



**CITY OF
SWIFT CURRENT**
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**SECTION 04015
ASPHALT CONCRETE**

DECEMBER 2015

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CONSTRUCTION SPECIFICATIONS

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1 GENERAL

1.1 DESCRIPTION

- 1.1.1 This section specifies requirements for the hot mix asphalt concrete paving.
- 1.1.2 The work includes the supply of aggregates and asphalt cement, and reclaimed asphalt pavement and mineral filler where applicable; asphalt plant mixing, transporting, placement finishing, and compaction to the requirements of this specification and shall conform to grade, thickness, and cross section shown on plans, or as stated elsewhere in the Contract Documents.
- 1.1.3 The work includes all materials certification, quality control, verification, and mix design testing, analysis and reporting to be completed as required in this specification.

1.2 RELATED SECTIONS

- 02010 Site Preparation and Grading
- 02015 Sub – Grade Preparation
- 03001 Aggregates General
- 03005 Granular Base Course
- 03010 Granular Sub – Base
- 03060 Geotextile and Rolled Erosion Control Devices
- 03070 Rip – Rap
- 04000 Asphalt Pavement Crack Routing and Sealing
- 04001 Asphalt Pavement Crack Sealing
- 04025 Prime, Tack and Fog Coats
- 04070 Asphalt Concrete Pavement Milling
- 06010 Concrete Side walk, Curb and Gutter Construction
- 07000 Pavement Markings
- 10000 Flexible Guide Posts and Delineators
- 12000 Regulatory Roadway Signs

1.3 INSPECTION AND TESTING

- 1.3.1 Inspection and testing shall be in accordance with the sections throughout this specification.

1.4 STANDARD MIX TYPES

- 1.4.1 Mix types designations and typical applications are as follows (Note: Mix Types to be selected on a project specific basis, as required by the nature of the project and quantities):

TYPE OF ROAD	Mix Type
Local/Residential	Type 1 or Type 2
Commercial/Industrial/Arterial/Collector	Type 2

1.5 DEFINITIONS

Asphalt Concrete: Generally refers to the final HMA product in place.

End Product Specification (EPS): A specification whereby the methods of construction are not defined. Under EPS the City or Project Manager 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.

Engineer: As referenced to in this specification, applies to the City of Swift Current or the designated project representative. (ie. Consultant/Project Manager or Design Engineer)

Hot Mix Asphalt (HMA): Generally refers to the mixture of aggregates and asphalt cement, and other additives where applicable.

Job Mix Formula: The job mix formula (JMF) establishes the proportioning of aggregate, asphalt cement and reclaimed asphalt pavement (RAP) and/or liquid anti-strip where applicable, to be used for the production of hot mix asphalt (HMA).

Lot or Block: A lot is a portion of the work being considered for acceptance. At the Project Managers discretion, any portion of the Work may be deemed a Lot. For City work, a typical street Block will be considered a Lot or Block.

Post-Production Quality Control: Materials and construction quality control conducted in accordance with this specification during and after plant mixing.

Pre-Production Quality Control: Materials and process quality control conducted in accordance with this specification prior to plant mixing.

Project Category: For the purposes of this specification, projects are to be identified in the Contract Special Provisions as Category A or Category B. Generally, Category A projects have asphalt concrete quantities greater than 2000 tonne of any one mix type and Category B projects have quantities of any one mix type less than 2000 tonne. In all cases the Special Provisions govern with respect to the applicable Project Category.

Quality Control: Materials and process monitoring and testing conducted by, or on behalf of the Contractor.

Quality Assurance: Acceptance testing and monitoring conducted on behalf of the Owner.

2 PRODUCTS

2.1 APPROVAL OF MATERIALS

- 2.1.1 No material shall be used until it has been checked or tested for compliance with specifications and been approved by the Project Manager. Representative samples of all materials proposed for use under these specifications shall be submitted to the Project Manager by the Contractor, or at the Contractor's expense, for testing and for the preparation of trial mixes to determine the job mix formula. All tests necessary to determine conformance with the requirements specified herein shall be performed under the supervision of the Project Manager.
- 2.1.2 Asphalt materials shall be approved by the Project Manager prior to use in the work. The Project Manager may accept a certified analysis by the refinery laboratory when a copy of the certified analysis accompanies each shipment of asphalt to the project. The Project Manager reserves the right to make check tests of the asphalt received on the job and if the system of certified analysis proves to be unsatisfactory to the Project Manager, he/she may discontinue this arrangement.

2.2 MATERIALS

- 2.2.1 Binder: Asphalt Cement and Cut-back Asphalt shall conform to the manufacturer's specifications and related ASTM Specifications for the material and shall be approved by the Project Manager prior to construction. 150/200 A penetration/viscosity graded asphalt cement or approved equivalent will be accepted.
- 2.2.2 Aggregates:
- Coarse aggregate is aggregate retained on the 5.0mm sieve; fine aggregate is aggregate passing the 5.0 mm sieve.
 - Aggregate material shall be crushed stone or gravel consisting of hard, durable, angular particles, free from clay lumps, cementation, organic material, frozen material, and any other deleterious materials.
 - Gradations to be within limits specified, when tested to ASTM C-136 and ASTM C-117. (*Table 2*)
 - Aggregate shall be processed to meet the following requirements:
 - Natural fines shall be pre-screened and stockpiled with not more than 20% of material retained on the 5.0 mm sieve and 100% passing the 10.0 mm sieve.
 - Aggregate delivered to the crushing plant shall be pre-screened and shall contain not more than 5% passing the 5.0 mm sieve.
 - If separating crushed aggregates, stockpiled the fraction or manufactured sand such that not more than 15% of material retained on the 5.0 mm sieve.
 - Physical properties of aggregates to meet the requirements in the following table.

