

# PAVEMENT DESIGN

## 1. ROAD PAVEMENTS

All road pavements shall be designed in consideration of design traffic loadings and evaluation of subgrade materials, environmental factors and available materials.

### 1.1. PAVEMENT TYPES

Typical pavements types are as follows:

- Unbound granular flexible pavement which may contain one or more modified layers
- Bound granular flexible pavement
- Rigid pavements (concrete)

### 1.2. DESIGN REPORT

*For purposes of determining an acceptable sub-grade & pavement design, designers should satisfy themselves that the pavement materials available in the general geographical area will perform to achieve the desired pavement life, and that the design will satisfy characteristic deflection testing for construction purposes.*

*Refer to chapter 7 – Construction and Appendix D for pavement material specifications and testing requirements.*

A pavement design for all new roadworks shall be prepared for approval, subject to a geotechnical engineer's report. The report shall utilise 4 day soaked "Californian Bearing Ratio" (CBR) testing undertaken on the relevant subgrade in accordance with AS1289 and shall recommend a design CBR and a pavement design thickness, determined using the methods outlined in Austroads standards for pavement design, based on Council's minimum standard Equivalent Standards Axle (ESA) requirements. Sub-grade and/or pavement material modification may form part of the design. The geotechnical report and pavement design report shall be submitted with the engineering plans. The engineering plans shall show pavement layer thicknesses (including the nominated ESA and design CBR parameters) based on the reports. Where alternative pavement designs are offered, the decision for the final adopted design shall be confirmed by the supervising geotechnical engineer and be reported to Council prior to construction of the pavement. Generally, pavements shall be consistent over long lengths of road, such that alternative designs for short sections of pavement are avoided.

In deep cuttings, fills or other instances where testing of subgrade is not possible until completion of bulk earthworks, pavement design or re-evaluation of a design, may occur upon assessment at subgrade level.



### 1.3. MINOR WORKS

For minor works within a public road (such as short lengths of shoulder, kerb & gutter in-fill, or access works) full testing described above may not be necessary, subject to an engineer's assessment.

Minimum requirements may be as follows:-

- 30mm AC10 over a 10mm primer seal or a 2 coat bitumen seal
- 300mm compacted thickness of a granular base course material (200mm may be considered for very minor traffic loadings)
- a compacted and stable subgrade

Alternatively, the developer may submit a design report for alternative pavement treatments.

### 1.4. AS-BUILT RECORDS

Records of actual pavement construction, where pavement amendments occurred, or where alternative pavements were approved, together with any subgrade replacement or modification, shall be collated as a final report to accompany the WAE plans.

## 2. DESIGN TRAFFIC LOADINGS

The design traffic loadings of Equivalent Standard Axels (ESA) are given in the following table. The nominated values may be increased by Council, subject to an assessment of any special circumstances for subdivision or development, where a higher value is adopted, based on ultimate traffic generation for the catchment area, originating from:

- strategic planning for future rezoning of land
- ultimate development of current zoned land
- staging of works and the resultant development and construction traffic

Council or the RMS reserve the right to nominate specific ESA's for Arterial roads such as a State or Regional roads. A general minimum of  $1 \times 10^7$  will apply.



## DESIGN TRAFFIC LOADINGS

ROAD TYPE	ESA'S	MAX NO. LOTS
Local - Place	$1 \times 10^5$	10
Local - Access	$1 \times 10^5$	20
Local - Secondary	$2 \times 10^5$	50
Local - Primary	$5 \times 10^5$	100
Collector - Secondary	$1 \times 10^6$	200
Collector - Primary	$1.5 \times 10^6$	300
Distributor - Secondary	$2 \times 10^6$	400
Distributor - Primary	$5 \times 10^6$	500
Sub-Arterial	$1 \times 10^7$ min	3500
Industrial - Secondary	$5 \times 10^6$	10
Industrial - Primary	$1 \times 10^7$	>10
School Bus / Public Route	$2/5 \times 10^6$ min	
Business / School Precinct	$1 \times 10^7$	

