

Municipal Infrastructure Technical Specification 04

Flexible Pavements

Edition 1 Revision 1
September 2026

ACT Government

Machinery of Government changes: On 1 July 2025, administrative arrangements were made to establish the City and Environment Directorate (CED). As of the date of publication of this document, the transition from Transport Canberra and City Services (TCCS) to CED, including updates to internal organisational structure, are yet to be finalised. References in this document to the organisation TCCS are to mean CED.

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Revision register

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	All	References to RMS updated to TfNSW		
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	All	General amendments to align with layout and structure of Municipal Infrastructure Technical Specifications documents, that are non-technical in nature		
	1.1.3	Minor update to guidance on proprietary products		
	1.1.1.1	Scope clarified for pavement base, subbase, asphalt and sprayed seal works		
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	1.1.4.2	Pavement definitions and nomenclature updated, including removal of Upper Zone of Formation		
	1.1.5.1	Hold point and Witness point requirements updated for pavement materials and construction. Refer to individual clauses for specific amendments.		
	1.2.2	Design and control requirements updated for modified and bound base and subbase materials		
	1.3.1.4	Recycled material requirements updated for granular base and subbase		
	1.3.1.5	Granular base material properties and testing requirements updated		
	1.3.1.6	Granular subbase material properties updated		
	1.3.2.1	Permitted test methods updated		
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	1.4.3.1	Permitted test methods updated		
	1.4.5.1	Longitudinal joint requirements updated for unbound granular base and subbase. Permitted test methods updated.		
	1.4.5.2	Permitted test methods updated		
	1.4.7.2	Moisture content test methods updated for unbound granular materials		
	1.4.7.3	Density test methods updated for unbound granular materials		
	1.4.9.1	Longitudinal joint requirements updated for removal of rejected pavement courses		

Edition/Revision number	Clause number	Description of revision	Authorised by	Date
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	1.4.10.2	Alternative treatment to primer or primerseal changed from a Witness point to a Hold point		
	1.4.10.5	Witness point removed for vehicle restrictions over unbound granular pavement		
	1.4.11	Reference to TfNSW specifications added for modified base and subbase materials		
	1.4.12	Reference to TfNSW specifications added for bound base and subbase materials		
	1.5.1	Work as Executed requirements added for recycled content in base and subbase materials		
	2.1	TfNSW sprayed seal specification requirements clarified		
	2.1.1	Microsurfacing specification reference updated to *TfNSW ATS-3450*		
	2.2	Requirements added for crumb rubber in sprayed seals		
	2.4.1	Work as Executed requirements added for recycled content in sprayed seals		
	3.1	TfNSW asphalt specification requirements clarified		
	3.1.1	Asphalt specification requirements updated for paths, access tracks and high modulus asphalt		
	3.1.2	Requirements added for recycled materials in asphalt		
	3.1.2.1	Conformity and rectification requirements added for recycled materials in asphalt		
	3.1.3	Requirements added for recycled plastics in asphalt		
	3.2	Asphalt material requirements updated and duplicate requirements removed		
	3.3.1	Work as Executed requirements added for recycled content in asphalt		

Edition/Revision number	Clause number	Description of revision	Authorised by	Date
	4.2	Pay items added for asphalt road humps, road cushions and car park humps		
	Annexure 1	Guidance added for recycled plastics in asphalt		
	Annexure 2	Guidance added for recycled plastics in asphalt on heavily trafficked roads		

Acknowledgement of Country

City and Environment Directorate (CED) acknowledges that Aboriginal people are the Traditional Owners of Australia. We acknowledge and pay respect to the Ngunnawal people as the custodians of the land and waters that we live and thrive on today and recognise any other people or families with connection to the lands of the ACT and region.

CED acknowledges that Canberra's cultural and natural heritage was maintained by the Traditional Custodians for many generations before colonial settlement on Australian soil. Aboriginal people's management of the land preserved the natural balance of local plants and animals. This knowledge of the environment in which we live is critical to the protection and restoration of our land today.

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1 Flexible pavements

1.1 General

1.1.1 Responsibilities

1.1.1.1 General

Requirement: Provide flexible pavement base and subbase, including supply, spreading, compaction and trimming of crushed rock, gravel and suitable soil pavement layers as documented.

Exclusions: This Specification does not include requirements for gravel surfaced pavements and does not include requirements for material layers below the subbase, such as Select Material in the Selected Material Zone or subgrades (refer *MITS 02B Bulk Earthworks*).

1.1.2 Cross references

General: The following documents are related to this Specification. The latest version of the documents is to be adopted.

1.1.2.1 ACT Legislation

Road Transport (General) Act (ACT)
Road Transport (Safety and Traffic Management) Act (ACT)
Road Transport (Safety and Traffic Management) Regulation (ACT)
Territory Plan and related Codes (ACT)
Public Roads Act (ACT)
Waste Management and Resource Recovery Act (ACT)

1.1.2.2 Technical Specifications

Requirement: The following Technical Specifications must be conformed to:

MITS 00 Preliminaries
MITS 01 Traffic Management
MITS 02 Earthworks
MITS 06 Concrete Kerbs, Open Drains and Paving Works

The full list of Technical Specifications can be accessed via the TCCS website.

1.1.2.3 Design Standards

General: The following Design Standards are related to this Specification:

MIS 02 Earthworks and Site Grading
MIS 03 Pavement Design
MIS 04 Subsurface Drainage

The full list of Design Standards can be accessed via the TCCS website.

1.1.2.4 TCCS Reference Documents

General: The following TCCS Reference Documents are related to this Specification:

Reference Document 4	Landscape Management and Protection Plans
Reference Document 6	Requirements for Design Acceptance Submissions
Reference Document 6A	Requirements for Design Acceptance Submissions for Infill Developments
Reference Document 7	Requirements for Operational Acceptance Submission for Hard Public Infrastructure Works
Reference Document 8	Requirements for Works as Executed Records
Reference Document 9	Requirements for Final Acceptance Submission for Hard Landscape Assets and Civil Works
Reference Document 10	Requirements for Soft Landscape Consolidation and Handover
Reference Document 11	Drafting Requirements for Ref 11 Summary Drawings

The full list of TCCS Reference Documents can be accessed via the TCCS website.

1.1.3 Referenced documents[1]

General: The following documents are incorporated into this Specification by reference:

1.1.3.1 Australian Standards

AS 1141	Methods for sampling and testing aggregates (Set)
AS 1141.3.1	Methods for sampling and testing aggregates: Method 3.1: Sampling – Aggregates
AS 1141.5	Methods for sampling and testing aggregates: Method 5: Particle density and water absorption of fine aggregate
AS 1141.6	Methods for sampling and testing aggregates: Particle density and water absorption of coarse aggregate (Set)
AS/NZS 1141.8	Methods for sampling and testing aggregates: Method 8: Water-soluble fraction of filler
AS 1141.11.1	Methods for sampling and testing aggregates: Method 11.1: Particle size distribution – Sieving method
AS 1141.12	Methods for sampling and testing aggregates: Method 12: Materials finer than 75 µm in aggregates (by washing)
AS 1141.14	Methods for sampling and testing aggregates: Method 14: Particle shape, by proportional caliper
AS/NZS 1141.17	Methods for sampling and testing aggregates: Method 17: Voids in dry compacted filler
AS 1141.22	Methods for sampling and testing aggregates: Method 22: Wet/dry strength variation
AS 1141.23	Methods for sampling and testing aggregates: Method 23: Los Angeles value
AS 1141.24	Methods for sampling and testing aggregates: Method 24: Aggregate soundness – Evaluation by exposure to sodium sulphate solution
AS 1141.25.1	Methods for sampling and testing aggregates: Method 25.1: Degradation factor – Source rock
AS 1141.25.3	Methods for sampling and testing aggregates: Method 25.3: Degradation factor – Fine aggregate

[1] Not all the documents are specifically referenced in the body of this Specification. However, they may be relied upon depending on the nature of the Works.

AS 1141.36	Methods for sampling and testing aggregates: Method 36: Sulfur in metallurgical slag, crushed rock and other pavement materials
AS 1141.41	Methods for sampling and testing aggregates: Method 41: Polished aggregate friction value – Horizontal bed machine
AS 1141.42	Methods for sampling and testing aggregates: Method 42: Pendulum friction test
AS 1141.50	Methods for sampling and testing aggregates: Method 50: Resistance to stripping of cover aggregates from binders
AS 1141.52	Methods for sampling and testing aggregates: Method 52: Unconfined cohesion of compacted pavement materials
AS 1160	Bituminous emulsions for construction and maintenance of pavements
AS 1289	Methods of testing soils for engineering purposes (Set)
AS 1289.2.1.1	Methods of testing soils for engineering purposes: Method 2.1.1: Soil moisture content tests – Determination of the moisture content of a soil – Oven drying method (standard method)
AS 1289.3	Methods of testing soils for engineering purposes: Soil classification tests (Set)
AS 1289.3.1.1	Methods of testing soils for engineering purposes: Method 3.1.1: Soil classification tests – Determination of the liquid limit of a soil – Four point Casagrande method
AS 1289.3.3.1	Methods of testing soils for engineering purposes: Method 3.3.1: Soil classification tests – Calculation of the plasticity index of a soil
AS 1289.3.4.1	Methods of testing soils for engineering purposes: Method 3.4.1: Soil classification tests – Determination of the linear shrinkage of a soil – Standard method
AS 1289.3.6.1	Methods of testing soils for engineering purposes: Method 3.6.1: Soil classification tests – Determination of the particle size distribution of a soil – Standard method of analysis by sieving
AS 1289.3.7.1	Methods of testing soils for engineering purposes: 3.7.1: Soil classification tests – Determination of the sand equivalent of a soil using a power-operated shaker
AS 1289.4.2.1	Methods of testing soils for engineering purposes: Method 4.2.1: Soil chemical tests – Determination of the sulfate content of a natural soil and the sulfate content of the groundwater – Normal method
AS 1289.5	Methods of testing soils for engineering purposes: Soil compaction and density tests (Set)
AS 1289.5.1.1	Methods of testing soils for engineering purposes: Method 5.1.1: Soil compaction and density tests – Determination of the dry density/moisture content relation of a soil using standard compactive effort
AS 1289.5.2.1	Methods of testing soils for engineering purposes: Method 5.2.1: Soil compaction and density tests – Determination of the dry density/moisture content relation of a soil using modified compactive effort
AS 1289.5.3.2	Methods of testing soils for engineering purposes: Method 5.3.2: Soil compaction and density tests – Determination of the field density of a soil – Sand replacement method using a sand pouring can, with or without a volume displacer
AS 1289.5.4.1	Methods of testing soils for engineering purposes: Method 5.4.1: Soil compaction and density tests – Compaction control test – Dry density ratio, moisture variation and moisture ratio
AS 1289.5.7.1	Methods of testing soils for engineering purposes: Method 5.7.1: Soil compaction and density tests – Compaction control test – Hilf density ratio and Hilf moisture variation (rapid method)

AS 1289.5.8.1	Methods of testing soils for engineering purposes: Method 5.8.1: Soil compaction and density tests – Determination of field density and field moisture content of a soil using a nuclear surface moisture-Density gauge – Direct transmission mode
AS 1289.6.1.1	Methods of testing soils for engineering purposes: Method 6.1.1: Soil strength and consolidation tests – Determination of the California Bearing Ratio of a soil – Standard laboratory method for a remoulded specimen
AS 2150	Asphalt – A guide to good practice
AS/NZS 2891	Methods of sampling and testing asphalt (Set)
AS/NZS 2891.2.2	Methods of sampling and testing asphalt: Method 2.2: Sample preparation – Compaction of asphalt test specimens using a gyratory compactor
AS/NZS 2891.3.1	Methods of sampling and testing asphalt: Method 3.1: Binder content and aggregate grading – Reflux method
AS/NZS 2891.5	Methods of sampling and testing asphalt: Method 5: Compaction of asphalt by Marshall method and determination of stability and flow – Marshall procedure
AS/NZS 2891.9.2	Methods of sampling and testing asphalt: Method 9.2: Determination of bulk density of compacted asphalt – Presaturation method
AS/NZS 2891.10	Methods of sampling and testing asphalt: Method 10: Moisture content of asphalt
AS/NZS 2891.11	Methods of sampling and testing asphalt: Method 11: Degree of particle coating
AS/NZS 2891.13.1	Methods of sampling and testing asphalt: Method 13.1: Determination of the resilient modulus of asphalt – Indirect tensile method
AS 3550.4	Waters: Part 4: Determination of solids – Gravimetric method[2]
AS 4964	Method for the qualitative identification of asbestos in bulk samples
AS 5101	Methods for preparation and testing of stabilized materials (Set)
AS 5101.4	Methods for preparation and testing of stabilized materials: Method 4: Unconfined compressive strength of compacted materials

