

Municipal Infrastructure Standard 03

Pavement Design

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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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	1.1.3.1	Applicable Australian Standards added		
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	All	General amendments to align with layout and structure of Municipal Infrastructure Standards documents, that are non-technical in nature		

Edition/Revision number	Section number	Description of revision	Authorised by	Date
	1.1.1.1	Scope and pavement types updated, including trunk road design requirements and expanded coverage of bound and stabilised pavements		
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	1.1.4	Minor update to guidance on proprietary products		
	1.1.5.2	Road and pavement definitions and pavement nomenclature updated, including removal of Upper Zone of Formation		
	2.1.1	Unsealed pavement terminology adopted and design requirements aligned with *AGPT06*		
	2.1.2	AGPT series added as a reference for pavement design variables		
	2.2.1	Subgrade assessment depth and guidance on subgrade variability updated		
	2.2.2	Annexure A established as the minimum requirements for geotechnical investigations		
	2.2.2.1	Subgrade CBR assessment requirements updated, including embankments, subsurface conditions and testing considerations		
	2.2.2.2	Requirement added to justify the selected design subgrade CBR		
	2.2.2.3	Section restructured and Upper Zone of Formation heading removed		
	2.2.3	Requirements added for amendments to pavement design during construction		
	2.2.4	Design requirements added for treatment of soft subgrades		
	2.2.5	Selected Material Zone design requirements added for municipal and trunk roads		
	2.3.1	Definitions and specification references updated for unbound, modified and recycled granular materials		

Edition/Revision number	Section number	Description of revision	Authorised by	Date
	2.3.2	Requirements expanded and updated for bound and stabilised pavement materials, including lightly bound pavement materials		
	2.3.3	Asphalt materials and modulus requirements updated, including crumb rubber asphalt and EME2		
	2.3.4	Concrete pavement design references and minimum compressive strength requirements updated		
	2.4	Design traffic loading section headings and scope updated for local access streets and other road classifications		
	2.4.1	Design traffic loading scope and descriptions updated		
	2.4.2	Presumptive design traffic loading limited to local access streets, and presumptive values for Collector Roads removed		
	2.4.3	High traffic pavement design references and threshold updated		
	2.4.4.1	Minimum design traffic loading requirements added for Collector Roads and bus routes		
	2.4.4.2	Pavement design life requirements updated for municipal and trunk roads		
	2.4.4.5	Heavy vehicle calculation methodology updated to exclude buses		
	2.4.4.6	Separate calculation of bus and other heavy vehicle traffic loading introduced		
	2.4.4.7	ESA parameters and traffic load distribution requirements updated for buses		
	2.4.4.8	Collector road design traffic calculation methodology added		
	2.4.6	Rigid pavement design traffic requirements updated for Collector Roads		
	3.1.1.1	Pavement extent requirements clarified and extended to splitter islands and paved medians		
	3.1.2	Primerseal terminology clarified		

Edition/Revision number	Section number	Description of revision	Authorised by	Date
	3.1.2.2	Shear-resistant pavement requirements clarified for roundabouts, braking, turning locations and locations where dynamic loads are applied		
	3.2.1	Sprayed seal design reference updated to *AGPT04K*		
	3.2.2	Asphalt surfacing types, thicknesses, binders and application requirements updated		
	3.2.2.1	Stone mastic asphalt pavement design and early skid resistance requirements added		
	3.3.1.1	Pavement thickness design requirements updated for municipal and trunk roads		
	3.3.1.2	TfNSW and Austroads design requirements added for pavements containing bound or stabilised layers		
	3.3.2	Concrete pavement standard drawings and construction specification references updated		
	3.4	Structural pavement rehabilitation scope, design life, assessment and treatment requirements added		
	4	Pavement construction specification references updated and TRIS/TRITS references removed		
	Annexure A	Minimum geotechnical investigation and soaked CBR testing requirements established (was previously specified as guidance)		
	Annexure B	Traffic load distribution tables added for electric buses and construction vehicles		

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.

Contents

Acknowledgement of Country v

1 Pavement design 1

1.1 General 1
1.1.1 Responsibilities 1
1.1.2 Cross references 2
1.1.3 Referenced documents 3
1.1.4 Standards 5
1.1.5 Interpretation 5

1.2 Pre-design planning 8
1.2.1 Consultation 8
1.2.2 Planning 8

2 Design criteria 9

2.1 Pavement 9
2.1.1 General 9
2.1.2 Design variables 9
2.1.3 Construction and maintenance 9

2.2 Subgrade evaluation 10
2.2.1 Design considerations 10
2.2.2 Geotechnical investigation 10
2.2.3 Amendments to pavement design during construction 11
2.2.4 Soft subgrades 12
2.2.5 Selected Material Zone 12

2.3 Materials 14
2.3.1 Unbound and modified granular materials 14
2.3.2 Bound materials 15
2.3.3 Asphalt materials 16
2.3.4 Concrete materials 16
2.3.5 Segmental pavers 16
2.3.6 Threshold treatments 17

2.4 Design traffic 17
2.4.1 General 17
2.4.2 Local access streets 17
2.4.3 Other land use zones 17
2.4.4 Other road classifications 18
2.4.5 Segmental pavements 20
2.4.6 Rigid pavements 20

3 Pavement Design 21

3.1 Pavement structure 21
3.1.1 General 21
3.1.2 Surfacing 21

3.2 Surface design 22
3.2.1 Sprayed bituminous seals 22
3.2.2 Asphalt 23
3.2.3 Segmental pavers 24

3.3 Pavement thickness design 24
3.3.1 Flexible pavements 24
3.3.2 Rigid pavements 26
3.3.3 Segmental pavers 26
3.3.4 Minimum pavement thickness 27

3.4 Structural rehabilitation of existing pavements 27

4 Documentation 29

Annexure A – Minimum requirements for geotechnical investigations 30

General 30

Annexure B – Traffic load data 31

Traffic load distribution tables for the E12 Electric Bus 31

Equivalent traffic load distribution from *AGPT02-17, Table O 2* 32

ESA and axle loads for typical fully loaded construction vehicles 33

List of tables

Table 3-1 Minimum residential design traffic for local access streets 17
Table 3-2 Asphalt surfacing 23
Table 3-3 Minimum requirements for geotechnical investigations 30
Table 3-4 Traffic load distribution for E12 Electric Buses 31
Table 3-5 Equivalent traffic load distribution for *AGPT02-17, Table O 2* 32
Table 3-6 ESA and axle loads for typical fully loaded construction vehicles 33

List of figures

Figure 3-1 Pavement nomenclature for embankments 7
Figure 3-2 Pavement nomenclature for cuttings 8
Figure 3-3 Example pavement structure design consisting of multiple pavement structure design options 12
Figure 3-4(a) Allowable practice for the use of natural in situ material as replacement for Select Material (Collector Roads) 13
Figure 3-4(b) Allowable practice for the use of natural in situ material as replacement for Select Material (local access roads) 14

1 Pavement design

1.1 General

1.1.1 Responsibilities

1.1.1.1 Objectives

General: Design of road pavements to meet the required design life, based on the subgrade strength, traffic loading, climatic conditions, environmental factors, and the selection of appropriate materials for subgrade, subbase, base and wearing surface.

Scope: Except where the scoping qualifier 'trunk roads' is used, this Standard applies to municipal roads in the ACT and does not apply to roads classified under the ACT Roads Hierarchy system as parkways, freeways, motorways, arterial roads, sub-arterial roads or to roads where the design traffic load is equal to or greater than 1×10^7 ESA (Equivalent Standard Axles) for the design life of the pavement.

Pavement types: The pavement types covered by this Standard are:

- Flexible granular pavements: Flexible pavements consisting of granular pavement materials with thin bituminous surfacing.
- Stabilised pavements: Flexible pavements that include one or more bound layers, created either in situ or in a plant.
- Deep lift DGA (dense graded asphalt) pavements: Flexible pavements consisting of predominantly asphaltic concrete layers.
- Segmental block pavements: Flexible pavements with segmental pavers surfacing.
- Concrete pavements: Rigid pavements in municipal areas such as bus stops.

Trunk roads: The design of road pavements for parkways, freeways, motorways, arterial roads, sub-arterial roads, and roads where the design traffic load is equal to or greater than 1×10^7 ESA, are to be designed in accordance with the following (listed in order of precedence):

(a) This Standard, only where the scoping qualifier 'trunk roads' is used;

(b) *TfNSW (RMS) Supplement to AGPT02* and all other applicable TfNSW supplements to Austroads Guide to Pavement Technology documents, TfNSW design standards and TfNSW Technical Directions; and

(c) *Austroads Guide to Pavement Technology (Set)*.

1.1.1.2 Precedence

Requirement: Where any document, except legislation or the *Territory Plan*, issued in conjunction with this Standard includes technical requirements that conflict with this Standard, the requirements of this Standard take precedence.

1.1.2 Cross references

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

1.1.2.1 ACT Legislation

Heavy Vehicle National Law (ACT)
Road Transport (General) Act (ACT)
Road Transport (Safety and Traffic Management) Act (ACT)
Road Transport (Safety and Traffic Management) Regulation (ACT)
Public Roads Act (ACT)
Public Unleased Land Act (ACT)
Territory Plan and General Codes (ACT)
Work Health and Safety Act (ACT)

1.1.2.2 Design Standards

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

MIS 04 Subsurface Drainage
MIS 05 Active Travel Facilities Design
MIS 07 Driveways
MIS 11 Off Street Parking
MIS 13 Traffic Control Devices

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

1.1.2.3 Technical Specifications

Requirement: The following Technical Specifications must be conformed to:

MITS 02 Earthworks
MITS 03 Underground Services
MITS 04 Flexible Pavements
MITS 07 Segmental Paving

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

1.1.2.4 TCCS Reference Documents

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

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.

