Saskatchewan Highways and Transportation

4100 – SPECIFICATION FOR ASPHALT CONCRETE

Table of Contents

TABLES

4100.1 GENERAL

4100.1.1 Description

4100.1.1.1 The work shall consist of mixing crushed aggregates, or a combination of crushed aggregates and reclaimed asphalt concrete, blender sand material as required, additives as required, and asphalt in a hot mix plant; and spreading and compacting the mixture on a prepared surface.

4100.1.2 Definitions

4100.1.2.1 The following definitions shall apply for this specification:

4100.1.2.1.1 Acceptance Limit is the maximum or minimum value for a test result above or below which the block and/or lot will be rejected.

4100.1.2.1.2 Acceptance Testing is the testing performed by the Engineer to determine compliance with the specifications regarding specified requirements, limits and tolerances for the quality of materials and workmanship supplied.

4100.1.2.1.3 Adjusted PrI is the adjusted profile results for smoothness in a block in which individual bumps and dips greater than 12 mm have been removed. The adjusted PrI in a block will be recalculated by removing the individual PrI results corresponding to the location of individual bumps and dips that are greater than 12 mm.

4100.1.2.1.4 Asphalt is the asphalt material being added as bituminous binder.

4100.1.2.1.5 Asphalt Concrete is the asphalt mix in place on the road including levelling and surface courses during and after spreading and compacting.

4100.1.2.1.6 Asphalt Mix is the mix after the asphalt mix aggregate and asphalt have been blended together.

4100.1.2.1.7 Asphalt Mix Aggregate is the aggregate after combining all virgin aggregates, additives and reclaimed asphalt concrete aggregate.

4100.1.2.1.8 Asphalt Mix Design is the laboratory determination of the precise proportions of asphalt, reclaimed asphalt concrete, additives, and all virgin aggregates to be blended together to meet the specified properties for the asphalt mix.

4100.1.2.1.9 Asphalt Mix Formula is the field determination during the plant calibration process of the precise proportions of asphalt, reclaimed asphalt concrete, additives, and all virgin aggregates to be blended together to meet the specified properties for the asphalt mix as produced at the plant.

4100.1.2.1.10 Block is the unit of measurement for assessing smoothness and individual bumps and dips. A block is a portion of the final lift of asphalt concrete that is one paver width wide and 100 m long. The first and last block on a construction section may be less than 100 m long.

4100.1.2.1.11 Density

4100.1.2.1.11.1 Asphalt Mix Design Density is the Marshall density for the compacted Asphalt Mix Design specimen (see 4100.1.2.1.8 above).

4100.1.2.1.11.2 Asphalt Mix Formula Density is the Marshall density for the compacted Asphalt Mix Formula specimen (see 4100.1.2.1.9 above).

4100.1.2.1.11.3 Field Density is the density of the Asphalt Concrete as determined by STP 204 – 6, Density-In-Place By Nuclear Gauge.

4100.1.2.1.11.4 Job Mix Formula Density is the Marshall density for the compacted Job Mix Formula specimen (see 4100.1.2.1.13 below).

4100.1.2.1.11.5 Specified Marshall Density is 97% of the 3-point moving average Marshall Density established for the Asphalt Mix Formula or the Job Mix Formula, whichever is in use.

4100.1.2.1.11.6 Target Density is the density established through the rolling pattern strip when the Specified Marshall Density is not achievable.

4100.1.2.1.12 Individual Bump And/Or Dip is a bump or dip measured in the vertical direction that exceeds 12 mm.

4100.1.2.1.13 Job Mix Formula is the field determination of the precise proportions of asphalt, reclaimed asphalt concrete, additives, and all virgin aggregates to be blended together to meet the specified properties for the asphalt mix as produced at the plant.

4100.1.2.1.14 Lot is approximately 200 tonnes of asphalt concrete which is assessed as a unit for the purpose of payment and selected to represent work produced by essentially the same process and materials. The final lot on a project may vary in mass from 101 t to 300 t.

4100.1.2.1.15 Mean is the arithmetic average of the test results within a lot.

4100.1.2.1.16 Moving Average is the arithmetic mean of 3 consecutive test results.

4100.1.2.1.17 Profile Index (PrI) is the sum of the vertical deviations, in millimetres, outside the 5 mm null band that a roadway deviates from a perfectly flat surface over a horizontal distance of 100 m. The PrI categories are as follows:

4100.1.2.1.17.1 Category I PrI applies to all blocks not identified below as Category II PrI.

4100.1.2.1.17.2 Category II PrI applies to the following circumstances:

4100.1.2.1.17.2.1 Curves with radius less than 600 m;

4100.1.2.1.17.2.2 Blocks within 50 m of a bridge or railway crossing;

4100.1.2.1.17.2.3 Single lift rehabilitation projects where the total thickness of asphalt concrete being placed is 50 mm or less, with the exception of profiled-milled sections;

4100.1.2.1.17.2.4 Areas where there is curb and gutter; and

4100.1.2.1.17.2.5 The block at each construction limit.

4100.1.2.1.18 Reclaimed Asphalt Concrete is asphalt concrete reclaimed from the roadway.

4100.1.2.1.19 Reclaimed Asphalt Concrete Aggregate is the aggregate remaining after the asphalt has been extracted from the Reclaimed Asphalt Concrete.

4100.1.2.1.20 Repair

4100.1.2.1.20.1 Class I Repair is a corrective improvement that removes and replaces, or overlays the defective or damaged block(s) or lot(s) and restores the block(s) or lot(s) to the specified standard.

4100.1.2.1.20.2 Class II Repair is a surface treatment that mends or corrects a structural defect to restore the surface to an acceptable standard (e.g. slurry seal).

4100.1.2.1.20.3 Class III Repair is a surface treatment that mends or corrects a surface defect but does not restore the surface to an acceptable standard (e.g. flush coat).

4100.1.2.1.20.4 Class IV Repair is a corrective improvement to the ride by reducing bump(s) and/or dip(s). An acceptable Class IV repair is one which removes or reduces the bump(s) and/or dip(s) through a smooth transition to the surrounding asphalt concrete without impairing the functionality and/or structural characteristics in the area of the bump(s) and/or dip(s).

4100.1.2.1.21 Segregated Area is an area 0.1 m^2 or greater where the surface texture is either too stony or lacking in continuous matrix of asphalt, fine aggregate and coarse aggregate in relation to the surrounding acceptable asphalt concrete.

4100.1.2.1.22 Segregation Severity

4100.1.2.1.22.1 None means a completely uniform surface texture. The matrix of asphalt and fine aggregate is in place between the coarse aggregate.

4100.1.2.1.22.2 Minor means significantly more stone is visible than in the surrounding acceptable asphalt concrete, usually with a lack of continuous contact with the surrounding matrix.

4100.1.2.1.22.3 Severe means areas that usually appear as very stony mix, with stone against stone, and may be missing matrix.

4100.1.2.1.23 Smoothness means the surface profile of the asphalt concrete with the Profile Index (PrI) as the measured output. Individual bumps and/or dips of 12 mm or less are considered a part of smoothness.

4100.1.2.1.24 Surface Defects that are due to the Contractor's operation shall include, but shall not be limited to the following:

4100.1.2.1.24.1 Areas of segregation less than 0.1 m^2;

4100.1.2.1.24.2 Areas containing excess or insufficient asphalt;

4100.1.2.1.24.3 Areas of open texture;

4100.1.2.1.24.4 Improper matching of longitudinal and transverse joints on final lift of asphalt concrete;

4100.1.2.1.24.5 Roller marks on final lift of asphalt concrete;

4100.1.2.1.24.6 Cracking or tearing;

4100.1.2.1.24.7 Contamination by diesel, hydraulic fluids, detergent or other harmful products;

4100.1.2.1.24.8 Foreign objects or materials that are detrimental to the asphalt concrete; and

4100.1.2.1.24.9 Clay balls or oversized materials.

4100.2 MATERIALS

4100.2.1 Asphalt

4100.2.1.1 The Department will supply and pay for the asphalt.

4100.2.2 Aggregate

4100.2.2.1 Virgin aggregate shall be composed of sound, hard and durable particles of sand, gravel and rock, free from injurious quantities of elongated, soft or flaky particles, shale, clay, loam, ironstone, coal and organic or other deleterious material.