1.1.3.2 TfNSW Specifications

TfNSW Specification 3051	Granular Pavement Base and Subbase Materials
TfNSW Specification 3151	Supply of Aggregate for Sprayed Seals
TfNSW Specification 3152	Aggregates for Asphalt
TfNSW Specification 3153	Reclaimed Asphalt Pavement Material
TfNSW Specification 3154	Granulated Glass Aggregate
TfNSW Specification 3211	Cementitious Materials, Binders and Fillers
TfNSW Specification 3252	Polymer Modified Binder for Pavements
TfNSW Specification 3256	Crumb Rubber
TfNSW Specification ATS-3450	Microsurfacing
TfNSW Specification M211	Crack Sealing Bituminous Surfaces
TfNSW Specification R71	Construction of Unbound and Modified Pavement Course
TfNSW Specification R73	Plant Mixed Heavily Bound Pavement Course
TfNSW Specification R75	Insitu Pavement Stabilisation using Slow Setting Binders
TfNSW Specification R76	Insitu Pavement Stabilisation using Foamed Bitumen
TfNSW Specification R106	Sprayed Bituminous Surfacing (with Cutback Bitumen)
TfNSW Specification R107	Sprayed Bituminous Surfacing (with Polymer Modified Binder)

[2] *AS 3550.4* has been withdrawn but is available to access

TfNSW Specification R110	Coloured Surface Coatings for Bus Lanes and Cycleways
TfNSW Specification R111	Sprayed Bituminous Surfacing (with Bitumen Emulsion)
TfNSW Specification R116	Heavy Duty Dense Graded Asphalt
TfNSW Specification R117	Light Duty Dense Graded Asphalt
TfNSW Specification R118	Crumb Rubber Asphalt
TfNSW Specification R119	Open Graded Asphalt
TfNSW Specification R121	Stone Mastic Asphalt
TfNSW Specification R123	Thin Open Graded Asphalt Surfacing
TfNSW Specification R126	High Modulus Asphalt (EME2)
TfNSW Specification Guide NR106	Guide to QA Specification R106 – Sprayed Bituminous Surfacing (with Cutback Bitumen)
TfNSW Specification Guide NR107	Guide to QA Specification R107 – Sprayed Bituminous Surfacing (with Polymer Modified Bitumen)
TfNSW Technical Direction TD 00018:2021	Dense graded asphalt containing high percentages of reclaimed asphalt pavement

1.1.3.3 TfNSW Test Methods

TfNSW T102	Pre-treatment of road construction materials by repeated compaction
TfNSW T109	Plastic limit and plasticity index of road construction materials
TfNSW T111	Dry density/moisture relationship of road construction materials
TfNSW T112	Dry density/moisture relationship of road construction materials (Modified compaction)
TfNSW T116	Unconfined compression strength of remoulded road construction materials
TfNSW T119	Field density of road construction materials (Sand replacement method)
TfNSW T120	Moisture content of road construction materials (Standard method)
TfNSW T121	Moisture content of road construction materials (Sand bath or hot plate method)
TfNSW T130	Dry density/moisture relationship of road construction materials (Blended in the laboratory with cementitious binders)
TfNSW T144	Hydrated lime for road construction materials (Lime demand test)
TfNSW T162	Compaction control test (rapid method)
TfNSW T171	Modified Texas triaxial compression test for pavement materials
TfNSW T173	Field wet density of road construction materials (Nuclear gauge in direct transmission method)
TfNSW T180	Moisture content of road construction materials (microwave oven method)
TfNSW T231	Frictional resistance of road surfaces by pendulum tester
TfNSW T239	Fractured faces of coarse aggregate
TfNSW T276	Foreign materials content of recycled crushed concrete
TfNSW T278	Aggregate shape by the ratio of greatest to least dimension
TfNSW T1004	Quantitative determination of chloride ion in water
TfNSW T1014	Quantitative determination of sulfate ion in water
TfNSW T1015	Microbiology of water used in roadworks (Thermotolerant coliforms)

1.1.3.4 Other publications

Proprietary products: Email CED.RoadStandards@act.gov.au for advice on proprietary products.

National Transport Research Organisation (NTRO) (formerly Australian Road Research Board)

NTRO	Best Practice Guide for Sealed Roads

Austroads

AGPT	Guide to Pavement Technology (Set)
AGPT04A	Guide to Pavement Technology Part 4A: Granular Base and Subbase Materials
AGPT04D	Guide to Pavement Technology Part 4D: Stabilised Materials
AGPT04E	Guide to Pavement Technology Part 4E: Recycled Materials
AGPT04J	Guide to Pavement Technology Part 4J: Aggregate and Source Rock
AGPT04K	Guide to Pavement Technology Part 4K: Selection and Design of Sprayed Seals
AGPT05	Guide to Pavement Technology Part 5: Pavement Evaluation and Treatment Design
AGPT/T232	Stripping Potential of Asphalt – Tensile Strength Ratio
AGPT/T274	Characterisation of Flexural Stiffness and Fatigue Performance of Bituminous Mixes
AGRD03	Guide to Road Design Part 3: Geometric Design
AP-C87	Austroads Glossary of Terms
AP-G96-21	Interim Guidelines for the Use of Recycled Waste Plastic in Local Government Road Surfacing Applications
AP-R669-22	Use of Road-grade Recycled Plastics for Sustainable Asphalt Pavements: Final Performance and Environmental Assessment Part A
AP-T37	Geotextile Reinforced Seals

Other Test Methods

AASHTO T 304 Uncompacted void content of fine aggregate

ISSA Technical Bulletin 145 Test Method for Determination of Methylene Blue Value (MBV) of Mineral Aggregate Fines

1.1.4 Interpretation

1.1.4.1 Abbreviations

General: For the purposes of this Specification, the following abbreviations apply:

ACT	Australian Capital Territory
AS	Australian Standard
ARRB	Australian Road Research Board
BRU	Beneficial Reuse
CBR	California Bearing Ratio
CED	City and Environment Directorate
DTP	Department of Transport and Planning, Victoria
EME2	Enrobés à Module Elevé Class 2 (referred to as high modulus asphalt)
EPA	ACT Environment Protection Authority, ACT Government, and its successors

ESA	Equivalent Standard Axles
MIS	Municipal Infrastructure Standard
MITS	Municipal Infrastructure Technical Specification
MPa	Megapascal
NATA	National Association of Testing Authorities
NSW EPA	NSW Environment Protection Authority, NSW Government, and its successors
NZS	New Zealand Standard
PAP	Principal's Authorised Person
PAFV	Polished Aggregate Friction Value
PI	Plasticity Index
PMB	Polymer Modified Binder
ppm	parts per million
RAP	Reclaimed Asphalt Pavement
RCCB	Recycled Crushed Concrete Base
RCCS	Recycled Crushed Concrete Subbase
SMA	Stone Matic Asphalt
TCCS	Transport Canberra and City Services, ACT Government, and its successors (including City and Environment Directorate)
TfNSW	Transport for NSW (formerly Roads and Maritime Services, RMS)
TOGAS	Thin Open Graded Asphalt Surfacing
TSR	Tensile Strength Ratio
UCS	Unconfined Compressive Strength
VENM	Virgin Excavated Natural Material

1.1.4.2 Definitions

General: For the purposes of this Specification, the definitions of terms used to define the components of the road reserve are in conformance with *AP-C87* and *AGRD03.* The definitions given below also apply:

Authorised Person: The Authorised Person is the person or body responsible for administering the Works Contract and has the same meaning as Contract Administrator, Principal's representative, Principal's Authorised Person (PAP), Superintendent or equivalent. The powers, duties and authorities of the Authorised Person are covered in the Contract.

Base: Layer(s) of material forming the uppermost structural element of a pavement and on which the surfacing may be placed. This may be composed of fine crushed rock, natural gravel, broken stone, stabilised material, asphalt or Portland cement concrete.

Binder: A material used in the mix to improve temperature susceptibility, response to transient loads and cohesive strength.

Bound material: A granular material, earthworks formation material or subgrade material to which a binder has been added to improve structural stiffness.

Collector Roads: Collector Roads comprise Minor Collector Roads, Major Collector Roads and any lesser category road directly connecting two such roads so as to form a continuation of the Minor or Major Collector Roads.

Contract: The agreement between the Principal and the Contractor.

Contractor: The person bound to execute the work under the Contract.

Design subgrade level: The design subgrade level is the underside of the Selected Material Zone and corresponds to the finished surface level of the subgrade materials. Where a pavement design contains no Selected Material Zone, it is the underside of the lowest material layer constructed to this Specification (typically the subbase). Refer to **Figure 4-1** and **Figure 4-2**.

Flexible pavement: A pavement which obtains its load-spreading properties from inter-granular pressure, mechanical interlock and cohesion between the particles of the pavement material.

Modified material: Granular materials to which small amounts of stabilising agent have been added to improve their performance without causing a significant increase in structural stiffness.

Pavement: The portion of a carriageway placed above the Selected Material Zone constructed to this Specification for the support of, and to form a running surface for, vehicular traffic. Where the pavement design consists of no Selected Material Zone, it is the portion of a carriageway placed above the design subgrade level. Refer to **Figure 4-1** and **Figure 4-2**.

Pozzolan: A siliceous or alumino siliceous material, which in itself possesses little or no cementitious value but which in finely divided form may be mixed with lime or Portland cement to form a cementitious material.

Principal: Principal has the same meaning as Owner, Client and Proprietor and is the party to whom the Contractor is legally bound to construct the Works. The primary obligation of the Principal is to make payments to the Contractor.

Select Material: Virgin excavated natural material (VENM) or approved beneficial reuse (BRU) material that conforms to the specified quality requirements of *MITS 02B Bulk Earthworks, Clause 1.4.12* and is placed within the Selected Material Zone, in road projects.

Selected Material Zone: The top part of earthworks formation in which material of a specified higher quality is required to be placed in accordance with the requirements of *MITS 02B Bulk Earthworks, Clause 1.4.11* and *Clause 1.4.12*. Refer to **Figure 4-1** and **Figure 4-2**.

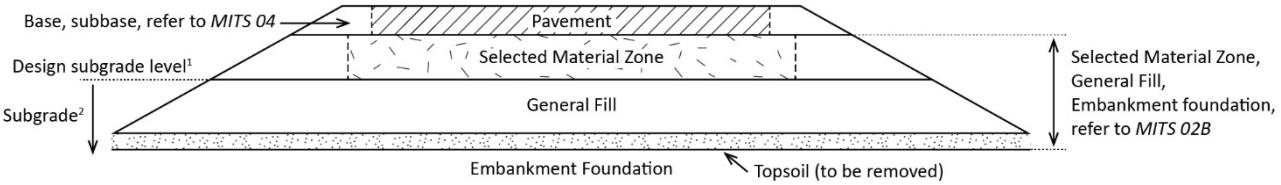
Subbase: The material laid above the Selected Material Zone but below the base either for the purpose of making up additional pavement thickness required over the Selected Material Zone, or to prevent intrusion of the earthworks formation material into the base, or to provide a working platform. This material is constructed to this Specification. Refer to **Figure 4-1** and **Figure 4-2**.

Subgrade: The material directly below the underside of the Selected Material Zone or the design subgrade level. For embankments, this is considered to be the General Fill material and embankment foundation, up to a depth of 1 m below the design subgrade level. For cuttings, this is considered to be the natural in situ material up to a depth of 1 m below the design subgrade level / floor of cutting. Refer to **Figure 4-1** and **Figure 4-2**.