1.1.2.5 Design Guides

General: The following Design Guides are related to this Standard:

Development Control Code for Best Practice Waste Management in the ACT (ACT No Waste)

1.1.3 Referenced documents[1]

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

1.1.3.1 Australian Standards

AS 1379	Specification and supply of concrete
AS/NZS 4455.2	Masonry units, pavers, flags and segmental retaining wall units: Part 2: Pavers and flags

1.1.3.2 Transport for New South Wales (TfNSW)

DS2012/001190	Pavement Standard Drawings – Rigid Pavement – Standard Details – Construction – Volume CC – Continuously Reinforced Concrete Pavement
DS2012/001191	Pavement Standard Drawings – Rigid Pavement – Standard Details – Construction – Volume CP – Plain Concrete Pavement
DS2014/005559	Pavement Standard Drawings – Rigid Pavement – Standard Details – Construction – Volume CJ – Jointed Reinforced Concrete Pavement

Roads and Maritime Supplement to Austroads Guide to Pavement Technology: Part 2: Pavement Structural Design (referred to as *'TfNSW (RMS) Supplement to AGPT02'* in this Standard)

TfNSW Supplement to Austroads Guide – Guide to Pavement Technology – Part 4F: Bituminous Binders (referred to as *'TfNSW Supplement to AGPT04F'* in this Standard)

TfNSW Supplement to Austroads Guide to Pavement Technology: Part 5: Pavement Evaluation and Treatment Design (referred to as '*TfNSW Supplement to AGPT05'* in this Standard)

Technical Direction – Pavements – PTD 2015/001 – Foamed Bitumen Stabilisation (referred to as *'TfNSW Technical Direction PTD 2015/001'* in this Standard)

TfNSW Specification R44	Earthworks
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 R83	Concrete Pavement Base

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

TfNSW Specification R106	Sprayed Bituminous Surfacing (with Cutback Bitumen)
TfNSW Specification R107	Sprayed Bituminous Surfacing (with Polymer Modified Binder)
TfNSW Specification R110	Coloured Surface Coatings for Bus Lanes and Cycleways
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 R126	High Modulus Asphalt (EME2)
TfNSW Specification 3051	Granular Pavement Base and Subbase Materials
TfNSW Specification 3071	Selected Material for Earthworks
TfNSW Specification 3151	Supply of Aggregate for Sprayed Seals
TfNSW Specification 3152	Aggregates for Asphalt

1.1.3.3 Other publications

Austroads

AGPT	Guide to Pavement Technology (Set)
AGPT01	Guide to Pavement Technology Part 1: Introduction to Pavement Technology
AGPT02	Guide to Pavement Technology Part 2: Pavement Structural Design
AGPT02-17	Guide to Pavement Technology Part 2: Pavement Structural Design (Edition 4.3, version 2017)
AGPT03	Guide to Pavement Technology Part 3: Pavement Surfacings
AGPT04A	Guide to Pavement Technology Part 4A: Granular Base and Subbase Materials
AGPT04C	Guide to Pavement Technology Part 4C: Materials for Concrete Road Pavements
AGPT04D	Guide to Pavement Technology Part 4D: Stabilised Materials
AGPT04F	Guide to Pavement Technology Part 4F: Bituminous Binders
AGPT04K	Guide to Pavement Technology Part 4K: Selection and Design of Sprayed Seals
AGPT04L	Guide to Pavement Technology Part 4L: Stabilising Binders
AGPT05	Guide to Pavement Technology Part 5: Pavement Evaluation and Treatment Design
AGPT06	Guide to Pavement Technology Part 6: Unsealed Pavements
AGPT07	Guide to Pavement Technology Part 7: Pavement Maintenance
AGPT08	Guide to Pavement Technology Part 8: Pavement Construction
AGRD	Guide to Road Design (Set)
AGRD01	Guide to Road Design Part 1: Objectives of Road Design
AGRD03	Guide to Road Design Part 3: Geometric Design
AP-C87	Austroads Glossary of Terms
AP-T85	Optimum Use of Granular Bases: Material Selection for Detailed Performance Evaluation

Queensland Department of Transport and Main Roads

Pavement Design Supplement: Supplement to 'Part 2: Pavement Structural Design' of the Austroads Guide to Pavement Technology (referred to as '*TMR Pavement Design Supplement*' in this Standard)

Technical Specification: Transport and Main Roads Specifications MRTS30 Asphalt Pavements (referred to as '*TMR MRTS30*' in this Standard)

Cement and Concrete Association of Australia

C&CAA T51 Guide to Residential Streets and Paths

Concrete Masonry Association of Australia

CMAA-PA02 Concrete Segmental Pavements – Design Guide for Residential Accessways and Roads

Clay Brick and Paver Industry Association (Think Brick Australia)

CBPI TBA1 Clay Paving Manual
CBPI Techniques 15 Design Considerations for Clay Paved Roadways

Institute of Public Works Engineering Australia (NSW Division)

Specification for Supply of Recycled Material for Pavements, Earthworks and Drainage

1.1.4 Standards

1.1.4.1 General

Road design: To *AGRD.*

Design considerations: To *AGRD01*.

Pavement structural design: To *AGPT02*.

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

1.1.5 Interpretation

1.1.5.1 Abbreviations

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

AADT	Annual Average Daily Traffic
ACT	Australian Capital Territory
ACTSD	ACT Standard Drawing
AS	Australian Standard
BRU	Beneficial Reuse
CED	City and Environment Directorate
CBR	California Bearing Ratio
DCP	Dynamic Cone Penetrometer
DGA	Dense Graded Asphalt
EME2	Enrobés à Module Elevé Class 2 (referred to as high modulus asphalt)
ESA	Equivalent Standard Axles
FGG	Fine Gap Graded
HVAG	Heavy Vehicle Axle Groups
MIS	Municipal Infrastructure Standard
MITS	Municipal Infrastructure Technical Specification

MRF	Modulus Reduction Factor
NZS	New Zealand Standard
PMB	Polymer Modified Binder
SMA	Stone Mastic 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)
VENM	Virgin Excavated Natural Material

1.1.5.2 Definitions

General: For the purposes of this Standard, 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:

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.

Concrete pavements: Rigid pavements in municipal areas such as bus stops.

Contract: The agreement between the Principal and the Contractor.

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

Deep lift DGA pavements: Flexible pavements consisting of predominantly asphaltic concrete layers.

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 *MITS 04 Flexible Pavements* (typically the subbase). Refer to **Figure 3-1** and **Figure 3-2**.

Flexible granular pavements: Flexible pavements consisting of granular pavement materials with thin bituminous surfacing.

Unsealed pavements: Flexible pavements consisting of granular pavement materials without dust free surfacing. Sometimes referred to as a gravel pavement.

Municipal road: All roads which become part of the public road system and are supplementary to parkways, freeways, motorways, arterial roads and sub-arterial roads. Municipal roads include Major Collector Roads, Minor Collector Roads, access streets and rear access lanes. For the purposes of this Standard, a road where the design traffic is less than 1×10^7 ESA is also considered to be a municipal road. Municipal roads' primary function is to provide access to leases/blocks.

Nominal kerb line: Also known as the nominal face of kerb, it is the location on the kerb, kerb and gutter or open concrete invert from which the road carriageway width is measured. Refer to *ACTSD-0101* and *ACTSD-0102* for actual location for each kerb type.

Path: A public access way for the movement of pedestrians, manually propelled vehicles and mobility scooters that is not located within a road.

Pavement: The portion of a carriageway placed above the Selected Material Zone constructed to *MITS 04 Flexible Pavements* 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 3-1** and **Figure 3-2**.

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.

Restricted Access Vehicles: Vehicles that exceed a dimension or mass limit under ACT road transport laws.

Restricted Access Vehicle routes: Approved routes for Restricted Access Vehicles which have been provided under ACT road transport laws.

Road reserve: The strip of public land between abutting property boundaries, specifically gazetted for the provision of public right of way. It includes the road carriageway, as well as paths, verges and landscape.

Segmental block pavements: Flexible pavements with segmental pavers surfacing.

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 *MITS 02B Bulk Earthworks*, *Clause 1.4.12*. Refer to **Figure 3-1** and **Figure 3-2**.

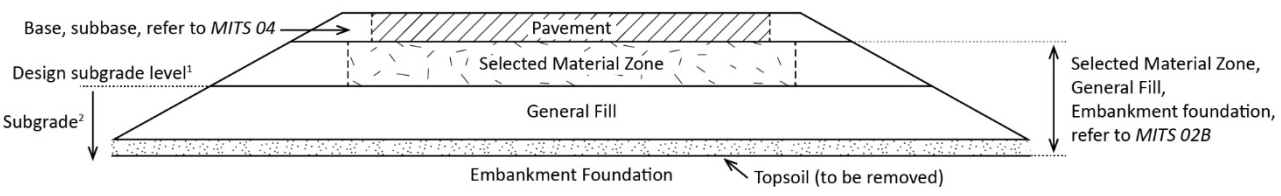
Stabilised pavements: Flexible pavements that include one or more bound layers, created either in situ or in a plant.