4100.2.3 Anti-Stripping Agents

4100.2.3.1 The Department will supply and pay for the anti-stripping agents.

4100.3 CONSTRUCTION

4100.3.1 Department Owned or Controlled Aggregate Sources

4100.3.1.1 The following shall apply to Department owned or controlled aggregate sources shown on the plans or as described in the Special Provisions:

4100.3.1.1.1 Overburden shall be removed from material deposits in accordance with Specification 2260 For The Removal Of Overburden.

4100.3.1.1.2 Rock passing a 610 mm square opening screen and larger than the maximum specified size shall be crushed and incorporated simultaneously throughout the crushing operation.

4100.3.1.1.3 Aggregate stockpiles shall be constructed in accordance with Specification 3600 For Stockpiling Aggregates.

4100.3.2 Binder, Filler and Blender Sand

4100.3.2.1 Filler and blender shall be provided in accordance with Specification 3400 For Binder, Filler And Blender Sand.

4100.3.3 Anti-Stripping Agents

4100.3.3.1 The Department will determine whether or not anti-stripping agent is required.

4100.3.3.2 When the Department has determined that anti-stripping agent is required, the Engineer will determine if hydrated lime or liquid anti-stripping agent shall be used.

4100.3.3.3 Hydrated Lime

4100.3.3.3.1 When hydrated lime is used, the following shall apply:

4100.3.3.3.1.1 The Contractor shall supply the equipment necessary to add the lime.

4100.3.3.3.1.2 The hydrated lime shall be blended by a pugmill into the cold aggregate feed.

4100.3.3.3.1.3 Sufficient water shall be added at the pugmill to ensure a minimum of 3% moisture content in the aggregate.

4100.3.3.3.1.4 The amount of hydrated lime added shall be approximately 1% of the total dry aggregate by weight, or as designated by the Engineer, for the Job Mix Formula.

4100.3.3.3.1.5 The Contractor shall ensure the procedures and equipment used for the addition of hydrated lime anti-stripping agent are adequate to ensure that the hydrated lime is added at a uniform consistent rate.

4100.3.3.3.1.6 The Contractor shall maintain records containing bills of lading, estimated quantities on hand, estimated quantities used, and at the completion of the project, the estimated unused quantity. The record of estimated usage shall be provided to the Engineer on a daily basis.

4100.3.3.3.1.7 At the end of the project the bulk measurement of the hydrated lime used on the project shall not deviate by more than 25% from the specified percentage designated by the Job Mix Formula. If the final amount of hydrated lime used on the project exceeds 125% of the specified percentage designated by the Job Mix Formula, the Department will deduct the cost of the hydrated lime used in excess of 125% from the Final Progressive Estimate. If the final amount of hydrated lime used on the project is less than 75% of the specified percentage designated by the Job Mix Formula, the Contractor shall perform at his expense a Class I repair on the asphalt concrete in a manner acceptable to the Engineer.

4100.3.3.4 Liquid Anti-Stripping Agent:

4100.3.3.4.1 When a liquid anti-stripping agent is used, the following shall apply:

4100.3.3.4.1.1 The Contractor shall supply the equipment necessary to add a liquid anti-stripping agent.

4100.3.3.4.1.2 The addition of liquid anti-stripping agent shall be accomplished through the use of a liquid anti-strip injection system containing a positive displacement pump with a variable speed motor, a totalizing flow meter, a sampling valve, a system check valve, a system isolation valve and an inline check valve. The injector pump motor shall be regulated by a signal from the asphalt flow meter.

4100.3.3.4.1.3 Liquid anti-stripping agent will be injected into the plant asphalt line just prior to entry into the drum mixer.

4100.3.3.4.1.4 The system shall be capable of regulating the flow rate resulting in consistent flow rate of liquid anti-stripping agent.

4100.3.3.4.1.5 The system shall be capable of re-circulating the liquid anti-stripping agent to the storage tank until the asphalt plant bypass valve is actuated.

4100.3.3.4.1.6 Liquid anti-stripping agent shall be added at a rate of approximately 1.0% of the weight of liquid asphalt added, or as designated by the Engineer, for the Job Mix Formula.

4100.3.3.4.1.7 The Contractor shall maintain records containing bills of lading, estimated quantities on hand, estimated quantities used, damaged barrels, and at the completion of the project, any estimated quantities of unused anti-stripping agent. The Contractor shall provide the record of estimated usage to the Engineer on a daily basis.

4100.3.3.4.1.8 At the end of the project the bulk measurement of the liquid anti-stripping agent used on the project shall not deviate by more than 10% from the specified percentage designated by the Job Mix Formula. If the final amount of liquid anti-stripping agent used on the project exceeds 110% of the specified percentage designated by the Job Mix Formula, the Department will deduct the cost of the liquid anti-stripping agent used in excess of 110% from the Final Progressive Estimate. If the final amount of liquid anti-stripping agent used on the project is less than 90% of the specified percentage designated by the Job Mix Formula, the Contractor shall perform at his expense a Class I repair on the asphalt concrete.

4100.3.3.4.1.9 The Contractor shall handle all barrels of liquid anti-stripping agent in such a manner that they can be returned to the supplier. The full cost of any barrels damaged such that they cannot be returned to the supplier, or any environmental clean-up required, will be charged back to the Contractor, and deducted from the Final Progressive Estimate. If the Contractor uses liquid anti-stripping in bulk, the full cost of any environmental clean-up required will be charged back to the Contractor and deducted from the Final Progressive Estimate.

4100.3.4 Aggregate

4100.3.4.1 The Contractor shall split the aggregate into 3 separate stockpiles in accordance with the following:

4100.3.4.1.1 The natural fines stockpile shall be produced by screening the raw aggregate over a maximum 9.0 mm square opening screen or 5.0 mm slotted screen prior to crushing.

4100.3.4.1.2 The aggregate retained on the screen shall be crushed and split into crushed coarse and crushed fine stockpiles.

4100.3.4.1.3 The crushed coarse stockpile shall contain no more than 10% of the material passing the 5.0 mm square opening sieve.

4100.3.4.1.4 The crushed fine stockpile shall contain no less than 90% of the material passing the 5.0 mm square opening sieve.

4100.3.4.1.5 The Contractor shall provide accurate measurements of quantities and percentages of aggregate being placed in each stockpile after producing 50% of the aggregate or 10 000 t, whichever is greater; or when all the aggregate is produced if the total quantity is less than 10 000 t. If the splits provided by the Contractor prove to be inaccurate and result in an aggregate shortage, securing additional equivalent aggregate shall be at the Contractor's expense.

4100.3.4.2 The crushed coarse, crushed fines, and natural fines stockpiles shall be mathematically recombined at the percentages provided by the Contractor. If the resulting aggregate does not meet the requirements of Table 4100.3.T1, the Contractor shall be required to reject a fraction of the material in the natural fines stockpile in accordance with General Provision 1500.2.8.

4100.3.4.3 If recycled asphalt concrete is designated in the contract, the following shall apply:

4100.3.4.3.1 The reclaimed asphalt concrete shall not exceed 40 mm when measured in any direction before entering the plant.

4100.3.4.3.2 The crushed coarse, crushed fines, natural fines and reclaimed asphalt concrete stockpiles shall be mathematically recombined at the percentages provided by the Contractor. If the resulting aggregate does not meet the requirements of Table 4100.3.T1, the Contractor shall be required to reject a fraction of the material in the natural fines stockpile in accordance with General Provision 1500.2.8.

4100.3.5 Asphalt Mix Design

4100.3.5.1 The asphalt mix design will be established by the Engineer in accordance with the requirements for Marshall Mix Design (STP 204-10) within 10 calendar days after 50% of the aggregate has been produced or 10 000 t, whichever is greater, and provided that the Contractor has complied with Section 4100.3.4.1.5.