## LARGE-LOT SUBDIVISION

ROAD TYPE	ESA'S
Residential (R5-V)	Apply ESA's as categorised above
Residential (R5-X)	Apply ESA's as categorised above
Residential (R5-Y)	Apply ESA's as categorised above
Residential (R5-Z)	Apply ESA's as categorised above



### **3. SUBGRADE EVALUATION**

Investigation and testing of existing subgrade materials shall be performed by a practicing geotechnical engineer through a NATA registered laboratory. A pavement design report, including subgrade investigation and 4 day soaked CBR test results establishing a “design CBR”, shall accompany the Construction Certificate (and engineering design), and be submitted to Council or the Accredited Certifier for approval.

Assessment of the supporting subgrade strength shall be in accordance with APRG Report No. 21 or Austroads Pavement Design.

All pavement investigations and design by the Geotechnical Engineer shall provide comment in respect to APRG Report No. 21 with reference to extent of testing, site investigation and assessment and pavement design.

### **4. SUBSURFACE DRAINAGE**

Subsurface drainage must be provided to protect the subgrade and pavement in locations that necessitate its use such as boxed construction, cuttings or areas with high water tables or in areas where subsurface moisture requires treatment.

Subsoil drainage pipes shall be provided on both sides of road pavements and where required by design, at new-to-existing pavement joints (see SD003, SD035 & SD032)

Where highly expansive soils and/or high moisture conditions are encountered special care should be taken for the placement of subsoil drains with respect to the any potential adverse affects upon the road pavement from significant moisture removal from the deeper levels of the subgrade.

