Amendment Register

|  |  |  |  |
| --- | --- | --- | --- |
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| 1.0 |  | Original issue | Oct 2001 |
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| 4.3 | Section references updated |
| 4.5 and 4.6 | Sections for Polymer Modified Bitumen and Penetrating Emulsion Prime added |
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| 2.5 | Submit seal design report, if requested |
| 4.1 | Table 4.2 – Aggregate Quality Category “D” removed |
| 4.6 | New Section for Crumb Rubber Modified Bitumen |
| 6.2 | Use of precoat material containing tar prohibited  Lead time between precoating aggregate and sealing revised |
| 6.5 | Minimum period between treatments using Penetrating Emulsion Primer added  Table 6.2 Penetrating Emulsion Primer added  Table 6.3 Penetrating Emulsion Primer and Crumb Rubber Modified Bitumen added |
| 6.6 and 6.7 | Degree of saturation (DOS) to comply with *S150 Roadworks* |

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TABLE OF CONTENTS

1.0 General 1

1.1 Section Content 1

1.2 Standards 1

1.3 References 2

2.0 QUALITY 2

2.1 Quality System 2

2.2 Inspection 2

2.3 Tests 2

2.4 Samples 3

2.5 Submissions 3

3.0 definitions 3

4.0 MATERIALS 4

4.1 Cover Aggregate 4

4.2 Prime Cover Material 5

4.3 Bitumen 5

4.4 Cutback Bitumen 6

4.5 Polymer Modified Bitumen 6

4.6 Crumb Rubber Modified Bitumen 6

4.7 Penetrating Emulsion Prime 6

4.8 Measuring Bituminous Materials 7

5.0 PLANT 7

6.0 surfacing 7

6.1 General 7

6.2 Precoating 8

6.3 Cutting Bitumen 8

6.4 Preparation for Spraying 8

6.5 Spraying Operations 9

6.6 Priming 10

6.7 Primer Sealing 11

6.8 Spreading Prime Cover Material 11

6.9 Spreading Cover Aggregate 11

6.10 Defective Surfacing 12

7.0 completion 12

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# General

## Section Content

Application of sprayed bituminous surfacing including priming, primer sealing, bitumen sealing, bitumen emulsion sealing, and resealing.

## Standards

|  |  |  |
| --- | --- | --- |
| Australian Standard | AS 1141.19 | Methods for sampling and testing aggregates – Fine particle size distribution in road materials by sieving and decantation |
| Australian Standard | AS 1141.50 | Methods for sampling and testing aggregates – Resistance to stripping of cover aggregates from binders |
| Australian Standard | AS 1160 | Bituminous emulsions for the construction and maintenance of pavements |
| Australian Standard | AS 1289.3.6.1 | Methods of testing soils for engineering purposes – Soil classification tests – Determination of the particle size distribution of a soil – Standard method of analysis by sieving |
| Australian Standard | AS 2008 | Bitumen for pavements |
| Australian Standard | AS 2157 | Cutback bitumen |
| Australian/New Zealand Standard | AS/NZS2341.2 | Methods of testing bitumen and related roadmaking products – Determination of dynamic viscosity by vacuum capillary viscometer |
| Australian Standard | AS 2341.12 | Methods of testing bitumen and related roadmaking products - Determination of penetration |
| Australian Standard | AS 2341.14 | Methods of testing bitumen and related roadmaking products – Determination of flashpoint of bitumen |
| Australian Standard | AS 2341.16 | Methods of testing bitumen and related roadmaking products - Determination of flashpoint of cutback bitumen |
| Australian/New Zealand Standard | AS/NZS2341.23 | Methods of testing bitumen and related roadmaking products - Determination of residue from evaporation |
| Australian/New Zealand Standard | AS/NZS2341.4 | Methods of testing bitumen and related roadmaking products - Determination of dynamic viscosity by rotational viscometer |
| Australian Standard | AS 2341.7 | Methods of testing bitumen and related roadmaking products - Determination of density using a density bottle |
| Australian/New Zealand Standard | AS/NZS2341.8 | Methods of testing bitumen and related roadmaking products - Determination of matter insoluble in toluene |
| Australian Standard | AS 3568 | Oils for reducing the viscosity of residual bitumen for pavements |
| Australian/New Zealand Standard, International Standards Organization | AS/NZS ISO 9001 | Quality management systems – Requirements |

