

1. GENERAL

1.1 RELATED WORK

- .1 Section 32 01 16 – Pavement Milling and Removals.
- .2 Section 32 12 13 – Asphalt Prime and Tack Coats.
- .3 Section 32 12 36.13 – Fog Seal.

1.2 DEFINITIONS

- .1 Asphalt Cement:
 - .1 The bituminous material that is used to bind the asphalt aggregate.
- .2 Asphalt Aggregate:
 - .1 The individual crushed and processed aggregate fractions before combining to produce the asphalt mix aggregate.
- .3 Asphalt Mix Aggregate:
 - .1 The mix after combining the asphalt aggregate fractions including filler or blending sand to produce the specified mix gradation.
- .4 Asphalt Mix:
 - .1 The mix produced by combining asphalt cement with the asphalt mix aggregate.
- .5 Bitumen:
 - .1 A class of black or dark coloured (solid, semisolid, or viscous) cementitious substance, natural or manufactured, composed principally of high molecular weight hydrocarbons, of which asphalts, tars, pitches, and asphaltites are typical.
- .6 Asphalt:
 - .1 A dark brown to black cementitious material in which the predominating constituents are bitumen's which occur in nature or are obtained through petroleum processing.
- .7 Cut-Back Products:
 - .1 Petroleum or tar residuum blended with distillates. Also referred to as liquid asphalts.
- .8 Bituminous Emulsion:
 - .1 A suspension of minute globules of bituminous material in water or in an aqueous solution.
 - .2 A suspension of minute globules of water or of an aqueous solution in a liquid bituminous material.
- .9 Performance Graded Asphalt Cement (PGAC):
 - .1 An asphalt binder that is produced from petroleum residue, either with or without the addition of non-particulate modifiers and meets the requirements of the current edition of AASHTO M320.

- .10 Performance Graded Asphalt Cement XX-YY:
 - .1 PGAC with XX being the high temperature performance grade and YY being the low temperature performance grade, as specified elsewhere in the Contract Documents, and meets the requirements of the current edition of AASHTO M320.
- .11 Polymer Modified Asphalt:
 - .1 Conventional asphalt cement to which one or more polymer compounds have been added to improve resistance to deformation at high temperatures and often cracking resistance at low temperatures.
- .12 Reclaimed Asphalt Pavement (RAP):
 - .1 Processed hot asphalt mix material that is recovered by partial or full depth removal. At this time no portion of the asphalt mix shall contain RAP, unless otherwise approved by the Engineer.

1.3 SAMPLES

- .1 At least four (4) weeks prior to commencing Work, the Contractor shall inform the Engineer of the proposed source of aggregate materials. The Contractor shall provide a sieve analysis of the aggregate material as well as aggregate physical property testing for the Engineer's review, including the source of the material. The Contractor shall submit an asphalt mix design based on the Marshall Method and trial mix test results to the Engineer for review.

1.4 SUBMISSIONS

- .1 Asphalt mix design and aggregate material for each required asphalt mix type shall be submitted to the Engineer at least four (4) weeks prior to commencing Work for review before being used. Coarse and fine aggregate shall be tested for physical properties as described in Table 2.2.3. No asphalt mix production can proceed until the applicable mix design and job-mix formula have been approved by the Engineer. All material test results shall be current or sampled within the last twelve (12) months of the mix design submission.
- .2 Preliminary review of the aggregate as represented by the samples shall not constitute general acceptance of all material in the deposit or source of supply. Materials may be considered unsuitable even though particle sizes are within the limits of the gradation sizes required, if particle shapes are thin or elongated or any other characteristic that precludes satisfactory compaction, or if the material fails to provide a pavement suitable for traffic. Rejected material will not be paid for. The Engineer has the right to request additional testing if there are any concerns with the proposed aggregate mix design.
- .3 Submit mill tests and gradation for mineral filler together with the mix design and as requested by the Engineer.
- .4 Mineral or chemical additives including, but not limited to anti-stripping, warm mix additive, etc., shall be identified within the mix design and approved by the Engineer.

1.5 MEASUREMENT AND PAYMENT

- .1 Hot mix asphalt pavement will be measured in square metres at the required thickness, and asphalt mix type, as specified within the Bid Form. Payment shall be compensation in full for furnishing, mixing, preparing, transporting, placing, rolling, aggregate testing, provision of a sieve analysis and asphalt mix design, and for all other labour and supervision, tools, equipment, and materials required to complete the Work. Payment for asphalt mix shall be subject to the penalties outlined in Section 3.7 for deficient asphalt mix, and formal inspection and acceptance by the Engineer and the Owner.
 - .1 Asphalt mix required as a levelling course in addition to the specified depth will be measured in tonnes. Payment shall be based on the applicable levelling course unit price, as provided within the Bid Form.
 - .2 Asphalt required as infill will be measured in tonnes or square metres as the required thickness as specified within the Bid Form. Payment shall be based on the applicable infill unit price, as provided in the Bid Form.

