Granular Pavement Materials

Road Building Model Specification

July 2022

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Acknowledgments

Main Roads Western Australia (Main Roads) technical guidelines and the Institute of Public Works Engineering Australia, Western Australia Division (IPWEA-WA) **Local Government Guidelines for Subdivisional Development** have been heavily referenced in preparing this road building specification.

The work of Reg Leach, Senior Consultant, Golder Associates Pty Ltd, in assembling the previous (2012) version of the Specification, upon which this document is based, is gratefully acknowledged.

Document Updates

The **Granular Pavement Materials** road building model specification was originally published in July 2022. Subsequent document updates are shown in the table below:

Date	Updates	Contents and purpose	Edition No.	Amended Modules

Each update will be listed above with the model specification, as amended, available from the WALGA website.

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1. SCOPE

This road building specification details the requirements for supply of unbound and centrally stabilised (plant-mix) **Granular Pavement Materials**, including basecourse and subbase. The Specification covers manufactured materials such as crushed granite rock base, naturally-occurring materials such as laterite gravel and bitumen emulsion stabilised crushed limestone (BSL).

Specifications for the supply of in situ stabilised pavement materials are provided in the Western Australia Local Government Association (WALGA) **Pavement Rehabilitation** road building model specification.

Specifications for the supply of recycled pavement materials, such as sourced from construction and demolition activities, are provided in the joint Institute of Public Works Engineering Australasia (IPWEA)/WALGA **Specification for the Supply of Recycled Road Base**.

2. REFERENCES

Australian Standards and Main Roads Western Australia (Main Roads) test methods are referred to in abbreviated form (e.g. AS 1234 or WA 123). For convenience, the full titles are given below.

Equivalent Australian Standard test methods may be substituted for the Main Roads test methods quoted in the Specification.

Australian Standards

AS 1141	Methods for Sampling and Testing Aggregates
AS 1152	Specification for Test Sieves
AS 1160	Bituminous Emulsions for the Construction and Maintenance of Pavements
AS 2008	Bitumen for Pavements

Main Roads Test Methods

WA 0.1	Random Sample Site Location
WA 110.1	Soil and Granular Pavement Material Moisture Content: Convection Oven Method
WA 115.1	Particle Size Distribution: Sieving and Decantation Method
WA 120.2	Liquid Limit: Cone Penetrometer Method
WA 121.1	Plastic Limit
WA 122.1	Plasticity Index
WA 123.1	Linear Shrinkage
WA 133.1	Dry Density/Moisture Content Relationship: Modified Compaction Fine and Medium Grained Soils
WA 140.1	Maximum Dry Compressive Strength
WA 141.1	Determination of the California Bearing Ratio of a Soil
WA 216.1	Flakiness Index
WA 220.1	Los Angeles Abrasion Value
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WA 717.1	Dispersion of Bitumen in Soil
WA 730.1	Bitumen Content and Particle Size Distribution of Asphalt and Stabilised Soil: Centrifuge Method
WA 915.1	Calcium Carbonate Content

WALGA Road Building Specifications

Aggregate and Cementitious Binders
Earthworks and Pavement Construction
Erosion Control and Foreshore Protection
Granular Pavement Materials
Pavement Rehabilitation

Sprayed Bituminous Surfacing
Supply and Laying of Asphalt Road Surfacing (IPWEA / AAPA)
Supply of Recycled Road Base (IPWEA / WALGA)

Acts and Regulations

Aboriginal Heritage Act 1972
Contaminated Sites Act 2003
Dangerous Goods Safety (Road and Rail Transport of Non-explosives) Regulations 2007
Environmental Protection Act 1986
Environmental Protection Regulations 1987
Environmental Protection (Clearing of Native Vegetation) Regulations 2004
Health (Pesticide) Regulations 2011
Main Roads Act 1930
Occupational Safety and Health Act 1984
Occupational Safety and Health Regulations 1996
Rail Safety National Law (WA) Act 2015
Road Traffic Code 2000
Wildlife Conservation Act 1950

Other References

Cocks et al. *The use of naturally Occurring Materials for Pavements in Western Australia*. Australian Geomechanics Journal, vol. 50, no. 1, pp 43-106, 2015.

