TWEED SHIRE COUNCIL

DEVELOPMENT DESIGN SPECIFICATION

D2

PAVEMENT DESIGN

VERSION 1.5

SPECIFICATION D2 – PAVEMENT DESIGN

CITATION

This document is named “Tweed Shire Council, Development Design Specification D2 - Pavement Design”.

ORIGIN OF DOCUMENT, COPYRIGHT

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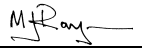
VERSIONS, D2 PAVEMENT DESIGN

VERSION	AMENDMENT DETAILS	CLAUSES AMENDED	DATE ISSUED (The new version takes effect from this date)	Authorised by the Director of Engineering Services
1.1	Original Version		1 July 2003	
1.2	Revise pavement and subgrade replacement material properties, correction to minimum pavement thickness, subsoil drainage and underground infrastructure treatment, clarify CBR testing requirements.	Cl D2.23; Table D2.2 and notes; Table D2.3 and notes; new Table D2.5	17 May 2006	
1.3	CBR testing requirements for subgrade evaluation Amend aggregate size for two-coat flush seals Update RMS, QDTMR and AUSTROADS publications to current versions Change reference to RTA to RMS	D2.06; Table D2.2 (notes); Table D2.5 D2.17; Table D2.3 D2.03; D2.07; D2.11; D2.13; D2.17 Table D2.2 (notes); Table D2.3 (notes)	11 September 2012	
1.4	Minimum pavement thickness for urban roads = 250mm	Table D2.2	2 January 2015	
1.5	Increase minimum pavement thickness to 300mm. Replace type 2.2 (CBR60) base course with type 2.1 (CBR80)	D2.10; Table D2.2; Table D2.3	24 August 2017	

DEVELOPMENT DESIGN SPECIFICATION D2

PAVEMENT DESIGN

GENERAL

D2.01 SCOPE

1. This specification sets out criteria for the design of subdivision and other road pavements and may also be applied to private roads, driveways, parking areas and right of way accesses. Design life is based on subgrade strength, traffic loading, environmental factors, and the selection of appropriate materials for select subgrade, selected fill, subbase, base and wearing surface.

Design Criteria

2. The Specification contains procedures for the design of the following forms of surfaced road pavement construction:

Surfaced Pavement Types

   (a) flexible pavements consisting of unbound granular or natural granular materials;

   (b) flexible pavements that contain one or more bound layers, including pavements containing asphalt layers other than thin asphalt wearing surfaces;

   (c) rigid pavements (i.e. cement concrete pavements);

   (d) The use of segmental block pavements is discouraged by Council. If it is proposed to incorporate segmental block pavements within the pavement design, prior express written approval is required from the Director of Engineering.

D2.02 OBJECTIVES

1. The objective in the design of the road pavement is to select appropriate pavement and surfacing materials, types, layer thicknesses and configurations to ensure that the pavement performs adequately and requires minimal maintenance under the anticipated traffic loading for a 25 year design life.

Pavement Performance

D2.03 REFERENCE AND SOURCE DOCUMENTS

(a) Council Specifications

D1	-	Road Design
D4	-	Subsurface Drainage Design
C242	-	Flexible Pavements
C244	-	Sprayed Bituminous Surfacing
C245	-	Asphaltic Concrete
C247	-	Mass Concrete Subbase
C248	-	Plain or Reinforced Concrete Base
C255	-	Bituminous Microsurfacing

(b) State Authorities

Roads and Traffic Authority, NSW - Sprayed Sealing Guide,1997

(c) Other

AUSTROADS - Guide to Pavement Technology

ARRB - Sealed Local Roads Manual, August, 2005.

CACA - T33 - Cement and Concrete Association, T33 - Concrete Street and Parking Area Pavement Design, 1984.

CACA - T35 - Cement and Concrete Association, T35 - Interlocking Concrete Road Pavements, A Guide to Design and Construction, 1986.

CACA - TN52 - Cement and Concrete Association, TN52 - Single-Lane Concrete Bus Bays, 1984.