## References

|  |  |  |  |
| --- | --- | --- | --- |
| Austroads | Test Method | AGPT-T190 | Specification framework for polymer modified binders |
| Austroads | Technical Report | AP-T262 | Performance requirements for bitumen sprayers |
| Queensland Department of Transport and Main Roads | Test Method | Q103B | Particle size distribution of aggregate – dry sieving |
| Queensland Department of Transport and Main Roads | Test Method | Q201 | Flakiness index of aggregate |
| Queensland Department of Transport and Main Roads | Test Method | Q216 | Degree of aggregate precoating |

Refer to the following Reference Specifications for Civil Engineering Works:

|  |  |
| --- | --- |
| S110 | General Requirements |
| S120 | Quality: Quality control testing |
| S150 | Roadworks |

# QUALITY

## Quality System

The supplier must maintain a Quality Assurance System with third party accreditation to *AS/NZS ISO 9001*. The supplier must notify the Contractor or Superintendent within two days of becoming aware that process control tests relevant to the work have fallen outside the specified limits.

## Inspection

Witness points

*Refer annexure*. Give sufficient notice so that inspection may be made of the following stages:

* Surfaces prepared for priming, sealing or surfacing.
* Commencement of bituminous spraying of each seal coat.

## Tests

General

Methods: Use the specified Australian Standard, Austroads or Queensland Department of Main Roads test methods.

Testing authority: Use a testing facility registered by NATA for the test required.

Process control tests

Perform sampling and testing of the type and frequency necessary to adequately control the work. Comply with the minimum requirements specified in *S120 Quality Clause 8.1*. *Refer annexure*.

Compliance assessment tests

General: The Contractor or Superintendent may carry out compliance assessment testing using a testing laboratory registered with NATA for the particular test.

Records

Show records of process control tests on control charts or graphs displayed on site in a readily accessible location and updated daily.

## Samples

General

On request, submit samples of each type of cover aggregate (40 kg) and bituminous material (8 L) supplied under the Contract. *Refer annexure*.

Identification

Attach a tag to each sample showing relevant information including description, source and nominal size of material, date sampled and by whom.

## Submissions

**Seal design report**

On request, submit the seal design report covering binder class, cover aggregate size and source the design method and calculations used to determine the designed spray rate and the designed spread rate. For seals involving multiple layers of binder and/or aggregate (e.g. double seals), include the minimum and maximum period between bituminous treatments. *Refer annexure*.

**Test program**

On request, submit details of the supplier's inspection and test program covering all specified properties of the materials. On request, submit details of recent test results demonstrating sustained compliance of the work and similar work with the required properties. *Refer annexure*.

Execution

General: Submit proposals for the methods and equipment to be used for the roadworks, including the following:

* Staging of the work, access and traffic control methods.
* Disposal of surface water, control of erosion, contamination and sedimentation of the site, surrounding areas and drainage systems.
* Methods and equipment for each operation.
* Sources of materials.
* Material stockpiles.

Records of measurement

Submit certified records of work performed.

# definitions

Actual spray rate: The spray rate for the relevant bituminous material at 15°C achieved during the surfacing operation.

Actual spread rate: The spread rate of cover aggregate or prime cover material achieved during the surfacing operation.

Additive: Cutter oil, flux oil and/or adhesion agent.

Binder: A material (bitumen, cutback bitumen and/or polymer modified bitumen) used to hold aggregate particles together as a coherent mixture.

Bitumen: A bituminous material obtained by processing the residue from refining certain naturally occurring crude oils.

Bitumen emulsion: A liquid product in which a substantial amount of bitumen (to which some oil may be added) is dispersed in a finely divided condition in water and stabilised, by means of one or more emulsifying agents.

Bituminous material: Bitumen, cutback bitumen, bitumen with cutter oil and/or flux oil and/or adhesion agent, polymer modified binder and/or crumb rubber.