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 *MITS 04 Flexible Pavements*. Refer to **Figure 3-1** and **Figure 3-2**.

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 3-1** and **Figure 3-2**.

Trunk roads: All roads which become part of the public road system and are classified as parkways, freeways, motorways, arterial roads, sub-arterial roads or where the design traffic load is equal to or greater than 1 x 10^7 ESA.

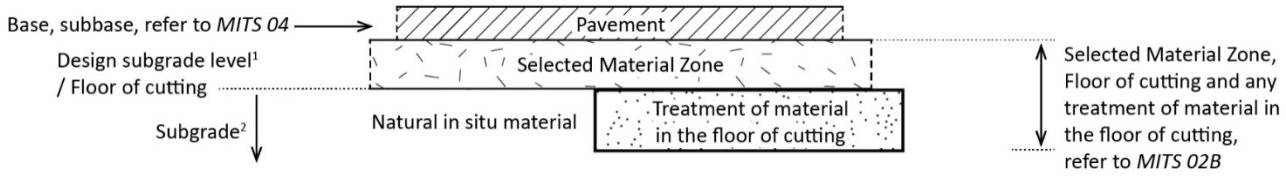
Works: The scope of works to be executed by the Contractor in accordance with the Contract.



[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 3-1 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 3-2 Pavement nomenclature for cuttings

1.2 Pre-design planning

1.2.1 Consultation

1.2.1.1 TCCS and other authorities

Requirements: Consult with TCCS and other relevant authorities during the preparation of design. In addition to the requirements of this Standard, identify the specific design requirements of these authorities.

1.2.1.2 Utilities services plans

Existing site conditions: Obtain plans from all relevant utilities and other organisations whose services, trees, important ecological habitats or other assets exist within the area of the proposed development. Plot this information on the relevant drawings, including the plan and cross sectional views. As a minimum, designs should refer to 'Before You Dig Australia' information that is readily available in most areas.

Responsibility: Confirm service plans' accuracy with on-site inspection and also potholing if deemed necessary. Protect existing assets to the satisfaction of asset owners.

Proposed new services: Detail any new services proposed or relocated as part of the proposed Works.

1.2.1.3 Safety in design

Requirement: Implement safety in design processes in accordance with the *Work Health and Safety Act*. Include consideration for the following:

- The potential for flooding.
- Traffic management.
- Stockpile location and stability.
- Identification and protection of existing services.
- Maintenance operations, including inspections and resurfacing.

1.2.2 Planning

1.2.2.1 Environment

The pavement design should consider relevant environmental factors in assessing the design subgrade strength and the choice of pavement and surfacing materials.

2 Design criteria

2.1 Pavement

2.1.1 General

Unsealed pavements: Flexible pavements consisting of granular pavement materials without dust free surfacing should be considered only for remote rural roads, minor access roads or temporary roads, in each case where access is via an existing unsealed road. Unsealed pavements to be designed in accordance with *AGPT06*.

2.1.2 Design variables

All proposed road pavements: Consider the following for urban and rural roads (refer *AGRD01* and *AGPT* for further details):

- Construction and maintenance considerations.
- Noise requirements (e.g. as specified in approved *Estate Development Plan*).
- Environmental factors such as moisture conditions.
- Subgrade evaluation.
- Pavement and surfacing materials.
- Design traffic.

2.1.3 Construction and maintenance

All proposed road pavements: Consider the following construction and maintenance factors for the type of pavement, choice of base and subbase materials, and the type of surfacing adopted:

- Documentation of joints incorporated in the design.
- Extent and type of drainage.
- Use of boxed or full width construction.
- Available equipment of the Contractor.
- Use of stabilisation.
- Dimensions of segmental paving units and layout of joints.
- Aesthetic, environmental and safety requirements.
- Social considerations, including retention of noise performance.
- Construction under traffic.
- Use of staged construction.
- Ongoing and long-term maintenance costs.

2.2 Subgrade evaluation

2.2.1 Design considerations

General: Subgrade condition and design parameters should be assessed from subsurface investigations. Geotechnical investigations and designs must consider the following factors:

- Sequence of earthworks construction.
- The compaction moisture content and field density specified for construction.
- In situ moisture content at the time of subgrade assessment.
- Moisture changes during service life.
- Susceptibility to flooding.
- Subgrade variability.
- The presence of, or otherwise weak layers below the design subgrade level particularly within the first 1,000 mm below the subgrade level.
- Stabilisation requirements.
- Dispersive soils and swell characteristics.
- Plasticity parameters.
- Salinity.

Subgrade variability: Subgrade CBR (California Bearing Ratio) testing of natural in situ material will yield variable results, and this shall be considered in the pavement design. For further detailed guidance, refer to *AGPT02, Section 5.3.1*.

2.2.2 Geotechnical investigation

General: Subsurface investigations shall be carried out by a suitably experienced geotechnical engineer in accordance with the minimum requirements for geotechnical investigations in **Annexure A**.

CBR samples: Unless otherwise directed by the pavement designer, all samples for CBR testing shall be compacted to 100% Standard Compaction and at Standard optimum moisture content, and tested after 4-day soaking under a 4.5 kg surcharge.

2.2.2.1 Assessment of subgrade CBR

General: Assessment of the design CBR shall be based on laboratory Soaked CBR values from relevant samples. Assessment of the design CBR below existing pavements should also take into account the results of the DCP (dynamic cone penetrometer) testing.

Selection of design subgrade CBR for pavement design purposes: The nominated design subgrade CBR for each pavement type in cut shall be equal to the characteristic CBR of the natural in situ material for the region. The characteristic subgrade CBR shall be:

(a) the minimum value of the measured CBR values from geotechnical investigations, or

(b) where the subgrade is homogenous and the coefficient of variation for measured CBR values is less than 0.25, the 10^{th} percentile of subgrade CBR values from geotechnical investigations can be adopted.

Selection of design subgrade CBR – embankments: For embankments where general fill is to be placed up to the design subgrade level, the designer shall nominate a design subgrade CBR value for each pavement type that considers the expected fill material that is likely to be available to the project.

Depth of investigation: The designer shall take into account the subsurface conditions for at least 1 m below anticipated subgrade level.

Subgrade CBR testing in poor drainage conditions: The designer shall assess whether the pavement will be subjected to very poor drainage conditions (e.g. floodways, excessive flooding for prolonged periods of time). The designer shall specify on the drawings that a 10-day soaked CBR test is to be adopted for construction phase subgrade CBR testing for roads with very poor drainage conditions.

Adoption of high subgrade CBR support conditions: If a subgrade CBR of 5% or above is nominated, the designer shall consider additional material testing requirements (for example a Plasticity Index test or CBR swell test) as part of construction verification testing of subgrade support conditions.

2.2.2.2 Presentation of results

Submission: Include a summary of all laboratory and field test results and assumptions and/or calculations made in the assessment of the design CBR for the cut and fill in the Pavement Design Report. Justification shall also be provided for the basis of selection of design subgrade CBR for each pavement type. Include the geotechnical investigation report in an appendix.

2.2.3 Amendments to pavement design during construction

Subgrade CBR testing during construction: Where no amendment to the pavement design is proposed, the purpose of subgrade laboratory Soaked CBR testing during construction is as follows:

(a) To verify the CBR of natural in situ material or general fill is equal to or greater than the nominated design subgrade CBR.

(b) To identify locations where CBR of natural in situ material or general fill is below the nominated design subgrade CBR, for which subgrade treatment is required. This includes replacement of unsuitable material and/or stabilisation of the material to improve CBR.

Except where permitted in *MITS 02B Bulk Earthworks, Clause 1.4.11.2* regarding the use of natural in situ material as replacement for Select Material in the Select Material Zone, laboratory soaked CBR testing of natural in situ material or general fill during construction is not to be undertaken to justify a reduced pavement thickness based on an amended higher design CBR value, unless an amendment to the pavement design is approved and certified by the pavement designer and the geotechnical engineer engaged as part of design.

Methodology for amendment to the pavement design during construction: Any amendments to the pavement design during the construction phase shall be based on geotechnical assessment conducted by the pavement designer responsible for the pavement design, and the geotechnical engineer engaged as part of design. Where construction phase laboratory soaked CBR testing of natural in situ material or General Fill is undertaken as justification to amend the pavement design, the designer shall comply with the requirements for assessment of subgrade CBR in **Section 2.2.2.1** and the minimum test frequency of *MITS 00B Quality Construction, Sub-annexure C1* (1 CBR test per 1,000 m^2, but not less than 3 CBR tests per lot).

Multiple pavement structure design options per road or region: A single pavement structure design based on a single nominated design subgrade CBR shall be adopted for any 100 m (minimum) road length, for the purposes of construction. Where a pavement designer has nominated multiple design subgrade CBR values,

like as is shown in **Figure 3-3**, with the intention that construction phase CBR testing of natural in situ material or General Fill is to be used to determine which pavement structure is to be adopted for construction, then the **Methodology for amendments to the pavement design during construction** in **Section 2.2.3** must be complied with.