Unbound material: A granular material with no significant capacity to resist tensile stresses.

Underlying layer: The pavement layer directly below the layer in question, refer to **Figure 4-1** and **Figure 4-2**.

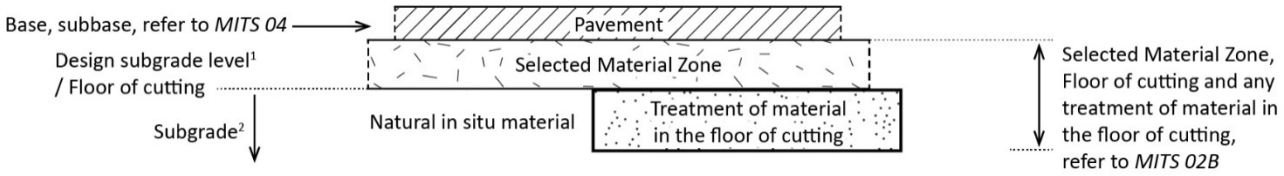
Works: The scope of works to be executed by the Contractor in accordance with the Contract.



[1] The design subgrade level is the underside of the Selected Material Zone. Where a pavement design contains no Select Material Zone, it is the underside of the subbase.

[2] The subgrade is generally considered to be the material below the design subgrade level to a depth of up to 1 m below the design subgrade level.

Figure 4-1 Pavement nomenclature for embankments



[1] The design subgrade level is the underside of the Selected Material Zone. Where a pavement design contains no Select Material Zone, it is the underside of the subbase.

[2] The subgrade is generally considered to be the material below the design subgrade level to a depth of up to 1 m below the design subgrade level.

Figure 4-2 Pavement nomenclature for cuttings

1.1.4.3 Submissions

Drawings: Prepare drawings or other documentation to record extent and constitution of final works in accordance with TCCS *Reference Document 8 – Requirements for Works as Executed Records*.

1.1.5 Hold points and Witness points

1.1.5.1 Notice

General: Give written notice to the Authorised Person for Hold points and Witness points in accordance with **Table 4-1** and **Table 4-2** respectively.

Modified base and subbase materials: Where modified base and subbase materials are proposed, all Hold points and Witness points in *TfNSW Specification R71* must be adopted, in lieu of the Hold points and Witness points in **Table 4-1** and **Table 4-2**, respectively.

Bound base and subbase materials: Where bound base and subbase materials are proposed, all Hold points and Witness points in the following TfNSW specifications must be adopted, in lieu of the Hold points and Witness points in **Table 4-1** and **Table 4-2**:

(a) Plant mixed heavily bound pavement course:

  (i) Cementitious stabilisation binders: To *TfNSW Specification R73*

  (ii) Lime stabilisation binders: To *TfNSW Specification R73*

(b) In situ pavement stabilisation using slow setting binders:

  (iii) Cementitious stabilisation binders: To *TfNSW Specification R75*

  (iv) Lime stabilisation binders: To *TfNSW Specification R75*

(c) Foam bitumen stabilisation: To *TfNSW Specification R76*

Sprayed bituminous surfacing: Except where specified otherwise in **Clause 2**, all Hold points and Witness points in the TfNSW specifications must be adopted for sprayed bituminous surfacing works.

Asphalt: Except where specified otherwise in **Clause 3**, all Hold points and Witness points in the TfNSW specifications must be adopted for asphalt works.

Table 4-1 Hold points

Item	Clause title	Requirement	Notice of inspection	Release by
Pre-construction planning				
HP4.1	1.2.1.1 – Proposed materials (base and subbase)	Prepare and submit schedule detailing material properties, including NATA test results	5 working days before ordering materials	Authorised Person
HP4.2	1.2.1.3 – Variations to approved materials	Submit details of changes to approved materials	5 working days before use in Works	Authorised Person
Materials				
HP4.3	1.3.1.4 – Recycled material	Submit evidence and test results outlined in submission requirements in **Clause 1.3.1.4**	10 working days before ordering materials	Authorised Person
HP4.4	1.3.2.1 – Alternative materials	Submit details of alternative material, including test results	5 working days before ordering materials	Authorised Person
Execution				
HP4.5	1.4.5.2 – Underlying layer	Inspection to determine suitability of underlying layer	1 working day before placing next layer	Authorised Person
HP4.6	1.4.6.6 – Subsequent layers	Submit completed test results of previous layer	1 working day before placing next layer	Authorised Person
HP4.7	1.4.7.1 – Lots for acceptance	Submit compaction test results	1 working day after testing	Authorised Person
HP4.8	1.4.7.2 – Compaction requirements and acceptance	Submit evidence that compaction is within tolerances	1 working day after test results	Authorised Person
HP4.9	1.4.8.1 – Acceptance of dimensions and levels – General	Submit lot survey reports	1 working day before next activity	Authorised Person
HP4.10	1.4.8.7 – Corrective action – rejected unbound layers	Submit proposal for corrective action	1 working day before next activity	Authorised Person
HP4.11	1.4.9.1 – Extent of removal	Submit proposal to remove less than full width	1 working day before next activity	Authorised Person
HP4.12	1.4.9.2 – Prior to replacement	Give notice for inspection of underlying material	1 working day before next activity	Authorised Person

Item	Clause title	Requirement	Notice of inspection	Release by
HP4.13	1.4.9.3 – Replacement	Submit proposed methods to make good	1 working day before next activity	Authorised Person
HP4.14	1.4.10.2 – Primer or primerseal	Submit proposal to adopt alternative to primer or primerseal	1 working day before next activity	Authorised Person
HP4.15	1.4.10.3 – Pavement condition before primer or primerseal	Submit evidence of dry back being achieved and give notice for inspection	1 working day before primer or primerseal	Authorised Person

Table 4-2 Witness points

Item	Clause title	Requirement	Notice of inspection
Pre-construction planning			
WP4.1	1.4.3.2 – Delivered materials	Give notice for inspection	Progressive
Materials			
WP4.2	1.4.4.1 – Stockpiling unbound material – Location	Give notice of proposed alternative locations	2 weeks before stockpiling
WP4.3	1.4.4.5 – Stockpiling unbound material – Sampling	Demonstrate test results from unbound stockpiles	3 working days after delivery
Execution			
WP4.4	1.4.6.1 – Compaction	Give notice of proposal to use alternative layer thickness	2 weeks before activity
WP4.5	1.4.6.5 – Rework	Give notice for inspection of reworked wetted-up layer	Progressive
WP4.6	1.4.8.2 – Layer width	Give notice of completion of layer width	Progressive
WP4.7	1.4.8.4 – Subbase surface deviation	Give notice of completed subbase surface	Progressive
WP4.8	1.4.8.5 – Base surface deviation	Give notice of completed base surface	Progressive
WP4.9	1.4.8.6 – Base adjacent to kerb and gutter	Give notice of completed base surface	Progressive
WP4.10	2.3 – Removal of loose stones	Give notice of completed surface	Progressive

1.2 Pre-construction planning

1.2.1 Design and control of unbound base and subbase materials

1.2.1.1 Proposed materials

Alternatives: Unbound base and subbase materials shall conform to either this Specification or to the requirements of the applicable Transport for New South Wales (TfNSW) material specification, including quality records and Hold points.

Schedule: Submit a schedule detailing the material properties of the proposed base and subbase, including sources of supply. Include test results from a NATA (National Association of Testing Authorities) registered laboratory as evidence that material properties conform to the requirements of this Specification.

This is a **HOLD POINT (HP4.1)**.

1.2.1.2 Approved base and subbase

General: Once the proposed materials have been approved, they are known as the approved base and subbase.

Pre-approval: Proposed base or subbase may be pre-approved under all of the following conditions:

(a) If the base or subbase was used in a separate contract within 12 months of proposed works date.

(b) If full approved details have been previously used.

(c) If the material properties remain unchanged from that previously approved.

(d) If the in-service performance of the base or subbase incorporating the nominated materials is acceptable.

1.2.1.3 Variations to approved materials

Written approval: Submit details of any changes to the approved base and subbase or source of supply.

This is a **HOLD POINT (HP4.2)**.

Non-conformance: Any change to the approved base and subbase without approval will be considered a nonconforming material and may be rejected.

1.2.2 Design and control of modified and bound base and subbase materials

1.2.2.1 Modified materials

Modification: If the proposed base or subbase is a modified material, the materials supply (including mix design and materials testing), delivery and construction, including placing, spreading, compacting, trimming, curing and testing, and any construction of trial pavement, must be in accordance with *TfNSW Specification R71.*

Mix design submission: Submit a nominated mix design in accordance with *TfNSW Specification R71.* Refer to *TfNSW Specification R71* for the mix design submission Hold point requirements for modified materials.

1.2.2.2 Bound materials

Stabilisation: If the proposed base or subbase is to be bound, the materials supply (including mix design and materials testing), delivery and construction, including placing, spreading, compacting, trimming, curing and testing, and any construction of trial pavement, must be in accordance with the following:

(a) Plant mixed heavily bound pavement course:

  (i) Cementitious stabilisation binders: To *TfNSW Specification R73*

  (ii) Lime stabilisation binders: To *TfNSW Specification R73*

(b) In situ pavement stabilisation using slow setting binders:

  (iii) Cementitious stabilisation binders: To *TfNSW Specification R75*

  (iv) Lime stabilisation binders: To *TfNSW Specification R75*

(c) Foam bitumen stabilisation: To *TfNSW Specification R76*

Mix design submission: Submit a nominated mix design in accordance with requirements of the applicable TfNSW specification. Refer to the applicable TfNSW specification for the mix design submission Hold point requirements for bound materials.

1.3 Materials

1.3.1 Unbound base and subbase materials

1.3.1.1 General

Guidance: To *MIS 03 Pavement Design*, *AGPT04A* and *Best Practice Guide for Sealed Roads (NTRO)* with properties as listed in this Specification.

Sampling and testing: To *AS 1289 (Set)* and *AS 1141 (Set).*

Requirement: Provide unbound granular materials, including blends of two or more different materials, which when compacted develop structural stability and are uniform in grading and physical characteristics. Base and subbase materials shall be manufactured from hard, durable stone or materials free of clay lumps, organic matter or other deleterious substances.

Production: Materials may be produced by crushing plant or naturally occurring granular materials. Methods and properties to conform to this Specification. The material may be crusher run or screened and recombined.

1.3.1.2 Dense graded materials

Designation: Unbound crushed rock materials are designated as follows:

DGB20: 20 mm nominal sized densely graded base

DGS20: 20 mm nominal sized densely graded subbase

DGS40: 40 mm nominal sized densely graded subbase.

1.3.1.3 Graded Macadam and Macadam material

Requirement: Graded Macadam and Macadam materials may only be used if specified or approved by the Authorised Person.

Designation: Graded Macadam and Macadam materials are designated as follows:

GMB20: 20 mm nominal sized graded macadam base

GMS40: 40 mm nominal sized graded macadam subbase.

1.3.1.4 Recycled material

General: Recycled building material used as granular base and subbase material shall primarily consist of crushed concrete or recycled pavement material. Recycled or manufactured materials may be blended with virgin materials or with other recycled materials to meet the requirements of this Specification.

Guidance: Refer to Section 10 of the Guide Notes in *TfNSW Specification 3051* for further guidance on the use of recycled materials in unbound granular road base and subbase.

Requirement: Conform to the maximum proportion of recycled materials in **Table 4-3**. The total proportion of recycled and manufactured constituent materials, other than slag or recycled crushed concrete, must not exceed 40% of the mix, unless otherwise approved by the Authorised Person.

Designation: Recycled crushed concrete materials are designated as follows:

RCCB20: 20 mm nominal sized recycled crushed concrete base

RCCS20: 20 mm nominal sized recycled crushed concrete subbase.

