

# **NZTA M01-A: 2022**

## **SPECIFICATION FOR PERFORMANCE- GRADED ASPHALT BINDER**

# 1 SCOPE

This document has been prepared as a Supplement to AASHTO M 332 *Standard Specification for Performance-Graded Asphalt Binders Using Multiple Stress Creep Recovery (MSCR) Test* in order that the criteria of Table 1 of M 332 can be used to specify binders for asphalt paving materials in New Zealand.

AASHTO M 332 Table 1 sets out the performance characteristics to be met by the binders used in New Zealand for asphalt manufacture. This specification is blind to the binder composition.

Binders are described in relation to the site climate conditions (Table 1) and traffic loading (Table 2). “S”, “H”, “V” and “E” grades are specified for Standard, Heavy, Very Heavy and Extreme traffic loading respectively.

The binder grades in this specification are applicable to all dense graded asphalt mixes.

## 2 RELATED DOCUMENTS

### 2.1 Waka Kotahi Documents:

- (a) NZTA M10, Specification for Dense Graded Asphaltic Concrete
- (b) NZTA M27, Specification for Stone Mastic Asphalt
- (c) NZTA P11, Specification for Open Graded Porous Asphalt
- (d) NZTA Q05, Specification for the Minimum Standard for Bitumen Quality

### 2.2 AASHTO Standards:

- (a) M 332, Performance-Graded Asphalt Binder Using Multiple Stress Creep Recovery (MSCR) Test
- (b) R 28, Accelerated Aging of Asphalt Binder Using a Pressurized Aging Vessel (PAV)
- (c) T 40, Sampling Bituminous Materials
- (d) T 48, Flash and Fire Points by Cleveland Open Cup
- (e) T 240, Effect of Heat and Air on a Moving Film of Asphalt Binder (Rolling Thin-Film Oven Test)
- (f) T 313, Determining the Flexural Creep Stiffness of Asphalt Binder Using the Bending Beam Rheometer (BBR)
- (g) T 314, Determining the Fracture Properties of Asphalt Binder in Direct Tension (DT)
- (h) T 315, Determining the Rheological Properties of Asphalt Binder Using a Dynamic Shear Rheometer (DSR)
- (i) T 316, Viscosity Determination of Asphalt Binder Using Rotational Viscometer
- (j) T 350, Multiple Stress Creep Recovery (MSCR) Test of Asphalt Binder Using a Dynamic Shear Rheometer (DSR).

### 2.3 ASTM Standards:

- (a) D92, Flash and Fire Points by Cleveland Open Cup Tester
- (b) D140, Standard Practice for Sampling Bituminous Materials
- (c) D2042, Standard Test Method for Solubility of Asphalt Materials in Trichloroethylene
- (d) D2872, Effect of Heat and Air on a Moving Film of Asphalt (Rolling Thin-Film Oven Test)
- (e) D4311, Standard Practice for Determining Asphalt Volume Correction to a Base Temperature
- (f) D4402, Viscosity Determination of Asphalt at Elevated Temperatures Using a Rotational Viscometer
- (g) D6521, Standard Practice for Accelerated Ageing of Asphalt Binder using a Pressurized Ageing Vessel (PAV)

- (h) D6648, Determining the Flexural Creep Stiffness of Asphalt Binder Using the Bending Beam Rheometer (BBR)
- (i) D6723, Determining the Fracture Properties of Asphalt Binder in Direct Tension (DT)
- (j) D7175, Determining the Rheological Properties of Asphalt Binder Using a Dynamic Shear Rheometer.
- (k) ASTM D7405, Standard Test Method for Multiple Stress Creep Recovery (MSCR) of Asphalt Binder Using a Dynamic Shear Rheometer

## 2.4 Standards New Zealand

- (a) AS/NZS 2341.8, Determination of Matter Insoluble in Toluene

## 3 QUALITY SYSTEM

The bitumen supplier shall establish, implement and maintain a quality system in accordance with the requirements of AS/NZS ISO 9001. The quality system shall be certified and regularly audited by a JAS-ANZ registered agency.

