

## **SECTION 24 - SUPERPAVE ASPHALT CONCRETE END PRODUCT SPECIFICATION (EPS)**

### **1.0 DESCRIPTION**

This item consists of supplying crushed aggregates, or a combination of crushed aggregates and reclaimed asphalt pavement (RAP), blending materials, anti-stripping agent, asphalt binder, production, loading, hauling, placing and compaction of asphalt concrete mixtures, including asphalt concrete patching. The limits of placement, application rates and the asphalt concrete mixture type shall be as stated in the contract specifications. Areas constructed will be subjected to various quality assurance testing.

It shall be the Contractor's responsibility to provide an acceptable product as specified. To achieve this, the Contractor shall implement and maintain a quality control system that will provide assurance that all components, as well as end result products, submitted to the Department for acceptance, conform to the contract requirements. This is without regard to whether the products are manufactured by the Contractor or purchased from suppliers or subcontractors.

Quality assurance tests shall be performed, by the Department, on random samples taken either at the production site or laydown site.

### **1.1 DEFINITIONS**

**1.1.1 End Product Specification (EPS).** An end product specification is a specification under which the Department monitors the Contractor's control of the processes that produce the items of construction. The Department accepts or rejects the end product according to a specified quality assurance plan. The Contractor is entirely responsible for quality control. End product acceptance is the responsibility of the Department including a statistically oriented program of quality assurance testing.

**1.1.1.1 Work Category.** The work will be classified as Work Category 1, Work Category 2, Work Category 3, or Work Category 4. The category defined will apply to all asphalt concrete produced. The categories are determined by the Department based on the total estimated tonnage of the Work as per Table 4.24.1.

**Table 4.24.1**

<b>Work Category</b>	<b>Total Estimated Tonnage</b>
Work Category 1	Greater than or equal to 6000 tonne
Work Category 2	Greater than or equal to 3000 tonne and less than 6000 tonne
Work Category 3	Less than 3000 tonne
Work Category 4	As per the Contract Documents

**1.1.2 Design Mix Formula (DMF).** The DMF is defined as the laboratory determination of the precise proportions of asphalt binder, additives and aggregates to be blended together to meet the specified properties for a given asphalt concrete mixture.

**1.1.3 Job Mix Formula (JMF).** The JMF is the resultant establishment of the single definite percentage for each sieve fraction of aggregate and asphalt binder content that will produce the desired asphalt concrete mixture properties under field conditions.

**1.1.4 Actual Asphalt Binder Content.** This is the percentage of asphalt binder in the asphalt concrete mixture, determined from quality assurance testing in accordance with ASTM D6307 -Test Method A.

**1.1.5 Lot.** For each mixture type specified, a Lot is defined as the quantity of asphalt concrete plant production, where approved changes to the Job Mix Formula have not occurred. The total quantity of asphalt concrete plant production in a Lot will be defined by the Work Category as Work Category 1, Work Category 2, Work Category 3 or Work Category 4, described in the following sections.

For all Work Categories, a separate Lot will be established at the discretion of the Engineer if conditions of construction

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indicate that it is likely that a portion of the Lot production is significantly different from the remainder of the Lot production.

**1.1.5.1 Work Category 1.** Under Work Category 1, a Lot will be defined as 2400 tonne. For loose samples, the Lot will be divided into 4 (four) approximately equal segments of 600 tonne, with one (1) sample taken from each segment. For core samples, the Lot will be divided into five (5) approximately equal segments, with one core sample taken from each segment.

If it is the last time the mixture is produced and this criterion cannot be met (i.e. less than 2400 tonne of mixture remain), the following shall apply:

- If the remaining plant production is 600 tonne or less, one (1) random loose sample will be obtained and the production added to the previous Lot. Five (5) random core samples will be obtained from the new Lot tonnage.
- If the remaining plant production is greater than 600 tonne but less than 1200 tonne, two (2) random loose samples will be obtained and the production will be added to the previous Lot. Six (6) random core samples will be obtained from this Lot.
- If the plant production is greater than 1200 tonne but less than 2400 tonne, four (4) random loose samples will be obtained, and the production will be designated as a separate Lot. Five (5) random core samples will be obtained from this Lot.

**1.1.5.2 Work Category 2.** Under Work Category 2, a Lot will be defined as 1500 tonne. For loose samples, each Lot shall be divided into three (3) approximately equal segments and one loose sample is taken from each segment. For core samples, each Lot shall be divided into five (5) approximately equal segments and one core sample is taken from each segment.

If it is the last time that the mixture is produced, and this criterion cannot be met (i.e. less than 1500 tonne of mixture remain) then the following shall apply:

- If the remaining plant production is 750 tonne or less, one (1) random loose sample will be obtained, and the production added to the previous Lot. Five (5) random core samples will be obtained from the new Lot tonnage.
- If the remaining plant production is greater than 750 tonne but less than 1500 tonne, three (3) random loose samples will be obtained and the production will be designated as a separate Lot. Five (5) random core samples will be obtained from this Lot.

**1.1.5.3 Work Category 3.** Under Work Category 3, a Lot will be defined as 1500 tonne. For loose samples, each Lot shall be divided into three (3) approximately equal segments and one loose sample is taken from each segment. For core samples, each Lot shall be divided into three (3) approximately equal segments and one core sample is taken from each segment.

If it is the last time that the mixture is produced, and this criterion cannot be met (i.e. less than 1500 tonne of mixture remain) then the following shall apply:

- If the remaining plant production is 750 tonne or less, one (1) random loose sample will be obtained, and the production added to the previous Lot. Three (3) random core samples will be obtained from the new Lot tonnage.
- If the remaining plant production is greater than 750 tonne but less than 1500 tonne, three (3) random loose samples will be obtained and the production will be designated as a separate Lot. Three (3) random core samples will be obtained from this Lot.

**1.1.5.4 Work Category 4.** Under Work Category 4, a Lot is defined as one (1) day of plant production. For loose samples, each Lot will be divided into two (2) approximately equal segments with a loose sample taken from each segment. No core samples shall be obtained for the Lot.

**1.1.6 Stratified Random Sample.** A stratified random sample is defined as a representative sample taken in an unbiased manner, by dividing a Lot into approximately equal segments. A random sample is taken from each area or segment.

**1.1.7 Sample Mean.** This is the arithmetic mean of the group of test results derived from the randomly selected samples.

**1.1.8 Mean of the Deviations.** This is the sum of the absolute values of the deviations divided by the number of tests in the Lot.

**1.1.9 Thickness.** Thickness is defined as the specified application rate indicated in the contract documents divided by the average bulk relative density obtained from the core samples for a given Lot.

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**1.1.10 Mixture Property.** Mixture properties measured for product acceptance and price adjustments are as follows:

- Gradation: p4750  $\mu\text{m}$ , p75  $\mu\text{m}$ , Asphalt Binder Content, Air Void Content, VMA Content, Thickness, Density and Smoothness.

**1.1.11 Referee Sample.** A referee sample is defined as the portion of the loose sample that is set aside by the Department representative's laboratory in the case of an appeal of Lot Asphalt Binder Content, Air Void Content, VMA Content, Gradation, and/or field Lottman by the Contractor.

**1.1.12 Preliminary Testing / Preliminary Aggregate Testing.** Preliminary Testing and Preliminary Aggregate Testing are defined as the testing that occurs prior to undertaking asphalt paving operations. Sampling and test data submissions must occur prior to, and within the same calendar year as, asphalt concrete mixture production for project segments as detailed in the contract documents and must be reported for a minimum of one sample per type of material, including RAP materials.

**1.1.13 Leveling Course.** A course (lift) of asphalt mixture of varying thickness placed on an existing pavement to compensate for existing pavement irregularities prior to placing the next course of asphalt mixture. The intention of the leveling course is to provide an improved working platform for the placement of subsequent asphalt courses (lifts). Asphalt mixture spread rate tolerances shall not apply to leveling courses. The thickness specification and the unit price adjustments relating to the density specification shall not apply to the leveling course. The rejection/acceptance criteria for density shall apply and be based on the lot average of the subplot densities. Core sample frequency will be based on the contract work category as specified in section 1.1.5. The overall quantity of asphalt to be applied as a leveling course shall not be exceeded unless otherwise approved by the Engineer.

## **2.0 REFERENCES**

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification refers to the following standards, specifications, or publications:

- Division 4 Section 1, Emulsified Asphalt
- Division 4 Section 2, Performance Graded Asphalt Binder (PGAB)
- Division 4 Section 4, Asphalt Concrete Hot Mixed-Hot Placed - 4.3 Anti-Stripping Agents
- Occupational Health and Safety Act
- Environmental Protection Act
- 1981 Asphalt Paving Plant Regulations
- Asphalt Institute Manual Series 2 (MS-2)
- AASHTO R35, Standard Practice for Superpave Volumetric Design for Asphalt Mixtures
- AASHTO R30, Standard Practice for Mixture Conditioning of Hot-Mix Asphalt (HMA)
- AASHTO M156, Standard Specification for Requirements for Mixing Plants for Hot-Mixed, Hot Laid Bituminous Paving Mixtures
- AASHTO T283, Standard Method of Test for Resistance of Compacted Asphalt Mixtures to Moisture-Induced Damage
- AASHTO T304, Standard Method of Test for Uncompacted Void Content of Fine Aggregate, Method A
- AASHTO T312, Standard Practice for Preparing and Determining the Density of Asphalt Mixture Specimens by Means of Superpave Gyrotory Compactor
- AASHTO T329, Standard Method of Test for Moisture Content of Asphalt Mixtures by Oven Method
- ASTM C88, Standard Test Method for Soundness of Aggregates by use of Sodium Sulfate or Magnesium Sulfate
- ASTM C117, Standard Test Method for Material Finer than 75  $\mu\text{m}$  (No. 200) Sieve in Mineral Aggregates by Washing
- ASTM C127, Standard Test Method for Relative Density (Specific Gravity) and Absorption of Coarse Aggregate
- ASTM C128, Standard Test Method for Relative Density (Specific Gravity) and Absorption of Fine Aggregate
- ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
- ASTM C207, Standard Specification for Hydrated Lime
- ASTM D75, Standard Practices for Sampling Aggregates
- ASTM D140, Standard Practice for Sampling Asphalt Materials
- ASTM D2041, Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixes
- ASTM D2172, Standard Test Methods for Quantitative Extraction of Asphalt Binder from Asphalt Mixtures - Test Method A
- ASTM D2419, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate

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- ASTM D2493, Standard Practice for Viscosity-Temperature Chart for Asphalt Binders
- ASTM D2726, Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Asphalt Mixtures
- ASTM D2950, Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Method
- ASTM D3203, Standard Test Method for Air Voids in Compacted Asphalt Mixtures
- ASTM D3549, Standard Test Method for Thickness or Height of Compacted Asphalt Mixture Specimens
- ASTM D3665, Standard Practice for Random Sampling of Construction Materials
- ASTM D4791, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
- ASTM D5361, Standard Practice for Sampling Compacted Asphalt Mixtures for Laboratory Testing
- ASTM D5444, Standard Test Method for Mechanical Size Analysis of Extracted Aggregate
- ASTM D5821, Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate
- ASTM D6307, Standard Test Method for Asphalt Content of Asphalt Mixtures by Ignition Method - Test Method A
- ASTM D6926, Standard Practice for Preparation of Asphalt Mixture Specimens Using Marshall Apparatus
- ASTM D6928, Standard Test Method for Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus
- ASTM D7428, Standard Test Method for Resistance of Fine Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus
- ASTM D7113, Standard Test Method for Density of Bituminous Paving Mixtures in Place by the Electromagnetic Surface Contact Methods
- ASTM E178, Standard Practice for Dealing with Outlying Observations
- NSDPW TM-2, Test Method for Modified Petrographic Analysis
- NSDPW TM-5, Test Method for Obtaining Loose Asphalt Concrete Mix Samples and Sampling of Compacted Asphalt Concrete Sample by Coring
- NSDPW TM-13, Procedure for Determination of the Specific Gravity of Aggregate Blends Containing Reclaimed Asphalt Pavement
- NSDPW TM-14, Procedure for Ignition Oven Calibration
- NSDPW TM-15, Procedure for Ignition Oven Correction Factor for Determination of Aggregate Breakdown
- NSDPW TM-16, Procedure for Gyratory Compactor Trial and Reporting

### **3.0 SUBMISSIONS AND DESIGN REQUIREMENTS**

**3.1 Establishing a Design Mix Formula (DMF).** Preparation and submission of the asphalt DMF for the Department's approval is the responsibility of the Contractor. The Contractor shall use professional engineering services and a qualified testing laboratory to assess the aggregate materials proposed for use and to carry out the design of the asphalt concrete mixture. The qualified testing laboratory shall be certified by Canadian Council of Independent Laboratories (CCIL) to a minimum of Superpave Mixture Design Testing - Type A, Aggregate Testing - Type D, and retain a minimum of one CCIL certified laboratory asphalt technician and one CCIL certified laboratory aggregate technician on staff. A single technician may hold both asphalt and aggregate certifications and satisfy the requirements.

**3.1.1 Requirements for Design Mix Formula.** The asphalt mixture design shall follow the Superpave method of the DMF as outlined in the latest edition of the Asphalt Institute Manual Series No. 2 (MS-2). The mixture design, at the design asphalt binder content, shall meet the requirements in Table 4.24.4 of this specification for each asphalt concrete mixture specified. All work and submissions shall be from the same calendar year as the placement of the asphalt mixture. The DMF shall be signed and stamped by a Professional Engineer licensed to practice in Nova Scotia.

**3.1.2 Submission of Design Mix Formula.** The Contractor's submission shall include the following information/materials:

- The specific gravity and the percentage by mass of each aggregate (including RAP, natural / blend sand, lime) to be used in the mixture.
- The mixture design gradation of the combined aggregate (including RAP, natural / blend sand, lime).
- Physical properties of the aggregates specified, in accordance with Table 4.24.4.
- All Superpave mixture design characteristics, including graphs used in arriving at the final mixture design, the bulk relative density of the combined aggregates, and the asphalt absorption of the combined aggregates.
- Viscosity-Temperature chart from the asphalt binder supplier as determined by ASTM D2493 or approved alternative method.
- Quarry/pit identification consisting of its name, name of owner, public highway from which it is accessed.
- Superpave mixture designs shall include the most recent Series B aggregate physical results. Mixture volumetrics shall be updated with the most recent Series B results to ensure compliance with Table 4.24.4 requirements. One-point mixture verifications shall be completed when Series B results change the combined aggregate specific gravity ( $G_{sb}$ ) by greater than or equal to 0.030 and/or when RAP AC contents change by greater than or equal to 1.00% from

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the initial mixture design values. One-point mixture verifications at the optimum asphalt binder content will include updated bulk relative specific gravity ( $G_{mb}$ ) and maximum theoretical specific gravity ( $G_{mm}$ ) testing to verify the physical and volumetric properties of the mixture.

**3.1.3 Evaluation of Design Mix Formula.** The Engineer will require up to two (2) working days from the time of receipt of the DMF, for evaluation by the Department representative. The Engineer will advise the Contractor of the acceptability. If the DMF does not meet the requirements of Table 4.24.4, it will be rejected. The Engineer will provide a written explanation to the Contractor that details why the DMF failed. The Contractor shall then provide another complete DMF in accordance with 3.1.1 Requirements for Design Mix Formula and re-submit it to the Engineer for evaluation. Each time a DMF is re-submitted, an additional two (2) working days, from the time of receipt of the revised DMF, shall be required for evaluation by the Department representative.

The Contractor's Design Mix Formula shall be accompanied with the appropriate mixture materials. Such materials shall be delivered by the Contractor to the Consultant retained by the Department for calibration testing. Samples required to calibrate the ignition oven, determine aggregate specific gravities and compact two briquettes at the design mix formula's optimum asphalt binder content are: 50 kg of each coarse aggregate, 50 kgs of Reclaimed Asphalt (RAP) (if applicable), 50 kg of each fine aggregate, 25 kg of natural / blend sand (if applicable), and 2 liters/mixture of PGAB. If required, additional materials such as anti-strip agents will be provided by the Contractor. Calibration materials shall be delivered at the earliest possible time to facilitate timely QA test results.

The Engineer will not accept any asphalt concrete mixture produced prior to the Contractor receiving written approval of the DMF from the Engineer.

**3.2 Establishing a Job Mix Formula (JMF).** The Contractor shall establish a JMF for each mixture type by placing a specified quantity of trial mixture (asphalt concrete mixture) at a location designated by the Engineer. The maximum allotted quantity of asphalt concrete allowed for establishment of the JMF is defined by the Work Category as per Table 4.24.2.

**Table 4.24.2**

Work Category	Lift	
	Base (tonnes)	Surface (tonnes)
1	600	300
2	500	250
3	500	250
4	Not Applicable	One Day Plant Production

Alternatively, the Contractor may elect to waive their trial mixture option and submit their JMF (and supporting documentation) directly to the Engineer for approval.

At the discretion of the Engineer, the Contractor may be permitted to carry over any unused portion of the base course allotment to supplement the surface course allotment.

The asphalt concrete placed in the trial sections will be tested to determine if it meets the requirements of Table 4.24.4. Unit price adjustments and repair/replace/reject criteria will be applied to the Thickness and Density properties. Repair/replace/reject criteria will be applied to the Air Void Content and VMA Content requirements of Table 4.24.7. The asphalt concrete will be assessed for surface defects in accordance with 5.7 - Surface Defects.

**3.2.1 Approval of Job Mix Formula.** The Contractor shall submit the JMF in writing to the Engineer for approval. The Contractor's submission shall include the following information:

- The percentage by mass of each aggregate (including natural / blend sand, lime) to be used in the mixture
- The JMF target asphalt binder content and gradation
- The % Air Voids, VMA and VFA from the trial mixture
- A minimum of three (3) sets of QC results

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The Engineer's written approval of the JMF will allow the Contractor to start/continue production.

**3.2.2 Field Adjustments to the Job Mix Formula.** A field adjustment to the JMF is defined as a change in the target gradation and/or asphalt binder content of a mixture, within specified limits, without a redesign of the mixture.

The Contractor shall request JMF changes in writing, including supporting test results (a minimum of 3 sets of QC results as per 3.2.1 - Approval of Job Mix Formula). Upon approval by the Engineer, revisions to the JMF will be applied to subsequent Lots only.

For each mixture type on the contract, the maximum allowable number of field adjustments to the JMF for Gradation, Air Void Content, VMA Content, and Asphalt Binder Content parameters, shall be based on Table 4.24.3.

**Table 4.24.3**

<b>Tender Quantity for Specified Mix (tonnes)</b>	<b>Maximum Number of JMF Changes per Parameter</b>
0 - 10000	2
10000 - 15000	3
15000 - 20000	4
20000 - 25000	5
25000 - 30000	6

The Contractor shall submit a revised DMF in accordance with 3.1.1 - Requirements for Design Mix Formula, for the following changes:

- A change in the source of the aggregate used in the asphalt concrete mixture.
- A change in material (different aggregate sizes) from the same source.
- A change in the source of the liquid anti-strip additive used in the asphalt concrete mixture.

The submission of a revised DMF is not required for a change in the source of the asphalt binder. However, documentation from the Contractor identifying the change is required.

### **4.0 MATERIALS**

**4.1 Performance Graded Asphalt Binder (PGAB).** PGAB shall be supplied by the Contractor, in accordance with the Standard Specification Division 4, Section 2. Specific PGAB grade requirements will be denoted in the contract specifications.

Within 7 (seven) calendar days prior to the first use of PGAB products, the Contractor shall supply to the Engineer a Quality Control Plan detailing the quality control activities related to the use of PGAB.

**4.2 Coarse Aggregate.** Coarse aggregate supplied by the Contractor shall be made from a quarried source and shall conform to the requirements stated in Table 4.24.4. Coarse aggregate shall be the portion retained on the 4750 µm sieve, free from coatings of clay, silt, or other deleterious material.

**4.3 Fine Aggregate.** Fine aggregate supplied by the Contractor shall be produced from a quarried source or in the case of a natural deposit, fine aggregate may be manufactured from the aggregate held on the 9500 µm sieve. In such cases, a tolerance of 10% passing the 9500 µm sieve, based on a washed sieve analysis, will be permitted. Fine aggregate shall be the portion passing the 4750 µm sieve and shall meet the physical requirements of Table 4.24.4.

**4.4 Natural / Blend Sand.** If required, natural / blend sand shall be supplied by the Contractor. Natural / blend sand shall be used to obtain acceptable physical mixture properties as outlined in Table 4.24.4. The maximum amount of natural uncrushed fine aggregate used shall be limited to 15% of the total aggregate in all mixture types.

**4.5. Reclaimed Asphalt Pavement (RAP).** The Contractor may use suitable RAP in the mixture as specified in the contract document(s) to a maximum of 15% by weight of mixture. Suitable RAP shall not contain any other additives including, but not limited to, Sulphur, crumb rubber, asphalt rubber, asbestos, produced sand, paving fabrics and reinforcement grids. The handling, stockpiling, storage and hauling of all RAP materials shall conform to the following

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requirements: stockpiles shall be constructed in a conical manner to reduce moisture accumulation; material handling equipment shall not be permitted to operate on the stockpile; stockpiles shall be constructed on a properly prepared sloped surface in order to provide positive drainage; RAP shall be stored in a separate cold bin; handling of the RAP shall be in such a manner as to avoid re-agglomeration; and shall be free of contamination and shall be processed in such a manner that all particles pass the 19 mm sieve size, the combined gradation of the mixture shall be provided in accordance with Table 4.24.4 requirements; RAP shall not be directly exposed to open flame during and/ or after introduction into the plant. For drum mix plants processing RAP, the mixing time shall be adjusted so that all heat transfer occurs in the drum.