Table 4-3 Recycled constituent materials

Recycled material	Maximum material proportion (% by mass)
Recycled crushed concrete [(i)] [(ii)]	100
Reclaimed asphalt pavement (RAP) [(iii)]	40
Crushed brick [(iv)]	20
Crushed glass fines [(v)]	10
Crumb rubber	0
Industrial slags [(i)] [(vi)]	100
Fly ash and furnace bottom ash [(vii)]	10% each
Recycled plastics	0

(i) Pavement materials with more than 30% recycled crushed concrete or slag must not be used within 100 mm of the underside of bituminous seals or asphalt with total thickness less than 175 mm, due to the potential for available cement or cementitious materials which may rehydrate and result in shrinkage cracking. Unconfined Compressive Strength (UCS) test to be undertaken for proposed road base materials (DGB20, RCCB20) containing recycled crushed concrete or slag as a constituent material, to *TfNSW Test Method T116* or *AS 5101.4*. UCS to be maximum 1.0 MPa.

(ii) For DGB20 and RCCB20 material that is used in pavements for Collector Roads, crushed concrete must be sourced from recycled structural concrete (structural concrete is defined as concrete containing reinforcement or from rigid pavements). For DGB20 and RCCB20 material that is used in pavements for local access streets and paths, and for all subbase material, crushed concrete from structural and non-structural sources and concrete washouts is acceptable.

(iii) Supply of RAP is to be in accordance with *TfNSW Specification 3153*.

(iv) Crushed bricks, excluding cement masonry bricks, are acceptable provided that they are uniform in quality and any adhering mortar or cement render does not produce any binding reaction in the base or subbase mix. UCS test to be undertaken for proposed road base (DGB20, RCCB20) containing crushed brick as a constituent material, to *TfNSW Test Method T116* or *AS 5101.4*. UCS to be maximum 1.0 MPa.

(v) Crushed glass fines must be clean and washed to ensure the sand is free of any sugar, paper or other contaminants. Supply of recycled crushed glass is to be in accordance with *TfNSW Specification 3154*. Note: In some TfNSW specifications this is referred to as 'granulated glass aggregate'.

(vi) Supply of slag is to be in accordance with *TfNSW Specification 3051, Clause 10.5*. UCS test to be undertaken for proposed road base (DGB20, RCCB20) containing slag as a constituent material, to *TfNSW Test Method T116* or *AS 5101.4*. UCS to be maximum 1.0 MPa.

(vii) The addition of fly ash or furnace bottom ash may not be acceptable if modification is to be carried out. UCS test to be undertaken for proposed road base materials (DGB20, RCCB20) containing fly ash or furnace bottom ash as a constituent material, to *TfNSW Test Method T116* or *AS 5101.4*. UCS to be maximum 1.0 MPa.

Expansive materials: Make adequate provisions to ensure that materials do not exhibit expansive reactions resulting from the presence of free Calcium Oxide, Magnesium Oxide or other expansive materials.

Limits of undesirable materials: The maximum limits for undesirable materials within the constituent recycled materials is to be as per *TfNSW Specification 3051, Table 3051.6*.

Testing for undesirable materials: *TfNSW Test Method T276* to be adopted for testing for undesirable materials. Test frequency to be 1 per 1,000 tonnes of constituent recycled material, or as per *TfNSW Specification 3051, Annexure 3051/L, Table 3051/L.1* or as agreed with the Authorised Person.

Traffic categories: For the purposes of interpreting Table 3051.6 in *TfNSW Specification 3051*, the relationship between design traffic (over a 20-year design life) and 'traffic category' is outlined in *TfNSW Specification 3051, Annexure 3051/A, Table 3051/A.N1*.

Asbestos: Recycled building materials, including recycled crushed concrete and crushed brick, shall contain zero asbestos. Testing for asbestos shall be undertaken in accordance with *AS 4964* at a test frequency of 1 per 1,000 tonnes of constituent recycled material.

Submission for approval: Submit the following to the Authorised Person prior to incorporation of recycled materials into the Works:

(a) Evidence such as stockpile management plans and test results where applicable, to verify that the constituent material has been weathered, cured and managed to exclude any reactivity that may cause the material to expand after it has been placed in the pavement, and contains zero asbestos and meets the requirements for limits of undesirable materials in *TfNSW Specification 3051, Table 3051.6*.

(b) Test results demonstrating compliance with any applicable resource recovery exemption.

This is a **HOLD POINT (HP4.3)**.

1.3.1.5 Base material properties

Base materials: Conform to **Table 4-4** both prior to and after placement in the pavement. Material requirements apply after pre-treatment of materials, if applicable.

Pre-treatment: To *TfNSW Test Method T102* unless pre-treatment test exemption is provided by the Principal.

Table 4-4 Base material properties

Test method	Description	DGB20 [(i)]	GMB20	RCCB20 [(i)]
AS 1289.3.6.1	Particle size distribution			
	% passing 26.5 mm sieve	100	100	100
	% passing 19.0 mm sieve	95–100	95–100	95–100
	% passing 13.2 mm sieve	78–92	50–70	78–92
	% passing 9.5 mm sieve	63–83	30–55	63–83
	% passing 4.75 mm sieve	44–64	–	44–64
	% passing 2.36 mm sieve	33–49	20–30	30–48
	% passing 425 µm sieve	14–23	6–15	13–21
	% passing 75 µm sieve	7–14	2–8	5–9
	% passing 13.5 µm sieve [(ii)]	3–7	–	–
	Retained between sieves			
	% retained 19.0–13.2 mm	6–21	–	–
	% retained 13.2–9.5 mm	6–19	–	–
	% retained 9.5–4.75 mm	10–25	–	–
	% retained 4.75–2.36 mm	5–23	–	–
	% retained 2.36–0.425 mm	12–33	–	–
	% retained 425–75 µm	4–15	–	–
	% retained 75–13.5 µm	1–9 [(ii)]	–	–
AS 1289.3.1.1	Liquid Limit (if non-plastic)	max 23	max 23	max 27
TfNSW T109	Plastic Limit (if plastic)	max 20	max 20	–

Test method	Description	DGB20[(i)]	GMB20	RCCB20[(i)]
AS 1289.3.3.1	Plasticity Index:[(iii)] Traffic category Rear lanes All other streets	 max 8 2–6	 max 8 max 8	 max 8 2–6
AS 1141.52	Maximum dry compressive strength on fraction passing 19 mm sieve (only applies if PI < 2)	min 1.7 MPa	–	min 1.7 MPa
AS 1141.14	Particle shape by proportional calliper – % misshapen (2:1)	max 35%	max 35%	max 35%
AS 1141.22	Aggregate wet strength[(iv)]	min 70 kN	min 130 kN	min 70 kN[(v)]
AS 1141.22	Wet/dry strength variation[(iv)] (dry − wet)/dry	max 35%	max 30%	max 35%[(v)]
AS 5101.4 or *TfNSW T116*	Unconfined Compressive Strength (UCS)[(vii)]	max 1.0 MPa	–	max 1.0 MPa
TfNSW T239	Two or more fractured faces (%)[(vi)]	min 75	min 85	–
AS 1141.36	Total sulphur content (% S by mass)	max 0.05	max 0.05	max 0.05
AS 1289.4.2.1	Water soluble sulphate content (% SO4 by mass)	max 0.10	max 0.10	max 0.10

(i) Filler (material passing 75 µm sieve) may be incorporated into the material to improve its particle size distribution and cohesion and/or to reduce its permeability. Submit to the Authorised Person details of the proposed source and the amount and type of filler prior to use. The filler is to be uniformly mixed through the coarse aggregate by use of a pugmill or alternative mixing system approved by the Authorised Person.

(ii) Determination of '% passing 13.5 µm sieve' is not required for materials containing 5% or more by mass of fly ash.

(iii) The Plasticity Index may be reduced to zero for materials containing 5% or more by mass of fly ash or when the material is to be bound. Where fillers other than fly ash are proposed and sufficient data is available to demonstrate adequate workability of the proposed mix, the Authorised Person may also permit a reduction to the Plasticity Index.

(iv) Test the fraction 19.0 mm to 9.5 mm. In the case of blended materials, also test the fraction 9.5 mm to 4.75 mm. Test any other fraction which is at risk of failing, in the opinion of the Authorised Person.

(v) For RCCB20, where sufficient data is provided to demonstrate acceptable performance, the Authorised Person may allow lower aggregate wet strength and higher wet/dry strength variation limits only for applications including paths and local access streets (not for Collector Roads or above).

(vi) Material that has been drilled, blasted and crushed is exempt from this requirement.

(vii) The UCS test only applies to DGB20 and RCCB20 which contains recycled concrete, bricks, fly ash, bottom ash or slag as constituent materials. For material classified as modified material, all requirements of *TfNSW Specification R71* are to be adopted (refer **Clause 1.2.2.1)**.

1.3.1.6 Subbase material properties

Subbase materials: Conform to **Table 4-5**. Material requirements apply after pre-treatment of materials, if applicable.

Pre-treatment: To *TfNSW Test Method T102* unless pre-treatment test exemption provided by the Principal.

Trench backfill: Subbase for use as trench backfill under roads shall conform to **Table 4-5**.

Table 4-5 Subbase material properties

Test method	Description	DGS20[(i)]	DGS40[(i)]	GMS40	RCCS20[(i)]
AS 1289.3.6.1	Particle size distribution				
	% passing 53.0 mm sieve	–	100	100	–
	% passing 37.5 mm sieve	–	95–100	–	–
	% passing 26.5 mm sieve	100	75–95	–	100
	% passing 19.0 mm sieve	95–100	64–90	50–75	95–100
	% passing 13.2 mm sieve	70–90	–	–	75–95
	% passing 9.5 mm sieve	58–80	42–78	15–35	60–90
	% passing 4.75 mm sieve	43–65	27–64	−5–15	42–76
	% passing 2.36 mm sieve	30–55	20–50	1–8	28–60
	% passing 425 µm sieve	10–30	10–23	0–4	10–28
	% passing 75 µm sieve	4–17	4–12	–	2–10
	% passing 13.5 µm sieve[(ii)]	2–10	2–7	–	–
AS 1289.3.1.1	Liquid Limit (if non-plastic)	max 23	max 23	–	max 27
TfNSW T109	Plastic Limit (if plastic)	max 20	max 20	–	–
AS 1289.3.3.1	Plasticity Index: Traffic category				
	Rear lanes	max 12	max 12	max 10	max 12
	All other streets	max 10	max 10	max 10	max 15
AS 1141.52	Maximum dry compressive strength on fraction passing 19 mm sieve (only applies if PI < 2)	min 1.0 MPa	min 1.0 MPa	–	min 1.0 MPa
AS 1141.14	Particle shape by proportional calliper – % misshapen (2:1)	max 35%	max 35%	max 35%	max 35%
AS 1141.22	Aggregate wet strength[(iii)]				
	Local access streets and paths	min 50 kN	min 50 kN	min 130 kN	min 50 kN
	Collector Roads and above	min 70 kN	min 70 kN	min 130 kN	min 70 kN
AS 1141.22	Wet/dry strength variation[(iii)] (dry − wet)/dry	max 40%	max 40%	max 30%	max 40%[(iv)]
AS 1289.5.1.1	4 day soaked CBR (98% standard compaction)	–	–	min 30%	–
TfNSW T239	Two or more fractured faces (%)[(v)]	min 75	min 85	min 75	
AS 1141.36	Total sulphur content (% S by mass)	max 0.05	max 0.05	max 0.05	max 0.05

Test method	Description	DGS20[(i)]	DGS40[(i)]	GMS40	RCCS20[(i)]
AS 1289.4.2.1	Water soluble sulphate content (% SO4 by mass)	max 0.10	max 0.10	max 0.10	max 0.10

(i) Filler (material passing 75 µm sieve) may be incorporated into the material to improve its particle size distribution and cohesion and/or to reduce its permeability. Submit to the Authorised Person details of the proposed source and the amount and type of filler prior to use. The filler is to be uniformly mixed through the coarse aggregate by use of a pugmill or alternative mixing system approved by the Authorised Person.

(ii) Determination of '% passing 13.5 µm sieve' is not required for materials containing 5% or more by mass of fly ash.

(iii) Test the fraction 19.0 mm to 9.5 mm. In the case of blended materials, also test the fraction 9.5 mm to 4.75 mm. Test any other fraction which is at risk of failing, in the opinion of the Authorised Person.