PAVEMENT STRUCTURE DESIGN

CLASS	DESIGN TRAFFIC LOADING (ESA)	DESIGN SUBGRADE CBR	PAVEMENT STRUCTURE	
ACCESS STREET B	$3X10^5$	3%	40	AC 10
				PRIME
			120	DGB20
			340	DGS20
		7%	40	AC 10
				PRIME
			120	DGB20
			170	DGS20
		10%	40	AC 10
				PRIME
			120	DGB20
			140	DGS20

Figure 3-3 Example pavement structure design consisting of multiple pavement structure design options

2.2.4 Soft subgrades

General: Where soft subgrades are identified as part of geotechnical investigations, develop a design for treatment of soft subgrades in accordance with *TfNSW Supplement to AGPT02, Section 3.14.1* or *TMR Pavement Design Supplement, Section 3.14.1* and *Section 5.9*. Seek advice from a geotechnical engineer for the design of treatments for soft subgrades.

2.2.5 Selected Material Zone

General: For municipal roads, where the design includes a Selected Material Zone, the Select Material shall be one of the classifications specified in *MITS 02B Bulk Earthworks, Clause 1.4.12*. When adopting the mechanistic-empirical design procedure, the Select Material in the Selected Material Zone shall be assumed to have a vertical design modulus no greater than the following (whichever is lower):

(a) 10 times the CBR of the nominated Select Material, or

(b) 150 MPa.

Use of natural in situ material as replacement for Select Material: Where the design includes a Selected Material Zone, the designer must not incorporate notes or specification requirements which override the requirements of *MITS 02B Bulk Earthworks, Clause 1.4.11.2* regarding the permitted practice to use natural in situ material as replacement for Select Material in the Selected Material Zone. Refer to **Figure 3-4(a)** and

Figure 3-4(b) for a graphical depiction of this permitted practice and the requirements of *MITS 02B Bulk Earthworks*, *Clause 1.4.11.2* for Collector Roads and local access roads, respectively.

Trunk roads: The pavement design shall contain a 300 mm thick Selected Material Zone, with material properties in accordance with *TfNSW Specification R44*. When adopting the mechanistic-empirical design procedure, the Select Material in the Selected Material Zone shall be assumed to have a design vertical modulus no greater than 150 MPa, in accordance with *TfNSW (RMS) Supplement to AGPT02, Section 5.6*.

Trunk roads – substitution of the Selected Material Zone: At locations where the widening of existing pavements is proposed, the designer may substitute the 300 mm thick Selected Material Zone with a suitably agreed alternative under the following conditions:

(c) The presence of shallow utilities which restrict the placement of the Selected Material Zone.

(d) Where pavement excavation depths impose unreasonable restrictions on temporary traffic control requirements and vehicle access through the site.

(e) Other reasons as agreed with Roads ACT.

The inclusion of a 300 mm thick Selected Material Zone in the pavement structure mitigates risks associated with variable subgrade conditions. Where the 300 mm thick Selected Material Zone is to be substituted with a suitably agreed alternative, the pavement designer remains responsible for ensuring risks associated with variable subgrade conditions are mitigated, and that the resulting pavement structure meets design life requirements.

Trunk roads: The use of natural in situ material as replacement for Select Material in the Selected Material Zone (above the design subgrade level) is prohibited for parkways, freeways, motorways, arterial roads, sub-arterial roads and roads where the design traffic load is equal to or greater than 1 x 10^7 ESA.

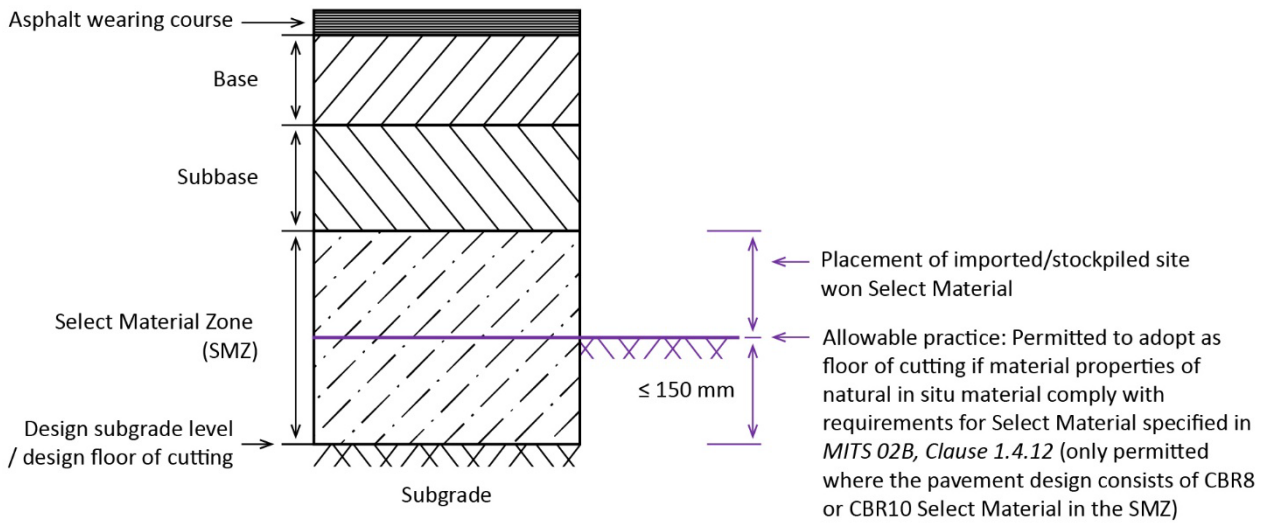


Figure 3-4(a) Allowable practice for the use of natural in situ material as replacement for Select Material (Collector Roads)

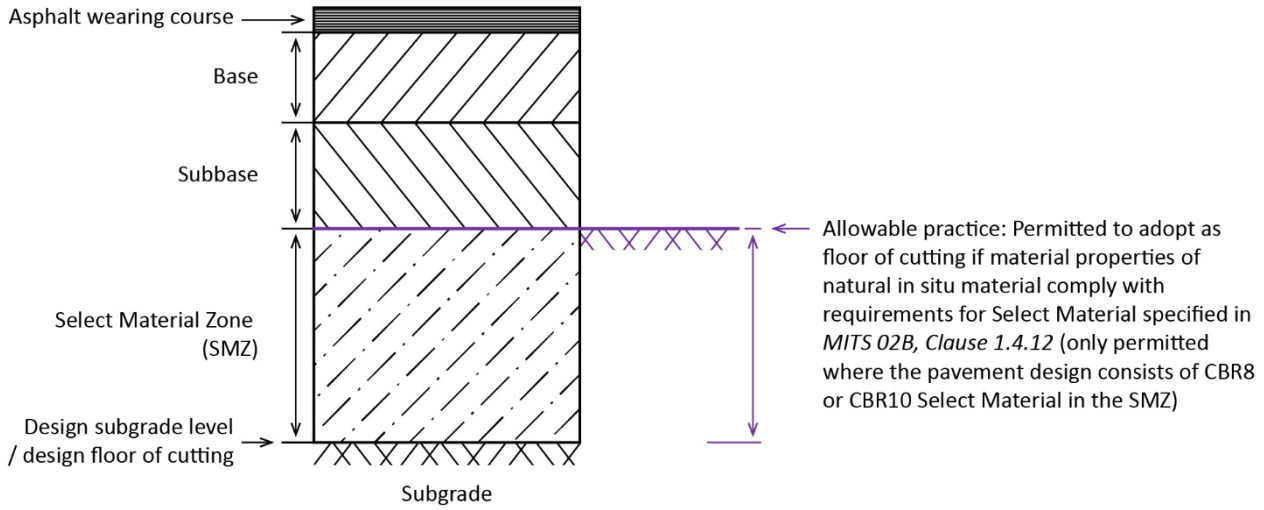


Figure 3-4(b) Allowable practice for the use of natural in situ material as replacement for Select Material (local access roads)

2.3 Materials

General: Select appropriate pavement and surfacing materials, types, layer thicknesses and configurations to ensure that the pavement performs to its design functions and requires minimal maintenance under the anticipated traffic loading for the design life adopted.

2.3.1 Unbound and modified granular materials

General (unbound granular materials): Unbound granular materials consist of gravels or crushed rocks which have a grading that makes them mechanically stable, workable and able to be compacted as defined in *AGPT02*.

General (modified granular materials): As defined in *AGPT02*, modified granular materials are granular materials to which small amounts of stabilising agents have been added to improve modulus or to correct other deficiencies in properties without causing a significant increase in tensile capacity. Modified materials have a maximum 28-day unconfined compressive strength of 1.0 MPa.

Material properties (unbound granular materials): To *MITS 04 Flexible Pavements*.

Material properties (modified granular materials): To *MITS 04 Flexible Pavements* and *TfNSW Specification R71*.

Mechanistic design: If mechanistic design is required, refer to *AGPT02, Table 6.1* for pavement material categories and design characteristics.

Recycled materials: Incorporate recycled materials to *MITS 04 Flexible Pavements*.

2.3.2 Bound materials

General: Bound materials for municipal roads are granular materials produced with the addition of a stabilisation binding agent to improve strength. Bound/stabilised materials generally have a 28-day unconfined compressive strength of above 2.0 MPa. The stabilisation binding agent should be:

- lime; or
- cement; or
- a slow setting cementitious material from a blend of cement, lime, fly ash or slag; or
- a bituminous binder, such as foamed bitumen or bitumen emulsion (foamed bitumen may include a supplementary binder, such as lime or cement).

Selection and pavement design: To *AGPT04D, TfNSW (RMS) Supplement to AGPT02, TfNSW Technical Direction PTD 2015/001* and *AGPT02*.