**4.6 Blending of Coarse and Fine Aggregates.** Blending of coarse and fine aggregate portions from two sources will be permitted. The coarse and fine aggregate composite blend shall meet the physical requirements of Table 4.24.4.

Blending of coarse and fine aggregate portions from two sources will be permitted when the Petrographic Number (PN) for the aggregate from the original (primary) source does not exceed the specified PN by more than 10%. The PN of the aggregate from the secondary (blending) source shall not exceed the specified PN limit. The PN of the combined sources shall not exceed the specified PN limit.

The minimum amount of secondary (blending) coarse and/or fine aggregate shall be at least 10% of the coarse and/or fine fraction. Aggregates shall be blended through the cold feed bins (i.e. coarse and fine aggregates from different sources shall be introduced into the mixture through individual cold feed bins).

Sand from the original source may be used provided the stone from which the sand is produced has a PN not more than 10% higher than the specified PN.

**4.7 Production of Aggregates.** The Contractor will be permitted to use asphalt concrete aggregates produced prior to award of the Contract, provided that the following pre-qualification conditions have been met:

- Written notification of the intent to commence aggregate production operations had been received by the Department at least five (5) working days prior to production start-up. Notification shall also have included a physical description of the pit or quarry; approximate tonnage of each aggregate size to be produced; as well as the anticipated schedule for aggregate production.
- Quality Control (QC) testing has been carried out in accordance with the Department's Superpave Asphalt Concrete End Product Specification (EPS) at the minimum sampling/testing frequencies as set out in Table 4.24.5 (Series A - Aggregate Characteristics and Series B - Aggregate Production).
- The Contractor has maintained all QC records and documentation and provided copies of all QC test results to the Department's Highway Construction Services Division, on a daily basis, within 24 hours of sampling/testing.
- The Contractor has granted the Department's representatives full access to production and storage sites at all times during production, allowing for the performance of any and all quality assurance (QA) testing and inspection deemed appropriate by the Department.
- Proper aggregate stockpiling procedures have been followed and stockpiles have been adequately maintained and protected from contamination and segregation.

The QC results received by Highway Construction Services will be forwarded to the Engineer upon award of Contract. Acceptance of aggregate production test results does not, in any way, relieve Contractors of their responsibility to produce an asphalt concrete mixture that meets the Specification.

The Contractor's Inspection Testing Plan (ITP), shall reference the aggregate QC testing carried out prior to award of Contract. Any additional aggregates required shall be produced in accordance with 6.0 - Quality Control/Quality Assurance.

**4.8 Anti-Stripping Agents.** If the Contractor elects to use anti-stripping agents, the incorporation of such products into the asphalt concrete mixture shall be done as specified throughout Division 4 Section 4 - Asphalt Concrete Hot Mixed - Hot Placed.

## **5.0 CONSTRUCTION METHODS**

**5.1 General.** Equipment shall be designed and operated to produce an end product complying with the requirements of this specification. Equipment used shall be of adequate rated capacity and shall be in good working order.

**5.2 Production.** The asphalt mixing plant and its components shall meet the requirements of AASHTO M156 and the latest edition of the Standard Specification.

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It is the joint responsibility of the paving Contractor and trucker to load the proper amount of asphalt concrete mixture into each truck. Any excess amount that shall be removed is the joint responsibility of the paving Contractor and the trucker. The removal of the excess material shall be accomplished in a manner that is consistent with the Occupational Health and Safety Act and shall not impact on the integrity, or promote segregation, of the asphalt concrete mixture material.

Asphalt concrete exceeding a temperature of 165°C at any point of the operation shall be cause for rejection.

**5.3 Transportation.** Asphalt concrete shall be transported from the paving plant to the work site in trucks that are properly equipped and in good working order.

The use of hydrocarbon fuels or solvents to lubricate the truck bodies or to clean tools or equipment, will not be permitted. A biodegradable release agent shall be supplied by the Contractor to clean or lubricate tools, equipment, and truck bodies.

**5.4. Placement.** Asphalt concrete shall be placed upon a prepared surface which is free from standing water and free of any loose or foreign material. The asphalt concrete shall be spread by a mechanical self-powered paver capable of achieving the specified grade, line, and crown.

Placement of asphalt concrete shall only be conducted during daylight hours, unless specifically noted otherwise in the contract specifications.

Horizontal and vertical contact edges of existing mats and contact faces of core holes, curbs, gutters, manholes, sidewalks, and bridge structures shall be coated with a thin film of tack before placing the asphalt concrete.

Failed areas in existing surfaces (paved or gravel) shall be repaired, as directed by the Engineer. Areas requiring repair will be identified by the Engineer in consultation with the Contractor. Irregularities in the horizontal alignment and grade along the outside edge of the asphalt concrete shall be corrected by the addition or removal of mixture before the edge is rolled. Paving of intersections, extra widths and other variations from standard lane alignment and as defined in the contract, whether by hand spreading or machine laying, shall be carried out concurrently with the machine laying operation of the regular mat, unless otherwise approved by the Engineer.

Fuel spills from the Contractor's equipment shall be immediately repaired by the Contractor to the satisfaction of the Engineer.

The Contractor shall not place asphalt concrete during rain, or when the surface is frozen, nor when the pavement surface shows signs of free-standing water or when the ambient temperature is below 5°C.

**5.4.1 Material Transfer Device.** The Contractor has the option to utilize a Material Transfer Vehicle (MTV). The Contractor will be paid an additional \$1.50 per tonne for all non-segregated, uniformly textured, smooth asphalt concrete applied using an approved MTV. The MTV is defined as a self-propelled transfer unit and (paver) insert hopper. The MTV shall transfer asphalt concrete mixtures from an unloading truck and re-mix the material prior to lay-down, without direct contact with the paver.

Areas subject to repairs because of segregation, non-uniform texture or roughness will not be eligible for the \$1.50 per tonne premium. Repairs, if required, shall extend the full width of the lane and the full depth of the lift in which the repair work is performed.

Material Transfer Vehicles that are not approved by the Department will not be eligible for the \$1.50 per tonne premium.

Contractors are advised that MTVs must be evaluated and approved by the Department or its representative prior to becoming eligible for the premium. Contractors wishing to have MTV units evaluated shall make a written request to the Department's Highway Construction Services Division. Contractors shall work co-operatively with the Department's evaluator(s) in establishing mutually agreed upon test conditions and variables. Once the Department has been satisfied that a proper evaluation has been completed, Contractors will be notified in writing regarding the eligibility of the MTV for the premium.



Table 4.24.4 - Asphalt Concrete Mixture Requirements

Sieve Designation (µm)	A-HF	B-HF	C-HF	D-HF	E-HF
	% (by mass) Passing Each Sieve				
37 500	100	-	-	-	-
25 000	90-100	100	-	-	-
19 000	70-90	90-100	100	-	-
12 500	60-80	70 - 90	90-100	100	100
9 500	-	60-75	70-90	90-100	95-100
4 750	25-60	35-58	45-68	52-75	90-100
2 360	15-45	25-45	25-55	25-55	45-90
1 180	-	-	-	-	30-60
600	-	-	-	-	-
300	-	3-20	6-20	5-20	15-30
150	-	-	-	-	-
75	1-7	2-6.5	2-6.5	2-7	6-12
<b>Physical Requirements for Asphalt Concrete</b>	<b>A-HF</b>	<b>B-HF</b>	<b>C-HF</b>	<b>D-HF</b>	<b>E-HF</b>
Air Void Content Target (%)	4.0				
Number of Gyration	75, or as directed in Contract Special Provisions				
Dust to Binder Ratio	0.6 - 1.2				
VMA (% min)	12	13	14	15	16
Voids Filled with Asphalt (%)	65 - 78				
TSR (% min)	80				

Physical Requirements for Coarse Aggregate	A-HF	B-HF	C-HF	D-HF	E-HF
Los Angeles Abrasion, (% max)	30				
Micro Deval, (% max)					
0.3 to < 3 million ESALs	20	20	17	17	17
≥ 3 million ESALs	18	18	15	15	15
Soundness (% max)	15				
Petrographic No. (max)	135			180	
Flat & Elongated Particles (% max)	10				
Fractured Particles, Two fractured faces, % by mass (min)	95			40	
Absorption (% max)	1.75				

Physical Requirements for Fine Aggregate	A-HF	B-HF	C-HF	D-HF	E-HF
Micro Deval, (% max)					
0.3 to < 3 million ESALs	22	22	18	18	18
≥ 3 million ESALs	20	20	17	17	17
Absorption (% max)	2				
Soundness (% max)	10				
Fine Aggregate Angularity (% min)	45				
Sand Equivalent (% min)	50				

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**5.5 Joint Construction.** All joints shall be constructed to ensure a dense, well-bonded, continuous seal to provide a smooth riding surface.

**5.5.1 Transverse Construction Joints.** Transverse joints shall be butt joints constructed at the end of each day's work and at other times when paving is halted for a period of time which results in the asphalt concrete cooling to below 120°C. When paving resumes, temporary tapers or ramps from previously placed asphalt concrete shall be cut back to full mat thickness to expose fresh, straight vertical surfaces. Loose or broken material shall be removed, and surfaces tacked, at the Contractor's expense, in accordance with the latest edition of the Standard Specification.

**5.5.2 Longitudinal Construction Joints.** Longitudinal joints in the top lift shall not be constructed within a travel lane except when paving in echelon or when paving tapers. Base course mats may have joints located within the lane, but not in the wheel path. Joints in succeeding lifts shall be offset a minimum of 150 mm to 300 mm for 100 Series Highways. Joint offset for all other classes of road shall be a minimum of 150 mm.

**5.5.2.1 Paving in Echelon.** Where described in the contract specifications, pavers shall be used in echelon to place the mat full width. The number of pavers required will be dependent on paving geometry. Upon completion of each day's paving, the maximum length of exposed longitudinal joint edge shall be 100 meters.

**5.5.2.2 Conventional Paving.** Prior to placing the adjacent mat, the exposed edge of each longitudinal joint shall be coated with emulsified asphalt (tack coat). Upon completion of each day's paving, the maximum length of exposed longitudinal joint edge shall be 100 meters.

**5.5.3 Keyed Joints.** When overlaying existing asphalt concrete pavement, keyed joints shall be constructed at both ends of the project, at all intersecting roads, ramps and at all bridge decks in the repaving area, as per the latest edition of the Standard Specification - Division 4, Section 4. Keyed joints shall only be required between the final lift of pavement and the existing pavement, unless otherwise directed by the Engineer.