QUEENSLAND DEPARTMENT OF TRANSPORT AND MAIN ROADS
- Pavement Design Manual, 2009
- Standard Specifications Roads

AS 1289 - Methods of soil testing for engineering purposes

(d) Standard Drawings that apply to this section:

PAVEMENT DESIGN CRITERIA

D2.04 DESIGN VARIABLES

1. Regardless of the type of road pavement proposed, the design of the pavement shall involve consideration of the following five input variables: ***Design Variables***

(a) Design Traffic

(b) Subgrade Evaluation

(c) Environment

(d) Pavement and Surfacing Materials

(e) Construction and Maintenance Considerations

D2.05 DESIGN TRAFFIC

1. The design traffic shall be calculated based on the following minimum design lives of pavement:- ***Minimum Pavement Design Life***

   (a) Flexible, Unbound Granular - 25 years

   (b) Flexible, Containing one or more bound layers - 25 years

   (c) Rigid (Concrete) - 40 years

   (d) Segmental Block - 25 years (If approval to use is granted by the Director of Engineering).

2. Design traffic shall be calculated in equivalent standard axles (ESAs) for the applicable design life of the pavement, taking into account present and predicted commercial traffic volumes, axle loadings and configurations, commercial traffic growth and street capacity. For new subdivisions, the design traffic shall take account of both the construction traffic associated with the subdivision development and the in-service traffic. ***Design Traffic***

3. The flexible pavement design shall be in accordance with the tables in section D2.23. The tables were made with reference to the following:- ***Flexible Pavement Design***

   (a) Queensland Transport, Pavement Design Manual, 2nd edition 1990, Chart 1.

   (b) Queensland Transport, Standard Specifications Roads, 3rd edition 1999.

   (c) ARRB - Sealed Local Roads Manual 1995, figures 10.3, 10.5

4. In general for rigid pavements, reference should be made to AUSTROADS Guide to Pavement Technology for the design. ***Rigid Pavement***

5. The traffic values (in ESAs) shown in Table D2.1 are to be used, but may be increased depending on the circumstances for the particular development whereupon other traffic data demonstrates that higher traffic volumes are expected. ***Design ESAs***

Street Type:		**Minimum Design ESA's - 25 year design life**
Urban Residential	- Laneways - Local Access - Neighbourhood Connector - Arterial/Distributor	1.5×10^4 3.7×10^4 7.5×10^5 1.5×10^6
Rural	- Class A - Class B - Class C - Class D - Arterial	6.65×10^5 1.11×10^5 4.44×10^5 8.87×10^5 2.22×10^6
Commercial and Industrial		1.5×10^6

Table D2.1

D2.06 SUBGRADE EVALUATION

1. Except where a mechanistic design approach is employed using AUSTROADS Guide to Pavement Technology, the measure of subgrade support shall be the California Bearing Ratio (CBR), with testing undertaken in accordance with AS 1289. Where a mechanistic design approach using linear elastic theory is employed for flexible pavements, the measure of subgrade support shall be in terms of the elastic parameters (modulus, Poisson's ratio). ***California Bearing Ratio***

2. The following factors must be considered in determining the design strength/stiffness of the subgrade: ***Design Considerations***

   (a) Sequence of earthworks construction

   (b) The compaction moisture content and field density specified for construction

   (c) Moisture changes during service life

   (d) Subgrade variability

   (e) The presence or otherwise of weak layers below the design subgrade level.

3. The subgrade Design CBR adopted for the pavement design must consider the effect of moisture changes in the pavement and subgrade during the service life, and hence consideration must be given to the provision of subsurface drainage in the estimation of equilibrium in-situ CBRs, and hence in the design of the pavement structure. Warrants for the provision of subsurface drainage are given in Specification for SUBSURFACE DRAINAGE DESIGN. If subsurface drainage is not provided, then the Design CBR adopted must allow for a greater variability in subgrade moisture content during the service life of the pavement, and hence a Design Moisture Content above the Optimum Moisture Content. ***Design CBR***

4. The calculation of the Design CBR shall be based on a minimum of three 4 day soaked CBR laboratory samples for each subgrade area, compacted to the relative density specified for construction, and corrected to allow for the effects of subsurface drainage (or lack of), climatic zone, and soil type if appropriate (as per the guidelines in ARRB SR41) to give an estimated equilibrium in-situ CBR. The Design CBR for each subgrade area is computed by using the appropriate formulae as follows: ***Calculation of Design CBR***

   Design CBR = Least of estimated equilibrium CBRs, for less than five (5) results

   Design CBR = 10th percentile of all estimated equilibrium CBRS, for five (5) or more results

   = C - 1.3S

   Where C is the mean of all estimated equilibrium CBRs, and
   S is the standard deviation of all values.

