



August 2012

WALGA SPECIFICATIONS

WALGA Specification 8 - Aggregate and Cementitious Binders

Submitted to:

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SPECIFICATION

Report Number. 127642097-001-S-Rev1

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**WALGA SPECIFICATION 8
AGGREGATE AND CEMENTITIOUS BINDER
REVISION REGISTER**

Date	Clause Number	Description of Revision	Authorised By



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WALGA SPECIFICATION 6 - AGGREGATE SPECIFICATIONS



1.0 SCOPE

This standard specifies the requirements of aggregates, including the source rock and the crushed screened product, for a range of nominal size aggregates used in sprayed sealing and concrete. It also includes a specification for cement and lime.

Quotations are to be supplied as set out in a Schedule of Rates included in Annexure A1 and in a Lump Sum Bill of Quantities included in Annexure A2.

Acknowledgment: The use of Main Roads WA specifications and guidelines and the Institute of Public Works Engineering Australia (WA Division) Local Government Guidelines for Subdivisional Development are gratefully acknowledged as the basis of these specifications.

2.0 REFERENCES

Australian Standards, MAIN ROADS Western Australia documents and Test Methods and ASTM test methods are referred to in abbreviated form (e.g. AS 1234, Main Roads 67-08-43 or WA 123). For convenience, the full titles are given below:

Equivalent Australian Standard and Main Roads test methods may be substituted for one another.

Australian Standards

AS 1141	Methods for Sampling and Testing Aggregates
AS 2758.1	Aggregate and Rock for Engineering Purposes – Part 1 Concrete Aggregate
AS 3973	General Purpose and Blended Cement
AS 1672.1	Limes and Limestone – Part 1 Limes for Building
AS 1726	Geotechnical Site Investigations
AS 2350	Methods of Testing Portland and Blended Cements
AS 4489	Test Methods for Limes and Limestones

MAIN ROADS Test Methods

WA 200.1	Sampling Procedures for Aggregates
WA 210.1	Particle Size Distribution of Aggregate
WA 212.1	Aggregate Moisture Content: Convection Oven Method
WA 212.2	Aggregate Moisture Content: Microwave Oven Method
WA 215.1	Average Least Dimension
WA 216.1	Flakiness Index
WA 220.1	Los Angeles Abrasion Value
WA 223.1	Crushing Test Value
WA 624.1	Potential Alkali – Silica Reaction by Accelerated Mortar Bar

Acts and Regulations

Environmental Protection Act 1986
Environmental Protection Regulations 1987
Aboriginal Heritage Act 1972
Wildlife Conservation Act 1950
Environmental Protection (Clearing of Native Vegetation) Regs 2004
Health Pesticide Regulations 1956
Dangerous Goods Safety (Road and Rail Transport of Non-explosives) Regulations 2007
Occupational Safety and Health Act 1984
Occupational Safety and Health Regulations 1996
Rail Safety Act
Road Traffic Code 2000
Main Roads Act 1930



3.0 ONE SIZED SEALING AGGREGATES

3.1 General

Crushed aggregate, including its source rock, shall meet the requirements of this specification.

3.2 Source Rock

Source rock shall be selected from an approved quarry site such that the feed to the primary crusher is fresh, hard and durable rock, free from clay, organic matter, weathered (except as allowed below) or friable material, and is consistent in appearance. A classification system for rock material weathering is defined in Table A9 of AS 1726. The proportions of weathered rock material in the source rock shall not exceed the following limits by mass:

Table 1: Proportions of Weathered Rock

Slightly Weathered Rock	10% Maximum
Distinctly weathered rock	0.1% maximum
Extremely weathered rock	0.1% maximum
Residual soil	0% maximum

Selection of source rock shall be such that the requirements shown in Table 2 are satisfied and sealing aggregate conforming to the following specifications is able to be produced.

Table 2: Source Rock Properties

Property	Limit	Method of Test
Pendulum Friction Test (PAFV)	45 min	AS 1141.42

3.3 Crushed Aggregate for Sprayed Sealing Works

Source rock shall be processed to produce crushed and/or screened aggregate suitable for sprayed sealing works which shall conform to the requirements shown in Table 3 and Table 4. The aggregate shall be of uniform quality, clean, hard and durable and shall be free from clay, organic matter and elongated particles. The aggregate shall be of a uniform colour and appearance for the whole of the application.

