

AS 2150:2020



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Asphalt — A guide to good practice



AS 2150:2020

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- Australian Asphalt Pavement Association
- Australian Chamber of Commerce and Industry
- Austroads
- National Association of Testing Authorities Australia

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Asphalt — A guide to good practice

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Preface

This Standard was prepared by the Australian members of the Joint Standards Australia/Standards New Zealand Committee CE-006, Asphalt and Sprayed Surfacing, to supersede AS 2150—2005, *Hot mix asphalt—A guide to good practice*.

After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this document as an Australian Standard rather than an Australian/New Zealand Standard.

The objective of this Standard is to provide manufacturers, specifiers and designers of asphalt mixes with recommendations for the manufacture and placing of asphalt for use in pavements.

This Standard is not intended for use as a project specification. Project specifications for most road pavement applications include standard specification documents issued by state road authorities, local government, the Australian Asphalt Pavement Association and AUS-SPEC (NatSpec).

Reference to this Standard may be made in specifications for minor works, in which case the Standard may be used to determine appropriate selection of materials, asphalt manufacture and standards of workmanship.

The objective of this revision is to incorporate improvements based on user experience and reflect technical developments taking place in the industry.

The major changes in this edition are as follows:

- (a) Amendment of the title.
- (b) Addition of a definition and description for warm mix asphalt.
- (c) Revision of [Appendix A](#) to remove some details relating to safe working practices that are defined elsewhere in relevant legislation and supplier responsibilities.
- (d) Deletion of [Appendix C](#) referring to basis of payment for asphalt work.

The terms “normative” and “informative” are used in Standards to define the application of the appendices to which they apply. A “normative” appendix is an integral part of a Standard, whereas an “informative” appendix is only for information and guidance.

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NOTES

Australian Standard®

Asphalt — A guide to good practice

1 Scope

This Standard sets out recommendations for the manufacture, supply and placing of asphalt, both hot mix and warm mix, for use in pavements, including the following:

- (a) Materials in the asphalt.
- (b) Asphalt properties.
- (c) Asphalt mix design.
- (d) Manufacturing, storage and delivery.
- (e) Sampling and testing.
- (f) Preparation of surfaces.
- (g) Spreading.
- (h) Compaction.
- (i) Finished surface properties.
- (j) Selection of type of asphalt.

This Standard includes typical composition and test properties for most common uses; however, this does not preclude the use of alternative components or mix properties to meet specific performance requirements.

This Standard does not include recommendations for cold mix asphalt prepared without heating or designed to be placed cold as maintenance patching material.

NOTE 1 Guidance on asphalt planning is given in [Appendix A](#).

NOTE 2 Guidance on selection of types of asphalt is given in [Appendix B](#).

NOTE 3 Guidance on principles of asphalt mix design is given in [Appendix C](#).

2 Normative references

There are no normative references in this document.

NOTE Documents referenced for informative purposes are listed in the Bibliography.

3 Terms and definitions

For the purpose of this Standard, the following terms and definitions apply.

3.1

added filler

mineral matter, suitable for use in asphalt that is added to the combined aggregate of an asphalt mix

Note 1 to entry: At least 75% of the filler should be finer than 0.075 mm. The entire filler should be finer than 0.600 mm.

3.2

adhesion agent

substance used for the purpose of improving the adhesion between a bituminous binder and aggregate

Note 1 to entry: This term usually refers to adhesion in the presence of water.

3.3

aggregate

material composed of discrete mineral particles of specified size or size distribution, produced from gravel, rock or metallurgical slag, using selective extraction, blasting, crushing and screening

3.3.1

coarse aggregate

aggregate having a nominal size not less than 5 mm

3.3.2

fine aggregate

aggregate that substantially passes a 4.75 mm sieve

3.3.3

gap-graded aggregate

graded aggregate in which one or more of the intermediate sizes are absent or present in small proportions

3.4

asphalt

mixture of bituminous binder and aggregate, with or without mineral filler, produced hot or warm in a mixing plant that is delivered, spread and compacted while hot or warm

3.5

binder

bituminous material used for the purpose of holding solid particles together as a coherent mass

3.6

bitumen

bituminous materials obtained by processing the material obtained from the refining of naturally occurring crude petroleum

3.7

bituminous

material that resembles or contains bitumen

3.8

bulk density

mass per unit volume including voids in a material

3.9

crumb rubber

rubber particles manufactured from waste or reclaimed rubber products such as vehicle tyres and graded to conform to a specified size range

Note 1 to entry: Crumb rubber is used in bitumen to improve binder properties.

