GENERAL SPECIFICATION

G7 ASPHALT PRODUCTION

Date JUNE 2012

Department *of* Infrastructure, Energy *and* Resources

Tasmania
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G7.1 GENERAL

G7.1.1 Scope

This specification sets out the requirements for the production of asphalt for roads and related applications. It sets the minimum requirements for:

- properties of materials to be used in asphalt production.
- mix design.
- process control in manufacture.
- evidence of compliance, records, sampling and testing frequencies during production.

G7.1.2 Objectives

The objectives of this specification are to:

- obtain a durable asphalt of consistent properties, appropriate to its intended usage.
- ensure that that the component materials and manufactured asphalt are of the specified quality.
- ensure that all information necessary to effectively manage the production of the asphalt is documented and in a manner that facilitates the inquisition of that information by both the Contractor and Superintendent.

G7.1.3 Obligations of Producer

The Producer in the following is the business/company that manufacturers the asphalt. The producer may be a subcontractor to a project or may be the Contractor.

The producer must have and work to a Third Party Certified Quality Plan. The Plan must include all the elements defined in this specification.

The Producer must be willing to:

- supply to the contractor all records of incoming products and produced asphalt tests, undertaken for a particular project.
- supply copies of the relevant job mix design report.
- provide samples of the materials used in the production of asphalt.
- carry out the necessary testing and adjustments required for the production and construction trial of *Standard Specification R55 Asphalt Placement*.
- provide access to the Contractor and Superintendent in order to inspect the plant and its operation, the Quality System documentation and test records.

G7.1.4 Traffic Categories

The required properties of asphalt and its components are based on the Traffic Categories defined in *Austroads Guide to Pavement Technology, Part 4B Asphalt, Appendix A Mix Design Procedures*. The particular traffic category will be nominated in the *Project Specification*. One of the following traffic categories will apply:

- light
- medium
- heavy
- very heavy.

G7.1.5 References

Asphalt production shall be in accordance with all DIER Standards and Specifications, in particular:

- G1 – General Provision
- G2 – Contract Management Plan

- G6 – Production of Aggregates and Rock Products.

and the Austroads Guide to Pavement Technology and Australian Standards.

Austroads Guide to Pavement Technology:

- AP-C87/08 Glossary of Austroads Terms**;**
- Part 3 Pavement Surfacings;
- Part 4B Asphalt;
- Part 4E Recycled Materials;
- Part 4F Bituminous Binders;
- Part 4H: Test Methods**;**
- Part 4K Seals;
- Part 8 Pavement Construction.

There are a number of Austroads reports referenced in these guides that are also to be used particularly:

- AG:PT/T190 Specification Framework for Polymer Modified Binders and Multigrade Bitumens;
- AP-T42/06 Guide to the selection and use of Polymer Modified Binders and Multigrade Bitumens.

Australian Standards:

- AS1141 – a Methods for Sampling and Testing Aggregates
- AS1160 – Bituminous Emulsions for Construction and Maintenance of Pavements
- AS1289 – Methods of Testing Soils for Engineering Purposes
- AS1672.1 – Limes and Limestones – Lime for Buildings
- AS2008 – Residual Bitumen for Pavements
- AS2150 – Hot Mix Asphalt- A guide to good practice.
- AS2758.5 – Aggregates and Rock for Engineering Purposes, Part 5: Asphalt Aggregates
- AS2891 – Methods of Sampling and Testing Asphalt
- AS3582.1 – Supplementary Cementitious Materials for use with Portland Cement, Part 1 – Fly Ash
- AS3582.2 – Supplementary Cementitious Materials for use with Portland Cement, Part 1 – Slag – Ground Granulated Iron Blast-Furnace.
- AS3582.3 – Supplementary Cementitious Materials for use with Portland Cement, Part 3 – Silica Fume
- AS3972 – Portland and Blended Cements.

G7.2 MATERIALS

G7.2.1 General

All materials used in the production of asphalt shall have consistent properties and shall satisfy the requirements of this specification. Each individual component of the supplied mix shall be obtained from the same source as the materials used to establish the Job Mix.

G7.2.2 Aggregates and Filler

The quality and acceptance criteria for fine and coarse aggregate and filler are set out in *Appendix G7.A*. The materials shall be supplied to a nominated and consistent grading.