3. DEFINITIONS

The following particular definitions shall apply:

- “basecourse” shall be the material placed in the uppermost layer of the pavement providing the bulk of the structural capacity and upon which a surfacing may be applied.
- “equivalent standard axles (ESAs)” shall be the number of standard axle loads that are equivalent in damaging effect to a pavement as an 80 kN single axle with dual tyres (SADT).
- ”pavement” shall be the portion of the road, excluding shoulders, constructed above the subgrade for the purpose of supporting vehicular traffic.
- “subbase” shall be the material placed between the subgrade and the basecourse to make-up the required pavement thickness (i.e. over-and-above basecourse) and/or to provide a working platform.
- “subgrade” shall be the trimmed or prepared portion of the formation upon which the pavement is constructed.
- “surfacing” shall be the material applied to the top of the basecourse for the purpose of resisting abrasion by vehicular traffic and preventing infiltration by water.

4. CRUSHED ROCK BASECOURSE

4.1 Applications

Type 1.1 crushed rock basecourse is suitable for use on all classes of road including freeways and controlled access highways.

Type 1.2 crushed rock basecourse is suitable for use on all classes of road excluding freeways and controlled access highways in metropolitan areas.

4.2 General

Crushed rock basecourse results from the mechanical crushing of hard rock source material with almost all the faces fractured. Crushed rock basecourse shall consist of a uniformly blended mixture of coarse and fine aggregate.

Coarse aggregate (≥ 4.75 mm) shall consist of clean, hard, durable, angular fragments of rock produced by crushing sound unweathered rock and shall not include materials which break up when alternately wetted and dried.

Fine aggregate (< 4.75 mm) shall consist of crushed rock fragments or a mixture of crushed rock fragments and natural sand or clayey sand. Crushed rock fine aggregate from each source shall, except as to size, comply with all the provisions specified for coarse aggregate.

The mixture of coarse and fine aggregate composing the basecourse shall be free from vegetable matter, lumps of clay, overburden or any other deleterious matter.

4.3 Particle Size Distribution

The particle size distribution of the crushed rock basecourse when tested in accordance with WA 115.1 shall comply with the requirements shown in Table 1. The grading of material passing the 37.5 mm sieve shall vary from coarse to fine in a uniform and consistent manner. The material shall not be gap graded as represented by the grading crossing from the maximum limit for one sieve size to the minimum limit for another sieve size.

Table 1 Crushed Rock Basecourse Particle Size Distribution

AS 1152 Sieve Size (mm)	% Passing by Mass Minimum and Maximum Limits	
	Type 1.1	Type 1.2
26.5	100	-
19.0	95 - 100	100
13.2	70 - 90	-
9.5	60 - 80	60 - 80
4.75	40 - 60	40 - 60
2.36	30 - 45	30 - 45
1.18	20 - 35	-
0.600	13 - 27	-
0.425	11 - 23	12 - 30
0.300	8 - 20	-
0.150	5 - 14	-
0.075	5 - 11	3 - 12

4.4 Other Acceptance Limits

The crushed rock basecourse shall also meet the other limits as shown in Table 2.

Table 2 Crushed Rock Basecourse other Acceptance Limits

Test	Limits	
	Type 1.1	Type 1.2
Dust Ratio (% passing 0.075 mm ÷ % passing 0.425 mm)	0.35 - 0.60	0.35 - 0.60
Liquid Limit (WA 120.2)	0 - 25%	0 - 25%
Plasticity Index (WA 122.1)	0 - 5%	0 - 5%
Linear Shrinkage (WA 123.1)	0.4% - 2.0%	0 - 2.0%

Test	Limits	
	Type 1.1	Type 1.2
Flakiness Index (WA 216.1)	0 - 30%	0 - 30%
Los Angeles Abrasion Value (WA 220.1)	0 - 35%	0 - 35%
Maximum Dry Compressive Strength (WA 140.1)	≥ 1.7 MPa	≥ 1.7 MPa
4-day Soaked California Bearing Ratio@ 99% MDD & 100% OMC (WA 141.1)	≥ 100%	≥ 100%
Wet/Dry Strength Variation (AS 1141.22)	0 - 35%	0 - 35%
Secondary Mineral Content (AS 1141.26) [1]	0 - 25%	0 - 25%
Accelerated Soundness Index (AS 1141.29) [2]	≥ 94%	≥ 94%

Notes:

1) The Secondary Mineral Content test is only applicable to basic igneous rock types.
2) The Accelerated Soundness Index test is only applicable to basic igneous rock types.

