The Work described herein shall be for the supply and installation of all materials necessary for the construction of a hot mixed bituminous pavement surface on an existing granular base course or existing asphalt pavement.

1.03 RELATED WORK Section 02303 Granular Base Course
Section 02305 Soil Cement Base Course

1.04 CLASSIFICATION OF WORK Asphalt Concrete Pavement shall be classified as either Class A Asphalt or Class B Asphalt

Class A Asphalt shall be used for all surface course pavement layers greater than fifty (50) square metres in surface area. Class A Asphalt shall have a minimum asphalt film thickness and fine natural sand restriction as stated in Part 2.05 of this Section.

Class B Asphalt shall be used for all full width base course pavement layers, pedestrian walkways and for surface course pavement layers equal to or less than fifty (50) square metres in surface area.

1.05 MIX DESIGN STATEMENT A minimum of twenty one (21) calendar days prior to the supply of any Asphalt Concrete, the Contractor shall submit, for review by the Engineer, a written Mix Design Statement which shall certify the Asphalt Concrete is proportioned and produced in accordance with the requirements of this Section and is suitable for incorporation into the Work.

The Mix Design Statement shall include the names of suppliers and sources of all Products and materials to be incorporated into the Work and documentation from an approved quality control program stating; the gradation of each aggregate used in the mix; the percentage by mass of each aggregate used in the mix; the gradation of the combined aggregate; Marshall Mix Design data including: design graphs, the bulk specific gravity

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of the combined aggregates, the asphalt absorption of the combined aggregates, and the recommended design asphalt content expressed as a percentage of mass of total mix.

The source of Product and material supply shall not be changed without the prior approval of the Engineer. Any material of a quality or nature not suitable for its intended use will be rejected. The Engineer reserves the right to prohibit the use of material from any source where, in his opinion, the character of the material or the method of manufacture is such as to make improbable the furnishing of material conforming to the requirements of this Section.

1.06 QUALITY ASSURANCE

The analysis and approval of materials by the City will not relieve the Contractor from his duty to produce an acceptable product as stated in this Section.

Quality assurance will be used to determine the acceptability of the Asphalt Concrete supplied and installed by the Contractor. The frequency and number of quality assurance tests shall be as determined by the Engineer. The Engineer will obtain samples of the Asphalt Concrete and its constituent materials required for quality assurance tests. The Contractor shall make no charge for these materials. The Contractor shall, at his sole expense, provide any assistance requested for the obtaining of samples and reinstate the pavement layers or other structures to the satisfaction of the Engineer at the locations where samples have been obtained.

The sampling and testing of Asphalt Concrete will be done in accordance with the latest revisions of the ASTM test methods at the time of testing with the exception of quality assurance tests to determine; the percent asphalt absorption of the aggregate; the effective asphalt content of the asphalt mix; the percent voids in the mineral aggregate; the percent air voids in the compacted asphalt mix; and the percent of the voids in the mineral aggregate (VMA) filled with asphalt which will all be done in accordance with the test procedures outlined in the latest revision of the Asphalt Institute Manual 'Mix Design Methods for Asphalt Concrete (MS-2)'.

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PART 2 PRODUCTS

- 2.01 ASPHALT CEMENT Asphalt cement used in the manufacture of each class of Asphalt Concrete Pavement shall be 150 - 200 (A) Grade conforming to the requirements of ASTM Standard D 946. The Contractor shall store and maintain the asphalt cement in a manner and at the temperature recommended by the manufacturer of the asphalt cement. Upon request by the Engineer, the Contractor shall provide the Engineer with a certificate of analysis from the manufacturer of the asphalt cement which clearly indicates the asphalt cement conforms to the requirements of this Section.
- 2.02 PRIME COAT Prime coat shall be cutback asphalt MC30 conforming to the requirements of ASTM Standard D 2027. Upon request by the Engineer, the Contractor shall submit the manufacturers test data and certification that the cutback asphalt conforms to the requirements of this Section.
- 2.03 TACK COAT Tack coat shall be emulsified asphalt SS-1 or SS-1h conforming to the requirements of ASTM Standard D 977. The emulsion shall not be diluted by the Contractor. Upon request by the Engineer, the Contractor shall submit the manufacturers test data and certification that the emulsified asphalt conforms to the requirements of this Section.
- 2.04 AGGREGATES The Contractor shall handle and stockpile all aggregate materials as described in Part 3.01 of Section 02303 Granular Base Course.
- The aggregates shall be clean, uncoated, hard, durable, normal density particles of crushed rock, crushed stone, crushed gravel, natural sand or manufactured sand. The aggregates shall be free of deleterious material including but not restricted to organic matter, sod, roots, clay, silt, loam, thin, elongated (length in excess of 4 times width) or laminated particles, soft, brittle or flaking particles, shale, mudstone, sandstone, siltstone, alkali, mica, weathered gneiss or pyrite.
- The combined coarse and fine aggregates,(and VMA additive sand if used), shall produce a well graded mixture that conforms to the following gradation