Bituminous binders: To:

(a) *TfNSW Supplement to AGPT04F*, *TfNSW Technical Direction PTD 2015/001* and all other applicable TfNSW supplements to Austroads Guide to Pavement Technology documents, design standards and Technical Directions;

(b) *AGPT04F, AGPT04L* and all other applicable Austroads guides and reports; and

(c) TfNSW specifications, including *TfNSW Specification R76*

Cementitious and lime stabilisation binders: To:

(d) *AGPT04L* and all other applicable Austroads guides and reports; and

(e) TfNSW specifications, including *TfNSW Specification R73* and *TfNSW Specification R75*.

Material properties: Design parameters and performance criteria for stabilised materials to be used for pavement design are given in *TfNSW (RMS) Supplement to AGPT02*, *TfNSW Technical Direction PTD 2015/001*, *AGPT02* and *AGPT04D.* Construction shall be to TfNSW specifications, including *TfNSW Specification R73*, *TfNSW Specification R75* and *TfNSW Specification R76*.

Trunk roads and municipal roads – lightly bound pavement materials – general: Lightly bound materials are granular materials with the addition of a small amount of cementitious binder to produce a lightly bound material with a 28-day unconfined compressive strength of between 1.0 MPa and 2.0 MPa. An upper limit of 2.0 MPa is specified to manage the risk of cracking and a lower limit of 1.0 MPa is specified to ensure sufficient strength is developed in the material to meet the load capacity intended through the pavement design. As of the date of publication of this Standard, TfNSW have not published any design standards or construction specifications for lightly bound materials and the use of lightly bound pavement materials has not been adopted on a project in ACT.

Trunk roads and municipal roads – lightly bound pavement materials – design: The designer shall adopt the design requirements of *TMR Pavement Design Supplement* for lightly bound material layers only, but not for other pavement layers which are to be designed in accordance with this Standard. The designer shall consider the adoption of TMR specifications for the construction of the lightly bound material layers, but not for other pavement layers which are to be constructed to *MITS 04 Flexible Pavements* and/or TfNSW specifications. Seek approval from Roads ACT where the adoption of a lightly bound material layer is proposed in the pavement design. Where lightly bound pavement materials are to be adopted in the pavement design, an appropriate mix design shall be developed, and a trial shall be undertaken to demonstrate that the required 28-day unconfined compressive strength of between 1.0 MPa and 2.0 MPa can be achieved.

2.3.3 Asphalt materials

General: For municipal road pavements, the binder is usually a standard bitumen product. The bitumen may be modified for special applications by the addition of specific polymers or foaming technologies.

Material designation: Asphalt types used in the ACT are identified as designated in *TfNSW Specifications R116, R117, R118, R119*, *R121* and *R126*. For asphalt mixes, excluding high modulus asphalt (EME2), this comprises two or three letters to identify the mix type followed by a number identifying the nominal maximum aggregate size in mm, as follows:

- Dense graded asphalt (e.g. AC14).
- Open graded asphalt (e.g. OG14).
- Stone mastic asphalt (e.g. SMA10).
- Fine gap graded asphalt (e.g. FGG07).
- Crumb rubber asphalt (e.g. CRA14).
- High modulus asphalt (EME2).

Dense graded asphalt: Note that both *TfNSW Specifications R116* and *R117* use the prefix 'AC' for dense graded asphalt mixes. However, the mixes are different. If both mixes are specified for a given project, then the drawings must be clear about where each specification applies.

Material properties: Design parameters and performance criteria for asphalt materials are given in *AGPT02.* The elastic modulus of asphalt shall be calculated using the requirements of *TfNSW (RMS) Supplement to AGPT02* and the latest version of the TfNSW (NSW Roads and Maritime Services) 'AC Modulus' software, available from TfNSW at Pavements@transport.nsw.gov.au or from City and Environment Directorate at CED.RoadStandards@act.gov.au.

Cold weather conditions: The designer shall consult with TCCS on proposed asphalt materials if the design is intended to be placed in winter.

2.3.4 Concrete materials

General: Concrete in municipal road applications is generally limited to specific applications such as bus stops or threshold pavements for access roads. These applications do not justify the use of non-standard concrete mixes. For concrete pavements which are expected to service higher traffic volumes or frequent heavy vehicle loads, refer to *TfNSW (RMS) Supplement to AGPT02*, *AGPT02* and all associated TfNSW standards and Austroads guidelines.

Material designation: Use 'N' class concrete as defined by *AS 1379*. A minimum compressive strength of 40 MPa should be specified for road pavements that will be trafficked by heavy vehicles.

Material properties: The maximum flexural strength for pavement design with N32 concrete is 4 MPa, in accordance with *AGPT02*. For higher strength concrete the maximum flexural strength for design is 0.7 times the square root of the compressive strength.

2.3.5 Segmental pavers

Requirement: Segmental pavers to *CMAA-PA02*, *CBPI TBA1* and *MITS 07 Segmental Paving*.

2.3.6 Threshold treatments

General: The use of a paving material other than asphaltic concrete as a treatment to differentiate road function is permitted. A reinforced concrete base will be required in accordance with this Standard. Shallow pattern stencilled concrete is preferred over segmental pavers; however, both treatments will be accepted.

2.4 Design traffic

2.4.1 General

Design methodology: Design traffic values in accordance with **Table 3-1** shall be applied for standard situations. However, these values do not cater for all situations, such as short-term heavy loading or unique vehicle loadings. The designer shall evaluate expected traffic loadings over the design life of the pavement and adopt the relevant design methodology:

- Local access streets: To **Section 2.4.2**.
- Other land use zones: To **Section 2.4.3**.
- Other road classifications: To **Section 2.4.4**.

2.4.2 Local access streets

Scope: This section applies only to local access streets not subject to loads from buses and not subject to short-term heavy loading such as from excessive construction vehicle loads due to nearby development or as described in *AGPT02, Section 12.7.1.*

Residential zones: Adopt **Table 3-1** for the design of flexible pavements for municipal roads for residential development and CZ5 zones.

Table 3-1 Minimum residential design traffic for local access streets

Street type	Design traffic for local access streets (20-year design period) (ESA)
Rear lanes	as for the connecting street
Access street Type A	6×10^4
Access street Type B	3×10^5

2.4.3 Other land use zones

Commercial zones (except Restricted Access Vehicle routes): The design traffic for minor road pavements in commercial zones shall be twice the design traffic listed in **Table 3-1** for the applicable street type.

Light Industrial Zones: The design traffic for minor road pavements in industrial zones shall be evaluated in accordance with the principles described in this Standard, but shall not be less than twice the design traffic listed in **Table 3-1** for the applicable street type.

Restricted Access Vehicle routes and General Industrial Zones: The design traffic shall be calculated in accordance with the procedures set out in **Section 2.4.4**. If the design traffic exceeds 1×10^7 ESA the pavement shall be designed and constructed in accordance with the requirements of *TfNSW (RMS) Supplement to AGPT02* and *AGPT02*.

Car parks: Allow for traffic load concentrations within car park areas, such as at entrances/exits. Refer to *MIS 07 Driveways* and *MIS 11 Off Street Parking*.

Paths: Paths shall be designed for at least 1,000 passes of a truck with gross vehicle mass of at least 10 tonnes. At designated vehicle crossings, increase the design traffic if applicable. Refer to *ACTSD-0501.*

2.4.4 Other road classifications

2.4.4.1 First-principle calculations

Scope: This section applies to all roads which are not local access streets in accordance with **Section 2.4.2**. For these roads the design traffic loads should be evaluated from first principles.

Minimum design traffic: Notwithstanding the requirements of this section, the design traffic loads described in **Section 2.4.2** shall be regarded as minimum values unless otherwise approved by TCCS. Notwithstanding the requirements of this section, the design traffic loads calculated from first principles for Collector Roads shall be no less than is 1×10^6 ESA.

Standard: *AGPT02, Section 7* covers detailed considerations of traffic design parameters and *AGPT02, Section 12* covers additional requirements for lightly trafficked pavements.

Bus loadings: All roads carrying buses must, as a minimum, have the pavement designed as for Collector Roads.

2.4.4.2 Minimum pavement design life

Criteria: The minimum design life for pavements is as follows:

- Collector Roads: 40 years.
- Deep lift or full depth asphalt pavements for all road categories: 40 years.
- All other pavements with lower classification than Collector Roads: 20 years.
- Notwithstanding the above requirements, the design life of an asphalt surfacing layer shall be 15 years.

Trunk roads: The minimum design life for pavements is as follows:

- Sub-arterial roads, arterial roads and highways/freeways: 40 years.
- Deep lift or full depth asphalt pavements for all road categories: 40 years.
- Notwithstanding the above requirements, the design life of an asphalt surfacing layer shall be 15 years.

In specific cases where directed, (e.g. some commercial or industrial areas), the type of pavement and appropriateness of the selected design life is to be confirmed with a 'whole of life' cost analysis.

2.4.4.3 Existing traffic

Traffic data: Existing traffic volumes and percentage heavy vehicles should be assessed from traffic counts if possible. Axle-pair counts from traffic signals can be obtained from the Traffic Signals Branch, TCCS. For the purpose of calculation of annual average daily traffic (AADT) from peak hour traffic volumes, it should be assumed that average AM + PM peak hour traffic volumes represent between 10% and 12% of AADT.

2.4.4.4 Growth rates

Criteria: The design growth rates should be selected based on results obtained from a traffic model calibrated for Canberra if applicable, on historical growth rates and on assessment of future demand.

