

Roads

Master Specification

RD-BP-C2 Construction of Foamed Bitumen Stabilised Pavement

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RD-BP-C2 Construction of Foamed Bitumen Stabilised Pavement

1 General

- 1.1 This Part specifies the requirements for the construction of Insitu and Plant Mixed Foamed Bitumen Stabilised Pavement.
- 1.2 The pavement shall be placed in the configuration specified in Contract Documents "Pavement Work". Any additional information regarding the project works is included in the Project Brief.
- 1.3 **"Supplementary Binder"** means any non-bituminous binder, such as lime or cement.
- 1.4 Documents referenced in this Part are listed below:
 - a) AS 1289 Methods of Testing Soils for Engineering Purposes.
 - b) AS 3972 GP & GB Cement.
 - c) AS 1672 Building Limes.
 - d) RD-BP-S1 Supply of Bituminous Materials.
 - e) PC-QA1 Quality System Requirements.

2 Quality Requirements

- 2.1 The Contractor shall prepare and implement a Quality Plan that includes the following documentation:
 - a) details of any supplementary binder to be used;
 - b) details of all plant types proposed and method of controlling binder content and moisture content (including methods to ensure uniformity);
 - c) procedures for calibration of plant (including frequency);
 - d) procedure for verifying binder content, including evidence of reliability of the procedure;
 - e) procedures for material handling, including mixing and control of segregation;
 - f) detailed procedures for pavement construction, including sequence of operations, from initial production through final placement, compaction and trim (including stabilisation depth and achieving surface finish where used with a spray seal); and
 - g) detailed procedures for ceasing operations in the event of rain or strong wind.
- 2.2 If not provided beforehand, the documentation shall be submitted at least 28 days prior to the commencement of site work. Provision of the documentation listed in this Clause shall constitute a **Hold Point**.

3 Materials

General

- 3.1 Prior to the incorporation of any material in the works, the Contractor shall provide evidence of compliance with this clause. Provision of this documentation shall constitute a **Hold Point**.

Bitumen

- 3.2 Binder shall be Class 170 Bitumen in compliance with RD-BP-S1 "Supply of Bituminous Materials". The Contractor shall provide evidence of the quality and age of the binder.

Supplementary Binders and Additives

- 3.3 Lime shall be Hydrated Lime conforming to AS 1672. Cement shall conform to AS 3972. Supplementary binders shall not be older than three months from time of manufacture. Any foaming agents used shall not constitute more than 2% of the bitumen by mass.

Water

- 3.4 Water shall be potable. Where the water is drawn from natural sources, an efficient filter is to be provided on the suction pipe to ensure freedom from weeds, roots, etc., which could cause blockage of jets in the stabiliser or stationary plant mixer.

Granular materials

- 3.5 If additional granular pavement material is required to improve the existing pavement material or to correct levels, this material shall be spread (insitu process) or introduced at the rate required (stationary plant-mix process) so as to produce a homogeneously blended mix. The material shall comply with RD-PV-S1 "Supply of Pavement Materials".

Recycled Asphalt Profilings

- 3.6 If Reclaimed Asphalt Pavement (RAP) is to be used as additional pavement material, it shall be:
- pulverised asphalt obtained from the profiling of asphalt pavements or by crushing to a graded material with a maximum particle size of 40 mm;
 - free flowing and capable of uniform spreading and incorporation into the recycled pavement or for addition through the stationary plant-mix; and
 - spread by the Contractor at the rate and / or to the levels specified in the mix design or schedule of job details.

4 Constraints to Work

Traffic

- 4.1 The length of run shall be determined to avoid delays to traffic in excess of 10 minutes. Sections of pavement opened to traffic during daylight hours shall be monitored by the Contractor. The Contractor shall implement appropriate action to ensure that traffic does not damage the freshly stabilised pavement.
- 4.2 Refer to PC-SM1 "Provision for Traffic" for other constraints relating to traffic control.

Sealing

- 4.3 A bituminous wearing course shall be placed not later than 7 days after stabilisation. A primer seal shall cure for a minimum of 3 days and a maximum of 21 days prior to the application of a spray seal or asphalt layer.

Excavation Adjacent to Retained Existing Pavement

- 4.4 Excavation adjacent to an existing pavement to be retained shall be carried out such that it does not damage the existing pavement.

