

**CITY OF WHITEHORSE SERVICING STANDARDS MANUAL**  
**PART 3 - SPECIFICATIONS**  
**SECTION 3.18 – WARM MIX ASPHALT**

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#### 3.18 WARM MIX ASPHALT

##### 3.18.1 SCOPE

The work described in this section is that required for construction of a warm mix asphaltic concrete surface course.

Warm Mix Asphalt (WMA) is the generic term used to describe the typical reduction in production, placement and compaction temperatures obtained through the application of WMA technologies usually described as foaming processes, organically modified mixes, or chemically modified mixes.

- .1 WMA mixing temperatures are those typically within the range of 20 to 50°C lower than conventional hot mix asphalt.

##### 3.18.2 MATERIALS

###### 3.18.2.1 AGGREGATES

###### APPROVAL

The Contractor is to submit to the Engineer at least ten workdays before start of paving, a mix design using the Marshall Method and performed by an independent testing laboratory acceptable to the Engineer. The Contractor is to submit a separate mix design for each change in the supplier or source of materials. No mixing of asphaltic concrete is to proceed until the Engineer approves the job mix formula or any subsequent changes.

Preliminary approval of the aggregate, as represented by the samples, is not to constitute general acceptance of all material in the deposits or source of supply; acceptance is to be subject to field tests taken at the discretion of the Engineer. 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 precludes satisfactory compaction, or if the material fails to provide a pavement suitable for traffic. The Engineer will determine the acceptability of the final material.

Aggregate is to consist of hard, durable, uniformly graded, crushed gravel, and is to not contain organic or soft materials that break up when alternately frozen and thawed, or wetted and dried, or other deleterious materials.

###### GRADATION

Coarse aggregate is aggregate retained on the 5.000 mm sieve. Fine aggregate is aggregate passing the 5.000 mm sieve. Fine aggregate is to contain manufactured or crushed fines at a percentage by mass of fine aggregate of minimum 70%. Aggregate is to be hard, clean, durable, free from coatings of silt, clay or

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other deleterious materials, and is to contain no organic matter. The combined aggregates are to meet the following gradation requirements when tested to ASTM C136 and C117.

SIEVE SIZE (mm)	PASSING BY MASS (%)
12.500	100
5.000	55-75
2.000	35-55
0.400	15-30
0.160	5-16
0.080	3- 8

Additional properties that are to be met are as follows:

Liquid Limit	Maximum 25, ASTM D423-66
Plasticity Index	Maximum 6, ASTM D424-59
Los Angeles Abrasion Gradation "B"	35% maximum loss by mass, ASTM C131- 76
Sand Equivalent	Minimum of 35% ASTM D2419-74
Magnesium Sulphate Soundness	
- Coarse Aggregate	Maximum 12%
- Fine Aggregate	Maximum 16%, ASTM C88-77
Absorption of Coarse Aggregate	Maximum 1.75%, ASTM C127-77
Lightweight Particles(Specific gravity less then 1.95)	Maximum 3% by mass, ASTM C123-69 (1975)
Flat Particles	Length to thickness ratio greater then 5, maximum of 15% by mass
Loss by Washing	1.5% maximum passing the 0.08 sieve, ASTM C117-80

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Crushed Fragments	60% minimum material retained on the 5.000 mm with 1 crushed face
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A minimum of 70% of material retained on the 5.000 mm sieve are to have at least two crushed faces.

Aggregate is to be hard, clean, durable, and free from clay and coatings of silt, clay, or other deleterious materials, and is to contain no organic matter.

When coarse aggregate grading is such that the material will tend to segregate in stockpiling or handling, such aggregate is to be supplied in two or more sizes. Each size of coarse aggregate required to produce the combined gradation specified above is to be placed in individual stockpiles satisfactory to the Engineer. When it is necessary to blend two or more coarse aggregates before placing them in the cold bins, the blending is to be done through separate bins at the cold elevator feeders, and not in the stockpile.

When it is necessary to blend fine aggregates from one or more sources to produce the combined gradation specified, each source or size of fine aggregate is to be placed in individual stockpiles at the plant site, and separated by bulkheads or other means satisfactory to the Engineer. The blending is to be done through separate bins at the cold elevator feeders and not in the stockpile.