The bitumen supplier shall develop and maintain a quality plan that describes the specific processes for inspection and testing, acceptance/rejection criteria, details of proposed methods and other quality-related issues. It shall describe how the requirements of this specification will be met at all times and how evidence demonstrating this compliance is provided and maintained. As a minimum standard the requirements of NZTA Q05 shall form the basis of the systems and procedures used to provide assurance that bitumen complying with this specification is supplied.

All sampling and testing to demonstrate compliance with this specification shall be carried out by a laboratory accredited to NZS ISO/IEC 17025.

## 4 MATERIALS AND MANUFACTURE

The binder must be derived from crude petroleum oil. Binders may include rheology modifiers (such as polymers) to improve their performance grade.

The bitumen supplied or bitumen feedstock used to prepare grades compliant with this specification shall comply with the approval requirements of clauses 4 and 5 of NZTA Q05 specification.

The binder must be homogenous, storage stable and free of water and deleterious materials. It shall not foam when heated to 175°C. The formation of a thin layer of bubbles is not considered to be foaming.

The binder shall be at least 99.5% soluble in trichloroethylene (ASTM D2042), or 99.0% in toluene (AS/NZS 2341.8).

This specification is only applicable for binders in which fibres or other particles are less than 250 microns in size.

## 5 BINDER GRADE SELECTION

### 5.1 Climate Zone

Identify the climate zone appropriate for the site location from the NZ Climate Zone Map for asphalt pavements in Section 9 of this document. Select the binder performance grade appropriate for the site from Table 1 below.

The climate zone map provides general guidance for selecting the correct binder performance grade. Engineering judgement shall be used when interpreting the map and selecting the binder performance grade. If advice or further guidance is needed contact:

- (a) Waka Kotahi Lead Advisor, Pavements, or

(b) Waka Kotahi Principal Surfacing Engineer at [pavements@nzta.govt.nz](mailto:pavements@nzta.govt.nz).

**Table 1: Binder Performance Grade**

Climate Zone	AASHTO M 332 Binder Performance Grade
Cool	PG 52 -16
Moderate	PG 58 -16
Warm	PG 64 -16

**Note:**

If doubt exists in respect of the correct climate zone for a specific location, select the binder performance grade for the next warmer zone.

## 5.2 Traffic Category

Determine the expected traffic level for the asphalt pavement over its service life and select the appropriate binder grade category from Table 2 below. Refer to the flow chart in Section 10 as an interpretation aid to Table 2.

**Table 2: Guide to Traffic Category**

AUSTROADS				AASHTO M 332 Binder Grade Category	
Traffic Category	Traffic Volume (ESA)	Traffic Speed (km/hr)	Typical Examples	Surface Mixes	Sub-Surface Mixes
Light	< 0.5 x 10 <sup>6</sup>	> 25	Suburban roads	Standard "S"	Standard "S"
Medium	< 0.5 x 10 <sup>6</sup>	< 25	Suburban intersections		
	< 5 x 10 <sup>6</sup>	> 25	Collector roads	Heavy "H"	Standard "S"
Heavy	< 5 x 10 <sup>6</sup>	< 25	Urban Intersections, climbing lanes		
	< 20 x 10 <sup>6</sup>	> 25	Free flowing urban arterial routes	Very Heavy "V"	Heavy "H"
Very Heavy	> 5 x 10 <sup>6</sup>	< 25	Congested urban routes and intersections		
	> 20 x 10 <sup>6</sup>	> 25	Motorways	Extreme "E"	Very Heavy "V"
	> 20 x 10 <sup>6</sup>	< 25	Toll plazas and heavy industrial sites such as ports, log yards and some transport yards		

**Notes:**

- Traffic Levels in ESAs are based on Austroads structural design levels.
- Grades S, H, V, E applicable to dense-graded asphalts (AC and DG grades in M10).
- Grades V and E are generally applicable to Stone Mastic Asphalt surfacing materials. Refer to NZTA M27 specification.
- Sub-surface asphalt courses are layers deeper than 80mm.
- Refer to M01-A Notes for guidance in selecting binders for open-graded porous asphalt.