Climatic Restraints

- 4.5 Stabilisation (including plant-mix operations, spreading, compacting and finishing) shall not proceed:
- during rain;
 - during periods when the wind is sufficiently strong to cause particles of the supplementary binder to become air-borne, unless effective mitigation procedures are adopted;
 - during conditions that may cause nuisance or danger to people, property or the environment;

- d) when the temperature (measured at a depth of 50 mm in the pavement for insitu work) is below 100°C; or
- e) when the air temperature measured in the shade exceeds 40°C.

5 Plant

General

- 5.1 The insitu stabiliser or plant-mix mixer shall comply with the following requirements:
 - a) have bitumen temperature gauges to verify bitumen temperature;
 - b) have computer controlled bitumen flow meter for verification of bitumen content;
 - c) have an inspection or test jet fitted to ensure the flow of bitumen and that the required expansion and half-life qualities of the bitumen are being achieved; and
 - d) have self-cleansing bitumen jets.
- 5.2 The Contractor shall provide a copy of the certificate of calibration for the binder measuring device (for both insitu and plant-mix operations). Provision of the certificate shall constitute a **Hold Point**.

Insitu Stabilisation

- 5.3 The insitu stabiliser shall:
 - a) have an engine power of greater than 375kW;
 - b) have bitumen injection systems linked to ground speed to ensure an accurate application throughout runs – irrespective of the speed of the plant;
 - c) be capable of supplying both water and binder to the pavement and mixing to the specified depth; and
 - d) supply both water and the binder such that incorporation rates can be varied across the full width of the stabilising box and incrementally across the box.

Plant-Mix

- 5.4 The plant shall comply with the following requirements:
 - a) be purpose built for the process of producing foamed bitumen stabilised road making materials, and be maintained and calibrated so as to provide a uniformly mixed product without segregation of the aggregate material;
 - b) have a fully computerised control system associated with weigh-cells on the variable feed rate for constituent materials, with read out meters to allow continuous monitoring and control of bitumen, supplementary binder, foaming water, added moisture and other additives, (e.g. wetting agents or dispersants). This monitoring at the operation control station is recorded by percentage by weight of pavement material; and
 - c) have a minimum continuous production capacity of 100 tonnes per hour.

Compaction Equipment

- 5.5 Compaction shall be undertaken with the following minimum equipment requirements:
 - a) a vibrating padfoot roller of a minimum mass of 18 t for compacting thicknesses of up to 250 mm, and a minimum mass of 21 t for compacting thicknesses of up to 300 mm;
 - b) a vibrating smooth drum roller with a minimum mass of 18 t; and
 - c) a multi-tyre roller with a minimum mass of 12 t.

6 Trial Pavement

- 6.1 Prior to the commencement of construction of the Foamed Bitumen Stabilised Pavement, the Contractor shall verify:
- the effectiveness of the construction plant;
 - the number of passes of the stabilisation machine necessary to achieve uniform pulverisation and mixing (insitu process); and
 - the field moisture content required to achieve specified compaction requirements.
- 6.2 This shall be undertaken by either constructing a trial pavement or providing documented evidence from a previous project using the same plant, materials and construction methodology. The Contractor shall provide 14 days prior notice of the construction of a trial pavement. Any trial pavement shall be located within the works area and shall be between 50 and 100 metres in length over the full width proposed to be stabilised.
- 6.3 Submission of the above notification and test results or evidence from a previous project shall constitute a **Hold Point**.

7 Construction Process

Initial Preparation and Milling

- 7.1 For insitu stabilisation, the pavement shall firstly be pulverised to 50 mm above the depth to be stabilised. If thick in-fill layers of asphalt are present, the Contractor shall mill the asphalt and evenly spread the milled asphalt onto the surface of the existing pavement to avoid creating discontinuities in the stabilised pavement.
- 7.2 Additional material required for shape correction shall be added after the preliminary pulverisation. It shall be spread onto the surface to a shape suitable for stabilisation and compacted and trimmed to the alignment, heights and shapes specified.
- 7.3 Prior to spreading the secondary binder, the existing surface shall be shaped, compacted and trimmed to the required shape to a degree that is sufficient to facilitate stabilisation, compaction and trimming to the alignment, heights and shapes specified.