Table 1 - Aggregate Physical Property Requirements

REQUIREMENT	ASTM TEST STANDARD	ALL MIX TYPES
Los Angeles Abrasion, Grading B (% Loss)	C131	32 max.
Magnesium Sulphate Soundness (% Loss) Coarse Aggregate: Fine Aggregate:	C88	12 max. 12 max.
Lightweight Particles (%)	C123	1.5 max.

- Blend Sand:
 - To consist of natural or manufactured sand passing the 5.0 mm sieve.
 - Stockpile volumes shall be maintained to ensure a minimum of 5000 tonne of plant mix production, or the entire project quantity.
 - Blend sand shall be dried if necessary to provide a uniform feed.
- Blended Aggregate Requirements:
 - Aggregate Gradation Requirements, including RAP, to meet the requirements of the following table.

Table 2 - Blended Aggregate Gradation Requirements

SIEVE SIZE (mm)	PERCENT PASSING SIEVE SIZE BY WEIGHT	
	Type 1	Type 2
16.00	100	100
12.50	100	90-100
10.00	90-100	79-92
5.00	55-85	50-72
2.00	30-65	32-51
0.800	20-45	20-35
0.400	10-30	15-27
0.160	5-15	7-15
0.080	2-9	4-9

- Coarse Aggregate Fracture: Of course fraction, 70% minimum of particles shall be retained on 5.0 mm sieve size by mass.

- Flat and Elongated Particles: Of coarse fraction (retained on 5.0 mm sieve size) 10% by mass shall be of flat and elongated particles greater than a 5:1 ratio.
- Manufactured Sand: Of total fine fraction, 50% minimum of manufactured sand shall pass 5.0 mm sieve size by mass),
- For mixes incorporating RAP, 50% of the RAP sand portion shall be considered manufactured sand. The sand equivalent value (ASTM D2419, mechanical method) determined for the fine aggregate portion shall be 45% minimum of total aggregate, the maximum RAP portion by mass shall be 15%.
- If aggregate has insufficient material passing the 80 μ m sieve, the Contractor shall supply mineral filler, approved by the Engineer, in the proportions required.
- The aggregate must exhibit an affinity for asphalt cement, and meet the Saskatchewan method for Aggregate Stripping Potential, and ASTM D4867. If the material has greater than 25% stripping potential, then a suitable anti-strip agent shall be utilized upon approval by the Engineer
- If an anti-strip agent is required it shall be at the Contractor's expense.
- For mixes which may occasionally require Mineral Filler, the mineral filler shall consist of finely ground particles of limestone, hydrated lime, Portland cement or other non-plastic mineral matter approved by the Engineer, in such quantities as will be required to meet the gradation of aggregate as specified above. It shall be thoroughly dry and free from lumps.
- Mineral dust consists of all mineral matter which will pass the No. 200 sieve; and hence includes such fine particles as may be in the coarse and fine aggregates as well as the mineral dust portion of the mineral filler. It shall be free from organic matter and clay particles.
- Delivery and Storage:
 - Aggregates: Stockpile minimum of 50% of total amount of aggregate required before commencing trial mix designs.
 - Reclaimed Asphalt Pavement (RAP): Stockpile minimum of 100% of total amount of RAP required before commencing trial mix designs.

2.3 MIX DESIGN

- 2.3.1 An asphalt mix design must be prepared and submitted to the Project Manager for review and approval at least two weeks prior to the Work. The Contractor shall retain qualified engineering and testing services licensed to practice in the Province of Saskatchewan. The cost of this work shall be borne by the Contractor.
- 2.3.2 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.

2.3.3 Design of Mix:

- 50 blows on each face of test specimens.
- When a 75 blow Marshall Design is required, approval and specification will be provided by the Engineer.
- The mix type will be specified in the Special Provisions of the contract, or as specified by the Project Manager.

2.3.4 The mix design submission shall include at least the following data:

- Aggregate specific gravity and asphalt absorption.
- Sand equivalent, coarse aggregate fracture, flat and elongated particles, and percent manufactured sand values.
- Asphalt cement supplier/refinery, specific gravity and mixing and compaction temperatures, based on temperature – viscosity properties of asphalt cement.
- Job mix formula including aggregate gradation and blending proportions, and design asphalt content.
- Maximum relative density at each trial asphalt content.
- Where reclaimed asphalt pavement (RAP) is to be incorporated into the mix, supply RAP gradation, RAP asphalt cement content and design recycle percentage.
- The maximum theoretical density of the Asphalt Mix at the design asphalt content and at each asphalt content considered above and below the design asphalt content.
- The temperature-viscosity chart for the asphalt binder being used and the recommended mixing and compaction temperature.
- Data to satisfy the requirements of the following:

Table 3 -Mixture Physical Property Requirements

PROPERTY	REQUIREMENTS	
	MIX TYPE	
	Type 1	Type 2
Marshall Stability (N)	7,000	10,000
Marshall Flow (mm)	2-5	2-5
Air Voids (%)	3.0 – 5.0	3.0 – 5.0
Voids in Mineral Aggregate (%)	13.5 - 15 .0	14 - 16
Voids Filled With Asphalt (%)	65 - 80	65 - 80
Film Thickness (µm)	7.5min.	7.5 min.
Retained Stability (%)	70 min.	70 min.