The binder shall conform to the properties specified in AASHTO M 332 Table 1 excepting Note *b*.

## 6 ORDERING THE BINDER

When specifying, ordering or supplying binder under this specification, clearly identify in the documentation the grade based on site temperature zone (cool, moderate or warm) and traffic load (i.e. S, H, V or E).

Specify the bitumen using the following format: PG [Climate Zone Temperature] [Binder Grade Category], for example:

- (a) For a binder required in a Moderate climate zone, with a Very Heavy grade category, order PG 58V.
- (b) For a binder required in a Warm climate zone, with a Heavy grade category, order PG 64H

## 7 SAMPLING AND TESTING

Sampling shall be carried out in accordance with AASHTO T 40, ASTM D140, or equivalent.

Binders manufactured in, or imported into New Zealand or blended to meet the specified grades in M 332 shall have the following tests specified in M 332 Table 1 carried out at source or upon import:

- (a) ASTM D92 or AASHTO T 48: Flash Point
- (b) ASTM D4402 or AASHTO T 316: Viscosity
- (c) ASTM D7175 or AASHTO T 315: Dynamic Shear
- (d) ASTM D2872 or AASHTO T 240: Accelerated aging in the Rolling Thin-Film Oven (RTFO)
- (e) Mass change post-RTFO
- (f) ASTM D7405 or AASHTO T 350: post-RTFO Multiple Stress Creep Recovery (MSCR)

Testing frequency shall be:

- (g) For imported bitumens: one full test per shipment for each PG grade imported or blended from imported bitumen
- (h) For binders blended to grade at bulk terminals, one full test for each PG grade supplied blended from samples drawn from each bulk delivery into the terminal.

AASHTO M 332 Table 1 specifies additional criteria for binders subjected to accelerated aging in the Pressure Aging Vessel (PAV, AASHTO R 28). The low temperature testing, Creep Stiffness and Direct Tension are not readily available in New Zealand laboratories hence less frequent testing is required. Low temperature testing to AASHTO T 313 and AASHTO T 314 shall be carried out on the highest performance grade (i.e. lowest  $J_{nr}$ ) binder derived from a specifically approved source as follows:

- (a) Once per annum for bitumen binders manufactured and blended in New Zealand
- (b) For imported binders, once per shipment for one PG grade imported, or blended from imported bitumen.

The low temperature results shall be reported to the Waka Kotahi Principal Surfacing Engineer for the purposes of data gathering and review of the applicability of the low temperature testing for New Zealand conditions.