Table 3: Crushed Aggregate Properties

Property	Requirement	Test Method
Los Angeles Abrasion Value (Note 2)		
Granite and other rock types	35% maximum	WA 220.1
Basalt	25% maximum	WA 220.1
Flakiness Index (Note 2)	35% maximum	WA 216.1
Average Least Dimension (Note 2)	Report	AS 1141.20.1 or WA 215.1
Water Absorption of Fine and Coarse Aggregate	2% maximum	AS 1141 6.1 AS 1141.5
Wet Strength	100kN minimum	AS 1141.22
Wet/Dry Strength Variation	35% maximum	AS 1141.22
Stripping Test Value (Note 1)	10% maximum	AS 1141.50
Degradation Factor	50 minimum	AS 1141.25.2
Secondary Mineral Content	25% maximum	AS 1141.26
Petrographic Examination	Statement of suitability for use as a sealing aggregate	



- Notes: 1. The aggregate shall be tested with 0.5% of adhesion agent in the binder using one of the following approved adhesion agents: Bitumite Concentrate, Redicote BE, Diamin TO-L, Fentamine BA422 and Bitumite Concentrate.
 2. Not applicable for crusher dust, sand, 7 mm and 5 mm aggregate.

Table 4: Sprayed Sealing Aggregate Particle Size Distribution Limits

AS Sieve Size (mm)	Percentage by Mass Passing Each Sieve for Each Nominal Size of Aggregate						
	20 mm	16 mm	14 mm	10 mm	7 mm	5 mm	3 mm
26.50	100						
19.00	80-100	100					
16.00	0-20	80-100	100				
13.20	0-2	0-20	80-100	100			
9.50		0-2	0-20	80-100	100		
6.70			0-2	0-20	80-100	100	
4.75				0-2	0-25	80-100	100
2.36					0-2	0-30	80-100
1.18	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-1.0	0-30
0.60							0-5

4.0 FINE AGGREGATES - CRUSHER DUST/SAND

Crusher dust/sand shall be suitable for use for primer-sealing and shall be clean coarse material that should not contain more than 4% by mass of material passing the 0.075 mm sieve and should be relatively free of clay and silt. The particles should be tough, durable, sound and free of deleterious material.

Unless otherwise approved by the Local Government Authority Representative, the material shall have the following properties:

Material shall be coarse, with a $D_{80} > 0.60\text{mm}$ and C_u (Coefficient of Uniformity) > 4 , where D_{80} is the particle size in millimetres at which 80%, by mass of the sample, is smaller in size and

$$C_u = \frac{D_{60}}{D_{10}},$$

where D_{60} and D_{10} are respectively equal to the particle size in millimetres at which 60% and 10%, by mass of the sample, is smaller in size.

The maximum particle size shall be 4.75 mm. Oversize material shall be removed by screening.

5.0 CONCRETE AGGREGATE

5.1 General

Aggregate for use in concrete shall conform to AS 2758.1 and this specification. The Local Government Authority may approve use of aggregates that do not comply in all respects to this specification provided evidence acceptable to the Local Government Authority is provided that the performance of concrete made with the aggregate is satisfactory for the type of use intended. Unless otherwise agreed by the Local Government Representative, aggregate supplied under this specification shall have a particle density limited to between 2.1 and 3.2 t/m³.

5.2 Durability

Unless otherwise agreed by the Local Government Authority, all aggregate shall suitable for use in exposure classification C as specified in AS 2758.1.



5.3 Fine Aggregate

Fine aggregate for concrete shall be defined as aggregate having a nominal size of less than 5 mm. Fine aggregates shall be natural sand unless otherwise agreed by the Local Government Authority and shall comply with the requirements of AS 2758.1.

The grading of the fine aggregate shall comply with the requirements of AS 2758.1 as specified in Table 5.