3.10

crushed recycled glass

granular material having a maximum nominal size of 5 mm and is primarily manufactured by crushing container glass

Note 1 to entry: Washing of crushed glass assists in the removal of contaminants and organic odour.

3.11
dense-graded asphalt
DGA

mixture of coarse aggregate, fine aggregate, filler and bitumen placed hot or warm and compacted to a dense state as a pavement layer or resurfacing

Note 1 to entry: This includes the use of modified binders and the addition of various additives to enhance the performance of asphalt.

3.12
fibre

additive for reducing binder drain-off in stone mastic asphalt and open-graded asphalt mixes

3.13
filler

material derived from aggregate or other granular material passing a 0.075 mm sieve

3.14
fine gap-graded asphalt
FGGA

dense mix with intermediate sized fractions replaced by finer fractions

Note 1 to entry: This asphalt may also contain more filler and bitumen.

3.15
gap-graded asphalt
GGA

asphalt mix in which gap-graded aggregate is used

Note 1 to entry: For example, fine gap-graded asphalt or stone mastic asphalt.

3.16
maximum density
MD

density that could be achieved in a sample of asphalt if it were possible to compact it so as to exclude all air voids between coated aggregate particles

Note 1 to entry: Maximum density is also known as void-free density.

3.17
maximum theoretical density
MTD

theoretical determination of maximum density based on the density of the materials used in the asphalt

3.18
maximum size

sieve size one size above that of the nominal size

3.19
modified binder

binder with enhanced performance achieved by the incorporation of additives or special processing to achieve specific physical properties

Note 1 to entry: Additives may be polymers, resins, rubber or other material.

3.20
nominal size

size designation of an aggregate or asphalt mixture, which gives an indication of the largest particle size present

3.21 **open-graded asphalt** **OGA**

bituminous mix using aggregate containing only small amounts of fine material and providing a high percentage of air voids

3.22 **quality system**

organizational structure, responsibilities, procedures, activities, capabilities and resources that together aim to ensure that products, processes or services will satisfy stated or implied needs

3.23 **reclaimed asphalt pavement** **RAP**

material reclaimed from an asphalt pavement by various means, including cold-milling, grader, backhoe, jack-pick or other methods may be used for this purpose

Note 1 to entry: For the purpose of this document RAP also includes plant waste and site returns.

3.24 **rejuvenating (recycling) agent (asphalt)**

typically a light petroleum product added to reclaimed asphalt pavement material to restore proper viscosity and plasticity to the bitumen

Note 1 to entry: This product usually contains maltenes.

3.25 **should**

indicates a recommendation

3.26 **stone mastic asphalt** **SMA**

gap-graded wearing course mix with a high proportion of coarse aggregate, which interlocks to form a skeletal structure to resist permanent deformation

Note 1 to entry: This asphalt has a high filler and binder content.

3.27 **voids filled with binder** **VFB**

difference between the voids in mineral aggregate and the air voids content of the compacted asphalt as a proportion of the voids in mineral aggregate in percentage

3.28 **voids in the mineral aggregate** **VMA**

intergranular void space in a compacted specimen when the volume of the aggregate is calculated from the bulk density of the aggregate

Note 1 to entry: The analysis of the composition of a compacted bituminous mix is carried out on a volumetric basis. However, as the direct measurement of volume is not possible, recourse is made to the relationship between mass and volume (density) in order to derive the required voids relationships. These voids relationships are illustrated in [Figure 1](#).

