November 2010

Alice Springs Town Council
BITUMINOUS SURFACE MAINTENANCE GUIDE

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TECHNICAL SPECIFICATION

1.2 OUTLINE DESCRIPTION

This section specifies the repairs and minor rehabilitation to existing bituminous surfaces and pavements with asphalt, and includes the repair of potholes, edge defects, surface deformations and cracks.

1.2 REFERENCED DOCUMENTS

Comply with the Standards and Publications quoted throughout this section unless specified otherwise.

1.3 DEFINITIONS

Hot Mix Asphalt

A hot mixed homogeneous blend of bitumen, aggregates, sand, mineral fillers produced at an approved asphalt plant. It is delivered, placed and compacted hot.

Cold Mix Asphalt

A premix, blended from bitumen, aggregate, sand and mineral filler, having a flux oil in the binder. It is workable at ambient temperatures.

Cutter

A light petroleum distillate (kerosene) added to bitumen to temporarily reduce its viscosity.

Flux Oil

A petroleum distillate (diesel) used to produce a long term reduction in viscosity of a binder.

Job Mix

The mix utilised for asphalt surfacing which is determined from laboratory testing of proposed materials and complies with the specified properties.

Fine Grained Aggregate

Where the average grain size of the constituent minerals is > 1mm. The average grain size is determined optically under a petrographic microscope.

Coarse Grained Aggregate

Where the average grain size of the constituent minerals is > 1mm. The average grain size is determined optically under a petrographic microscope.

Pavement Profiling

The use of a pavement profiler to remove worn, oxidised, aged or out of shape pavements, and for correcting poor surface conditions to make the pavement suitable for re-sheeting or resealing.

Wearing Surface

The section of pavement upon which the traffic travels, this includes the layer(s) of asphalt or spray seal in a flexible pavement above the base.

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Regulation Patching

Surface repairs and shape correction without dig-out and/or squaring up, will usually not be straight sided due to irregularities in the pavement and feathering repair techniques.

Reconstruction Patching

Repairs with profiling, dig-out and/or squaring up, may be confined to the surface course or extend through all courses.

1.4 IDENTIFICATION AND TYPES OF FAILURES

The Superintendent will identify the defect and then order the appropriate method of repair. Defect types are grouped into one of the following modes of pavement distress;

Deformations:

Include corrugations, depressions, rutting, shoving.

Cracks

Cracks promote water entry and can be a primary cause of other defects including deformations and potholes.

Edge breaks

Occur along the interface of a sealed pavement and unsealed shoulder.

Potholes

Steep sided or bowl shaped cavities or delaminations extending into layers below the wearing course, usually due to failures associated with an aged, cracked or debonded bituminous surface.

Patch

An area of pavement surface where the original has been replaced or covered, surface texture deficiencies Includes polishing, ravelling, bleeding, generally rectified by reseal not specified in this section.

1.5 REPAIR OPERATIONS

Undertake repair operations to rectify identified distress modes.

1.5.1 Pothole Patching

Applies to potholes and delaminations. Prepare hole by removing all loose aggregate, dust and the like. Trim edges to sound material, creating a vertical side and square bottom. Tack coat the sides and bottom with bitumen emulsion or cut back bitumen. Remove excess tack coat. Place patching material in layers no greater than 2.5 times the nominal size, and thoroughly compact. Finish the pothole slightly higher than adjacent pavement surface, between 3mm and 5mm.

Only with the approval of Council for temporary measures, when using cold mix, thoroughly aerate the mix to remove some cutter oil or flux oil.

Level the patch by hand raking, motor grader or pull type blade. Remove all loose aggregate around the edges of the patch so patch can be raked and rolled to a smooth junction with the old surface. Compact asphalt material with hand tamper for small holes and where possible,

compact by using a rammer or vibrating plate. Compact large patches with a vibrating smooth drum roller. Cold mixes can be topped with a light application of sand to prevent pick up. Temporary patching with aggregate and emulsion requires approval of the Superintendent. For such work, keep traffic off the patch until patch is stable.