4.5 Moisture Content

Crushed rock basecourse shall be thoroughly mixed with water using a pugmill to produce a homogeneous product suitable for placement into the final position.

Crushed rock basecourse shall be pre-wet to greater than 95% of the optimum moisture content (OMC) as determined by WA 133.1 before delivery to site.

5. GRAVEL BASECOURSE

5.1 Applications

Gravel basecourse is suitable for use on most Local Government roads, with consideration of the application specific requirements before use on freeways or controlled access highways.

The suitability of each Type of gravel basecourse for varying traffic loading conditions is presented in Table 3. In addition to traffic loading, the performance of Type 2.3 and Type 2.4 gravel basecourse is dependent on the climatic region, as presented in ANNEXURE A - GRAVEL TYPE SELECTION FOR CLIMATIC REGIONS AND TRAFFIC A.

Table 3 Maximum Design Traffic Loading for Gravel Basecourse Materials

Gravel Basecourse Material	Maximum Design Traffic (Arid/Semi-Arid)	Maximum Design Traffic (Humid/Sub-Humid)
Type 2.1	1.0×10^7 ESAs	1.0×10^7 ESAs
Type 2.2	5.0×10^6 ESAs	5.0×10^6 ESAs
Type 2.3	5.0×10^6 ESAs	1.0×10^6 ESAs
Type 2.4	5.0×10^5 ESAs	5.0×10^4 ESAs
Type 2.5	5.0×10^6 ESAs	5.0×10^6 ESAs

5.2 General

Gravel basecourse is won from naturally occurring deposits with minimal effort. Crushed gravel has been subject to a mechanical crushing process with at least one of the faces fractured.

Gravel basecourse shall consist of durable pebble in soil mortar. The material shall be free from particles having any dimension greater than 50.0 mm and free from clods, stumps, roots, sticks, vegetable matter or other deleterious materials. Gravel basecourse having any particle dimension greater that 50.0 mm shall be deemed oversize and shall not be accepted.

5.3 Particle Size Distribution

The particle size distribution of gravel basecourse shall be determined in accordance with WA 115.1. The particle size distribution of the portion passing a 37.5 mm sieve shall conform to the grading limits shown in Table 4. The grading of material passing the 37.5 mm sieve shall vary from coarse to fine in a uniform and consistent manner. The material shall not be gap graded as represented by the grading crossing from the maximum limit for one sieve size to the minimum limit for another sieve size.

Table 4 Gravel Basecourse Particle Size Distribution

AS 1152 Sieve Size (mm)	% Passing by Mass Minimum and Maximum Limits				
	Type 2.1	Type 2.2	Type 2.3	Type 2.4	Type 2.5
37.5	100	100	100	100	-
19.0	72 - 100	72 - 100	95 - 100	95 - 100	100
9.5	50 - 78	50 - 81	50 - 100	50 - 100	-
4.75	36 - 58	36 - 66	36 - 81	36 - 81	45 - 65
2.36	25 - 44	25 - 53	25 - 66	25 - 66	30 - 50
1.18	18 - 35	18 - 43	18 - 53	18 - 53	-
0.600	13 - 28	-	-	-	-
0.425	11 - 25	11 - 32	11 - 39	11 - 39	12 - 30
0.300	9 - 22	-	-	-	-
0.150	6 - 17	-	-	-	-
0.075	4 - 13	4 - 19	4 - 23	4 - 23	4 - 13
0.0135	2 - 9	2 - 9	2 - 11	2 – 11	-

5.4 Other Acceptance Limits

The gravel basecourse shall also meet the other limits as shown in Table 5.

