

Roads

Master Specification

RD-PV-C1 Construction of Unstabilised Granular Pavements

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1	Initial issue (formerly 21 Construction of Unstabilised Granular Pavement)	28/06/19
2	Formatting for publishing	20/09/19
3	Update to Test Frequency and methods in Table 9-1 and Clause 4.11; addition of clauses for moisture content in Clauses 4.4 and 4.5, and Table 9-1; inclusion of requirement for testing moisture content in the mid-depth of layer for dryback in Clause 4.6; addition of Clause 2.1(c); plus minor errors.	August 2020

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RD-PV-C1 Construction of Unstabilised Granular Pavements

1 General

- 1.1 This Part specifies the requirements for the construction of unstabilised granular pavement.
- 1.2 Formation levels and pavement levels shall comply with the specified tolerances. Designated pavement thicknesses are nominal and do not constitute acceptance criteria.
- 1.3 Documents referenced in this Part are listed below:
 - a) AS 1289 Methods of Testing Soils for Engineering Purposes.
 - b) RD-PV-S1 Supply of Pavement Materials.
 - c) AG-PT-T251 Ball Penetration Test

2 Quality Requirements

- 2.1 At a minimum, the Contractor's Quality Plan shall include the following documents, procedures and / or instructions:
 - a) method of pavement construction;
 - b) proposal for compliance with Clause 4 "Trial Pavement";
 - c) proposal for assigning optimum moisture content (OMC) values;
 - d) proposed test frequency and locations for pavement hardness testing in accordance with Clause 4 under "Pavement Hardness".
- 2.2 If not submitted beforehand, this documentation shall be submitted at least 28 days prior to the commencement of site work.
- 2.3 Provision of the procedures listed in this Clause shall constitute a **Hold Point**.

3 Materials and Mixing Plant

- 3.1 At least 7 days prior to the placement of Class 1, 2 or 3 Pavement Materials, the Contractor shall provide test results demonstrating that the material complies with the requirements of RD-PV-S1 "Supply of Pavement Materials".
- 3.2 Provision of the documentation shall constitute a **Hold Point**.
- 3.3 Subbase and base materials shall be mixed using a pugmill mixer unless otherwise specified. The mixing plant shall be capable of consistently producing a homogeneous mixture of uniformly distributed component materials and water.

4 Placement

Trial Pavement

- 4.1 At the discretion of the superintendent, if marginal material is to be used, a trial pavement is to be undertaken in accordance with the below.
- 4.2 Any trial pavement shall be at least 100 metres long and may form part of an unbound pavement layer that is not a surface course. The Contractor shall provide 7 days prior notice of the construction of a trial pavement.
- 4.3 At least 14 days prior to the commencement of construction of the upper base, the Contractor shall demonstrate that the requirements for surface finish, compaction and hardness can be achieved using the plant, materials and construction methodology proposed for the base. 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. Submission of the above notification and test results or evidence from a previous project shall constitute a **Hold Point**.

Compaction Moisture Content

- 4.4 On compaction, the subbase, working platform and base materials should have a moisture content within the tolerance specified in Table 1 of AS 1289.5.4.2.

- 4.5 The location of tests should be selected by the Contractor for each lot on a stratified random basis in accordance with AS 1289.1.4.2. The number of strata should be equal to the number of tests required for a given lot.

Dryback Requirements

- 4.6 Placement of subsequent pavement layers shall not commence until the moisture content of the underlying pavement layer is less than that specified in Contract Documents "Pavement Work", or if no moisture content has been specified therein, 70% of OMC. This includes individual lifts of pavement layers.
- 4.7 Areas to be sealed shall be tested for moisture content. The location of tests shall be selected by the Contractor for each lot on a stratified random basis in accordance with AS 1289.1.4.2. The number of strata shall be equal to the number of tests required for a given lot.
- 4.8 For road widenings and / or pavement works adjoining existing pavements, a minimum of one per 100 metres additional testing is required along the joint line. The location of tests shall be selected by the Contractor for each lot on a stratified random basis in accordance with AS 1289.1.4.2.
- 4.9 Prior to the placement of subsequent pavement layers, including sprayed bituminous surfacing or asphalt treatment, a **Hold Point** shall apply.

Pavement Hardness

- 4.10 Where the base course is to be covered with a spray seal wearing course, the Contractor shall conduct Pavement Hardness tests prior to sealing.
- 4.11 A minimum of 3 tests shall be undertaken per site. Tests shall be located randomly in each wheel path of each lane constructed. Results shall be submitted 2 days prior to the application of prime or primer seal.
- 4.12 Submission of the hardness test results shall constitute a **Hold Point**.

5 Surface Finish

- 5.1 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.
- 5.2 For spray seals, the Contractor shall include in the procedures for the placement of base, a minimum of 6 passes with a multi-wheel roller with a fully ballasted mass >30t to achieve a uniformly tight surface, or an alternative procedure to achieve an equivalent compaction effort.
- 5.3 The Quality Plan shall provide full details of the proposed pavement construction procedures incorporating this requirement.