1.5.2 Regulation Patching

Patch defect areas where only the surface needs repair. Applies to deformations, and edge break defects. The Superintendent will specify the suitable type of hot mix asphalt or cold mix asphalt for the patch material in the CSR. Remove all debris and any loose materials on the pavement. Repair any potholes or cracks as required, refer other clauses. Apply a tack coat to the area under repair at the application rate to suit surface conditions. Supply, place, spread and compact the asphalt in layers until finished surface is flush with the existing surface. Compact in layers approximately 2.5 times the size of the mix aggregate and bring up to surface in layers level with the intended surface profile. Compact smaller holes with vibrating plate compactor and/or mechanical tampers.
Compact larger patches with a small vibrating roller. Depending on the size of the patch, level by hand raking, a pull type drag, or paver. Remove all aggregate larger than the feather edge so that the edges of the patch can be raked and rolled to a smooth junction with the old surface. Brush off and remove all loose material from area.

1.5.3 Reconstruction Patching

Patch defect areas requiring squaring up and or the removal of distressed pavement. The Superintendent will specify the suitable type and size hot mix asphalt or cold mix asphalt for patch material in the CSR.
Excavate the area to the required depth with reclaimer/profiler plant, and clean excavation of all loose aggregate, dust and water.
Cut back the edges of the hole to sound material cut the side vertically in order to provide shoulders against the movement of the patch, and square the bottom. Square up the surface shape of the patch to provide a neat appearance.
Apply a tack coat to the sides and bottom of the hole. Avoid applying too much tack coat so as not to induce a condition known as a fatty patch.
Supply, place, spread and compact the asphalt in layers in the hole until finished surface is flush with existing surface.
Compact in layers approximately 2.5 times the size of the mix aggregate and bring up to surface in layers level with the intended surface profile. Depending on the size of the patch, level by hand raking, a pull type drag, or paver.
Remove all aggregate larger than the feather edge so that the edges of the patch can be raked and rolled to a smooth junction with the old surface.
Compact larger patches with a small vibrating roller.
Depending on the size of the patch, level by hand raking, a pull type drag, or paver. Remove all waste materials from the road reserve. Waste stock piles are not permitted for any duration.

1.5.4 Reconstruction Patching – Alternative Method

Obtain the prior approval of the Superintendent to use this method of reconstruction patching where asphalt is not locally available.
Excavate the distressed pavement to sound material or to a depth of 300mm. Square up the surface shape of the patch to provide a neat appearance.
Clean the excavation of all loose material, dust and water. Cut back the edges of the hole to sound material.
Cut the sides vertically in order to provide shoulders against movement of the patch, and square the bottom.
If sound material is not reached at 300mm depth, stabilise the subgrade 150mm deep with 3% cement for granular materials or 3% lime for clay materials. (allow 10kg/sq.m for 150mm depth).

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Supply, place, spread, mix and compact base course gravel in 100mm maximum layers until flush with the existing surface.
Broom the surface of the patch and remove waste material from the site. Apply spray seal or emulsion to the patch and overlap the existing surfacing by 100mm.
Apply 10mm size aggregate to the surface. Rectify any failure of the surfacing at no additional cost.

1.5.5 Crack Sealing

For cracks wide enough to be treated, first clean the crack with air pressure, and then fill with a binder having viscosity low enough to enable it to be poured or worked into cracks. Do not undertake crack sealing when wet.
Take care to ensure that the cutback bitumen, bitumen emulsion, rubberised bitumen or latex modified bitumen used does not bridge across the crack at the surface. Assist the binder to penetrate cracks by using a squeegee. Lightly sand the surface to prevent traffic picking up surplus binder if necessary.
For wide cracks, first clean the crack and fill with fine asphalt or bituminous slurry.
Large areas with fine cracks and minimal pavement distortion will be spray sealed, slurry sealed or resurfaced with plant mix, in accordance with other sections of the specification.