Table 5 Gravel Basecourse other Acceptance Limits

Test	Limits				
	Type 2.1	Type 2.2	Type 2.3	Type 2.4	Type 2.5
Dust Ratio (% passing 0.075 mm ÷ % passing 0.425 mm)	0.3 - 0.6	0.3 - 0.7	0.3 - 0.7	0.3 - 0.7	0.4 - 0.7
Liquid Limit (WA 120.2)	0 - 25%	0 - 25%	0 - 30%	0 - 35%	0 - 25%
Plasticity Index (WA 122.1)	-	0 - 6%	0 - 10%	0 - 16%	0 - 5%
Linear Shrinkage (WA 123.1)	0 - 2%	0 - 3%	0 - 5%	0 - 8%	0 - 1%
Maximum Dry Compressive Strength (WA 140.1)	≥ 2.3 MPa	≥ 2.3 MPa	≥ 1.7 MPa	≥ 1.7 MPa	≥ 1.7 MPa
4-day Soaked California Bearing Ratio @ 96% MDD & 100% OMC (WA 141.1)	≥ 80%	≥ 80%	≥ 80%	≥ 80%	≥ 80%
Weighted Linear Shrinkage (% passing 0.425 mm x LS)	-	≤ 150	≤ 200	≤ 250	≤ 250
Secondary Mineral Content (AS 1141.26) [1]	≥ 25%	≥ 25%	≥ 25%	≥ 25%	≥ 25%
Accelerated Soundness Index (AS 1141.29) [2]	≥ 94%	≥ 94%	≥ 94%	≥ 94%	≥ 94%

Notes:

1) The Secondary Mineral Content test is only applicable to basic igneous rock.
2) The Accelerated Soundness Index test is only applicable to basic igneous rock.

5.5 Moisture Content

Gravel basecourse shall be mixed to a uniform moisture content in the range of 85% to 115% of OMC and left to "cure" for at least 24 hours prior to compaction. Compaction shall be carried out within 72 hours of gravel curing commencing.

6. FERRICRETE BASECOURSE

6.1 Applications

Type 3.1 Ferricrete basecourse is suitable for use on all classes of road excluding freeways and controlled access highways in metropolitan areas.

Type 3.2 Ferricrete basecourse is suitable for use on most Local Government roads, with consideration of the application specific requirements before use on freeways or controlled access highways.

6.2 General

Ferricrete basecourse results from the mechanical crushing of iron-rich sedimentary rock duricrust (caprock) with at least one of the faces fractured.

Ferricrete basecourse shall predominantly consist of crushed indurated Ferricrete and may include natural fragmented Ferricrete and lateritic gravel. For blended materials, the proportion of crushed material shall not be less than 50%. The material shall be generally free from organic matter and other deleterious materials.

6.3 Source Rock

The source rock for Ferricrete basecourse shall also meet the toughness limits as shown in Table 6.

Table 6 Source Rock Acceptance Limits (Ferricrete Basecourse)

Test	Limits	
	Type 3.1	Type 3.2
Los Angeles Abrasion Value (WA 220.1)	≤ 60%	≤ 45%

6.4 Particle Size Distribution

The particle size distribution of Ferricrete basecourse when tested in accordance with WA 115.1 shall comply with the requirements shown in Table 7. The grading of material passing the 37.5 mm sieve shall vary from coarse to fine in a uniform and consistent manner. The material shall not be gap graded as represented by the grading crossing from the maximum limit for one sieve size to the minimum limit for another sieve size.

Table 7 Ferricrete Basecourse Particle Size Distribution

AS 1152 Sieve Size (mm)	% Passing by Mass Minimum and Maximum Limits	
	Type 3.1	Type 3.2
37.5	100	100
19.0	72 - 100	72 - 100
9.5	50 - 78	50 - 81
4.75	36 - 58	36 - 66
2.36	25 - 44	25 - 53
1.18	18 - 35	18 - 43
0.600	13 - 28	-

AS 1152 Sieve Size (mm)	% Passing by Mass Minimum and Maximum Limits	
	Type 3.1	Type 3.2
0.425	11 - 25	11 - 32
0.300	9 - 22	-
0.150	6 - 17	-
0.075	4 - 13	4 - 19
0.0135	2 - 9	2 - 9

6.5 Other Acceptance Limits

The Ferricrete basecourse shall also meet the other limits as shown in Table 8.

Table 8 Ferricrete Basecourse other Acceptance Limits

Test	Limits	
	Type 3.1	Type 3.2
Dust Ratio (% passing 0.075 mm ÷ % passing 0.425 mm)	0.3 - 0.7	0.4 - 0.6
Liquid Limit (WA 120.2)	0 - 25%	0 - 30%
Plasticity Index (WA 122.1)	0 - 6%	0 - 6%
Linear Shrinkage (WA 123.1)	0 - 2%	0 - 3%
Maximum Dry Compressive Strength (WA 140.1)	≥ 2.3 MPa	≥ 1.7 MPa
4-day Soaked California Bearing Ratio @ 96% MDD & 100% OMC (WA 141.1)	≥ 80%	≥ 80%
Flakiness Index (WA 216.1)	0 - 20%	0 - 20%

6.6 Moisture Content

Ferricrete basecourse shall be thoroughly mixed with water to produce a homogeneous product with a uniform moisture content of 90% - 110% of the OMC before placement into final position.

