# Dense Graded Asphalt

DIPL Roadworks Master – March 2022

## CONTRACTORS RESPONSIBILITIES

The Contractor is responsible for the production and placing of the registered and approved design mix in accordance with the technical requirements of this specification.

The Contractor must undertake quality control testing in accordance with CONFORMANCE TESTING and maintain a record of test results in accordance with the Contractor’s Quality System.

## Standards and Publications

Conform to the following Standards and Publications unless specified otherwise:

AS 1141(set) Methods for sampling and testing aggregate

AS 1141.5 Particle density and water absorption of fine aggregate

AS 1141.6.1 Particle density and water absorption of coarse aggregate - Weighing-in-water method

AS 1141.14 Particle shape, by proportional calliper

AS 1141.22 Wet/dry strength variation

AS 1141.23 Los Angeles value

AS 1141.24 Aggregate soundness – Evaluation by exposure to sodium sulphate solution

AS 1141.41 Polished aggregate friction value – Horizontal bed machine

AS 1141.42 Pendulum friction test

AS 1160 Bitumen emulsions for the construction and maintenance of pavements.

AS 2008 Bitumen for pavements.

AS 2150 Hot mix asphalt – A guide to good practice.

AS 2157 Cutback bitumen.

AS 2758.5 Aggregates and rock for engineering purposes – Coarse asphalt aggregates.

AS 2891(set) Methods of sampling and testing asphalt.

AUSTROADS

AGPT04B Austroads Guide to Pavement Technology Part 4B: Asphalt

AGPT04H Austroads Guide to Pavement Technology Part 4H: Test Methods

AGPT/T103 Pre-treatment and Loss on Heating of Bitumen Multigrade and polymer Binders (rolling thin film oven [RTFO] test)

AGPT/T108 Segregation of Polymer Modified Binders

AGPT/T111 Handling Viscosity of Polymer Modified Binders (Brookfield Thermosel)

AGPT/T112 Flash Point of Polymer Modified Binders

AGPT/T121 Shear Properties of Polymer Modified Binders (ARRB ELASTOMETER)

AGPT/T122 Torsional Recovery of Polymer Modified Binders

AGPT/T131 Softening Point of Polymer Modified Binders

Austroads Technical Specification ATS 3110 Supply of Polymer Modified Binders

Austroads Test Method ATM 453 Surface Deviation Using a Straight Edge

NT PUBLICATIONS

NTCP 103.1 Site selection by the stratified random technique

NTCP 107.1A Surface Roughness

NTMTM Northern Territory Materials Testing Manual - available via <https://transport.nt.gov.au/infrastructure/technical-standards-guidelines-and-specifications/materials-testing-manual>

NTTM Northern Territory Test Method

NORTHERN TERRITORY ROAD SURFACING STANDARDS

Bituminous Rise and Fall – accessible via

<https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/road-surfacing-standards>

OTHER PUBLICATIONS

MRWA Main Roads Western Australia, Test Methods

## Definitions

|  |  |
| --- | --- |
| **Table - Definitions – Dense Graded Asphalt** | |
| **TERM** | **DEFINITION** |
| **AAPA** | Australian Asphalt Pavement Association |
| **Coarse Grained Aggregate** | Where the average grain size of the constituent minerals is greater than 5 mm. The average grain size is determined optically under a petrographic microscope. |
| **Fine Grained Aggregate** | Where the average grain size of the constituent minerals is less than 5 mm. The average grain size is determined optically under a petrographic microscope. |
| **IRI** | International Roughness Index (IRIqc) |
| **Job Mix** | Adjusted blend composition of registered mix design based on production trial. |
| **Lot** | A lot will represent no more than one shift's production.  A lot will be continuous and will have been brought to completion at the same time. |
| **Material Properties** | Intrinsic properties of the sourced material. These may differ from the properties required when the material is incorporated into the works. |
| **mpm** | Metres per minute |
| **NTCP** | Northern Territory Code of Practice – found in the NTMTM |
| **NTMTM** | Northern Territory Materials Testing Manual |
| **NTTM** | Northern Territory Test Method - found in the NTMTM |
| **RAP** | Reclaimed Asphalt Pavement – a recycled material |
| **Registered Mix Design** | An asphalt mix which has been placed on the Department’s Asphalt Mix Design Register and approved for use by the Superintendent. |
| **Shall** | Is indicative of a mandatory requirement unless the context clearly indicates otherwise. |
| **VLD** | Vehicles per lane per day |
| **Warm Mix Asphalt** | Warm Mix Asphalt (WMA)” is asphalt that contains a warm mix additive, or utilises a warm mix process, that has the ability to reduce the mixing and compaction temperature requirements below the typical temperatures used for that application. |

## ASPHALT MIX DESIGN

### Mix Type and Design Traffic Category

Supply as follows: Mix Type ***[enter data]*** for Wearing Course

Mix Type ***[enter data]*** for Structural Course

Mix Type ***[enter data]*** for Correction Course

Mix Type ***[enter data]*** for Patching Work

[ Insert the required design mix type 1,2,3,4 or 5 for the particular work. Deep lift asphalts shall be minimum mix type 4]

Traffic Category; ***[enter data]***

[Nominate Heavy or Medium or Light in accordance with the TRAFFIC CATEGORIES clause. Seek advice from the Pavement Engineer if the grade is steep]

### Design Mix Requirements – Hold Point

All asphalt mixes proposed for use on works for the Northern Territory Government shall be registered in accordance with Department’s **Registration of asphalt mix designs - Technical directive** accessible via <https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/road-surfacing-standards> .