If the Contractor elects to use an approved drier-drum asphalt mixing process, the designated aggregates are to be split on the 5.000 mm sieve, and each material is to be stockpiled separately so that intermixing of each size and type does not occur. The coarse aggregate stockpile is to contain no more than 20% passing the 5.000 mm sieve, and the fine aggregate stockpile is to contain no more than 20% retained on the 5.000 mm sieve. At least 2,000 tonnes of aggregate is to be placed in each stockpile prior to the start of mixing operations.

The Contractor, during the crushing and splitting process, is to provide a convenient means for accurately and representatively:

- Sampling the individual coarse and fine aggregate streams, and the combined aggregate stream in its proper proportion;
- Sampling the individual coarse and fine aggregate streams and weighing the total amounts of both coarse and fine materials being produced.

#### MINERAL FILLER

Mineral filler is to be added in the mixing plant if the aggregate gradation is such that its addition is necessary to meet the above specifications. Mineral filler is to consist of Portland Cement, pozzolan, commercially ground stone dust or other mineral dust approved by the Consultant. Mineral filler is to have a plasticity index of zero and is to meet the following gradation requirements:

SIEVE NO. (mm)	PASSING BY MASS (%)
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0.400	100
0.160	90 - 100
0.080	70-100
0.045	62 - 100

#### 3.18.2.2 ASPHALT CEMENT

The asphalt cement is to be uniform in character, free of water and is to not foam when heated to 175 degrees Celsius. It is to meet the following specifications:

Viscosity	500+ poises, 60 degrees Celsius at 30 cm vacuum, ASTM D2171
Penetration	150A-200A, 100g in 5.0 sec. At 25 degrees Celsius, ASTM D5
Flash point	205+ degrees Celsius, ASTM D92
Thin film over test	ASTM D1754
Penetration	40+% of original, 100 g in 5 sec. At 25 degrees Celsius, ASTM D5
Ductility	100+ at 25 degrees Celsius, ASTM D113
Solubility in trichloro-ethylene	99.5% ASTM D2042

#### 3.18.2.3 STORAGE

No stacking conveyor is to be used to stockpile aggregate for a continuous mix or drum plant. Reference to continuous mix plant in Section 17.4.0 is also to include drum plant.

The aggregate is to be stockpiled at the mixing plant in such a manner that no segregation of the various particle sizes is produced. The asphalt binder is to be stored in suitable tanks at a temperature not exceeding 150°C.

#### 3.18.3 DESIGN MIX

A qualified testing laboratory is to be employed to prepare a mix design and job mix formula for the aggregate on which the tender is based. The mix design and job mix formula are to be submitted to the Engineer for approval a minimum of ten days prior to paving. No paving is to commence before the Engineer's approval is given for the mix design or job mix formula. The Engineer may also require a trial batch.

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The laboratory mix design is to be based on the Marshall Method. Absorption of asphalt into the aggregate is to be taken into account using the ASTM bulk specific gravity of the aggregate in calculating optimum asphalt content.

The mix design is to meet the following specifications

	<b>RANGE</b>
Max size of aggregate (mm)	12.5
Number of compaction blow each end of specimen	50
Stability (kN) at 60 degrees Celsius	4.5
Minimum Retained Stability (%)	75
Flow (0.25 mm unit)	8-16
% Voids total mix	4.0 ± 1.0
%Voids in mineral aggregate	14.5 min
% Aggregate voids filled with asphalt	73-85
Minimum film thickness <sup>2</sup> (µm)	7.0

The job mix formula is to be posted in a conspicuous place within sight of the plant operator. The Engineer must approve any subsequent changes in writing. The job mix formula is to list the following information:

1. Batch Plants:

- The sieve analysis of the combined aggregate in the mix
- The aggregate size range in each bin separation to be used
- The weight of the material to be used from each bin for 1 batch of mix
- The weight of asphalt to be used in each batch
- The mixing from the temperature
- Viscosity relationship for the asphalt

2. Continuous Mix Plants:

- The weight of asphalt per tonne of mix
- The mixing temperature of the asphalt mix as determined from the temperature-viscosity relationship for the asphalt
- The setting of the feed systems

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Proportions for a continuous-feed mixing plant is to be determined based on a field trial, which is to be carried out at least 48 hours prior to placing the mix on the job site.