G7.2.3 Binder

Bitumen

Standard Classes of bitumen shall comply with the requirements of *AS2008*. Unless otherwise specified in the project specification, the binder shall be Class 170 bitumen.

Other Binders

Polymer modified binder shall comply with *AG:PT/T190*.

Additives

The type and proportion of additives to be used in the mix, other than those specified elsewhere in this specification, shall be in accordance with an approved specification. An approved specification may be a manufacturer's recommendation, purchaser's specification or as agreed between parties.

Rejuvenating Agent

Rejuvenating agent, if required in mixes incorporating recycled asphalt, shall be a low volatility oil capable of combining with bitumen to counteract hardening and produce a lower viscosity grade of binder. Rejuvenating agent shall comply with recognised standards for such materials

G7.2.4 Reclaimed Asphalt Pavement

Reclaimed asphalt (RAP) shall be crushed and screened as necessary to ensure a maximum size no greater than the maximum size of asphalt being produced and to achieve a reasonably well graded, free flowing, and consistent product.

RAP shall be free of foreign material such as unbound granular base, broken concrete, crumbed rubber or other contaminants. Asphalt containing tar shall not be used.

RAP shall be placed in separate stockpiles prior to use. The stockpiles shall be tested for consistency in grading and binder content.

Restrictions apply as to where asphalt that contains RAP can be used and to the proportion of RAP that is acceptable in a mix (Refer to *Standard Specification R55 Asphalt Placement Appendix R55.A1 Dense Graded Mixes*).

G7.3 JOB MIX DESIGN

G7.3.1 General

All products supplied to DIER projects shall be designed in accordance with this specification. Designs shall meet all the requirements of *Standard Specification R55 Asphalt Placement Appendix R55.A* and shall be appropriate to the Traffic Category nominated in the *Project Specification*.

Each mix design shall be identified by a unique number and shall be designated the Job Mix.

G7.3.2 Mix Design

Mix designs shall be determined in accordance with the Austroads procedures or by the Marshall procedure (*AS2891.5*). In the event that the design procedure is not defined in the *Project Specification*, either of the above two design procedures may be adopted.

For the purposes of this specification, the Marshall mix design procedure involves all the steps of APRG Report 18, Level 1, but using Marshall compaction in place of gyratory compaction. The estimation of bitumen film thickness shall be included in both procedures.

A mix design report shall be prepared for each product. The content of the report is defined in *Table G7.1 – Information to be included in the Job Mix Design Report*.

Level 2 and / or Level 3 testing of APRG Report 18 may be specified in the *Project Specification* for dense graded asphalt. The preparation, conditioning and testing shall be undertaken in accordance with APRG Report No 18. While Level 2 and Level 3 tests do not form part of the job mix design criteria, the results shall be included in the Job Mix Design Report.

Where Level 2/3 testing is nominated, these will be all or some of the following as listed in the *Austroads Pavement Guide Part 4B Appendix A*, i.e. Level 2/3 testing that is additional to level 1:

Level 2

- Film index (binder film thickness)
- Creep
- Modulus
- Moisture susceptibility
- Beam fatigue resistance.

Level 3

- Deformation resistance.

Table G7.1 – Information to be included in the Job Mix Design Report

1.	Asphalt type, nominal size, design traffic category, mix design methodology, date of tests.
2.	Details of constituent materials including aggregates, filler, binder, additives (if used) and source of materials.
3.	The nominated grading, binder content, design air voids, effective binder film thickness and proportion of each component in the mix.
4.	Test results verifying constituent material properties and test results of trial mixes made at varying binder contents to arrive at the design mix.
5.	Test results, including graphs, of all tests used to establish that the mix complies with the requirements of this Specification.
6.	The following test results performed on a batch of each mix proposed to be used, and produced from the mixing plant from which the asphalt is to be supplied: • Grading • Binder Content • Maximum density • Air voids at laboratory design compaction level • For Dense Graded asphalts in Very Heavy Traffic Category, the Air voids at 250 cycles of gyratory compaction.
7.	Results of any Level 2 or Level 3 tests.