4100.3.5.2 Further to Section 4100.3.4.1.5, if the Department is required to do an additional mix design because the splits provided by the Contractor prove to be inaccurate, the Contractor will be assessed the rate specified in the Special Provisions.

4100.3.5.3 The asphalt mix design type will be specified in the Special Provisions. The asphalt mix characteristics shall meet the requirements in Table 4100.3.T1.

TABLE 4100.3.T1

ASPHALT CONCRETE MIX DESIGN TYPES AND CHARACTERISTICS

Mix Design Type/ Design Factors -Mix Characteristics	**1**	**2**	**3**	**4**	**5**	**6**
Asphalt Type	150-200 A or 200-300 A			150-200 A or 200-300 A		
Marshall Blows	50 blows			75 blows		
Aggregate Type/Sieve Designation*	70 or 70 R	71 or 71 R	72 or 72 R	70 or 70 R	71 or 71 R	72 or 72 R
18.0 mm	100.0			100.0		
16.0 mm	78.0 – 98.0	100.0		78.0-98.0	100.0	
12.5 mm	68.0 – 92.0	78.0 – 98.0	100.0	68.0 – 92.0	78.0 – 98.0	100.0
9.0 mm	54.0 – 80.0	66.0 – 90.0	66.0 – 90.0	54.0 – 80.0	66.0 – 90.0	66.0 – 90.0
5.0 mm	38.0 – 65.0	46.0 – 72.0	46.0 – 72.0	38.0 – 65.0	46.0 – 72.0	46.0 – 72.0
2.0 mm	18.0 – 46.0	23.0 – 51.0	23.0 – 51.0	18.0 – 46.0	23.0 – 51.0	23.0 – 51.0
900 um	10.0 – 33.0	15.0 – 37.0	15.0 – 37.0	10.0 – 33.0	15.0 – 37.0	15.0 – 37.0
400 um	5.0 – 25.0	10.0 -- 27.0	10.0 -- 27.0	5.0 – 25.0	10.0 – 27.0	10.0 – 27.0
160 um	3.0 – 13.0	3.0 – 14.0	3.0 – 14.0	3.0 – 13.0	3.0 – 14.0	3.0 – 14.0
71 um	2.0 – 9.0	2.0 – 9.0	2.0 – 9.0	2.0 – 9.0	2.0 – 9.0	2.0 – 9.0
Air Voids, %	3.0 – 5.0					
Air Voids (Field), %	4.0 – 9.0					
Deleterious Material, Maximum % **	2.0					
Film Thickness, Minimum um	7.5					
Flow, mm	1.5 – 3.5					
Fracture, Minimum % ***	60.0	70.0	80.0	75.0	85.0	95.0
Lightweight Aggregate, Maximum %	1.0					
Retained Stability, Minimum %	70.0					
Sand Equivalent, Minimum	45					
Stability, Minimum N	5500			7000		
Voids Filled, %	65.0 - 78.0					
V. M. A., %	13.5 – 15.5	14.0 – 16.0	14.0 – 16.0	13.5 – 15.5	14.0 – 16.0	14.0 – 16.0

*A tolerance of 3% in the percent by weight retained on the maximum size sieve will be permitted providing 100% of the oversize passes the 22.4 mm sieve for Type 70 and Type 70 R aggregate, the 18.0 mm sieve for Type 71 and 71 R aggregate and the 16 mm sieve for Type 72 and 72 R aggregate.

**Deleterious material includes all other injurious material other than lightweight pieces.

** *The Fractured Face percentage will be calculated on the aggregate after combining all virgin aggregates and additives, excluding reclaim.

TABLE 4100.3.T1 *continued*

ASPHALT CONCRETE MIX DESIGN TYPES AND CHARACTERISTICS

Mix Design Type/ Design Factors - Mix Characteristics	**7**	**8**	**9**	**10**	**11**	**12**
Asphalt Type	300-400 A			300-400 A		
Marshall Blows	50 blows			75 blows		
Aggregate Type/Sieve Designation*	70 or 70 R	71 or 71 R	72 or 72 R	70 or 70 R	71 or 71 R	72 or 72 R
18.0 mm	100.0			100.0		
16.0 mm	78.0 – 98.0	100.0		78.0-98.0	100.0	
12.5 mm	68.0 – 92.0	78.0 – 98.0	100.0	68.0 – 92.0	78.0 – 98.0	100.0
9.0 mm	54.0 – 80.0	66.0 – 90.0	66.0 – 90.0	54.0 – 80.0	66.0 – 90.0	66.0 – 90.0
5.0 mm	38.0 – 65.0	46.0 – 72.0	46.0 – 72.0	38.0 – 65.0	46.0 – 72.0	46.0 – 72.0
2.0 mm	18.0 – 46.0	23.0 – 51.0	23.0 – 51.0	18.0 – 46.0	23.0 – 51.0	23.0 – 51.0
900 um	10.0 – 33.0	15.0 – 37.0	15.0 – 37.0	10.0 – 33.0	15.0 – 37.0	15.0 – 37.0
400 um	5.0 – 25.0	10.0 – 27.0	10.0 – 27.0	5.0 – 25.0	10.0 – 27.0	10.0 – 27.0
160 um	3.0 – 13.0	3.0 – 14.0	3.0 – 14.0	3.0 – 13.0	3.0 – 14.0	3.0 – 14.0
71 um	2.0 – 9.0	2.0 – 9.0	2.0 – 9.0	2.0 – 9.0	2.0 – 9.0	2.0 – 9.0
Air Voids, %	3.0 – 5.0					
Air Voids (Field), %	4.0 – 9.0					
Deleterious Material, Maximum % **	2.0					
Film Thickness, Minimum um	7.5					
Flow, mm	1.5 – 3.5					
Fracture, Minimum % ***	50.0	60.0	70.0	75.0	85.0	95.0
Lightweight Aggregate, Maximum %	1.0					
Retained Stability, Minimum %	70.0					
Sand Equivalent, Minimum	45.0					
Stability, Minimum N	5500			7000		
Voids Filled, %	65.0 - 78.0					
V. M. A., %	13.5 – 15.5	14.0 – 16.0	14.0 – 16.0	13.5 – 15.5	14.0 – 16.0	14.0 – 16.0

*A tolerance of 3% in the percent by weight retained on the maximum size sieve will be permitted providing 100% of the oversize passes the 22.4 mm sieve for Type 70 and Type 70 R aggregate, the 18.0 mm sieve for Type 71 and 71 R aggregate and the 16 mm sieve for Type 72 and 72 R aggregate.

**Deleterious material includes all other injurious material other than lightweight pieces.

** *The Fractured Face percentage will be calculated on the aggregate after combining all virgin aggregates and additives, excluding reclaim.

4100.3.6 Plant Requirements

4100.3.6.1 A uniform mixture shall be produced in which all particles are thoroughly coated. Aggregate particles shall not be coated with residue from fuel combustion. The asphalt mix shall contain no more than 0.5% moisture by weight.

4100.3.6.2 If reclaimed asphalt concrete is added, the following shall apply:

4100.3.6.2.1 The plant shall contain equipment that will prevent the reclaimed asphalt concrete from coming into direct contact with the flame, thus minimizing oxidation of the asphalt in the reclaimed asphalt concrete.

4100.3.6.2.2 The Contractor shall undertake all the necessary adjustments to ensure proper heat transfer and breakdown of the reclaimed asphalt concrete to form a homogeneous end product. The plant shall be capable of heating the reclaimed asphalt concrete particles and blending them with virgin aggregate and any required asphalt to create a homogeneous mix at the plant discharge.

4100.3.7 Plant Calibration and Operation

4100.3.7.1 Plant Calibration:

4100.3.7.1.1 The Contractor shall provide the Engineer with at least three calendar days advance notice of when he plans to do the plant calibration.

4100.3.7.1.2 During plant calibration, the Engineer will assess the property variations of the asphalt mix produced during the calibration process against the asphalt mix design.

4100.3.7.1.3 If the asphalt mix meets the properties and/or characteristics as shown in Table 4100.3.T1, the Contractor may commence hauling to the road upon receiving written approval from the Engineer.