5. Where practicable, the Design CBR obtained from laboratory testing should be confirmed by testing performed on existing road pavements near to the job site under equivalent conditions and displaying similar subgrades. ***Field Confirmation***

6. The pavement design shall include a summary of all laboratory and field test results and assumptions and/or calculations made in the assessment of Design CBR. ***Summary of Results***

7. CBR testing shall be undertaken within the natural soil a minimum of 500mm below the expected pavement thickness. Where replacement material has been placed no additional CBR testing is required for replacement thickness of less than 500mm. This replacement material shall not be considered to reduce the pavement

thickness as specified in Table D2.2. Replacement material greater than 500mm in depth shall be subject to additional CBR testing in accordance with Table D2.5 and may be included in the design strength of the pavement having regard for the CBR results of the natural subgrade.

D2.07 ENVIRONMENT

1. The environmental factors which significantly affect pavement performance are moisture and temperature. Both of these factors must be considered at the design stage of the pavement. Reference should be made to AUSTROADS Guide to Pavement Technology and to ARRB-SR41. ***Reference***

2. The following factors relating to moisture environment must be considered in determining the design subgrade strength/stiffness and in the choice of pavement and surfacing materials:

   (a) Rainfall/evaporation pattern

   (b) Permeability of wearing surface

   (c) Depth of water table

   (d) Relative permeability of pavement layers

   (e) Whether shoulders are sealed or not

   (f) Pavement type (boxed or full width)

3. The effect of changes in moisture content on the strength/stiffness of the subgrade shall be taken into account by evaluating the design subgrade strength parameters (i.e. CBR or modulus) at the highest moisture content likely to occur during the design life, i.e. the Design Moisture Content. The provision of subsurface drainage may, under certain circumstances, allow a lower Design Moisture Content, and hence generally higher Design CBR. ***Evaluate Design CBR***

4. The effect of changes in temperature environment must be considered in the design of pavements with asphalt wearing surfaces, particularly if traffic loading occurs at night when temperatures are low, thus causing a potential reduction in the fatigue life of thin asphalt surfacing. The effect of changes in temperature environment should also be considered for bound or concrete layers. ***Temperature Change***

5. The pavement design shall include all considerations for environmental factors, and any assumptions made that would reduce or increase design subgrade strength, or affect the choice of pavement and surfacing materials.

D2.08 PAVEMENT AND SURFACING MATERIALS

1. Pavement materials can be classified into essentially six categories according to their fundamental behaviour under the effects of applied loadings: ***Pavement Classification***

   (a) Unbound granular materials, including modified granular materials

   (b) Bound (cemented) granular materials

   (c) Asphaltic Concrete

   (d) Cement Concrete

   (e) Unbound natural granular materials

   (f) Stabilised materials

2. Surfacing materials can also be classified into essentially four categories or types:- ***Surfacing Classification***

   (a) Sprayed bituminous seals (flush seals)

   (b) Asphaltic concrete and bituminous microsurfacing (cold overlay)

   (c) Cement Concrete

   (d) Segmental Pavers – Use discouraged by Council.

3. Unbound granular or natural granular materials, including modified granular materials, shall satisfy the requirements of the Construction Specification for FLEXIBLE PAVEMENTS C242. ***C242***

4. Bound (cemented) granular materials shall satisfy the requirements of the Construction Specification for FLEXIBLE PAVEMENTS.

5. Asphaltic concrete shall satisfy the requirements of the Construction Specification for ASPHALTIC CONCRETE.

6. Cement concrete shall satisfy the requirements of the Construction Specifications for MASS CONCRETE SUBBASE, PLAIN OR REINFORCED CONCRETE BASE, or FIBRE REINFORCED CONCRETE, as appropriate.