- 2.3.5 The retained stability test is to ensure that the asphaltic mix has reasonably good durability. One of the Marshall specimens is soaked in a water bath at 60°C for twenty-four (24) hours. A Marshall stability performed on this specimen shall have retained a minimum of 70% of the initial stability.
- 2.3.6 Representative samples of all aggregates proposed for use shall be submitted, when requested, to the Project Manager sufficiently in advance of the commencement of operations or during operations to permit the Project Manager to carrying out Quality Assurance tests.
- 2.3.7 No asphalt concrete shall be supplied or placed until the Project Manager has received copies of the mix design and has given written approval of its use.

2.4 JOB MIX FORMULA

- 2.4.1 Prior to full production and paving operations for the project, the contractor shall provide the Project Manager with an Asphalt Mix Sample from the production plant for testing to verify the Asphalt Mix Design.
- 2.4.2 The Contractor shall not proceed with paving operations until the Job Mix formula is approved.
- 2.4.3 At the Project Manager’s discretion the Asphalt Mix Sample may be obtained directly from other projects that the contractor is performing work on prior to the project that is being tested.
- 2.4.4 If the Asphalt Mix Sample meets the tolerances shown in *Table 4* when compared to the Asphalt Mix Design the Project Manager will approve the Asphalt Mix Design as the original Job Mix Formula, and the Contractor may proceed with paving operations.

Table 4 – Maximum Permissible Variation of Asphalt Mix Sample from Mix Design

SIEVE SIZE OR PROPERTY	MAXIMUM PERMISSIBLE VARIATION
5.0 mm and larger	± 5% and within the tolerance of Table 2
2.0 mm	± 4% and within the tolerance of Table 2
800 µm and 400 µm	± 3% and within the tolerance of Table 2
160 µm	± 2% and within the tolerance of Table 2
80 µm	± 1.5% and within the tolerance of Table 2
Air Voids	± 0.5% and within the tolerance of Table 3
Asphalt Content %	± 0.3% of approved mix design
Density (kg/m ³)	± 20 of approved mix design

- 2.4.5 If the asphalt sample mix does not meet the tolerances shown in *Table 4*, an additional sample will be required. Not more than three Asphalt Mix Samples will be permitted.
- 2.4.6 A new Asphalt Mix Design will be required if the Asphalt Mix Samples do not meet the tolerances of *Table 4*.

2.5 VARIANCE FROM APPROVED JOB MIX FORMULA

- 2.5.1 Once established, no alterations to the Job Mix Formula will be permitted unless a new Job Mix Formula is submitted by the Contractor and approved by the Project Manager.
- 2.5.2 Requests for Job Mix Formula revisions must be submitted in writing by the Contractor.
- 2.5.3 If the proposed revisions to the Job Mix Formula exceed the tolerances of *Table 3*, or exceed any of the following limits relative to the Asphalt Mix Design, a new mix design will be required.
 - ± 5% passing the 5.0 mm sieve.
 - ± 1.0% passing the 80 um sieve.
 - ± 0.3% asphalt content

2.6 PRODUCTION TOLERANCES

- 2.6.1 Tolerances, acceptance/rejection, and payment adjustments for ongoing production of the Asphalt Concrete shall be in accordance with the Section 6 and 7 of this Specification.

3 EXECUTION

3.1 CONTINUITY OF PRODUCTION

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

3.2 MIX PRODUCTION

- 3.2.1 Preparation of Mineral Aggregate: The mineral aggregates shall be at as low a temperature as is consistent with proper mixing and laying and in no case to exceed 175°C. The mineral aggregate shall be natural sand, or a combination of natural sand and gravel and/or crushed stone screenings. All aggregate particles shall be clean and durable and shall not contain clay balls or other aggregations of fine material.
- 3.2.2 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.
- 3.2.3 Incorporate RAP such that it does not come in direct contact with the burner flame.
- 3.2.4 Plant emissions shall not exceed the limits set by Saskatchewan Ministry of Environment.
- 3.2.5 Mix temperature at point of plant discharge shall not vary from the mixing temperature identified in the mix design by more than ±5°C.
- 3.2.6 Maximum permissible moisture, at point of plant discharge, is 0.2% by mass of mix.

3.3 PREPARATION FOR PAVING

- 3.3.1 The Contractor shall provide the Project Manager a minimum of six hours' notice of the intention to commence paving over any previously approved primed or tacked surface.

- 3.3.2 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.
- 3.3.3 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.