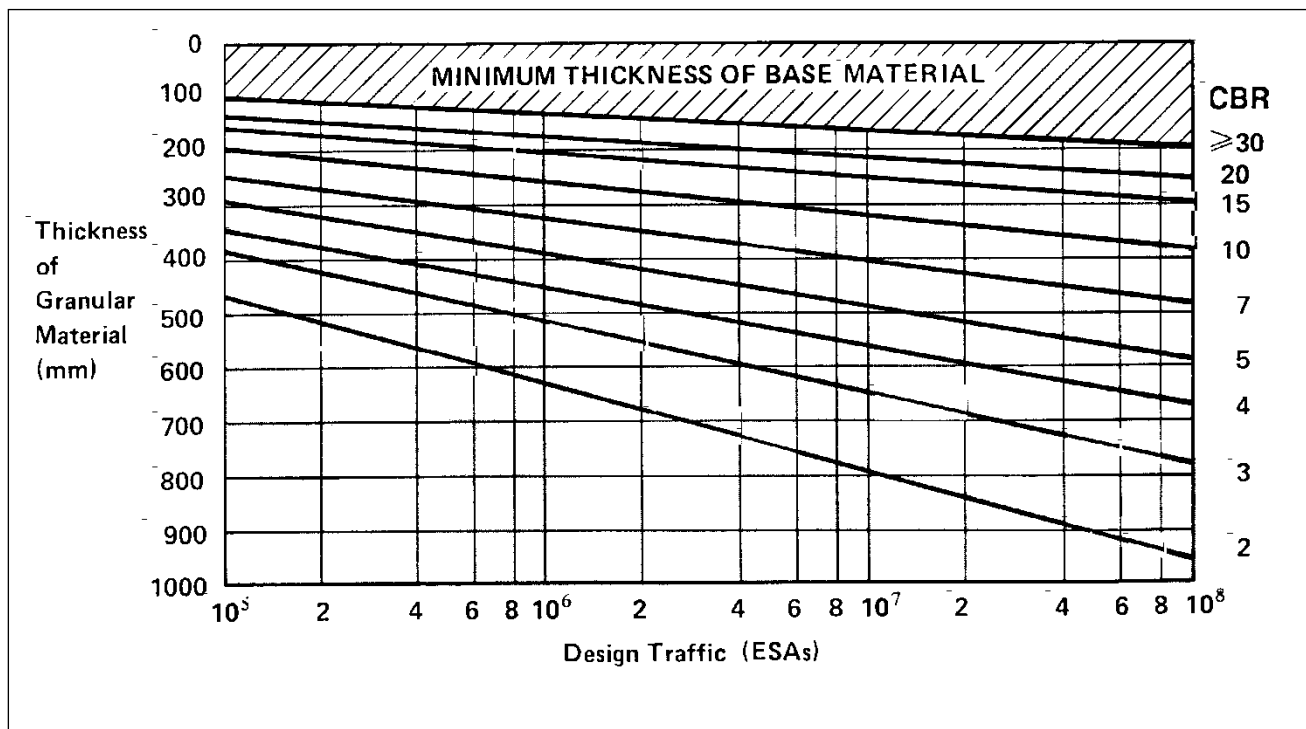
### **5. PAVEMENT DESIGN**

Public road pavements shall comprise of at least one subbase layer and one basecourse layer with a sealed wearing surface. Pavement layers may be combined into a single layer of base course material.

#### **5.1. FLEXIBLE PAVEMENT**

Pavement thickness designs shall be based upon assessed subgrade strength and the following charts, with the nominate/approved traffic loadings.

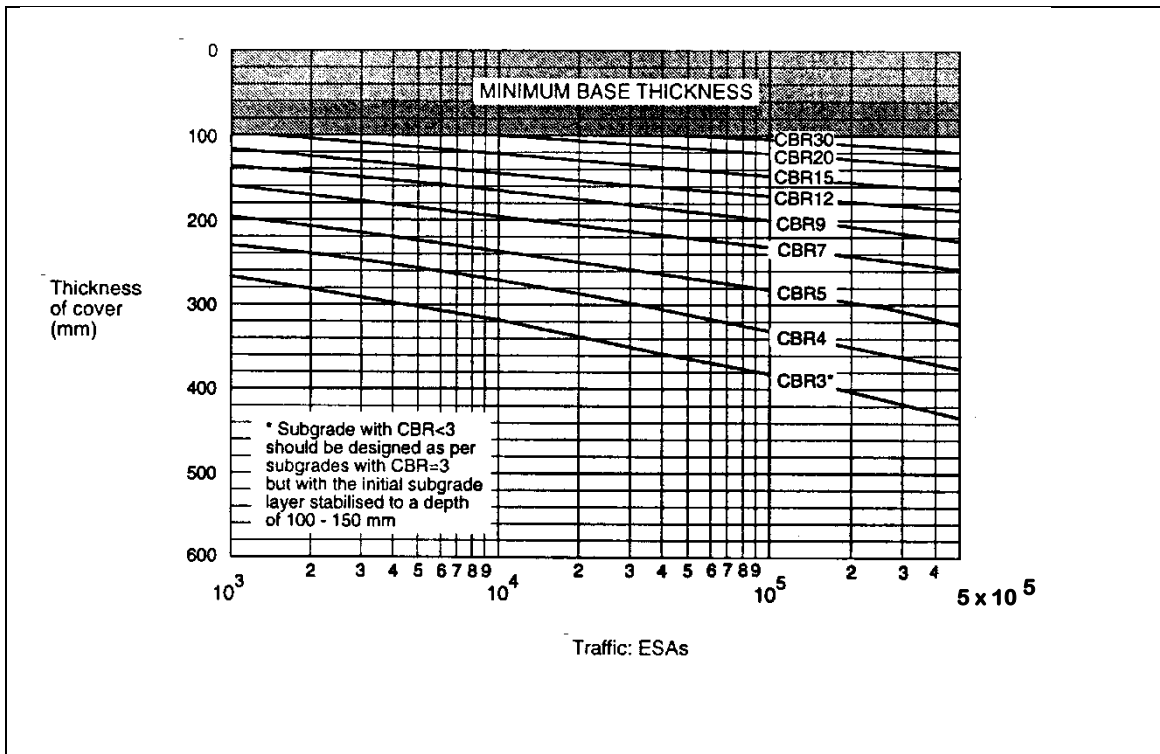




### DESIGN CHART FOR GRANULAR PAVEMENTS WITH THIN BITUMINOUS SURFACING FROM AUSTRROADS PAVEMENT DESIGN GUIDE

The minimum pavement thickness for flexible pavements will be derived as follows:-