**Hold Point -** No asphalt shall be supplied until the mix has been registered and the Superintendent has approved the mix for use.

Approval of a registered asphalt mix for use under the Contract does not relieve the Contractor from employing suitable manufacturing and handling techniques to ensure performance of the mix. Satisfy all contractual obligations in regards to rectification of defects.

The manufacturer must notify the Superintendent of any proposed changes to the components or proportions of components used in the registered mix.

**Hold Point** - Where it is proposed to change the source grading or nature of the components or binders, new mix designs must be carried out in accordance with the Department’s **Registration of asphalt mix designs – Technical directive** accessible via <https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/road-surfacing-standards> .

Registration of mix designs must be renewed every 2 years from the date of acceptance.

If a registered mix has unsatisfactory handling or field performance, the Contractor or Superintendent may request the mix be de-registered.

## Traffic Categories

Unless specified otherwise, the following traffic categories shall be used to determine the required mix design level and binder type.

|  |  |  |  |
| --- | --- | --- | --- |
| ***Table - Mix Type and Binder Type for Traffic Categories*** | | | |
| **Traffic Category** | **Mix Type** | **Application** | **Binder Type** |
| Light | 1 & 2 | Cycle paths and pedestrian traffic | Class 320 or S10E |
| Medium | 2, 3 & 6 | Car parking and low volume Traffic and Car Parks | Class S10E |
| Heavy | 3 | Regional rural subdivisions outside urban areas, and regional rural asphalt | A20E |
| Heavy | 5 | All Urban Roads and Intersections and Industrial Estates | A15E |
| All | 4 | Structural layers | A15E |

Urban areas are defined as follows:

1. Darwin region urban area is nominated as North of Cox Peninsular Road (Stuart Highway), west of Trippe Road (Arnhem Highway) and the end of seal on Gunn Point Road
2. Katherine, Tennant Creek and Alice Springs urban areas are defined as the areas within the respective town boundaries.

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| **Table – Mix type designation** | | | | | | |
| **Mix Type** | **1** | **2** | **3** | **4** | **5** | **6** |
| **Aggregate size (mm)** | 7 | 10 | 14 | 20 | 14  (A15E) | 10  (Car Park) |

### Under Path Growth Inhibitor

For pedestrian, cycle, and shared paths, where subgrade is above existing natural surface a layer of under path growth inhibitor (UPGI) is to be poured on to the exposed natural surface and be spread, by raking, at a rate of 2.5 kg/m2.

## Materials

### Coarse Aggregates

Ensure 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. Coarse aggregates must conform to the requirements of ***Table - Properties - Coarse Aggregates***:

| ***Table - Properties - Coarse Aggregates*** | | |
| --- | --- | --- |
| **Property** | **Acceptance Criteria** | **Test Method** |
| Proportion of misshapen particles | 15% maximum at 2:1 calliper ratio | AS 1141.14 |
| Los Angeles Abrasion | 35% maximum loss | AS 1141.23 |
| Polished Aggregate Friction Value | 45 minimum | AS 1141.41 & AS 1141.42 |
| Wet Strength | 150 kN minimum | AS 1141.22 |
| Wet/Dry Strength Variation | 35% maximum | AS 1141.22 |
| Dry Density | Report | AS 1141.6.1 |
| SSD Density | Report | AS 1141.6.1 |
| Water Absorption | 2.5% maximum | AS 1141.6.1 |

### Fine Aggregates

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

Where crushed fine materials are from sources other than the source of the coarse material used in the asphalt mix the parent rock must meet all the requirements listed in the ***Table - Properties - Coarse Aggregates.***

Fine aggregates must conform to the requirements of the ***Table - Properties - Fine Aggregates***

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| --- | --- | --- |
| ***Table - Properties - Fine Aggregates*** | | |
| **Property** | **Acceptance Criteria** | **Test Method** |
| Soundness | ≤ 12% weighted loss | AS 1141.24 |
| Dry Density | Report | AS 1141.5 |
| SSD Density | Report | AS 1141.5 |
| Water Absorption (crushed materials) | 3.0% maximum | AS 1141.5 |
| Water Absorption (Quartz Sands) | 1.5% maximum | AS 1141.5 |

### Mineral Filler

Filler must consist of mineral material, natural or crushed mineral materials, hydrated lime or cement with a particle size smaller than 0.075mm.

Filler must be dry, free from lumps, clay, organic material or any other deleterious material, and must comply in all other respects with the requirements of AS 2150.