3.4 HOT MIX ASPHALT PLACING – AMBIENT AIR TEMPERATURE

- 3.4.1 No hot mix asphalt shall be dispatched to the field unless the ambient air temperature, as issued by Environment Canada, is rising and meets the following minimum requirements:
- Thickness less than 50mm: + 7°C
 - Thickness greater than 50mm: + 2°C
- 3.4.2 No surface lift asphalt shall be placed regardless of ambient air temperature until the road surface is 5°C or higher, and the Project Manager has issued approval to proceed.

3.5 HOURS OF OPERATION

- 3.5.1 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 Project Managers approval.

3.6 TRANSPORTATION OF HOT MIX ASPHALT

- 3.6.1 Trucks shall be equipped with waterproof tarpaulins of sufficient weights and size to cover the entire open area of the truck box. Regardless of weather conditions, tarpaulins shall be used.
- 3.6.2 Vehicles used for the transportation of hot mix asphalt 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.
- 3.6.3 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.
- 3.6.4 The speed and weight of hauling trucks shall be regulated so that, in the opinion of the Project Manager, no damage will occur to any portion of the work underway. Any damage to the tack coat, prime coat or the existing surface caused by the Contractor's equipment shall be repaired by the Contractor at their own expense.
- 3.6.5 Any load of hot mix with a temperature less than 120°C, will be considered reject, and not incorporated into the work.

3.7 HOT MIX ASPHALT SPREADERS

- 3.7.1 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 Project Manager.
- 3.7.2 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 produce a finished surface of uniform texture.
- 3.7.3 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 moveable 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 of manual screed control may be used subject to approval by the Project Manager.

3.8 HAND TOOLS

- 3.8.1 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.
- 3.8.2 Tamping irons may be used to consolidate the material along structures inaccessible to the rollers. Mechanical compaction equipment, satisfactory to the Project Manager, may be used instead of tamping irons.
- 3.8.3 For purposes of checking the finished surface, Contractors must provide and carry on each paving machine a 3 metre straight edge and slope measuring level.

3.9 PRE-LEVELLING FOR ASPHALT CONCRETE

- 3.9.1 Pre-levelling of uneven surfaces over which thin 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 Project Manager.
- 3.9.2 The asphalt concrete used as levelling course shall be compacted thoroughly with pneumatic-tired rollers.

3.10 PAVING OPERATIONS

- 3.10.1 The asphalt concrete shall be placed to the design thickness as shown on the contract drawings or directed by the Project Manager. The maximum thickness of any single constructed course shall not exceed 75mm or that specified by the Project Manager. 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 Project Manager.
- 3.10.2 A constant supply of hot asphalt shall be maintained to minimize delay in work. Otherwise, if the temperature of the uncompacted mat cools below 110°C, the contractor shall cut back the mat to the graded and compacted area.

- 3.10.3 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 co-ordinated with the production rate of the asphalt plant without intermittent operation of the spreader.
- 3.10.4 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 Project Manager, at the Contractor's expense.

3.11 AREAS INACCESSIBLE TO THE PAVING MACHINE

- 3.11.1 Areas that are inaccessible to the paving machine may be paved by other methods, as approved by the Project Manager.
- 3.11.2 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 of uniform density and correct depth. Material must be handled so as to avoid segregation.
- 3.11.3 Areas inaccessible to the roller shall be compacted by tamping with mechanical or hand tampers.

3.12 COMPACTION

- 3.12.1 Before rolling is started, the surface shall be visually inspected. Inequalities in depth, fat spots, or sandy accumulations, and irregularities in alignment or grade along the outside edge shall be corrected. The Contractor shall provide competent workmen to correct irregularities as outlined. The paver shall operate in no lane for more than one day before the adjacent lane is placed.
- 3.12.2 The Contractor shall supply sufficient compaction equipment to:
- Provide a compaction rate that will equal or exceed the placing rate of the spreader.
 - Ensure the specified compaction is attained before the temperature of the mat falls below 80°C.
- 3.12.3 The rollers shall be kept in continuous motion while on the hot mat in such a manner that all parts of the pavement receive equal compression. Rollers shall be operated by competent and experienced personnel.
- 3.12.4 Vibratory rollers shall not be used on soil cement base.
- 3.12.5 The motion of the rollers shall be slow enough at all times to avoid displacement of the hot mixture. Any displacement occurring as a result of reversing the direction of the roller, or

from any other cause shall be corrected immediately by the use of lutes and fresh mixture when required.

- 3.12.6 Where new pavement structure abuts the existing pavement surface that is 100 mm thick or greater, the Contractor shall cold mill plane 50 mm of existing surface for a distance of a minimum two (2) metres to allow the top lift to be placed across the construction joint. The end of the milled joint shall produce a straight line across the paved surface with a vertical face to pave to. For existing pavement surfaces less than 100 mm thick, sawcutting is acceptable. The finished surface across the joint shall be smooth, such that when a three (3) metre straight edge is placed across the joint, no gaps appear between the straight edge and the pavement edge.
- 3.12.7 The breakdown rolling shall take place as closely behind the laying machine as the temperature and condition of the mat will allow. If used, pneumatic tire rolling will be made with the tire pressure at a level such that only light rutting is evident. Pneumatic rolling shall continue until two complete coverages have been made by the roller with the tire pressure at 850 kPa for collector, industrial and arterial roads and 600 kPa for residential roads. Pneumatic rolling is to be completed before the temperature of the placed mix falls below 95°C.
- 3.12.8 Steel tire rolling - For final rolling, a steel tire roller shall be used. After final rolling of the surface course, the asphalt shall meet the gutter at an elevation of 10 mm above and along the entire lip of the gutter except on the high side of superelevation curve where it shall be flush with the lip of the gutter. Final rolling shall be carried on until all roller marks are eliminated and no further compaction is possible.