(iv) For RCCS20, where sufficient data is provided to demonstrate acceptable performance, the Authorised Person may allow higher wet/dry strength variation limits only for applications including paths and local access streets (not for Collector Roads or above).

(v) Material that has been drilled, blasted and crushed is exempt from this requirement.

1.3.2 Modified Texas triaxial classification

1.3.2.1 Alternative materials

Requirement: Submit proposal for the use of any unbound base or subbase material that conforms to the requirements of **Table 4-4** and **Table 4-5**, except for:

(a) Particle size distribution grading to *AS 1289.3.6.1*;

(b) Particle shape by proportional calliper to *AS 1141.14;* or

(c) Two or more fractured faces to *TfNSW Test Method T239.*

Proposed material: Submit details of the proposed material (after pre-treatment as required for base or subbase), including the following:

(d) Acceptable compaction characteristics and field performance.

(e) Modified Texas triaxial classification and associated tests.

(f) Maximum permitted deviation from the nominated particle size distribution.

This is a **HOLD POINT (HP4.4)**.

Test method: *TfNSW Test Method T171*.

Requirements: To **Table 4-6**.

TfNSW Test Method T171 tested: At 83–87% of Optimum Moisture Content and 99 – 101% of Maximum Dry Density as determined by one of the test methods specified in **Clause 1.4.7.3**.

Table 4-6 Modified Texas triaxial classification number requirements

Material class	Modified Texas triaxial classification number (*TfNSW Test Method T171*)
Base	
Rear lanes	max 2.5
All other streets	max 2.2
Subbase	max 3.2

1.3.2.2 Deviation from nominated particle size distribution grading

Requirements: To **Table 4-7**.

Table 4-7 Maximum deviation of particle grading

Test method	Description	DGB20	DGS20	DGS40
AS 1289.3.6.1	Maximum deviation from particle size distribution			
	% passing 53.0 mm sieve	–	–	–
	% passing 37.5 mm sieve	–	–	±0
	% passing 26.5 mm sieve	±0	±0	±8
	% passing 19.0 mm sieve	±3	±3	±8
	% passing 13.2 mm sieve	±7	±8	–
	% passing 9.5 mm sieve	±6	±6	±8
	% passing 4.75 mm sieve	±6	±6	±6
	% passing 2.36 mm sieve	±6	±6	±6
	% passing 0.425 mm sieve	±4	±4	±4
	% passing 0.075 mm sieve	±2	±2	±2

1.3.3 Modified base and subbase materials

1.3.3.1 General

Specification: If the proposed base or subbase is a modified material, the materials supply (including mix design and materials testing) and delivery must be in accordance with *TfNSW Specification R71*.

Hold points and Witness points: All Hold points and Witness points in *TfNSW Specification R71* must be adopted, in lieu of the Hold points and Witness points in **Table 4-1** and **Table 4-2**, respectively.

1.3.4 Bound base and subbase materials

1.3.4.1 General

Specification: If the proposed base or subbase is to be bound, the materials supply (including mix design and materials testing) and delivery must be in accordance with the following:

(a) Plant mixed heavily bound pavement course:

(i) Cementitious stabilisation binders: To *TfNSW Specification R73*

(ii) Lime stabilisation binders: To *TfNSW Specification R73*

(b) In situ pavement stabilisation using slow setting binders:

(iii) Cementitious stabilisation binders: To *TfNSW Specification R75*

(iv) Lime stabilisation binders: To *TfNSW Specification R75*

(c) Foam bitumen stabilisation: To *TfNSW Specification R76*

Hold points and Witness points: All Hold points and Witness points in the following TfNSW specifications must be adopted, in lieu of the Hold points and Witness points in **Table 4-1** and **Table 4-2**:

(d) Plant mixed heavily bound pavement course:

(v) Cementitious stabilisation binders: To *TfNSW Specification R73*

(vi) Lime stabilisation binders: To *TfNSW Specification R73*

(e) In situ pavement stabilisation using slow setting binders:

(vii) Cementitious stabilisation binders: To *TfNSW Specification R75*

(viii) Lime stabilisation binders: To *TfNSW Specification R75*

(f) Foam bitumen stabilisation: To *TfNSW Specification R76*

1.3.4.2 Water

Requirement: Water for use in the Works must be free from deleterious amounts of materials such as oils, salts, acids, alkalis and vegetable substances. Water taken from any source other than an Icon Water supply system must conform to **Table 4-8**.

Table 4-8 Water quality

Test method	Description	Maximum level
TfNSW T1004	Chloride ion	600 ppm
TfNSW T1014	Sulphate ion	400 ppm
AS 3550.4	Undissolved solids	1% by mass
TfNSW T1015	Thermo-tolerant coliforms (recycled water)	1,000 per 100 mL

1.4 Execution

1.4.1 Site establishment

Survey: Confirm site surface and benchmarks. Conform to *MITS 00 Preliminaries*.

Registration and insurance: Conform to *MITS 00 Preliminaries*.

Operation: Conform to EPA requirements.

1.4.2 Provision for traffic

1.4.2.1 General

Requirement: Conform to *MITS 01 Traffic Management*.

1.4.3 Delivery

1.4.3.1 Transport of materials

Delivery vehicles: Provide enclosure to avoid loss of material during transit.

Condition: Provide materials sufficiently damp to avoid segregation and loss of fines during transit.

Moisture content: Uniformly distributed so that the moisture content on the day of use is less than the optimum moisture content to one of the test methods specified in **Clause 1.4.7.2**, or the moisture content as specified by the Authorised Person ±0.5%.

1.4.3.2 Delivered materials

Notice: Give notice of arrival of materials for inspection.

This is a **WITNESS POINT (WP4.1)**.

1.4.4 Stockpiling unbound material

1.4.4.1 Location

Stockpile sites: Locate stockpile sites as shown on the drawings or give notice of proposed alternative locations.

This is a **WITNESS POINT (WP4.2)**.

Multiple sources: If materials of different types or from different sources are delivered to site, they shall be placed in separate stockpiles.

1.4.4.2 Preparation

Condition: Clear stockpile sites of all vegetation and extraneous matter, and shape to form a crown to allow area to drain freely. Compact the area to a relative compaction ≥ 95%, to *AS 1289.5.4.1* for standard compactive effort.

1.4.4.3 Stockpile maintenance

Stockpile dimensions: Constructed with slopes no greater than 2:1 for heights up to 2.5 m. Where stockpiles are greater than 2.5 m in height, slopes may be reduced to 1:1 subject to the Contractor's work methods and site safety considerations.

Moisture content: Maintain stockpiled material at a moisture content sufficient to avoid loss of fines.

Contamination of materials: Maintain stockpiles and stockpile sites to make sure materials do not become intermixed, segregated or contaminated with foreign material.

1.4.4.4 Restoration

Surplus material: Upon completion of the Works, clear stockpile sites of all surplus material and leave in a clean and tidy condition.

1.4.4.5 Sampling

Test: Sample and test stockpiles within 3 days of delivery to *AS 1141.3.1* and as directed by the Authorised Person.

This is a **WITNESS POINT (WP4.3)**.

1.4.5 Spreading

1.4.5.1 General

Process: Spread in uniform layers as near as practicable to the required thickness by direct tipping from suitable vehicles or by the use of a mechanical spreader. If material becomes segregated it shall be remixed to produce a consistent material.

Multiple sources: If materials from different sources are delivered to site, they shall be placed in separate lots.

Transverse joints: Locate at a minimum offset of 2 m from any joint in layer below.

Longitudinal joints: Construction of new full width pavement shall contain no longitudinal joints in the granular base or subbase. For pavement widening, longitudinal joints shall only be located as shown on the drawings. If not shown on the drawings, locate longitudinal joints along lane marking line or mid-way between lane marking lines. Offset a minimum of 100 mm from any joint in layer below.

Moisture content when spreading: 60–90% of the laboratory optimum moisture content as determined by one of the test methods specified in **Clause 1.4.7.2**.

1.4.5.2 Underlying layer

Requirement: Moisture content < 80% of the laboratory optimum moisture content, to one of the test methods specified in **Clause 1.4.7.2**, and free from rutting or foreign matter.

Quality: Before spreading of base and subbase material, give notice so that inspection may be made of the underlying layer quality, including the assessment of required moisture content.

This is a **HOLD POINT (HP4.5)**.

1.4.5.3 Nonconforming underlying layer

Correction: If Contractor activities cause the underlying layer to become nonconforming, correct the underlying layer to conform to this Specification. If the layer is materially different to when it was approved (e.g. due to rain), the Contractor shall re-test and demonstrate conformance with this Specification at no cost to the Principal.

1.4.6 Trimming and compaction

1.4.6.1 Compaction

Process: Spread, shape and compact each layer in uniform thicknesses. Trim layer to conform to the documented thickness.

Compacted layer thickness 100 mm minimum. Maximum layer thickness shall be limited to that which will allow compaction to specified densities by the equipment available or 200 mm, whichever is smaller. A maximum layer thickness greater than 200 mm may be approved by the Authorised Person prior to use and the Authorised Person may require that the layer be tested for compaction density in two sub-layers. Provide layers of equal thickness in multilayer courses. Give notice of the proposed use of any layer thickness outside of this range.

This is a **WITNESS POINT (WP4.4)**.

1.4.6.2 Compaction procedure

Conformance: Uniformly compact each layer of the base and subbase courses over their entire area and depth conforming to **Clause 1.4.7**.

Moisture content: Maintain within 60–90% of the optimum moisture content during compaction.

One-way cross fall sections: Compact from the low side to the high side.

Crowned sections: Compact from edge to crown on each side of the pavement.

Rollers: Pass parallel to the centreline of the pavement and uniformly overlap each preceding pass.

1.4.6.3 Plant

Watering equipment: Use water spraying equipment that is capable of uniformly distributing water in controlled quantities and in uniform widths.

Protection: Do not stand watering and compaction plant on the pavement being compacted.

Self-propelled plant: Use self-propelled compaction plant, where practical.

1.4.6.4 Trimming

Process: Surfaces of base materials shall be constructed higher than the specified levels and cut to profile by power grader or trimming machine towards the end of the compaction process. Rolling shall then continue until the specified density is achieved.

Cuttings: Cuttings from the trimmed surface may be used to a maximum depth of 50 mm in the bottom of adjoining layers of base material subject to non-contamination by other materials.

1.4.6.5 Rework

Wetted up layers: If an unbound layer becomes wetted up after compaction is complete, dry out and give notice for inspection. If necessary, uniformly re-compact and trim to the documented density requirements and level tolerances.

Inspection: Give notice for inspection of reworked wetted up layer.

This is a **WITNESS POINT (WP4.5)**.

1.4.6.6 Subsequent layers

Tests: Do not place subsequent layers until all required testing has been completed and the test results for each layer have been submitted.

This is a **HOLD POINT (HP4.6)**.

1.4.6.7 Unstable areas

Rejection criteria: Any unstable areas that develop during rolling or are identified by proof rolling.

Dry back and replacement: Open up, dry back and re-compact to the requirements of this Specification. Alternatively, remove the full depth of layer, dispose of and replace with fresh material to conform to **Clause 1.4.9**.

1.4.6.8 Matching to existing

Process: Unless otherwise specified, where a pavement is to be joined to an existing pavement, remove a strip of the existing pavement to a minimum width of 300 mm for its full depth. Trim the edge to approximately 45° in steps to a maximum height of 150 mm. Trim the bituminous surface to a neat edge using a saw cut, pneumatic tool or equivalent.

1.4.7 Acceptance of compaction

1.4.7.1 Lots for acceptance

Acceptance of work: Based on density testing of the work in lots.

Density testing: Submit results verifying the required relative compaction has been achieved.

This is a **HOLD POINT (HP4.7)**.

1.4.7.2 Compaction requirements and acceptance

Lot compaction acceptance: Minimum relative compaction for standard compactive effort is ≥ 102%. (Note: This is approximately equivalent to 100% Modified compaction for granular base and subbase materials.)

