

PART R21**CONSTRUCTION OF UNSTABILISED GRANULAR PAVEMENT****CONTENTS**

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1. GENERAL

- .1 This Part specifies the requirements for the construction of unstabilised granular pavement.
- .2 Formation levels and pavement levels must comply with the specified tolerances. Designated pavement thicknesses are nominal and do not constitute acceptance criteria.
- .3 Documents referenced in this Part are listed below:
AS 1289 Methods of Testing Soils for Engineering Purposes

2. QUALITY REQUIREMENTS

- .1 At a minimum, the Contractor's Quality Plan must include the following documents, procedures and/or instructions:
 - (a) method of pavement construction; and
 - (b) proposal for compliance with Clause 4 "Trial Pavement".
 - (c) proposed test frequency and locations for pavement hardness testing in accordance with Clause 4.3 "Pavement Hardness".
- .2 If not submitted beforehand, this documentation must be submitted at least 28 days prior to the commencement of site work.
- .3 Provision of the procedures listed in this Clause shall constitute a **HOLD POINT**.

3. MATERIALS AND MIXING PLANT

- .1 At least 7 days prior to the placement of Class 1, 2 or 3 Pavement Materials, the Contractor must provide test results demonstrating that the material complies with the requirements of Part R15 "Supply of Pavement Materials".
- .2 Provision of the documentation shall constitute a **HOLD POINT**.
- .3 Subbase and base materials must be mixed using a pugmill mixer unless otherwise specified. The mixing plant must be capable of consistently producing a homogeneous mixture of uniformly distributed component materials and water.

4. PLACEMENT**Trial Pavement**

- .1 At least 14 days prior to the commencement of construction of the upper base, the Contractor must 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 must be undertaken by either constructing a trial pavement or providing documented evidence from a previous project using the same plant, materials and construction methodology.

- .2 Any trial pavement must be at least 100 m long and may form part of an unbound pavement layer that is not a surface course. The Contractor must provide 7 days prior notice of the construction of a trial pavement.
- .3 Submission of the above notification and test results or evidence from a previous project shall constitute a **HOLD POINT**.

General

- .4 Placement of subsequent pavement layers must not commence until the moisture content of the underlying pavement layer is less than that specified in **Contract Specific Requirements** "Pavement Work", or if no moisture content has been specified therein, 70% of OMC.
- .5 Areas to be sealed must be tested for moisture content. The location of tests must 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 must be equal to the number of tests required for a given lot.
- .6 Prior to the placement of subsequent pavement layers, including sprayed bituminous surfacing or asphalt treatment, a **HOLD POINT** shall apply.

Pavement Hardness

- .7 Where the base course is to be covered with a spray seal wearing course, the Contractor must conduct Pavement Hardness tests prior to sealing.
- .8 A minimum of 3 tests must be undertaken per lane kilometre or part thereof. Sites must be located randomly in each wheel path of each lane constructed. Results must be submitted 2 days prior to the application of prime or primerseal.
- .9 Submission of the hardness test results shall constitute a **HOLD POINT**.

5. SURFACE FINISH

- .1 The surface of the pavement layers must be uniformly tight and free of loose uncompacted material, segregated or 'bony' material or soft, over wet areas and free of roller indentations.
- .2 For spray seals, the Contractor must 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.
- .3 The Quality Plan must provide full details of the proposed pavement construction procedures incorporating this requirement.

6. COMPACTION ACCEPTANCE CRITERIA

Quality Standards

- .1 All pavement layers must be uniformly compacted to the full depth and over the full width.
- .2 Statistical analysis, using an unknown variability scheme, must be used under this Contract to determine acceptance of compaction.
- .3 Compliance must be based on the analysis of a random set of tests taken from each lot of the works in accordance with Clause 6.3 below. Compliance must be indirectly in terms of percentage defective compared to the desired quality of the lot (10% defective).
- .4 The Contractor must achieve a 90% probability assurance that accepted lots comply with the desired quality. The acceptability characteristic k, quantified in Table 6.3.3 is used to provide this statistical assurance.
- .5 The Contractor must 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 must be excluded from the lot before testing commences.
- .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.