2.4.4.5 Proportion of heavy vehicles

Criteria: The proportion of heavy vehicles (Austroads vehicle Classes 3 to 12), excluding buses, used for pavement design should be selected based on traffic classification counts on similar roads and assessment of demand. A minimum value of 3% should be adopted for proportion of heavy vehicles, excluding buses, unless data is available to indicate a lower value.

2.4.4.6 Design traffic volumes

Heavy vehicle traffic: The design heavy vehicle traffic, excluding buses, for the life of the road pavements should be calculated in accordance with *AGPT02, Section 12.7* (Calculation of design traffic volumes for lightly trafficked roads) and *AGPT02, Section 7* (Calculation of design traffic volumes approaching or exceeding 10^6 ESA). The heavy vehicle traffic should allow for construction traffic loads for adjacent developments.

AGPT02, Table 7.4 provides the values of cumulative growth factor for a range of annual growth rates and design periods.

Bus traffic: Bus traffic is to be calculated separately to heavy vehicle traffic for the purposes of calculating design traffic loading. Bus traffic shall be calculated based on expected or known bus service frequency information, in consultation with TCCS. The total design traffic loading is to be calculated as the summation of bus traffic loading and heavy vehicle traffic loading.

Trunk roads: Bus traffic is to be calculated separately to heavy vehicle traffic for the purposes of calculating design traffic loading. Bus traffic shall be calculated based on expected or known bus service frequency information, in consultation with TCCS. The total design traffic loading is to be calculated as the summation of bus traffic loading and heavy vehicle traffic loading.

2.4.4.7 Design traffic loads – Equivalent Standard Axles (ESA)

Heavy vehicle traffic: The design traffic load shall be calculated by multiplying the design total heavy vehicle traffic by the average ESA per heavy vehicle. Except for Collector Roads, the average ESA per heavy vehicle for pavements carrying mixed heavy vehicle traffic shall be not less than the following default values (to be used in the absence of other information):

- For average number of heavy vehicles per lane per day (averaged over the design life) – less than 16: 0.7 ESA per heavy vehicle.
- For average number of heavy vehicles per lane per day (averaged over the design life) – 16 or greater: 1.2 ESA per heavy vehicle.

The average ESA per heavy vehicle for pavements carrying predominantly one or two types of commercial or industrial heavy vehicle shall be determined for those vehicle types assuming they are fully loaded.

Bus traffic: The design traffic load for buses shall be calculated separately from heavy vehicle traffic, and shall be calculated by multiplying the design total bus traffic by the average ESA per bus of 3.74, with a traffic load distribution as listed in **Annexure B, Table 3-4**.

Trunk roads: The design traffic load for buses shall be calculated separately from heavy vehicle traffic, and shall be calculated by multiplying the design total bus traffic by the average ESA per bus of 3.74, with a traffic load distribution as listed in **Annexure B, Table 3-4**.

2.4.4.8 Design traffic – methodology for Collector Roads

All Collector Roads must be assumed to carry at least one bus route at a frequency applicable to the location.

The design traffic loads for Collector Roads must be calculated as the sum of four components:

(a) The load from buses for the design period, with an average ESA per bus of 3.74 and a traffic load distribution as listed in **Annexure B, Table 3-4**;

(b) The load from future construction traffic required to complete the estate, and all future stages of estate development, if applicable, assuming all heavy vehicles are fully loaded (refer **Annexure B, Table 3-6**);

(c) The load from construction traffic required to construct the expected dwellings or other facilities, assuming all heavy vehicles are full laden. A default value of 25% of the traffic applicable for item (b) may be adopted for estate development if the expected construction traffic is only to construct low-rise residential dwellings. For construction traffic for the construction of mid-rise and high-rise buildings, design traffic loading is to be calculated from first principles; and

(d) The load from the design traffic for the design period based on the in-service traffic model, based on an average ESA per heavy vehicle of 1.30 and traffic load distribution according to *AGPT02-17, Table O 2* or equivalent as listed in **Annexure B, Table 3-5**.

2.4.4.9 Presentation of results

Submission: Include a summary of all data sources, assumptions and results in the Pavement Design Report, and include the data and calculations in an appendix.

2.4.5 Segmental pavements

Segmental pavements: For interlocking concrete segmental pavements, the simplification of replacing ESAs with the number of heavy vehicles exceeding 3 tonne gross mass contained in *CMAA-PA02* is acceptable up to a design traffic of 10^6 ESA. Beyond this, calculate the design ESA from first principles as stated above.

2.4.6 Rigid pavements

Rigid pavements: For rigid pavements not on Collector Roads, calculate the number of heavy vehicle axle groups (HVAG) based on the ESA/HVAG data in *AGPT02, Table 12.2.*

3 Pavement Design

3.1 Pavement structure

3.1.1 General

3.1.1.1 Pavement extent

Pavement extent at edge of kerbs: The pavement structure (typically the subbase layer) shall extend a minimum of 75 mm behind the rear face of any kerb and/or channel (gutter). If a kerb or gutter is not provided, the pavement shall extend at least 0.5 m outside the edge line.

Pavement extent under splitter islands or paved medians: Continue full pavement structure, including subgrade, Select Material and granular base material, up to underside of asphalt surfacing layer for at least 600 mm behind the back of kerb at traffic islands and medians.

3.1.1.2 Drainage

Precautions: Make provision for pavement layer drainage on the assumption that during the service life of the pavement ingress of water will occur.

Standard: *MIS 04 Subsurface Drainage*.

3.1.2 Surfacing

3.1.2.1 General

Requirement: Streets shall have a bituminous wearing surface as follows except where the pavement is designed for concrete or segmental block surfacing:

(a) Urban residential streets: Prime coat, plus asphalt.

(b) Commercial and industrial streets: Prime coat, plus asphalt.

(c) Maintenance access tracks:

  (i) Prime coat, plus one or two coat sprayed seal; or

  (ii) Prime coat, plus asphalt.

  (d) Temporary surfaces:

  (iii) Prime, plus one or two coat sprayed seal; or

  (iv) Primerseal (also referred to as an initial seal in Austroads documentation).

Temporary protection: Where a primed surface is to be trafficked before the asphalt wearing course is applied, a primerseal shall be applied. Use prime plus seal where the surface is expected to be trafficked for more than 6 months.

3.1.2.2 Braking, turning and dynamic impact load zones

Surfacing requirements: For braking and turning zones the surfacing requirements are as follows:

(a) Roundabouts should have suitable pavements to resist shear loading. Therefore, deep lift asphalt pavement, full depth asphalt pavement or concrete pavement shall be adopted.

(b) For intersections and roundabouts where the design AADT > 3,000, PMB (polymer modified bitumen) should be used in the asphalt surfacing layer.

(c) Locations which require both braking and turning movements due to a sudden change in the horizontal alignment of the road, such as at chicanes or where horizontal deflection devices are installed, such as at slow points and at centre blister islands, should have suitable pavements to resist shear loading. Therefore, deep lift asphalt pavement, full depth asphalt pavement or concrete pavement shall be adopted. This does not include median treatments such as refuge island, unless vehicles are required to undertake both braking and turning movements due to a change in horizontal alignment of the road.

(d) Locations where dynamic impact vehicle loads are applied to the pavement, such as before and after vertical deflection devices, should have suitable pavements to resist dynamic impact vehicle loads. Therefore, deep lift asphalt pavement, full depth asphalt pavement or concrete pavement shall be adopted. Refer to *MIS 13 Traffic Control Devices, Section 2.9.5* for further detail.

3.2 Surface design

3.2.1 Sprayed bituminous seals

Standard: Sprayed bituminous seals, including primerseals, shall be designed in accordance with *AGPT04K*, as updated.

Criteria: Primerseals should be specified with the following nominal aggregate sizes:

- 5–7 mm size aggregate for traffic less than or equal to 200 vehicles per lane per day.
- 7–10 mm size aggregate for traffic more than 200 vehicles per lane per day.
- 10 mm aggregate for very hot and/or wet conditions and traffic more than 600 vehicles per lane per day.

Double/double seals, comprising a minimum of two coats binder and two coats of aggregate shall use 10 mm size aggregate for the first coat and 7 mm or 5 mm size aggregate for the second coat unless otherwise agreed by TCCS.

Single coat sprayed seals shall use 10 mm size aggregate.

Other seal types in accordance with *AGPT04K*, as updated, may be used subject to approval by TCCS.

3.2.2 Asphalt

Municipal roads: The following asphalt types shall be used unless specific conditions dictate otherwise:

Table 3-2 Asphalt surfacing

Road category	FGG07*	FGG10*	AC7*	AC10*	AC14*	SMA10
Paths****	✓	✓	✓	✓	X	X
Maintenance access tracks***	✓	✓	✓	✓	X	X
Rear lanes	✓	✓	✓	✓	X	X
Access roads	X	✓	X	✓	X	X
Collector Roads	X	X	X	✓**	✓**	X

✓ indicates acceptable

X indicates not acceptable

* indicates construction to *TfNSW Specification R117* where the design traffic load is less than 1 x 10^7 ESA. For asphalt paths and maintenance access tracks, refer to *MITS 04 Flexible Pavements*, *Clause 3.1.1* for specification requirements.

** Where the design traffic load is equal to or greater than 1 x 10^6 ESA ,the asphalt surfacing must be 45 mm thick AC14 with an A15E PMB over a prime and 10 mm spray seal.