4100.3.7.1.4 The asphalt mix will be rejected if the requirements of Table 4100.3.T1 are not met, and no asphalt mix shall be hauled to the road. The Engineer will provide a modified or new asphalt mix design.

4100.3.7.1.5 After 24 hours of asphalt mix production, if the asphalt mix properties are consistent and meet all specified requirements, the Engineer will approve the Asphalt Mix Formula as the Job Mix Formula.

4100.3.7.2 Plant Operation

4100.3.7.2.1 For the initial 24 hours of plant production at each plant set-up, the asphalt added shall not vary by more than 0.5% from the design asphalt content. Full-scale plant production shall not commence until the percentage of asphalt added to trial batches of asphalt mix complies with the foregoing requirement.

4100.3.7.2.2 After the initial 24 hours of production, the Contractor shall cease operations if the moving average of asphalt added varies by more than 0.3% from the Job Mix Formula.

4100.3.7.2.3 After the Job Mix Formula aggregate gradation has been established, the following shall apply:

4100.3.7.2.3.1 The Contractor shall cease operations if the moving average for any sieve does not comply with the specified requirements listed below:

TABLE 4100.3.T2

MAXIMUM PERMISSIBLE SIEVE VARIATION

Maximum Permissible Variation from the Job Mix Formula	
Sieve Designation	Percent By Weight Passing Canadian Metric Sieve Series
16.0 mm	±5.0
12.5 mm	±5.0
9.0 mm	±5.0
5.0 mm	±5.0
2.0 mm	±4.0
900 um	±3.0
400 um	±3.0
160 um	±2.0
71 um	±1.5

4100.3.7.2.3.2 Road operations shall not recommence until the specified requirements are met.

4100.3.7.2.3.3 Upon re-commencement of operations, the specified requirements shall be met on each of the initial 2 tests.

4100.3.7.2.3.4 Failure to cease operations shall subject all subsequent materials to the requirements of General Provision 1400-7 (Unacceptable and Unauthorized Work).

4100.3.7.2.4 The Contractor shall immediately shut down the plant when:

4100.3.7.2.4.1 The stack emissions temperature exceeds the asphalt mix temperature at the mixer discharge by more than 20°C or;

4100.3.7.2.4.2 The temperatures exceed the limits outlined in the following table:

TABLE 4100.3.T3

TEMPERATURE LIMITS

Grade of Asphalt	Degrees Celsius		
	Maximum Temperature of Dry Aggregate	Asphalt Storage Temperature	Asphalt Mix Temperature at Mixer Discharge
150-200A	160	120-175	135-155
200-300A	160	120-175	130-150
300-400A	150	114-175	120-140
400-500A	140	110-175	110-130

4100.3.7.2.5 All material produced subsequent to the occurrence of an event specified in Section 4100.3.7.2.4 will be deemed to be unacceptable material for the purposes of General Provision 1400-7 (Unacceptable And Unauthorized Work).

4100.3.7.2.6 Plant operations shall not recommence until the temperature limits in Section 4100.3.7.2.4 are met.

4100.3.7.2.7 The Contractor shall dispose of any rejected asphalt mix or asphalt concrete in a manner that is acceptable by the Engineer.

4100.3.8 Delivering to the Road

4100.3.8.1 Truck boxes shall be clean and free from accumulations of asphalt mix and foreign materials. Excess truck box lubricants such as light oil, detergent, lime solutions, gasoline, kerosene, diesel or other similar products shall not be allowed to contaminate the asphalt mix, and shall be disposed of in an environmentally acceptable manner.

4100.3.8.2 Every truck used to transport the asphalt mix shall be equipped with a tarpaulin which is waterproof and can be securely fastened, when required, to protect the asphalt mix from precipitation and excessive heat loss.

4100.3.8.3 Prior to unloading into the paver, the temperature at a depth of 40 mm below the surface of the asphalt mix in the truck box shall not be less than 110°C.

4100.3.8.4 Trucks shall be turned around only at approaches.

4100.3.9 Pavers

4100.3.9.1 Pavers shall be self-propelled units capable of spreading and finishing the asphalt concrete to the specified typical cross section and thickness shown on the paving plans. For traffic lanes, pavers shall be operated using the following:

4100.3.9.1.1 Automatic screed controls, for the control of longitudinal and transverse slope and joint matching. The automatic control device shall be capable of being operated from either side of the paver.

4100.3.9.1.2 Vibrating screed

4100.3.10 Spreading

4100.3.10.1 If designated by the Engineer, a tack coat shall be applied in accordance with Specification 4000 For Asphalt Prime, Tack and Flush Coat.

4100.3.10.2 Asphalt mix shall be spread on dry, clean, and unfrozen surfaces.

4100.3.10.3 Asphalt concrete shall be placed in accordance with the following temperature limitations:

4100.3.10.3.1 Paving may begin, for other than the final lift, when the temperature is 0°C provided the temperature is forecast, by Environment Canada, for the closest location to the project, to reach at least 5°C that day.

4100.3.10.3.2 The final lift of asphalt concrete shall not be placed if:

4100.3.10.3.2.1 The atmospheric temperature is less than 5°C; or

4100.3.10.3.2.2 The surface temperature is less than 7°C.

4100.3.10.4 The minimum and maximum thickness of a compacted lift of asphalt concrete shall meet the following requirements:

TABLE 4100.3.T4

MINIMUM AND MAXIMUM LIFT THICKNESS

Lift	Type 70 or 70 R Aggregate		Type 71 or 71 R Aggregate		Type 72 or 72 R Aggregate	
	Minimum Thickness	Maximum Thickness	Minimum Thickness	Maximum Thickness	Minimum Thickness	Maximum Thickness
Top	40 mm	60 mm	35 mm	50 mm	30 mm	50 mm
Lower	30 mm	60 mm	30 mm	50 mm	25 mm	50 mm

4100.3.10.5 The following clause shall apply only when shimming and levelling are specified in the Special Provisions as being applicable to the Contract.

4100.3.10.5.1 The Contractor shall shim and level any pavement depressions designated by the Engineer. The use of a motor grader and hand raking will be permitted.

4100.3.10.5.2 All work involved with shimming and levelling will be paid for at the contract unit bid price(s) where applicable.

4100.3.10.5.3 The Contractor shall complete all shimming and levelling operations such that the material has cooled sufficiently before the placement of asphalt concrete.

4100.3.10.6 Longitudinal joints shall not be permitted in the lane. Longitudinal joints shall be vertical butt type, well bonded and sealed, and finished to provide a continuous, smooth profile across the joint.

4100.3.10.7 The asphalt mix temperature in the paver shall not be less than 110°C.

4100.3.10.8 Contact faces of curbs, gutters, manholes, and sidewalks shall be coated with asphalt using a hand applicator before placing the asphalt mix.

4100.3.10.9 When paving is discontinued on the roadway, the asphalt concrete shall be temporarily feathered to a slope of 10 horizontal to 1 vertical. When paving is resumed, the transverse joint shall be straight and have a vertical face when the taper is removed.

4100.3.10.10 Asphalt mix shall not be placed or allowed to fall on previously laid top lift asphalt concrete or the existing asphalt concrete.

4100.3.10.11 Transverse construction joints from one lift to the next shall be separated by at least 2 m.

4100.3.10.12 Road intersections and approaches shall be paved in accordance with the plans or as directed by the Engineer.

4100.3.10.13 If designated by the Engineer, a flush coat shall be applied in accordance with Specification 4000 For Asphalt Prime, Tack and Flush Coat.

4100.3.11 Compacting

4100.3.11.1 At the beginning of the work, the Contractor shall establish a rolling pattern for achieving the Specified Marshall Density. The rolling pattern strip shall comply with the following:

4100.3.11.1.1 The rolling pattern strip shall have a length of at least 250 m and shall be of the same thickness as the lift it represents.

4100.3.11.1.2 The material used shall conform to the requirements of the asphalt concrete stated in the contract or as specified by the Engineer.

4100.3.11.1.3 The Engineer and/or the Contractor at any time may order the construction of a new rolling pattern strip if there are reasons to indicate that the paving operation, the mix design or lift thickness have been altered.