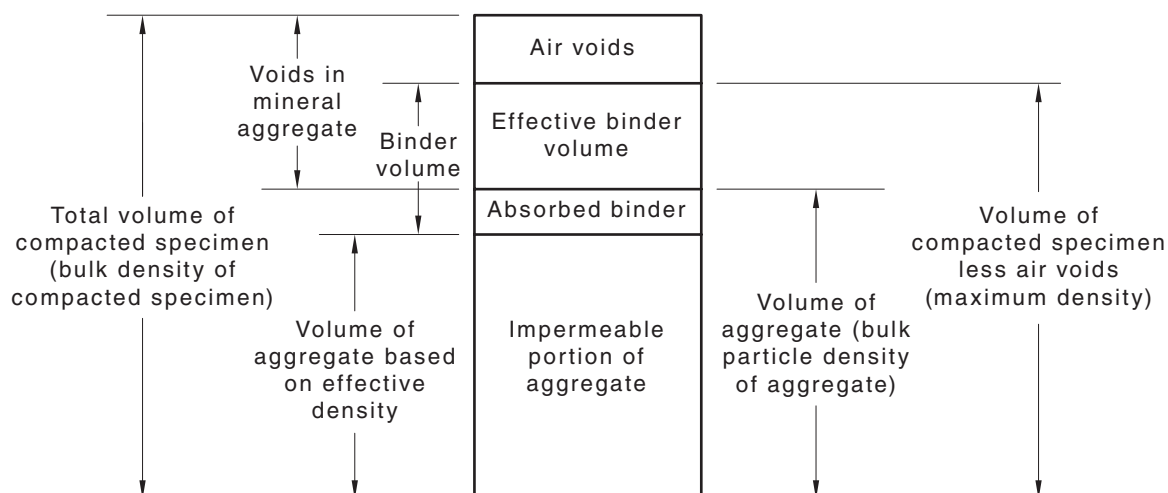


Figure 1 — Voids relationships

3.29

warm mix asphalt

WMA

asphalt that is produced and placed at a lower temperature than hot mix asphalt by the use of additives and/or production processes that allow the temperature of the asphalt to be reduced

Note 1 to entry: The temperature would be reduced typically by 20 °C to 30 °C below that of hot mix asphalt.

Note 2 to entry: The reduction in energy associated with asphalt production at a lower temperature results in a reduction in greenhouse gas emissions.

4 Materials

4.1 Aggregates

4.1.1 Coarse aggregate

Coarse aggregate should conform to AS 2758.5 and the job specification.

4.1.2 Fine aggregate

Fine aggregate should consist of crushed rock particles from a source with coarse aggregate conforming to AS 2758.5, clean sand, or crushed glass particles. The fine aggregate should be clean, hard, durable and free from lumps of clay and other aggregations of fine materials, organic material and other deleterious material.

4.1.3 Crushed recycled glass

The supply of crushed recycled glass as a fine aggregate should comply with relevant legislative requirements for the use of waste materials.

Crushed recycled glass aggregate shall —

- (a) be of nominal size of 5 mm or less;
- (b) not be produced from any materials sources such as ceramics, cathode ray tubes, fluorescent light fittings and laboratory glassware;
- (c) be granular, free flowing and consistent in gradation;

- (d) be essentially free of any other contaminants (i.e. paper, plastic, metals or other deleterious materials); and
- (e) be free from any putrid odour.

Crushed recycled glass aggregate should meet the property requirements in [Table 1](#).

Table 1 — Test requirements for materials for use as crushed recycled glass

Property	Test method	Acceptance criteria
Particle size distribution	AS 1141.11.1	Within nominated particles size distribution envelopes
Material finer than 75 um	AS 1141.12	Report
Particle dry density	AS 1141.5	Report
Water absorption	AS 1141.5	≤ 1.0%

4.2 Filler

Filler is that portion of mineral matter passing a 0.075 mm sieve. It includes rock dust derived from coarse and fine aggregates used in the production of asphalt and any other materials added to supplement the quantity and properties of filler in the mix.