When existing pavement has been removed in advance of paving the joint area, the Contractor shall construct a temporary (asphalt concrete ramp) taper at the joint area to a slope of at least 50 horizontal to 1 vertical (50H:1V), as per the latest edition of the Standard Specification - Division 4, Section 4. Temporary tapers (ramps) shall be installed immediately following milling of the keyed joint and prior to opening the area to traffic.

**5.6 Compaction.** Compaction equipment shall consist of at least one of each of the following:

- Vibratory roller, Pneumatic-tired roller, Finish roller

Along curbs, manholes and similar structures and locations not accessible to full size rollers, the mixture shall be compacted with smaller compaction equipment, such as vibrating plate tampers, or by hand tampers.

**5.7 Surface Defects.** The finished surface of any pavement course shall have a uniform texture and shall be free of visible signs of defects. The Engineer will identify any obvious defects and determine remedial requirements, which may include removal and replacement in accordance with 6.5.1 - Removal and Replacement. Such defects shall include, but not be limited to, the following:

- Segregated areas;
- Areas of excess or insufficient asphalt binder;
- Dust balls;
- Roller marks, tire marks;
- Cracking or tearing;
- Improper matching of longitudinal and transverse joints;
- Sampling locations not properly reinstated;
- Improper cross slope;
- Fuel spills, hydraulic fluid, hydrocarbons or any deleterious fluid on the mat;
- Deleterious materials.

## **6.0 QUALITY CONTROL / QUALITY ASSURANCE**

**6.1 Quality Control.** The Contractor shall be responsible for quality control testing in accordance with Table 4.24.005, throughout every stage of the work from the crushing and production of aggregates to final product acceptance, to ensure materials and workmanship comply with the requirements of this specification. The quality control testing shall be completed at a qualified testing laboratory which shall be certified by Canadian Council of Independent Laboratories (CCIL) to a minimum of Superpave Mixture Compliance Testing - Type B and retain a minimum of one CCIL certified laboratory asphalt technician. Quality control testing of aggregates shall be completed at a qualified testing laboratory which shall be certified by Canadian Council of Independent Laboratories (CCIL) to a minimum of Aggregate Testing -

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Type D and one CCIL certified laboratory aggregate technician on staff. A single technician may hold both asphalt and aggregate certifications and satisfy the requirements.

At no time will the Engineer issue instructions to the Contractor as to setting of dials, gauges, scales, and meters. However, the Engineer may advise the Contractor against the continuance of any operations or sequences of operations which may result in non-compliance with specification requirements.

The Contractor shall also be responsible for Quality Control testing of asphalt concrete patching mixture used within the limits of the Contract. Asphalt concrete patching mixture shall not be considered as part of a Lot; however, QC records and documentation shall be made available in accordance with 6.1.2 - Sampling and Test Results.

**6.1.1 Quality Control Inspection Testing Plan (ITP).** Following award of Contract, and at least 10 (ten) working days prior to commencement of asphalt concrete aggregate production, the Contractor shall submit, in writing to the Engineer, an ITP covering all phases of the contract performance, including the name of the party retained to prepare the ITP.

The ITP shall include, but not be limited to, identification and description of inspection and required test procedures to be used to fulfill the conditions of the Contract and supporting documentation to verify CCIL certification of laboratory and staff for QC testing. The ITP shall be sufficiently comprehensive and detailed to assure the Engineer of the Contractor's willingness and ability to control the construction production and processes. Once accepted by the Engineer the plan becomes a part of the Contract and shall be enforced accordingly. Any changes to the ITP shall be communicated to the Engineer in advance of the change and shall include information regarding mobile laboratories location, laboratory equipment, and staff changes. Failure to notify CCIL and the Engineer of changes affecting certification shall result in the loss of the right to appeal until notification and approval is obtained.

If the Contractor elects to take loose samples from the roadway, the ITP shall describe the sampling procedure in sufficient detail to ensure that the affected area is kept to a minimum. The method used to reinstate the sample area shall be outlined such that the resulting mixture is uniform, non-segregated, and well compacted. Test methods, sampling and minimum frequency of testing are shown in Table 4.24.5.

The Engineer will provide written approval of the ITP within 5 (five) working days of receiving the same. The Contractor shall be required to update and resubmit the ITP to the Engineer for approval, as conditions or changes warrant.

**6.1.2 Sampling and Test Results.** Where specified, random sampling procedures shall be followed, and where no specific random sampling procedure is specified, the sampling procedure shall be as identified by the Contractor in the ITP. The Contractor shall be responsible for the interpretation of the test results and the determination of any action to be taken to ensure that all materials and work conform to the requirements of the Contract.

**The Contractor shall maintain all QC records and documentation. Results of all QC testing carried out in accordance with Table 4.24.5 shall be provided to the Engineer and Highway Construction Services within 24 hours of testing. All QC documentation shall always be made available for inspection by other Department personnel during the course of the Contract.**

At the end of the construction season, and no later than January 31 of the following year, the Contractor shall provide the Engineer with a final report detailing all quality control test data. The report shall be provided in an electronic format approved by the Department. A copy shall also be provided to the Department's Highway Construction Services Division, Miller Lake.

**6.2 Quality Assurance.** Quality Assurance (QA) will be the responsibility of the Department. In addition to QA testing used to determine unit price adjustments, the Department may, at its sole discretion, examine, inspect or test any aspect of the Contractor's work as deemed appropriate. Such inspections and testing shall not relieve the Contractor of their responsibilities for quality control.

**6.2.1 Sampling.** Random sample locations (loose samples and core samples) for QA testing will be generated by the Engineer for each Lot and trial mixture. For the trial mixture, a minimum of 3 (three) random loose samples will be taken for QA testing (i.e. for determination of maximum theoretical density) with one sample occurring in each third of the trial tonnage. Sample tonnages will be provided to the Contractor at the start of the trial.

All QA samples shall be taken and labeled by the Contractor in the presence of the Engineer (or designated representative). Cores damaged during sampling or handling shall be discarded and new samples shall be taken immediately adjacent (within 300 mm) to the original sample location. The Engineer (or designated representative) will be responsible for transporting the samples to the Department representative's laboratory.

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Neither loose nor core samples will be taken from small areas such as tapers, aprons, bridge approaches, areas of handwork, gores, and asphalt mixture used for isolated leveling and repair of failed areas, however, the tonnage contained therein will be included in the Lot.

Random samples will not be taken in areas of obvious surface defects as indicated in 5.7 - Surface Defects. These areas will be marked and repaired in accordance with 6.5.1 - Removal and Replacement.

**6.2.2 Sample Testing.** Unless otherwise specified, QA samples will be tested in accordance with the latest edition of the test methods outlined in Table 4.24.6.

**6.2.3 Asphalt Binder Content and Gradation.** The asphalt concrete mixture shall be sampled using the procedure as outlined in NSDPW-TM5 (latest edition). The number of loose samples per Lot shall be as defined in 1.1.5 - Lot. The sample location shall be selected as follows:

Under Work Categories 1 through 3, a random tonnage sample will be determined by the Engineer. The Engineer will provide the Contractor with approximately two hours advance notice of loose sampling requirements, based on projected tonnage/production rates. Under Work Category 4, a loose sample will be taken at the midpoint of the Lot.

Each sample will be split into 2 (two) equal portions. One portion will be tested and the other will be set aside in the event that a re-test is required. The mean of the deviations for the Lot will be evaluated for acceptance and rejection requirements as indicated in Table 4.24.7.

**6.2.4 Asphalt Air Void Content.** The asphalt concrete mixture shall be sampled using the procedure as outlined in NSDPW-TM5 (latest edition). The number of loose samples per Lot shall be as defined in 1.1.5 - Lot. The sample location shall be selected as follows:

Under Work Categories 1 through 3, a random tonnage sample will be determined by the Engineer. The Engineer will provide the Contractor with approximately two hours advance notice of loose sampling requirements, based on projected tonnage/production rates. Under Work Category 4, a loose sample will be taken at the midpoint of the Lot.

Each sample will be split into 2 (two) equal portions. One portion will be tested and the other will be set aside in the event that a re-test is required. The mean of the deviations for the Lot will be evaluated for acceptance and rejection requirements as indicated in Table 4.24.7.

**6.2.5 VMA Content.** The asphalt concrete mixture shall be sampled using the procedure as outlined in NSDPW-TM5 (latest edition). The number of loose samples per Lot shall be as defined in 1.1.5 - Lot. The sample location shall be selected as follows:

Under Work Categories 1 through 3, a random tonnage sample will be determined by the Engineer. The Engineer will provide the Contractor with approximately two hours advance notice of loose sampling requirements, based on projected tonnage/production rates. Under Work Category 4, a loose sample will be taken at the midpoint of the Lot.

Each sample will be split into 2 (two) equal portions. One portion will be tested and the other will be set aside in the event that a re-test is required. The average for the Lot will be evaluated for acceptance and rejection requirements as indicated in Table 4.24.7.

**6.2.6 Asphalt Density.** Lots and trial mixture areas will be divided into segments of approximately equal quantity. The number of segments will correspond to the Work category of the Work. Core samples will be taken from the roadway in locations designated by the Engineer.

Coring locations for each Lot will be selected as follows:

The Engineer will provide the Contractor with sample locations (station and offset) following placement of all asphalt concrete within a given Lot or trial mixture area. Where traffic control conditions warrant, consideration will be given to providing random core sample locations for a given mat (i.e. before all asphalt concrete for the Lot has been placed).

For the trial mixture, a minimum of 3 (three) random core samples will be taken for QA thickness and density testing.

Two QA core samples will be taken at each random sample location. One core sample will be used for initial QA testing and the other core sample will be set aside in the event it is required for appeal testing.

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Cores will not be taken within 150 mm of the pavement edge or longitudinal joint, nor closer than 6 m to a transverse joint. Cores shall not be taken within 10 m of a loose sample location. Cores will be obtained a minimum of 12 hours and a maximum 24 hours after the placement of the asphalt concrete. The Contractor will have the option of using dry ice to obtain the cores earlier than 12 hours after placement. The Engineer may use discretion in relocating random core locations that fall within areas of severe vertical curvature (ie. base or crest of a hill).

The percent compaction for each core sample shall be determined using the individual core density and the average maximum theoretical density for the Lot. The sample mean of the Lot or trial mixture density result will be evaluated for Acceptance and Rejection requirements as indicated in Table 4.24.7. The Project Segments will be classified as Density Category A, or Density Category B. Projects classified as Density Category A will be evaluated based on the subplot densities and permit individual sample appeals as detailed in Section 6.3.3. Projects classified as Density Category B will be evaluated based on the mean density of the lot and individual sample appeals shall not be permitted.