2. PRODUCTS

2.1 BITUMINOUS BINDER

- .1 The bituminous binder shall be of uniform character, free of water, and shall not foam when heated to 175°C. Solvents used in the manufacture of cut-back asphalts shall be derived from petroleum oils. Emulsifiers used to stabilize asphalt emulsions shall not be harmful to the performance of the asphalt in service.
- .2 Bituminous binder shall meet the following specifications:

Asphalt Cement	AASHTO Test Method	ASTM Test Method	Specification
Absolute Viscosity at 60°C, 30cm vacuum, poises	N/A	D2171	500+
Penetration, 25°C, 100g, 5 sec.	T49	D5	150 - 200A
Flash Point (Cleveland Open Cup, °C)	T48	D92	205+
Thin Film Oven Test	T179	D1754	4.0 max.
Penetration after test, 25°C, 100g 5 sec., % of original	T49	D5	40+
Ductility at 25°C	T51		100.0 max.
Solubility in Trichloroethylene	T44	D2042	99.5+

- .3 Polymer Modified Asphalt Cement: shall be performance graded as determined by the current edition of AASHTO M320.

2.2 ASPHALT MIX

- .1 Asphalt Mix Aggregate
 - .1 Asphalt mix aggregate shall not contain more than 3% by weight deleterious materials such as shale, ironstone, and coal. The maximum permissible organic content is 1.0% by weight.
 - .2 Asphalt mix aggregate shall meet the gradation requirements stated in the following table, when tested to the current edition of ASTM designations C-136 and C-117.

Sieve Designation	Asphalt Mix Type (% Passing)			
	S1	S2	Ultra-thin	Modified H2
20mm	-	-	-	-
16mm	-	100	-	-
12.5mm	100	80-92	100	100
10mm	83-92	70-84	98-100	83-92
5mm	55-70	50-65	85-95	55-70
1.25mm	26-45	26-45	38-48	26-45
0.630mm	18-38	18-38	25-35	18-38
0.315mm	12-30	12-30	12-23	12-30
0.160mm	8-20	8-20	6-15	8-20
0.080mm	4-8	4-8	4-8	4-10

.3 The physical properties for aggregate shall meet the following requirements:

Requirement	Asphalt Mix Type			
	S1	S2	Ultra-thin	Modified H2
Coarse Aggregates				
Coarse Agg. Micro-Deval (% Loss Max.) (AASHTO T327)	17 max.	17 max.	17 max.	17 max.
Soundness (5 Cycles) (% loss MgSO ₄) (AASHTO 104)	12.0 max.	12.0 max.	12.0 max.	16.0 max.
Organic Content (% Passing 5.0mm)	1.0 max.	1.0 max.	1.0 max.	1.0 max.
Crush Count – 1 Face (% Retained 5.0mm Sieve)	-	-	-	98 min.
Crush Count – 2 Faces (% Retained 5.0mm Sieve)	70 min.	70 min.	80 min.	90 min.
Flat and Elongated Particles (% maximum at 4:1) (ASTM D4791)	20	20	20	20
Wash Pass 75µm sieve (% maximum loss)	2.0	2.0	2.0	1.3
Magnesium Sulphate Soundness (% maximum loss) (AASHTO T104)	15	15	15	12
Fine Aggregates				
Manufactured Fines (% Passing 5.0mm Sieve)	-	-	70 min.	75 min.
Micro-Deval Abrasion (% Loss Max.) (AASHTO T327)	25	25	25	20
Plasticity Index (PI) (AASHTO T90)	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic

Notes:

- .1 Crush Count is the percentage of the crushed aggregate retained on the 5.0mm plus sieves having either one (1) or more fractured faces or two (2) or more fractured faces caused by the crushing operation.
- .2 Manufactured fines are the percentage by mass of the crusher run manufactured sand passing the 5mm sieve.
- .4 Variation from approved job mix formula:
 - .1 All asphalt mixes shall be supplied to the approved job mix formula within the range of tolerances specified below. Where tolerances are not specified, the values stated below shall be considered absolute, minimums, maximums or allowable ranges. Unless otherwise stated specification limits are based on single tests and include sampling, testing, and process variance.