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Class A & B Asphalt Concrete Aggregate	
Standard Sieve Size	Percent Passing Sieve (by total dry mass)
19 mm	100%
12.5 mm	80-95%
9.5 mm	70-90%
4.75 mm	50-75%
2.36 mm	35-55%
1.18 mm	25-45%
600 um	18-34%
300 um	10-22%
150 um	5-12%
75 um	3-6%
minimum crush count	60%
maximum deleterious	5%
maximum Los Angeles abrasion loss	35%

The deleterious percentage is the percentage by mass of total dry aggregate particles retained on the 4.75 millimetre sieve and each coarser sieve which are determined by the Engineer to be a deleterious material.

The crush count is the percentage by mass of total dry aggregate particles retained on the 4.75 millimetre sieve and each coarser sieve which are not deleterious and have least one or more freshly fractured face.

Gradation analysis will be performed according to ASTM Standards C117 and C136 test procedures. The Los Angeles abrasion loss test will be performed according to ASTM Standard C131 test procedure.

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2.05 MIX-DESIGN
 REQUIREMENTS

The aggregate and asphalt cement shall be mixed in proportions to conform to the following criteria which are based on the Marshall Method of Mix Design and the latest revision of the Asphalt Institute Manual 'Mix Design Methods for Asphalt Concrete MS-2'.

MARSHALL METHOD MIX CRITERIA	Class A and Class B Asphalt Concrete	
	minimum	maximum
Asphalt Cement (percent by mass of total mix)	5.0 %	7.0%
Compaction, number of blows each face of specimen	50	
Stability (Newtons)	5340 N	n/a
Flow, (0.25 millimetre units)	8	16
Air Voids (percent)	3 %	5 %
Voids in Mineral Aggregate (VMA) (percent)	minimum 13.5 (at 4.0% design air voids)	
Voids Filled with Asphalt (VFA) (percent)	65 %	78 %

For Class A Asphalt Concrete the addition of fine natural sand (more than 50 percent (50%) passing the 600 micron (um) sieve) to the combined aggregate gradation shall be limited to a maximum of 15 percent (15%) by mass of total dry aggregate.

All Class A Asphalt Cement shall have a minimum Asphalt Film Thickness (AFT) of 8.5 microns (um).

The Asphalt Film Thickness shall be determined from the following equation:

$$AFT = BI \times 4870$$

where:

AFT = Asphalt Film Thickness (um)

BI = Bitumen Index

4870 = conversion constant

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$$\text{BI} = \text{EAC} / \text{SAI} \times 100$$

where:

EAC = Effective Asphalt Content
(% by mass of aggregate)

SAI = Surface Area Index (ft²/lb of aggregate)

$$\text{SAI} = 2 + 0.02a + 0.04b + 0.08c + 0.14d + 0.3e + 0.6f + 1.6g$$

where: a, b, c, d, e, f, and g are % of total aggregate passing sieve sizes 4.75mm, 2.36mm, 1.18mm, 600um, 300um, 150um and 75um respectively.

Analysis of the Asphalt Concrete mix will be performed according to the following ASTM Standard test procedures;

C127	Specific Gravity and Absorption of Coarse Aggregate
C128	Specific Gravity and Absorption of Fine Aggregate
D854	Specific Gravity of Soils
D979	Practice for Sampling Bituminous Paving Mixtures
D2726	Bulk Specific Gravity and Density of Compacted Bituminous Mixtures using Saturated Surface-Dry Specimens
D2172	Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
D2041	Theoretical Maximum Specific Gravity of Bituminous Paving Mixtures
D6307	Asphalt Content of Hot-Mix Asphalt by Ignition Method

The Asphalt Concrete Paving mixture shall be manufactured in a mix plant that conforms to the requirements of the Asphalt Institute Manual 'Asphalt Plant Manual (MS-3); to the requirements of ASTM Standard D995, or as approved by the Engineer.