3.13 LONGITUDINAL AND TRANSVERSE JOINTS

- 3.13.1 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 on to the mat. 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 m.
- 3.13.2 Longitudinal joints shall not be located within travel lanes, unless approved by the Project Manager.
- 3.13.3 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.
- 3.13.4 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.
- 3.13.5 At the end of each days' 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.

3.14 UTILITY APPURTANCES

- 3.14.1 Where water valve boxes or manholes are rebuilt, constructed, raised or lowered and/or adjusted in conjunction with surface construction or renewal, adjust the appurtenances such that the top surface of the appurtenance is flush with the finished grade of the pavement, sidewalk or boulevard.
- 3.14.2 Where it is necessary to raise manhole frames it shall be done with approved precast rings or blocks meeting the requirements of the current issue of ASTM C478. Joints between slab top blocks, and frame shall be mortared, and the joints finished flush and smooth. Joints between slab top, precast rings, and frame shall be made watertight utilizing preformed bituminous gaskets or other approved sealant. Under no circumstances shall the depth from the rim of the manhole to the first ladder rung be more than 800 mm.
- 3.14.3 A tack coat shall be provided to the vertical surface of utility appurtenances prior to paving.
- 3.14.4 After placing rolling and compacting the asphalt, depressions or bumps measured from centerline to the top of the appurtenances under a straight edge, (a minimum of 3 m long), placed parallel to the road, are not to exceed the following values:
- 20mm depression
 - 5mm bump
- 3.14.5 Any depressions or bumps exceeding these tolerances shall be repaired at the Contractor's expense.
- 3.14.6 Any uplifting or settlement of water valve boxes and/or manhole frames shall be corrected to conform to this specification.
- 3.14.7 The paved surface adjacent to utility appurtenances shall be free of segregation with a tight uniform surface.
- 3.14.8 The Contractor shall replace any appurtenances damaged by his work or forces. Any existing damaged appurtenances found within the proposed work zone shall be replaced by the Contractor as approved by the City at an agreed lump sum price.
- 3.14.9 The Contractor shall carry out his work in such a manner so as to prevent any foreign material from entering the storm or sanitary systems. In the event that the Contractor is unable to clean these appurtenances, the Contractor shall immediately notify the Project Manager and such shall be cleaned at the expense of the Contractor.

3.15 OPENING TO TRAFFIC

- 3.15.1 Prior to any application of traffic, paving mats shall be sufficiently cool to resist any deformation or surface scuffing.
- 3.15.2 The Project Manager may, at their discretion, require means of cooling (e.g. application of water) completed pavements prior to opening to traffic.

4 QUALITY CONTROL AND QUALITY ASSURANCE

4.1 GENERAL

- 4.1.1 The Project Manager shall have access to all production processes and materials used for the work to monitor material quality as often as deemed necessary. Such inspection and testing shall not in any way relieve the Contractor of the responsibility for meeting the requirements of this specification.
- 4.1.2 At least three (3) weeks prior to commencing work, inform the Project Manager of the proposed source of aggregates and provide access for sampling.
- 4.1.3 Provide samples of asphalt cement in accordance with Section 2.

4.2 QUALITY CONTROL

- 4.2.1 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 Project Manager will not be considered as quality control tests.
- 4.2.2 The Contractor shall be totally responsible for production of materials and construction that meet all specified requirements.
- 4.2.3 All quality control shall be conducted by qualified personnel.
- 4.2.4 Pre-Production testing and sampling and minimum frequencies are described in the following table.

Table 5 - Pre-Production Quality Control Requirements

Quality Control Requirement	Minimum Frequency
Asphalt Cement Certification	Once per Year or for change in supplier
Aggregate Physical Properties	Once every 3 Years, or for change in source
Crushed Coarse Aggregate Gradation Analysis and Fracture Content	One for every 1000 tonne of each class of material processed into stockpile, or one analysis for each material every production day when production rate is less than 1000 tonne
Manufactured Sand Aggregate Gradation	
Natural Fine Aggregate Gradation	
Blend Sand Aggregate Gradation	
Reclaimed Asphalt Pavement (RAP) Asphalt Content and Extracted Aggregate Gradation	One for each 500 tonne delivered to stockpile, or one for each location when delivery rate is less than 500 tonne
Penetration of asphalt cement recovered from RAP by Abson Method	One for each 2000 tonne delivered to stockpile
Trial Mix Design by Marshall Method	One per Year, or as required for a change in asphalt cement supply, aggregate gradation or aggregate source.
Plant Calibration	As required

- 4.2.5 Post-Production testing and sampling and minimum frequencies are described in the following table

Table 6 - Post-Production Quality Control Requirements

Quality Control Requirements	Minimum Frequency
Hot Mix Asphalt Analysis (including Asphalt Content, Aggregate Gradation, Marshall Density and Void Properties)	One for every 500 tonne of each mix type supplied under this specification. See Note 1.
Hot Mix Asphalt Temperature	Minimum frequency not specified.
Cold Feed Aggregate Analysis	Minimum frequency not specified.
Maximum Relative Density of Hot Mix Asphalt	Minimum frequency not specified.
Compaction Monitoring (Core or Nuclear Density)	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 Project Manager.