- Overall pavement thickness shall be a minimum of 300mm
- Base-course shall be determined from the Pavement Thickness Design Chart, where the minimum thickness is 100mm.
- Sub-base thickness shall be determined from the Pavement Thickness Design Chart, using the relevant CBR curve by subtracting the base-course layer thickness from the required total pavement thickness. Irrespective of the foregoing, the minimum sub-base thickness shall not be less than 125mm.
- Asphaltic concrete thickness shall be a minimum of 30mm and may be included as pavement "depth" in determining the pavement thickness. Two coat flush bitumen seals shall not be considered part of the pavement thickness.
- The pavement designer should be satisfied that the design will meet the requirements of this Manual in respect to permissible deflection and pavement life.
- Where a combined sub-base/base single-layer (with for example bound materials) pavement is proposed, a geotechnical engineer shall report on the proposal, nominating the materials (source) and relevant compaction and testing methods.



**DESIGN CHART FOR GRANULAR PAVEMENTS WITH THIN BITUMINOUS SURFACING,  
BASED ON A 90 PERCENT CONFIDENCE LEVEL  
(for minor rural roads)**

**5.2. RIGID PAVEMENT (CONCRETE)**

Rigid pavements on public roads shall be designed in accordance with the following documents:

- Concrete Pavement Design for Residential Streets - Cement and Concrete Assoc. of Aust.
- Pavement Design - Austroads Standards
- RMS supplements and directory notes to Austroads standards.
- RMS Concrete Pavement Manual.

Minimum thicknesses shall be:

- Sub-base - 150mm minimum
- Base - 170mm minimum

The base shall be jointed, reinforced concrete.

Details prepared by an engineer, are required for (but not limited to):

- a. subgrade preparation to achieve a design CBR
- b. a proposed sub-base concrete mix adopting 5MPa minimum characteristic strength



- c. a proposed base concrete mix adopting 32MPa minimum characteristic strength
- d. a nominated maximum slump and testing procedure (with reference to chapter 7)
- e. a proposed thickness for sub-base and base courses
- f. steel reinforcement
- g. joint types and locations
- h. interface treatments between layers
- i. placement, compaction, surface texture and curing methods
- j. Nominating the finished surface to be rake-textured in accordance with the RMS rake specifications
- k. Nominating the application of a curing agent.

### 5.3. SEGMENTAL BLOCK PAVEMENT

Segmental block pavements, where permitted, shall be constructed of concrete or clay pavers. Such pavements shall be designed in accordance with the following:-

- Clay segmental block pavements:-
  - Up to 10<sup>6</sup> ESAs – Clay Segmental Pavements – Design manual, Clay Brick and Paver Association.
  - Between 10<sup>6</sup> ESAs and 10<sup>7</sup> ESAs – The design will involve the above document and Austroads Pavement Design Manual with the method producing the thicker design to be adopted.
  - Over 10<sup>7</sup> ESAs – Austroads Pavement Design Manual.
- Concrete segmental block pavements:-
  - Up to 10<sup>6</sup> ESAs – Cement and Concrete Association Technical Note 35.
  - Over 10<sup>6</sup> ESAs – Austroads Pavement Design Manual.

Concrete pavers shall be 80mm thick Shape 'A'; clay pavers being 65mm thick Class '4' being laid in a herring bone pattern. All areas of block paving shall be provided with a suitable concrete edge restraint. Large paved areas shall be bedded and laid in accordance with the supplier's guidelines. Allowance must be made for an adequate number of expansion joints and restraining beams.