*** For maintenance access tracks which are designed to service larger heavy vehicles (e.g. rural fire service trucks or heavy vehicles operated by utility authorities) or are on steep gradients, adopt AC10 asphalt surfacing.

**** Asphalt binder for paths shall be specified as C320 binder or lower classification.

Requirement: For Collector Roads or pavements subjected to high shear forces and/or high volumes of heavy vehicles (noting **Section 3.3.1.1 (b)** for flexible granular pavements, and **Section 3.1.2.2** for braking and turning zones), the minimum thickness and requirements of asphalt surfacing shall be:

- no less than 3 times the nominal maximum aggregate size of the specified asphalt material, and
- greater than or equal to 45 mm wearing course with A15E polymer modified binder.

Requirement (other municipal roads): For other municipal roads, the minimum thickness of asphalt surfacing shall be:

- no less than 3 times the nominal maximum aggregate size of the specified asphalt material, and
- greater than or equal to 30 mm.

The designer shall specify the following:

- FGG (fine gap graded) asphalt with AR450 binder must use a warm mix asphalt technology that gives improved workability in construction and must not be placed when the temperature conditions are less than required by *MITS 04 Flexible Pavements*.
- Dense graded asphalt with AR450 or polymer modified binder may use a warm mix asphalt technology that gives improved workability in construction when the temperature conditions are less than required by *MITS 04 Flexible Pavements* , subject to demonstration that specified compaction levels can be achieved.

Prime or Primerseal coats shall be indicated on the drawings below the asphalt surfacing.

3.2.2.1 Stone mastic asphalt

Trunk roads and municipal roads – design requirements: Where stone mastic asphalt (SMA) is proposed to be adopted as a wearing course, the following requirements are to be adhered to:

(a) SMA must not be adopted as a wearing course for a flexible granular pavement.

(b) A 10 mm PMB sprayed seal must be provided directly below the SMA wearing course.

(c) The design thickness of the SMA wearing course must be a minimum 40 mm for SMA10 and a minimum 50 mm for SMA14 (not including the thickness of the underlying sprayed seal).

Trunk roads – early skid resistance: Where SMA is proposed for roads with posted speed limit 80 kph or higher across intersections or other braking zones, the designer must assess the risk of reduced early skid resistance and propose a treatment for mitigating this risk. This shall include at least one of the following:

(d) Adoption of traffic controls during the first 3 months of opening to traffic, or until skid resistance meets appropriate levels, to reduce the posted speed limit to 60 kph or less across intersection and braking zones.

(e) Adoption of sand gritting to *TMR MRTS30* requirements with subsequent monitoring of surfacing functional requirements, including texture and skid resistance. The designer is to incorporate a monitoring regime into the construction specification to require such monitoring to occur during construction and after opening to traffic.

3.2.3 Segmental pavers

Requirement: Segmental pavers for roads or trafficked areas to *AS/NZS 4455.2* and *MITS 07 Segmental Paving*.

Edge restraint: Design the edges of all paving to be constrained by either kerbing and/or guttering, or by concrete edge strips.

3.3 Pavement thickness design

3.3.1 Flexible pavements

3.3.1.1 Unbound granular flexible pavements – Bituminous surfaced

Low design traffic: Design unbound granular flexible pavements with thin bituminous surfacings, including those with cement or lime modified granular materials, with design traffic up to 10^5 ESA to *AGPT02, Figure 12.2*. For the purpose of the pavement design, FGG asphalt and seals shall not be considered structural layers.

Moderate design traffic:

(a) For design traffic between 10^5 ESA and 10^6 ESA, design using *AGPT02, Figure 8.4*. For design traffic above 10^6 ESA, use *AGPT02, Figure 8.4* and the mechanistic design in accordance with the requirements of *AGPT02*.

(b) Unbound thickness of the base layer and the combined base plus subbase layers must be at least the thicknesses required by *AGPT02, Figure 8.4*. The thickness of the asphalt surfacing may be considered to contribute to the required total thickness over the subgrade but does not affect the required minimum thickness of granular base. Other surfacing types (such as sprayed seals) are considered to make no contribution to the required thickness of granular material.

(c) Unbound granular subbase must be incorporated into the pavement design. The thickness of the unbound granular subbase shall be in accordance with the pavement thickness design requirements of *AGPT02*, but shall be no less than 100 mm. Unbound granular base material can be adopted in the subbase layer of the pavement design, but shall be placed and compacted as a separate course to the overlying unbound granular base layer.

High design traffic: The following applies:

(d) Flexible granular pavements must not be used for a design traffic equal to or greater than 1×10^7 ESA.

(e) Flexible granular pavements for roads with a design traffic load equal to or greater than 1×10^6 ESA and less than 1×10^7 ESA must use AC14 asphalt surfacing 45 mm thick with an A15E PMB over a prime and 10 mm spray seal.

(f) Unbound thickness of the base layer and the combined base plus subbase layers must be at least the thicknesses required by *AGPT02, Figure 8.4*. The thickness of the asphalt surfacing may be considered to contribute to the required total thickness over the subgrade but does not affect the required minimum thickness of granular base. Other surfacing types (such as sprayed seals) are considered to make no contribution to the required thickness of granular material.

(g) Unbound granular subbase must be incorporated into the pavement design. The thickness of the unbound granular subbase shall be in accordance with the pavement thickness design requirements of *AGPT02*, but shall be no less than 100 mm. Unbound granular base material can be adopted in the subbase layer of the pavement design, but shall be placed and compacted as a separate course to the overlying unbound granular base layer.

(h) Flexible granular pavements with a design traffic load equal to or greater than 5×10^6 ESA and less than 1×10^7 ESA must be designed using a mechanistic-empirical method in accordance with the latest versions of *AGPT02* and the *TfNSW (RMS) Supplement to AGPT02*, and constructed in accordance with *TfNSW Specifications R71*, *R106* and *R117* (or *R116* if applicable) and referenced specifications.

Select Material: Select Materials, if required, must be specified in the Selected Material Zone in accordance with *MITS 02B Bulk Earthworks*, *Clause 1.4.12.*

Trunk roads: The following applies:

(i) Flexible granular pavements must not be used for a design traffic equal to or greater than 1×10^7 ESA.

(j) Flexible granular pavements for roads with a design traffic load equal to or greater than 1×10^6 ESA and less than 1×10^7 ESA must use AC14 asphalt surfacing 45 mm thick with an A15E PMB over a prime and 10 mm spray seal.

(k) Unbound thickness of the base layer and the combined base plus subbase layers must be at least the thicknesses required by *AGPT02, Figure 8.4*. The thickness of the asphalt surfacing may be considered to contribute to the required total thickness over the subgrade but does not affect the required minimum thickness of granular base. Other surfacing types (such as sprayed seals) are considered to make no contribution to the required thickness of granular material.

(l) Flexible granular pavements with a design traffic load equal to or greater than 5×10^6 ESA and less than 1×10^7 ESA must be designed using a mechanistic-empirical method in accordance with the latest versions of *AGPT02* and the *TfNSW (RMS) Supplement to AGPT02*, and constructed in accordance with *TfNSW Specifications R71*, *R106* and *R116* and referenced specifications.

3.3.1.2 Flexible pavements containing bound layers with asphalt surfacing

Mechanistic design: Design flexible pavements containing one or more bound layers, including cement stabilised layers or thick asphalt layers other than thin asphalt surfacings, using mechanistic design as set out in *AGPT02, Section 8.*

Design criteria: For mechanistic design of municipal roads, a project reliability of 95% shall be used unless otherwise specified by TCCS. Design shall also take account of the variation in asphalt modulus with heavy vehicle speed as set out *in AGPT02,* using a design speed of 20 km/hr less than the posted speed limit.

Requirement: The pavement thickness indicated on the drawings shall be at least 10 mm greater than the calculated thickness for thick asphalt pavements, or 20 mm greater for pavements containing cemented materials. The additional thickness shall be provided in the most critical layer for the design.

Stabilised materials: Pavements containing one or more stabilised material layers, as defined in **Section 2.3.2**, shall be designed in accordance with the requirements of **Section 2.3.2**.

3.3.2 Rigid pavements

Criteria: Design rigid (concrete) pavements with design traffic up to 10^6 HVAG to either *C&CAA-T51* or *AGPT02, Section 12.9.* For design traffic above 10^6 HVAG, design to *AGPT02, Section 9*.

The concrete base thickness indicated on the drawings shall be at least 10 mm greater than the calculated thickness. The designer must detail all joint types and locations on the drawings – refer *C&CAA-T51* or TfNSW Pavement Standard Drawings *DS2012/001190*, *DS2012/001191* and *DS2014/005559* which contain standard details for the construction of rigid pavements.

Specification: *TfNSW Specification R83* is not considered appropriate for rigid pavements in municipal roads with low traffic volumes. For municipal roads with low traffic volumes, construction should be specified to *MITS 10 Concrete for General Works*, but the designer is to assess the suitability of use of *MITS 10 Concrete for General Works* (for example, the use of fibre-reinforced concrete with macro synthetic fibres may not be suitable for concrete road pavements). The designer should also include extensive notes on the drawings relating to requirements for joints, surface finishes, tolerances, etc.