Cover aggregate: Aggregate that forms a permanent wearing surface on a pavement.

Crumb Rubber Modified Bitumen: Bitumen blended with crumb rubber which is generally obtained from the shredding and grinding of scrap rubber from vehicle tyres.

Cutting back bitumen: The temporary reduction of bitumen viscosity by the addition of cutter oil (light petroleum distillate).

Designed spray rate: The spray rate for the relevant bituminous material at 15°C that is deemed suitable by the Superintendent.

Designed spread rate: The spread rate of cover aggregate or prime cover material that is deemed suitable by the Superintendent.

Double seal or two coat seal: A seal coat made up of two successive applications of binder and aggregate.

Flash point: The temperature at which the vapour of a substance momentarily takes fire, but does not continue to burn, when heated under specific test conditions.

Holding seal: See primer seal.

Polymer modified bitumen: Bitumen containing dispersed polymeric material.

Precoating: The coating of aggregate with a precoating agent to create the initial bonding between the bituminous binder and the aggregate.

Prime: An application of a bituminous material to a prepared base as a preliminary treatment to a more permanent bituminous surfacing.

Primer: A fluid bituminous material that is applied to a prepared base.

Primer binder: A material more viscous than a primer and required to act both as a primer and binder.

Primer seal: The application of a primer binder and aggregate to a cold planed, newly constructed or re-constructed pavement surface, to hold that surface until the permanent surface is applied.

Prime cover material: Material used to cover a prime to enable traffic to use the pavement. Prime cover material may be clean sand, crusher dust or cover aggregate.

Reseal: A maintenance seal on an existing bituminous surface.

Seal: A thin surface layer of bituminous material into which aggregate has been incorporated.

Single seal: A seal coat made up of one application of binder and aggregate.

Spray run: The area of pavement selected for coverage with a bituminous material during one continuous operation with a sprayer.

# MATERIALS

## Cover Aggregate

General requirement: Cover aggregate must consist of crushed rock, crushed gravel or uncrushed gravel, and be free from dust, clay, vegetable matter and other deleterious material.

Particle size distribution (grading): Test to Queensland Department of Transport and Main Roads method *DTMR Q103B* or the appropriate Australian Standard method *AS 1141.19* or *AS 1289.3.6.1*. Comply with the requirements of Table 4.1 for the relevant nominal size.

Material properties: Test to the specified Queensland Department of Transport and Main Roads or the Australian Standard methods. Comply with the requirements of Table 4.2 for the relevant quality category.

Conformance criteria: Comply with the requirements of *S120 Quality Clause 8.2*.

Table4.1 – Particle size distribution

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| A.S. sieve size (mm) | % passing by mass for each nominal size | | | | | |
| 20 mm | 16 mm | 14 mm | 10 mm | 7 mm | 5 mm |
| 26.5 | 100 |  |  |  |  |  |
| 19.0 | 85 - 100 | 100 | 100 |  |  |  |
| 16.0 |  | 85 - 100 |  |  |  |  |
| 13.2 | 0 - 20 | 0 - 60 | 85 - 100 | 100 |  |  |
| 9.50 | 0 - 5 | 0 - 15 | 0 - 30 | 85 - 100 | 100 |  |
| 6.70 |  |  | 0 - 5 | 0 - 30 | 85 - 100 | 100 |
| 4.75 |  |  |  | 0 - 8 | 0 - 30 | 85 - 100 |
| 2.36 | 0 - 1 | 0 - 1 | 0 - 1 | 0 - 1 | 0 - 10 | 0 - 30 |
| 1.18 |  |  |  |  | 0 - 5 | 0 - 5 |

Table4.2 – Material properties

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Property | Units | Test method | Aggregate quality category | | |
| A | B | C |
| Flakiness index (nominal sizes ≥10 mm) | % max | *DTMR Q201or AS 1141.15* | 30 | 35 | 35 |
| Ten percent fines values (wet) (1) | kN min | *AS 1141.22* | 175 | 150 | 100 |
| Wet/dry strength variation(1) (2) | % max | *AS 1141.22* | 30 | 35 | 40 |
| Proportion of weak particles | % max | *AS* *1141.32* | 1 | 2 | 3 |
| Crushed faces (3) | % min | *AS* *1141.18* | 80 | 80 | 80 |