G7.3.3 Previously Designed Mixes

Previously designed mixes that satisfy all of the following conditions will be accepted if:

- the job mix complies with all the requirements of this specification and the requirements of the project specification.
- the project work is undertaken within a two-year period of the date of testing shown in the job mix design report.
- the type, quality and source of all constituent materials remain unchanged.
- the proportions of aggregates and filler are not varied by more than 20% of the proportion of that component in the original Job Mix.

A mix design shall be invalid after two (2) years or if there are changes to any of the components.

All asphalt mix designs are to be provided to the Superintendent and Documents.RandT@dier.tas.gov.au (Asset Management) after acceptance by the Superintendent.

G7.4 QUALITY CONTROL AND EVIDENCE OF COMPLIANCE

G7.4.1 General

The Producer shall ensure that:

- the asphalt has been produced under controlled conditions, using products of known quality and variability.
- incoming materials are of the specified quality.
- the asphalt has been produced, stored and handled in a manner that is not detrimental to its performance in place.
- there is documentation, readily available to the contractor and superintendent, which demonstrates that the above and any specific requirements are being met.
- production control testing of the product is undertaken, including the production of quality control charts.
- all loads of the asphalt are inspected for uniformity, storage time and temperature.

G7.4.2 Producer's Quality Plan

The Producer's Quality Plan shall include the following:

- inspection and test regimes for incoming materials and manufactured asphalt.
- presentation and analysis of data, including incoming materials and control charts of manufactured asphalt.
- records system covering product and test traceability, evidence of compliance and including changes to the source of supplies and changes to the proportions of a mix.
- notification of changes.
- handling and storage of incoming products and actions and notifications when incoming products do not comply.
- moisture control and particle grading limits and tolerances for incoming granular materials.
- mix design methodologies, recording and numbering systems.
- manufacture of asphalt. this should include any special provisions for recycled asphalt when recycled asphalt is to be used in a project.
- storage and delivery of asphalt including limits on storage temperatures and storage times.

G7.4.3 Incoming Materials

These must be of known quality and uniformity. The required frequency of testing of incoming materials is included in *Table G7.2 – Frequency of Testing of Component Materials*.

Table G7.2 - Frequency of Testing of Component Materials

Test	Minimum Frequency
Grading	*Appendix G7.A* and Note below
Coarse Aggregate Durability	Refer *Standard Specification G6*
Polished Aggregate Friction Value	Refer *Standard Specification G6*
Flakiness Index of coarse aggregate	Refer *Standard Specification G6*
Added filler	Certification of each delivery
Binder viscosity	Certification of each delivery
RAP grading and binder content	One test per 500t of RAP

Evidence of compliance of the incoming aggregates shall be in the form of control charts provided by the supplier of the component materials. The testing frequency for grading undertaken by the supplier should be about 1 test per 600t.

G7.4.4 Production Testing

The Producer shall undertake production control testing.

Samples for process control testing shall be randomly selected (random sampling) by a recognised statistical technique from fresh production asphalt at the asphalt plant. Samples shall not be mixed.

Frequency of sampling and testing shall not be less than that shown in *Table G7.3 – Frequency of Sampling and Testing of Production Asphalt*. The table provides for two levels of minimum frequency.

The reduced frequency may only be adopted where:

- there is evidence that the quality of incoming aggregates is monitored in accordance with *G7.4.3* and can be shown to be consistent with the quality requirements and allowable tolerances in grading of *Appendix G7.A*.
- the process is demonstrated to be under statistical control (*G7.4.5*).
- where a non-conformance occurs in any test requirement for the production asphalt, the frequency of sampling and testing for that particular property shall be increased to the normal level until conforming results have been obtained on five consecutive samples.

Table G7.3 – Frequency of Sampling and Testing of Production Asphalt

Test	Normal Minimum Frequency	Reduced Minimum Frequency
Grading	One test per 300t of asphalt plant production	One test per 500t of asphalt plant production
Binder Content	One test per 300t of asphalt plant production	One test per 500t of asphalt production
Maximum density	One test per 300t of asphalt plant production	One test per 500t of asphalt plant production
Temperature	Each loaded truck	Lesser of each loaded truck or one per 15 minutes

G7.4.5 Monitoring and Control

The Producer shall implement suitable measures for monitoring and controlling the asphalt production process. The measures shall include:

- the use of statistical control charts for:
- grading, including at least four (4) sieve sizes, one of which must be the 0.075mm sieve.