The volumetric settings of the aggregate and asphalt are to be determined by the Contractor and approved by the Engineer. These settings are to be interlocked, so that a change in the volume of aggregate automatically results in a corresponding change in the volume of asphalt.

The mix produced is to conform to the job mix formula approved by the Engineer and to the following tolerances:

- The weight of aggregate from any bin, as well as the total weight of aggregate for each bin, is not to vary from the job mix formula by more than:

SIEVE SIZE (mm)	VARIATION BY MASS (%)
10.000 and larger	+/-7
5.000 to 10.000	+/-5
2.000 to 0.160	+/-4
0.063	+/-2

- The percent of asphalt in the mix is not to vary by more than 0.3% from the percentage indicated in the approved mix design.
- The mixing temperature for asphaltic materials is not to vary from those specified in the job mix formula by more than nine degree Celsius. In no case is the mixing temperature to exceed the maximum mix temperature indicated from the asphalt temperature-viscosity curve data.

The Engineer is to have the ability to request that a trial batch be produced and be tested the first time the asphalt mix design is being used for the season or at any time it is found that the actual asphalt mix is deviating from the mix design.

#### 3.18.3.1 ASPHALTIC BINDER DATA

Temperature-viscosity data or curves, as obtained from the refineries, for the various grades and types of asphaltic material to be used, are to be made available to the Engineer.

#### 3.18.3.2 TEST DATA

The Contractor is to submit all test data performed by the accredited testing company to the Engineer within 72 hours of receiving results.

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#### 3.18.3.3 CHANGES

The Contractor is to notify the Engineer of all proposed changes in the mix proportions. No changes are to be made until a representative of the Engineer is there to witness the change.

#### 3.18.4 MIXING PLANT

The paving plant is to be of a type capable of consistently meeting or exceeding all of the requirements of these specifications.

##### 3.18.4.1 WARM MIX ASPHALT PRODUCTION

.1 Produce WMA by combining aggregates with asphalt cement modified by one of the processes described hereunder and using additives or processes that are accepted by at least one Canadian provincial MOT or U.S. state DOT for use in the production of WMA and ensure the same after-compaction physical properties as hot mix asphalt concrete produced using asphalt cement as specified in this Section.

- For foaming processes, provide to the Engineer for approval at least 30 days prior to starting production, a quality control plan which includes but is not limited to:
  - The manufacturer's established water injection target rate or water bearing/water based additive proportion.
    - Assurance that potable water will be used in water injection systems.
  - Target production temperature rate for the plant.
  - Target temperature range for compaction.
  - Any modifications required to plant.
  - Method of monitoring the injection system or water bearing/water based additive proportion and method of stopping production in event of a failure of system.
  - If using water injection process, assurance that the water will inject into the asphalt binder flow before the asphalt binder spray makes contact with aggregate. Water will not be allowed to come in contact with aggregate prior to binder spray.
  - Copy of MOT or DOT approved products list showing acceptance of warm mix process proposed for this project or a letter from the MOT or DOT indicating that the process has been accepted by them for use with WMA.

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- For organic or chemical additives, provide to the Engineer for approval at least 30 days prior to starting production, a quality control plan which includes but is not limited to:
  - Identify proposed additives.
  - Copies of the additive suppliers' production specifications, highlighting where those specifications differ from this Section.
  - One sample of the additive. Size of sample will depend on the additive.
  - Target production temperature rate for the plant.
  - Target temperature range for compaction.
  - Method of monitoring the additive amount introduced to the mix, and method of stopping production in event of a failure of system.
  - Copy of MOT or DOT approved products list showing acceptance of warm mix additive proposed for this project or a letter from the MOT or DOT indicating that the additive has been accepted by them for use with WMA.
- .2 Notwithstanding where this Section may conflict with WMA technology provider specifications for production of WMA, the WMA technology provider specifications will take precedence.
- .3 Ensure that only one WMA foaming process or WMA additive regime is used unless approved by the Engineer.

#### 3.18.5 TRANSPORTATION

The mixture is to be transported from the mixing plant to the work in vehicles with tight metal bottoms previously cleaned of all foreign materials. The vehicle is to be suitably insulated, and each load is to be covered with canvas or other suitable material of sufficient size to protect it from weather conditions.