Mixing and Placement

General

- 7.4 Mixing uniformity shall be continuously inspected visually by the Contractor and work shall stop when bitumen streaks or blotches are observed.
- 7.5 The resultant material shall have no lenses, pockets, lumps or granules of either incompletely mixed material, or incompletely mixed stabilising agent.
- 7.6 The sprayed bitumen shall exhibit a minimum expansion ratio of 10 and a half-life of 20 seconds at the time of incorporation.
- 7.7 The bitumen shall be sprayed at a temperature of between 170°C and 190°C. The expansion ration and half-life of every tanker load of bitumen shall be checked using the inspection nozzle on-board the mixing chamber.
- 7.8 The bituminous binder shall not be incorporated into the pavement material where the foaming properties of the bitumen load supplied is less that that specified above.
- 7.9 The construction tolerance for the application rate for the binder and supplementary binder is +/-10% of the specified values.
- 7.10 The Contractor shall complete a Daily Record Sheet, which shall then be certified correct by the Contractor and forwarded within 18 hours of the completion of a day's work. Details of all materials applied shall be recorded immediately after completion of each activity.

In situ Stabilisation

- 7.11 Where in situ stabilisation is used, the mixing of the binder and the mixing of the supplementary binder shall be undertaken in two separate passes and the pulverised material shall be stabilised to the depth specified.
- 7.12 Cutting, pulverising and mixing shall continue until all material passes a 37.5 mm AS sieve and the lime, water, and foamed bitumen are evenly distributed through the mass to produce a mixture of unchanging appearance.
- 7.13 The stabilisation machine shall be equipped with a variable depth of cut control and an accurate gauge of depth of cut readily visible to the operator. Stabilisation work undertaken each day shall be to the full width of the lane.
- 7.14 Bituminous Binders shall be uniformly incorporated by a controlled device that provides calibration to the application rate of bitumen.
- 7.15 The mixing chamber shall be equipped with a spray system to allow variable widths of binder to be incorporated into the pavement material.
- 7.16 Supplementary binders shall be uniformly spread with the use of a spreader equipped with calibrated electronic load cells to ensure that a controlled mass is spread across the pavement.
- 7.17 The spreader should be equipped with gates to allow variable width of supplementary binder.
- 7.18 The Contractor shall record the tonnage of supplementary binder used per run and mat or tray results at regular (at least daily) intervals. Once the supplementary binder has been spread, the only traffic that may travel over the area to be stabilised shall be construction plant employed for the stabilisation work.
- 7.19 The stabilising equipment shall have provision for adding water to the mixture automatically at a variable controlled rate to bring the material to the moisture content necessary to achieve compaction. The equipment shall be capable of including other additives, e.g. wetting agents or dispersants.

Plant – Mix Stabilisation

- 7.20 Where a plant mix is used, the binder shall be uniformly incorporated by a controlled device that provides calibration to the application rate of bitumen. The inspection nozzle shall be used to verify the foaming characteristics for every bitumen tanker load.
- 7.21 Application rate checks / reconciliation measured in kilograms per tonne of product shall be monitored and recorded for every 100 tonnes of production, via the on-board weigh-cell computerised accumulator system.
- 7.22 Regular calibration of all weigh cells within the plant shall be undertaken and recorded, in line with the manufacturer's published guidelines.
- 7.23 The material produced by the stationary plant-mix shall be transferred and spread in one concurrent operation, and after compaction, the finished surface levels on the base (and / or subbase) courses shall be within the permitted tolerances without subsequent addition of material.
- 7.24 The thickness of each compacted layer shall be neither less than 100 mm nor more than 200 mm. The mix is to be placed without visual signs of segregation and any such areas are to be removed and replaced with fresh mix.

Initial Compaction and Trimming

- 7.25 Immediately after stabilisation, the stabilised area shall be initially compacted to eliminate the height differential between the bulked stabilised material and any wheel ruts left by the stabiliser in the stabilised layer. This may be achieved with two passes of a vibrating roller immediately after the completion of stabilisation.
- 7.26 After the initial compaction and before final compaction commences, the surface shall be trimmed to approximately the alignment, heights and shapes specified for the completed work.

- 7.27 Any depressions shall be filled with excess, complying, mixed (stabilised) material that is placed and compacted within three hours of bituminous stabilisation.

Trimming After Final Compaction

- 7.28 After final trimming, the surface shall be free from loose pockets, holes, bumps, lenses of material and marks caused by a pad foot roller.
- 7.29 Final trimming shall be carried out as soon as practicable after the rollers have completed the compaction of the pavement.
- 7.30 All trimming shall be cut to waste and the material disposed of. Any treatment necessary to rectify localised depressions and rises shall be subject to prior approval.