### Reclaimed Asphalt Pavement (RAP)

Crush and screen reclaimed asphalt pavement (RAP) from milling or excavation of existing asphalt as necessary to achieve a well graded, free flowing and consistent product. Ensure a maximum size no greater than the maximum size of the asphalt being produced.

RAP material must not contain tar binder and must be free of contaminants such as unbound granular base material, concrete, clay, soil, organic matter or any other deleterious material.

Processed RAP material must be placed in separate stockpiles prior to use. Where RAP material has been stockpiled for some time and is no longer in a free-flowing condition, reprocessing must be undertaken to ensure that it is free flowing at the time of incorporation into the manufacturing of new asphalt materials.

RAP addition in manufactured asphalt must not exceed:

* 15% by mass in base layers, and
* 10% by mass in the wearing course.

## Binders

### Standard Binder

Standard Classes of bitumen to conform to the requirements of AS 2008.

Manufacture all AS 2008 bitumens in a refinery and have NATA endorsed certificates of manufacture.

Durability Value in accordance with AS/NZS 2341.13 is to be a minimum of 7 days with no maximum value.

* + 1. **Polymer Modified Binder**

A mixture of Standard AS 2008 Class bitumen and elastomeric polymer or crumb rubber additive.

The PMB must be manufactured under a quality management system which is certified to AS/NZS ISO 9001 by a JASANZ accredited certifier (or accredited by another Accreditation Body Member of the International Accreditation Forum).

The manufacturer must implement a documented process control system to produce PMBs of a consistent quality conforming to the requirements of this Specification.

As a minimum, the process controls must include:

* + 1. a method for determining and controlling the formulation during the production process;
    2. keeping records of the composition of the constituent materials for each batch; and
    3. recording sampling frequencies and test results.

The manufacturer must:

* + 1. operate an Inspection and Test Plan (ITP) which demonstrates that the PMB complies with this specification and includes testing of the PMB, analysis of results (including control charts);
    2. ensure the all PMB supplied can be traced to the production batch and associated test report; and
    3. ensure that procedures / guidelines for the handling, storing, and transport of the binders that ensures homogeneity and conformity at the time of incorporation into the works are readily available to the Principal and Contractor.

Supply all quality documents to the Superintendent upon request.

All conformance testing to be carried out in accordance with Austroads and Australian Standard Test Methods.

Base binders for the production of PMB must meet the specification limits outlined in ***Table - Base Binder for Polymer Modified Bitumen***, from the refinery. All base binders must be process tested for conformance to ensure compliance before manufacture into PMB's.

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| --- | --- | --- |
| **Table – Base Binder for Polymer Modified Bitumen** | | |
| **Property** | **Specification limit**  **minimum** | **Specification limit**  **maximum** |
| Viscosity at 60oC, Pa.s | 140 | 380 |
| Viscosity at 135oC, Pa.s | 0.25 | 0.65 |
| Penetration at 25oC (100g, 5s),*pu* (*pu* unit is  0.1mm) | 40 |  |
| Flashpoint oC | 250 | N/A |
| Matter Insoluble in toluene, percent mass | N/A | 1.0 |
| Short Term effect of heat and air  (Rolling Thin film Oven Test)  Viscosity of residue at 60oC as a  percentage of original | N/A | 300 |
| Long term effect of Heat and air, days | 7 | 7 |
| Density at 15oC, t/m3 | To be reported | To be reported |

Polymer Modified Binders must conform to the requirements outlined in ***Table - Polymer Modified Binders for Asphalt Applications***.

| **Table - Properties of Polymer Modified Binders for Asphalt Applications** | | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| **Test Method** | **Binder property** | **Class** | | | | |
| **A35P** | **A25E** | **A20E** | **A15E** | **A10E** |
| AS/NZS 2341.4 or AGPT/T111(1) | Viscosity at 165 °C (Pa.s) max.(1) | 0.6 | 0.6 | 0.6 | 0.9 | 1.1 |
| AGPT/T122 | Torsional recovery at 25°C, 30 s (%) | 6–21 | 17–30 | 38–70 | 55–80 | 60–86 |
| AGPT/T131 | Softening point (°C) | 62–74 | 52–62 | 65–95 | 82–105 | 88–110 |
| AGPT/T125 | Stress ratio at 10 °C min. | TBR(2) | TBR | TBR | TBR | TBR |
| AGPT/T121 | Consistency 6% at 60 °C (Pa.s) min.(3) | 1000 | 400 | 500 | 900 | 1000 |
| AGPT/T121 | Stiffness at 25 °C (kPa) max. | 120 | 45 | 35 | 30 | 30 |
| AGPT/T108 | Segregation (%) max. | 8 | 8 | 8 | 8 | 8 |
| AGPT/T112 | Flash point (°C) min. | 250 | 250 | 250 | 250 | 250 |
| AGPT/T103 | Loss on heating (% mass) max. | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |

### Bitumen Emulsion

A rapid setting bitumen emulsion, conforming to requirements of AS 1160 must be used in the works when applied as a tack coat.

### Additives

Additives such as bitumen adhesion agents or hydrated lime shall be used in the mix.