Sieve Designation	Maximum Permissible Variation (% By Weight Passing)		
	S1, S2	Ultra-thin	Modified H2
20mm	± 5.0	-	± 5.0
16mm	± 5.0	-	± 5.0
12.5mm	± 5.0	-	± 5.0
10mm	± 5.0	± 1.0-2.0	± 5.0
5mm	± 5.0	± 3.0-4.5	± 5.0
1.25mm	± 4.0	± 3.0-4.5	± 4.0
0.630mm	± 3.0	± 3.0-4.5	± 3.0
0.315mm	± 2.0	± 3.0-4.5	± 2.0
0.160mm	± 2.0	± 2.0-3.0	± 2.0
0.080mm	± 2.0	± 1.5-2.0	± 2.0

- .2 Tolerances stated in this section shall apply to all asphaltic concrete mix types unless otherwise specified. If the tolerances stated above or identified in Section 2.2.1 (Asphalt Mix Type (% Passing)) are not adhered to within the asphalt mix, the penalties as identified in Section 3.7 shall apply.
- .3 The job mix formula, as originally established, shall remain in effect until modified in writing. Should a change of aggregate(s) be made, or when unsatisfactory results or other conditions make it necessary, the Contractor shall submit a new mix design for approval.
- .4 S1, S2:
 - .1 Permissible variations in asphalt cement content: ± 0.4%.
 - .2 Permissible variation of mix temperature at discharge from plant: ± 5°C.
- .5 Ultra-thin:
 - .1 Permissible variation in asphalt cement content from job mix: ± 0.2%.
 - .2 Permissible in variation in percentage of air voids: Lower Limit: 2.5 to 3.0, Upper Limit: 5.0 to 5.5.
 - .3 Permissible variation in Marshall stability: 9.0 to 10.0kN.
 - .4 Permissible variation ion flow index: Lower Limit: 1.5 to 2.0mm, Upper Limit: 5.0 to 5.3mm.
 - .5 Permissible variation in film thickness: Lower Limit: 7.5 to 8.0 µm, Upper Limit: 10.0 to 10.5 µm.
 - .6 Permissible variation of mix temperature at discharge from plant: ± 5°C.
- .6 Modified H2:
 - .1 Permissible variation in percentage of air voids: ± 0.5%.
 - .2 Permissible variation in asphalt cement content from job mix: ±0.3%.

- .3 Permissible variation of mix temperature at discharge from plant: $\pm 10^{\circ}\text{C}$.
- .2 Asphalt Mix
 - .1 Asphalt mix shall consist of a homogeneous mixture of asphalt mix aggregate and asphalt cement mixed in a central plant.
 - .2 Marshall mix designs are to be completed in accordance with the current edition of the Asphalt Institute Manual Series No. 2 (MS-2), ASTM D6926, D6927 and D5581, and AASHTO T-245 unless otherwise modified by the Engineer.
 - .3 Liquid anti-stripping agents shall be added to the asphalt cement to achieve a stripping potential. Resistance of Compacted Bituminous Mixture to Moisture Induced Damage, AASHTO T2832, shall be used to determine the Tensile Strength Ratio (TSR). The Contractor shall provide test results identifying the type and amount of anti-stripping agent required to meet the specifications. Regardless of the anti-stripping agent percent required to meet the minimum TSR, a minimum of 0.3% liquid anti-stripping agent by mass of asphalt cement shall be incorporated into the asphalt concrete pavement mix. The Contractor shall provide the brand name and technical literature of the product to be used. The Cost of the anti-stripping agents shall be included within the applicable unit prices provided within the Bid Form.
 - .4 Physical properties for the asphalt mix shall meet the following requirements at the design content and gradation:

Property	Notes	Asphalt Mix Type			
		S1	S2	Ultra-thin	Modified H2
Asphalt Grade		150/ 200A	150/ 200A	PG 64-37	PG 70-31 (with min. 3% Polymer content)
Maximum Size of Aggregate (mm)		12.5	16	10	12.5
Marshall (blows per face)		75	75	75	75
Minimum Marshall Stability at 60°C (KN)	(1)	6	8	11	12
Minimum Retained Stability (%)		70	70	75	75
Marshall Flow Index (mm)	(1)	2-4	2-4	2-5	2-3.5
Air Voids in Mixture (%)	(2)	3-5	3-5	3-5	3.5-4
Voids in Mineral Aggregate (%)	(2)	13-15	13-15	-	13.5 min.
Voids Filled with Asphalt (%)	(2)	65-75	65-75	75-85	65-75
Minimum Film thickness (μm)	(3)	6.5	6.5	8	7
Tensile Strength Ratio (%)		>75	>75	>75	>80

Notes:

- .1 Marshall Stability and Flow Index shall be determined according to the current edition of ASTM Designation D6927 with the exception that briquettes shall be fan cooled. A mechanical compactor, calibrated by a certified hand hammer, shall be used to prepare briquettes.
- .2 The percentage of air voids and percentage of voids filled with asphalt shall be determined in accordance with the current edition of ASTM D3203, ASTM C127, and C128.