The inside surface of the box may be lubricated with a light coating of soap or detergent solution; petroleum derivatives are not to be permitted. Any accumulation of asphaltic material, which has collected in the box, is to be thoroughly cleaned before loading with hot mix. Trucks are to be clean of mud or any substance, which could contaminate the working area.

#### 3.18.6 PLACING

Unless otherwise permitted by the Engineer, a mechanical self-powered paver is to spread the mixture. The paver is to have an automatic levelling device and automatic grade control capable of spreading the mix without segregation or tearing, in thickness varying from 12 mm to 150 mm and in widths greater than 3.0 m and to true line, grade and cross-section as shown on the plans.

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The mixture is to be laid at a temperature not lower than 120 degrees Celsius or higher than 140 degrees Celsius. The atmospheric air temperature is to not be less than 2 degrees Celsius and rising, no frost is to be present and the road surface is to be dry.

Where the asphaltic surface course is to be placed in two lifts, the first lift is to be placed, finished and compacted for the full width as shown on the drawings, prior to commencing on the second lift. The maximum lift thickness is 75 mm.

In placing the second lift, the individual mixture spreads are to be aligned in a manner such that the longitudinal joints in each layer will not coincide.

In narrow areas, deep or irregular sections, intersections, turnouts, or driveways, where it is impractical to spread with a paver, the Contractor may use hand methods as directed by the Engineer.

#### **3.18.6.1 WEATHER LIMITATIONS**

The mixture is not to be placed:

- during periods of rain or when there is an imminent danger of rain;
- during excessive winds; or
- when air temperature is 2 degrees Celsius or cooler or frost is present on the surface.

#### **3.18.6.2 BASE PREPARATION**

Where tack coat or prime coat is applied, it is to be thoroughly cured prior to placing the mixture. The Contractor is to remove all loose and foreign material and water. Where existing pavements are to be overlaid, a levelling course of hot mix asphaltic concrete may be required prior to placing the surface course. Unless otherwise approved by the Engineer, this course is to be laid with a paving spreader and is to meet all the requirements of this section.

#### **3.18.6.3 SURFACE REQUIREMENTS**

Prior to the addition of material to any mat, the surface is to be broken with the tines of a rake to ensure proper bonding. Edges against which additional pavement is to be placed is to be straight and approximately vertical. A lute rake is to be used immediately behind the paver, when required, to obtain a true line and vertical face.

#### **3.18.6.4 HAND SPREADING**

In small areas where the use of mechanical finishing equipment is not practical, the mix may be spread and finished by hand, if so directed by the Engineer. The material is to be distributed uniformly to avoid segregation of the coarse and fine aggregates. Broadcasting of material is not to be permitted. During the spreading operation, all material is to be thoroughly loosened and uniformly distributed by a lute rake. Material that has formed into lumps and does not break down readily is to be rejected.

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#### **3.18.6.5 ROLLING**

The rollers used for compaction are to be self-propelled steel-wheeled or rubber-tired rollers, providing at least 35 Newtons per millimeter width of tread. The roller is to be in good condition, without backlash when reversed, and is to be operated by a competent rollerman. The wheels are to be kept properly moistened, but excess water or oil will not be permitted. The rollers must be kept in continuous operation as nearly as practicable, and all parts of the pavement are to receive substantially the same compaction. Rolling is to be done at a maximum speed of 5 km per hour.

At least one self-propelled steel-wheeled roller is to be used for every 40 tonnes of asphaltic concrete laid per hour. Rolling is to start as soon as the pavement 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 pavement is to be rolled diagonally in two directions. At all curbs, manholes and other appurtenances, and at all locations not accessible to the rollers, hand tampers are to be used to produce the same density as provided by the roller. Where the asphaltic concrete is laid in more than one lift, each lift is to be so compacted.

#### **3.18.6.6 PROTECTION OF APPURTENANCES**

The Contractor is to protect all exposed appurtenances with a suitable cover to prevent the bonding of asphalt to the surface. This includes valve boxes, manholes, and concrete curbs. The Contractor is to consider exposed valve boxes and manhole covers to protect them from roller damage while compacting the first layer of asphalt.