4100.3.11.1.4 Compaction shall commence immediately and shall be completed before the temperature of the asphalt concrete falls below 55°C for 150-200 A and 200-300 A asphalt concrete mixes, and 40°C for 300-400 A and 400-500 A asphalt concrete mixes.

4100.3.11.1.5 Compaction shall continue until the Specified Marshall Density is achieved or until no appreciable increase in the Field Density can be achieved, even with the use of fully ballasted pneumatic tired rollers with a minimum tire pressure of 620 kPa and having the tire size and wheel load indicated in the table below:

TABLE 4100.3.T5

ROLLER TIRE SIZE AND MINIMUM LOAD

Tire Size (mm)	Minimum Load Per Tire (kg)
190.5 x 381.0	950
228.5 x 508.0	1 300
279.4 x 508.0	1 900

4100.3.11.1.6 The speed of steel rollers shall not exceed 5 km/h and the speed of pneumatic rollers shall not exceed 8 km/h.

4100.3.11.1.7 The rolling pattern strip, if accepted, shall remain in place and shall become part of the completed work.

4100.3.11.2 If the Specified Marshall Density is not achieved, then the value of the Field Density achieved after complying with Section 4100.3.11.1 will be used as the Target Density. Job Mix Formula Densities will continue to be taken, and should change occur in Field Density, lift thickness, or the lane being paved, the Engineer may direct that the Specified Marshall Density control procedure be re-established.

4100.3.11.3 Each lift of asphalt concrete shall be compacted to the Specified Marshall Density established for the lot in accordance with the following:

4100.3.11.3.1 The Specified Marshall Density for the lot will be established using a 3-point moving average.

4100.3.11.3.2 When a new moving average is initiated, it will include the entire lot where the sample is taken and will apply to subsequent lots until the next 3-point moving average is established.

4100.3.11.3.3 A new moving average will be initiated for each new asphalt mix design.

4100.3.11.4 Longitudinal joints shall be rolled directly behind the paver.

4100.3.11.5 All asphalt mix shall be thoroughly compacted, and after final rolling, the finished surface of the mat shall be free from segregation, waves, hairline cracks, and other obvious defects.

4100.3.11.6 Traffic shall not be allowed to travel on the finished surface until the surface has cooled to a temperature as to ensure that no deformation or other defects to the surface will occur.

4100.4 SAMPLING AND TESTING

4100.4.1 General

4100.4.1.1 The failure of the Engineer to provide test results within the time provided in this specification shall not relieve the Contractor of his obligation to remedy any defect, but the Department will be obligated to reimburse the Contractor for any additional costs incurred by the Contractor to remedy the defect, if the additional costs are attributable to the delay in receiving results.

4100.4.2 Acceptance Testing

4100.4.2.1 General

4100.4.2.1.1 Within this specification, certain requirements, limits and tolerances are specified regarding the quality of materials and workmanship to be supplied. Compliance with these requirements, where so specified, will be judged by testing as described in this section. These tests cannot be disputed on the grounds of statistical theory or a specified or implied Contractor's risk.

4100.4.2.1.2 The results of acceptance testing for Field Density, smoothness, individual bumps and dips, segregation and surface defects will be used for acceptance, rejection and pay adjustments for the block or lot.

4100.4.2.1.3 Initial acceptance testing will be performed free of cost to the Contractor.

4100.4.2.1.4 If the remedial work by the Contractor on a rejected block or lot involves a repair of the asphalt concrete in the block or lot, all test results from acceptance testing performed on the rejected block or lot prior to the remedial work will be discarded and new sampling and acceptance testing will be performed in accordance with Section 4100.4.2.2.

4100.4.2.2 Sampling and acceptance testing will be in accordance with the following:

4100.4.2.2.1 For **Field Density**:

4100.4.2.2.1.1 The Engineer will develop a correlation between the results of the nuclear gauge and the results of the asphalt concrete cores obtained from the compacted lift of asphalt concrete. The density results obtained from the cores will be used to correct the Field Density results obtained from the nuclear gauge.

4100.4.2.2.1.2 Testing will be conducted prior to the placement of the next lift of asphalt concrete.

4100.4.2.2.1.3 Upon notification from the Contractor that a lot has been inspected and is ready for acceptance testing, the Engineer will locate 3 test sites in the lot in accordance with the requirements for Sampling Location By Random Method (STP 107).

4100.4.2.2.1.4 The Engineer will measure the Field Density at 3 test sites for each lot in accordance with the requirements for Density-In-Place By Nuclear Gauge (STP 204-6).

4100.4.2.2.1.5 The Engineer will provide the Contractor with a copy of the results of acceptance tests within 2 calendar days of receiving notification from the Contractor that the lot is ready for acceptance testing.

4100.4.2.2.1.6 If the acceptance test results on a lot indicate a penalty for Field Density, the Contractor will be allowed one opportunity to re-roll the lot. The random sampling procedure for re-testing will exclude areas falling within traffic wheel paths.

4100.4.2.2.2 For **smoothness** and **individual bumps and dips**:

4100.4.2.2.2.1 The surface of the blocks will be profiled by the Engineer in accordance with the standard test procedures.

4100.4.2.2.2.2 If a block is located within a rejected lot, the surface of the block will not be profiled until the lot has been remedied.

4100.4.2.2.2.3 The Engineer will provide the Contractor with a copy of the results of acceptance tests for smoothness and individual bumps and dips within 12 calendar days of the placement of the asphalt concrete.

4100.4.2.2.2.4 When all the acceptance tests for a block are completed, the Engineer will advise the Contractor as to the acceptability of the block with respect to smoothness and individual bumps and dips.

4100.4.2.2.3 For **segregation**:

4100.4.2.2.3.1 Each lane-km, including the shoulder, will be inspected for areas of segregation.

4100.4.2.2.3.2 After receiving notification from the Contractor that the asphalt concrete is ready for acceptance testing, the Engineer will provide the Contractor with the locations of the visually identified segregation in accordance with the following:

4100.4.2.2.3.2.1 Within 12 calendar days during the course of the construction; and

4100.4.2.2.3.2.2 Within 4 calendar days after the completion of all the asphalt concrete.

4100.4.2.2.3.3 A segregated area will be categorized by the worst condition prevalent for 50% or more of the length of the segregated area.

4100.4.2.2.3.4 If the worst condition in a segregated area is not prevalent for at least 50% of the length of the area, then the area will be measured in relation to the length of minor and severe segregation.

4100.4.2.2.4 For **surface defects**:

4100.4.2.2.4.1 Each lane-km, including the shoulder, will be inspected for surface defects.

4100.4.2.2.4.2 After receiving notification from the Contractor that the asphalt concrete is ready for acceptance testing, the Engineer will provide the Contractor with the locations of the visually identified surface defects in accordance with the following:

4100.4.2.2.4.2.1 Within 12 calendar days during the course of the construction; and

4100.4.2.2.4.2.2 Within 4 calendar days after the completion of all the asphalt concrete.

4100.4.3 Exclusions to Random Sampling

4100.4.3.1 Random sampling methods will not apply to the following:

4100.4.3.1.1 Smoothness;

4100.4.3.1.2 Small areas such as approaches, tapers, areas of handwork and gores;

4100.4.3.1.3 Areas of visually identified segregation; and

4100.4.3.1.4 Areas of surface defect repair.

4100.4.4 Appeal of Acceptance Test Results and Appeal Testing

4100.4.4.1 General

4100.4.4.1.1 The Contractor cannot appeal test results that are within the full or bonus payment range.

4100.4.4.1.2 The Engineer will provide the Contractor with a copy of the results of appeal tests within 6 calendar days of delivery of the samples.

4100.4.4.1.3 Appeal testing will be performed by the Department, and the new results shall be binding on the Contractor and the Department.

4100.4.4.1.4 If the appeal testing does not result in a decrease of the pay adjustments, all testing costs incurred during the appeal procedures shall be paid by the Contractor. The rate for Department testing will be as designated in the Special Provisions.

4100.4.4.1.5 If the Engineer determines that certain test results are faulty due to testing equipment malfunction, improper testing procedures or calculations, re-testing will be performed at the expense of the Department.