2.06 ASPHALT MIX
PLANT

The mix plant shall be operated in accordance with the manufacturer's recommendations with regard to discharge, temperature and the amount of moisture removed from the aggregate. The Contractor shall submit a certificate of calibration certifying the mix plant has been calibrated to

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produce a uniform Asphalt Concrete mixture in accordance with the requirements of this Section. Asphalt cement storage tank calibration and output tables or charts shall be made available to the Engineer when requested.

The plant settings for asphalt cement, aggregate, supplementary material and VMA additive sand shall be established in accordance with the Job Mix Formula and shall not be adjusted without the prior approval of the Engineer.

When the Asphalt Concrete Pavement contains Reclaimed Asphalt Pavement (RAP), the mix plant shall be capable of thoroughly separating and heating the RAP particles and blending the RAP with the aggregate and asphalt cement, to create a homogeneous mix at the plant discharge. The plant shall also contain specialized mixing equipment that prevents the RAP from coming into direct contact with the flame.

PART 3 EXECUTION

3.01 JOB MIX

One (1) week prior to the start of paving operations, the Contractor shall submit, for review by the Engineer, the results of three (3) separate sets of complete Marshall analyses, prepared by an approved quality control program, from samples taken at the asphalt mix plant, which certify the aggregate proportioning, target gradation and asphalt content requirements of the Mix Design Statement (with or without adjustments) have been met and the mix proportions selected produce Asphalt Concrete of the specified strength, durability and performance requirements stated in this Section. The Mix Design Statement revised or not, if accepted by the Engineer, becomes the Job Mix Formula for all Asphalt Concrete incorporated into the Work.

The Contractor shall not change or alter the Job Mix Formula without the Engineers written approval, and change may require the submission of a new Mix Design Statement complete with Marshall analysis data.

The aggregate gradation of the Asphalt Concrete shall not deviate from that of the Job Mix Formula by more than the allowable deviations shown below and shall remain within the gradation limits shown in Part 2.04 of this Section.
(percent passing by total dry mass)

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12.5 mm sieve and larger:	± 6.0%
9.5 mm and 4.75 mm sieves:	± 5.0%
2.36 mm and 1.18 mm sieves:	± 4.0%
600 um and 300 um sieves:	± 3.5%
150 um sieve:	± 2.5%
75 um sieve:	± 1.5%

The asphalt cement content of the Asphalt Concrete shall not deviate from that of the Job Mix Formula by more than plus or minus 5.0 percent (5%) and shall remain within the limits shown in Part 2.05 of this Section.

3.02 SITE CONDITIONS

Placement of Asphalt Concrete Pavement shall be limited to daylight hours between May 01st and October 15th. The placement of lower layers of Asphalt Concrete Pavement after October 15th requires the prior approval of the Engineer.

Asphalt Concrete Pavement shall only be placed under the following conditions;

- For the top wearing layer of pavement: when the atmospheric temperature at the Site, measured 150 millimetres above the surface to be paved is not less than 6 degrees Celsius and rising. If the wind velocity exceeds 10 kilometres per hour, the atmospheric temperature shall be at least 10 degrees Celsius and rising. For all other layers of pavement; when the atmospheric temperature at the Site, measured 150 millimetres above the surface to be paved is not less than 0 degrees Celsius and rising; and
- The existing pavement surface or the upper 750 millimetres of the granular base is free of any frost; and
- The weather is not misty or rainy; and
- Precipitation is not a threat at the Site within twelve (12) hours as forecast by Environment Canada; and
- The relative humidity is less than 75 percent (75%); and
- Wind conditions are such that a uniform prime or tack coat coverage can be achieved; and
- All curb and roadway repairs have been completed to the satisfaction of the Engineer; and
- The Engineer has reviewed and approved the Contractor's schedule and plans for placing and rolling of the Asphalt Concrete Pavement; and.
- In the Engineer's opinion, there is sufficient equipment, trucks, and Asphalt Concrete Pavement at the Site to allow the Work to proceed without interruption.