- .3 The minimum asphalt content by dry mass of aggregate is 6.3% for Ultra-thin mixes.
- .4 Temperature: Asphalt mix temperature at point of plant discharge shall not vary from that specified in the job mix formula by more than $\pm 10^{\circ}\text{C}$.
- .5 Moisture in asphalt mix: Maximum permissible moisture in the asphalt mix at point of plant discharge is 0.2% by weight of mix.

2.3 MINERAL FILLER

- .1 Mineral filler shall consist of Portland Cement, Pozzolan, commercially ground stone dust or other mineral dust approved by the Engineer. Mineral filler shall have a Plasticity Index of zero (0), and when tested by means of laboratory sieves it shall meet the following gradation:

Sieve Designation	% Passing
0.4mm	100
0.16mm	not less than 90
0.08mm	not less than 70
0.045mm	not less than 62

- .2 Mineral filler is to be dry and free flowing when added to the aggregate.

3. EXECUTION

3.1 EQUIPMENT

- .1 All tools, machinery, plant, and equipment used in handling materials and executing any part of the Work shall be subject to the approval of the Engineer. All such equipment shall be maintained in efficient working order and where any of the machinery plant or equipment is found to be unsatisfactory; it shall be improved or replaced by the Contractor to the satisfaction of the Engineer.
- .2 Asphalt Mixing Plant
 - .1 Capable of consistently producing a homogeneous mixture in which all aggregate particles are uniformly and thoroughly coated with asphalt.
- .3 Trucks for Transporting Mix
 - .1 Compatible with the size and capacity of the paver; with clean, tight smooth-sided boxes equipped with waterproof tarpaulins of sufficient size to cover securely all material when the boxes are fully loaded.
- .4 Paver
 - .1 Self-propelled; with automatic screed controls to maintain grade from a reference stringline and to control crossfall, smoothness and joint matching; with vibratory screed equipped with vibratory extensions and augers capable of uniformly spreading the asphalt mix to specified widths and depths without segregation or tearing. Follow the manufacturer’s recommended operating procedures.
- .5 Rollers
 - .1 Self-propelled, reversible; static steel-tired or pneumatic-tired rollers, or vibratory rollers; with wetting and scraping devices to prevent adhesion of mix to drums or tires (petroleum derivatives are not permitted for cleaning); capable of attaining

the required density and smoothness; pneumatic-tired rollers are to be equipped with wind skirts. Follow the manufacturer’s recommended operating procedures.

.6 Hand Tools

- .1 Rakes, lutes, tampers, straightedges, levels, and other hand tools as required to complete the Work.

3.2 PLACING

- .1 Obtain the Engineer’s approval of the base and existing surface, tack coat or prime coat prior to placing the asphalt mix. Asphalt mix shall be placed in layers to obtain the following minimum and maximum compacted lift thickness:

Mix Type	Minimum Compacted Thickness (mm)	Maximum Compacted Thickness (mm)
S1	35	75
S2	40	75
Ultra-thin	20	35
Modified H2	40	75