Provided full details of the type of additive proposed to be used.

The material must be nominated and shown as part of the mix design in accordance with the **Asphalt Mix Design** clause in this work section.

## Sampling of Binder

* + 1. **Test Request**

Test requests are to be sent to the panel period contractor to witness sampling and arrange testing.

* + 1. **Supply of Sampling Containers**

Supply all sampling containers as required for sampling purposes.

Sample containers are to be leak proof and having a capacity of not less than one litre.

Sample containers must be clean, rust free and capable of receiving a product at high temperatures.

* + 1. **Definition of Sampling**

A sample is three containers of product collected at the same time from the same supply source.

One sample container is for the Contractor's analysis.

Two sample containers are for the Department to analyse.

Note: Refer to the Superintendent for requirements if samples are non-conforming

* + 1. **Frequency of Samples**

Refer to CONFORMANCE TESTING.

* + 1. **Collection of Samples – Witness Point**

Take samples prior to addition of adhesion agents.

Conformance test sampling is to be collected at point of delivery.

Ensure adequate sampling points are available when sampling from point of manufacture.

**Witness Point** - Take samples from the point of manufacture on transfer from the bulker to the asphalt plant.

All sampling must be in accordance with Australian Standards and/or Austroads standards. The supplier is to perform the sampling. Ensure staff carrying out sampling are competent in sampling methods.

Ensure sampling techniques do not allow contamination of the samples.

Where samples are not collected, 20% reduction adjustments (***Table - Payment Adjustments*** in MEASUREMENT AND PAYMENT) will apply to the total materials represented.

* + 1. **Sample Identification**

Samples must be clearly identified with permanent marker on adhesive labels on each tin.

Mark samples with the following information on the container at the time of collection.

* Container number.
* Sample number.
* Date and time of sample taken.
* Designation or Classification of Materials.
* Sample Temperature.
* Tanker Number.
* Name of Supplier.
* Lot number.
* Site Identification.
* Road Number.

## PAVING PLANS

Submit detailed Paving Plans within **21 days** after award of the contract, with detailed diagrams in a form of aerial photographs, design drawings or similar and daily tonnages of the works – see below for minimum requirements.

* 1. Date, Shift number - relate this to the paving plans, time of works, tonnes of Asphalt, square metres.
  2. Ensure paving run numbers are shown on plan diagrams.
  3. Paving Plan must be accurate to allow for efficient Communications planning.
  4. Submit paving / section plan in Excel, editable format.
  5. Submit detailed pictures of the sites with reference to the shift number and date.
  6. All paving plans are to be aligned with the TGS.

### Make allowances under Provision for Traffic for mandatory attendance of WZ1 traffic scheme designer to be onsite at all times.

## Surface Preparation

### New Construction – Witness Point

**Witness Point -** Give the Superintendent not less than 24 hours notice of the location and scheduled commencement time of surface preparation works.

The contractor must prepare existing surfaces to ensure that asphalt construction can be completed in accordance with the requirements of this specification.

The Contractor must:

* ensure that the surface has been adequately prepared so that the specified asphalt material density can be achieved. If the Contractor suspects that the base layer is inadequate for asphalt construction the Contractor must inform the Superintendent;
* ensure that the surface has been adequately prepared to achieve shape and level requirements where required;
* ensure that the exposed granular base layer is tightly bound and free from vegetation and other foreign matter;
* ensure there are no laminations or false pavements within the exposed surface;
* remove all foreign matter by sweeping or other means; and
* ensure that exposed granular layers have sufficiently dried back to the requirements of the **Final Pavement Surface** clause in PAVEMENTS AND SHOULDERS.

The Contractor must apply a bituminous spray seal prime coat to the exposed granular surface as specified in SPRAY SEALING.

Prior to laying base or wearing surface asphalt all depressions greater than 15 mm must be filled with an asphalt correction course layer. Minimum asphalt layer thicknesses must be observed during this procedure.

### Resurfacing of Existing Bitumen and Concrete Surfaces

All vegetation and loose and extraneous matter must be removed prior to the application of bituminous resurfacing materials.

Depressions greater than 25 mm must be filled with an asphalt correction course layer. Minimum asphalt layer thicknesses must be observed during this procedure.

### Cold Planing

Unless otherwise specified or directed by the Superintendent, cold planing shall be carried out in such a manner as to leave a uniform surface parallel with the specified ultimate finished surface of the pavement.

Cold milling forward cutting speed shall not exceed 15mpm.

Use at a minimum a 2 metre profiler drum.

All loose materials must be removed from the planed surface prior to placing asphalt.

Exposed granular materials must be watered, re-compacted to form a tight and hard surface and, where specified, must be primed or resurfaced with a 7 mm emulsion bituminous seal prior to pacing asphalt. The bituminous seal must be supplied and applied in accordance with SPRAY SEALING.