7. BITUMEN STABILISED LIMESTONE BASECOURSE

7.1 Application

Bitumen stabilised limestone (BSL) basecourse is suitable for use on most Local Government roads, with consideration of the application specific requirements before use on freeways or controlled access highways.

7.2 General

BSL basecourse shall be produced by the addition of 2.0% residual bitumen by mass of crushed limestone material. The source limestone (Tamala limestone) shall be free from sand, roots and other foreign material.

The bitumen emulsion blended with the crushed limestone material shall comply with the requirements of AS 1160 for Grade ASS/170-60 emulsion. The emulsifier used in the manufacture of the emulsion shall be Vinsol resin unless otherwise agreed.

The bitumen used in the manufacture of the emulsion shall be Class 170 bitumen conforming to AS 2008. Contractors shall nominate the source of supply for the bitumen emulsion with their quotation.

All water added during BSL manufacture and during construction shall contain a wetting agent such as Teepol, Comprox or similar, which shall be added at a rate of 1.0 L of wetting agent per 4000 L of water.

The mixing process shall produce a homogeneous mixture with uniformly distributed bitumen creating a thin film covering the crushed limestone particles.

7.3 Particle Size Distribution

The particle size distribution of BSL basecourse on delivery shall be determined in accordance with WA 730.1 and shall comply with the details shown in Table 9.

Table 9 BSL Particle Size Distribution

As 1152 Sieve Size (mm)	% Passing by Mass Minimum and Maximum Limits
26.5	100
19.0	90 - 100
4.75	60 - 90
1.18	35 - 75
0.075	0 - 15

7.4 Other Acceptance Limits

The BSL basecourse shall also meet the other acceptance limits as shown in Table 10.

Table 10 BSL Other Acceptance Limits

Test	Limits
Los Angeles Abrasion Value of Crushed Limestone (WA 220.2)	20% - 60%
Calcium Carbonate Content (WA 915.1)	60% - 80%
Dispersion of Bitumen in Soil (WA 717.1) [1]	Class 1
Bitumen Content (WA 730.1)	2.0% - 2.2%
Maximum Dry Compressive Strength (WA 140.1) [2]	≥ 10.5 kPa

Notes:

1) Determined from 3 randomly selected samples tested in accordance with WA 717.1. All results shall reflect Class 1 unless acceptance of a single Class 2 result is approved.
2) Testing to be conducted on unconfined samples following 24 hours curing and 16 hours drying.

7.5 Moisture Content

BSL basecourse shall be stockpiled at the point of manufacture for at least 72 hours before delivery to site. BSL basecourse shall be pre-wet to greater than 95% of the OMC as determined by WA 133.1 before delivery to site.

8. GRAVEL SUBBASE

8.1 Applications

Type 5.1 gravel subbase is suitable for use on all classes of road including freeways and controlled access highways.

8.2 General

Gravel subbase shall consist of durable pebble in soil mortar. The material shall be free from cobbles greater than 75.0 mm and free from clods, stumps, roots, sticks, vegetable matter or other deleterious materials.

8.3 Particle Size Distribution

The gravel subbase shall meet the grading requirements shown in Table 11 when tested in accordance with WA 115.1. The grading of material passing the 75.0 mm sieve shall vary from coarse to fine in a uniform and consistent manner. The material shall not be gap graded as represented by the grading crossing from the maximum limit for one sieve size to the minimum limit for another sieve size.

Table 11 Gravel Subbase (Type 5.1) Particle Size Distribution

AS 1152 Sieve Size (mm)	% Passing by Mass Minimum and Maximum Limits
75.0	100
37.5	80 - 100
19.0	50 - 100
9.5	36 - 81
4.75	25 - 66
2.36	18 - 53
1.18	13 - 43
0.425	8 - 32
0.075	3 - 19

8.4 Other Acceptance Limits

The gravel subbase shall also meet the other limits as shown in Table 12.