- .2 Place the asphalt mix to the thicknesses, grades, and lines indicated within the Plans or Drawings or as directed by the Engineer.
- .3 Placing Conditions:
 - .1 Place asphalt mix for lifts other than the surface lift only when the surface on which paving is to commence is above 2°C.
 - .2 Place asphalt m for the surface lift only when the surface on which paving is to commence is above 5°C and the ambient air temperature is a minimum 5°C and rising. Surface lifts shall not be placed under any other circumstances.
 - .3 When the temperature of the surface on which the material is to be placed falls below 10°C, provide extra rollers as necessary to obtain the required compaction before cooling.
 - .4 Do not place asphalt mix when pools of standing water exist on the surface to be paved, during rain or fog, or when the surface is damp.
 - .5 If the conditions of 3.2.3.1 and 3.2.3.2, above, cannot be adhered to, the Contractor shall make a written request to the Engineer for a deviation from these conditions. If, in the opinion of the Engineer, the deviation from the conditions of 3.2.3.1 and 3.2.3.2 is warranted, the Engineer shall provide written confirmation to the Contractor indicating the same. In the event placement of the hot mix asphalt pavement is permitted it is understood that the Contractor, at its sole expense, will employ additional testing/measures to confirm that the paving completed outside of the project specifications ultimately meets the project compaction and surface finish tolerance specification. The costs associated with the additional QC testing/measures are to be borne solely by the Contractor; the Owner will bear no additional costs for the QC activities that will be employed by the Contractor. Such QC testing/measures shall include the completion of a compaction control strip to confirm, given the environmental conditions and equipment and resources of the subcontractor, that all practicable efforts are being made to satisfy the project specifications. It will remain the responsibility of the Contractor, in its sole judgement, to cease paving if the compaction and surface tolerance specifications are not being adequately achieved.

- .6 Approval to place asphalt mix outside of the conditions provided within 3.2.3.1 and 3.2.3.2 shall not relieve the Contractor of its duties, warranties, or guarantees associated with the Work, or in any way hinder the assessment of the project completion date.
- .4 Asphalt mix shall be spread at temperatures which, when measured in the hopper of the spreader, are not lower than 125°C or higher than 150°C.
- .5 In small areas where the use of mechanical finishing equipment is not practical, the asphalt mix may be spread and finished by hand if directed by the Engineer. The asphalt mix shall be distributed uniformly to avoid segregation of the coarse and fine aggregates. Broadcasting of asphalt mix shall not be permitted. During the spreading operation, all asphalt mix shall be thoroughly loosened and uniformly distributed by lutes or rakes. Any asphalt mix that has formed into lumps and does not break down readily shall be rejected.

3.3 ROLLING AND COMPACTION

- .1 Before rolling is started, the surface shall be checked, inequalities in depth adjusted and fat spots or sandy accumulations replaced and irregularities in alignment or grade along the outside edge shall be corrected.
- .2 The rollers must be kept in continuous operation as nearly as practicable, and all parts of the pavement shall receive substantially the same compaction. Rolling shall be done at a maximum speed of 5km per hour or as determined through Contractor determined rolling patterns.
- .3 At least one (1) roller shall be used for every 40 tonnes of asphalt mix placed per hour. Rolling shall start as soon as the asphalt mix will bear the roller without checking or undue displacement, working from the low part or edge to the high part or edge continuously until no roller marks are left in the finished surface and no further compaction is possible. Where width permits, the asphalt mix shall be rolled diagonally in two directions. At all curbs, manholes and other appurtenances, and at all locations not accessible to the rollers, hand tampers shall be used which produce the same density as provided by the roller. Where the asphalt mix is laid in more than one (1) lift, each lift shall be so compacted.
- .4 The minimum compacted density to be achieved on various surfaces, unless otherwise dictated by the Engineer, is as follows:

Minimum Density	Type of Paving
98%	New paving and all stages in staged paving
97%	Lane paving
97%	Rehabilitation overlay greater than 40mm thick
96%	Rehabilitation overlay 40mm thick or less
96%	Paved trails
94.5%	Ultra-thin overlay

3.4 JOINTS

- .1 The asphalt mix shall be laid so that all longitudinal joints are made while the first mat of the two being laid is above 80°C. This may be accomplished by limiting paver advancement taking into consideration air temperature and wind speed.
- .2 A narrow strip along the edge of a mat which is joined with another asphalt mat shall be left without rolling until the adjoining mat has been placed against it. The joint which is formed shall be rolled immediately after the adjacent mat has been placed to ensure a bonding of the material while the asphalt mix is still hot.
- .3 Transverse joints shall be carefully constructed and thoroughly compacted to provide a smooth-riding surface. Joints shall be straight edged to assure smoothness and true alignment and shall be offset at least one metre from joints of adjacent mats. The vertical face shall be treated with freshly laid asphalt mix raked against it, tamped with hot tampers and rolled. Heat shall be used as necessary to ensure a proper bond.
- .4 All concrete or metal structures such as gutters, manholes, etc. shall be painted with an approved bituminous material prior to placing the asphalt mix.