Joints

General

- 7.31 Prior to commencing the next day's work, and where the stabilisation operation, including compaction, has been halted for any reason for a period exceeding 4 hours, the Contractor shall provide construction joints at each discontinuity in the operation.
- 7.32 Where necessary for traffic safety, the Contractor shall temporarily ramp longitudinal and transverse joints. Temporary ramping shall be formed with hot asphalt or premix such that the slope of the ramp is not less than 10 horizontal : 1 vertical. Ramps shall be removed prior to the application of the primer seal, spray seal or asphalt surfacing.
- 7.33 A construction joint is be deemed to be fresh when the material on each side of the joint has been placed and compacted within 4 hours.

Longitudinal Joints

- 7.34 Longitudinal joints shall not be located in the wheel paths. Where a fresh longitudinal joint between adjacent runs is to be compacted, the outside 300 mm of material from the first run shall be left uncompacted until the adjacent material is ready for compaction.
- 7.35 Overlaps of joints that are not fresh shall not be less than 75 mm and not greater than 150 mm. The overlap of stabilising agent of all longitudinal joints shall not exceed 150 mm.

Transverse Joints

- 7.36 Where transverse joints are not made within 4 hours, the adjoining section previously stabilised shall be cut back by at least 1.5 m. The cutback material shall be removed, disposed of and replaced in accordance with this specification.
- 7.37 For the insitu process, after this material has been replaced with complying material, the secondary binder shall be spread over the 1.5 m cutback length and it shall be included in the stabilisation process of the adjoining section to be stabilised.

8 Curing

- 8.1 The water curing operation shall commence immediately after the completion of compaction. Water curing is generally used for foamed bitumen stabilised pavements prior to the bituminous curing coat being applied.
- 8.2 The stabilised layer surface and edges shall be maintained in a slightly damp condition, via an occasional application of uniformly applied fine mist, until the layer is sealed with a bituminous wearing course.
- 8.3 Water shall be applied in a manner such that slurring of the surface, pavement instability and erosion and / or flushing of the pavement surface are all avoided.

9 Surface Finish

- 9.1 The surface of the pavement layers shall be uniformly tight and free of loose uncompacted material, segregated or 'bony' material or soft, over wet areas and free of roller indentations.
- 9.2 Where a spray seal is to be used on a foam bitumen base course, the Contractor shall include in the procedures for the placement of base, a minimum of 6 passes with a Class PR22 multi-wheel roller to achieve a uniformly tight surface.
- 9.3 The surface level of the stabilised base shall not vary by more than 5 mm in any direction when tested with a 3 m straight edge. The crossfall shall not depart from the corresponding crossfall shown in the documents by more than 0.5% absolute.
- 9.4 The finished wearing course and any lower layers constructed shall have a smooth transverse and longitudinal profile. If RD-BP-D3 "Surface Characteristics" is included in this Specification, the measured roughness values in NAASRA roughness counts per kilometre shall not exceed those specified in the "Pavement Work".
- 9.5 The crossfall shall be measured:
 - a) between any two points more than 2 metres apart except where a pavement verge is less than 2 metres wide. For pavement verges less than 2 metres wide, the measurement shall be made between the extreme edges of the pavement verge on each side of the pavement;
 - b) transverse to the centre line of the carriageway;
 - c) within the boundaries of a cross-section element which has a constant crossfall.
- 9.6 The Contractor shall maintain the stabilised layer during curing and until it has been overlaid with another pavement layer or surfaced with the final wearing course.

10 Sampling and Testing

Lots

- 10.1 Acceptance of the quality of the stabilised layer shall be based on an analysis of a set of random sited tests taken from each lot of the works.
- 10.2 The Contractor shall determine the proportion of the works that will constitute a single lot in accordance with PC-QA1 "Quality System Requirements". Compliance will apply to the whole of the lot of the works from which the set of tests is taken.
- 10.3 Any area which is deemed unsuitable shall be excluded from the lot before testing commences. Excluded areas shall be rectified prior to testing.
- 10.4 This includes:
 - a) segregated or "bony" areas;
 - b) soft, over-wet or "fatty" areas;
 - c) ravelling and loose material; compaction planes; or
 - d) surface cracking, shoving and ruts.