1.6 MATERIALS

1.6.1 Aggregates

The combined particle size distribution to be in accordance with the tables MIX PROPORTIONS. COARSE AGGREGATES
Ensure that coarse aggregates are clean, hard, high strength, angular, skid resistant, durable crushed stone of uniform quality and free from laminated particles, clay and other aggregations of fine material, soil, organic matter and any other deleterious material. Conform to the following: Proportion of misshapen particles: 15% maximum at 2:1 caliper ratio. Los Angeles Abrasion
- Fine grained aggregate: 30% maximum loss.
- Coarse grained aggregate: 35% maximum loss.
- Sulphate Soundness: 12% maximum loss.
- Polished Aggregate Friction Value: 45 minimum.

FINE AGGREGATES

Ensure that fine aggregates are clean, hard, sharp, washed, durable natural sand and/or material manufactured from crushed stone of uniform quality and free from clay and other aggregations of fine material, soil, organic matter and any other deleterious material.

1.6.2 Mineral Filler

A finely divided mineral material, hydrated lime or cement with a particle size smaller than 0.075 mm. Use filler that is dry, free from lumps, clay, organic material or any other deleterious material, and complies in all other respects with the requirements of AS:2357.

1.6.3 Bituminous Binder

A straight run bitumen Class 320.

1.6.4 Bitumen Emulsion

A rapid setting bitumen emulsion made with bitumen Class 320.

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1.6.5 Additive

An additive may be proposed provided that full details of the type of additive are provided and the mix design standards of the PROPORTIONING OF MIXES Clause are attained.

1.7 PROPORTIONING OF MIXES FOR HOT MIX ASPHALT

1.7.1 Mix Type for Hot Mix Asphalt

The Superintendent will order Rural and/or Urban Mix Type Number with issue of CSR.

1.7.2 Manufacture of Hot Mix Asphalt

Mix in a plant capable of producing asphalt that complies with the approved design mix. Bitumen temperature: 135 deg. C to 160 deg. C prior to mixing. Heat aggregates to such a temperature that when filler and binder are added, the temperature of the mixed asphalt is between 135 deg. C and 170 deg. C.

1.7.3 Mix Assessment and Approval of Hot Mix Asphalt Types

Upon request, provide a minimum of 3 Marshall Test results of a job mix and submit to the Superintendent the following:

- - A statement detailing the combined aggregate/ filler grading and binder content of the design mix, and the proportion of each constituent material in the design mix.
- - Samples of the constituent materials in the design mix, and
- - Details of the type of additive/s if any, and its proportion within the mix.

Provide sample quantities as listed in the Table - CONSTITUENT MATERIAL SAMPLE QUANTITIES FOR HOT MIX ASPHALT

Table - Constituent Material Sample Quantities for Hot Mix Asphalt

Material	Sample Quantity
Binder	15 Litres
Coarse Aggregate	
Each constituent material	100 kg
nominal size >10mm	75 kg
Each constituent material	50 kg
nominal size >10mm	5 kg
Fine Aggregate - each -constituent material sufficient for job mix verification	As requested
Added Filler	
Additive	

At the discretion of the Superintendent, the submitted samples will be dispatched to an appropriate asphalt testing laboratory for Level 1 and Level 3 testing, as per the procedures of APRG 18.
Using the samples of constituent materials submitted, the proposed design mix may be assessed for compliance with the requirements of Clauses, PROPERTIES, TABLE – MIX PROPORTIONS and TOLERANCES.
The proposed job mix shall have a maximum Wheel Tracking Rate of 0.35mm per 1,000 passes at design air voids for urban work, and 0.45mm per 1,000 passes at design air voids

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for rural work, as determined by the Wheel Tracking test defined in APRG 18 (Australian Provisional Guide, Revision No. 1), Selection and Design of Asphalt Mixes.
The Wheel Tracking Rate is the slope of the rut depth versus number of passes curve between 4,000 and 10,000 passes. Adjust the proposed mix design as required to satisfy the specified requirements.
The Combined aggregate/filler grading of the approved job mix will be termed the Approved Job Grading. The binder content of the approved job mix will be termed the Approved Job Binder Content.
Failure of submitted samples of constituent materials or the job mix to comply with the requirements specified herein will result in rejection of the job mix. In this case, submit a revised job mix design.