3.5 FINISH

- .1 The finished pavement shall be true to the required profile and cross-section. Tests of pavement profile and thickness shall be made after the first layer of asphalt mix has been placed. The allowable tolerance for finished pavement shall be ± 5 mm, and the surface shall show no depressions or bumps exceeding 3mm under a straight edge 3m long placed parallel to the road centreline. Depressions or bumps greater than 5mm shall be corrected.
- .2 The finished surface shall have a tight knit texture free of visible signs of poor workmanship such as, but not limited to:
 - .1 Segregation
 - .1 The finished pavement surface shall have a uniform texture and be free of segregated areas. A segregated area is defined as an area of the pavement where the texture differs visually from the texture of the surrounding pavement. All segregation shall be evaluated by the Engineer to determine repair requirements. The severity of segregation shall be rated as follows:
 - .1 Slight - The matrix of asphalt cement and fine aggregate is in place between the coarse aggregate particles, however there is more stone in comparison to the surrounding acceptable mix.
 - .2 Moderate - Significantly more stone than the surrounding asphalt mix and exhibits a lack of surrounding matrix.
 - .3 Severe - Appears as an area of very stony mix, stone against stone, with very little or no matrix.
 - .2 Segregated areas shall be repaired by the Contractor as directed by the Engineer. The following methods of repair are identified:
 - .1 Slight - squeegee asphalt to completely fill the surface voids.
 - .2 Moderate - slurry seal for full mat width.
 - .3 Severe - removal and replacement or overlay.
 - .2 Areas exhibiting excess or insufficient asphalt.
 - .3 Improper matching of longitudinal and transverse joints.

- .4 Roller marks, cracking, checking, or tearing.
- .3 If surface and grade tolerances are exceeded, or if the surface texture is not met, grind down and resurface the defective areas as required by the Engineer, except where otherwise specified in Section 3.5.2. All repairs shall be regular in shape and finished using good workmanship practices to provide an appearance acceptable to the Engineer. Any other methods of repair proposed by the Contractor will be subject to the approval of the Engineer.

3.6 TESTING AND INSPECTION

- .1 Quality Assurance
 - .1 The Engineer or its representative shall retain core samples from the completed pavement, from which thickness of pavement and density of pavement tests shall be made.
 - .2 One (1) core shall be taken for approximately every 1,000m² of placed asphalt mix or at least once each day during placing operations. Core samples will be taken to verify the asphalt thickness and density for each layer.
 - .3 Loose asphalt mix samples shall be collected by the Engineer or its representative at least once each day during placing operations. Loose samples shall be taken in accordance with the current addition of the applicable ASTM standards. The following tests shall be carried out:
 - .1 Marshall stability (test for resistance of plastic flow of bituminous mixtures) using Marshall Apparatus as per the current edition of ASTM D1559.
 - .2 Sieve analysis of extracted aggregates in accordance with the current edition of ASTM C136 and entire washed sample in accordance with the current edition of ASTM C117.
 - .3 Bulk specific gravity of compacted mixtures in accordance with the current edition of ASTM D2726.
 - .4 Asphalt content of paving mixtures in accordance with the current edition of ASTM D2172.
 - .5 The percentage of voids in the mineral aggregates (VMA) is to be calculated based on the current edition of ASTM D2726 Bulk Specific Gravity of the aggregate.
 - .6 Air voids in compacted mix in accordance with the current edition of ASTM D3203.
 - .4 The Contractor shall provide the fresh, asphalt mix used to repair all core holes and apply a patch of slurry seal with no additional compensation.
 - .5 Sampling and testing performed by the Engineer is Quality Assurance testing and shall not be in lieu of the Quality Control testing required to be performed by the Contractor.
- .2 Quality Control
 - .1 The Contractor is fully responsible, at all times and at its entire cost, for ensuring that the Quality of the Work is within the Finish Tolerances specified herein.
 - .2 All Quality Control test results performed by the Contractor by a qualified testing agency on its behalf shall be submitted to the Engineer immediately upon their completion.
 - .3 The Contractor shall be responsible for filling and compacting all core holes flush with the surrounding surface with fresh asphalt mix, even those core holes carried out for Quality Assurance. Upon completion of the filling and compacting of the

core holes, the Contractor, at its sole expense shall slurry seal each core hole location.

- .4 Quality Control testing related to the density of the finished product shall be conducted with a nuclear density gauge and by coring; the nuclear density readings shall be correlated to the core densities. A minimum of one core sample for every 1,000m² of asphalt pavement surface shall be taken for each lift, from the same mat as the Quality Assurance core. If the initial core density is below that specified, it shall be discarded, and three (3) new cores will be taken within 10m of the original core location at a minimum spacing of 2.5m between cores. The average density of the three (3) new cores will represent that area.