Table 5: Fine Aggregate - Grading Requirements and Limits of Deviation

Sieve Size	Uncrushed fine aggregate		Crushed fine aggregate	
	Size Limits, mass of sample passing (%)	Maximum deviation from submitted sample grading (%)	Size Limits, mass of sample passing (%)	Maximum deviation from submitted sample grading (%)
9.50	100		100	
4.75	90 to 100	± 5	90 to 100	± 5
2.36	60 to 100	± 5	60 to 100	± 10
1.18	30 to 100	± 10	30 to 100	± 15
0.600	16 to 100	± 15	15 to 80	± 15
0.300	5 to 50	± 10	5 to 40	± 10
0.150	0 to 20	± 5	0 to 25	± 5
0.075	0 to 5		0 to 20	± 5

The maximum amount of water absorption for fine aggregates shall not exceed 1.5 percent when tested in accordance with AS 1141.5, AS 1141.6.1 or AS 1141.6.2.

The maximum weighted average loss when determined in accordance with AS 1141.24 (Aggregate Soundness – Evaluation by exposure to sulphate solution) shall not be greater than 12 percent.

5.4 Coarse Aggregate

Course aggregate for concrete shall be defined as aggregate having a nominal site equal to or greater than 5 mm. Coarse aggregates shall be crushed igneous rock or crushed or screened river gravel conforming to the requirements of AS2758.1. All coarse aggregates shall be single-sized. Graded coarse aggregates shall not be used unless otherwise approved by the Local Government Authority. The maximum amount of water absorption for coarse aggregates shall not exceed 2.5 percent.

All aggregates proposed for use in the Works shall comply with the requirements of the "Alkali-Reactive Materials" clause of AS 2758.1. Aggregates shall be classified by Main Roads WA Test Method WA 624.1 and those aggregates having potential for substantial AAR shall not be used.

The Wet strength and wet/dry strength variation when determined in accordance with AS 1141.22 shall be not less than 100 kN and 25% respectively.

The Los Angeles Value when tested in accordance with AS 1141.23 or Main Roads WA 220.1 shall be not more than 30%.

The Sodium Sulphate Soundness weighted average loss shall be not more than 6% when tested in accordance with AS 1141.24.

The Flakiness Index shall not exceed 35 % when tested in accordance with AS 1141.15 or Main Roads WA 216.1.

The grading of the one sized coarse aggregate shall comply with the requirements of AS 2758.1 as specified in Table 6.



Table 6: Coarse Aggregate Grading Requirements

Sieve size	Mass of sample passing %				
	Nominal size of single sized aggregates (mm)				
	28	20	14	10	7
37.5	100				
26.5	85 to 100	100			
19.0	-	85 to 100	100		
13.2	0 to 20	-	85 to 100	100	
9.5	-	0 to 20	-	85 to 100	100
6.7	-	-	0 to 20	-	85 to 100
4.75	0 to 5	0 to 5	-	0 to 20	-
2.36	-	-	0 to 5	0 to 5	0 to 20
0.075	0 to 2	0 to 2	0 to 2	0 to 2	0 to 2

The limits of deviation from the submitted sample grading shall be as specified in AS 2758.1. Sampling for the purposes of carrying out tests shall be in accordance with AS 1141 or Main Roads WA 200.1.

6.0 GENERAL PURPOSE AND BLENDED CEMENTS

Cement shall comply with the requirements of AS 3972 for the type and blend specified. Sampling and testing of cement shall be in accordance with AS 2350. The cement shall be sufficiently dry to flow freely during application.

Unless otherwise specified by the Local Government Authority, cement shall also comply with the requirements of Australian Technical Infrastructure Committee (ATIC) Specification SP43. The Cementitious Material Registration Scheme (CMRS) shall be used to confirm that the cement complies to ATIC - SP43.

Prior to supply of cement the Contractor shall confirm that the cement complies with ATIC – SP43 and shall provide the CMRS registration number for the cement to the Local Government Representative for approval of the cement.

7.0 LIME

Quicklime and hydrated lime shall comply with the requirements of AS 1672.1. Sampling and testing of lime shall be in accordance with AS 4489. Hydrated lime shall be sufficiently dry to flow freely during application.