Shape "C" concrete pavers may be permitted in small infill areas such as residential street thresholds. (see below)

### 5.4. ACCESSWAYS

Accessways to specialty-use areas or facilities such as public utility plant, parks, pollution control devices etc. where heavy vehicles are expected to gain access, shall be a minimum of 3.0 metres wide and constructed in concrete in accordance with the publication by the Cement and Concrete Association of Australia – "Concrete Pavement Design for Residential Streets".



Generally the following parameters shall be maintained (see SD012):

- 150mm thick
- 32 MPa 28 day strength
- Two layers of SL72 mesh fabric
- Sub-base, 100mm compacted thickness of “road-base” material

## 5.5. ROUNDABOUTS

All roundabout pavements shall be designed for construction with fibre-reinforced concrete, with reference to “rigid pavement” RMS standard design and construction requirements. The minimum concrete design mix specification shall provide 32MPa characteristic strength, 4.25 Flexural strength, with 50kg/m<sup>3</sup> of steel fibre (Reo Pave 25 or equivalent). Where construction constraints are significant such as major traffic flow impediments, consideration may be given to alternative pavement types, such as deep-strength asphalt or similar, where justified.

## 5.6. INTERSECTION THRESHOLDS

Where intersection thresholds are approved they shall be provided in accordance with standard drawing SD025 – sheet 1, as a “heavy duty” plain concrete pavement as shown on SD012, with reference to SD026 where a dished drain is necessary.

Coloured concrete is not considered a satisfactory long-term treatment, but where approved, colour additive must include hardener (75-90MPa), be applied as a minimum of two coats and be sealed with a polymer solvent based sealer. Texture may be applied to a maximum depth of 5mm.

## 5.7. PAVEMENT JOINTS

All vertical pavement joints (new-to-existing), whether longitudinal or transverse, shall be benched a minimum of 300mm. (with reference to SD032)

Unless the adjoining pavements consist of the same material, and satisfactory compaction bonding of those materials can be achieved, subsoil drainage shall be provided in accordance with RMS QA Spec R37 “Intra-pavement Drains” at the direction of Council or the geotechnical engineer.

## 6. WEARING COURSE

For the application of bituminous surfacing, refer to Chapter 7 - Construction.





For alternative decorative finishes, Council's approval is required to use such finishes in public roads. Smooth and/or irregular surfaces for roads and footway crossings, such as "deep-stamped" or "exposed river gravel" paving, is not permitted. Supporting documentation shall be submitted with any request to decorative finished products and shall include:-

- Full specifications of the product.
- Durability and colour fastness
- Skid/abrasion resistance.

## **7. EXISTING PAVEMENT RECONSTRUCTION**

Where required by Council, existing road pavements shall be reconstructed, rehabilitated or re-surfaced. A pavement design shall be prepared for and approved by Council based on this chapter adopting an ESA value as determined by Council.

Where new works about an existing natural gravel pavement, it is preferred that the new pavement materials be an approved natural gravel in accordance with the specifications of this Manual. (Refer to "Pavement Joints" above).

Circumstances where construction works may be necessary are:

- Where either the existing pavement or surface quality are assessed by Council as incapable of sustaining the additional traffic loads from the development
- Where vehicle turning movements occur, such that an asphalt wearing surface is appropriate to control premature surface deterioration
- Where a longitudinal surface profile is significantly irregular
- Where surface shape (eg. crossfall) does not conform to standard design parameters
- Where small local "patching" type pavement failures are required by Council.
- Where works coincide with Council's *Forward Works Management Plan*.

The limits of such works shall be determined by Council, but will normally be applied to development that:

- creates new intersections onto an existing road
- requires shoulder or parking lane works
- warrants new or replacement kerb and gutter
- has frontage to, or requires vehicle access along an existing road that exhibits stress and/or has significant surface deterioration, and (subject to geotechnical testing) exhibits a failure to meet design requirements in this Manual.

Best design practice shall be employed such that a holistic approach is achieved, eliminating partial ("patchwork"), or part-lane, pavement sections.