#### **3.18.7 JOINTS**

The mixture is to be laid so that all longitudinal joints are made while the first mat of the two being laid is still hot. A narrow strip along the edge of a mat, which is joined with another asphalt mat, is to be left without rolling until the adjoining mat has been placed against it. The joint, which is formed, is to be rolled immediately after the adjacent mat has been placed to ensure a bonding of the material while the asphalt is still hot.

Transverse joints are to be carefully constructed and thoroughly compacted to provide a smooth-riding surface. Joints are to be straight-edged to assure smoothness and true alignment and are to be offset at least one meter from joints of adjacent mats.

In order to ensure that the surface does not become cooled prior to laying an adjacent "run", the spreader is to not advance beyond the limits shown in the table below unless directed by the Engineer, i.e. on collector or arterial roads:

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Air Temperature (°C)	Maximum Length of Advancement (m)
Above 27	250
15 - 27	190
7 - 15	125
Below 7	90

All concrete or metal structures such as gutters, manholes, etc. are to be painted with an approved bituminous material prior to placing the asphalt.

The Contractor is to saw cut and tack all joints that are not attached on the same paving day. Payment for this work is to be included in the applicable unit item and no additional payment will be made elsewhere.

#### 3.18.8 CLEANUP

Locations are to be cleared of all excess material resulting from the paving operation, including if directed by the Engineer, flushing of sanitary and storm mains to remove debris. Flushed debris is to be collected in manholes and removed from the site. Any damage to the Engineer's or private property caused by the Contractor is to be repaired to the Engineer's satisfaction within 3 days of the date of completion of the street or lane. Failure to clean up may result in other crews undertaking this work without notice to the Contractor and at the Contractor's expense.

#### 3.18.9 TOLERANCE AND PENALTIES

##### 3.18.9.1 THICKNESS

The pavement is to have the thickness specified on the construction drawings. Areas suspected to be deficient are to be cored, as directed by the Engineer, based on one core for every 1000 square meters of pavement. At least one core is to be taken at the designated Marshall location.

Should the asphalt be found to be deficient in thickness the Contractor will be permitted to take two additional asphalt cores in an effort to limit the amount of the asphalt penalty.

The Contractor is to advise the City of their intention to re-core at the time of submission of initial test results to the Engineer. Re-coring is to take place a maximum of 4 weeks from receipt of notification to re-core after which re-core test results will not be considered in the penalty calculation.

The locations of the two additional cores are to be located within the same asphalt mat as the original deficient core and is to be located no more than half way between the deficient core and the next adjacent core or contract boundary. Within these two parameters, the exact core locations are to be determined by the Contractor and approved by the Engineer.

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A deficiency penalty is to be assessed according to the following:

<b>Asphalt Thickness</b>	<b>Tolerance Deficiencies</b>	<b>Deficiency Penalty</b>
50 mm	47 to 35 mm	$[C - [A^2/B^2] * C] * Q$
50 mm	Under 35 mm	Replacement by Contractor
75 mm	71 to 53 mm	$[C - [A^2/B^2] * C] * Q$
75 mm	Under 53 mm	Replacement by Contractor
100 mm	95 to 70 mm	$[C - [A^2/B^2] * C] * Q$
100 mm	Under 70 mm	Replacement by Contractor

Where:        A = Average core thickness  
                   B = Specified core thickness  
                   C = Contract unit price  
                   Q = Quantity of deficient HMAC

For any cores of a thickness greater than specified, the specified thickness is to be used for the purpose of all calculations and averages.

No additional payment will be made to the Contractor for thickness greater than specified.

The Contractor is to fill all core holes within a maximum period of 24 hours.

**3.18.9.2 DENSITIES**

Densities are to be based on core samples, each of which is to represent approximately 1000 square meters per constructed lift. Asphalt densities are specified as 98% of the standard laboratory Marshall. A minimum of one Marshall per day is to be performed with one core sample taken at a designated Marshall location.

If any core fails to meet the density specified, two additional cores are to be taken within one meter of the first core sample, and the average density of the three cores are to represent the area.

Re-coring is to take place a maximum of 4 weeks from submission of the initial test results, after which re-core test results will not be considered in the penalty calculation.

No additional rolling, to achieve a more favorable density, is to be allowed, WITHOUT the WRITTEN CONSENT OF THE ENGINEER.