Table 12 Gravel Subbase (Type 5.1) Other Acceptance Limits

Test	Limits
Liquid Limit (WA 120.2)	0 - 30%
Plasticity Index (WA 122.1)	0 - 10%
Linear Shrinkage (WA 123.1)	0 - 4%
4-day Soaked California Bearing Ratio @ 94% MDD & 100% OMC (WA 141.1)	≥ 30%
Secondary Mineral Content (AS 1141.26) [1]	0 - 25%
Accelerated Soundness Index (AS 1141.29) [2]	≥ 94%

Notes:

1) The Secondary Mineral Content test is only applicable to basic igneous rock types.
2) The Accelerated Soundness Index test is only applicable to basic igneous rock types.

9. CRUSHED LIMESTONE SUBBASE

9.1 Applications

Type 5.2 crushed limestone subbase is suitable for use on all classes of road including freeways and controlled access highways.

Crushed limestone subbase may also be used as a basecourse on very low traffic roads where the performance of material from a known source has been proven to provide satisfactory performance in a similar application.

9.2 General

The source material for the supply of crushed limestone subbase (Tamala limestone) shall be free of organic material, clay lumps, cap rock or any other foreign material deleterious to its performance in the pavement.

9.3 Particle Size Distribution

The crushed limestone subbase shall meet the grading requirements shown in Table 13 when tested in accordance with WA 115.1.

Table 13 Crushed Limestone Subbase (Type 5.2) Particle Size Distribution

AS 1152 Sieve Size (mm)	% Passing by Mass Minimum and Maximum Limits
75.0	100
19.0	55 - 85
2.36	35 - 65
0.075	0 - 15

9.4 Other Acceptance Limits

The crushed limestone subbase shall also meet the other limits as shown in Table 14.

Table 14 Crushed Limestone Subbase (Type 5.2) Other Acceptance Limits

Test	Limits
Los Angeles Abrasion Value of Crushed Limestone (WA 220.2)	20% - 60%
Calcium Carbonate Content (WA 915.1)	60% - 80%
4-day Soaked California Bearing Ratio @ 94% MDD & 100% OMC (WA 141.1)	≥ 50%

10. CRUSHED ROCK SUBBASE

10.1 Applications

Type 5.3 crushed rock subbase is suitable for use on all classes of road including freeways and controlled access highways.

10.2 General

All crushed rock subbase shall consist of a uniform blended mixture of coarse and fine aggregate. The mixture shall be free from vegetable matter, lumps of clay, overburden or any other deleterious matter.

10.3 Particle Size Distribution

The particle size distribution of the crushed rock subbase when tested in accordance with WA 115.1 shall meet the requirements shown in Table 15. The grading of material passing the 37.5 mm sieve shall vary from coarse to fine in a uniform and consistent manner. The material shall not be gap graded as represented by the grading crossing from the maximum limit for one sieve size to the minimum limit for another sieve size.

Table 15 Crushed Rock Subbase (Type 5.3) Particle Size Distribution

AS 1152 Sieve Size (mm)	% Passing by Mass Minimum and Maximum Limits
26.5	100
19.0	95 - 100
9.5	60 - 85
4.75	40 - 70
2.36	30 - 55
1.18	20 - 42
0.600	13 - 32
0.425	11 - 28
0.300	8 - 25
0.150	5 - 20
0.075	5 - 15

10.4 Other Acceptance Limits

The crushed rock subbase shall also meet the other limits as shown in Table 16.

Table 16 Crushed Rock Subbase (Type 5.3) other Acceptance Limits

Test	Limits
Liquid Limit (WA 120.2)	0 - 25%
Plasticity Index (WA 122.1)	0 - 5%
Linear Shrinkage (WA 123.1)	0 - 2.0%
4-day Soaked California Bearing Ratio @ 96% MDD & 100% OMC (WA 141.1)	≥ 70%
Secondary Mineral Content (AS 1141.26) [1]	0 - 25%
Accelerated Soundness Index (AS 1141.29) [2]	≥ 94%

Notes:

1) The Secondary Mineral Content test is only applicable to basic igneous rock types.
2) The Accelerated Soundness Index test is only applicable to basic igneous rock types.

11. MATERIAL QUALITY

The Contractor shall implement a quality management system to ensure material supplied under the Contract complies in all respects to the specified requirements for the Type of material purchased.

Testing shall be carried out in accordance with the relevant Main Roads or equivalent Australian Standard test method. Sampling methods shall be random and unbiased. Random site selection must be undertaken in accordance with WA 0.1.