Prior to supply of lime the Contractor shall confirm that the material complies with AS 1762.1 and shall provide a NATA endorsed quality report for all relevant test properties for the material to be supplied to the Local Government Authority Representative for approval of the cement.

8.0 MATERIAL QUALITY

The Contractor shall implement a quality control system to ensure material supplied under this contract complies in all respects to the specified requirements for the type of material purchased.

The quality control system shall include the minimum testing requirements detailed in Table 7.



Table 7: Minimum Quality Control Testing Requirements

Property	Minimum Number of Tests
Aggregate	
PSD (WA 210.1 or AS 1141.11)	3 tests per quarry production lot
Flakiness Index (WA 216.1 or AS 1141.15)	3 tests per quarry production lot
LA Abrasion (WA 220.1 or AS 1141.23)	1 test per 12 months
Water Absorption (AS 1141.5/6)	1 test per 12 months
Degradation Factor (AS 1141.25.2)	1 test per 12 months (excluding acid igneous rock)
Wet Strength and Wet/Dry Strength Variation (AS 1141.22)	1 test per 12 months
Petrographic Examination (AS 1141.22)	1 test per 12 months per material type
Secondary Mineral Content (AS 1141.26)	1 test per 12 months (excluding acid igneous rock)
Resistance to Stripping (AS 1141.50)	1 test per 12 months (sealing aggregate only)
ALD (AS 1141.20.1)	Minimum 3 tests per lot per aggregate size (sealing aggregate only).
Water Absorption (AS 1141.5, AS 1141.6.1 or AS 1141.6.2)	1 test per 12 months
Aggregate Soundness (AS 1141.24)	1 test per 12 months
Potential Alkali-Silica Reaction (WA 624.1)	1 test per 12 months
Cement	
Suite of tests for properties specified in AS 3972	1 certificate per supply lot
Lime	
Suite of tests for properties specified in AS 1672.1	1 certificate per supply lot

Notes: Aggregates

- 1) A lot shall be no more than one (1) days production or 1000 m³ whichever is the lesser and shall be homogeneous in terms of quality.
- 2) The quality control system shall include separate stockpiling of each aggregate type and size on well prepared stockpile sites at the quarry or pit.
- 3) Prior to the supply of any material the Contractor shall certify that material supplied by the Contractor complies in all respects with the specified requirements and shall provide test certificates that demonstrate compliance.
- 4) The Contractor shall provide ready access of Local Government Authority Representative to inspect the quarry, pit or production and or manufacturing site and to take samples.
- 5) The Contractor shall provide ready access of Local Government Authority Representative to inspect the quarry, pit or production and or manufacturing site and to take samples.
- 6) Conformance of the aggregate at its source shall be construed only as authorising the Contractor to deliver the material. Contamination of the aggregate during cartage, or failure to cart and stockpile the aggregate as specified shall render the material non-conforming. The Contractor shall not be paid for non-conforming material or its cartage.

9.0 SUPPLY

9.1 Aggregate

The source of aggregate supplied by the Contractor shall be nominated with the Tender.

Where specified, the Contractor shall supply the aggregate into nominated stockpile sites at the time specified by the Local Government Authority and shall make all necessary arrangements with the Local Government Authority Representative concerning load size, rate for supply, timing of the delivery and documentation. Different aggregate sizes and types shall be placed in clearly identified and separate stockpiles.



Any contamination of aggregate during delivery or stockpiling that is due in any way to the Contractor's activities shall be corrected at no cost to the Local Government Authority.

Where specified, the Contractor shall provide for the Local Government Authority to have ready access to the quarry or pit and shall load the Local Government Authority trucks with the specified aggregate size and type.

9.2 Cement

The Contractor shall arrange cement delivery. The Contractor shall be responsible for all arrangements in regard to the transfer of cement between delivery vehicles, on site bulk storage facilities and cement spreaders.

Transportation units and storage bins for bulk cement shall be weatherproof and shall be constructed so that there is no dead storage. The Contractor shall demonstrate that the transport units and storage bins for bulk cement do not have any dead storage. If dead storage exists the bins shall be emptied completely at least once every three months. Cement delivered in bags shall be stored in weatherproof structures having floors raised above the ground. Cement that is more than three months old shall not be supplied.