1. Carry out test on one significant sieve fraction, where possible, on particles passing the A.S. 13.2 mm sieve but retained on the A.S. 9.5 mm sieve.
2. If Greenstone source material (Metamorphic Group) does not comply with the specified maximum wet/dry strength variation limits, it may be used provided that the ten percent fines values (wet) is at least 60 kN greater than the specified maximum value for the relevant subtype.
3. *Testing only required when aggregate is not obtained from a blasted face in a quarry.*

## Prime Cover Material

General requirement: Prime cover material must consist of natural sand or crushed rock particles of size generally smaller than 4.75 mm but larger than 0.075 mm.

Contamination: Prime cover material must be free from soluble salts, organic matter, clay and other deleterious material.

## Bitumen

Bitumen: Generally to *AS 2008*.

Bitumen emulsion: To *AS 1160*.

General requirement: Bitumen must be homogeneous and free from any inorganic matters, other than that naturally present in crude petroleum.

Foaming: Bitumen must not foam when heated to 175ºC.

Material properties: Comply with the requirements of *AS 2008*.

Conformance criteria: Comply with the requirements of *S120 Quality Clause 8.2*.

## Cutback Bitumen

Cutback bitumen: Generally to *AS 2157*. A product made from residual bitumen complying with *AS 2008* by the addition of cutter oil complying with *AS 3568*. Select grades to suit the prepared surface and the weather conditions.

Priming classes: Cutback bitumen grades AMC00, AMC0, AMC1.

Primer sealing and premix classes: Cutback bitumen grades AMC2, AMC3, AMC4.

Sealing classes: Cutback bitumen grades AMC5, AMC6, AMC7.

Mixture: Use volatile diluent compatible with the bitumen to produce a homogeneous mixture.

Storage and transport: Store and transport in purpose built containers in such a way that contamination does not occur.

Flashpoint: Test to *AS 2341.16*. A minimum flashpoint temperature of 38°C applies to cutback bitumen grades AMC00, AMC0, AMC1, AMC2, AMC3 and AMC4. A minimum flashpoint temperature of 50°C applies to cutback bitumen grades AMC5, AMC6 and AMC7.

Other material properties: Comply with the requirements of *AS 2157*.

Conformance criteria: Comply with the requirements of *S120 Quality Clause 8.2*.

## Polymer Modified Bitumen

Polymer modified bitumen: Generally to *Austroads Test Method AGPT/T190*.

Material properties: Test to the specified Austroads methods. Comply with the requirements of AGPT/T190 for the relevant quality category of sprayed sealing or crumb rubber PMB classes. Refer Annexure for PMB Class to be used.

Conformance criteria: Comply with the requirements of S120 Quality Clause 8.2.

## Crumb Rubber Modified Bitumen

Crumb rubber modified bitumen: Generally to *Austroads Test Method AGPT/T190*.

Material properties: Test to the specified Austroads methods. Comply with the requirements of AGPT/T190 for the relevant quality category of sprayed sealing crumb rubber classes. Refer Annexure for Crumb Rubber Modified Bitumen Class to be used.

Conformance criteria: Comply with the requirements of S120 Quality Clause 8.2.

## Penetrating Emulsion Prime

Penetrating emulsion prime: Purposely formulated bitumen emulsion designed to be used as an alternative to cutback bitumen prime. Submit details of the proposed penetrating emulsion prime along with supporting evidence of previous satisfactory performance on pavements under Australian conditions.

Material properties: Test to the specified Australian Standard methods. Comply with the requirements of Table 4.3 for the relevant quality category.

Table 4.3 – Material properties

|  |  |  |  |
| --- | --- | --- | --- |
| Property | Units | Test method | Specification Value |
| Binder Content | % | *AS/NZS 2341.23* | 18 min |
| Viscosity @ 25ºC | mPa.s | *AS/NZS 2341.4* | 30 max |

Conformance criteria: Comply with the requirements of *S120 Quality Clause 8.2*.