- 4.2.6 Pre-Production Quality Control test data as specified shall be reported to the Project Manager for approval one week prior to commencing the project, or as requested. No Work shall commence until the Project Manager approves submitted test data.
- 4.2.7 Post-Production Quality Control test data as specified shall be reported to the Project Manager daily as the Work proceeds.

4.3 QUALITY CONTROL COMPLIANCE WITH SPECIFIED TOLERANCES

- 4.3.1 The test data derived by Post-Production Quality Control mix testing, shall be compared to the tolerances set forth in this specification. The Project Manager has the right to suspend mix production when 2 tests running average for any property is outside of the specified tolerance limits.
- 4.3.2 If mix production is suspended due to samples out of tolerance, supply shall not commence again until it is demonstrated that corrective action has been taken.
- 4.3.3 Hot Mix Asphalt Temperature. Plant mix at point of discharge that is not within 5% of mixing temperature specified in mix design shall be subject to rejection at discretion of the Project Manager.
- 4.3.4 Plant mix that does not meet temperature requirements specified at the point of plant discharge shall be subject to rejection at the discretion of the Project Manager.

4.4 ACCEPTANCE SAMPLING AND TESTING (QUALITY ASSURANCE)

- 4.4.1 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.
- 4.4.2 Sampling and acceptance testing is described in the following table.

Table 7 - Acceptance Testing Requirements

Acceptance Testing	Minimum Frequency
Hot Mix Asphalt Analysis (including Binder Content, Aggregate Gradation, Marshall Density, Maximum Relative Density, Void Properties, Marshall Stability and Flow)	For each mix type, one test for each 3500 sq.m. of placement, or three tests per lot, whichever is greater. See Note 1.
Compaction Testing (Core Density) and Thickness Determination	For each mix type, one test for each 2000 sq.m. of placement, or three tests per lot, whichever is greater.
Hot Mix Asphalt Temperature	No minimum frequency.

Note 1: The Project Manager shall have the right to reduce the minimum number of mix samples and number of tests. Should non-compliance be indicated by the sample(s) tested, the Project Manager reserves the option to test the remaining samples.

- 4.4.3 The Project Manager will obtain loose mix samples from the paver or from a location acceptable to the Project Manager.
- 4.4.4 The timing of mix sampling shall be stratified, with each sample representing a similar production quantity.
- 4.4.5 Core locations will be selected using stratified random sampling procedures. The lot will be divided into segments meeting or exceeding the minimum frequency specified and of approximately equal area. In each segment a test site will be located using random numbers to determine the longitudinal and transverse coordinates. The Project Manager may select other core locations based on visual non-conformance.
- 4.4.6 Areas within 3m of transverse joints or 0.3m of a mat edge shall be excluded from compaction acceptance sampling and testing.

5 APPEAL OF ACCEPTANCE TESTING RESULTS

5.1 GENERAL

- 5.1.1 The Contractor may appeal the results of acceptance testing for Compaction Standard or Asphalt Content for any lot subject to rejection or unit price reduction. The notice of appeal shall be submitted in writing to the Project Manager within 48 hours of receipt of the acceptance testing results.
- 5.1.2 Appeals will only be considered if cause can be shown and the requirements specified have been satisfied.
- 5.1.3 Quality Control tests initiated after the Contractor's receipt of the acceptance test results will not be considered, when evaluating cause for appeal.

5.2 ASPHALT CONTENT APPEAL

- 5.2.1 A stratified random sampling plan shall be developed by the Project Manager with the same number of segments as the original number of samples for the subject lot. Sufficient

core sample (150mm diameter) will be acquired from each segment to enable asphalt content determinations.

- 5.2.2 For asphalt content appeal testing, the Contractor will have the option for the testing to be done by the testing laboratory undertaking the project acceptance testing, or an independent testing laboratory selected by the Project Manager.
- 5.2.3 The average of the appeal test results will be used for acceptance and unit price adjustment, and shall be binding on both the Owner and the Contractor.
- 5.2.4 If the average appeal test result verifies that any unit price reduction or rejection applies for that Lot, the costs of the appeal sampling and testing will be borne by the Contractor. If the result show that a penalty or rejection no longer applies, the sampling and appeal costs will be the responsibility of the Owner.

5.3 COMPACTION STANDARD

- 5.3.1 The testing laboratory conducting the project acceptance sampling and testing will routinely retain companion samples sufficient for the determination of maximum relative density.
- 5.3.2 For compaction standard appeal testing, the Contractor will have the option for the testing to be done by the testing laboratory undertaking the project acceptance testing, or an independent testing laboratory selected by the Project Manager.
- 5.3.3 The average of the appeal tests will be used for acceptance and unit price adjustment, and shall be binding on both the Owner and the Contractor.
- 5.3.4 If the new compaction results verify that any unit price reduction or rejection applies for that Lot, the costs of the appeal sampling and testing will be borne by the Contractor. If the result shows that a unit price reduction no longer applies, the appeal testing costs will be the responsibility of the Owner.
- 5.3.5 Core density and thickness appeals will only be considered if a case can be made that the stratified random sampling plan, or locations selected by the Consultant based on visual non-conformance was biased or testing was in error.