Alternative compaction acceptance: Zones with relative compaction < 102% (standard compactive effort) but ≥ 100% may be accepted provided evidence is submitted to show that such zones constitute less than 5% of the lot.

This is a **HOLD POINT (HP4.8)**.

Moisture content: All zones shall have a moisture content in the range of 60–90% of the optimum moisture content as determined.

Field moisture content – test method: Determine the moisture content in accordance with one of the following test methods over the full depth of the granular layer:

(a) *TfNSW Test Method T120*

(b) *TfNSW Test Method T121*

(c) *TfNSW Test Method T180*

(d) *AS 1289.2.1.1.*

Optimum moisture content – test method: Determine the optimum moisture content in accordance with one of the following test methods:

(e) *TfNSW Test Method T111*

(f) *TfNSW Test Method T112**

(g) *TfNSW Test Method T162*

(h) *AS 1289.5.1.1*

(i) *AS 1289.5.2.1**

(j) *AS 1289.5.7.1.*

*Note: *TfNSW Test Method T112* and *AS 1289.5.2.1* are only to be used if maximum dry density is specified for the material using modified compactive effort.

1.4.7.3 Relative compaction using in situ dry density

Method: Calculate the relative compaction of pavement material at each location tested for in situ dry density to *AS 1289.5.4.1*, as follows:

- Relative compaction % = [(In situ dry density)/(Comparative dry density)] x 100.

Comparative dry density: Equal to the maximum dry density (standard compactive effort) determined in the laboratory by testing samples to one of the following test methods:

(a) *TfNSW Test Method T111*

(b) *TfNSW Test Method T112**

(c) *TfNSW Test Method T162*

(d) *AS 1289.5.1.1*

(e) *AS 1289.5.2.1**

(f) *AS 1289.5.7.1.*

*Note: *TfNSW Test Method T112* and *AS 1289.5.2.1* are only to be used if maximum dry density is specified for the material using modified compactive effort.

In situ dry density: Test the compacted material to one of the following test methods:

(g) *TfNSW Test Method T119*

(h) *TfNSW Test Method T173*

(i) *AS 1289.5.3.2*

(j) *AS 1289.5.8.1*

Sampling locations: The location of the sample for determining the maximum dry density must be the same as for the in situ density.

1.4.7.4 Proof rolling

The Authorised Person may require the Contractor to perform proof rolling to demonstrate compaction.

1.4.7.5 Corrective action – rejected layers

Non-conformance report: All nonconforming layers shall be the subject of a non-conformance report.

General: Work may only proceed above the nonconforming layer subject to the approval of the Authorised Person.

Rework: Rework lots that have been rejected in regard to compaction and resubmit for compaction assessment. If the moisture content is nonconforming, correct as necessary. Unless otherwise permitted, mix mechanically for the full depth of the layer to uniformly distribute moisture prior to rolling.

1.4.7.6 Removal

Replacement: Remove any unbound material which, in the opinion of the Authorised Person, has become degraded, segregated or otherwise reduced in quality by reworking. Dispose of and replace with fresh material to conform to **Clause 1.4.9**.

1.4.8 Acceptance of dimensions and levels

1.4.8.1 General

Acceptable limits: Conform to **Table 4-9** for acceptable limits of departure from the dimensions shown on the drawings, which may occur during construction.

Lots: Conform to the maximum lot size and minimum test frequencies in *MITS 00B Quality Construction*. Each pavement layer is to be surveyed for level and thickness conformance.

Survey reports: Submit survey reports covering line and level for each lot.

This is a **HOLD POINT (HP4.9)**.

Table 4-9 Pavement dimension and level tolerance

Pavement	Criteria	Tolerance	
Base	Surface level	±5 mm +10 mm −0 mm ±5 mm	if immediately adjacent to gutter if not immediately adjacent to gutter from a 3 m straight edge laid in any direction measured after trimming and immediately prior to sealing
	Thickness	+20 mm −0 mm +30 mm −10 mm	if automatic level control used if automatic level control not used
Subbase	Surface level	+10 mm −25 mm	measured after trimming
	Thickness	±10 mm	measured after trimming
Total pavement layers above Selected Material Zone and subgrade	Thickness	−10 mm	

1.4.8.2 Layer width

Tolerance: Zero to +100 mm of the design widths for both base and subbase, measured from the design centreline to the edge of the constructed pavement base/subbase layer, but limited to 50 mm per side and as shown on the drawings. Give notice for inspection of completed layer width.

This is a **WITNESS POINT (WP4.6)**.

1.4.8.3 Surface level

Surface: Parallel to the proposed finished wearing surface after final compaction and trimming of both base and subbase layers. The surface shape shall be such that water cannot accumulate at any point.

1.4.8.4 Subbase surface deviation

Surface: From design level, after trimming. Give notice for inspection of completed subbase surface.

This is a **WITNESS POINT (WP4.7)**.

1.4.8.5 Base surface deviation

Surface: From design level or from a 3 m long straight edge laid in any direction, after trimming and immediately prior to sealing. Additionally, there must be no abrupt change of levels in the transition from the pavement to fixed structures such as a bridge deck.

Inspection: Give notice for inspection of completed base surface.

This is a **WITNESS POINT (WP4.8)**.

1.4.8.6 Base adjacent to kerb and gutter

Surface: From the level of the lip of the gutter, minus the design thickness of the wearing surface.

Inspection: Give notice for inspection of completed base surface.

This is a **WITNESS POINT (WP4.9)**.

1.4.8.7 Corrective action – rejected unbound layers

Non-conformance report: All nonconforming layers shall be the subject of a non-conformance report.

Trimming: Submit proposal to correct surface by trimming without filling, to produce a uniform, hard surface.

This is a **HOLD POINT (HP4.10)**.

1.4.8.8 Removal

Replacement: If corrective action is unachievable, remove and dispose of material and replace with fresh material to conform to **Clause 1.4.9**.

1.4.9 Removal and replacement of rejected courses

1.4.9.1 Extent of removal

Requirement: Remove rejected material over full length of rejected lot.

Exception: Submit proposal to remove less than the full width, as constructed, if the cause of rejection can be isolated. Form a new longitudinal cold joint located along the centreline of traffic lane or along the linemarkings for the traffic lanes.

This is a **HOLD POINT (HP4.11)**.

1.4.9.2 Prior to replacement

Inspection: Give notice of completion of removal of rejected base or subbase, for inspection before commencement of replacement works.

This is a **HOLD POINT (HP4.12)**.

1.4.9.3 Replacement

Materials: Provide materials for replacement works, including spreading, compaction, trimming and test the replacement materials, to conform to the requirements of this Specification.

Damage: Submit proposed methods to make good any damage to underlying or abutting layers or structures due to the removal or replacement of rejected courses.

This is a **HOLD POINT (HP4.13)**.

1.4.10 Maintenance before completion of wearing surface

1.4.10.1 Dry back

General: For all roads except local access streets, allow granular base material to dry back to less than or equal to 70% of Standard optimum moisture content before applying the prime or primerseal.

Test requirement: If the moisture ratio in the base material exceeded 70% at the time of compaction and/or the base materials were subject to water infiltration since last tested, test for dry back at same frequency as for compaction testing and close to density test locations. The moisture content sample must be obtained over the full layer thickness and be tested in accordance with the moisture content testing requirements of **Clause 1.4.7.2**.

1.4.10.2 Primer or primerseal

Prepared surface: Maintain the accepted condition of the base course until the wearing surface is completed.

Extent: Within 7 days of acceptance of a lot, cover the base course with a prime or primerseal, over the full width, to **Clause 2** or **Clause 3**.

Alternative to primer or primerseal: Give notice and seek approval from the Authorised Person for any alternative procedure proposed, including demonstration that application of primer or primerseal is not feasible. The Authorised Person is not obligated to accept the proposal to adopt a proposed alternative procedure.

This is a **HOLD POINT (HP4.14)**.

1.4.10.3 Pavement condition before primer or primerseal

Pavement condition: Submit evidence of dry back being achieved and give notice for inspection.

Restore condition: If the base condition deteriorates before prime or primerseal application, and approval to proceed with bitumen surfacing work is withdrawn, dry back and re-prepare the base.

This is a **HOLD POINT (HP4.15)**.

1.4.10.4 Surface drainage

Ponded water: Maintain adequate drainage of the pavement before completion of the wearing surface and remove any ponded water within 12 hours if free drainage is not achievable.

1.4.10.5 Restrictions on movement

Limits: Only vehicles registered for road use and loaded within legal limits are permitted to use the pavement.

Restrictions: Prevent construction plant and vehicles not involved in current construction or testing activities from using the pavement before the application of primerseal.

1.4.11 Modified base and subbase materials

1.4.11.1 General

Specification: If the proposed base or subbase is a modified material, construction, including placing, spreading, compacting, trimming, curing and testing, and any construction of trial pavement, must be in accordance with *TfNSW Specification R71*.

Hold points and Witness points: All Hold points and Witness points in *TfNSW Specification R71* must be adopted, in lieu of the Hold points and Witness points in **Table 4-1** and **Table 4-2**, respectively.

1.4.12 Bound base and subbase materials

1.4.12.1 General

Specification: If the proposed base or subbase is to be bound, the construction, including placing, spreading, compacting, trimming, curing and testing, and any construction of trial pavement, must be in accordance with the following:

(a) Plant mixed heavily bound pavement course:

  (i) Cementitious stabilisation binders: *To TfNSW Specification R73*

  (ii) Lime stabilisation binders: To *TfNSW Specification R73*

(b) In situ pavement stabilisation using slow setting binders:

  (iii) Cementitious stabilisation binders: To *TfNSW Specification R75*

  (iv) Lime stabilisation binders: To *TfNSW Specification R75*

(c) Foam bitumen stabilisation: To *TfNSW Specification R76*

Hold points and Witness points: All Hold points and Witness points in the following TfNSW specifications must be adopted, in lieu of the Hold points and Witness points in **Table 4-1** and **Table 4-2**:

(d) Plant mixed heavily bound pavement course:

  (v) Cementitious stabilisation binders: To *TfNSW Specification R73*

  (vi) Lime stabilisation binders: To *TfNSW Specification R73*

(e) In situ pavement stabilisation using slow setting binders:

  (vii) Cementitious stabilisation binders: To *TfNSW Specification R75*

  (viii) Lime stabilisation binders: To *TfNSW Specification R75*

(f) Foam bitumen stabilisation: To *TfNSW Specification R76*

1.5 Completion

1.5.1 Submissions

Work as Executed Records: To *MITS 00B Quality Construction*.

Recycled materials: For any project in which recycled materials are incorporated into unbound, modified or bound base and subbase, the following are to be provided as part of the Works as Executed submission:

(a) Denotation on the pavement plans or pavement details showing where materials have been adopted that contain recycled content.

(b) Materials mix design information for the materials that contain recycled content.

2 Sprayed bituminous surfacing

2.1 General

Precedence: In many areas of road infrastructure construction and management, the ACT has adopted the relevant specifications of Transport for New South Wales (TfNSW). The relevant TfNSW documents for sprayed bituminous surfacing Works are identified and referenced in these specifications. The sprayed bituminous surfacing Works must be carried out according to the referenced TfNSW specifications with the exception of items detailed in this Specification for sprayed bituminous surfacing Works. This applies to all sprayed bituminous surfacing Works, including materials supply (including mix design and materials testing), delivery, application, any trials, sampling and testing, and all Hold point and Witness point requirements. Where any differences in practice exist between the TfNSW specifications and this Specification for sprayed bituminous surfacing Works, the latter will prevail.

2.1.1 Scope

Sprayed bituminous surfacing (with cutback bitumen): To *TfNSW Specification R106*.

Sprayed bituminous surfacing (with polymer modified bitumen): To *TfNSW Specification R107*.

Microsurfacing: To *TfNSW Specification ATS-3450*.

Sprayed bituminous surfacing (with emulsified bitumen): To *TfNSW Specification R111*.

Cover aggregate for bituminous surfacing: To *TfNSW Specification 3151*.

2.2 Materials

Aggregates for sealing purposes: The PAFV for all aggregate shall not be less than 48.