## Measuring Bituminous Materials

General: Measure by volume at 15ºC.

Temperatures higher than 15ºC: Use the bitumen volume conversion formula for primers and binders, where T is the temperature of the material at which the volume has been measured. For calculation purposes, assume that the conversion factors are the same for bitumen, bituminous mixes and cutter.

Bitumen volume conversion formula: Volume at TºC = Volume at 15ºC / [1-(T-15)/1667]

# PLANT

General: Provide the required plant necessary for the performance of the particular operation.

Aggregate spreader: A mechanical spreader capable of accurately spreading a uniform layer of aggregate.

Bitumen tank: A tank suitable for the storage and/or transport of bitumen.

Drag broom: A mechanical broom suitable for the distribution of unevenly spread aggregate without disturbance of particles freshly embedded in binder.

Road broom: A drawn rotary broom or self propelled rotary broom suitable for sweeping or cleaning road surfaces. Where suitable, a vacuum system may be used.

Rubber-tyred roller: A dual axle, multi-wheeled roller with a minimum load of one tonne per tyre. Tyres must be smooth and be able to operate at a pressure of at least 550 kPa.

Sprayer: A bitumen sprayer that complies with the requirements of Austroads publication *AP-T262* *Performance Requirements for Bitumen Sprayers*, and has a current Queensland Sprayer Certificate issued by Queensland Department of Main Roads or by an approved national testing authority.

Steel-wheeled roller: A roller with steel wheels having a minimum diameter of 0.9 m and a maximum axle load of 5 tonnes. Do not use vibratory equipment unless approved otherwise by the Superintendent.

# surfacing

## General

Finished surface level tolerances

General: Provide a finished surface that is free draining and evenly graded between level points.

Edges abutting gutters: Within + 5 mm or flush with the level of the actual gutter edge or lip of channel.

Horizontal surfaces

Absolute tolerance: ± 50 mm, except where alignment with an existing road structure is necessary. Join new construction to the existing work in a smooth manner.

Surfacing system

Specify details of the surfacing treatment in the annexure. *Refer annexure*.

## Precoating

Precoating agents

Provide precoating agents that have satisfied plate stripping tests with the binder and aggregate. The percentage of stripping determined in accordance with the Australian Standard test method *AS 1141.50* must not exceed 10%. Use precoating agents contained in the QDTMR *Approved Product Listing for Aggregate Precoating Agents.*

Restriction: Do not use precoating agents containing tar.

Application

General: Apply precoating agent thinly and evenly using a fine pressure spray to a moving stream of aggregate, or by other suitable means, so that particles are fully coated without excess material.

Degree of precoat: At least 85% of the total surface area of the aggregate is covered with the precoating agent in accordance with Queensland Department of Transport and Main Roads test method Q216.

Wet aggregate: If the aggregate is too wet to precoat, or contains enough moisture to cause uneven distribution of the precoating agent, dry the aggregate by turning the stockpile over. Do not provide precoated aggregate containing moisture until the moisture has evaporated and the precoating agent has adhered efficiently.

Application rate: Generally 6 - 12 L/m3 of aggregate. Vary rate of precoating agent to suit the nature of the aggregate, the efficiency of the precoating methods, the absorptive properties of the aggregates, and the amount of moisture and dust present.

Lead times: Apply precoating agent within the following time periods between precoating and spreading of precoated aggregate:

* Precoating agent not containing waste oil
* 7 days minimum and 56 days maximum
* Precoating agent containing waste oil
* 28 days minimum and 98 days maximum

## Cutting Bitumen

Generally: Heat sufficient bitumen for immediate needs only. Do not keep the material at spraying temperature for longer than 10 hours. Do not reheat.

Mixing and heating (on site): Heat the bitumen at a rate not exceeding 30ºC/h and circulate cutback bitumen for 20 minutes to ensure through mixing.

Heating devices: Use devices capable of uniform heating without damaging bituminous materials.