### Shape and Surface Roughness

Where surface shape of an existing pavement is corrected by cold planing, the application of the resurfacing asphalt layer is considered to be new work. For the purposes of measuring surface roughness, the asphalt surfacing following correction of surface shape by cold planing will be designated as new work and roughness limits specified in ***Table – Finished Pavement Properties*** in **Finished Pavement Properties** sub-clause, in **Conformance** clause in this work section, must be achieved.

### Temporary Works – Hold Point

Where the cold planed surface is to be opened to traffic, the surface must be cleaned of all loose material and both transverse and longitudinal ramps must be installed in accordance with the **Temporary Ramps** sub-clause in the **Spreading** clause in this work section or other means to provide for the safe passage of traffic.

**Hold Point** -This work must be approved by the Superintendent before the section is opened to traffic.

All temporary ramping materials and/or other measures must be removed prior to placing new asphalt.

### Tack Coat

Apply a fine spray of bitumen emulsion lightly and evenly over the whole of the area to be covered with asphalt. Apply tack coat to all edges.

The pavement must be dry and dust free before any application of tack coat.

Apply tack coat by spray bar fitted to mechanical sprayer. Hand spray only in areas where it is impractical to use a spray bar.

Protective splash boards or spray skirts must be used to eliminate over spray beyond the surface where tack coat is being applied.

Application rate of Residual Binder must be 0.3 litres/square metre unless otherwise directed by the Superintendent.

Allow the tack coat to 'break' before laying the asphalt.

Clean and tack coat existing surfaces against which new work is to be laid.

Re-apply Tack coat where damaged by construction traffic or weather.

## MIXING

Asphalt materials must be manufactured in a plant capable of consistently producing asphalt that complies with the approved registered mix design. The asphalt material must meet manufacturing temperature requirements out lined in ***Table - Acceptable Temperature Ranges by Materials***.

|  |  |  |
| --- | --- | --- |
| ***Table – Acceptable Temperature Ranges by Materials*** | | |
| **Material** | **Minimum Temperature (°C)** | **Maximum Temperature (°C)** |
| Class 320 Bitumen | 150 | 170 |
| S10E PMB | 150 | 175 |
| A15E PMB | 160 | 175 |
| Asphalt at discharge from asphalt mixing plant | 135 \* | 170 |
| \* Minimum of 130°C when produced as warm mix asphalt | | |

### Asphalt Material Storage

Asphalt may be stored in hot storage facilities for a period not exceeding 24 hours from the time of manufacture.

## TRANSPORT AND SUPPLY

### Transport

All transport vehicles must be free from oil and/or fuel leaks.

Asphalt materials must be transported by trucks with clean trays which permit seamless discharge of the asphalt material to the receiving hopper.

The asphalt material must be covered with suitable tarps to reduce the rate of cooling during transport.

Delivery trucks must be fitted with adjustable tailgate(s) to allow control of the mix during discharge into the receiving hopper.

All delivery dockets must provide information that can trace each load to the manufacturing cycle and also to the point of placement.

Delivery dockets must record:

* Unique Docket Number,
* Time of Departure,
* Temperature at point of discharge from the manufacturing plant,
* Product Type and Bitumen Type, and
* Mass of Materials - Individual load tonnage and cumulative tonnage.

### Rate of Supply

The frequency of asphalt material deliveries must be planned to achieve a uniform rate which is in line with the capacity of spreading and compaction processes.

Rate of delivery must allow continuous placing of the asphalt material having regard to;

* the number of haulage vehicles available, and
* the haulage distance to the work site.

Cooling must be minimised by prompt delivery and placement of the asphalt material at the site.

## SPREADING

### General - Witness Point

**Witness Point** - Give at least 24 hours notice before commencement of asphalt material spreading.

The asphalt material must be laid at a uniform thickness to the tolerances listed in ***Table - Finished Pavement Properties*** in **Finished Pavement Properties** sub-clause in the **Conformance** clause in this work section. The paving operation must be one continuous operation where practical. Where a break in paving occurs due to a planned stop or prolonged delay period a transverse joint must be constructed.

Asphalt that has cooled below acceptable initial rolling temperature(s) must be removed from site and replaced prior to initial rolling.

Asphalt must not be laid when rain is imminent. Paving must cease during heavy or continuous rain, or in wet conditions where the material will not adhere or key to existing surfaces.

Remove from site all rain affected and/or temperature depleted materials, at no cost to the Principal.

### Mechanical Spreading

The spreading machine must have a capacity of placing not less than 250 tonnes of asphalt material per shift.

Paving machines must be self-propelled and equipped and operated with an electronic levelling apparatus.

Where limited quantities of asphalt are required, or the area to be paved is restricted or of limited width, such as footpaths or parking areas, other spreaders approved by the Superintendent may be used.

### Hand Spreading

Hand spreading will be permitted only in locations where spreading with a paving machine is impractical. Hand work may be used to correct localised depressions and/or irregularities.

Spreading of excess material over newly placed asphalt during joint matching is not permitted. All excess material must be removed and discarded from the site. Broadcasting of asphalt over the mat is not permitted at any time.

### Laying Pattern - Witness Point

Work must be completed as one continuous operation where practical.