4100.4.4.1.6 In the case of an appeal, the Department will not be responsible for any delays including but not limited to Contractor's downtime, or other costs as a result of awaiting the receipt of the appeal test results, or due to the nature and values of the appeal test results.

4100.4.4.2 Appeal of the acceptance test results shall be in accordance with the following:

4100.4.4.2.1 For **Field Density**:

4100.4.4.2.1.1 Within 2 calendar days of receipt of the acceptance test results for a lot, the Contractor may appeal the acceptance test results by requesting appeal tests. The following procedures shall apply:

4100.4.4.2.1.1.1 The Engineer will locate 2 appeal test sites in the lot in accordance with the requirements for Sampling Location By Random Method (STP 107).

4100.4.4.2.1.1.2 The Engineer will measure the Field Density at each appeal test site and in the vicinity of the original 3 acceptance test sites in accordance with the requirements for Density-In-Place By Nuclear Gauge (STP 204-6).

4100.4.4.2.1.1.3 The mean of the test results from the 5 referee sites will be used for the purpose of acceptance, rejection and determination of pay adjustments.

4100.4.4.2.2 For **smoothness** and **individual bumps and dips**:

4100.4.4.2.2.1 Within 2 calendar days of receipt of the acceptance test results for a block, the Contractor may appeal the test results by requesting appeal tests.

4100.4.4.2.2.2 The Engineer will re-test the entire block for smoothness and individual bumps and dips, if either is under appeal.

4100.4.4.2.3 For **segregation**:

4100.4.4.2.3.1 Within 6 calendar days of receipt of the locations of the visually identified segregation, the Contractor may appeal the acceptance test results by requesting appeal tests.

4100.4.4.2.3.2 The Engineer will obtain a core sample at a location that is representative of the area being considered. The core sample will be obtained in accordance with the requirements for Asphalt Concrete Samples Obtained By Coring (STP 204-5).

4100.4.4.2.3.3 The Engineer will determine the Field Density, asphalt content and the aggregate gradation of the sample.

4100.4.4.2.3.4 The area will be considered non-segregated if the aggregate gradation complies with requirements specified in section 4100.3.7.2.3.

4100.4.4.2.3.5 If the aggregate gradation does not comply with the requirements specified in section 4100.3.7.2.3:

4100.4.4.2.3.5.1 The area will be considered minor segregation if the test results indicate the Field Density of the asphalt concrete meets or exceeds 94% of the Marshall Density established for the Job Mix Formula or Asphalt Mix Formula, and the asphalt content deviates by not more than 0.6% from the asphalt content approved for the Job Mix Formula or Asphalt Mix Formula.

4100.4.4.2.3.5.2 The area will be considered severe segregation if the conditions in section 4100.4.4.2.3.5.1 are not met.

4100.5 ACCEPTANCE, REJECTION AND REPAIRS

4100.5.1 General

4100.5.1.1 The Contractor shall provide a finished product conforming in quality and accuracy of detail to the dimensional and tolerance requirements of the specifications and drawings. Where no tolerances are specified, the standard of workmanship shall be in accordance with normally accepted good practice.

4100.5.2 Rejection

4100.5.2.1 The block or lot will be rejected as unacceptable work if:

4100.5.2.1.1 The Field Density for the lot is outside the acceptance limits outlined in section 4100.7.2.1.1.

4100.5.2.1.2 The PrI for the Block is outside the acceptance limits outlined in section 4100.7.2.1.2.

4100.5.2.1.3 Any individual bumps and/or dips exceed 12 mm.

4100.5.2.2 Areas of segregation and surface defects will be considered unacceptable work until the areas are repaired and accepted by the Engineer.

4100.5.3 Repairs

4100.5.3.1 General

4100.5.3.1.1 The Contractor shall not undertake any repair on any defective work prior to notifying the Engineer. Any areas repaired prior to obtaining the Engineer's approval will not be considered for payment.

4100.5.3.1.2 Work on any block or lot which has been rejected shall be remedied within 30 calendar days of receipt of the acceptance test results.

4100.5.3.1.3 All remedial work shall be performed at the Contractor's expense, including the cost of materials.

4100.5.3.1.4 The Contractor shall pay the cost of all re-testing performed following the remedying of work in any block or lot that has been rejected. The rate for Department testing will be as designated in the Special Provisions.

4100.5.3.1.5 Repairs shall be subject to the approval of the Engineer.

4100.5.3.1.6 Alternate repair methods proposed by the Contractor shall be subject to approval of the Engineer. The nature of the deficiencies shall be taken into account in the consideration of the method of repair.

4100.5.3.1.7 Acceptable remedial measures to a rejected block or lot, or areas within a block or lot are as follows:

4100.5.3.1.7.1 A **Class I repair** either overlays or removes and replaces the asphalt concrete.

4100.5.3.1.7.1.1 If an overlay is used as the remedial measure, the following shall apply:

4100.5.3.1.7.1.1.1 A tack coat shall be applied in accordance with Specification 4000 For Asphalt Prime, Tack and Flush Coat unless otherwise directed by the Engineer.

4100.5.3.1.7.1.1.2 The minimum overlay thickness shall be as specified in Table 4100.3.T4 for top lift.

4100.5.3.1.7.1.1.3 Adjacent lanes and shoulders shall be overlaid to the same thickness and length.

4100.5.3.1.7.1.1.4 On all lifts of asphalt concrete below the final lift, the overlay shall be completed prior to the next lift being placed.

4100.5.3.1.7.1.2 If a removal and replace operation is used as the remedial measure, the following shall apply:

4100.5.3.1.7.1.2.1 The work shall be performed in accordance with Specification 4105 For Reclaiming Asphalt Concrete.

4100.5.3.1.7.1.2.2 The asphalt concrete shall be removed by cold milling to a minimum depth as specified in Table 4100.3.T4 for the lift being removed.

4100.5.3.1.7.1.2.3 A tack coat in accordance with Specification 4000 For Asphalt Prime, Tack and Flush Coat, unless otherwise directed by the Engineer, shall be applied to the milled surface.

4100.5.3.1.7.1.2.4 The asphalt concrete material removed by the milling operation shall be the property of the Contractor.

4100.5.3.1.7.1.2.5 The asphalt concrete used for back-filling the milled area shall be subject to the same specifications as the original pavement.

4100.5.3.1.7.2 A **Class II repair** is typically either the placing of a slurry seal on the entire block or lot, or the placing of a spot slurry seal patch or patches within the block or lot.

4100.5.3.1.7.2.1 For slurry seals or slurry seal patches, the following shall apply:

4100.5.3.1.7.2.1.1 The seal shall be a mixture of a dry, non- plastic sand, an emulsified asphalt SS-1 (slurry), potable water, and, if needed, acceptable additives such as Portland Cement, and Carbon Black, for colour.

4100.5.3.1.7.2.1.2 The gradation of the sand shall be as follows:

TABLE 4100.3.T6

SLURRY SEAL SAND GRADATION

Sieve Designation	Percent by Weight Passing Canadian Metric Sieve Series
900 um	100.0
400 um	70.0 – 95.0
160 um	60.0 – 80.0
71 um	20.0 – 42.0
Plasticity Index	Non Plastic

4100.5.3.1.7.2.1.3 The mix proportions for a 1 000 litre batch of seal shall be as follows:

4100.5.3.1.7.2.1.3.1 360 litres of SS-1 (slurry);

4100.5.3.1.7.2.1.3.2 270 litres of potable water; and

4100.5.3.1.7.2.1.3.3 850 kg of dry, non-plastic sand.

4100.5.3.1.7.2.1.4 The Contractor shall add the water to the emulsified asphalt followed by the addition of the sand.

4100.5.3.1.7.2.1.5 The Contractor shall thoroughly mix the seal. If a mineral filler is used, it shall be blended into the mixture. A minimum amount of additional water may be added to obtain a fluid, homogeneous mixture.

4100.5.3.1.7.2.1.6 If a tack coat is required, the same asphalt chosen for the seal binder shall be used. The tack coat shall be applied in accordance with Specification 4000 For Asphalt Prime, Tack And Flush Coat, unless otherwise directed by the Engineer.