Use of crumb rubber: Adopt the following requirements for the use of crumb rubber in sprayed bituminous surfacing:

(a) *TfNSW Specification 3252* for crumb rubber modified binders.

(b) *TfNSW Specification 3256* for the crumb rubber constituent material to be incorporated into a crumb rubber modified binder.

2.3 Execution

General: Clause 9 of *TfNSW Specification R106*, *TfNSW Specification R107* and *TfNSW Specification R111*, shall also include 5 mm and 7 mm aggregates in stone removal requirements.

The removal of loose stones is a **WITNESS POINT (WP4.10)**.

Warning signage: Areas where speed limits exceed 60 km/h and that are opened to traffic prior to final sweeping, must have temporary speed zone ‘loose stones’ and ‘slippery’ warning signs and temporary 60 km/h speed zoning in place until the maximum allowable loose aggregate requirement is met.

2.4 Completion

2.4.1 Submissions

Work as Executed Records: To *MITS 00B Quality Construction*.

Recycled materials: For any project in which recycled materials are incorporated into sprayed bituminous surfacing, the following are to be provided as part of the Works as Executed submission:

(a) Denotation on the pavement plans or pavement details showing where materials have been adopted that contain recycled content.

(b) Materials mix design information for the materials that contain recycled content.

3 Asphalt

3.1 General

Precedence: In many areas of road infrastructure construction and management, the ACT has adopted the relevant specifications of Transport for New South Wales (TfNSW). The relevant TfNSW documents for asphalt Works are identified and referenced in these specifications. The asphalt Works must be carried out according to the referenced TfNSW specifications with the exception of items detailed in this Specification for asphalt Works. This applies to all asphalt Works, including materials supply (including mix design and materials testing), delivery, placement, including paving and compaction, any construction of trial pavement, sampling and testing, and all Hold point and Witness point requirements. Where any differences in practice exist between the TfNSW specifications and this Specification for asphalt Works, the latter will prevail.

3.1.1 Scope

Light duty dense graded asphalt: Asphalt for municipal roads with traffic loading less than 10^7 ESA (equivalent standard axles) shall be constructed to *TfNSW Specification R117*.

Asphalt paths and maintenance access tracks: Asphalt for paths and maintenance access tracks shall be constructed to *TfNSW Specification R117* or *AS 2150*, but with the following supplemental amendments:

(a) A maximum RAP amount of 20% applies.

(b) Ride quality testing is not required.

(c) Surface shape: The surface of the asphalt wearing course should not deviate from the bottom of a 3 m long straightedge by more than:

  (i) 5 mm in the longitudinal direction

  (ii) 7 mm in the direction transverse to centreline.

(d) Spreading of asphalt shall be by self-propelled paving machine unless otherwise approved by the Authorised Person.

(e) In situ air voids testing not required.

(f) The compacted asphalt thickness of the wearing course must be between 3.0 to 5.0 times the nominal mix size. Where the Authorised Person deems by visual inspection that the asphalt thickness is non-compliant, the Authorised Person may request that testing for asphalt thickness be undertaken. Otherwise, testing of asphalt thickness is not required.

(g) Placed asphalt must be homogeneous in appearance, and must not exhibit segregation, cracking, ravelling, bony or fatty material, or have been damaged during construction.

Crack sealing: To *TfNSW Specification M211.*

Stone mastic asphalt: To *TfNSW Specification R121*.

Thin Open Graded Asphalt Surfacing (TOGAS): To *TfNSW Specification R123.*

Heavy duty dense graded asphalt: To *TfNSW Specification R116*.

Open graded asphalt: To *TfNSW Specification R119*.

High modulus asphalt (EME2): To *TfNSW Specification R126*.

Coloured surface coatings for bus lanes and cycle ways: To *TfNSW Specification R110*.

3.1.2 Recycled materials in asphalt

Reclaimed asphalt pavements (RAP): To: *TfNSW Specification R116, TfNSW Specification R117, TfNSW Specification 3153* and *TfNSW Technical Direction TD 00018:2021*.

Crumbed Rubber Asphalt: To:

(a) *TfNSW Specification R118* and *TfNSW Specification 3256* for the incorporation of crumb rubber using the 'dry method'.

(b) *TfNSW Specification 3252* and *TfNSW Specification 3256* for blended crumb rubber binders.

Recycled crushed glass[3]: To: T*fNSW Specification R116*, *TfNSW Specification R117*, *TfNSW Specification R118* and *TfNSW Specification 3154*.

Industrial slag: The use of industrial slags (steel furnace slags) as replacement for aggregates in the asphalt mix is to be in accordance with *TfNSW Specification R116*, *TfNSW Specification R117*, *TfNSW Specification R118* and *TfNSW Specification 3152*.

Added fillers for asphalt: The use of added fillers such as fly ash, cement works flue dust and ground limestone in the asphalt mix are to be adopted in accordance with *TfNSW Specification R116*, *TfNSW Specification R117*, *TfNSW Specification R118* and *TfNSW Specification 3211*.

Recycled plastics: As of the date of effect of this Specification, TfNSW specifications are silent on the use of recycled plastics or printer cartridge toner in asphalt mixes, and such asphalt mixes are not approved for use by TfNSW. Until such time that specifications are developed by TfNSW or other state jurisdictions, Roads ACT will allow the use of asphalt mixes containing recycled plastics for lightly trafficked roads (as defined below) subject to **Clause 3.1.3**. For heavily trafficked roads, the adoption of asphalt mixes containing recycled plastics will require formal approval by Roads ACT on a case-by-case basis – refer to **Annexure 2** for further details. Further context on the adoption of recycled plastics in asphalt is provided in **Annexure 1**.

3.1.2.1 Recycled materials in asphalt – grading conformity

Conformance criteria: Placed asphalt that is observed to contain recycled content that does not achieve particle grading requirements (e.g. recycled crushed glass with an aggregate diameter greater than 5 mm), shall be deemed as nonconforming.

Rectification: The nonconforming asphalt material shall be rectified by a hot-mix asphalt patch treatment as agreed by the Authorised Person. The minimum asphalt patch treatment dimensions shall be 1 m x 1 m and the longitudinal edge of the patch must not align with the wheel path.

[3] In TfNSW specifications, this is referred to as 'granulated glass aggregate'

3.1.3 Requirements for use of recycled plastics in asphalt

3.1.3.1 Design criteria

Design criteria: The requirements of **Clause 3.1.3** applies to asphalt mixes containing recycled plastics to be adopted for roads where the design traffic load is less than 1 x 10^6 ESA for a 20-year design life.

3.1.3.2 Mix design and performance requirements

General: In addition to the mix design submission requirements of *TfNSW Specification R117* or *TfNSW Specification R116*[4]*, Clause 2*, the following additional mix design and performance requirements are to be adhered to.

Maximum aggregate size: Recycled plastics must be of granular form having a maximum size of 6.7 mm using the sieve size analysis test method in *AS/NZS 2891.3.1* or *AS 1141.11.1* (dry method only).

Particle size distribution: The particle size distribution of the recycled plastic-modified aggregate mix must be similar to the equivalent conventional aggregate mix according to the following criteria, using the sieve size analysis test method in *AS 1141.11.1* (dry method only):

(a) Maximum 1.5% difference for each particular fraction.

(b) Maximum 4.0% difference in the total gradation.

Performance requirements: The following performance tests are to be undertaken for the nominated recycled plastic-modified asphalt mix in order to compare against the results of the same tests undertaken for the equivalent conventional asphalt mix:

(c) Compactability tests in accordance with the test methods outlined in *AS/NZS 2891.2.2*[5] and *AS/NZS 2891.9.2*. Tests are to be undertaken to measure air voids after 250 gyrations. Acceptance criteria for air voids is between 2.0% and 5.5%.

(d) Moisture sensitivity test in accordance with *Austroads AGPT/T232*. Tests are to be undertaken to measure tensile strength ratio (TSR). Acceptance criteria is minimum 80% TSR.

(e) Fatigue performance test in accordance with *Austroads AGPT/T274*. Tests are to be undertaken to measure micro strain level at 106 cycled to 50% of initial modulus. The strain value of the recycled plastic-modified asphalt mix is to be equivalent or greater than that of the conventional asphalt mix.

(f) One of the following:

  (i) Stability and flow test for Marshall compacted specimens in accordance with the test method in *AS/NZS 2891.5*[5]. Stability and flow results to be equivalent or improved upon than that of the conventional asphalt mix.

  (ii) Resilient modulus test in accordance with the test method in *AS/NZS 2891.13.1*. The resilient modulus is to be equivalent or greater than that of the conventional asphalt mix.

[4] Regardless of whether the mix design submission and production testing requirements of *TfNSW Specification R117* or *TfNSW Specification R116* are adopted, the mix design, performance and production testing requirements outlined in this Specification, including annexures, for the use of asphalt mixes containing recycled plastics on lightly trafficked roads, are to be adhered to.

[5] Standard temperatures in the applicable test methods do not apply as they are intended for specified grades of bitumen or polymer modified binder (PMB) intended for use in conventional asphalt. Recycled waste plastic modified binders or the addition of recycled waste plastic by the dry process will require laboratory compaction temperatures in excess of that used for C320 bitumen and likely in excess of the laboratory compaction temperature for some PMBs. Both *AS/NZS 2891.2.2* and *AS/NZS 2891.5* have an appendix to describe a process of how to determine an alternative compaction temperature.

3.1.3.3 Production testing requirements

Production testing: In addition to production tests outlined in *TfNSW Specification R117[4], Table R117/L.2* or *TfNSW Specification R116, Table R116/L.2[4]*, the asphalt manufacturer is to undertake the following tests:

(a) One of the following performance-based production tests:

  (i) Stability and flow test for Marshall compacted specimens in accordance with the test method in *AS/NZS 2891.5[5]*. Acceptance criteria: stability and flow results to be equivalent to results achieved as part of mix design submission. Minimum test frequency is one test per 1,000 tonnes of the approved asphalt mix.

  (ii) Resilient modulus test in accordance with the test method in *AS/NZS 2891.13.1*. Acceptance criteria: resilient modulus is to be equivalent or greater than the results achieved as part of mix design submission. Minimum test frequency is one test per 1,000 tonnes of the approved asphalt mix.

(b) Moisture content test for asphalt in accordance with *AS/NZS 2891.10*. Acceptance criteria is maximum 0.5%. Minimum test frequency is one test per day of plant production of the approved asphalt mix.

(c) Moisture sensitivity test in accordance with *AGPT/T232*. Acceptance criteria is minimum 80% TSR. Minimum test frequency is one test per 5,000 tonnes of the approved asphalt mix.

(d) Uniform coating of binder test in accordance with *AS/NZS 2891.11*. Acceptance criteria is minimum 95%. Minimum test frequency is one test per 5,000 tonnes of the approved asphalt mix.

3.1.3.4 Document management system

General: A manufacturer of an asphalt mix containing recycled plastic must maintain a documented management system which details how the asphalt manufacturer will manage processes for the manufacture, storage and transport of asphalt containing recycled waste plastic.

3.1.3.5 Mix design submission and approval

Submission: The submission of the above mix design and mix performance tests are to be provided to Roads ACT in the format as shown in Austroads Research Report *AP-R669-22, Table C 7*. All test records are also to be attached to the submission.

Approval: Once approval of a mix design incorporating recycled plastics is granted by Roads ACT, it can be adopted on lightly trafficked roads where the design traffic load is less than 1×10^6 ESA for a 20-year design life.

Variation to performance test requirements: Roads ACT may forego one or more of the performance tests if the asphalt manufacturer can demonstrate, with documentary evidence and appropriate test records, that the asphalt mix can achieve the required performance and the asphalt mix is approved for use by another state or territory jurisdiction of Australia.

Heavily trafficked roads: Refer to **Annexure 2** regarding the design submission and approval of an asphalt mix incorporating recycled plastics on moderately and heavily trafficked roads where the design traffic load is greater than 1×10^6 ESA.

3.1.3.6 Resource recovery exemption

EPA approval: The asphalt manufacturer is required to seek approval from Environment Protection Authority (EPA) for the use of recycled plastics in a proposed asphalt mix, or agreement from EPA that a 'resource recovery exemption' granted by the NSW Environment Protection Authority (NSW EPA) can be applied in the ACT.