The frequency of tests shall always be adequate to demonstrate that the material complies with the Specification. As a minimum, testing frequencies shall be as shown in Table 17. Prior to supply, the Contractor shall certify that the material complies in all respects with the specified requirements and shall provide National Association of Testing Authorities, Australia (NATA) endorsed test certificates to demonstrate compliance.

Unless otherwise specified, all testing shall be performed by a Laboratory holding current NATA accreditation for the methods undertaken. NATA accreditation shall be maintained until the completion of the Contract. All test reports shall be NATA endorsed by a current approved signatory for the Laboratory conducting the testing.

The Contractor shall allow, or cause to allow, the Local Government ready access to the quarry, pit, production and/or manufacturing site to inspect the works and/or to collect material samples.

Table 17 Minimum Testing Frequency for Granular Pavement Materials

Method		Material Type	Minimum Frequency
WA 115.1	Particle Size Distribution	1.1, 1.2, 2.1, 2.2, 2.3, 2.4, 2.5, 3.1, 3.2, 5.1, 5.2, 5.3	1 : 2,000 m^3
WA 120.2	Liquid Limit	1.1, 1.2, 2.1, 2.2, 2.3, 2.4, 2.5, 3.1, 3.2, 5.1, 5.3	1 : 2,000 m^3
WA 122.1	Plasticity Index	1.2, 2.2, 2.3, 2.4, 2.5, 3.2, 5.1, 5.3	1 : 2,000 m^3
WA 123.1	Linear Shrinkage	1.1, 1.2, 2.1, 2.2, 2.3, 2.4, 2.5, 3.1, 3.2, 5.1, 5.3	1 : 2,000 m^3
WA 140.1	Maximum Dry Compressive Strength	1.1, 1.2, 2.1, 2.2, 2.3, 2.4, 2.5, 3.1, 3.2, 4.1	1 : 5,000 m^3
WA 141.1	California Bearing Ratio of a Soil	1.1, 1.2, 2.1, 2.2, 2.3, 2.4, 2.5, 3.1, 3.2, 5.1, 5.2, 5.3	1 : 5,000 m^3
WA 216.1	Flakiness Index	1.1, 1.2, 3.1, 3.2	1 : 5,000 m^3
WA 220.1	Los Angeles Abrasion Value	1.1, 1.2, 3.1, 3.2	1 : 5,000 m^3
WA 220.2	Los Angeles Abrasion Value of Crushed Limestone	4.1, 5.2	1 : 5,000 m^3
WA 717.1	Dispersion of Bitumen in Soil	4.1	1 : 1,000 m^3
WA 730.1	Bitumen Content and Particle Size Distribution of Asphalt and Stabilised Soil	4.1	1 : 5,000 m^3
WA 915.1	Calcium Carbonate Content	4.1, 5.2	1 : 5,000 m^3
AS 1141.22	Wet/Dry Strength Variation	1.1, 1.2, 2.1, 2.2, 2.3, 2.4, 2.5, 3.1, 3.2, 4.1, 5.1, 5.2, 5.3	1 : 5,000 m^3
AS 1141.26	Secondary Minerals Content	1.1, 1.2, 2.1, 2.2, 2.3, 2.4, 2.5, 3.1, 3.2, 5.1, 5.3	3 : Contract
AS 1141.29	Accelerated Soundness Index	1.1, 1.2, 2.1, 2.2, 2.3, 2.4, 2.5, 3.1, 3.2, 5.1, 5.3	3 : Contract
AS 1160	Bituminous Emulsions for Pavements	4.1	1 : 10,000 m^3
AS 2008	Bitumen for Pavements	4.1	1 : 10,000 m^3

12. SUPPLY OF MATERIALS

The Contractor shall nominate the source of the pavement materials to be supplied with the quotation.

Unless otherwise specified, the Contractor shall deliver the materials to the nominated stockpile sites on the date and time specified. The Contractor shall confirm all necessary arrangements concerning load size, rate for supply, timing of the delivery and documentation prior to delivery. Different material Types shall be placed in separate, clearly identified stockpiles.