7. Sprayed bituminous seals shall satisfy the requirements of the Construction Specification for SPRAYED BITUMINOUS SURFACING.

8. Bituminous microsurfacing (cold overlay) shall satisfy the requirements of the Construction Specification for BITUMINOUS MICROSURFACING.

9. Stabilised pavement materials shall conform to the Construction Specification C241 requirements. The designer shall complete Annexure C241A and this completed annexure shall be submitted with the construction certificate application unless otherwise agreed by Council.

D2.09 CONSTRUCTION AND MAINTENANCE CONSIDERATIONS

1. The type of pavement, choice of base and subbase materials, and the type of surfacing adopted should involve consideration of various construction and maintenance factors as follows:

   (a) Extent and type of drainage

   (b) Use of boxed or full width construction

   (c) Available equipment of the Subdivider

   (d) Use of stabilisation

   (e) Aesthetic, environmental and safety requirements

   (f) Social considerations

   (g) Construction under traffic

   (h) Use of staged construction

   (i) Ongoing and long-term maintenance costs

These factors are further discussed in AUSTROADS Guide to Pavement Technology.

PAVEMENT THICKNESS DESIGN

D2.10 PAVEMENT STRUCTURE - GENERAL

1. The pavement thickness, including the thickness of surfacings, shall not be less than 300mm for all roads

Minimum Pavement Thickness

2. Notwithstanding subgrade testing and subsequent pavement thickness design, the thickness of subbase and base layers shall not be less than the following:-

   (a) Flexible pavement:
   - Subbase 150mm,
   - Base 150mm

   (b) Rigid pavement:
   - Subbase 100mm,
   - Base - 190mm for continuously reinforced pavements and
     - 150mm for jointed pavements, including steel-fibre reinforced concrete.

3. The subbase layer shall extend a minimum of 150mm behind the rear face of any kerbing and/or guttering.

Subbase Extent

4. The base and surfacing shall extend to the lip of any kerbing and/or guttering. Where the top surface of the subbase layer is below the level of the underside of the kerbing and/or guttering, the base layer shall also extend a minimum of 150mm behind the rear of the kerbing and/or guttering.

Base Extent

5. For unkerbed roads, the subbase and base layers shall extend at least to the nominated width of shoulder.

Unkerbed Roads

6. The pavement designer shall make specific allowance for traffic load concentrations within carpark areas (eg entrances/exits).

Carparks

D2.11 UNBOUND GRANULAR FLEXIBLE PAVEMENTS (BITUMINOUS SURFACED)

1. Unbound natural granular flexible pavements with thin bituminous surfacings, including those with cement or lime modified granular materials, with design traffic up to 2.22×10^6 ESAs shall be designed in accordance with section D2.23.

2. For design traffic above 2.22×10^6 ESAs, the design shall be in accordance with Queensland Department of Transport and Main Roads Pavement Design Manual, 2009.

D2.12 FLEXIBLE PAVEMENTS CONTAINING BOUND LAYERS (BITUMINOUS SURFACED)

1. Flexible pavements containing one or more bound layers, including cement, lime, stabilised layers or asphaltic concrete layers other than thin asphalt surfacings, shall be designed in accordance with section D2.23.

2. Bound layers may be assumed to be equivalent to unbound layers of the same thickness, and the pavement designed in accordance with section D2.23.

D2.13 RIGID PAVEMENTS

1. Rigid (concrete) pavements shall be designed in accordance with either CACA -T33 or AUSTROADS Guide to Pavement Technology. ***Rigid (Concrete)***

2. Single lane concrete bus bays adjacent to a flexible pavement shall be designed in accordance with CACA -TN52.

D2.14 SEGMENTAL BLOCK PAVEMENTS

1. Approval must be obtained in writing from the Director of Engineering Services prior to the Subdivider incorporating Concrete Segmental Block Pavers in the proposed Pavement Design. ***Segmental Block Pavers***

   Where written approval to use segmented pavers is granted by the Director of Engineering Services, the pavers must be laid either on a reinforced concrete sub-base as directed by Council.