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3.03 LINE & GRADE

The Engineer will establish horizontal and vertical control on the Site. Prior to commencing the Work, the Contractor shall satisfy himself as to the meaning and correctness of all control points and benchmarks, no claim shall be made for any alleged inaccuracy because of his failure to read same correctly. The Contractor shall maintain all control points and benchmarks in good order and transfer the horizontal and vertical control to the Work. If, in the opinion of the Engineer, the Contractor's method of setting alignment and grade is inaccurate or insufficient, the Engineer shall have the right to order that a more suitable method be used to ensure that accurate grade and /or alignment is maintained.

3.04 SURFACE PREPARATION

Prior to the application of the Prime/Tack coat or Asphalt Concrete Pavement the Contractor shall remove and dispose of all loose material, dirt, sand, clay, dust or other objectionable materials from the full width of the surface to be paved with a rotary power sweeper. All depressions not reached by the power sweeping shall be hand swept. Paint firmly bonded to the surface that has the chalk removed may remain. The Contractor shall cover and seal all street appurtenances, manholes covers, valve covers, catch basin lids, survey monuments and other street hardware with building paper, plastic sheeting or other approved material. The Contractor shall protect concrete curbing, driveways and sidewalks prior to the application of Prime/Tack Coat. The Contractor shall remove existing fillets and ramps at approaches or adjacent to paved surfaces or other structures. The Contractor shall saw cut a full depth vertical face along existing asphalt pavements to be joined to the new Asphalt Concrete Pavement

3.05 PRIME COAT ON GRANULAR BASE

The Contractor shall not apply Prime Coat until all surface preparations have been completed as stated in Part 3.04 of this Section, the installation of granular base course, concrete curb & gutter, driveways, sidewalks, and underground utility appurtenances has been completed, the pavement surface is clean, dry and the Engineer has authorized the Work to proceed.

The existing base shall be brought to the specified grade, cross-section and density prior to the application of the Prime Coat. The surface of the base shall be well-bound, free from loose float, excessive dust or other unacceptable material. The Prime

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Coat shall only be applied when conditions are satisfactory and the moisture content of the granular base course is 2 percent (2%) or more below optimum.

Prime Coat shall be applied at locations specified by the Engineer using a distributor which conforms to the requirements of Part 2.03 Section 02575 Seal Coat and at a uniform rate between 1.0 and 2.0 litres of Prime Coat per square metre of surface area and within a temperature range of between 30 degrees Celsius and 70 degrees Celsius.

The application shall be made uniformly over the full width of the roadway to be paved and shall extend 300 millimetres beyond the outer edges of the proposed pavement surface on un-curbed roadways. Penetration shall be considered attained when free bitumen has been absorbed and vehicles can travel the section without pick-up or splash. Where the Prime Coat has not been entirely absorbed within twenty-four (24) hours of application, or such later time as the Engineer permits, the Engineer may direct the Contractor to supply and install sufficient sand over the surface to blot up the excess Prime Coat. The supply and installation of blotter sand shall be considered incidental to Work.

The Contractor shall take all necessary precautions to ensure that buildings, structures, vehicles, manhole covers, inlet grates, trees, wheel guards, curbs, guard rails and other roadway appurtenances or surfaces are not spattered or coated with Prime Coat. Prime Coat shall not be spilled, sprayed, or tracked on completed sections of the Work or adjacent structures. The Contractor shall promptly remove all spattering and over spray caused by his operations

No vehicular traffic will be allowed on the Prime Coat surface, nor will any subsequent bituminous treatment be allowed without the prior approval of the Engineer.

3.06 TACK COAT ON EXISTING PAVEMENT

The Contractor shall not apply Tack Coat until all surface preparations have been completed as stated in Part 3.04 of this Section, the installation of milling, concrete curb & gutter, driveways, sidewalks, and underground utility appurtenances has been completed, the surfaces are clean and the Engineer has authorized the Work to proceed.

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Tack Coat shall be applied at locations specified by the Engineer using a distributor which conforms to the requirements of Part 2.03 Section 02575 Seal Coat and at a uniform rate between 0.25 and 0.70 litres of Tack Coat per square metre of surface area (depending upon existing surface conditions) and within a temperature range of between 5 degrees Celsius and 30 degrees Celsius.