## 8 TEST METHOD EQUIVALENCY

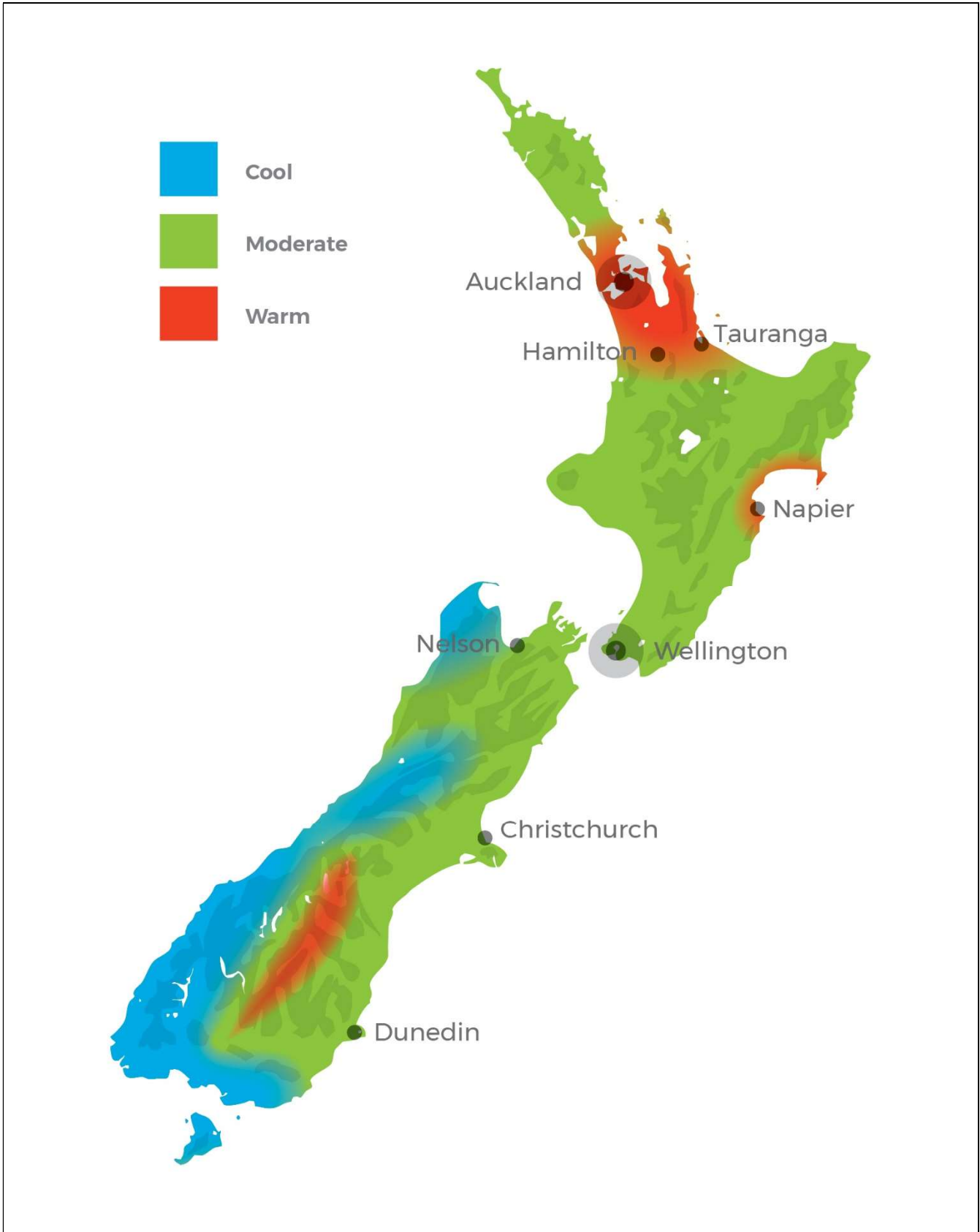
AASHTO M 332 specification uses AASHTO methods for testing the bitumen which may not be offered by New Zealand laboratories. ASTM equivalent test methods are acceptable for use as in Table 3 below.