4100.5.3.1.7.2.1.7 The seal shall be neat and square; and uniform and homogeneous with no uncovered areas, ridges or loose aggregate.

4100.5.3.1.7.2.1.8 Hand or mechanical squeegees may be used to spread the seal.

4100.5.3.1.7.2.1.9 The completed seal shall be kept free of all traffic until it has cured sufficiently to prevent pickup of aggregate particles.

4100.5.3.1.7.2.1.10 Any tests performed by the Engineer on the seal will be quality assurance tests and will not be considered as quality control tests.

4100.5.3.1.7.3 A **Class III repair** is typically a flush coat on the entire block or lot, or the placing of a spot flush coat(s) within the block or lot.

4100.5.3.1.7.3.1 A flush coat or spot flush coat shall be applied in accordance with Specification 4000 For Asphalt Prime, Tack and Flush Coat, unless otherwise directed by the Engineer.

4100.5.3.1.7.4 A **Class IV repair** is typically either a re-rolling operation to remove or reduce the bump(s) or a shim operation to remove or reduce dip(s). Other methods of Class IV repairs proposed by the Contractor shall be subject to the approval of the Engineer.

4100.5.3.1.7.4.1 For repairs to a bump(s), the following shall apply:

4100.5.3.1.7.4.1.1 The repair procedure shall not cause damage to the asphalt concrete such as, but not limited to, excessive crushing, pulverizing or displacing the asphalt concrete or its surface.

4100.5.3.1.7.4.1.2 The area repaired shall have a smooth transition to the surrounding pavement without impairing the functionality and/or structural characteristics of the service life of the area.

4100.5.3.1.7.4.2 For repairs to a dip(s), the following shall apply:

4100.5.3.1.7.4.2.1 If shimming is used, the area shimmed shall have a smooth transition to the surrounding pavement. The shim shall have sufficient thickness and be thoroughly compacted to prevent ravel of the shimmed area.

4100.5.3.1.7.4.2.2 If a tack coat is required, the tack coat shall be applied in accordance with Specification 4000 For Asphalt Prime, Tack and Flush Coat, unless otherwise directed by the Engineer.

4100.5.3.2 Repairs shall be in accordance with the following:

4100.5.3.2.1 For **Field Density**:

4100.5.3.2.1.1 If after re-rolling, the Field Density of a lot remains outside the acceptance limit, the Contractor shall perform a Class I repair.

4100.5.3.2.1.2 If the area(s) requiring repairs appears to be isolated:

4100.5.3.2.1.2.1 The Engineer may identify the area(s) through additional testing.

4100.5.3.2.1.2.2 The Contractor shall perform a Class I repair for only the portion of the lot requiring repairs.

4100.5.3.2.1.2.3 If the isolated repair area continues into an adjacent lot, which is deemed acceptable through acceptance testing, that portion of the adjacent lot shall be repaired along with the portion of the unacceptable lot.

4100.5.3.2.2 For **smoothness**:

4100.5.3.2.2.1 If the acceptance test results on a block indicate a pay adjustment for smoothness, additional work to improve the smoothness will not be allowed except the Contractor will be allowed to perform a Class I or Class IV repair on individual bumps and dips that exceed 12 mm.

4100.5.3.2.2.2 If the smoothness of the final lift of asphalt concrete of a block is outside the acceptance limit outlined in Table 4100.7.T9, the block shall be repaired by a Class I repair.

4100.5.3.2.3 For **individual bumps and dips**:

4100.5.3.2.3.1 Individual bumps and dips that exceed 12 mm in the vertical direction shall be repaired by a Class I or Class IV repair.

4100.5.3.2.3.2 Work to repair individual bumps and dips $\leq$ 12 mm will not be permitted.

4100.5.3.2.4 For **segregation**:

4100.5.3.2.4.1 The Contractor shall repair all segregated areas, except for minor segregation on lower lifts, but including segregated areas with nil pay adjustment. These repairs will not affect the initial pay adjustments assessed in accordance with Tables 4100.7.T10 and 4100.7.T11 with the exception of a Class I repair.

4100.5.3.2.4.2 Severe segregation on lower lifts of asphalt concrete shall be repaired by a Class I repair.

4100.5.3.2.4.3 Segregated areas on the final lift of asphalt concrete shall be repaired in accordance with the following:

4100.5.3.2.4.3.1 Minor segregation on the lane or shoulder shall be repaired by a Class II repair. If the minor segregation is more than one half the lane width or is across the centre of the lane, the full width shall be repaired.

4100.5.3.2.4.3.2 Severe segregation:

4100.5.3.2.4.3.2.1 Individual areas less than 100 m in length shall be repaired with a Class II repair slurry seal patch over the full lane or shoulder width.

4100.5.3.2.4.3.2.2 Individual areas 100 m or greater in length shall be repaired over the full lane or shoulder by a Class II repair slurry seal or by a remove and replace Class I repair.

4100.5.3.2.5 For **surface defects**:

4100.5.3.2.5.1 On all lifts of asphalt concrete, surface defects shall be repaired with a Class I to Class IV repair, in a manner that is acceptable to the Engineer.

4100.5.3.3 Payment options in lieu of repairs:

4100.5.3.3.1 For smoothness and individual bumps and/or dips, the following shall apply, at the discretion of the Engineer, for the final lift of asphalt concrete in a block:

4100.5.3.3.1.1 If the Category I PrI is $\leq$ 23 or the Category II PrI is $\leq$ 28, and individual bumps and/or dips exceed 12 mm, a $2,000 penalty per bump and/or dip plus the adjusted PrI pay adjustment may apply, to a maximum of $6,000.

4100.5.3.3.1.2 If the Category I PrI is > 23 or the Category II PrI is > 28, and no individual bumps and/or dips exceed 12 mm, a $6,000 penalty may apply.

4100.5.3.3.1.3 If the Category I PrI is > 23 or the Category II PrI is > 28, and individual bumps and/or dips exceed 12 mm:

4100.5.3.3.1.3.1 A $6,000 penalty may apply if the adjusted PrI for the Category I PrI is > 23 or the Category II PrI is > 28.

4100.5.3.3.1.3.2 A $2,000 penalty per bump and/or dip plus the adjusted PrI pay adjustment may apply, if the adjusted PrI for the Category I PrI is $\leq$ 23 or the Category II PrI is $\leq$ 28.

4100.5.3.3.2 For segregation and surface defects requiring a Class II repair, the Contractor may, subject to the discretion of the Engineer, be charged a fee as shown in the Special Provisions to compensate the Department for having others make the repairs at a later date.

4100.6 MEASUREMENT

4100.6.1 Asphalt Concrete

4100.6.1.1 Asphalt concrete will be measured in tonnes.

4100.7 PAYMENT

4100.7.1 General

4100.7.1.1 Payment for Asphalt Concrete will be at the contract unit price per tonne with pay adjustments for Field Density, smoothness, severity of segregation, segregation frequency and final surface condition.

4100.7.1.2 The contract unit price will be full compensation for completing the work except for those activities for which specific provision for payment is made in this section.

4100.7.1.3 If it is stated in the Special Provisions that anti-stripping agent is required, the addition of hydrated lime or liquid anti-stripping agent shall be a subsidiary obligation of the Contractor. If it is determined during the contract that anti-stripping agent is required, the Contractor will be paid at the rate specified in the Special Provisions.

4100.7.1.4 If the shoulder is laid separately from the main lane, the pay adjustments for Field Density for asphalt concrete on the shoulder will be at 50% of the regular rates specified in Tables 4100.7.T7 or 4100.7.T8.

4100.7.1.5 Segregation and surface defects on the shoulder will be excluded from pay adjustments for segregation severity, segregation frequency and final surface condition. The Contractor shall repair segregation and surface defects on the shoulder in accordance with section 4100.5.3.

4100.7.1.6 If the contract includes a bid item for:

4100.7.1.6.1 Hauling Asphalt Concrete, payment will be made in accordance with Specification 2405 For Hauling On The Basis Of The Kilometre.