6 Compaction Acceptance Criteria

Quality Standards

- 6.1 All pavement layers shall be uniformly compacted to the full depth and over the full width.
- 6.2 Statistical analysis, using an unknown variability scheme, shall be used under this Contract to determine acceptance of compaction.
- 6.3 Compliance shall be based on the analysis of a random set of tests taken from each lot of the works in accordance with this Clause 6. Compliance shall be indirectly in terms of percentage defective compared to the desired quality of the lot (10% defective).
- 6.4 The Contractor shall achieve a 90% probability assurance that accepted lots comply with the desired quality. The acceptability characteristic k , quantified in Clause 6.17 is used to provide this statistical assurance.
- 6.5 The Contractor shall determine the proportion of the works which will constitute a single lot. Compliance will apply to the whole of the lot of the works from which the set of tests is taken. Any area which is deemed unsuitable shall be excluded from the lot before testing commences.
- 6.6 At a minimum, non-homogeneous excluded areas include:
- a) segregated or "bony" areas;
 - b) soft and over-wet areas;
 - c) ravelling and loose material;

- d) compaction planes; and
 - e) surface cracking, shoving and ruts.
- 6.7 Excluded areas shall be rectified prior to testing. If the total of the excluded areas in a lot exceeds 10% of the lot, the whole of the lot shall be rectified prior to testing.

Dry Density Ratio

- 6.8 The layers shall be compacted uniformly to the full depth and over time the full width to the minimum Dry Density Ratios stated in the Contract Documents or on the drawings. Where no densities are provided on these, the following values shall apply:
- a) Basecourse: 98% Modified Compaction
 - b) Subbase or working platform: 96% Modified Compaction

Number and Location of Tests

- 6.9 The frequency of testing of the various pavement layers shall be as follows:
- a) Subbase and base - one test per 500 square metres with a minimum of 6 tests per lot.
 - b) Note: For subbase with lots less than 2 500 square metres the minimum frequency of testing shall be one test per 500 square metres with a minimum of 2 tests per lot.
 - c) For base with lots less than 2 000 square metres the minimum frequency of testing shall be one test per 400 square metres with a minimum of 2 tests per lot.
 - d) Acceptance shall be on an absolute basis.
 - e) Shoulder (where not part of base) - a minimum of one test per 200 m.
- 6.10 The location of tests shall be selected by the Contractor for each lot on a random stratified basis in accordance with AS 1289.1.4.2. The number of strata shall be equal to the number of tests required for a given lot.

Testing Accuracies

- 6.11 Field density and laboratory maximum dry density measurements shall be made to the nearest 0.01 t/m³. Dry Density Ratio shall be calculated to the nearest 0.1%. Test location co-ordinates shall be measured to the nearest 100 mm.

Determination of Mean and Standard Deviation

- 6.12 The sample mean (\bar{X}) of n dry density ratio measurements (x_i) shall be determined using the following relationship:

$$\bar{X} = \frac{1}{n} \sum_{i=1}^n x_i$$

- 6.13 The sample standard deviation (s) shall be determined using the following relationship:

$$s = \sqrt{\frac{\sum_{i=1}^n [\bar{X} - x_i]^2}{n - 1}}$$

Outlier Value

- 6.14 To determine if the lowest value (X_1) or highest value (X_n) of the lot is low or high by chance, or that the value occurred by construction / materials not being consistent with the lot, the following test shall be performed (ref: ASTM E178).

- 6.15 The statistic:

$$T_1 = \frac{\bar{X} - X_1}{s} \quad \text{or} \quad T_n = \frac{X_n - \bar{X}}{s}$$

depending on which value is under question, is calculated and this is compared to the table of critical values.

- 6.16 If the value of T_1 or T_n exceeds the value of T in Table RD-PV-C1 6-1, the low value or high value or both shall be removed from the lot, and the lot mean and standard deviation shall be recalculated using the remaining results. The lot area which gave rise to the outlier value shall be delineated and treated independently to the lot.

Table RD-PV-C1 6-1 Critical Values of T

No. of Tests	Value
4	1.46
5	1.67
6	1.82
7	1.94
8	2.03
9	2.11
10	2.18
11	2.23
12	2.29

- 6.17 The statistic L_s shall be determined using the following relationship:

$$L_s = X - ks$$

where k is a multiplier. The value k is given in Table RD-PV-C1 6-2 below for different samples sizes.

Acceptance Limits

- 6.18 A lot is accepted if L_s is equal to or exceeds L , where L is the minimum required Dry Density Ratio at any location. If L_s is less than L the whole of the lot is rejected and the test results shall be discarded. The specified values of L for each pavement layer are stated in Contract Documents "Pavement Work" or on the Drawings. The specified values of k are given in Table RD-PV-C1 6-2 for different sample sizes.