6 ACCEPTANCE/REJECTION, REPAIRS AND PAY ADJUSTMENTS

6.1 GENERAL

- 6.1.1 The Contractor shall provide an end product conforming to the quality and tolerance requirements of this specification and plans. Where no tolerances are specified, the standard of workmanship shall be in accordance with normally accepted good practices.
- 6.1.2 If any there are any mix properties or surface defects in the end product that are outside of the acceptance limits and are not repaired to the satisfaction of the Project Manager, or Engineer the Block or Lot will be rejected as unacceptable work.
- 6.1.3 Unit price reductions will only be applied on the basis of full quality acceptance testing.

- 6.1.4 Failure to satisfy the Post-Production Quality Control requirements of this specification will result in the mix supplied during such period to be subject to rejection unless otherwise accepted by the Project Manager.
- 6.1.5 Mix supplied during periods when the Post-Production Quality Control 3 test running average is outside the specified tolerances is subject to rejection.
- 6.1.6 Mix not meeting the plant discharge or on-site temperature tolerance requirements specified herein shall be subject to rejection.

6.2 REMEDIAL WORK

- 6.2.1 Any Block or Lot that has been rejected shall be remedied within 30 days of receipt of acceptance test results.
- 6.2.2 Methods for repairs and remedial work shall be approved by the Project Manager prior to completing any repair and remedial work.
- 6.2.3 All remedial work shall be performed at the Contractor’s expense, including the cost of materials.
- 6.2.4 The Contractor shall pay the cost of all re-testing performed following the remedying of any work that has been rejected.

6.3 ASPHALT CONTENT

- 6.3.1 For full payment, the Lot Mean Asphalt Content must be within 0.30% of the approved JMF value, as specified.
- 6.3.2 Payment adjustment for asphalt content is as follows:

Table 8 – Asphalt Content Payment Adjustment Factor

Asphalt Content Deviation from JMF Value (%)	Payment Adjustment (% of ACP Price)
± 0.30 or less	0
± 0.31 to ±0.40	- 10
± 0.41 to ±0.45	- 25
± 0.46 to ±0.50	- 50
Greater than ± 0.50	Reject (Remove & Replace)

- 6.3.3 All asphalt removed and replaced shall be at the Contractor’s expense.

6.4 THICKNESS (NEW CONSTRUCTION AND TOP LIFT ONLY)

- 6.4.1 The pavement shall have the thickness specified on the Contract Drawings. Areas suspected to be deficient shall be cored, as directed by the Project Manager, on the basis of 1 core for every 1000 square metres of pavement. At least 1 core shall be taken at the designated Marshall location.
- 6.4.2 Should the asphalt be found to be deficient in thickness, the Contractor will be permitted to take 2 additional cores in an effort to isolate and confirm the deficient areas. The

location of the two additional cores shall be located no further than half way between the deficient core, and the next adjacent core, or paving boundary. The exact location of the core locations are to be determined by the Contractor, and approved by the Project Manager. The Contractor shall be responsible for all costs associated with the re-coring of the asphalt.

6.4.3 A payment adjustment shall be assessed according to the following:

Table 9 – Thickness Deficiency Payment Factors

Thickness Deficiency (mm)	Payment Adjustment (% of ACP Price)
0 to 5	0
6 to 9	- 10
10 to 12	- 25
13 to 15	- 50
Over 15	Remove and Replace

6.4.4 No additional payment will be made to the Contractor if the asphalt pavement is thicker than the specified thickness.

6.4.5 The Contractor shall fill all core holes within a maximum period of 24 hours.

6.5 COMPACTION

6.5.1 Compaction shall be based on core samples, each of which shall represent approximately 1000 square metres per constructed lift. Asphalt densities are specified as **97%** of the standard laboratory Marshall. A minimum of 1 Marshall per day shall be performed with 1 core sample taken at a designated Marshall location or as specified by the Project Manager.

6.5.2 If any core fails to meet the density specified, no more than 2 additional cores may be taken within 1 metre of the first core sample, and the average density of the three cores shall represent the area. No additional rolling to achieve a more favourable density shall be permitted. The Contractor shall be responsible for all costs associated with the recoring of the asphalt concrete.

6.5.3 If the average densities for a Block or Lot are less than specified, a pay adjustment shall be assessed according to the following:

Table 10 – Pay Adjustments for Compaction

% of Maximum Theoretical Density (Lot/Block Average)	Payment Adjustment (% of ACP Price)
> 96.9	0
96.6 to 96.9	- 2.0
96.0 to 96.5	- 5.0
95.0 to 95.9	- 10.0
94.0 to 94.9	- 20.0
93.0 to 93.9	- 35.0

91.0 to 92.9	- 50.0
< 91.0	Remove and Replace

- 6.5.4 All Lot or Block with an average below 91% standard Marshall density shall be removed and replaced at the Contractor's expense.
- 6.5.5 No adjustment to the unit price is to be made for areas with a density higher than that specified.