Tack Coat shall be uniformly applied over the full width of roadway surfaces that have become dry, dusty or dirty, have been previously paved, milled or soil-cement. Tack Coat shall be uniformly applied to the contact surfaces of concrete headers, curbs and gutters; manholes, and the exposed faces of transverse and longitudinal edges of existing pavements.

The Contractor shall not apply Tack Coat in the gutter of a concrete curb and gutter section unless directed otherwise by the Engineer. The Contractor shall take all necessary precautions to ensure that buildings, structures, vehicles, manhole covers, inlet grates, trees, wheel guards, curbs, guard rails and other roadway appurtenances or surfaces are not spattered or coated with Tack Coat. Tack Coat shall not be spilled, sprayed, or tracked on completed sections of the pavement. The Contractor shall promptly remove all spattering and over spray caused by his operations

The Contractor shall not commence paving operations until such a time as the emulsion has 'broke'. The Contractor shall prevent any unnecessary passage of traffic upon the tack coat until a lift of asphalt pavement has been placed.

3.07 ASPHALT CONCRETE DELIVERY

Asphalt Concrete Pavement shall be transported from the asphalt mixing plant to the Site in such a manner as to prevent segregation, contamination or loss of Asphalt Concrete mix. Trucks shall be compatible with the size and capacity of the spreading equipment. The truck boxes shall be tight, clean, with smooth metal bottoms complete with an insulated waterproof or other approved cover of sufficient size to protect the Asphalt Concrete mix from precipitation and excessive heat loss during transportation. The cover shall extend a minimum of 300 millimetres over the sides and be attached to tie downs unless the truck is furnished with a mechanical or automated covering system. The cover shall be used when directed by the Engineer. The inside surface of all vehicles used for hauling

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Asphalt Concrete Pavement may be lightly lubricated with a thin fuel oil, paraffin oil, lime water or soap solution just prior to loading. Excess truck box lubricants shall not contaminate the Asphalt Concrete mix and shall be disposed of in an environmentally acceptable manner. Under no circumstances shall the Asphalt Concrete mix be allowed to adhere to the truck box.

3.08 PLACING ASPHALT PAVING MIX

The Contractor shall provide notice to the Engineer of his intention to place Asphalt Concrete Pavement a minimum of twenty-four (24) hours in advance of any Asphalt Concrete Pavement placement. No Asphalt Concrete Pavement shall be placed until the Engineer has approved the condition of the compacted base materials, milled roadway surface; or previous layer (lift) of Asphalt Concrete Pavement; surface preparation; the installation of water valve casing, manholes, curb and gutter, catch basin lids; the application of prime coat or tack coat; the methods of conveying, placing and compacting the Asphalt Concrete Pavement and the sequence of placement. Asphalt Concrete Pavement placed without the Engineer's prior approval will be rejected and shall be promptly removed from the Site.

Where the specified pavement thickness exceeds 60 millimetres, two (2) or more layers (lifts) of Asphalt Concrete Pavement shall be placed. The top or wearing layer shall be a minimum of 50 millimetres thick. The thickness of each layer shall be within a tolerance of 5 millimetres of the specified pavement thickness. If automatic grade controls are used, the thickness requirement will not apply to the first layer placed. The thickness of a levelling course shall be within a tolerance of 15 millimetres of the required grade.

Unless directed otherwise by the Engineer, the top layer of asphalt concrete for shoulders, tapers, transitions, road connections, private drives, curve widening, change control lanes, turnouts, left turn pockets, and other such areas, shall not be placed before the top layer of asphalt concrete for the adjoining through lane has been placed and compacted. At locations where the number of lanes is changed, the top layer for the through lanes shall be paved first. The Contractor shall not proceed to place Asphalt Concrete Pavement on a previously paved layer (lift) until such a time as the previously layer has been thoroughly compacted and has cooled to the ambient temperature.

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Asphalt Concrete shall be delivered to the Site and placed at a temperature optimum for proper compaction, taking into consideration the weather conditions, the temperature of the surface on which the mixture is to be placed, and the thickness of the Asphalt Concrete Pavement layer (lift). In no case shall the Asphalt Concrete mix be placed at a temperature of less than 125 degrees Celsius nor greater than 155 degrees Celsius.