1.7.4 Table - Properties of Hot Mix Asphalt

Conform to the following mix requirements:

Marshall Characteristics	Rural	Urban
Compactive effort (number of blows each end of specimen):	50	75
Stability of mix (kN):	5 min	8 min
Flow (mm):	2 – 5	2 – 5
Air voids (%):	3 – 7	3 – 7
Voids in mineral aggregate (%):	14 min.	14 min.

Conform to the following target mix proportions and properties;

1.8 PROPORTIONING OF MIXES FOR COLD MIX ASPHALT

1.8.1 Mix Type for Cold Mix Asphalt

The Superintendent will order the Mix Type Number with issue of a CSR.

1.8.2 Manufacture of Cold Mix Asphalt

Dry mix aggregate and mineral filter to provide a homogenous blend; add bituminous binder until the specified percentage is reached.
Carry out further mixing until a minimum of 90% of the coarse aggregate particles are coated. Add additional bitumen so that a satisfactory mix can be achieved, if so directed by the Superintendent.

1.8.3 Table – Aggregate and Mineral Filler Mix Proportions

Refer Clause 1.14 for Table

1.8.4 Table – Total Mix Proportions of Cold Mix Asphalt

1.8.5 Specification Limits for the Binder Mix of Cold Mix Asphalts

Bitumen;	100 parts
Flux;	Between 5 and 15 parts, depending on location and climatic conditions. Will be specified on the CSR.
Cutter;	10 parts

1.9 SURFACE PREPARATION

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1.9.1 Existing Bitumen and Concrete Surfaces

Remove all vegetation, loose and extraneous matter.

1.9.2 Tack Coat

Apply a fine spray of bitumen emulsion lightly and evenly over the whole of the area to be covered with asphalt. Hand spray only in areas where it is impractical to use a spray bar.
Application rate: 0.3 – 0.6 litres/square metre.
Allow the tack coat to 'break' before laying the asphalt. Clean and tack coat existing asphalt face against which new work is to be laid.

1.10 TRANSPORT AND SUPPLY

Insulate the bodies of trucks, block out corners with timber, and cover the body with a fitted tarpaulin when transporting distance is over 20 km or when temperatures are below 20 deg C.

1.11 SPREADING AND LAYING

Lay the final surface layer at a uniform thickness, and as one continuous operation.
Construct a transverse joint whenever the operation ceases.
Remove from site, prior to initial rolling, asphalt which has cooled below the required initial rolling temperature.
Hand spread in locations where mechanical spreading is not practical, and to correct localized depressions or irregularities.
Take the asphalt directly from the spreader hopper or dump asphalt onto metal sheets or existing hard clean surfaces.
Do not dump asphalt directly onto the area where it is to be spread. Complete the work as one continuous operation.
Remove from site all excess or spilt asphalt.

1.11.1 Minimum Temperatures of Hot Mix Asphalt

Comply with the minimum laying and initial rolling temperatures.
Cease laying asphalt during heavy or continuous rain, or in wet conditions where the material will not adhere or key to the surface. Laying temperature: 135 deg C. Initial rolling temperature:
105 deg C.

1.11.2 Joints Generally

Minimise the number of longitudinal and transverse joints.
Offset joints in multiple layer work by at least 100 mm so that joints in the surface course do not overlay joints in the previous course.
Overlap the finished asphalt by 25 mm to 75 mm when spreading.
Push the overlap asphalt back immediately to form a ridge along the joint.
Roll the ridge to form a smooth joint. Remove excess asphalt prior to final rolling.
Prevent the accumulation of coarse particles along the joint by raking.

1.11.3 Transverse Joints

Form by cutting the end of the spread material to a vertical face and remove loose material.
Check the surface adjacent to the joint with a straight edge and correct any surface defects immediately.

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Treat the face of the joint with bitumen emulsion tack coat prior to spreading adjacent section.
Provide ramps of compacted asphalt (maximum grade 5% relative to pavement grade) when joints are left overnight on trafficked pavements.