Compliance: For recycled materials that are the subject of 'resource recovery exemptions' granted by the EPA or the NSW EPA, comply with the conditions attached to any exemption as a 'consumer', 'processor' or 'producer', as appropriate, and provide evidence demonstrating such compliance, including all record keeping requirements.

3.2 Materials

General: Unless specified otherwise, all binder shall be C450 for intermediate and base asphalt courses.

RAP: RAP is not permitted for use in stone mastic asphalt (SMA) or Thin Open Graded Asphalt Surfacing (TOGAS) mixes.

3.3 Completion

3.3.1 Submissions

Work as Executed Records: To *MITS 00B Quality Construction*.

Recycled materials: For any project in which recycled materials are incorporated into asphalt, the following are to be provided as part of the Works as Executed submission:

(a) Denotation on the pavement plans or pavement details showing where materials have been adopted that contain recycled content.

(b) Materials mix design information for the materials that contain recycled content.

4 Measurement and payment

4.1 Measurement

4.1.1 General

Payments made to the Bill of Quantities: To *MITS 00 Preliminaries*, this Specification, the drawings and **Clause 4.2**.

Scope: Measurement for payment will include all works shown on the plans or as specified but will not include asphalt lost in transit, works not shown on the plans and variations in quantities due to variations in actual thickness exceeding the specified tolerances.

4.1.2 Methodology

The following methodology will be applied for measurement and payment:

(a) Allow for all work, materials, testing and quality assurance requirements in each Pay item.

(b) Excavation and preparation of subgrade: To *MITS 02 Earthworks*.

(c) Kerb and gutter: To *MITS 06 Concrete Kerbs, Footpaths and Minor Works*.

(d) Miscellaneous minor concrete work not included in the Pay items in this Specification: To *MITS 06 Concrete Kerbs, Footpaths and Minor Works*.

4.2 Pay items

Table 4-10 Pay Items

Item No	Pay items	Unit of measurement	Schedule of rates scope
4.1	Base material	m^2 The area is determined by the area of work as measured by survey and specified on the drawings or as directed by the Authorised Person. A separate Pay item shall be allowed for each total relevant thickness shown on the drawings.	This Pay item shall include supply, spreading, compaction and trimming of base material at the specified moisture content. Take no account of allowable tolerances.
4.2	Subbase material	m^2 The area is determined by the area of work as measured by survey and specified on the drawings or as directed by the Authorised Person. A separate Pay item shall be allowed for each total relevant thickness shown on the drawings.	This Pay item shall include supply, spreading, compaction and trimming of subbase material at the specified moisture content. Take no account of allowable tolerances.

Item No	Pay items	Unit of measurement	Schedule of rates scope
4.3	Match to existing pavement	linear metre constructed	This Pay item shall include all works associated with matching granular pavement layers to the existing pavement as described in **Clause 1.4.6** or as shown on the drawings. This includes excavation and removal of the existing pavement, compaction, and trimming. The Pay item shall also include all plant, equipment, labour, supervision, material, transport, milling, and sawing or cutting costs, and for all incidentals for milling, cutting or sawing the asphalt/pavement layers in accordance with the drawings. Payment will not distinguish between various depths of sawing or cutting work, or pavement materials, irrespective of the number of separate cuts which may be required for sawing or cutting the layer to the required depth.
4.4	Supply and spray primer, primerbinder	litres measured at 15°C The quantities shall be determined by multiplying the target application rate of the combined mixture of all materials (including any field or refinery incorporated cutter or flux) by the area of road surface sprayed for each sprayer run.	This Pay item shall include preparation of the surface to be sprayed, including brooming where required, and supply, heating and spraying of primer and primerbinder. A separate Pay item shall be included in the Contract for each type of primer and primerbinder. For example: 4.4.1 AMC00 4.4.2 AMC0 4.4.3 Field cutback primer/primerbinder etc
4.5	Supply and spray binder	litres measured at 15°C The quantities shall be determined by multiplying the target application rate of binder by the area of road surface sprayed for each sprayer run. Measurement shall include bitumen used for tack coats as specified.	This Pay item shall include preparation of the surface to be sprayed, including brooming where required, adhesion agent where specified and supply, heating and spraying of bitumen. A separate Pay item shall be included in the Contract for each type of binder. For example: 4.5.1 Class 240 4.5.2 Class 450 etc
4.6	Supply, incorporate and spray cutter oil in binder	litres measured at 15°C The quantities shall be determined by multiplying the target application rate by the area of road surface sprayed for each sprayer run.	This Pay item shall include incorporation and mixing into a homogeneous blend of cutback bitumen.

Item No	Pay items	Unit of measurement	Schedule of rates scope
4.7	Supply, incorporate and spray flux oil in binder	litres measured at 15°C The quantities shall be determined by multiplying the target application rate by the area of road surface sprayed for each sprayer run.	This Pay item shall include incorporation and mixing into a homogeneous blend of cutback bitumen.
4.8	Supply, precoat, apply and incorporate aggregate	m^3 The volume is determined by the area of work as measured by survey and specified on the drawings or as directed by the Authorised Person, multiplied by the relevant design thickness shown on the drawings.	This Pay item shall include the supply, stockpiling as appropriate, precoating, spreading, rolling into the binder of precoated aggregate and removal of excess aggregate where appropriate. A separate Pay item shall be included in the Contract for each nominal size of aggregate, precoated as specified. For example: 4.8.1 10 mm aggregate (precoated) 4.8.2 14 mm aggregate (precoated)
4.9	Asphalt	tonnes The weight is determined by the area of work as measured by survey and specified on the drawings or as directed by the Authorised Person, multiplied by the relevant thickness shown on the drawings, multiplied by a density of 2.4 tonnes per m^3.	This Pay item shall include all operations involved in the supply, spreading and compaction of the asphalt. A separate Pay item shall be included in the Contract for each type of binder, nominal size of aggregate and application designation. For example: 4.9.1 AC-HD 10 Corrective Course 4.9.2 SMA 14 Wearing Course 4.9.3 FGG-A Wearing Course
4.10	Remove existing asphaltic concrete paving	m^2 The area is determined by the area of work as measured by survey and specified on the drawings or as directed by the Authorised Person, regardless of depth.	This Pay item includes the saw cutting of the asphaltic concrete paving irrespective of depth, removal of paving including underlying courses irrespective of depth and disposal of waste materials off site and payment of all fees for disposal to an approved landfill or recycling facility.
4.11	Mill existing pavement	m^2 The area is determined by the area of work as measured by survey and specified on the drawings or as directed by the Authorised Person, regardless of depth.	This Pay item shall include the milling of existing asphaltic concrete pavement and disposal of any waste materials off site, including payment of all fees for disposal to an approved landfill or recycling facility.

Item No	Pay items	Unit of measurement	Schedule of rates scope
4.12	Supply and lay geotextile fabric	m^2 of geotextile material installed, not including overlaps required at joints.	All activities associated with the construction of a geotextile liner, including the supply and installation of the nominated liner material to manufacturer specification. A separate Pay item shall be included in the Contract for each type of liner material.
4.13	Asphalt road humps	m^2 This area is determined by the total area of the humps, including the top platform, the departure ramps and the side slopes.	This Pay item shall include all activities associated with construction of asphalt road humps after removal or milling of existing asphalt pavement has taken place. This includes treatment of underlying existing granular base and underlying existing asphalt pavement surfaces, placement of asphalt pavement for the road hump, matching to existing asphalt pavement surface, treatment of transverse and longitudinal joints with heat applied bituminous joint sealing overbanding tape, and any required survey, sampling and testing to be undertaken. This Pay item excludes any removal or milling of existing pavement materials, which are covered by other Pay items. This Pay item excludes the placement or reinstatement of asphalt outside the extents of the hump, which is covered by Pay item 4.9.
4.14	Asphalt road cushions	m^2 This area is determined by the total area of the cushions, including the top platform, the departure ramps and the side slopes.	This Pay item shall include all activities associated with construction of asphalt road cushions after removal or milling of existing asphalt pavement has taken place. This includes treatment of underlying existing granular base and underlying existing asphalt pavement surfaces, placement of asphalt pavement for the road cushion, matching to existing asphalt pavement surface, treatment of transverse and longitudinal joints with heat applied bituminous joint sealing overbanding tape, and any required survey, sampling and testing to be undertaken. This Pay item excludes any removal or milling of existing pavement materials, which are covered by other Pay items. This Pay item excludes the placement or reinstatement of asphalt outside the extents of the cushion, which is covered by Pay item 4.9.

Item No	Pay items	Unit of measurement	Schedule of rates scope
4.15	Asphalt car park humps	Linear metre constructed The total linear metres of car park hump is determined by the total length of car park hump constructed.	This Pay item shall include all activities associated with construction of asphalt car park humps after removal or milling of existing asphalt pavement has taken place. This includes treatment of underlying existing granular base and underlying existing asphalt pavement surfaces, placement of asphalt pavement for the car park hump, matching to existing asphalt pavement surface, treatment of transverse and longitudinal joints with heat applied bituminous joint sealing overbanding tape, and any required survey, sampling and testing to be undertaken. This Pay item excludes any removal or milling of existing pavement materials, which are covered by other Pay items. This Pay item excludes the placement or reinstatement of asphalt outside the extents of the car park hump, which is covered by Pay item 4.9.

Annexure 1 – Additional context on recycled plastics in asphalt

Context

In September 2022, Austroads completed Austroads Project *APT6305* for the use of road-grade recycled plastics for sustainable asphalt pavements. This research was carried out by RMIT University and culminated in the completion of four research reports which can be downloaded from the Austroads website.

Prior to this, Austroads published the *Interim Guidelines for the Use of Recycled Waste Plastic in Local Government Road Surfacing Applications (AP-G96-21)* in July 2021. This was intended to provide interim guidance to local government agencies on the adoption of asphalt mixes containing recycled plastics on municipal streets, in lieu of the existence of any specification.

The research conducted as part of Austroads Project *APT6305* is expected to enable state and territory jurisdictions to develop specifications for the use of recycled plastics in asphalt. However, as of the date of this Specification, no state or territory jurisdiction of Australia has specifications in place for the use of recycled plastics in asphalt.

Until such time that a formal specification for use of recycled plastics in asphalt is developed, Roads ACT is taking a risk-based approach and its adoption will be permitted on lightly trafficked roads subject to the requirements of this Specification. For heavily trafficked roads, adoption of recycled plastics in asphalt will be reviewed on a case-by-case basis – refer to **Annexure 2** for details.

Roads ACT is monitoring the development of specifications for recycled plastics in asphalt by other major jurisdictions and will seek to incorporate such specifications into the Municipal Infrastructure Technical Specifications (MITS) at the appropriate time.

This Specification refers to the different methods of incorporating recycled plastics into an asphalt mix which are:

(a) Wet method, where recycled plastics in the form of either flakes, pellets, or powder is added into bitumen as a polymer to produce polymer-modified bitumen.

(b) Dry method, where plastics are added into the asphalt mix as a replacement for quarry aggregates.

(c) Mixed method, where low-melting point plastics are included into hot aggregates before the addition of hot bitumen to improve the binding properties between aggregates and bitumen.

Annexure 2 – Adoption of recycled plastics in asphalt for heavily trafficked roads

Mix design submission and approval

For the adoption of an asphalt mix containing recycled plastics on roads with design traffic loading greater than 1 x 10^6 ESA for a 20-year design life, Roads ACT will assess each proposed asphalt mix on a case-by-case basis via the products approval process.

The granting of approval, or conditional approval, of an asphalt mix by Roads ACT will require that the asphalt manufacturer submit the results of more stringent material property tests and performance tests. Roads ACT will also require evidence of its approval for use on higher trafficked roads by another state or territory jurisdiction such as TfNSW or DTP (Department of Transport and Planning, Victoria). The additional material property tests and performance tests to be undertaken are to be agreed with Roads ACT. Appendix B and Appendix C of Austroads Research Report *AP-R669-22* outlines the tests recommended by Austroads to be undertaken.