6.6 AGGREGATE GRADATION

- 6.6.1 The pay adjustments shown in Table 11 shall be applied to each sieve analysis completed within a Lot/Block:

Table 11 – Payment Adjustment for Aggregate Gradation

SIEVE SIZE	Gradation Deviation from the JMF (%)	Payment Adjustment (% of ACP price)
5mm and greater	± 0.0 to 5.0	0.0
	± 5.1 to 5.6	- 1.0
	± 5.7 to 6.2	- 2.5
	± 6.3 to 6.8	- 4.0
	± 6.9 to 9.0	- 10.0
	> 9.0	Reject
800 µm	± 0.0 to 3.0	0.0
	± 3.1 to 4.0	- 2.0
	± 4.1 to 5.0	- 5.0
	± 5.1 to 6.0	- 10.0
	> 5.0	Reject
160 µm	± 0.0 to 2.0	0.0
	± 2.1 to 2.5	- 5.0
	± 2.6 to 3.0	- 10.0
	> 3.0	Reject
80 µm	0.0 to 0.5	0.0
	± 0.6	- 0.5
	± 0.7	- 1.5
	± 0.8	- 3.0
	± 0.9	- 5.0
	± 1.0	- 7.5
	± 1.1 to 1.2	- 12.0
	> 1.2	Reject

- 6.6.2 There will be no payment made for a Lot/Block if the average percent by mass retained on the maximum size sieve exceeds 3.0%.
- 6.6.3 The dollar value of the total pay adjustment for each Lot/Block will be the sum of the pay adjustment for each sieve.
- 6.6.4 The maximum pay reduction for aggregate gradation in a Lot/Block will be 15%. A Lot/Block will be rejected if the total pay adjustment exceeds 15%.

6.7 AIR VOIDS

6.7.1 The pay adjustment for each Lot/Block will be determined in accordance with Table xx

Table 12 – Pay Adjustments For Air Voids

Average of Air Void Variance from JMF	Payment Adjustment (% of ACP Price)
0.0 to 0.70	0
0.71 to 1.00	- 2.0
1.01 to 1.30	- 8.0
1.31 to 1.50	- 14.0
> 1.5	Remove and Replace

6.8 SMOOTHNESS

6.8.1 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:

- Base Course - 10 mm in 3 m
- Surface Course - 5 mm in 3 m

6.8.2 When deviations in excess of the above tolerances are found, the pavement surface shall be corrected by methods satisfactory to the Project Manager. Correction of defects shall be carried out until there are no deviations anywhere greater than the allowable tolerances.

6.9 SEGREGATION

6.9.1 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.

6.9.2 All segregation will be evaluated by the Project Manager to determine repair requirements.

6.9.3 The severity of segregation will be rated as follows:

- Slight - The matrix of asphalt cement and fine aggregate is in place between the coarse aggregate particles, however there is more stone in comparison to the surrounding acceptable mix.
- Moderate - Significantly more stone than the surrounding mix, and exhibit a lack of surrounding matrix.
- Severe - Appears as an area of very stony mix, stone against stone, with very little or no matrix.

6.9.4 Segregated areas shall be repaired by the Contractor as directed by the Project Manager. The following methods of repair are identified.

- Slight - Squeegee asphalt to completely fill the surface voids.
 - Moderate - slurry seal for full mat width.
 - Severe - removal and replacement or overlay.
- 6.9.5 All repairs shall be regular in shape and finished using good workmanship practices to provide an appearance suitable to the Project Manager.
- 6.9.6 Any other methods of repair proposed by the Contractor will be subject to the approval of the Project Manager.
- 6.9.7 Repairs will be carried out by the Contractor at their expense.

7 MEASUREMENT AND PAYMENT

7.1 MEASUREMENT

- 7.1.1 Asphalt Concrete supplied and placed will be measured in square metres or tonnes of material placed, as detailed in the Tender Form. Asphalt paid by the square metre will be measured by the area of the top lift of asphalt placed (not including the slope).

7.2 PAYMENT

- 7.2.1 The Unit Price for Asphalt Concrete shall be full compensation for all materials, accordance with these specifications.
- 7.2.2 Material shall be scaled and recorded by the Contractor on duplicate weight slips. Weight slips must be supplied at the time of delivery and a copy supplied to the Project Manager.
- 7.2.3 The weight scale shall be inspected and certified by Weights and Measures Inspection Services of the Federal Department of Consumer and Corporate Affairs, at the Contractor's expense and as often as the Project Manager may direct.
- 7.2.4 The Unit Price applicable to each Lot quantity of asphalt concrete will be calculated as follows:

$$\text{LOT UNIT PRICE} = (\text{CONTRACT UNIT PRICE} \times \text{PA}_{\text{AC}} \times \text{PA}_{\text{COM}} \times \text{PA}_{\text{T}} \times \text{PA}_{\text{AV}})$$

Where:

- PA_{AC} = Asphalt Content Payment Adjustment
- PA_{COM} = Compaction Payment Adjustment
- PA_T = Thickness Payment Adjustment (When Applicable)
- PA_{AV} = Thickness Payment Adjustment

END OF SECTION