1.11.4 Longitudinal Joints

Keep joints straight or follow the line of curvature. Minimize the unsupported length left overnight. Rectify broken sections of unsupported edge by cutting a vertical face before resuming laying.
Treat the face of the joint with bitumen emulsion tack coat prior to spreading adjacent section.
Longitudinal joints shall not be left overnight on a pavement in use by traffic.
Transverse Match of Overlay to Existing Pavement:

- Saw cut existing asphalt pavement 20 mm depth along the match line of joint.
- Remove taper wedge of existing asphalt pavement along the overlay side of match joint.
- Feather the asphalt overlay down to the existing pavement to achieve a maximum slope of 1 in 40 and for the full width of the pavement.
- Ensure depth of overlay above existing pavement in taper wedge area is not less than 20 mm.

1.12 COMPACTION

1.12.1 General

For large patches, compact by using at least two rollers, one pneumatic tyred and one tandem steel wheeled.
Provide additional steel wheeled roller(s) for each additional 30 tonne (or part thereof) spread in excess of 30 tonne per hour.
Stand compaction plant clear of new asphalt surface.
Remove from site plant with fuel or oil leaks.
Defer rolling if excessive displacement of the asphalt occurs but only until the asphalt has cooled sufficiently to permit rolling to continue.

1.12.2 Initial Rolling

Roll immediately behind the spreader using a steel wheeled roller having a minimum weight of 8 tonnes and a maximum unit load on the rear drum equivalent to 55kN per metre width of drum.
Provide steel wheeled rollers with adjustable scrapers and keep the drums moist with water.
Prevent the mix from sticking to the drums.
Avoid ponding of water on the pavement surface.

1.12.3 Intermediate Rolling

Roll with a self-propelled pneumatic tyred roller of at least 10 tonnes mass, a minimum tyre pressure of 550 kPa and a minimum total load of 1 tonne on each tyre.
Increase the load to 2 tonnes per tyre where practicable.
Ensure tyre pressures are uniform and maintained within 5% of the specified figure.
Rolling surfaces to be smooth.

1.12.4 Final Rolling

Roll with a steel wheeled roller as used for initial rolling.

1.12.5 Joint Compaction

Compact all joints and edges. Roll all joints.

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Overlap joints in adjoining runs by a minimum of 1 m.

1.12.6 Rolling Speed

Steel wheeled roller: 1.5 m/sec. maximum, Pneumatic tyred roller: 0.75 m/sec. Maximum for the first pas. 4.5 m/sec. Maximum for subsequent passes. Avoid abrupt stops and starts.

1.12.7 Vibrating Plant

Mass	6 Tonnes minimum
Drum width	1.5 Metres minimum
Vibrating frequency	2,000 -3,000 cycles per minute
Amplitude range	0.4-0.8mm

Initial passes (not less than two) to be non-vibrating.
Provide steel wheeled rollers with adjustable scrapers and keep drums moist with water.
Disengage vibrator when accelerating, decelerating or standing.

1.12.8 Deep Lift Rolling Pattern

Applies to asphalt placed in layers exceeding 75 mm compacted thickness.
Asphalt to be placed and compacted in layers not exceeding 150 mm maximum.
Commence rolling not less than 300 mm clear of the edge of asphalt that is laterally unsupported.
Advance outwards towards the edge in 100 mm increments.
Delay rolling within 200 mm of an unsupported edge to allow mix cooling and minimise distortion.
Complete rolling in such time that specified densities are obtained.

1.12.9 Hand Tampers

Compact by vibratory plates or hand tampers in location inaccessible to rollers.
Side tamp before rolling the edge of all asphalt which is not laterally supported.
Finish hand tamped surfaces smoothly and conforming with machine finished areas.

1.13 CONFORMANCE

1.13.1 Conformance Testing

The Contractor will be responsible for process control testing.
The Contractor will be responsible for ordering the conformance tests.HYG

1.13.2 Tolerances

Conform to the following: Surface to be smooth, dense and true to shape.

Thickness:	Not less than specified.
Surface levels:	0 to + 10 mm maximum deviation from design level.
Straight edge Deviation:	5 mm maximum in 3 metres.
Surface roughness:	50 counts5 mm maximum in 3 metres./km – maximum, or at Superintendents' discretion.
Skid resistance:	Not less than specified in NTTM 304.1, Table 2.
Job mix:	Within the following variation limits.