**Table 3: ASTM equivalent test methods**

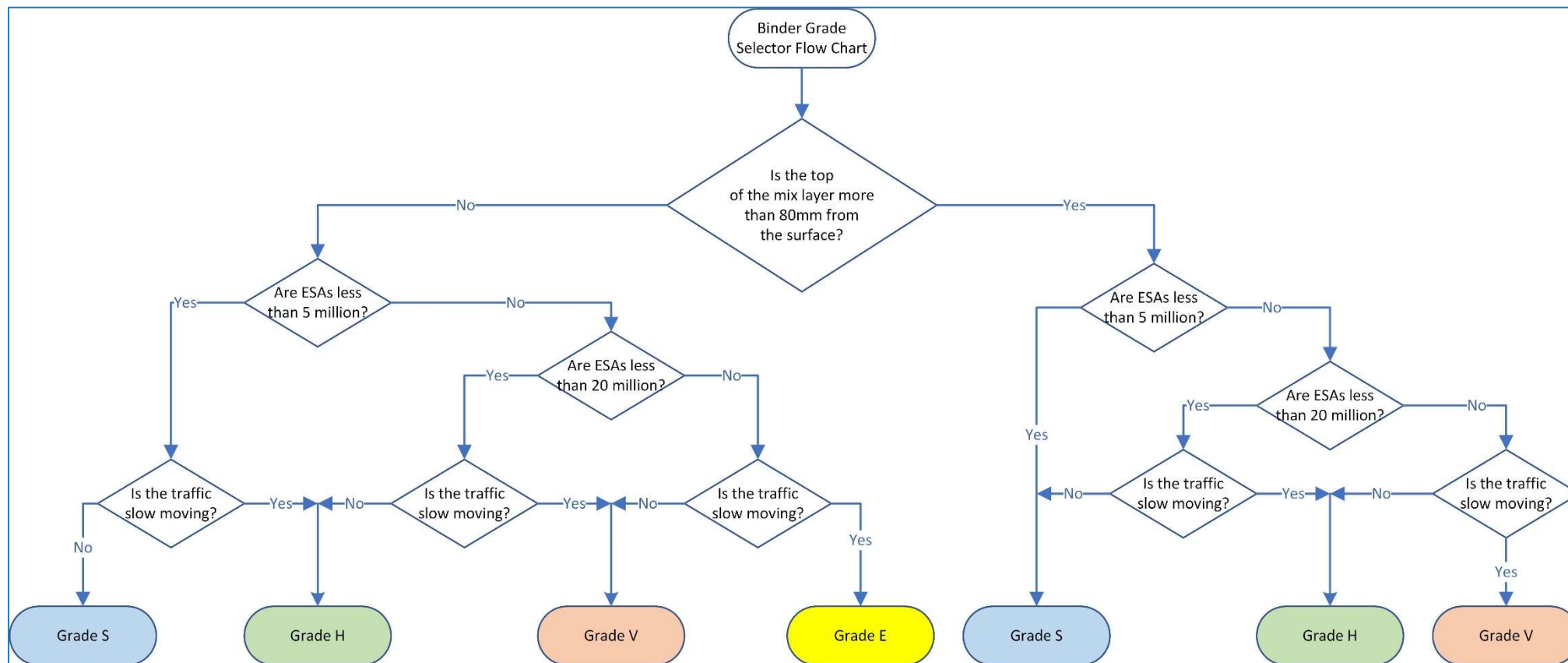
Test	Default method	Equivalent Method
Accelerated aging of asphalt binder using PAV	AASHTO R 28	ASTM D6521
Sampling asphalt materials	AASHTO R 66	ASTM D140
Solubility of bituminous materials	AASHTO T 44	ASTM D2042
Flash and fire points by Cleveland open cup	AASHTO T 48	ASTM D92
Effect of heat and air (RTFOT)	AASHTO T 240	ASTM D2872
Flexural creep stiffness using bending beam rheometer	AASHTO T 313	ASTM D6648
Fracture properties of asphalt binder in direct tension	AASHTO T 314	ASTM D6723
Rheological properties using dynamic shear rheometer	AASHTO T 315	ASTM D7175
Viscosity using rotational viscometer	AASHTO T 316	ASTM D4402
MSCR of asphalt binder using dynamic shear rheometer	AASHTO T 350	ASTM D7405

## 9 APPENDIX A: CLIMATE ZONE MAP

Figure 1: New Zealand Climate Zone Map



## 10 APPENDIX B: BINDER GRADE SELECTOR FLOW CHART



**Notes:**

- (a) The flow chart above is based on standard axle loadings. Where axle loadings are extreme, for example in industrial or aviation applications then the heavier duty grades of binder should be considered for use.
- (b) For the selection of Grade E binders for surfacing mixes and Grade V binders for sub-surface mixes, slow traffic should be interpreted as stop-start traffic movements at sites such as intersections, toll plazas, roundabouts or other areas of very high stress and extended loading periods.