D2.15 RESERVE

SURFACING DESIGN

D2.16 CHOICE OF SURFACE TYPE (NEW ROADS IN URBAN / RURAL-RESIDENTIAL SUBDIVISIONS)

1. Except where the pavement is designed for concrete or segmental block surfacing (provided written approval to use segmented pavers has been granted by the Director of Engineering Services), the wearing surface shall be a bituminous wearing surface of primer seal plus asphalt. Widening work shall be consistent with the existing road surfacing. ***Bitumen Wearing Surface***

2. At intersection approaches and cul-de-sac turning circles on residential streets with flush seals, either bituminous microsurfacing or asphalt surfacing shall be provided within the vehicle braking and turning zones. ***Braking and Turning Zones***

3. Variations to these requirements may be approved by Council in special circumstances. ***Approval***

D2.17 SPRAYED BITUMINOUS SEALS (FLUSH SEALS)

1. The design of sprayed bituminous (flush) seals, including primer seals, shall be in accordance with the AUSTROADS Guide to Pavement Technology. ***Seal Design***

2. Two-coat flush seals shall be double-double seals, comprising a minimum of two coats binder and two coats of aggregate. The preferred seal types are: ***Two- Coat Flush Seals***

1st coat	14mm
2nd coat	7mm

3. Single coat flush seals shall be allowable if bituminous microsurfacing (or asphaltic concrete) is to be applied as the finished surface. The preferred seal type is either 7mm or 10mm. ***Single Coat Flush Seal***

D2.18 BITUMINOUS MICROSURFACING (COLD OVERLAY)

1. Bituminous microsurfacing, also referred to as 'cold overlay', shall be designed to provide a nominal compacted thickness of not less than 12mm. ***Minimum Thickness***

2. As a minimum, a 7mm primer seal and a single coat flush seal shall be indicated on the Design Plans below the bituminous microsurfacing. ***Primer Seal and Single Coat Seal***

D2.19 ASPHALTIC CONCRETE

1. In light to medium trafficked residential, rural or commercial streets (design traffic up to approximately 3 x 10^5 ESAs), the asphalt mix design shall be "a fine gapped graded mix" in accordance with the Construction Specification for ASPHALTIC CONCRETE – C245. ***Light to Medium Traffic***

2. In medium to heavily trafficked residential, rural or commercial roads and in all industrial and classified roads, the asphalt mix design shall be a dense graded mix in accordance with the Construction Specification for ASPHALTIC CONCRETE. ***Medium to Heavy Traffic***

3. Asphaltic concrete surfacings shall be designed to provide a nominal compacted layer thickness of not less than 25mm on light to medium trafficked residential, rural and commercial streets, and 50mm on medium to heavily trafficked residential, rural or commercial roads and on all industrial and classified roads. ***Minimum Thickness***

4. A 7mm or 10mm primer seal is mandatory on all roads to be asphalt surfaced and shall be indicated on the Design Plans below the asphalt surfacing. A tack coat in the order of 0.2 litres of residual bitumen per square metre must be applied prior to the laying of the asphalt and shall be indicated on the Design Plans. ***Primer Seal***

5. If stamped asphalt is proposed the asphaltic concrete thickness is to be increased by at least 10mm.

D2.20 SEGMENTAL PAVERS

1. The choice of paver type, shape, class and laying pattern lies with Council. ***Type, Shape, Class and Laying Pattern***

2. Where approval to use segmented pavers is granted, the edges of all paving shall be designed to be constrained by either kerbing and/or guttering, or by concrete edge strips. ***Edge Constraint***

DOCUMENTATION

D2.21 DESIGN CRITERIA AND CALCULATIONS

1. All considerations, assumptions, subgrade test results, and calculations shall be submitted with the pavement design for approval by Council. ***Submission Details***

2. The Design Plans shall clearly indicate the structure, material types and layer thicknesses of the proposed pavement and surfacing. ***Design Plans***

SPECIAL REQUIREMENTS

D2.22 RESERVED

D2.23 FLEXIBLE PAVEMENT DESIGN

1. The flexible pavement is to be designed in accordance with tables 2.2 and 2.3. The pavement design shall be such that contamination of the base or sub-base by the subgrade material will not occur.