**6.2.7 Thickness.** The asphalt concrete will be placed in lifts at the prescribed thickness as per the contract specifications and/or as directed by the Engineer. The pavement thickness will be determined from the cores obtained in 6.2.6 - Asphalt Density.

The Engineer may use discretion in relocating random core locations that fall within areas of severe vertical curvature (i.e. base or crest of a hill).

The maximum thickness for a Lot shall be determined on a segment-by-segment basis, corresponding to tonnage-based coring segments. Individual thickness results will be evaluated for Acceptance and Rejection requirements as indicated in Table 4.24.7. If the maximum thickness does not meet the requirements of Table 4.24.7, the tonnage in excess of the calculated amount will be subtracted from the lot tonnage as determined by weigh tickets.

**6.2.8 Performance Graded Asphalt Binder (PGAB) Sampling.** PGAB samples shall be obtained and packaged as follows:

One PGAB sample shall be obtained per 5000 t of asphalt concrete mixture produced by the Contractor, on a random basis, as determined by the Engineer. The Engineer may opt to request one random sample per day. Samples shall be a minimum size of one liter and shall be taken from the Contractor's storage tank in accordance with ASTM D140.

Contractors shall ensure that their asphalt storage tank(s) are equipped with sampling spigots. The samples shall be labeled with the contract number, date, time, grade, and type of PGAB, supplier, refinery, and the name and the proportions of any additives added to the PGAB.

It will be the Engineer's responsibility to submit PGAB samples for quality assurance testing (to the Consultant under contract with NSDPW for Bituminous Testing) in accordance with the latest edition of the Standard Specification Division 4 Section 2.

**6.2.9 Smoothness.** The smoothness of the finished surface (top lift) of the pavement shall be measured by the Department, using a Class 1 Inertial Laser Profiler, in accordance with the latest edition of the Standard Specification - Appendix H. Price adjustments for International Roughness Index (IRI), Localized Roughness and Mandatory Penalty will be as per Appendix H of the Standard Specification unless otherwise indicated in the contract documents.

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**Table 4.24.5 - Quality Control Testing Requirements**

Series	Tests	Standard	Minimum Frequency
<b>A</b>	<b>Aggregate Characteristics</b>		
	1. Sampling	ASTM D75	
	2. Sieve Analysis	ASTM C117 & C136	Preliminary Testing & Series B
	3. Soundness (NaSO <sub>4</sub> )	ASTM C88	Preliminary Aggregate Tests
	4. Los Angeles Abrasion	ASTM C131	Preliminary Testing & Series B
	5. Micro-Deval (Coarse and Fine Aggregate)	ASTM D6928 & D7428	Preliminary Testing & Series B
	6. Petrographic Number	NSDPW TM-2	Preliminary Testing & Series B
	7. Flat & Elongated Particles (4:1)	ASTM D4791	Preliminary Testing & Series B
	8. Specific Gravity and Absorption, Coarse Aggregate	ASTM C127	Preliminary Testing & Series B
	9. Specific Gravity and Absorption, Fine Aggregate	ASTM C128 <sup>(1)</sup>	Preliminary Testing & Series B
	10. Fine Aggregate Angularity <sup>(2)</sup>	AASHTO T304	Preliminary Testing & Series B
	11. Sand Equivalent	ASTM D2419	Preliminary Testing & Series B
	12. Fractured Particles	ASTM D5821	Preliminary Testing & Series B
	13. Stripping Test	AASHTO T283 (visual by NSDPW)	Preliminary Aggregate Tests (per mix design) & Series B
	14. Absorption	ASTM C127	Preliminary Testing & Series B
15. RAP Materials	NSDPW TM-13	Preliminary Testing & Series B	
<b>Series</b>	<b>Tests</b>	<b>Standard</b>	<b>Minimum Frequency</b>
<b>B</b>	<b>Aggregate Characteristics</b>		
B - Crushing	1. Sampling	ASTM D75	
	2. Sieve Analysis (Crushed)	ASTM C117 & C136	2 coarse & fine agg. / Lot
	3. Sieve Analysis (Natural/Blend Sand)	ASTM C117 & C136	One per 300 tonnes
	4. Fractured Particles	ASTM D5821	One per 1000 tonnes
	5. Flat & Elongated Particles (Coarse)	ASTM D4791	One per 5000 tonnes
B – Mix Production	6. Specific Gravity and Absorption, Coarse Aggregate	ASTM C127	One per 5000 tonnes HMA <sup>(5)</sup>
	7. Specific Gravity and Absorption, Fine Aggregate	ASTM C128 <sup>(1)</sup>	One per 5000 tonnes HMA <sup>(5)</sup>
	8. Fine Aggregate Angularity <sup>(2)</sup>	AASHTO T304	One per 20000 tonnes HMA
	9. Sand Equivalent	ASTM D2419	One per 20000 tonnes HMA
	10. Micro-Deval (Coarse and Fine Aggregate)	ASTM D6928 & D7428	One per 20000 tonnes HMA
	11. Los Angeles Abrasion	ASTM C131	One per 20000 tonnes HMA
	12. Stripping Test (Field Samples)	AASHTO T283 (visual by NSDPW)	One per 20000 tonnes HMA
	13. RAP Materials	NSDPW TM-13	One per 5000 tonnes HMA <sup>(5)</sup>
(1) P75 µm material shall be removed prior to determining the specific gravity of the fine aggregate.			
(2) Applies to all fine aggregate.			
(5) Sample every 5000 tonnes HMA and test every 10000 tonnes HMA. QA companion samples to be delivered to QA consultant central laboratory in case of appeal.			
<b>C</b>	<b>Cold Feed</b>		
	1. Sampling	ASTM D75	
	2. Sieve Analysis (Combined Gradation)	ASTM C117 & C136	2 per Lot
	3. Aggregate Moisture Content	ASTM D2216	2 per Lot
	<b>Hot Bin (Batch Plants)</b>		
1. Sampling	ASTM D75		
2. Sieve Analysis	ASTM C117 & C136	As required	

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<b>D</b>	<b>Plant Inspection</b>		
	1. Verification that Asphalt Cement Delivery Pipe location is in accordance with manufacturer's recommendations	AASHTO M156	Initial set-up, and following changes in plant configuration
	2. Asphalt Binder	Division 4, Section 2	1 per 5000 tonnes or 1 per Lot
	<b>Mixture Testing</b>		
	1. Mix Asphalt Binder Content <sup>(3)</sup>	ASTM D2172, ASTM D6307	3 tests per Lot
	2. Extracted Aggregate Sieve Analysis <sup>(3)</sup>	ASTM D5444	3 tests per Lot
	3. Mix Moisture Content <sup>(3)</sup>	AASHTO T329	2 tests per Lot
	4. Forming Gyrotory Specimens <sup>(3)</sup>	AASHTO T312	3 tests per Lot
<b>E</b>	<b>Other Related Tests</b>		
	1. Bulk Relative Density	ASTM D2726	Each core or briquette
	2. Void Calculations, Cores or Formed Specimens <sup>(4)</sup>	ASTM D2726	Each core or briquette
	3. Temperatures (plant and road)		5 per day per location
	4. Sampling of Bituminous Mixtures (for Compaction)	ASTM D2726	3 per Lot or as specified
	5. Density of Bituminous Concrete (by Nuclear or Electromagnetic Methods)	ASTM D2950 or D7113	1 per hour
	6. Random Test Site Locations	ASTM D3665	Each Lot
	7. Correction Factors, Nuclear Moisture-Density Measurement	ASTM D2950 or D7113	Once per contract or as required
<p>(3) Under Work Category 4, the minimum frequency of testing shall be two tests per Lot. Conditions may warrant an increase in the frequency of any of the quality control tests. The decision, arrangements, and costs for which are the responsibility of the Contractor.</p> <p>(4) If two consecutive air void results fall outside the specified limits, the Contractor shall stop production. Prior to continuing production, the Contractor shall provide the Engineer with written details of what measures have been taken to improve the properties of the mixture. The Contractor shall not continue production until such time that the Engineer has issued written approval to do so. Failure on the part of the Contractor to adhere to this requirement may result in the portion of the Lot affected being ineligible for payment.</p>			

**Table 4.24.6 - Quality Assurance Test Methods**

Test Description	Test Method
Sampling Mixtures	NSDPW - TM5
Coring	ASTM D5361
Sieve Analysis of Extracted Aggregate	ASTM D5444
Bulk Relative Density	ASTM D2726
Theoretical Maximum Relative Density	ASTM D2041
Asphalt Content Determination by Ignition Method	ASTM D6307 - Test Method A
Asphalt Content Extraction by Solvent Method	ASTM D2172 - Test Method A
Void Calculations, Asphalt Concrete Specimens	ASTM D3203
Percent Compaction, Asphalt Concrete Pavement	ASTM D3203
Specific Gravity and Absorption, Coarse Aggregate	ASTM C127
Specific Gravity and Absorption, Fine Aggregate	ASTM C128
Forming Gyrotory Specimens	AASHTO T312
Moisture Content Asphalt Concrete Mixtures	AASHTO T329
Random Sampling of Construction Materials	ASTM D3665
Thickness of Compacted Bituminous Materials	ASTM D3549
Performance Graded Asphalt Binder (PGAB) Sampling	ASTM D140
Asphalt Stripping (Lottman) Test	AASHTO T283

**6.2.10 Application Rate/Thickness and Cross Slope.** The Contractor shall place the asphalt concrete in lifts at the thickness and cross slope indicated in the contract specifications or as otherwise directed by the Engineer.

Tonnage, thickness, and cross slope shall be evaluated on a Lot-by-Lot basis. Tonnage shall govern the maximum amount of asphalt concrete placed. The total tonnage placed in a Lot shall not exceed the quantity determined by the following calculations:

(a) New Paving All Lifts (i.e. On Gravel, Pulverized or Recycled Asphalt Surfaces)

$$[1.10 \times (\text{application rate}) \times (\text{theoretical length}) \times (\text{theoretical width})] \div 1000$$

(b) Repaving (i.e. 1<sup>st</sup> Lift Over Existing Asphalt, Including Milled Surfaces):

$$[1.15 \times (\text{application rate}) \times (\text{theoretical length}) \times (\text{theoretical width})] \div 1000$$

(c) Repaving (i.e. 2<sup>nd</sup> Lift and Subsequent Lifts):

$$[1.10 \times (\text{application rate}) \times (\text{theoretical length}) \times (\text{theoretical width})] \div 1000$$

The quantity in excess of the calculated amount will be subtracted from the Lot tonnage determined by weigh tickets. Cross slope shall govern the minimum specified tolerance of the lines and grades for the asphalt concrete. The specified cross slope shall be maintained within  $\pm 0.5\%$  ( $\pm 15$  mm when measured over 3.0 m, perpendicular to the centerline).