- .7 Excluded areas must 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 must be rectified prior to testing.

Number and Location of Tests

- .8 The frequency of testing of the various pavement layers must be as follows:
- (a) Subbase and base - one test per 500 square metres with a minimum of 6 tests per lot.
- NOTE: For subbase with lots less than 2 500 square metres the minimum frequency of testing must be one test per 500 square metres with a minimum of 2 tests per lot.
- For base with lots less than 2 000 square metres the minimum frequency of testing must be one test per 400 square metres with a minimum of 2 tests per lot.
- Acceptance must be on an absolute basis.
- (b) Shoulder (where not part of base) - a minimum of one test per 200 m.
- .9 The location of tests must 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 must be equal to the number of tests required for a given lot.

Testing Accuracies

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

Determination of Mean and Standard Deviation

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

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

- .12 The sample standard deviation (s) must be determined using the following relationship:

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

Outlier Value

- .13 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 must be performed (ref: ASTM E178).
- .14 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.

- .15 If the value of T_1 or T_n exceeds the value of T in Table 6.15, the low value or high value or both must be removed from the lot and the lot mean and standard deviation must be recalculated using the remaining results. The lot area which gave rise to the outlier value must be delineated and treated independently to the lot.

TABLE 6.15 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

- .16 The statistic L_s must be determined using the following relationship:

$$L_s = X - ks$$

where k is a multiplier. The value k is given in (c) below for different samples sizes.

Acceptance Limits

- .17 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 must be discarded. The specified values of L for each pavement layer are stated in **Contract Specific Requirements** "Pavement Work" or on the Drawings. The specified values of k are given in Table 6.17 below for different sample sizes.

TABLE 6.17 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

- .18 The allowable tolerances on the finished levels of each pavement course must be as stated in **Contract Specific Requirements** or on the drawings.

- .19 In addition to the tolerances specified, the base surface must not deviate by more than 10 mm from a 3 m straight edge laid on the surface.
- .20 The algebraic differences of the deviation in base levels from the design levels for two points up to 20 m apart longitudinally must not be greater than 20 mm. Levels higher than specified are taken as positive deviations and those lower than specified are taken as negative.
- .21 The tolerance on lateral position and on overall width must be ± 50 mm.

Survey on Pavement Layers

- .22 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.
- .23 The frequency and location of testing must be as detailed in Part CH30 "Survey".

Maintenance

- .24 Completed sections of any course must be maintained in a well drained condition until covered with overlying material or primed/primer sealed, as applicable. Ruts or corrugations must not be allowed to form and the Contractor must 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

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

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

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

CLAUSE REF.	HOLD POINT	RESPONSE TIME
2.3	Submission of Procedures (if not submitted beforehand)	7 days
3.2	Evidence of compliance for Pavement Material	7 days
4.3	Trial Pavement Results	1 working day
4.6	Prior to placement of subsequent pavement layers	1 working day
4.9	Conformation of pavement hardness prior to application of spray seal	1 working day

9. VERIFICATION REQUIREMENTS AND RECORDS

- .1 The Contractor must undertake the testing specified in this Clause and supply written evidence of compliance with the lot package.

CLAUSE REF.	SUBJECT	PROPERTY	TEST PROCEDURE	TEST FREQUENCY	ACCEPTANCE LIMITS
Refer Part R15	Pavement Material Properties	Refer Table R15.6.2	Refer Table R15.5.2	Refer Table R15.5.2	Refer Part R15 Attachment A
4.4	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
4.7	Pavement Placement	Pavement Hardness	TP 349	One site (i.e. 3 tests) per wheel path per 100 lineal metres of lane	National Highways: ≤ 2.5 mm Other Roads: ≤ 3.0 mm
6.	Pavement Compaction	Dry Density Ratio	TP 320	Refer Clause 6.	Refer Part R20
6.22	Surface of pavement course	Levels	As specified in Part CH30	As specified in Part CH30	Refer Part R20