- binder content.
- maximum (voids free bulk) density.

The charts shall include the date of sampling and a reference that could be used to establish the test report and the daily or progressive production at the time of sampling.

Suitable decision rules for determining that the process is under statistical control.

Elements of the process control system that incorporate the application of statistical process control shall be included in the Producer's Quality Plan.

G7.4.6 Production Tolerances

Production tolerances on grading and binder contents shall comply with *Table G7.4 – Production Tolerances*.

Table G7.4 – Production Tolerances

Grading:	**Maximum Tolerance on Job Mix Percentage**
Sieve size on size larger than nominal size	Nil
4.75mm sieve and larger	±7
2.36mm sieve	±5
1.18mm sieve	±5
0.600mm sieve	±4
0.300mm sieve	±4
0.150mm sieve	±2.5
0.075mm sieve	±1.5
Binder Content: Percent by mass	±0.3

G7.4.7 Delivery Dockets

Delivery dockets shall include the following information:

- time and temperature of asphalt at point of loading.
- mass of asphalt in vehicle.
- progressive mass totals on either daily or whole of job basis.

APPENDIX G7.A – AGGREGATES AND FILLERS ACCEPTANCE CRITERIA

G7.A.1 Scope

This section sets out the required quality limits of coarse aggregate, fine aggregate and filler used in the production of asphalt.

G7.A.2 Quality

All rock products, including crusher dust, shall be obtained from sources complying with *Standard Specification G6 Production of Aggregate and Rock Products*.

The quality limits are expressed in terms of either a maximum or minimum value. Except for certain properties of coarse aggregate where compliance is based on the assigned value, the limits apply to the particular lot or consignment under test. Where the test result is outside the specific limit, the particular lot or consignment shall not be used in the production of asphalt.

G7.A.3 Assigned Values

The specified maximum and minimum quality limits apply to the assigned value (*Standard Specification G6 Production of Aggregates and Rock Products*) for:

- wet strength and wet/dry strength variation
- flakiness index
- polished aggregate friction value
- average least dimension

G7.A.4 Nominated Grading and Tolerances

Coarse and fine aggregates shall be supplied to a nominated grading and to the tolerances shown in *Table G7.A.1 – Allowable Tolerances on Nominated Grading*. The frequency of testing shall not be less than specified in *AS2758.5 Appendix A* unless the materials come from a source which maintains statistical control over particle size distribution and tests at a frequency of not less than one (1) test per 500 tonnes of production. In addition the evidence of compliance with these requirements must be available to the Contractor and Superintendent.

Table G7.A.1 – Allowable Tolerances on Nominated Grading

Dimensions of aggregate	Tolerance %
Pass 26.5 mm sieve and larger	±10
Pass 4.75 mm sieve to 19.0 mm sieve inclusive	±8
Pass 1.18 mm sieve to 2.36 mm sieve inclusive	±6
Pass 0.300 mm sieve to 0.600 mm sieve inclusive	±5
Pass 0.150 mm sieve	±3
Pass 0.075 mm sieve	±2

G7.A.5 Coarse Aggregate

Coarse aggregate is comprised of particles that are retained on the 4.75mm sieve. Coarse aggregate shall comply with *Australian Standard AS 2758 Part 5* with the application of those test properties specified in *Table G7.A.2 – Coarse Aggregate Requirements for Hardness and Durability Based on Wet Strength and Wet / Dry Strength Variation* and *Table G7.A.3 – Other Coarse Aggregate Requirements*.

All coarse aggregate shall be sourced from rock with a minimum PAFV 48.