As Sieve (mm)	%Passing (BY Mass)
4.75 or larger	+ or -7
2.36	+ or -5

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1.18 to 0.30.150	+ or -4
0.15	+ or -3
0.075	+ or -2

Bitumen content: Maximum variation 0.3% by mass.

1.13.3 Conformance Sampling and Testing

Sample materials as directed by Superintendent.

1.13.4 Table – Asphalt Testing Frequencies

For large patching works, conform to the following testing frequencies.

Test Method No.	Test Method	Minimum Test Frequency
AS /NZS 2891.3	Bitumen content	1 per 50 t
	- Mixing temp.	Every mix
	- Laying temp..	Every 30 min
AS 2891	Density	1 per 50 t
AS 2891.5	Thickness	1 per density
AS /NZS 2891.3	Particle size distribution	1 per 50 t
AS 2341.3	Viscosity	1 per 10,000 L
AS 2891.5	Stability of mix	1 per 50 t
AS 2891.5	Flow	1 per 50 t
AS 2891.8	Air voids	1 per 50 t
AS 2891.8	Voids in mineral Aggregate	1 per 50 t

1.13.5 Conformance of Compaction

Base the conformance of compaction on lots, determined from cores.
Subdivide all items of work into lots.
Give each lot a lot number.
Number the lots using a logical system.
Maintain a register of all lots and lot numbers.
Include the location of the lot on the lot register.

Lots of work will be selected by the Contractor, based upon:

- Lot will represent no more than one shifts production.
- Lots will be continuous and have been brought to completion at the same time.
- Lot will be composed of homogeneous material with no distinct changes in attribute values.

Each lot will be subject to conformance testing.
Lots will be checked for level tolerance.
Quality of the lot will be judged as conformance or non-conformance of each lot including all tests conducted on the lot.
When lots fail to satisfy the conformance criteria, payment adjustments or rejection of the lot shall be in accordance with the Payment Adjustments clause in Measurement and Payment.

Should the lot under consideration be subdivided then class each subdivision as a lot and subject each subdivided lot to lot testing.
Treat non-conforming lots which are subdivided after testing as separate lots and retest each and every subdivided lot.

Core sample locations will be selected by the laboratory on a stratified random basis in accordance with NTCP 103.1.
Supply copies of the completed stratified random selection with each compaction report.

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There shall be six cores per lot.

Relative Compaction is the percentage ratio of the insitu density of the compacted asphalt and the reference density of the asphalt.
The reference density shall be the mean of the maximum density measurements determined from the conformance sampling and testing.

The Characteristic Value of Relative Compaction (Rc) is calculated as follows:
Rc = R – ks
where R = the mean of the relative compaction results for the lot
k = the standard deviation.
The Standard Deviation (s) is calculated as follows:
s = (sum of (xi – R)2 divided by (n – 1))0.5
where xi = an individual test result
R = the mean of n results
n = the number of test results in the lot.
The multiplier values are specified in the
MISCELLANEOUS PROVISIONS Section,

Multiplier Values clause.

The work represented by a lot shall be assessed as the characteristic value of insitu air voids where the characteristic value of air voids (%) = 100 – Rc. Conform to the following limits of characteristic Value of Air Voids:

	Light Traffic	Medium Traffic	Heavy Traffic
Conformance	3.0- 8.0	3.0 -8.0	3.0 -7.0

The CONFORMANCE OF COMPACTION clause only applies to a specified asphalt thickness of 30mm or greater. Backfill all core holes with asphalt conforming to the specified properties for the subject mix, and compact to the required density.

1.13.6 Rideability

Surface roughness testing will be carried out by the Superintendent at the discretion of the Superintendent.