Any contamination, wetting up or other problem during delivery and supply that is due in any way to the Contractor's activities shall be corrected at no cost to the Local Government Authority.

9.3 Lime

The Contractor shall arrange lime delivery. The Contractor shall be responsible for all arrangements in regard to the transfer of lime between delivery vehicles, on site bulk storage facilities and lime spreaders.

Transportation units and storage bins for bulk lime shall be weatherproof and shall be constructed so that there is no dead storage. The Contractor shall demonstrate that the transport units and storage bins for bulk cement do not have any dead storage. If dead storage exists the bins shall be emptied completely at least once every three months. Lime delivered in bags shall be stored in weatherproof structures having floors raised above the ground. Lime that is more than three months old shall not be supplied.

Any contamination, wetting up or other problem during delivery and supply that is due in any way to the Contractor's activities shall be corrected at no cost to the Local Government Authority.

10.0 REGULATORY REQUIREMENTS

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



11.0 ANNEXURE A1

Schedule of Rates

The quantities in this Schedule of Rates are the estimated quantities of the Works and are not to be taken as the actual or correct quantities. The Contractor shall be paid for the measured quantity of each section or item of work described below and executed under the contract at the rates and amounts entered applicable thereto.

Item	Description	Unit	Qty	Rate (i)	Amount	
					\$	¢
Sealing Aggregate						
1	14 mm sealing aggregate	m ³				
2	10 mm sealing aggregate	m ³				
3	7 mm sealing aggregate	m ³				
4	5 mm sealing aggregate	m ³				
5	Sand/crusher dust	m ³				
6	Cartage	m ³ /km				
Concrete Aggregate						
7	Fine aggregate	m ³				
8	28 mm aggregate	m ³				
9	20 mm aggregate	m ³				
10	14 mm aggregate	m ³				
11	10 mm aggregate	m ³				
12	7 mm aggregate	m ³				
13	Cartage	m ³ /km				
Cement						
14	GP and blends	tonne				
15	Cartage	tonne/km				
Lime						
15	Quicklime	tonne				
16	Hydrated Lime	tonne				
17	Cartage	Tonne/km				
GST Exclusive Total						
GST Amount						
Total Amount of Tender						

Note (i): Rate to include all overheads, incidentals, mobilisation and demobilisations, testing and aggregate loading.



12.0 ANNEXURE A2

Price Schedule (Lump Sum Bill of Quantities)

All items in this Bill of Quantities shall be priced and extended by the Tenderer and the lump sum accepted by the Local Government Authority shall equal the TOTAL AMOUNT GST INCLUSIVE. Any errors in the rates or prices entered in this Schedule shall be corrected by agreement between the Tenderer and the Local Government Authority. Where no agreement can be reached, any errors shall be corrected as determined by the Local Government Authority so that the total amount of tender for all items in this Schedule continues to equal the lump sum accepted by the Local Government Authority.

Item	Description	Unit	Qty	Rate (i)	Amount	
					\$	¢
Sealing Aggregate						
1	14 mm sealing aggregate	m ³				
2	10 mm sealing aggregate	m ³				
3	7 mm sealing aggregate	m ³				
4	5 mm sealing aggregate	m ³				
5	Sand/crusher dust	m ³				
6	Cartage	m ³ /km				
Concrete Aggregate						
7	Fine aggregate	m ³				
8	28 mm aggregate	m ³				
9	20 mm aggregate	m ³				
10	14 mm aggregate	m ³				
11	10 mm aggregate	m ³				
12	7 mm aggregate	m ³				
13	Cartage	m ³ /km				
Cement						
14	GP and blends	tonne				
15	Cartage	tonne/km				
Lime						
15	Quicklime	tonne				
16	Hydrated Lime	tonne				
17	Cartage	Tonne/km				
GST Exclusive Total						
GST Amount						
Total Amount of Tender						

Note (i): Rate to include all overheads, incidentals, mobilisation and demobilisations, testing and aggregate loading.



Report Signature Page

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