**Witness Point** - Provide a construction program and paving plan at least 7 working days prior to commencement of works. Paving plans must be confirmed prior to the commencement of each shift.

Laying patterns are not to have longitudinal joints programmed to be left as cold joints. Full width paving shall be programmed.

### Construction Joints

Paving plans must detail the construction processes and procedures. Use processes and procedures which minimise longitudinal and transverse construction joints.

Longitudinal joints must be located within the lane line of the pavement or the traffic sump line. Longitudinal joints must not be located under wheel paths.

Longitudinal joints must be laterally off-set by 100 mm and transverse joints by 500 mm when paving multiple layers.

Construction joints must be minimised within intersections, and within the braking zones in approaches to intersections, and within acceleration zones of intersections.

During paving overlap each adjoining lane by at least 25 mm to form an even transverse surface. Proud asphalt material must be raked back immediately to form a ridge along the top of the joint. Where excess material remains in place, this material must be removed from the joint area prior to compaction rolling. Following rolling the resultant joint must be smooth and of similar texture to the pavement in general.

### Transverse Joints

Form transverse joints by cutting with a purpose-built asphalt cut off wheel, or diamond saw, or profiler, to form a vertical face. All waste asphalt is to be removed from site.

When constructing transverse joints, in new works and resurfacing works, ensure that the joint and the approaches to the joint do not deviate more than 5 mm under a 3 metre straight edge. Cut back existing pavement to a true level surface with no deviation. Cut back must be a minimum of 200 mm or be sufficient in length to match existing pavement levels and to also maintain cross falls.

Transverse joints include joints created where a paving machine has stopped in any surfacing works.

Exposed joint faces must be treated with bitumen emulsion tack coat prior to placing asphalt against them.

Offset transverse joints in adjacent runs by 1m minimum.

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 10 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.

### Longitudinal Joints – Hold Point

**Hold Point** – Provide a plan showing all proposed longitudinal joints. The plan must be approved by the Superintendent prior to works depicted commencing.

Do not leave unfinished longitudinal joints. Where in unforeseen circumstances longitudinal joints must be left unfinished the site must have traffic management in place, with traffic management personnel on site, until the joint is finished, at no cost to the Principal.

All longitudinal joints must be parallel to and follow the shape of the road alignment unless directed otherwise by the Superintendent.

Edges must not remain unsupported unless directed otherwise by the Superintendent. Unsupported edges must be cut back at least 75 mm if adjacent runs are not paved within the time taken to cool below acceptable paving temperatures.

All unsupported edges left over-night must have tapered edges and must be cut back prior to paving adjacent runs.

All open faces must be treated with bitumen emulsion tack coat prior to paving.

### Temporary Ramps

Provide compacted asphalt ramps measuring a maximum 1% grade relative to existing surrounding pavement grades, where transverse joints are left overnight under traffic.

Longitudinal Ramps must be a minimum of 300 mm wide under traffic, and must be visually monitored at all times for the period the ramps are in use.

All costs relating to temporary works must be included in the Contractor’s cost proposal and will be deemed to have been included in the contract price. No additional payment will be made for temporary works.

## COMPACTION

### Compaction Generally

All plant and equipment used for the execution of the works must be free of oil and fuel leaks.

Compaction methodology must be used so that rollers do not stop on the hot new asphalt surface.

Defer rolling if excessive displacement of the asphalt occurs but only until the asphalt has cooled sufficiently to permit rolling to continue.

The depth of each layer compacted must not exceed 5 times the nominated aggregate maximum size.

### Compaction Temperatures - Witness Point

Compaction must be completed prior to cooling of the asphalt material below temperatures at which point the material may be damaged by rolling or at the point at which densification ceases.

**Witness Point** - The Contractor must advise the Superintendent of temperature limits relating to compaction.

### Initial Rolling

Initial breakdown rolling must commence immediately following asphalt placement behind the spreader using a steel wheeled roller. Initial rolling must not result in adverse displacement or cracking.

Steel wheeled rollers must be fitted with adjustable scrapers and the drums must be kept moist with water to prevent the mix from sticking to the drums.

### Intermediate Rolling

Self-propelled pneumatic tyred rollers with the same tyre pressure in all compacting tyres must be used for intermediate rolling. Rollers must be fitted with water lubricant systems that stop the asphalt sticking to the rubber tyres. Do not use detergents or other chemicals for lubrication. Sand may be spread on the new asphalt to prevent the asphalt sticking to the tyres. Rolling must be completed during applicable material temperatures.

### Final Rolling

A static steel wheeled roller must be used during final rolling. This procedure must remove all roller marks from the surface to ensure a smooth even surface.

### Joint Compaction

All joints and free edges must be constructed and compacted to obtain acceptable surface texture.

Offset transverse joints in adjoining runs by 1 m minimum.

Rolling of unsupported edges must not result in shape loss and/or excessive lateral displacement.

Finished joints must obtain a smooth even surface which does not exceed 5 mm deviation under a 3 m straight edge.

Test all joints for straight edge compliance immediately as a joint is created.