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

The combined filler should be as follows:

- (a) The combined filler for medium, heavy and very heavy mix types should have a mean value of dry compacted voids (refer to AS/NZS 1141.17) of not less than 38%, determined from the measured value of dry compacted voids of each individual filler component and the proportion by mass in that fraction of the job mix finer than the 0.075 mm sieve.
- (b) Where reactive clay may be in the mineral filler the combined filler (excluding hydrated lime) should have a methylene blue value of ≤ 10 mg/g when determined in accordance with AS 1141.66. Where the methylene blue value exceeds 10 mg/g and hydrated lime is used as a filler the combined filler (including hydrated lime) should have a methylene blue value of ≤ 18 mg/g. The proportion of hydrated lime and other filler(s) in the test has to be the same that will be used during manufacture of the asphalt including hydrated lime.

Added filler (material not derived from the aggregate components) should conform to the relevant Standards listed in [Table 2](#). Materials other than those listed may be used where evidence is provided 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 it is derived from materials described in [Clause 4.1.2](#)

Materials for use as added filler should meet the test requirements specified in [Table 4](#).

Table 2 — Standards for materials used as added filler

Material	Standard ^a
Hydrated lime	AS 1672.1
Fly ash	AS/NZS 3582.1
Cement kiln dust ^b	—
Slag	AS 3582.2
Ground limestone ^c	—
Cement	AS 3972

Table 2 (continued)

Material	Standard ^a
^a Recommended test methods are set out in Table 4 . ^b Cement kiln dust should be solid material extracted from the flue gases in the manufacture of Portland cement, having a maximum water-soluble fraction of 20% by mass, and be within the grading limits specified in Table 3 . ^c Ground limestone should consist of rock dust derived from the grinding of limestone and be within the grading limits specified in Table 3 .	

Table 3 — Grading limits for ground limestone and cement kiln dust materials for use as added filler

Sieve size mm	Percentage passing sieve size by mass
0.600	100
0.300	95–100
0.075	75–100

Table 4 — Test requirements for materials for use as added filler

Filler type	Test type	Test method	Test requirements
All	Grading (0.600 mm, 0.300 mm and 0.075 mm sieves)	AS 1141.11.1	Report
All	Voids dry compacted filler	AS/NZS 1141.17	Report
All	Moisture content	AS 4489.2.1	3% max.
Cement kiln dust	Water soluble fraction	AS/NZS 1141.8	20 max.

4.3 Binder

4.3.1 Bitumen binder

Bitumen binder, including multigrade binder, should be in accordance with AS 2008 and the job specification.

4.3.2 Polymer-modified binder

Polymer-modified binder should conform to the Austroads ATS-3110, *Supply of Polymer Modified Binders*.

4.4 Fibre

The type and proportion of fibre to be used should be in accordance with an approved specification.

NOTE An approved specification may be a manufacturer's recommendation, purchaser's specification or as agreed between the relevant parties.

4.5 Adhesion agent

The type and proportion of adhesion agent to be used should be in accordance with an approved specification.

NOTE An approved specification may be a manufacturer's recommendation, purchaser's specification or as agreed between the relevant parties.

4.6 Reclaimed asphalt pavement (RAP)

Reclaimed asphalt pavement (RAP) should be free of foreign material such as unbound granular base, broken concrete, raised pavement markers or other contaminants. RAP containing tar should not be used.

RAP should be crushed and screened as necessary to ensure a maximum size no greater than the maximum size of asphalt being produced or 20 mm, whichever is less, and to achieve a reasonably well-graded, free-flowing and consistent product.

Before use, processed RAP should be placed in separate stockpiles, kept dry, and stored under cover protected from rainfall and surface water on a sloping pad for drainage. It should not be driven on during the stockpiling process.

NOTE Driving will result in compaction of the RAP making it difficult to retrieve in a free-flowing state.

4.7 Rejuvenating agents

The type and proportion of rejuvenating agents to be used should be in accordance with an approved specification.