The Asphalt Concrete mix shall be spread by means of a self-propelled mechanical paver complete with a screed and augers. The paver shall be equipped with both automatic and manual controls capable of adjusting the screed to produce the required line, grade, profile, cross-section and longitudinal joint matching. The paver shall produce a uniformly textured surface free from tearing, shoving, gouging, segregation, or other surface irregularities. To adjust grade and profile and confine the edges of the mix to true lines, pavers shall employ mechanical devices such as an edge runner, a reference shoe, a floating beam, skid or travelling string line. A floating beam shall be supported by wheels or skis in a floating tandem arrangement.

The paver shall operate independently of the delivery truck being unloaded or shall be capable of propelling the delivery truck being unloaded in a satisfactory manner. The brakes of the delivery truck shall not be depended upon to maintain contact between the delivery truck and the paver. The speed of the paver shall be maintained at a uniform rate that is in balance with the Asphalt Mix Plant production, but in no case shall the paver exceed a speed of 15 metres per minute.

The Engineer reserves the right to, at any time, order the Contractor to terminate the placing of Asphalt Concrete Pavement if, in the Engineers opinion, the paver is unable to operate in a continuous and uninterrupted manner or the paver is unable to produce a consistent finished surface as required in this Section.

At locations inaccessible to the paver the Asphalt Concrete Pavement shall be placed by any means practicable to obtain the specified results stated in this Section.

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3.09 JOINTS

The Contractor shall construct joints in the Asphalt Concrete Pavement as described in this Section, as shown on the Drawings, described in Section 01001 Supplemental Conditions or as directed by the Engineer

The location of joints shall be as set out on the Site by the Engineer and shall conform to the following requirements:

- A longitudinal joint in the top layer shall correspond with the edge of a traffic lane.
- No longitudinal joint shall be located in the wheel path area of a traffic lane.
- A longitudinal joint shall be offset not less than 150 millimetres alternately each side of the edge of a traffic lane
- A longitudinal joint shall not be located within 150 millimetres of an existing longitudinal joint in an underlying pavement structure.
- A transverse joint shall not be located within 10.0 metres of any other transverse joint in the same pavement layer nor within 2.0 metres of an existing transverse joint in an underlying pavement layer nor within 2.0 metres of an adjacent transverse joint in the same layer.

Joints shall be of a vertical butt type and thoroughly compacted, tightly bonded, sealed and finished to provide a continuous smooth profile across the joint that when checked with a 3 metre straight edge placed across the joint the distance between the straight edge and the surface of the pavement is less than or equal to 5 millimetres at any point. Longitudinal joints shall be made true to line and parallel to the pavement edge wherever practicable. On curved or tapered sections, the joint shall be shaped so as to be as smooth as possible. Jagged, stepped or wandering edges shall be reshaped to a smooth line. Asphalt Concrete Pavement shall not be placed against an existing asphalt surface until the joint preparation has been completed as described in this Section and is approved by the Engineer.

Joints which do not conform to the line and grade or have a rounded top corner shall be cut back a minimum width of 150 millimetres to a location such that the pavement immediately before the joint, when checked with a 3 metre straight edge, exhibits no tapering or rounding down. Joints against an

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existing pavement shall be prepared by saw cutting, cold planning other methods approved by the Engineer, such that the face of the existing pavement is vertical with a square top corner.

Asphalt Concrete mix which overlaps a previously placed pavement or existing structure shall be removed prior to the commencement of rolling.

3.10 COMPACTION

The Contractor's compaction equipment shall be of a type designed and manufactured for asphalt finish rolling and supplied in sufficient quantities to produce a uniform, tight knit pavement surface having a minimum of 97 percent (97%) of Marshall Density and shall include a minimum of one dual steel wheeled vibratory roller or combination roller, having a vibratory steel wheel roller and a minimum of four pneumatic tire rollers, and one pneumatic rubber tired roller.