## Preparation for Spraying

Surface preparation

Extent: Prepare surface to be sprayed plus either an area that is a minimum of 250 mm beyond the surface to be sprayed, or one which extends to the edge of the formation, whichever is the lesser.

Cleaning

General: Immediately before spraying remove loose and foreign material on the finished base surface, including dust, debris and sand spread on primed surfaces, and until a mosaic of well embedded stone shows on the surface. Keep traffic off the cleaned surface.

Method: Use suitable power blowers or road brooms, or using hand methods where inaccessible to power equipment.

Potholes

Trim to a regular shape and a uniform depth of at least 75 mm. Tack coat the sides and bottom, and patch with a suitable bituminous premix, sanded after completion. Allow sufficient time for premix to cure before spraying the surface.

## Spraying Operations

Protection

Protect adjacent surfaces during spraying. Place drip trays under spray bars when the sprayer is stationary. Clean bituminous materials from adjacent surfaces or, if this is not possible, replace and make good the surface. Protect freshly sprayed surfaces from contamination.

Restrictions

Pavement surface temperature: Do not commence spraying until the surface temperature of the pavement is above 20ºC for bitumen or above 25ºC for polymer modified binder, for at least one hour before spraying commences. *Refer annexure*.

Weather conditions: Do not spray during rain or if rain is likely to fall prior to the spreading of cover aggregate and the completion of rolling.

Minimum period between bituminous treatments *Refer annexure*:

* When the primer is cutback bitumen, allow at least 3 days between priming and sealing
* When the primer is penetrating emulsion prime, allow at least 24 hours between priming and sealing
* Allow at least 3 days between first and second seals
* Allow at least 14 days between a primer seal and a seal

Method of application

Apply bituminous materials by means of the mechanically operated spray bar of a bitumen sprayer. In areas not accessible to the mechanical sprayer, spray using hand spray equipment attached to the mechanical sprayer.

Spraying

General: Completely and uniformly cover the surface to be treated. Prevent the spray overlapping previously treated areas, except that where part width spraying is used; lap the longitudinal joint between adjacent runs by 50 mm.

Table6.2 – Primer application rates

|  |  |  |
| --- | --- | --- |
| Surface type | Suitable primer grade | Application rate |
| Low porosity. Extremely hard and tightly bonded surface such as dense graded crushed rock. | AMC00 or AMC0 (low viscosity primers) | 0.5 - 1.0 L/m2 |
| Medium porosity. Gravels with sandy silt binders. | AMC0 or AMC1 (medium viscosity primers) | 0.5 - 1.0 L/m2 |
| High porosity. Lack of textured appearance resulting from deficient binding material. | AMC1 or AMC2 (high viscosity primers) | 0.8 - 1.4 L/m2 |
| All surfaces - undertake trial area to confirm suitability of prime and application rate. | Penetrating emulsion primer | 0.9 - 1.5 l/m2 |

Spraying temperature

Spray bituminous material within the temperature range given in Table6.3.

Table6.3 – Spraying temperature range of bituminous material

| Material | Grade | Spraying temperature range (°C) | |
| --- | --- | --- | --- |
| Minimum | Maximum |
| Cutback bitumen | AMC00 | Ambient | Ambient |
| AMC0 | 35 | 55 |
| AMC1 | 60 | 80 |
| AMC2 | 75 | 100 |
| AMC3 | 95 | 115 |
| AMC4 | 110 | 135 |
| AMC5 | 120 | 150 |
| AMC6 | 135 | 160 |
| AMC7 | 150 | 175 |
| Penetrating emulsion prime | \* | Ambient | \* |
| Bitumen | Class 170 | 160 | 190 |
| Class 320 | 170 | 195 |
| Polymer modified bitumen | \* | \* | \* |
| Crumb rubber modified bitumen | S45R, S15RF, S18RF | 190 | 200 |

\* Refer to manufacturer’s recommendations

Recording

Requirement: After each spray run, record all details of the sealing operations on appropriate bituminous materials spraying record sheets.

Actual spray rate: Calculate actual spray rate for each spray run at 15ºC prior to the next spray run. Use volume conversion formula specified in *Clause 4.8* in relation to changes in temperature of bituminous materials.