3.7 PENALTIES

.1 Asphalt Content

- .1 If a deficiency in asphalt content is found based upon the Quality Assurance tests performed on the loose asphalt mix samples, and the Contractor wishes to dispute the result, the initial result is discarded and three (3) cores shall be taken, within the same mat as the loose sample was taken from, by an independent qualified testing firm, at the Contractor's expense. In this case, the average asphalt content of the three (3) new cores shall represent the area. The taking of the three (3) new cores shall be witnessed by the Engineer and must be taken within forty-five (45) days from the issuance of the Quality Assurance results.
- .2 The area represented by the Quality Assurance test shall be rejected if the area is deficient in asphalt content by an amount of 0.51% or greater. The Contractor shall, at their own expense, remove and replace the asphalt mix in the deficient representative area(s) to the limits determined by the Engineer. No additional payment shall be made for mobilization, materials, labour, or any other cost incidental to the correction of the deficient density.
- .3 Replaced asphalt mix material will be subject to the same quality testing procedures indicated within this Contract. Any and all costs associated to the replaced asphalt mix material shall be borne by the Contractor including but not limited to quality control testing and Engineer construction management.
- .4

.2 Thickness

- .1 If a deficiency in thickness is found based upon the Quality Assurance tests, and the Contractor wishes to dispute the result, the initial core is discarded and three (3) new cores shall be taken within 10m of the original core location and within the same asphalt mat by an independent qualified testing firm, at the Contractor's expense. In this case, the average thickness of the three (3) new cores shall represent the area. The taking of the three (3) new cores shall be witnessed by the Engineer and must be taken within forty-five (45) days from the issuance of the Quality Assurance results.
- .2 The Contract Unit Price for the area represented by the Quality Assurance test shall be adjusted as follows for areas deficient in thickness:
 - .1 No payment shall be made for asphaltic surface course deficient in thickness by more than 10mm.
 - .2 No price adjustment shall be made for surface course found to be deficient by less than 3mm or thicker than specified.

- .3 If the surface course is found deficient by more than 3mm but less than or equal to 10mm of the design thickness; then the unit price shall be adjusted as follows:

Asphalt Thickness Pay Factors (PA_t)	
Specified Deficiency (mm)	Price Adjustment
≤3	No Reduction
4 to 10	Adjusted Price = $\frac{(\text{Avg. Core Thickness})^2}{(\text{Specified Thickness})^2} \times \text{Contract Price}$
>10	No Payment

- .4 In the instance of "No Payment" the Contractor may, at their own cost, grind and resurface the representative area(s) to correct the thickness deficiency, to the limits determined by the Engineer. No additional payment shall be made for mobilization, materials, labour, or any other cost incidental to the correction of the deficient thickness.
- .5 Corrective measures taken will be subject to the same quality testing procedures indicated within this Contract. All costs associated with the corrective measure(s) shall be borne by the Contractor including but not limited to quality control testing and the Engineer's construction management.
- .3 Density

- .1 The Quality Assurance cores will also be used to determine density. If any tested core fails to meet the density specified, and the Contractor wishes to dispute the result, three (3) new cores shall be taken within 10 m of the original core location and in the same asphalt mat by an independent qualified testing firm, at the Contractor's expense. In this case, the average density of the three (3) new cores shall represent the area. The taking of the three (3) new cores shall be witnessed by the Engineer and must be taken within forty-five (45) days from the issuance of the Quality Assurance results. The compacted density of the new cores collected by the Contractor's testing firm shall be determined using the Marshall density determined by the Quality Assurance testing.
- .2 If the densities are less than specified, the Contract Unit Price for the area represented by the Quality Assurance test shall be adjusted as follows:

Asphalt Density Pay Factors (PA_d)					
98% Required		97% Required		96% Required	
Actual Density %	Pay Factor %	Actual Density %	Pay Factor %	Actual Density %	Pay Factor %
98.0	100.0	97.0	100.0	96.0	100.0
97.9	99.9	96.9	99.9	95.9	99.7
97.8	99.8	96.8	99.7	95.8	99.3
97.7	99.6	96.7	99.4	95.7	98.9
97.6	99.4	96.6	99.1	95.6	98.4
97.5	99.1	96.5	98.7	95.5	97.8
97.4	98.7	96.4	98.2	95.4	97.1
97.3	98.3	96.3	97.7	95.3	96.4
97.2	97.8	96.2	97.1	95.2	95.6
97.1	97.2	96.1	96.3	95.1	94.6
97.0	96.5	96.0	95.5	95.0	93.4
96.9	95.8	95.9	94.6	94.9	92.2