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**6.2.11 Reporting.** The Engineer will provide the Contractor with a copy of the results of QA testing within 1 (one) working day of their availability. Acceptance test results for a given Lot will not be reported to the Contractor until the quality control results for that Lot have been reported to the Engineer. Tests performed by the Engineer will not be considered to be quality control tests. If the Lot results for any one of the QA properties is outside the acceptance limits as listed in Table 4.24.4, the Lot will be evaluated in accordance with 6.4 - Analysis of Rejected Lots.

**6.3 Appeals.** In the event of an appeal, the Contractor shall serve notice of appeal to the Engineer, in writing, within 48 hours of receipt of the QA test results.

The Contractor may have a representative present during appeal testing. During the period of the testing, the Contractor's representative shall comment on anything concerning the testing which he or she does not consider to be valid, and the Engineer will respond to all comments in order to resolve them.

Prior to leaving the testing laboratory any unresolved comments regarding the testing procedures are to be given to the Engineer in writing. Any comments, with respect to the testing procedures, which are made subsequent to the Contractor's representative leaving the laboratory will not be considered. The new Sample Mean or Mean of the Deviations, whichever the case may be, so obtained shall be binding on both the Contractor and the Department.

**6.3.1 Lot Mix Appeals.** The Contractor may appeal the results of QA testing for Bulk Specific Gravity of the Aggregate ( $G_{sb}$ ), Theoretical Maximum Specific Gravity ( $G_{mm}$ ), Bulk Relative Specific Gravity ( $G_{mb}$ ), Asphalt Binder Content, Gradation, and Core Thickness for any rejected or penalized Lot. The Contractor may appeal the results for QA testing for Core Density for any rejected or penalized lot/sublot. In the event of an appeal request, the appealed property will be used in the calculations of all parameters affected. The new test results shall be binding.

**6.3.2 Trial Mix Appeals.** The Contractor may appeal the results of QA testing for Bulk Specific Gravity of the Aggregate ( $G_{sb}$ ), Theoretical Maximum Specific Gravity ( $G_{mm}$ ), Bulk Relative Specific Gravity ( $G_{mb}$ ), and Core Thickness for any rejected or penalized trial mixture. The Contractor may appeal the results for QA testing for Core Density for any rejected or penalized trial mixture lot/sublot. In the event of an appeal request, the appealed property will be used in the calculations of all parameters affected. The new test results shall be binding.

**6.3.3 Appeal of Individual Test Results.** The Contractor may appeal individual results of acceptance testing for the Bulk Specific Gravity of the Aggregate ( $G_{sb}$ ), Theoretical Maximum Specific Gravity ( $G_{mm}$ ), Bulk Relative Specific Gravity ( $G_{mb}$ ), Asphalt Binder Content, and Gradation properties only. When an individual test result from a Lot is challenged, the validity of the test result in question will be determined in accordance with ASTM E178, Standard Practice for Dealing with Outlying Observations, using a "t" - test at a 5% significance level. Interpreting from ASTM E178, Table 1, the critical value is interpreted from the 2.5% significance level at the appropriate number of observations. If the outlier test procedure shows that the challenged test result is valid, then it will be used in the calculations. If the outlier test procedure shows that the challenged test result is not valid, then the test result will be discarded unless there is an obvious error in the calculations or in transposing of the numbers. If there is no obvious error, the referee sample will be tested by the Engineer. Regardless of the presence of outlying observations in the re-tested sample and remaining original results, the results from the referee sample will be binding on both the Contractor and the Department and will be used in the calculations. The results from the outlier testing will be used for any subsequent appeals. The referee sample shall be tested for the following mixture properties: Theoretical Maximum Specific Gravity ( $G_{mm}$ ), Bulk Relative Specific Gravity ( $G_{mb}$ ), Asphalt Binder Content, and Gradation, in the event that the results are needed for additional appeals, if required. A new Mean of the Deviations, for the combined test results, will be determined and this value will be used for acceptance and unit price adjustments.

The Contractor may appeal the results of QA testing for Core Density for any rejected or penalized lot/sublot. Appeal test results are final and binding and shall supersede the original results for the rejected or penalized lot/sublot.

**6.3.4 Appeal of Test Results for the Entire Lot.** The Contractor may appeal the entire Lot QA test results for the Bulk Specific Gravity of the Aggregate ( $G_{sb}$ ), Theoretical Maximum Specific Gravity ( $G_{mm}$ ), Bulk Relative Specific Gravity ( $G_{mb}$ ), Asphalt Binder Content, Gradation, and Core Thickness properties for any rejected or penalized Lot only once. Appeal of test results for the entire Lot will only be considered if just cause can be shown by the Contractor that the acceptance test results are not representative of the product placed. If the Contractor's quality control test results indicate greater deviations from the JMF than the quality assurance test results, no appeal will be allowed.

**6.3.4.1 Appeal of Lot Asphalt Binder Content and Gradation.** If the Lot Asphalt Binder Content, and/or Gradation is appealed, the Engineer will submit the referee samples obtained in 6.2.3 - Asphalt Binder Content and Gradation, for testing at the Department representative's laboratory. All original test results of the property appealed will not be considered. Only the new test results from the appeal will be used.

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**6.3.4.2 Appeal of Lot or Trial Air Void Content.** If the Lot or Trial Air Void Content is appealed, the Engineer will submit the referee samples obtained in 6.2.4 - Asphalt Air Void Content, for testing at the Department representative's laboratory. The contractor must specify which physical property is being appealed (Theoretical Maximum Specific Gravity ( $G_{mm}$ ), Bulk Relative Specific Gravity ( $G_{mb}$ ), or both). All original test results of the property appealed will not be considered. Only the new test results from the appeal will be used.

**6.3.4.3 Appeal of Lot or Trial VMA Content.** If the Lot or Trial VMA Content is appealed, the Engineer will submit the referee samples obtained in 6.2.5 - Asphalt VMA Content, for testing at the Department representative's laboratory. The contractor must specify which physical property is being appealed (Bulk Specific Gravity of the Aggregate ( $G_{sb}$ ), Theoretical Maximum Specific Gravity ( $G_{mm}$ ), Bulk Relative Specific Gravity ( $G_{mb}$ ), or all). All original test results of the property appealed will not be considered. Only the new test results from the appeal will be used.

**6.3.4.4 Appeal of Lot/Sublot or Trial Mixture Density.** If the Lot/Sublot Density or Trial Mixture Density is appealed, the Engineer will submit the appeal core samples obtained in 6.2.6 - Asphalt Density, for testing at the Department representative's laboratory.

The appeal test results shall be final and binding and shall supersede the original test results.

**6.3.4.5 Appeal of Lot or Trial Mixture Thickness.** If the Lot or Trial Mixture thickness is appealed, the Engineer will submit the appeal core samples obtained in 6.2.6 - Asphalt Density, for testing at the Department representative's laboratory. The test results from the original Lot will be discarded and superseded by the test results for the appeal samples. For thickness appeals under Work Category 1 and Work Category 2, four (4) of the five (5) test results shall meet or exceed the lift thickness tolerance specified in Table 4.24.7. For Work Category 3, all test results shall meet or exceed the lift thickness tolerance.

**6.3.5 Payment of Appeal Testing Costs.** If the new test results after the appeal process indicate that a penalty no longer applies, then the testing costs incurred by the Department during the appeal process for that Lot shall be borne by the Department. The Contractor shall be responsible for any other costs that they may incur.

If the new test results after the appeal process verify that a unit price adjustment or rejection remains valid for that Lot, the sampling and testing costs incurred by the Department during the appeal procedure shall be charged to the Contractor, as outlined in Table 4.24.10. The Contractor is responsible for any other costs that they may incur.

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**Table 4.24.7 - Acceptance and Rejection Requirements**

	Payment			Repair/Replace Reject
	Full	Increased	Reduced	
<b>Density (%) Theoretical Maximum Relative (Sample Mean)</b>				
Lot	Payment Based on Unit Price Adjustment (Per Table 4.24.11)			<89.0
<b>Asphalt Binder Content (%) (Mean of the Deviations of the Lot from the JMF)</b>				
Type A-HF, B-HF	0.0 - 0.40	N.A.	0.41 - 0.70	>0.70
Type C-HF	0.0 - 0.30	N.A.	0.31 - 0.55	>0.55
Type D-HF, E-HF	0.0 - 0.30	N.A.	0.31 - 0.55	>0.55
<b>Air Voids (%) (Mean of the Deviations of the Lot from the Target of 4%)</b>				
All Types	0.0 - 1.00	N.A.	1.01 - 2.00	>2.00
<b>VMA (%) (Average Deviation of the Lot from Mixture Type Specified Value)</b>				
Type A-HF	11.50 - 12.99	≥ 13.0	10.50 - 11.49	< 10.50
Type B-HF	12.50 - 13.99	≥ 14.0	11.50 - 12.49	< 11.50
Type C-HF	13.50 - 14.99	≥ 15.0	12.50 - 13.49	< 12.50
Type D-HF	14.50 - 15.99	≥ 16.0	13.50 - 14.49	< 13.50
Type E-HF	15.50 - 16.99	≥ 17.0	14.50 - 15.49	< 14.50
<b>Gradation (µm) (%) (Mean of the Deviations of the Lot from the JMF)</b>				
Type A, B-HF (4750)	0.00 - 6.00	N.A.	6.01 - 10.00	>10.00
-75	0.00 - 0.80	N.A.	0.81 - 1.50	>1.50
Type C-HF (4750)	0.00 - 5.00	N.A.	5.01 - 9.00	>9.00
-75	0.00 - 0.50	N.A.	0.51 - 1.20	>1.20
Type D-HF, E-HF (4750)	0.00 - 5.00	N.A.	5.01 - 9.00	>9.00
-75	0.00 - 0.50	N.A.	0.51 - 1.20	>1.20
In addition to the acceptance/rejection requirements for gradation, the following shall apply: a) The Lot will be rejected if the average of the lot test results for the 4750 µm sieve size falls outside the gradation limits specified in Table 4.24.4. b) The Lot payment will be reduced by \$5.00 per tonne, if the average of the Lot test results for the 75 µm sieve size exceeds, up to the maximum of 1.0%, the upper gradation limit specified in Table 4.24.4. c) The Lot will be rejected if the average of the Lot test results for the 75 µm sieve size exceeds, by more than 1.0%, the upper gradation limit specified in Table 4.24.4.				
<b>Thickness, % of the Number of Cores Taken Within Tolerance</b>				
Lot	≥75.0%	N.A.	N.A.	<75.0%

New Paving All Lifts (i.e. On Gravel, Pulverized or Recycled Asphalt Surfaces):

Minimum Lift Thickness Tolerance = 0.85 x specified thickness  
 Maximum Lift Thickness Tolerance = 1.15 x specified thickness

Repaving (i.e. 1<sup>st</sup> Lift Over Existing Asphalt, Including Milled Surfaces):

Minimum Lift Thickness Tolerance = 0.80 x specified thickness  
 Maximum Lift Thickness Tolerance = 1.20 x specified thickness

Repaving (i.e. 2<sup>nd</sup> Lift and Subsequent Lifts):

Minimum Lift Thickness Tolerance = 0.85 x specified thickness  
 Maximum Lift Thickness Tolerance = 1.15 x specified thickness

If the Thickness for the first lift of asphalt concrete is less than the tolerance, and a second lift of asphalt concrete is to be placed under the Contract, the Contractor shall place the second lift of the asphalt concrete to achieve a thickness equivalent to the total combined thickness required. The total first lift thickness shall be verified, for the deficient Lot, by the cores taken from the second lift of the identified deficient Lot.