2. For a design CBR of less than 3, the subgrade shall be either replaced with CBR 15 minimum or improved to a minimum of CBR 15 providing the subgrade is sufficiently strong enough, and adequately bridges any underground infrastructure, for construction to proceed. The replacement layer thickness of 250mm for CBR1 or less and 150mm for CBR less than 3 is to be below the pavement depth required for a CBR 3. After applying this selected subgrade layer the flexible pavement is to be designed for a design subgrade CBR of 3. ***Replacement Sub-grade for CBR less than 3***

3. A working platform is to be provided or subgrade improvement made where the construction loads are not within the design strength capacity of the subgrade.

4. Where sand replacement material is to be used, insitu testing shall be undertaken.

5. Subsoil drainage is to extend below subgrade replacement material. ***Subsoil drainage***

5. The frequency of CBR testing to be undertaken shall be in accordance with Table D2.5 ***Frequency of CBR testing***

Urban & Rural Residential Roads

Minimum pavement thickness in millimetres
(add wearing surface thickness to get total depth of pavement)

Rural Res. or Urban Road Type	**Laneways**	**Local Access Street**	**Neighbourhood Connector Road**	**Arterial, Distributor, Shopping Strip Access, Industrial**
ESA Maximum	1.5×10^4	3.7×10^4	7.5×10^5	1.5×10^6
Subgrade CBR				
<3 refer note#1				
3	410	435	540	575
4	345	365	460	500
5	300	315	410	455
6	300	300	385	430
7	300	300	360	400
8	300	300	340	380
9	300	300	315	360
10	300	300	300	340
12	300	300	300	320
15	300	300	300	300
20	300	300	300	300
>=30	300	300	300	300

Minimum Course thickness

Asphaltic Concrete	25 (FGG7)	25 (FGG7)	25 (DG10)	50 (DG14)
Top Course	150	150	150	150
Pavement Material Type	2.1 (CBR 80)	2.1 (CBR 80)	2.1 (CBR 80)	2.1 (CBR 80)
Bottom Course	150	150	150	150
Pavement Material Type	2.4 (CBR 45)	2.4 (CBR 45)	2.3 (CBR 45)	2.3 (CBR 45)

Key
FGG = Fine Gap Graded asphalt in accordance with the Construction Specification for ASPHALTIC CONCRETE
DG = Dense Graded asphalt in accordance with the Construction Specification for ASPHALTIC CONCRETE

Table D2.2

1. All pavements shall be a minimum of 300mm thick
2. Replace subgrade with compacted CBR 15 (or greater). Refer to clause D2.23.2.
3. All CBR testing to be undertaken in natural subgrade material and not subgrade replacement material.
4. The total pavement depth is the thickness from this table plus the A.C. thickness.
5. For soils where the CBR is not listed adopt the next lowest CBR (no interpolation)
6. For arterial roads or those with greater than 5000 vpd the pavement design shall be in accordance with the requirements of the RMS and approved by Council.
7. With a reduced frequency of subgrade CBR testing the pavement thickness is to be increased with a select fill (= CBR 15) by the amount in millimeters of 150-0.227 x (remaining area not tested in square meters).
8. For developments that are constructed in stages it is recommended that the pavement thickness be increased as damaging illegal traffic loads are often carried over the earlier stages.
9. Polymer modified asphaltic concrete is to be used at roundabouts and industrial intersections where skewing forces are frequently exerted on the pavement.
10. Traffic volumes are expected maximums at the end of a 25-year design life.

11. Subgrade replacement material (minimum CBR 15) shall only be used as subgrade replacement material and shall not form part of the design pavement.
12. Pavement gravels shall be CBR 45 or greater. Pavement materials of lesser quality shall not be incorporated in the base or sub base layers.
13. Each grade of asphalt proposed requires approval of the mix design by Council. Applications for approval must be accompanied by a certificate issued by Queensland Department of Main Roads (or approved equivalent).
14. CBR testing shall be undertaken at any significant change in soil type.
15. The lowest CBR value achieved for each section shall be used for the design of future pavements.
16. The sampling is to be randomly located within each homogeneous length of the subgrade along the proposed road pavement with each unit being of sufficient length to accommodate economical construction.
17. Design CBR Least estimated insitu CBR (for less than 5 results)
    Design CBR 10^{th} percentile of all estimated insitu CBR (for more than four test results)
18. The samples are to be taken generally in the position of the outer wheel path on both sides of the proposed road. The sampling should confirm homogeneous material over the unit length concerned.
19. Sketch plan of location of tests, soil profile indicating depth, and soil description is to be submitted with the test results and pavement design for Council approval.