1:14 TABLES

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1.8.3 **Table – Aggregate and Mineral Filler Mix Proportions**

Conform to the following mix proportions;

Mix Type	CM 1	CM 2	CM 3	CM 4	CM 5	CM 6	CM 7	CM 8
	Dense Graded				Open Graded			
	% Passing (Dry Mass)							
AS SIEVE (mm)	7 mm	10 mm	14 mm	20 mm	7 mm	10 mm	14 mm	20 mm
53.0								
37.5								
26.5				100				100
19.0			100	95 – 100			100	95 - 100
13.2		100	85 - 100			100	90 - 100	50 – 90
9.5	100	90 - 100	70 - 85		100	90 - 100	40 - 75	30 – 65
6.7	90 - 100			58 – 74	85 - 100	30 - 75	10 - 35	10 – 35
4.75	70 - 90	58 - 70	46 - 65	45 – 60	30 - 70	20 - 55	5 - 25	5 – 25
2.36	45 - 60	35 - 50	28 - 45	37 – 50	10 - 40	5 - 30	0 - 10	0 – 10
1.18		22 - 38	15 - 30	22 – 36	0 – 20	0 - 10		
0.60	15 - 30	12 - 27	10 - 23	12 – 26	0 – 10			
0.30	10 - 20	6 - 16	5 - 17	6 – 20				
0.15	4 - 14	4 - 14	3 - 11	4 – 15				
0.075	3 - 8	2 - 6	2 - 5	2 – 10	0 – 4	0 - 4	0 - 4	0 – 4
				1 – 5				
Total %	100	100	100	100	100	100	100	100

The grading curve shall be smooth and shall not vary from the outer one third of the range between the specified limits for one sieve size to the opposite outer one third of the range between the specified limits for an adjacent sieve size.

1.8.4 **Table – Total Mix Proportions of Cold Mix Asphalt**

Conform to the following mix proportions;

Mix Type	CM 1	CM 2	CM 3	CM 4	CM 5	CM 6	CM 7	CM 8
	Dense Graded				Open Graded			
Size	7 mm	10 mm	14 mm	20 mm	7 mm	10 mm	14 mm	20 mm
Material	% Of Total Mix							
Aggregate and filler %	94.2 – 95.2	94.8 – 95.8	95.0 – 96.0	95.3 – 96.3	95.0 – 96.0	95.5 – 96.5	95.5 – 96.5	96.0 – 97.0
Residual binder %	4.8 - 5.8	4.2 - 5.2	4.0 - 5.0	3.7 - 4.7	4.0 - 5.0	3.5 - 4.5	3.5 - 4.5	3.0 - 4.0
Total Mix %	100	100	100	100	100	100	100	100

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1.7.4 **Table – Mix Proportions**

Mix Type	HM 1	HM 2	HM 3	HM 4	HM 5	HM 6
	Dense Graded				Open Graded	
	% Passing (Dry Mass)					
As Sieve (mm)	5 mm	10 mm	14 mm	20 mm	10 mm	20 mm
53.0						
37.5						
26.5				100		100
19.0			100	95 – 100		95 - 100
13.2		100	85 – 100	75 – 90	100	80 - 90
9.5		90 - 100	70 – 85	60 – 80	90 - 100	65 - 80
6.7	100	70 - 90	62 – 75	50 – 70	40 - 70	52 - 65
4.75	85 - 100	58 - 76	53 – 70	40 – 60	30 - 50	45 - 55
2.36	55 - 75	40 - 58	35 – 52	25 – 43	10 - 30	30 - 43
1.18	38 - 57	27 - 44	24 – 40	18 – 35	5 - 20	20 - 35
0.60	26 - 43	17 - 35	15 – 30	14 – 27	0 - 15	14 - 27
0.30	15 - 28	11 - 24	10 – 24	9 – 21	0 - 10	9 - 21
0.15	8 - 18	7 - 16	7 – 16	6 – 15	0 - 7	7 - 15
0.075	4 - 11	4 - 7	4 – 7	3 – 7	0 - 4	3 - 6
Bitumen binder (% by mass)	5.0 - 7.0	4.5 - 6.5	4.6 - 6.5	4.0 – 6.0	3.5 – 5.5	3.5 - 5.5
Compacted thickness (mm)	10 - 25	25 - 40	35 – 55	50 – 80	25 - 40	50 - 80
Bitumen film thickness (min micron)	8.5	8.5	8.5	8.5	8.5	8.5

The grading curve shall be smooth and shall not vary from the outer one third of the range between the specified limits for one sieve size to the opposite outer one third of the range between the specified limits for an adjacent sieve size.

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