Steel wheeled rollers shall be self-propelled and have a minimum total mass of 7.25 tonnes. Vibratory rollers shall provide for the adjustment of both amplitude and frequency of vibration, and shall be equipped with an automatic device that prevents the drum from vibrating unless the roller is moving. Pneumatic rubber tire rollers shall be self-propelled and have a minimum compacting width of 1.5 metres and a minimum gross wheel load of 13kN per wheel. The tire arrangement shall be such that compaction will be obtained across the full width of the roller. Each roller shall be equipped with an attachment which continuously moistens the contact surfaces of the wheels to prevent adhesion of the Asphalt Concrete to the rollers.

The Contractor shall follow the approved rolling pattern. Changes to the rolling pattern are subject to the review and approval of the Engineer. Compaction of the Asphalt Concrete Pavement shall consist of three (3) separate rolling operations as follows:

Breakdown Rolling shall be performed with steel-wheeled roller(s) and commence as soon as possible after the Asphalt Concrete mix has been placed without causing undue checking and displacement of the mix. Rolling shall start longitudinally at the outside edge(s) and proceed toward the center of the pavement overlapping on successive passes a minimum of 150

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millimetres. Joints shall be rolled prior the remainder of the layer. Wherever practicable, the joint shall be rolled with the roller travelling parallel to the joint and with a minimum of seventy-five percent of the width of the roller supported by the adjacent (cold) asphalt surface. After the initial pass of the roller the joint shall be checked and corrected, as required, prior to any further rolling. Curves shall be rolled from the inside radius to the outside radius of the mat. Breakdown rolling shall consist of a minimum of four (4) roller passes over the entire surface area of the Asphalt Concrete Pavement.

Intermediate Rolling shall be performed with pneumatic-tired roller(s). Intermediate rolling shall follow the breakdown rolling while the Asphalt Concrete mix is plastic and at a temperature that will produce the maximum in place density.

Final Rolling shall be performed with a tandem steel-wheeled roller. The roller shall continuously roll the warm pavement until all roller marks are eliminated and no further compaction can be achieved. If vibratory rollers are used for final rolling, the last rolling pass shall be in the static mode and cover the entire surface area of the Asphalt Concrete Pavement.

The total surface area of each layer of Asphalt Concrete Pavement shall receive equal compaction. Rollers shall be operated continuously and shall be capable of reversing direction without backlash. The speed of the rollers shall not exceed 5 kilometres per hour and shall at all times be slow enough to avoid displacement of the Asphalt Concrete mix and any displacement occurring shall at once be corrected by the use of rakes and fresh Asphalt Concrete mix. Rolling with steel-wheeled rollers shall be discontinued if excessive crushing or pulverizing of the aggregate or displacement of the pavement surface is observed.

Roller wheels shall be kept properly moistened with water, limewater, a water solution containing small quantities of a detergent or other approved parting agent. Excess water or parting agent on the pavement surface shall be promptly removed by the Contractor. Rollers shall not stand idle on the

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warm unconsolidated pavement or on any rolled pavement which has a surface temperature exceeding 60 degrees Celsius. Rollers shall be parked off the newly constructed pavement when not in use or when being serviced. Rollers shall be moved to and from the pavement in a manner that does not damage the pavement edge. The tracks or wheels of spreading equipment shall not be operated on the pavement surface until final compaction has been completed and the pavement has cooled to atmospheric temperature.

At locations where the Asphalt Concrete Pavement is placed in areas inaccessible to the rolling equipment, the asphalt concrete shall be thoroughly compacted to the required lines, grades and cross sections by means of a pneumatic tamper or by other methods that will produce the same degree of compaction as a pneumatic tamper.

When asphalt pavement placement operations are suspended the forward end of the fresh pavement shall be thoroughly compacted and the surface tapered to a slope of 10 horizontal to 1 vertical. The taper may be placed on tar paper and shall be removed, and when paving is resumed. The transverse joint shall be straight and have vertical face when the taper is removed

The Engineer will make in-place density analysis, to ASTM Standard D 2950 to determine the acceptability of the compacted Asphalt Concrete Pavement, as placed and compacted by the Contractor. In addition to compaction/density tests, pavement specimens may be taken to verify compaction tests.

The measured in place density of the completed Asphalt Concrete Pavement shall be an average of ninety seven percent (97%) of the 50 blow Marshall Density of the Asphalt Concrete mix, with no individual test being less than ninety-five percent (95%).