Asphalt Density Pay Factors (PAD)					
98% Required		97% Required		96% Required	
Actual Density %	Pay Factor %	Actual Density %	Pay Factor %	Actual Density %	Pay Factor %
96.8	95.0	95.8	93.6	94.8	90.7
96.7	94.2	95.7	92.5	94.7	89.1
96.6	93.3	95.6	91.3	94.6	87.3
96.5	92.3	95.5	89.9	94.5	85.1
96.4	91.1	95.4	88.4	94.4	82.6
96.3	89.8	95.3	86.7	94.3	79.5
96.2	88.5	95.2	84.8	94.2	75.5
96.1	87.1	95.1	82.7	94.1	69.7
96.0	85.5	95.0	80.3	94.0	60.0
95.9	83.8	94.9	77.6	Under 94.0	Reject
95.8	82.0	94.8	74.3		
95.7	80.0	94.7	70.6		
95.6	77.7	94.6	66.0		
95.5	75.4	94.5	60.0		
95.4	73.0	Under 94.5	Reject		
95.3	70.3				
95.2	67.2				
95.1	63.7				
95.0	60.0				
Under 95.0	Reject				

Asphalt Density Pay Factors (PAD) - Ultra-thin Overlay	
94.5% Required	
Actual Density %	Pay Factor %
94.5	100.0
93.5 - 94.49	98.0
92.5 - 93.49	90.0
91.5 - 92.49	75.0
91.0 - 91.49	50.0
Under 91.0	Reject

- .3 In the instance of "Reject", the Contactor shall, at their own expense, remove and replace the asphalt mix in the deficient representative areas to the limits determined by the Engineer. No additional payment shall be made for mobilization, materials, labour, or any other cost incidental to the correction of the deficient density.
 - .4 Replaced asphalt mix material will be subject to the same quality testing procedures indicated within this Specification. All costs associated to the replaced asphalt mix shall be borne by the Contractor including but not limited to quality control testing and Engineer construction management.
- .4 Gradation
- .1 If a deficiency in gradation is found based upon the Quality Assurance tests performed on the loose asphalt mix samples, and the Contractor wishes to dispute the result, the initial result is discarded and three (3) cores shall be taken, within the same mat as the loose sample was taken from, by an independent qualified testing firm, at the Contractor's expense. In this case, the average gradation of the three (3) new cores shall represent the area. The taking of the three (3) new cores

shall be witnessed by the Engineer and must be taken within forty-five (45) days from the issuance of the Quality Assurance results.

- .2 If the gradation deviations are outside of the tolerances specified in Section 2.2 Asphalt Mix, the asphalt mix being represented by the Quality Assurance tests, shall be rejected at the Engineers discretion. The Contractor shall, at their own expense, remove and replace the asphalt mix in the deficient representative area(s) to the limits determined by the Engineer. No additional payment shall be made for mobilization, materials, labour, or any other cost incidental to the correction of the deficient density.
- .3 Replaced asphalt mix material will be subject to the same quality testing procedures indicated within this Contract. Any and all costs associated to the replaced asphalt mix shall be borne by the Contractor including but not limited to quality control testing and Engineer construction management.

3.8 CLEAN UP

- .1 Locations shall be cleared of all excess material resulting from the paving operation and any damage caused by the Contractor shall be repaired to the Engineer’s satisfaction within three (3) days of the date of completion of the street or lane. Failure to clean up or repair damage within three (3) days of being notified may result in other crews undertaking this Work without notice to the Contractor and deducting the costs from monies due to the Contractor.
- .2 No traffic shall be allowed on the finished surface until it has cooled to the ambient atmospheric temperature.

END OF SECTION

REVISION LOG		
DATE	REVISION	COMMENTS
05/10/2019	Added Asphalt Grade to Asphalt Mix Table.	N/A
05/10/2019	Clarification to Clause 2.2.2.3 Asphalt Mix associated with Tensile Strength Ratio (TSR).	N/A
05/10/2019	Addition of Clause 2.2.4.4 and 2.2.4.5.	Clarification to Variations from Approved Job Mix Formula
05/10/2019	Addition of Clause 2.1.3.	Clarification to the Polymer Modified Asphalt Cement.
05/13/2019	Removed Asphalt Mix Types “B” and “HWY1” from Section 32 12 16.	N/A
02/18/2021	Added Asphalt Mix Type “Modified H2” to Section 32 12 16.	N/A
02/16/2024	Reference Update, Clerical Updates	N/A