### Hand Tampers

Compact asphalt materials by vibratory plates or hand tampers in locations inaccessible to rollers. Finish hand tamped surfaces to a smooth even surface conforming with machine finished areas.

All free edges not laterally supported are to be pushed up with a heavy hand rake and tamped, to form a firm and cohesive edge of not less than 60° slope prior to rolling the free edge or applying the adjacent paving run.

## CONFORMANCE

### Conformance Testing

The Contractor must undertake internal process control testing daily.

The Superintendent will carry out all conformance testing of materials and completed pavement properties through the Conformance Testing Panel Period Contract.

Bitumen used in the Asphalt production shall be tested in accordance with CONFORMANCE TESTING.

The Contractor must formally request conformance testing using the "Conformance Test Request" form not less than 2 working days prior to sampling and/or testing taking place.

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

When lots fail to satisfy the conformance criteria, payment adjustments or rejection of the lot shall be in accordance with ***Table - Rate of Payment Adjustments*** in MEASUREMENT AND PAYMENT, in the **Rate of Payment Adjustments** sub-clause.

### Process Testing

Supply individual lot process test result daily, for all shifts, including Bitumen and Asphalt results in excel format, at a minimum to AAPA Pavement Work Tips No.15, accessible via <https://www.afpa.asn.au/technology-publications/work-tips/> . Detail individual lots with chainages.

### Finished Pavement Properties

The works must conform to the requirements listed in this work section, and ***Table - Surface Shape Requirements*** and ***Table – Finished Pavement Properties*** in this work section, and***Table – Relative height tolerances for new works abutting existing works*** in PAVEMENTS AND SHOULDERS*.*

|  |  |  |
| --- | --- | --- |
| ***Table - Surface Shape Requirements*** | | |
| **Layer** | **All Roads – Maximum Deviation Below 3m Straight Edge (mm) (to ATM 453)** | |
| **Parallel to Centreline** | **Transverse to Centreline** |
| Wearing Course | 5 | 7 |
| Intermediate and Base | 8 | 12 |

|  |  |
| --- | --- |
| ***Table - Finished Pavement Properties*** | |
| Finish pavement surfaces smooth, dense, true to shape and to the following tolerances; | |
| Thickness: | Average not less than specified. |
| Surface levels: | Maximum deviation from design level 0 to +10 mm |
| Surface roughness  (NTCP 107.1A): | 2 IRI – Mean Surface Roughness for new works 2.3 IRI – Mean Surface Roughness for resurfacing work. |
| Contamination from chemicals, petroleums (including oils, petrol and diesel) or solvents | Non-compliance - Remove and replace affected areas |

|  |  |
| --- | --- |
| ***Table - Testing Sequence for Surface Roughness for Pavement Type*** | |
| **Pavement type** | **Surface Roughness Testing sequence** |
| Deeplift asphalt pavements | On final wearing surface |
| Asphalt Overlays and Thin Shape correcting Surfaces (thickness < 50 mm ) | On final wearing surface. |
| Asphalt surface on new granular pavement (thickness 40 mm and over) | On finished base layer, to meet requirements of PAVEMENTS AND SHOULDERS.  On final wearing surface. |

### Conformance of Asphalt Production

Conform to the variation limits to the approved Job Mix Design shown in ***Table - Variation Limits To The Approved Job Mix Design***

| ***Table - Variation Limits To The Approved Job Mix Design*** | |
| --- | --- |
| **Grading:** | |
| **AS SIEVE (mm)** | **% PASSING (by mass)** |
| 4.75 or larger | + or - 7 |
| 2.36 | + or - 5 |
| 1.18 to 0.30 | + or - 4 |
| 0.15 | + or - 3 |
| 0.075 | + or - 2 |
| **Bitumen Content:** | Maximum variation 0.3% by mass to the Approved Job Mix Design: |
| **Maximum Density:** | Maximum variation 5% by mass to the Approved Job Mix Design |

When lots fail to satisfy the conformance criteria, payment adjustments or rejection of the lots will be in accordance with the **Rate of Payment Adjustments** sub-clause in MEASUREMENT AND PAYMENT.

### Conformance Sampling and Testing Frequencies

The Superintendent will undertake conformance sampling of bitumen and asphalt materials taken from trucks, and tanks, at the mixing plant, and of the finished asphalt pavement, in accordance with the requirements of CONFORMANCE TESTING.

Bitumen used for asphalt production shall be sampled daily.

### Asphalt Compaction

The contractor must provide details of work lots to Superintendent, including:

* map of lot location(s) relative to land marks including direction;
* lot numbers; and
* lot register.

Work lots must:

* consist of no more than one shift's production;
* be continuous; and
* consist of homogeneous material without distinct changes in characteristic properties.

Each lot will be subject to conformance testing including:

* asphalt material testing;
* in-situ compaction;
* level compliance where appropriate:
* roughness; and
* visual assessment.

When lots fail to satisfy the conformance criteria, payment adjustments, or rejection of the lots, will be in accordance with the **Rate of Payment Adjustments** sub-clause in MEASUREMENT AND PAYMENT.