Table G7.A.2 – Coarse Aggregate Requirements for Hardness and Durability Based on Wet Strength and Wet / Dry Strength Variation

Test Property	**Test Value**	
	Heavy / Very Heavy Traffic Mix Types	Other Mix Types
Wet strength (kN minimum)	150	100
Wet / Dry Strength Variation (% maximum)	35	35

Table G7.A.3 – Other Coarse Aggregate Requirements

Test Property	**Test Value**	
	Heavy / Very Heavy Traffic Mix Types	Other Mix Types
Flakiness Index (% maximum)	25	35
Weak Particles (% maximum)	1	1
Water Absorption (% maximum)	2	2.5

Note:
For SMA the test values for Heavy/Very Heavy Traffic Mix Types in Tables G7.A.2 – Coarse Aggregate Requirements for Hardness and Durability Based on Wet Strength and Wet / Dry Strength Variation and *G7.A.3 – Other Coarse Aggregate Requirements above apply.*

G7.A.6 Fine Aggregate

Fine aggregate shall consist of crushed rock particles finer than the 4.75mm sieve and manufactured from a source complying with the requirements of *Standard Specification G6 Production of Aggregate and Rock Products*, clean sand, or both.

The fine aggregate shall be clean, hard, durable and free from lumps of clay and other aggregations of fine materials, organic material and any other deleterious material.

Fine aggregate consisting of crushed rock particles shall have a minimum Degradation Factor, Crusher Fines of 60 when tested in accordance with *AS 1141.25.3*.

If natural sands, intended for use as a fine aggregate, have a sand equivalent (*AS 1289.3.7.1*) of less than 60, the contractor shall provide evidence, in the form of test data, that this particular non-conformance is not detrimental to the performance of the asphalt.

G7.A.7 Mineral Filler

Mineral filler is that portion of mineral matter passing a 75 micron sieve, and includes rock dust derived from coarse and fine aggregates used in the production of asphalt in accordance with this specification, and any other materials added to supplement the quantity and properties of filler in the mix.

The total filler component in the combined job mix for medium, heavy and very heavy traffic mix types shall have a value of dry compacted voids (*AS 1141.17*) not less than 38%.
If this requirement is not satisfied, the Contractor shall provide evidence, in the form of test data, that this particular non-conformance is not detrimental to the performance of the asphalt.

Filler shall be consistent in mineral composition and dry compacted air voids. It shall be dry, and free from lumps, clay, organic matter or other material deleterious to asphalt.

Added filler (material not derived from aggregate components) shall comply with the relevant standards listed in *Table G7.A.4 – Standards for Materials Used as Added Filler*. The Superintendent may approve materials other than those listed provided that the Contractor supplies evidence of the quality and effect of the proposed materials on the properties of the asphalt mix. Rock dust that is not derived from the aggregate components may also be used as added filler provided that it is derived from a material that meets the requirements of this specification.

Table G7.A.4– Standards for Materials Used as Added Filler

Material	Standard – ref note 1
Hydrated Lime	*AS 1672.1 Limes and Limestone – Lime for Building*
Fly Ash	*AS 3582.1 Fly Ash Table 1, Fine Grade*
Cement Kiln Dust	See note 2
Slag	*AS 3582.2 Slag – Ground Granular*
Ground Limestone	See note 3
Cement	*AS 3972 Portland and Blended Cements*

Notes:
1. Provision of test certificates for compliance with the relevant Australian Standard and this specification shall be limited to those tests listed in Table G7.A.6 – Test Requirements for Materials for Use as Added Filler.

2. Cement kiln dust shall be solid material extracted from the flue gases in the manufacture of Portland cement, having a maximum water soluble fraction complying with Table R55.B.7.3 and with the grading limits specified in Table G7.A.6 – Grading Limits for Ground Limestone & Cement Kiln Dust Materials.

3. Ground limestone shall consist of rock dust derived from the grinding of sound limestone and complying with the grading limits specified in Table G7.A.5 – Grading Limits for Ground Limestone & Cement Kiln Dust Materials.

Table G7.A.5 – Grading Limits for Ground Limestone & Cement Kiln Dust Materials

Sieve Size AS (mm)	Percentage passing sieve size (by mass)
0.600	100
0.300	95-100
0.075	75-100

Materials for use as added filler shall meet the test requirements specified in Table G7.A.6.

Table G7.A.6 – Test Requirements for Materials for Use as Added Filler

Filler type	Test type	Test Requirements
All	Grading (AS 0.600mm, 0.300mm and 0.075mm sieves)	Report
All	Voids dry compacted filler	Report
All	Moisture content	3% max.
Fly ash	Loss on ignition	4% max.
Cement kiln dust	Water soluble fraction	20% max.

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