NOTE An approved specification may be a manufacturer's recommendation, purchaser's specification or as agreed between the relevant parties.

4.8 Warm mix additives

Warm mix additives are added to the bituminous binder or during the manufacturing process to improve the workability of asphalt at temperatures lower than hot mix asphalt. Typical materials used in Australia include wax-based additives that modify the viscosity/temperature relationship of the binder or chemical additives that impact on the chemistry of the binder at the interface with aggregates. Another warm mix technology is the addition of water to create bitumen foaming during the manufacture of asphalt.

5 Properties of asphalt mixes and their evaluation

5.1 General

Typical properties and limits for the usual types of asphalt used in Australia are given in [Tables 5 to 9](#), and [Clauses 5.2 to 5.4](#). These limits have been derived from a history of hot mixed asphalts and may need to be varied depending on the purpose for which the asphalt is to be used or the job-specific requirements.

This Standard refers to the following two methods of laboratory compaction of test specimens for the determination of the mechanical properties of asphalt:

- (a) *The Marshall method* — The Marshall method (refer to AS/NZS 2891.5) has traditionally been the most commonly used procedure in Australia for the compaction, mechanical testing and design of asphalt mixes. [Table 11](#) shows typical levels of Marshall compaction applied to various dense-graded, open-graded, stone mastic and fine gap-graded asphalts.

- (b) *Gyratory compaction* — Gyratory compaction (refer to AS/NZS 2891.2.2) for laboratory determination of the volumetric properties is in use in Australia in association with a range of new mechanical tests for performance characterization of asphalt. [Table 12](#) shows typical levels of gyratory cycles applied to the compaction of laboratory specimens for various dense-graded, open-graded, stone mastic and fine gap-graded asphalts.

Design criteria should apply to only one method of laboratory compaction as nominated at the point of supply, unless otherwise specified.

5.2 Composition and volumetric properties

5.2.1 General

[Tables 5](#) to [9](#) give typical limits for particle size distribution (grading), binder content and volumetric properties.

The aggregate grading and binder content ranges provided in [Tables 5](#) to [9](#) are limits within which a job mix target grading and binder content should be determined. When production tolerances are applied to the target grading (job mix), actual test results may lie outside the limits of the Tables.

5.2.2 Particle size distribution (aggregate grading)

The grading of the combined aggregate should be determined in accordance with AS 1141.11.1. Grading of aggregate in an asphalt mix should be determined in accordance with AGPT-T234 (ignition oven method), or AS/NZS 2891.3.1, AS/NZS 2891.3.2 or AS/NZS 2891.3.3.

5.2.3 Binder content

The binder content should be determined in accordance with AGPT-T234 (ignition oven method), or AS/NZS 2891.3.1, AS/NZS 2891.3.2, or AS/NZS 2891.3.3.

5.2.4 Air voids

The air voids content should be determined in accordance with AS/NZS 2891.8.

5.2.5 Maximum density (MD) and maximum theoretical density (MTD)

The maximum density and the maximum theoretical density should be determined in accordance with AS/NZS 2891.7.1 or AS 2891.7.3 and AS/NZS 2891.8, as appropriate.

NOTE Industry practice has adopted AS/NZS 2891.7.1 as the preferred method for determination of maximum density.

5.2.6 Bulk density

The bulk density of a compacted asphalt mix prepared in accordance with AS/NZS 2891.5 or AS/NZS 2891.2.2 should be determined in accordance with AS/NZS 2891.9.1, AS/NZS 2891.9.2 or AS/NZS 2891.9.3, as appropriate.

NOTE Industry practice has adopted AS/NZS 2891.9.2 as the preferred method for determination of bulk density of dense asphalt mixes (dense-graded, stone mastic and fine gap-graded) and AS/NZS 2891.9.3 for bulk density of open-graded asphalt.

5.2.7 Voids in mineral aggregate

The voids in mineral aggregate of compacted mix should be determined in accordance with AS/NZS 2891.8.