Should the lot under consideration be subdivided then each sub-lot will be subjected to separate testing.

Non-conforming lots, which are subdivided must be retested individually following subdivision.

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.

Carry out density testing as soon as practicable after completion of works. The work represented by a lot will be assessed as the mean value of in-situ air voids where the Mean Value of Air Voids is calculated in accordance with CONFORMANCE TESTING.

Conform to ***Table - Mean Value of Air Voids***.

The **Conformance of Compaction** clause only applies for asphalt thickness greater than or equal to 30 mm.

|  |  |  |  |
| --- | --- | --- | --- |
| ***Table - Mean Value of Air Voids*** | | | |
| **Reduction Level** | **Light Traffic** | **Medium Traffic** | **Heavy Traffic** |
| Conformance | 3.0 – 8.0 | 3.0 – 8.0 | 3.0 – 7.0 |
| Reduction Level 1 | 8.1 – 9.5 | 8.1 – 9.5 | 7.1 – 8.5 |
| Reduction Level 2 | 9.6 – 10.0 | 9.6 – 10.0 | 8.6 – 9.0 |
| Reduction Level 3 | 10.1 – 11.0 | 10.1 – 11.0 | 9.1 – 10.0 |

## Price Adjustment for Bitumen

* + 1. **General – Witness Point**

The basis of price adjustment (rise and fall), to the Contract rates shall be as follows.

The Contract requires a review of the Contract Unit Rates for Bituminous Products during the Contract period. With applicable claims for price adjustment, the Contractor shall submit a request for price adjustment to the Principal with all invoices. The price adjustment claimed must be calculated in accordance with the formula below.

**Witness Point -** The claim must be supported by adequate information to substantiate the adjustment in Unit Rates. The Contractor must provide details of the relevant average bitumen price indexes from both the date of Contract Award, and the commencement date of application of the seal or the approved program date for the commencement of sealing application. The commencement of sealing date is to be confirmed by the Superintendent.

It is the intention that revised Rates shall reflect the Contractor’s current costs incurred at the time of application of Bitumen Products based on relevant cost adjustment indices or other industry factors.

Where the delays to the Sealing Date are not approved by the Principal as an approved deviation from the Construction Programme (in accordance with the Contract), then for the purpose of calculating adjustments the Sealing Date will be back dated to a date that reflects the Construction Programme as provided in accordance with the Contract.

* + 1. **Definitions**

|  |  |
| --- | --- |
| **Table – Definitions – Dense Graded Asphalt – Bitumen Price Adjustment** | |
| **Bitumen Products** | Are the Schedule of Rates line items subject to adjustment, which include (where applicable); Primes, Primer Seal, Seal, Pre-coat, Enrichment Coat, Seal Coat, applied to Aggregate. |
| **Average Bitumen Price** | Is the average published list selling price (per tonne) for Class 170 bitumen for the applicable month, The applicable month is the month during which the applicable date falls. The applicable dates are Contract Award date, and/or Approved Program Date for the commencement of sealing works (application of bitumen products), and/or the actual date on which sealing works (application of bitumen products) commenced. |
| **Approved Sealing Date** | Is the date that the Bitumen Products were applied to the works if this is the approved date, or the approved scheduled date for commencement of sealing works. It is not the date that payment is claimed. |

* + 1. **Basis of Adjustment**

Price Adjustment for Bitumen will be on the following basis:

1. The adjustment shall be undertaken at the time of making claims for payment of applicable bitumen works undertaken.
2. The relevant statistics used for calculation of price adjustment of Bitumen Products rates shall be drawn from the VicRoads Publication “Rise and Fall Indices LABOUR, CONSTRUCTION & AVERAGE BITUMEN PRICE” available at <https://webapps.vicroads.vic.gov.au/VRNE/tenconin.nsf/webFreeForms/4B01451960BD9891CA257367001DFA9A?OpenDocument>.
3. The Principal will not calculate split payments where sealing operations occur during more than one month.

| **Table – Dense Graded Asphalt – Formula for Bitumen Price Adjustment** | |
| --- | --- |
| **Formula** | **Pn = Pb + ( (Mn/970) - (Mb/970) )** |
| **Pn** | Is the new scheduled bitumen price, expressed as dollars per litre, calculated by applying the formula set out below. |
| **Pb** | This is the base scheduled bitumen price, expressed as dollars per litre, accepted by the Principal in the initial contract rate or sum in the Schedule of Rates or Bill of Quantities. |
| **Mn** | Is the applicable New Monthly Average Bitumen Price. This will be the value for the month during which sealing operations commenced, or the date sealing operations were scheduled to commence in the approved programme of works. It is expressed in dollars per tonne. |
| **Mb** | Is the monthly Base Average Bitumen Price for the month during which the Contract award date falls, for this Contract, expressed in dollars per tonne. |
| **Note:** 970 is representative of the litres of bitumen at 15 degrees in 1000kg of bitumen  **Note:** “+” means add; “-“ means subtract, “**/”** means divide by the value following the symbol; calculations in the brackets to be performed first. | |