Rural Roads

Minimum pavement thickness in millimetres
(add wearing surface thickness to get total depth of pavement)

RURAL ROAD TYPE	CLASS A	CLASS B	CLASS C	CLASS D	ARTERIAL
AADT	<150	150 – 250	250 – 1000	1000 - 2000	>2000 (4)
ESA Maximum	6.65×10^4	1.11×10^5	4.44×10^5	8.87×10^5	2.22×10^6
Subgrade CBR					
<3 refer note #1					
3	455	470	520	545	575
4	380	395	440	465	530
5	330	340	390	420	485
6	300	310	365	390	460
7	300	300	340	365	430
8	300	300	315	345	415
9	300	300	300	325	395
10	300	300	300	305	375
12	300	300	300	300	350
15	300	300	300	300	315
20	300	300	300	300	300
>=30	300	300	300	300	300
Minimum Course Thickness					
Surfacing	2 coat flush seal (14/7 double - double)	2 coat flush seal (14/7 double - double)	2 coat flush seal (14/7 double – double)	2 coat flush seal (14/7 double - double)	2 coat flush seal (14/7 double - double)
Top Course	150	150	150	150	150
Pavement Material Type	2.1 (CBR 80)	2.1 (CBR 80)	2.1 (CBR 80)	2.1 (CBR 80)	2.1 (CBR 80)
Bottom Course	150	150	150	150	150
Pavement Material Type	2.4 (CBR 45)	2.4 (CBR 45)	2.3 (CBR 45)	2.3 (CBR 45)	2.3 (CBR 45)

Table D2.3

1. Replace subgrade with compacted CBR 15 (or greater). Refer to clause D2.23.2.
2. All CBR testing to be undertaken in natural subgrade material and not subgrade replacement material.
3. The total pavement depth is the thickness from this table plus the wearing surface.
4. For soils where the CBR is not listed adopt the next lowest CBR (no interpolation)
5. For arterial roads or those with greater than 5000 vpd the pavement design shall be in accordance with the requirements of the RMS and approved by Council.
6. With a reduced frequency of subgrade CBR testing the pavement thickness is to be increased with a select fill (= CBR 15) by the amount in millimeters of 150-0.227 x (remaining area not tested in square meters).
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9. Traffic volumes are expected maximums at the end of a 25 year design life.
10. Subgrade replacement material (minimum CBR 15) shall only be used as subgrade replacement material and shall not form part of the design pavement.
11. Pavement gravels shall be CBR 45 or greater. Pavement materials of lesser quality shall not be incorporated in the base or sub base layers.

Required earthworks testing for pavements design

PURPOSE	LOCATION	FREQUENCY	TEST
Design of pavement thickness	Define the limits of the material type found or show on sketch plan localities of test sites	Non-cohesive soils The greater of 1 per 1100 m^2 1 per homogeneous soil type (1 minimum)	4 day soaked CBR (laboratory) compacted to 95% of MDD using standard compaction effort
		Cohesive soils The greater of 1 per 660 m^2 1 per homogeneous soil type (2 minimum)	

Table D2.4

Frequency of CBR Testing for Pavement Design

Testing Type	Laneways & Local Access Streets ESA < 3.7×10^4	Neighbourhood, Connector, Arterial, Shopping & Industrial ESA > 3.7×10^4
Laboratory	Minimum 2 samples Maximum 120m intervals	Sample at one site every 60 to 100m
Soaked CBR and Routine Soil Tests	NATA registered laboratory tests on all relevant materials	NATA registered laboratory tests on all relevant materials
Field	Minimum 3 tests on subgrade.	1 test on subgrade every 50m
Dynamic Cone and Field Moisture Content	Routine soil tests on subgrade from 1 of these	Routine soil test on subgrade from 3 of these

Table D2.5

D2.24 RESERVED

D2.25 RESERVED