Table RD-PV-C1 6-2 Specified Values of k

No. of Tests Per Lot (N)	k
n = 4	0.62
n = 5	0.68
n = 6	0.72
n = 7	0.76
n = 8	0.78
n = 9	0.81
n = 10	0.83
n = 11	0.85
n = 12	0.86
n = 13	0.88
n = 14	0.89
n = 15	0.90
n = 16	0.91
n = 17	0.92
n = 18	0.93
n = 19	0.94
n = 20	0.95

Levels and Tolerances

- 6.19 The allowable tolerances on the finished levels of each pavement course shall be as stated in Contract Documents or on the drawings.
- 6.20 In addition to the tolerances specified, the base surface shall not deviate by more than 10 mm from a 3 m straight edge laid on the surface.

- 6.21 The algebraic differences of the deviation in base levels from the design levels for two points up to 20 m apart longitudinally shall not be greater than 20 mm. Levels higher than specified are taken as positive deviations and those lower than specified are taken as negative.
- 6.22 The tolerance on lateral position and on overall width shall be ± 50 mm.

Survey on Pavement Layers

- 6.23 Survey is required to verify that the pavement layers have been set out and that the work is in accordance with the figures and dimensions on the Drawings and within the limits of specified tolerances.
- 6.24 Survey on pavement layers shall be carried out in accordance with PC-SI1 Site Surveys.
- 6.25 The frequency and location of testing shall be as detailed in PC-SI1 Site Surveys.
- 6.26 The frequency of testing longitudinally shall be as stated in the Contract documents. Where no longitudinal frequencies are provided, the testing shall be no more than 10 m apart.

Maintenance

- 6.27 Completed sections of any course shall be maintained in a well-drained condition until covered with overlying material or primed / primer sealed, as applicable. Ruts or corrugations shall not be allowed to form and the Contractor shall ensure that the shape and degree of compaction immediately prior to overlaying or priming comply with the requirements of Clause 6 "Compaction Acceptance Criteria" and Clause 7 "Levels and Tolerances".

7 Test Procedures

- 7.1 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-PV-C1 7-1 Test Procedures

Test		Test Procedure
Sampling Of Soil, Aggregates And Rocks		TP 226
Preparation Of Samples		AS 1289.1
Site Selection By Stratified Random Technique		AS 1289.1.4.2
Field Density:	Nuclear Method	AS 1289.5.8.1
Moisture Content:	Oven Drying Method	AS 1289.2.1.1
	Microwave Method	AS 1289.2.1.4
Maximum Dry Density:	Modified Compaction	AS 1289.5.2.1
	Three Point Method	TP 164 ⁽¹⁾
Selection Of Maximum Dry Density		TP 166 ⁽²⁾
Dry Density Ratio		TP 320
Pavement Hardness		TP 349

(1) The three point method may be used to provide MDD value in stabilised material.

(2) For granular pavement materials only.

8 Hold Points

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

Table RD-PV-C1 8-1 Hold Points

Document Ref.	Hold Point	Response Time
2.3	Submission of Procedures (if not submitted beforehand)	7 Working Days
3.2	Evidence of compliance for Pavement Material	7 Working Days
4.3	Trial Pavement Results	1 Working Day
4.9	Prior to placement of subsequent pavement layers	1 Working Day
4.12	Conformation of pavement hardness prior to application of spray seal	1 Working Day

9 Verification Requirements and Records

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

Table RD-PV-C1 9-1 Verification Requirements

Document Ref.	Subject	Property	Test Procedure	Test Frequency	Acceptance Limits
Refer RD-PV-S1	Pavement Material Properties	Refer Table RD-PV-S1 6.2	Refer Table RD-PV-S1 5.2	Refer Table RD-PV-S1 5.2	Refer RD-PV-S1 Attachment A
4.4	Pavement Compaction	Moisture Content	AS 1289.2.1.1 or AS 1289.2.1.4	The same as the number of strata for a given lot.	Table 1 of AS 1289.5.4.2
4.6	Pavement Placement	Moisture Content	AS 1289.2.1.1 or AS 1289.2.1.4	The same as the number of strata for a given lot.	Less than 70% of OMC
4.11	Pavement Placement	Pavement Hardness	AG-PT-T251	For each site, a minimum of 3 tests located randomly in each wheel path, of each lane constructed.	National Highways: ≤ 2.5 mm Other Roads: ≤ 3.0 mm
6.	Pavement Compaction	Dry Density Ratio	AS1289.5.4.1-2007	Refer Clause 6 under “Number and Location of Tests”.	Refer Clause 6, under “Dry Density Ratio”
6.22 and 6.26	Surface of pavement course	Levels	As specified in PC-SI1 Site Surveys.	No more than 10 m apart longitudinally. As specified in PC-SI1 Site Surveys.	Refer Clause 6 under “Level and Tolerances”