4100.7.1.6.2 Reclaimed Asphalt Concrete, payment will be made in accordance with Specification 4105 For Reclaiming Asphalt Concrete.

4100.7.1.6.3 Hauling Reclaimed Asphalt Concrete, payment will be made in accordance with Specification 2405 For Hauling On The Basis Of The Kilometre.

4100.7.1.6.4 Filler And Blender, payment will be made in accordance with Specification 3400 For Binder, Filler And Blender Sand.

4100.7.1.6.5 Hauling Filler And Blender, payment will be made in accordance with Specification 2405 For Hauling On The Basis Of The Kilometre.

4100.7.1.6.6 Tack Coat And Flush Coat, payment will be made in accordance with Specification 4000 For Asphalt Prime, Tack and Flush Coat.

4100.7.1.7 The rate the Department will pay for rejecting aggregate in excess of 10%, or for rejecting aggregate to improve the quality of the asphalt mix design, will be as designated in the Special Provisions of the contract.

4100.7.1.8 The Contractor will be charged at cost for the value of the asphalt and other additives in any asphalt mix that is rejected or wasted, in accordance with the following:

4100.7.1.8.1 The quantity of material rejected or wasted will be determined by the Engineer.

4100.7.1.8.2 The Contractor will not be charged for rejected or wasted material if it has been incorporated back into the work in a manner acceptable to the Engineer.

4100.7.1.8.3 For calculation purposes, the asphalt content will be that of the Job Mix Formula or Asphalt Mix Formula.

4100.7.1.9 When defects in rejected blocks or lots have been remedied, the pay adjustments for Field Density, smoothness, severity of segregation, segregation frequency and final surface condition will be based on testing of the repaired sections where applicable.

4100.7.1.10 The pay adjustments determined through testing of the remedial work will be applied to that quantity of material in the block or lot which was originally rejected.

4100.7.1.11 If any lot or block has been rejected under section 4100.5.2, payment will not be made for the asphalt concrete in the lot or block until the rejected work has been remedied.

4100.7.2 Pay Adjustments

4100.7.2.1 The dollar value of the pay adjustment will be as follows:

4100.7.2.1.1 For **Field Density**:

4100.7.2.1.1.1 The pay adjustment for each lot will be determined from Table 4100.7.T7. If the asphalt mix is a recycled mix with more than 10% reclaimed material, the pay adjustments will be at 50% of the values specified in Table 4100.7.T7.

TABLE 4100.7.T7

PAY ADJUSTMENTS FOR FIELD DENSITY

% of Marshall Density of Job Mix Formula	Pay Adjustment Dollars Per Tonne
≥ 99.0	+1.00
98.9	+0.90
98.8	+0.80
98.7	+0.70
98.6	+0.60
98.5	+0.50
98.4	+0.40
98.3	+0.30
98.2	+0.20
98.1	+0.10
98.0	0.00
97.9	0.00
97.8	0.00
97.7	0.00
97.6	0.00
97.5	0.00
97.4	0.00
97.3	0.00
97.2	0.00
97.1	0.00
97.0	0.00
96.9	-0.05
96.8	-0.10
96.7	-0.20
96.6	-0.30
96.5	-0.40
96.4	-0.50

Table 4100.7.T7 Continued	
% of Marshall Density of Job Mix Formula	Pay Adjustment Dollars Per Tonne
96.3	-0.60
96.2	-0.70
96.1	-0.80
96.0	-0.90
95.9	-1.00
95.8	-1.50
95.7	-2.00
95.6	-2.50
95.5	-3.00
95.4	-3.50
95.3	-4.00
95.2	-4.50
95.1	-5.00
95.0	-5.50
94.9	-6.00
94.8	-7.00
94.7	-8.00
94.6	-9.00
94.5	-10.00
94.4	-11.00
94.3	-12.00
94.2	-13.00
94.1	-14.00
94.0	-15.00
92.5 – ≤ 93.9	No Payment
< 92.5	Reject

4100.7.2.1.1.2 If the Specified Marshall Density is not achieved and the Target Density of Section 4100.3.11.2 must be used, the pay adjustment for each lot will be determined from Table 4100.7.T8. If the asphalt mix is a recycled mix with more than 10% reclaimed material, the pay adjustments will be at 50% of the values specified in Table 4100.7.T8.

TABLE 4100.7.T8

PAY ADJUSTMENTS FOR TARGET DENSITY APPLICATIONS

% of Target Density	Pay Adjustment - Dollars Per Tonne
≥ 99.0	0.00
98.9	-0.10
98.8	-0.20
98.7	-0.30
98.6	-0.40
98.5	-0.50
98.4	-0.60
98.3	-0.70
98.2	-0.80
98.1	-0.90
98.0	-1.00
97.9	-1.10
97.8	-1.20
97.7	-1.30
97.6	-1.40
97.5	-1.50
97.4	-1.60
97.3	-1.70
97.2	-1.80
97.1	-1.90
97.0	-2.00

Table 4100.7.T8 Continued	
% of Target Density	Pay Adjustment - Dollars Per Tonne
96.9	-2.50
96.8	-3.00
96.7	-3.50
96.6	-4.00
96.5	-4.50
96.4	-5.00
96.3	-5.50
96.2	-6.00
96.1	-6.50
96.0	-7.00
95.9	-7.50
95.8	-8.00
95.7	-8.50
95.6	-9.00
95.5	-10.00
95.4	-11.00
95.3	-12.00
95.2	-13.00
95.1	-14.00
95.0	-15.00
≤ 94.9	Reject

4100.7.2.1.2 For **smoothness**:

4100.7.2.1.2.1 The pay adjustment for each block in the final lift of asphalt concrete will be determined in accordance with Table 4100.7.T9:

TABLE 4100.7.T9

PAY ADJUSTMENTS FOR SMOOTHNESS

Category I PrI	Category II PrI	Pay Adjustment for Smoothness of Top Lift - Dollars per Block Lump Sum
0	0 – 1	+200
1 – 2	2 – 3	+150
3 – 4	4 – 6	+100
5 – 6	7 – 9	+50
7 – 10	10 – 15	0
11 – 12	16 – 17	-25
13	18	-50
14	19	-75
15	20	-100
16	21	-150
17	22	-200
18	23	-300
19	24	-400
20	25	-500
21	26	-600
22	27	-800
23	28	-1000
> 23	> 28	Reject

4100.7.2.1.2.2 The pay adjustment for smoothness will be prorated for blocks less than 100 metres in length.

4100.7.2.1.3 For **severity of segregation**:

4100.7.2.1.3.1 The pay adjustment will be determined from Table 4100.7.T10.

TABLE 4100.7.T10

PAY ADJUSTMENTS FOR SEVERITY OF SEGREGATION

Severity of Segregation	Pay Adjustment Dollars per Square Metre
None	0
Minor	- 3.00
Severe	- 6.00

4100.7.2.1.4 For **segregation frequency**:

4100.7.2.1.4.1 The pay adjustment will be determined from Table 4100.7.T11.

TABLE 4100.7.T11

PAY ADJUSTMENTS FOR SEGREGATION FREQUENCY

Segregation Frequency per Lane Kilometre	Pay Adjustment Dollars per Lane Kilometre
0 – 5	0
6 – 15	- 250
16 +	- 500

4100.7.2.1.5 For **final surface condition**:

4100.7.2.1.5.1 For each lane-kilometre of top lift meeting all of the requirements from Table 4100.7.T12, a bonus of $350 will be paid.

TABLE 4100.7.T12

REQUIREMENTS FOR FINAL SURFACE CONDITION BONUS

Number of Blocks with PrI > 10	Number of Individual Bumps/Dips > 8 mm	Number of Segregated Areas	Number of Surface Defects
0	0	0 – 2	0 – 5

4100.7.3 Maximum Pay Adjustment

4100.7.3.1 The sum of the pay adjustments for each lot will not exceed the maximum pay adjustment. The maximum pay adjustment will be calculated as follows:

Maximum Pay Adjustment per Lot	=	Contract Unit Price per Tonne	x	Tonnes of Asphalt Concrete in Lot