## Priming

General: Prime the newly constructed granular pavement to achieve and maintain a strong bond between the granular surface and the permanent treatment seal.

Material: Cutback bitumen grades complying with *AS 2157*.

Application: Select cutback bitumen grades and application rates to suit the pavement surface, generally in accordance with Table 6.2.

Pavement dry back: Do not prime on damp pavement. Allow the top pavement surface to dry out sufficiently to at least degree of saturation (DOS) specified in *S150 Roadworks* for the appropriate Class of gravel and to achieve 6 - 10 mm depth of primer penetration into the pavement pores. For Class 1 gravel, this is typically a DOS of 65%.

Primed surface: Keep traffic off the primed surface. Where the primed surface is open to light traffic use (such as pedestrian and light construction traffic), cover surface with clean sand or crusher dust. Allow at least 4 hours between priming and the spreading of prime cover material.

Unkerbed edges: Extend the primer 150 mm beyond the edge of the seal.

## Primer Sealing

General: Provide primer seal to newly constructed granular pavement that is subject to vehicular traffic or to cold planed (profiled) surface where the granular pavement is exposed or to hold the newly constructed pavement in good condition until the permanent seal treatment can be applied.

Moisture content: Do not primer seal pavement that have a high moisture content. Allow the pavement to dry back to at least the degree of saturation (DOS) specified in *S150 Roadworks* for the appropriate gravel Class before applying the primer seal. For Class 1 gravel, this is typically a DOS of 65%.

## Spreading Prime Cover Material

Spreading: Spread prime cover material evenly to completely cover the surface.

Wet cover material: Do not use wet cover material containing free surface water.

Time limit: Allow at least 4 hours between priming and the application of cover material to permit penetration of the prime, unless traffic requirements dictate otherwise.

Excess cover material: Remove all excess cover material from the pavement.

## Spreading Cover Aggregate

Spreading

Timing: Immediately after the binder or primer binder has been sprayed, cover with a uniform layer of precoated aggregate. Do not leave any portion of binder without cover aggregate for longer than 10 minutes after spraying.

Method: Carry out spreading using an aggregate spreader. Spread cover aggregate to form a single layer on the pavement surface of partly interlocked aggregates after compaction. Make every attempt to achieve the required spread pattern on the first spreading pass.

Under spreading: Retreat bare or insufficiently covered areas as soon as possible with a further light spreading run or by hand spreading.

Uneven distribution: Drag broom the affected area until it is evenly distributed without dislodgment of any embedded cover aggregate.

Sealing: Incorporate the first course of aggregate thoroughly into the binder before a second course is applied. Remove loose particles from the sealed area by sweeping lightly, without disturbing embedded aggregate.

Pneumatic tyred rolling

Timing: Immediately after spreading, roll and drag broom the area until it is uniformly covered with aggregate thoroughly embedded in the binder. Roll uniformly over the whole area with multi-tyred rollers. Complete rolling as soon as possible but not later than 3 days after spraying. Roll during daylight hours.

Rolling rate: Not less than 6 passes within 1 hour of spraying at every point on the surface. *Refer annexure*.

Moist cover aggregate: For Class 170 bitumen, delay rolling until the cover aggregate has dried sufficiently to promote adhesion but not such that the binder has become cold. For polymer or crumb rubber modified binder, start rolling immediately and continue until adhesion is complete.

Loose aggregate

When the aggregate has been evenly spread and embedded, remove loose particles remaining on the pavement and apply additional aggregate as required.

Surface finish

Provide an even, smooth riding and free draining surface.

## Defective Surfacing

Primer

Actual rate of application < 90% of designed spray rate: Make up the deficiency with a second spray run.

Actual rate of application > 110% of designed spray rate: Cover the surface with sand.

Binder and primer binder

Actual rate of application < 90% or > 110% of designed spray rate: Remove defective seal and reseal the surface.

Conformance criteria

Acceptance and rejection criteria: Comply with the requirements of *S120 Quality Clause 8.2*.

# completion

Traffic on pavement

Give notice before opening the pavement to traffic before the work is completed. Provide adequate means of protection.