**6.4 Analysis of Rejected Lots.** Following an appeal of the entire Lot, in accordance with 6.3.2 - Appeal of Test Results for the Entire Lot, if the new test results continue to indicate rejection, the new test results will be analyzed, at the discretion of the Engineer, to determine whether or not a portion of the Lot is acceptable. An analysis, as determined by the Engineer, will be carried out to determine which segments may be acceptable. If the analysis indicates partial Lot acceptance, only those areas corresponding to the sample segment(s) in which rejected material placement occurred shall be subject to 6.5.1 - Removal and Replacement. Any and all price adjustments corresponding to the recalculated test results (excluding those in the rejected segment(s)) shall apply.

**6.5 Repairs.** Rejected work shall be repaired, remedied, overlaid, or removed and replaced at the Contractor's expense. The asphalt concrete replacement or overlay shall be the same asphalt concrete mixture designation as that which was removed or overlaid. All joints and the underlying asphalt concrete mat shall be tack-coated prior to repair. Any rejected area will be subject to the repair options listed in Table 4.24.8.

The mixture tonnage associated with the repair shall be produced in accordance with this specification. The repair tonnage shall be sampled in accordance with 1.1.5 - Lot. Asphalt concrete comprising repaired areas shall be subject to testing in accordance with 6.0 - Quality Control/Quality Assurance. Unit price adjustments calculated in accordance with Tables 4.24.12, 4.24.13, 4.24.14, 4.24.15, 4.24.16, 4.24.17, and Tables 6.1 and 6.2 of the Smoothness Specification - Appendix H shall apply.

The cost of retesting shall be borne by the Contractor as listed in Table 4.24.10. All costs associated with repairs, removal and replacement, or overlays shall be the responsibility of the Contractor.

**Table 4.24.8 - Repair Requirements**

Reason for Repair	Repair Option
Smoothness	Standard Specification, Appendix H
Thickness	Removal and Replacement, Overlaying
Surface Defects, Density, Air Voids, Asphalt Binder Content, VMA, Gradation	Removal and Replacement

**6.5.1 Removal and Replacement.** Rejected Lots or segments of Lots shall be removed by cold milling the full width of the lane to the full depth of the lift in which the work is being performed. Isolated dust balls not exceeding 100 mm in any dimension as measured on the surface of the pavement shall be removed by core saw to the full depth of the lift in which the work is being performed and replaced with asphalt mixture to the satisfaction of the Engineer. Any isolated dust ball exceeding 100 mm in any dimension as measured on the surface of the pavement shall be removed by cold milling the full width of the lane to the full depth of the lift in which the work is being performed and to a minimum length of five (5) meters unless otherwise directed by the Engineer. Any 100 m<sup>2</sup> area in a paved lane where the total number of dust balls exceeds four (4) shall be removed by cold milling the full width of the lane to the full depth of the lift in

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which the work is being performed and to a length as determined by the Engineer. Any 0.1 km lane length where the total number of dust balls is greater than or equal to ten (10) the Contractor shall cease production of asphalt and the area will be subject to removal and replacement unless otherwise directed by the Engineer. Asphalt mixtures produced and in transit to the project location shall be subject to inspection upon placement and may be considered for removal and replacement. The Contractor shall not resume production or placement of asphalt mixtures for the project segment until it is proven that the asphalt mixtures are acceptable as per the Department's specifications as determined by the Engineer.

Material removed shall become the property of the Contractor, to haul and stockpile or otherwise dispose of in an environmentally acceptable manner, at the Contractor's expense.

**6.5.2 Overlaying.** Overlaying as a method of repair will only be considered in areas designated by the Engineer, for Lots or segments of Lots which are subject to rejection based on thickness. The asphalt concrete mixture used to construct the overlay shall meet the same requirements as the pavement which is overlaid. The overlay shall extend the full width of the underlying pavement surface and have a finished compacted thickness of not less than 80 mm for B-HF and 50 mm for C-HF and 40 mm for D-HF.

A keyed joint shall be constructed at each end of the overlaid section as per 5.5.3 - Keyed Joints. If an acceptable grade and cross slope cannot be achieved, the Contractor shall repair the area in accordance with 6.5.1 - Removal and Replacement. If an overlay results in the need for additional shouldering material or adjustments to guideposts and guardrail, this work shall be carried out, at the Contractor's expense, in accordance with the applicable items as per the Standard Specification.

**6.6 Dispute Resolution for Segregation.** Asphalt concrete shall be placed in accordance with the contract specifications and shall be free from segregation. Segregated areas shall be removed by cold milling the full width of the lane and full depth of the lift in which the work is being performed. The asphalt concrete mixture used to replace the segregated material shall be the same mixture type and thickness as that removed. All costs associated with this work shall be borne by the Contractor.

The Department has assigned designated technical personnel who will be contacted by the Engineer in the event of a dispute between the Engineer and the Contractor with respect to identification and removal of segregated areas.

One or more of the designated personnel will review the areas in question with the Engineer and Contractor's representative within 48 hours of notification by the Engineer. The decision of the Department's designated personnel with respect to the required action shall be final.

**7.0 METHOD OF MEASUREMENT**

The quantity of asphalt concrete to be measured for payment shall be the number of tonnes of mixture placed and accepted in accordance with this specification. The quantity of PGAB will be measured separately.

**7.1 Unit Price Adjustments.** Unit Price Adjustments calculated in accordance with Tables 4.24.11, 4.24.12, 4.24.13, 4.24.14, 4.24.15, and 4.24.16 of this specification shall apply. If the calculated total unit price adjustment for the lot (UPA<sub>LOT</sub>) results in a negative (penalty), the unit price adjustment will be adjusted according to the Work Category as per Table 4.24.9.

**Table 4.24.9**

<b>Work Category</b>	<b>Application of UPA</b>
1	100%
2	75%
3	50%
4	50%

Unit Price Adjustments as per Table 6.1 and Table 6.2 of the Smoothness Specification - Appendix H shall apply, unless otherwise noted in the contract documents.

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**7.2 Application of Unit Price Adjustments.** Unit Price Adjustments will be applied to each Lot as per Formula [1]. The Unit Price Adjustment for compacted density will be applied independently of Unit Price Adjustments determined for mixture properties. The Unit Price Adjustment for mixture properties will be largest negative Unit Price Adjustment of the following: Air Void Content, Voids in Mineral Aggregate (VMA) or the mixture constituents (p4750 µm sieve, p75 µm sieve, and AC content). A positive Unit Price Adjustment for VMA Content will only apply when there are no negative Unit Price Adjustments for other mixture properties (Air Voids, p4750 µm sieve, p75 µm sieve, and AC content) or compacted density. In addition, a positive Unit Price Adjustment for VMA Content will only apply when mixture properties (Dust to Binder Ratio and VFA) comply with Table 4.24.4.

**Formula [1]:  $UPA_{LOT} = UPA_{DEN} + UPA_{MIX}$**

where:

$UPA_{MIX}$  = the largest of applicable negative UPAs as follows:

- 1)  $UPA_{AV}$ ; or
- 2)  $UPA_{VMA}$ ; or
- 3)  $UPA_{GRAD} + UPA_{ABC}$ ; or
- 4) if  $UPA_{AV} + UPA_{GRAD} + UPA_{ABC} = 0$ , and  $UPA_{VMA} > 0$ , then  $UPA_{VMA}$  is applied.

$UPA_{LOT}$  = Total Unit Price Adjustment for the Lot.

$UPA_{DEN}$  = Average of Sublot Unit Price Adjustment for Compacted Mat Density (as per Table 4.24.11)<sup>1</sup>

$UPA_{MIX}$  = Unit Price Adjustment for Mixture Properties

$UPA_{AV}$  = Unit Price Adjustment for Air Void Content (as per Table 4.24.14)

$UPA_{VMA}$  = Unit Price Adjustment for VMA Content (as per Table 4.24.15)

$UPA_{ABC}$  = Unit Price Adjustment for Asphalt Binder Content (as per Table 4.24.12 or Table 4.24.13)

$UPA_{GRAD}$  = Unit Price Adjustment for Gradation (as per Table 4.24.16)

<sup>1</sup>) For Projects denoted as Density Category B -  $UPA_{DEN}$  = Unit Price Adjustment for the Mean of the Lot Density

**8.0 BASIS OF PAYMENT**

**8.1 Asphalt Concrete Mixtures.** Asphalt concrete mixtures will be paid for at the contract unit price per tonne for mixture incorporated and accepted in the work, which price shall be full compensation for furnishing and transporting of all materials including aggregates, natural / blend sand, PGAB, heating, hauling, handling, mixing, placing and compacting the mixture, the supply of all equipment, plant, labour, traffic control and incidentals necessary to complete the work.

PGAB used in the asphalt concrete mixture (including patching and gutter material) shall be paid as a separate item and shall be based on the average Lot Quality Assurance ignition oven burns. Unit price adjustments associated with the asphalt binder material (temperature deviations) shall apply as per Division 4, Section 2 - Performance Graded Asphalt Binder.

Price adjustments determined in accordance with this specification will be calculated on a Lot-by-Lot basis and issued on the final progress estimate.

**8.1.1 Payment for Rejected Mixture.** The Department will pay for only the original mixture quantity. The Contractor is fully responsible to bear all costs associated with repair of rejected areas, including all materials, equipment, plant, labour, traffic control and incidentals necessary to complete the work to the satisfaction of Engineer.

**Table 4.24.10 - Charges for Retesting**

Activity	Price
Smoothness Testing	Standard NSDPW Inspection Agreement Rates
Laboratory Testing	Standard NSDPW Inspection Agreement Rates

## **9.0 WARRANTY**

**9.1 Extended Warranties.** The Contractor shall provide Performance Assurance for the full duration of the longest extended warranty period (Extended Warranty). The combined Performance Assurance for the Extended Warranty period(s) for this Contract shall be in the form of a Certified Cheque, Irrevocable Standby Letter of Credit, Bank Draft, Money Order, or Contract Maintenance Bond in the amount of ten percent (10%) of the Contract value. Performance Assurance for the Extended Warranty period shall be delivered to the Engineer at least thirty (30) days prior to the beginning of the Extended Warranty period.