If the densities are less than specified, a deficiency penalty is to be assessed according to the following:

$$[-0.041[X-98]^2]U.P.] * Q$$

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Where :           U.P. = Unit Price  
                  X   = Actual Asphalt Density (%)  
                  Q   = Quantity

All asphalt below 95% standard Marshall density is to be removed and replaced at the Contractor's expense.

### **3.18.9.3 SMOOTHNESS**

The surface of the compacted pavement is to be true to the required grade and cross-section with a smooth riding quality acceptable to the Engineer.

In addition to the above, when checked with a 3.0-meter straightedge, held in successive positions parallel or perpendicular to the centerline and in contact with the surface, the pavement surface is not to deviate from the straightedge by more than 3 mm.

If, in the opinion of the Engineer, an objectionable riding surface exists, the Contractor is to either grind and resurface with asphalt overlay or remove and replace the asphalt surface.

### **3.18.9.4 TEXTURE**

The completed pavement is to have a tightly knit texture and is to be free from segregation and surface cracking. The Contractor's Consultant is to redesign Mixes that are excessively tender or difficult to roll. The new design is to meet all of the requirements of this section, and is to be submitted to the Engineer for approval at least three working days prior to its use.

Classifying pavement segregation

- .1 A segregated area is defined as an area of the pavement where the texture differs visually from the texture of the surrounding pavement. For the purposes of classifying pavement segregation, only segregated areas greater than 0.1 m<sup>2</sup> and center-of-paver streaks greater than 1 m long will be considered.
  - .2 Moderate or severe segregated areas which do not meet these size parameters will be considered obvious defects. Pavement segregation will be classified as follows:
    - .1 "Slight": The matrix, asphalt cement and fine aggregate is in place between the coarse aggregate. However, there is more stone in comparison to the surrounding acceptable mix.

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- .2 “Moderate”: Significantly more stone than the surrounding mix; moderately segregated areas usually exhibit a lack of surrounding matrix.
  - .3 “Severe”: Appears as an area of very stony mix, stone against stone, with very little or no matrix.
  - .4 “Centre-of-Paver Streak”: Appears as a continuous or semi-continuous longitudinal "streak" typically located in the middle of the paver "mat".
- .3 Inspections for pavement segregation
- .1 Inspections by the Contractor
    - .1 The Contractor is to perform a daily inspection of the paving operations on all lifts of pavement to identify any instances of pavement segregation. If segregation is evident, the Contractor is to take immediate corrective action to his operations to identify the cause and prevent any further occurrence of segregation.
  - .2 Inspections by the Engineer
    - .1 Inspections during construction
      - .1 The Engineer will inspect the pavement to identify any instances of pavement segregation. If segregation is evident, the Engineer will immediately notify the Contractor so that corrective action can be taken to prevent further occurrence of segregation.
      - .2 Typically, each pavement Lot would be inspected as soon as possible after the Lot is placed. During the inspection(s), the Engineer will identify and record any areas of moderate and severe segregation and any areas of center-of-paver streak. Areas requiring repair in accordance with 1.3.5.4 will be marked. The Engineer will provide the Contractor with a written assessment (location and severity) of the segregated areas as soon as possible following each inspection.

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- .2 Inspection following construction
  - .1 The Engineer will conduct a second inspection of the top lift, normally one week after the substantial completion of paving work. During this inspection, the Engineer will identify and record any areas of slight, moderate and severe segregation and any areas of center-of-paver streak which were not identified in the inspections during construction. The Engineer will provide the Contractor with a written assessment (location and severity) of the segregated areas as soon as possible following this inspection.
  
- .4 Repairing pavement segregation
  - .1 Pavement segregation, obvious defects, deteriorated repairs or failures identified during the inspection performed approximately one week after substantial completion of paving operations will require repair.
  - .2 Pavement segregation identified in the inspections performed during construction is to be repaired at the Contractor's expense and in accordance with the following:
    - .1 Moderate and severe segregation in the top lift of pavement and on entrances and intersections are to be repaired.
    - .2 For entrances and the portion of intersections outside the through travel lanes and shoulders, areas of moderate and severe segregation are to be repaired in accordance with the methods of repair listed for moderate segregation. Intersections and entrances are also to be neatly shaped, smooth and free of surface defects and depressions.
  - .3 Slight segregation on any lift of pavement will not require repair.
  - .4 Moderate segregation on lower lifts will not require repair.
  - .5 Severe segregation on lower lifts will only require repair in instances where, in the opinion of the Engineer, the segregated area will affect the long term structural integrity of the pavement structure. Such repair will not be required in instances where the Engineer determines that the paver screed is "dragging" due to distortion of the existing surface.