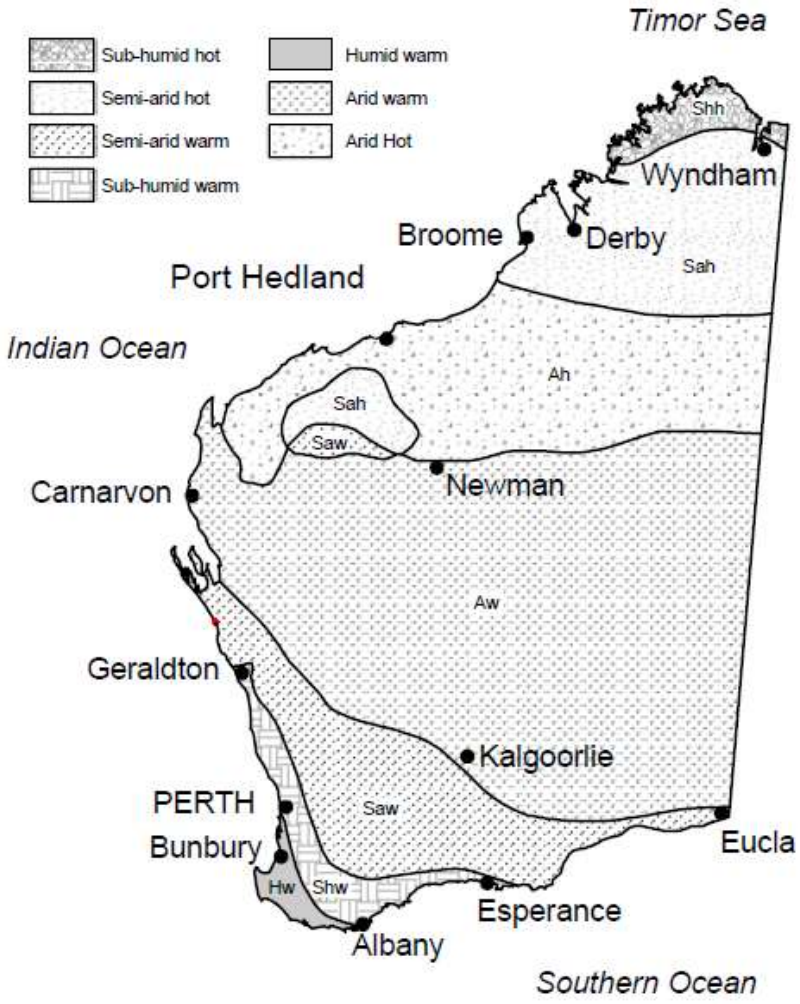
Where the Contract includes cartage, the Contractor shall remove and replace at no cost to the Local Government any granular pavement material that becomes contaminated during transport, delivery or stockpiling.

Where the Contract excludes cartage, the Contractor shall allow, or cause to allow, the Local Government or nominated third-party ready access to the quarry, pit, production and/or manufacturing site and shall provide any assistance necessary to ensure satisfactory load-out of the specified material.

13. REGULATORY REQUIREMENTS

The Contractor shall conform to all relevant statutory and regulatory requirements including environment, aboriginal heritage, wildlife conservation, dangerous goods, occupational safety and health, rail safety and road safety.

ANNEXURE A - GRAVEL TYPE SELECTION FOR CLIMATIC REGIONS AND TRAFFIC



Source: Climatic Regions of Western Australia - Thornthwaite's Method (After Gentilli 1972)

Table 18 Pavement Material Type Selection for Climatic Regions and Traffic

Climatic Region	Traffic Loading (ESAs) [1]				
	≤5 × 10^6	≤10^6	≤5 × 10^5	≤10^5	≤5 × 10^4
	Type of Material				
Sub-humid hot	2.2	2.2	2.2	2.3	2.3
Semi-arid hot	2.3	2.3	2.3	2.4	2.4
Arid hot	2.3	2.3	2.4	2.4	2.4
Arid warm	2.3	2.3	2.4	2.4	2.4
Semi-arid warm	2.3	2.3	2.3	2.3	2.4

Climatic Region	Traffic Loading (ESAs) [1]				
	≤5 × 10^6	≤10^6	≤5 × 10^5	≤10^5	≤5 × 10^4
	Type of Material				
Sub-humid warm	2.2	2.2	2.2	2.3	2.3
Humid warm	2.2	2.2	2.2	2.2	2.2

Note:

1) Gravel selection in accordance with these criteria assumes that the pavement will be well drained and not subject to inundation.