When compaction tests indicate the density of the Asphalt Concrete Pavement is less than ninety seven percent (97%) of the 50 blow Marshall Density the Contractor shall adjust his production and/or compaction procedures to raise the density to the required level.

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3:11 FINISHING
TOLERANCES

The surface of the Asphalt Concrete Pavement shall have a uniform smooth appearance, free of segregated, open and torn sections, cracking, ruts, humps, depressions, irregularities, roller/tire marks, waves or uneven sections, ruts, depressions, streaking, bleeding, ravelling or other irregularities.

The Asphalt Concrete Pavement surface will be checked by the Engineer using a 3.0 metre straight edge. The deviation of the finished surface between the testing edge of the straight edge and the surface of the finished pavement measured between any two points of the surface in the same plane or placed on the curb parallel to the center line of the roadway shall not exceed 5 millimetres. Longitudinal joints shall not deviate from alignment by more than 75 millimetres. The transverse slope of the surface of each layer shall not vary from the specified slope by more than 0.4 percent.

The finished Asphalt Concrete Pavement surface adjacent to concrete gutters, catch basin lids, pavement headers, or other fixed structures shall be even with or slightly above (not to exceed 5 millimetres) than the surface of the structure.

The finished Asphalt Concrete Pavement surface adjacent to manhole lids, valve casings and other street hardware contained within the pavement structure shall be even with or slightly below (not to exceed 10 millimetres) the elevation of the topmost portion of the hardware. The pavement surface shall be given a smooth, gentle taper down to the surface of the contained hardware.

3:12 CORRECTION OF
DEFECTS

The Contractor shall, at his sole expense, promptly correct or replace Asphalt Concrete Pavement which has failed to attain the required density and Mix Design Requirements; is not within the tolerances stated in this Section; displays surface defects or a finish which is not acceptable to the Engineer. Any costs for additional quality assurance testing or inspection of corrected Work shall be paid for by the Contractor at no additional expense to the City.

The Engineer will mark out the areas for repair, replacement or overlay. The removal and replacement of a layer or construction of a bituminous overlay shall be for the entire pavement width. Repairs shall be regular in shape. A saw

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cut/milling machine shall be used to produce a vertical face along the boundary of the defective area or joint. Material within the sawn boundaries shall be removed to the full depth of the lift in such a manner that the vertical faces are not damaged. Tack coat shall be applied and vertical faces shall be painted. New Asphalt Concrete Pavement shall be placed and compacted as stated in this Section.

3.13 CLEAN-UP

The Contractor shall maintain the Site as described in Section 01710 Cleanup. Prior to opening the roadway to any vehicular traffic the Contractor shall remove the masking material from all street appurtenances, manholes covers, valve covers, catch basin lids, survey monuments and other street hardware covered as stated in Part 3.04 of this Section. Any street appurtenance, manhole cover, manhole, valve cover, catch basin lid, catch basin, survey monument, curb face, concrete gutter section, shoulder, or boulevard which contains bonded or loose prime/tack coat and/or asphalt concrete shall have the material removed and the surface cleaned to the satisfaction of the Engineer.

**3.14 OPENING TO
TRAFFIC**

Traffic or construction equipment shall not travel on the new Asphalt Concrete Pavement until quality assurance testing has been completed, the pavement has cooled to atmospheric temperature, and the Engineer has directed the Contractor to remove all barricades and open the roadway to traffic.

The opening of any paved roadway to vehicular traffic shall not constitute acceptance of the Work by the City and the Contractor shall remain solely responsible for the care and the maintenance of the Work until final completion of the Work has been issued by the City.

**3.15 COMPLETION OF
THE WORK**

Substantial Completion of the Work will be issued when all roadways have been paved, opened to traffic, and the Work has been inspected and approved by the Engineer.

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Final Completion of the Work will be issued when the following requirements have been completed as certified by the Engineer;

- All products supplied and incorporated into the Work are as specified in this Section; and
- Asphalt Concrete Pavement has been installed to the elevation, alignment, cross section and thickness as described in this Section, described in Section 01001 Supplemental Conditions, shown on the Drawings or as set out on the Site by the Engineer; and.
- All defects have been remedied to the satisfaction of the Engineer; and
- All sampling locations have been properly reinstated.
- All clean up has been completed as stated in this Section

END OF SECTION