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- .6 Only moderate and severely segregated center-of-paver streak on the top lift of pavement will require repair.
- .7 Methods of repair
  - .1 Moderate Segregation - The Contractor has the option of using a slurry patch or a WMA patch.
  - .2 Severe Segregation - The Contractor has the option of removal and replacement or overlay.
  - .3 Any other methods of repair proposed by the Contractor will be subject to the approval of the Engineer.
- .8 The Engineer will mark out the area of repair. The "marked area" will extend a minimum of 0.5 meters beyond the segregated area. For center-of-paver streak, the "marked area" will extend a minimum of 100 mm laterally and 0.5 meters longitudinally beyond the streak.
- .9 Cut the pavement so that all edges are vertical, the sides are parallel to the direction of traffic and the ends are skewed between 15-25 degrees. Coat edges with a tack coat conforming to Section 08040 and allow to cure.
- .10 Repairs for segregation using an overlay are to be for the entire pavement width. Repairs for segregation using removal and replacement are to be for the full lane width, full lane width and shoulder or the shoulder only as applicable, depending on the extent of the segregated area. The full depth of the asphalt lift is to be removed and replaced with new WMA pavement using an appropriate paver and cold milling equipment.
- .11 All repairs are to be regular in shape and finished using good workmanship practices to provide an appearance suitable to the Engineer. Traffic is to be kept off all repairs for a sufficient period of time to ensure that tracking does not occur.
- .12 All WMA patching and other repairs for which compaction is normally required are to be properly compacted.
- .13 In the event repairs cover existing roadway lines or markings, the Contractor is to reinstate the lines and markings at his expense and to the satisfaction of the Engineer.

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- .14 Repairs are to be completed during construction or shortly after construction, except when prevented by inclement weather or seasonal shutdown. In these cases, the Contractor is to complete the repairs prior to June 15 of the following year.
  
- .5 Segregation payment holdback
  - .1 Payment holdbacks of up to 25% of each progress payment may be withheld until the final product is accepted by the Engineer. If deficiencies are identified during the inspection approximately one week after substantial completion, the payment will be held until the deficiencies are repaired and meet specification requirements. If no deficiencies are identified during the inspection approximately one week after substantial completion, the payment will be released within two weeks of the inspection.
  
  - .2 Payment holdbacks for pavement segregation will apply to deficiencies identified in the top and bottom lift of WMA pavement. Segregated areas, center-of-paver streak and any repaired segregated areas identified by the Engineer either during construction or during the inspection conducted approximately one week after substantial completion of paving work, will be used to determine payment holdbacks.
  
- .6 Payment for work that had been rejected, but was made acceptable
  - .1 When defects have been remedied in Lots or Sublots which had been rejected, the work will no longer be considered deficient. Acceptable work will not delay the release of payment. Deficiencies identified in the inspection approximately one week after substantial completion require repair prior to release of the payment holdback.
  
- .7 Repair of failed areas in existing surfaces
  - .1 Repair of failed areas in existing surfaces will be paid for at the Contract unit prices bid for the work.
  
- .8 Finish surface quality tolerances
  - .1 Finished asphalt surface to be inspected after final rolling at selected locations.

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- .2 Finished asphalt surface not to have irregularities exceeding 5 mm when checked with a 4.5 m straight edge placed between any two contacts.
  
- .9 Defective work
  - .1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required. If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form a true and even surface and compact immediately to specified density.
  - .2 Repair areas showing checking or hairline cracking.
  - .3 Asphalt pavement not meeting the specified compaction, thickness, segregation or finish surface quality tolerances may be required to be replaced or overlaid at the Contractor's expense.
  
- .10 Cored areas
  - .1 Contractor is to fill all core holes with WMA material immediately after the core has been removed from the road surface. Compaction and finished surface quality are required to meet density specifications and surface quality specifications.

##### 3.18.9.5 TRAFFIC

No traffic is to be allowed on the finished surface until it has cooled to atmospheric temperature.