3.3.3 Segmental pavers

3.3.3.1 Concrete segmental pavements

Criteria: Design concrete segmental pavements with design traffic up to 10^6 estimated heavy vehicles exceeding 3 tonne gross mass to *CMAA-PA02.*

3.3.3.2 Clay segmental pavements

Criteria: Design clay segmental pavements with design traffic up to 10^6 ESAs to *CBPI TBA1* and *CBPI Techniques 15.*

3.3.4 Minimum pavement thickness

Requirement: Irrespective of the pavement thickness calculated in **Section 3.3.1.1**, the minimum pavement thickness, including the thickness of surfacings, is as follows:

(a) Roads with kerb and channel (gutter): 250 mm.

(b) Uncurbed roads: 200 mm.

(c) Car parks: 150 mm.

(d) Paths: 150 mm.

Subbase and base layers: Refer to minimum layer thickness in *MITS 04 Flexible Pavements*.

3.4 Structural rehabilitation of existing pavements

General guidance – trunk roads and municipal roads: Structural rehabilitation is concerned with restoring or increasing the pavement's structural capacity and remaining life. Treatments would generally be considered structural rehabilitation when it:

- addresses structural deficiencies in the existing pavement.
- requires pavement design to determine the required additional structural capacity.
- extends pavement life by restoring or increasing its ability to carry future traffic loads.

By contrast, treatments such as:

- resealing,
- asphalt resurfacing,
- crack sealing,
- minor patching, and
- surface corrections

are usually regarded as maintenance or functional rehabilitation, because they primarily restore surface characteristics rather than increase structural capacity.

Minimum pavement design life – trunk roads and municipal roads: Minimum pavement design life for structural rehabilitation of existing pavements is to be in accordance with **Section 2.4.4.2**. Where this is not deemed practical, undertake one or more of the following assessments to demonstrate that adoption of a reduced design life will result in better outcomes for the Territory, and seek approval from Roads ACT:

- Whole of life cost assessment to demonstrate minimised whole-of-life cost for the Territory.
- Traffic assessment to demonstrate unacceptable traffic impacts associated with structural rehabilitation treatments which adhere to the minimum design life requirements of **Section 2.4.4.2**.
- Any other type of assessment deemed acceptable to Roads ACT.

Design traffic – municipal roads: Comply with **Section 2.4**.

Design traffic – trunk roads: Comply with the following:

- **Section 2.4**, only where the scoping qualifier ‘trunk roads’ is used
- *TfNSW (RMS) Supplement to AGPT02*
- *AGPT02*.

Evaluation of existing pavements – trunk roads and municipal roads: Comply with *TfNSW Supplement to AGPT05* and *AGPT05* for investigation and evaluation of existing pavements.

Design of pavement rehabilitation treatments – municipal roads: Comply with *TfNSW Supplement to AGPT05* and *AGPT05* but with the following supplemental departures:

- The application of the modulus reduction factor (MRF) shall be in accordance with *AGPT05, Section 10.7.5*. The MRF requirements of *TfNSW Supplement to AGPT05, Section 10.7.5* do not apply.

Design of pavement rehabilitation treatments – trunk roads: Comply with *TfNSW Supplement to AGPT05* and *AGPT05*.

The surfacing type shall comply with noise requirements to the extent approved by TCCS. Ultra-thin asphalt or microsurfacing shall be acceptable as a resurfacing option subject to approval by TCCS.

4 Documentation

Requirements: Comply with TCCS *Reference Document 6 – Requirements for Design Acceptance Submissions*.

Construction specifications: Pavements for municipal roads designed under this Standard shall refer to *MITS 04 Flexible Pavements* for construction of flexible pavements, and *MITS 10 Concrete for General Works* or the relevant TfNSW specifications for construction of rigid pavements.

Trunk roads: Pavements for trunk roads shall refer to the relevant TfNSW specifications for construction specifications.

Where applicable, the following TfNSW specifications include annexures that must be completed by the pavement designer:

TfNSW Specification R44	Earthworks
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)
TfNSW Specification R110	Coloured Surface Coatings for Bus Lanes and Cycleways
TfNSW Specification R116	Heavy Duty Dense Graded Asphalt
TfNSW Specification R117	Light Duty Dense Graded Asphalt
TfNSW Specification R119	Open Graded Asphalt
TfNSW Specification R121	Stone Mastic Asphalt
TfNSW Specification 3051	Granular Pavement Base and Subbase Materials
TfNSW Specification 3071	Selected Material for Earthworks
TfNSW Specification 3151	Supply of Aggregate for Sprayed Seals
TfNSW Specification 3152	Aggregates for Asphalt

Annexure A – Minimum requirements for geotechnical investigations

General

General: The pavement design must be based on geotechnical investigations undertaken to the minimum requirements of **Table 3-3.** Note that additional investigation may be required for structures, site classification or other reasons.

Table 3-3 Minimum requirements for geotechnical investigations

Factors	Greenfield sites	Existing pavements
Subsurface investigation method	Backhoe or excavator test pits Large diameter augers (min 300 mm)	Diatube coring (asphalt and concrete) Auger (max 300 mm diameter) Test pits if directed
Investigation depth*	At least 1 m below anticipated subgrade level or existing surface, whichever is deeper	At least 1 m below existing pavement structure
Investigation spacing	Maximum 100 m intervals but can be adjusted by up to 20% for site-specific conditions (but no less than 2 per discrete area)	
Logging	Log every horizon; include sketch if horizon depth varies significantly	Scrape side of hole clean to measure horizon depths Measure surface thickness to nearest 5 mm
In situ investigations	As directed (e.g. in situ density)	Dynamic cone penetrometer (DCP)
Sampling	Bulk samples from likely subgrade or fill materials at every location	Sample granular and subgrade/fill; sample size will depend on investigation method
Sample testing frequency	As agreed between pavement designer and geotechnical engineer, but typically at least 50% of samples; must be sufficient to characterise range of subgrade and fill materials Soaked CBR testing must be undertaken at a sample test frequency of maximum 100 m intervals (but no less than 2 per discrete area)	
Laboratory testing	Soaked CBR Grading (by wet sieving) Atterberg Limits + Linear Shrinkage Emerson dispersion Other tests as relevant	Atterberg limits + Linear Shrinkage Moisture content (fill and subgrade) Soaked CBR (if adequate sample size) Aggregate grading (if adequate sample size) Other tests as relevant

* Investigation may be terminated at shallower depth if refusal on rock encountered; deepen investigation to practical extent while soft or wet conditions are encountered

Annexure B – Traffic load data

Traffic load distribution tables for the E12 Electric Bus

Table 3-4 provides the traffic load distribution applicable for the Yutong E12 Electric Buses that are currently part of the Transport Canberra bus fleet as of the date of publication of this Standard. The loads are based on an adopted average passenger loading of 100% capacity during one weekday peak period per day, 50% capacity at other times on weekdays and Saturdays, and 25% on Sundays. The relative number of assumed trips is based on present bus services in the Gungahlin district.

Table 3-4 Traffic load distribution for E12 Electric Buses

Axle group load (kN)	Axle group type	
	SAST %	SADT %
40	0.0000	0.0000
50	34.5516	0.0000
60	54.2752	0.0000
70	11.1733	0.0000
80	0.0000	2.1199
90	0.0000	53.0943
100	0.0000	21.7973
110	0.0000	22.6538
120	0.0000	0.3347
130	0.0000	0.0000
140	0.0000	0.0000
150	0.0000	0.0000
160	0.0000	0.0000
Total	**100.0000**	**100.0000**
Proportion of each axle group	0.5	0.5

Measure	Value
NHVAG	2.0
ESA/HVAG	1.87
ESA/HV	3.74

Equivalent traffic load distribution from *AGPT02-17, Table O 2*

The post construction, in-service traffic loading is based on the *Austroads Guide to Pavement Technology Part 2: Pavement Structural Design (AGPT02-17), Appendix O, Table O 2* for Collector Roads with no buses. Table O 2 has non-standard load values (i.e. not multiples of 10 kN) so **Table 3-5** is provided with the load frequencies adjusted to give the same ESA/HV with standard load values.

Table 3-5 Equivalent traffic load distribution for *AGPT02-17, Table O 2*

Axle group load (kN)	Axle group type		
	SAST %	SADT %	TADT %
20		11.3547	
30	14.4998	6.9213	9.5890
40	43.5421	14.5484	20.0277
50	35.5839	11.0550	
60	6.3741	8.7695	
70		16.8167	
80		21.6303	
90		8.9041	16.1282
100			6.1715
110			
120			
130			
140			15.4782
150			32.6054
160			
Total	100.0000	100.0000	100.0000
Proportion of each axle group	0.451	0.262	0.287

Measure	Value
NHVAG	2.22
ESA/HVAG	0.59
ESA/HV	1.30

ESA and axle loads for typical fully loaded construction vehicles

Table 3-6 shows the ESA and corresponding axle loads for fully loaded construction vehicles which are typically utilised for estate development works.

Table 3-6 ESA and axle loads for typical fully loaded construction vehicles

Axle Group Type	SAST (steer)	TAST (steer)	TADT	TRDT
Standard Load	5.40	9.07	13.76	18.55
Allowable Load	6.0	11.0	16.5	20.0
Full Load ESA	1.52	2.16	2.07	1.35

Truck Type	Gross Vehicle Mass	Typical Load Capacity	No of axle groups			Typical ESA
6-axle rigid truck + dog trailer	42.5	25–27	2		2	6.2
6-axle semitrailer	42.5	25	1		1	1 4.9
4-axle agitator	27.5	17		1	1	4.2

– All loads in tonnes

– Allowable load for TAST steer axle group assuming load sharing

– Allowable load in 3-axle dog trailer 20 tonnes to meet GVM limit