The Extended Warranty shall begin one year following the date of Substantial Performance. The Contractor shall supply the Department with Performance Assurance thirty (30) days prior to the beginning of the Extended Warranty period. The Extended Warranty period shall be for two (2) years. Performance Assurance shall be retained for the full duration of the Extended Warranty period.

Where the Contractor has provided a Certified Cheque, Irrevocable Standby Letter of Credit, Bank Draft, or Money Order as Contract Security and elects not to replace the original security deposit with new Performance Assurance for the Extended Warranty period, the Engineer shall retain the full amount of the Contractor's original security deposit for the duration of the Extended Warranty period.

Subject to satisfactory performance and fulfillment of all obligations under the Contract, the Contractor shall be entitled to be repaid the money so deposited, without interest.

Duration of Performance Assurance shall be as described in the following subsections:

**9.1.1 Extended Warranty - Asphalt.** Longitudinal joints in the surface course of asphalt concrete paving and the paved surface shall be subject to an Extended Warranty. Repairs shall be performed in accordance with the following subsections:

**9.1.1.1 Longitudinal Joints.** Defects and omissions as referenced in Division 1, Section 3, Subsection 39.0 of the Department's Standard Specification shall include construction related defects, at or adjacent to the longitudinal joint, such as ravelling, segregation, de-bonding, pot holing, or cracking. If defect(s) are observed at or near the longitudinal joint, within the Extended Warranty period, the Engineer will determine whether the defects are construction related.

The Contractor shall repair, at their own expense, all construction-related defects as identified by the Engineer. Cracks up to 20 mm wide shall be filled and sealed (no routing is required) in accordance with Division 4, Section 11 - Crack Filling and Crack Sealing (EPWS) of the Department's Standard Specification. Defects that cannot be repaired by crack filling and sealing shall be cold planed to a width of 600 mm and to the same depth of the surface course. Emulsified asphalt tack shall be applied to all joints and the underlying asphalt concrete.

Asphalt concrete removed by cold planing shall be replaced with the equivalent type of asphalt concrete material as that which was removed and be in accordance with this specification. The hot mix asphalt shall be compacted to 93% of the Maximum Theoretical Density (per ASTM D3202) using both a rubber-tired roller to obtain maximum compaction and a steel drum roller to obtain smoothness. Combination rollers are acceptable. The perimeter of the repaired area shall be sealed with a rubberized joint sealing material as specified in Division 4 Section 11.

**9.1.1.2 Paved Surface.** Defects and omissions as referenced in Division 1, Section 3, Sub section 39.0 of the Department's Standard Specification shall include construction related defects, on the pavement ***related to top-down ravelling, cracking, premature stripping, and/or potholing***. If defect(s) are observed on the pavement surface, within the Extended Warranty period, the Engineer will determine whether the defects are material/construction related.

The Contractor shall repair at their own expense, all construction related defects as identified by the Engineer. ***Defects shall be cold planed to a full lane width and to the same depth of the surface course.*** Emulsified asphalt tack shall be applied to all joints and the underlying asphalt concrete.

Asphalt concrete removed by cold planing shall be replaced with the equivalent type of asphalt concrete material as that which was removed and be in accordance with this specification. The hot mix asphalt shall be compacted to 93% of the Maximum Theoretical Density (per ASTM D3202) using both a rubber-tired roller to obtain maximum compaction and a steel drum roller to obtain smoothness. Combination rollers are acceptable. The perimeter of the repaired area shall be sealed with a rubberized joint sealing material as specified in Division 4 Section 11.

Table 4.24.11 – Lot/Sublot Unit Price Adjustment for Density

% of Maximum Theoretical Density	Unit Price Adjustment (\$ per Tonne)	% of Maximum Theoretical Density	Unit Price Adjustment (\$ per Tonne)
≥95.0	+2.00	91.9	-1.20
94.9	+1.90	91.8	-1.40
94.8	+1.80	91.7	-1.60
94.7	+1.70	91.6	-1.80
94.6	+1.60	91.5	-2.00
94.5	+1.50	91.4	-2.40
94.4	+1.40	91.3	-2.80
94.3	+1.30	91.2	-3.20
94.2	+1.20	91.1	-3.60
94.1	+1.10	91.0	-4.00
94.0	+1.00	90.9	-4.40
93.9	+0.90	90.8	-4.80
93.8	+0.80	90.7	-5.20
93.7	+0.70	90.6	-5.60
93.6	+0.60	90.5	-6.00
93.5	+0.50	90.4	-6.50
93.4	+0.40	90.3	-7.00
93.3	+0.30	90.2	-8.00
93.2	+0.20	90.1	-9.00
93.1	+0.10	90.0	-10.00
<b>93.0</b>	<b>0.00</b>	89.9	-11.00
92.9	-0.10	89.8	-12.00
92.8	-0.20	89.7	-13.00
92.7	-0.30	89.6	-14.00
92.6	-0.40	89.5	-15.00
92.5	-0.50	89.4	-16.00
92.4	-0.60	89.3	-17.00
92.3	-0.70	89.2	-18.00
92.2	-0.80	89.1	-19.00
92.1	-0.90	89.0	-20.00
92.0	-1.00	<89.0	Reject

a) Projects denoted as Density Category A shall have payment based on the mean of the individual sublot unit price adjustment.  
 b) Projects denoted as Density Category B shall have payment based on the unit price adjustment determined by the mean density of the lot.



Table 4.24.12 - Type A-HF and B-HF Unit Price Adjustment for Asphalt Binder Content

Mean of the Deviations of Actual Asphalt Binder Content from the JMF		Unit Price Adjustment For Asphalt Binder Content (\$ per Tonne)
A-HF, B-HF	0.00 to 0.40	0.00
	0.41 to 0.45	-1.00
	0.46 to 0.50	-2.00
	0.51 to 0.55	-3.00
	0.56 to 0.60	-4.00
	0.61 to 0.65	-5.00
	0.66 to 0.70	-6.00
	>0.70	Reject

Table 4.24.13 - Type C-HF, D-HF and E-HF Unit Price Adjustment for Asphalt Binder Content

Mean of the Deviations of Actual Asphalt Binder Content from the JMF		Unit Price Adjustment For Asphalt Binder Content (\$ per Tonne)
C-HF, D-HF, E-HF	0.00 to 0.30	0.00
	0.31 to 0.35	-1.25
	0.36 to 0.40	-2.50
	0.41 to 0.45	-3.75
	0.46 to 0.50	-5.00
	0.51 to 0.55	-6.25
	>0.55	Reject

Table 4.24.14 - Unit Price Adjustment for Air Void Content

Mean of the Deviations of Actual Air Void Content from the Target (4%)	Unit Price Adjustment For Asphalt Air Void Content (\$ per Tonne)
0.00 to 1.00	0.00
1.01 to 1.10	-0.50
1.11 to 1.20	-1.00
1.21 to 1.30	-2.00
1.31 to 1.40	-4.00
1.41 to 1.50	-6.00
1.51 to 1.60	-8.00
1.61 to 1.70	-10.00
1.71 to 1.80	-12.00
1.81 to 1.90	-14.00
1.91 to 2.00	-16.00
> 2.00	Reject

Table 4.24.15 - Unit Price Adjustment for VMA Content

Average Deviation of Actual VMA Content from the Mixture Type Specified Value	Unit Price Adjustment For VMA Content (\$ per Tonne)
$\geq + 1.00$	0.40
- 0.50 to + 0.99	0.00
- 0.51 to - 0.60	-0.50
- 0.61 to - 0.70	-0.60
- 0.71 to - 0.80	-0.70
- 0.81 to - 0.90	-0.80
- 0.91 to - 1.00	-0.90
- 1.01 to - 1.10	-1.00
- 1.11 to - 1.20	-2.00
- 1.21 to - 1.30	-3.00
- 1.31 to - 1.40	-4.00
- 1.41 to - 1.50	-5.00
> - 1.50	Reject

Table 4.24.16 - Unit Price Adjustment for Gradation

Sieve Designation (µm)	Mean of the Deviations of the Gradation from the JMF			Unit Price Adjustment for Gradation
	A-HF, B-HF	C-HF	D-HF, E-HF	\$ per Tonne
4750	0.00 to 6.00	0.00 to 5.00	0.00 to 5.00	0.00
	6.01 to 6.20	5.01 to 5.20	5.01 to 5.20	-0.50
	6.21 to 6.40	5.21 to 5.40	5.21 to 5.40	-1.00
	6.41 to 6.60	5.41 to 5.60	5.41 to 5.60	-1.50
	6.61 to 6.80	5.61 to 5.80	5.61 to 5.80	-2.00
	6.81 to 7.00	5.81 to 6.00	5.81 to 6.00	-2.50
	7.01 to 7.20	6.01 to 6.20	6.01 to 6.20	-3.00
	7.21 to 7.40	6.21 to 6.40	6.21 to 6.40	-3.50
	7.41 to 7.60	6.41 to 6.60	6.41 to 6.60	-4.00
	7.61 to 7.80	6.61 to 6.80	6.61 to 6.80	-4.50
	7.81 to 8.00	6.81 to 7.00	6.81 to 7.00	-5.00
	8.01 to 9.00	7.01 to 8.00	7.01 to 8.00	-10.00
	9.01 to 10.00	8.01 to 9.00	8.01 to 9.00	-15.00
	>10.00	>9.00	>9.00	Reject
75	0.0 to 0.80	0.0 to 0.50	0.0 to 0.50	0.00
	0.81 to 0.90	0.51 to 0.60	0.51 to 0.60	-1.00
	0.91 to 1.00	0.61 to 0.70	0.61 to 0.70	-2.00
	1.01 to 1.10	0.71 to 0.80	0.71 to 0.80	-3.00
	1.11 to 1.20	0.81 to 0.90	0.81 to 0.90	-5.00
	1.21 to 1.30	0.91 to 1.00	0.91 to 1.00	-7.50
	1.31 to 1.50	1.01 to 1.20	1.01 to 1.20	-12.00
	>1.50	>1.20	>1.20	Reject
<p>In addition to the acceptance/rejection requirements for gradation, the following shall apply:</p> <p>a) The Lot will be rejected if the average of the Lot test results for the 4750 µm sieve size falls outside the gradation limits specified in Table 4.24.4.</p> <p>b) The Lot payment will be reduced by \$5.00 per tonne if the average of the Lot test results for the 75 µm sieve size exceeds, up to the maximum of 1.0%, the upper gradation limit specified in Table 4.24.4.</p> <p>c) The Lot will be rejected if the average of the Lot test results for the 75 µm sieve size exceeds, by more than 1.0%, the upper gradation limit specified in Table 4.24.4.</p>				