Depth

- 10.5 The depth of stabilisation shall be verified by measuring the depth of the cutting (insitu) or placed material (plant-mix) adjacent to an existing pavement material in at least two locations within the lot and measured to the nearest 5 mm for conformation against the requirements of Contract Documents.
- 10.6 Achieving the specified stabilised layer thickness shall constitute a **Hold Point**.

Compaction

- 10.7 Stabilised pavement layers shall be compacted uniformly to the full depth and over the full width. Unless otherwise stated in Contract Documents, compaction shall not be less than that specified in Table RD-BP-C2 11-1.
- 10.8 The location of the tests shall be on a stratified random basis in accordance with TP061. Acceptance shall be based on discrete results. Where a result fails, the stratum represented by that result shall be the subject of a Non-Conformance Report.
- 10.9 Laboratory compaction testing shall be performed on a “one to one” basis with the field density testing unless it can be demonstrated that an assigned MDD can be consistently established in accordance with TP166.
- 10.10 Sampling sites shall be determined by the stratified random method and the MDD bulk samples removed and the compaction points completed within an hour and a half of the binder being applied.
- 10.11 The field compaction test shall be performed at the same location that the related laboratory compaction sample was derived.
- 10.12 Achieving the specified compaction standard shall constitute a **Hold Point**.

11 Test Procedures

- 11.1 The Contractor shall use the following test procedures (refer https://www.dpti.sa.gov.au/contractor_documents) to verify conformance with the Specification:

Table RD-BP-C2 11-1 Test Procedures

Test	Test Procedure
Site selection by stratified random technique	TP061
Sampling of soil, aggregates and rocks	TP226
Preparation of samples	AS 1289.1
Moisture content:	
Oven drying method	AS 1289.2.1.1
Microwave method	AS 1289.2.1.4
Field density:	
Sand replacement method	AS 1289.5.3.1
Nuclear method	AS 1289.5.8.1
Determination of the dry density / moisture content relation of a soil – 3 point method	TP 164
Assignment of maximum dry density and optimum moisture content values	TP 166
Compaction control test – dry density ratio and moisture ratio	TP 320
Binder content:	
Pressure filtration method	TP 470
Ignition oven method	AST 04:1999

12 Hold Points

- 12.1 The following is a summary of Hold Points referenced in this Part:

Document Ref.	Hold Point	Response Time
2.2	Submission of Procedures (if not in Post Tender Submission)	7 days
2.2	Submission of Program (if not in Post Tender Submission)	7 days
3.1	Evidence of materials compliance	1 day
5.2	Certificate of calibration of binder measuring device	1 day
6.3	Trial Pavement	1 day
10.6	Achieving Stabilised Layer Thickness Requirement	1 day

Document Ref.	Hold Point	Response Time
10.12	Achieving Compaction Requirement	1 day

13 Verification Requirements and Records

Test Records

13.1 The Contractor shall undertake the testing specified in this Clause and supply written evidence of compliance with the lot package.

Table RD-BP-C2 13-1 Test Records

Document Ref.	Subject	Property	Test Procedure	Test Frequency	Acceptance Limits
7	Pavement Material properties	Insitu Work: Binder Application Rate	Determined by "on-board" measuring devices	each 100 m linear interval	within $\pm 10\%$ of that specified
		Plant Mix : Binder Application Rate	Determined by calibrated plant measuring devices	each continuous production run or 100 tonnes of pavement material	within $\pm 10\%$ of that specified
9*	Ride Quality	NAASRA Roughness Counts	Refer Part RD-PV-C2	Refer Part RD-PV-C2	Refer Contract Documents
11	Pavement Construction	Dry Density Ratio	TP 320	1 test per 400m ² per layer with a minimum of 3 tests per Lot.	not less than 96%
11	Pavement Construction	Stabilisation Depth	Direct Measurement	2 locations per lot	Refer Contract Documents

* If PC-QA1 Surface Characteristics Roughness is included in this Specification.

Other Records

13.2 The Contractor shall supply the following records:

Table RD-BP-C2 13-2 Other Records

Document Ref.	Subject	Record To Be Provided
7.10	Daily Record of Work	Details of each days' work, including quantities on materials used, i.e.: Records of tanker dipping's for runs or plant use, Binder temperature records, Records of weighing / measuring cell readouts, Records of mat / tray spread rate assessment, Binder and supplementary binder rate calculations, Assumptions made in determining application rates.