



## DS4 - Transportation

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## DS4 Transportation

### 4.1 General

All Standards referenced in this code shall be the latest version at the time of design.

### 4.2 Carriageway and Road Reserve Widths

#### 4.2.1 Urban Roads

- i. All new roads shall be designed with carriageway and road reserves that comply with the minimum dimensions shown in Table 1.

Except where shown on the tables, only roads with a minimum reserve width of 12m (except service lanes) will be accepted for vesting in Council. All other roads will be private-ways and will require maintenance in perpetuity by the owners of lots that are served by the private-way.

**Table 1: Urban Roads**

Classification	Minimum Width - m		Max Grade-%	Road Function
	Road Reserve	Carriageway (Excl Kerb and channel)		
Private Way serving up to 2 Units	2.7	2.5	20	Private Access: max length 35m
Private Way serving 3 to 6 Units	3.0	2.5	12.5	Private Access: Max length 100m with provision for mid point passing if greater than 70m.
Roads serving up to 30 Household Units. (With Dispensation)	12.0	6.0	12.5	Local Access, Connects with Local Roads
Roads serving up to 30 Household Units	15.0	6.0	12.5	Local Access, Connects with Local Roads
Roads serving 30 -100 Household units (With Dispensation)	15	8	12.5	Local Access, Connects with Local Roads
Roads serving 30 -100 Household units	17	8	12.5	Local Access, Connects with Local Roads
Roads serving 101 - 200 Household Units (With Dispensation)	17.0	8.0	10	Local Access, Connects with Through Road
Roads serving 101 - 200 Household Units	20.0	8.0	10	Local Access, Connects with



				Through Road
Road serving 201 – 300 Household units	20.0	11.0	8	Local Access. Some Through function.
Roads serving > 300 Household units	Specific	Specific	specific	Local Access to & Through function.
Local Road in Industrial or Commercial zone <1000pce	20	11	5	Local and Cul-de-sac
Industrial & Commercial Roads or >1000pce	26.0	13.0	5	Access through Industrial and Commercial Areas
Service Lane	7.0	6.0	5	Loading of goods – no frontage

- ii. The minimum carriageway and road reserve widths shown in the table make no allowance for additional intersection requirements, batters or embankments, urban design elements e.g. specimen tree plantings, bus facilities, swale drains or road widening for horizontal or vertical curves. Preliminary design is required for every road prior to registration of SO plans to determine final boundary locations in order to:
  - Provide sufficient berm width for urban design elements such as specimen tree plantings
  - Provide sufficient width for bus facilities
  - Provide sufficient width for swale drains
  - Provide sight distances for intersections complying with the Austroads standards and entranceways complying with WBOPDC standards with a 0.5m separation to the boundary
- iii. Carriageway widths shall be as shown on the drawings in the Development Code: Construction.
- iv. At any stage of the design (including concept), a safety audit may be required by the Authorised Officer. Safety Audits will be at the Applicant's expense.
- v) Use of the widths identified "With Dispensation" in Table 1, shall only be used in Greenfield development, and shall be subject to the demonstration by the Developer of an integrated and comprehensive plan for the development. The plan shall show how the development fits with Quality Urban Design, as set out in Section 1 of the Code.

#### 4.2.2 Alternative Design

- i. Where the stated minimum requirements for private ways can not be readily achieved the applicant is to state in detail the arrangements to be made for:
  - Access for fire appliances
  - Refuse collection
  - Directions for emergency services
  - Postal delivery
  - Stormwater management



- ii. Carriageway width may be determined taking account of the following factors:
- Public transportation requirements
  - The likelihood of opposing traffic
  - The likelihood of continuous parking on both sides of the road
  - The likelihood of vehicles turning into driveways
  - On road space for cyclists
  - Consistency with adjacent sections of road
  - Future development

### 4.2.3 Cycle Lanes

On road cycle lanes may also be required in addition to the requirements displayed in Table 1 and 2.

Where cycleway routes are identified in the Walking and Cycling Strategy the following guide shall apply:

*Cycle lane next to kerb or road edge*

	Lane Width (m)		
Speed limit (km/h)	≤ 50	70	100
Minimum width	1.5	1.6	2.0

*Cycle lane next to parallel parking:*

	Lane Width (m)		
Speed limit (km/h)	≤ 50	70	100
Minimum width	1.6	2.1	2.5

*Cycle lane next to angle parking (all speeds)*

	Lane Width (m)		
Parking angle	45°	60°	90°
Minimum width	1.5	2.0	2.5

Cycleway design shall, as a minimum, comply with Austroads Guide to Engineering Practice, Part 14: Bicycles and New Zealand Supplement to the Austroads Guide to Traffic Engineering Practice, Part 14: Bicycles, or version current at the time of application.

### 4.2.4 Roads – Rural Zones

The minimum required carriageway and road reserve width for roads in all rural zones is determined by calculating the average annual daily traffic volume (AADT) and then referring to table 2. The calculation of Passenger Car Equivalent (PCE) takes account of the predicted percentage of heavy commercial vehicles and terrain by applying factors to a formula as below:

Traffic volume – shall be assessed on the following basis:

Lots of 4 ha or greater in area	15 pce per lot
Lots less than 4 ha in area	10 pce per lot

Factors for percentage Heavy Commercial Vehicles (HCVs)

Cars	90%
HCVs	10%



Vehicle Factors	
Cars	1.0
Trucks	6.0
Buses	3.4
Truck and Trailer	10

Calculation

Multiply the traffic generation from each lot by the percentage composition for cars & HCVs and then multiply by the vehicle factor.

Example

Lot area = 20ha

=> No of lots = 1,

=> Total PCE = 15

PCE Calculation

Cars	= 15 x 90% x 1.0 =	13.5
HCVs	= 15 x 10% x 5.0 =	<u>7.5</u>
Total PCE	=	<u>21.0</u>



**Table 2: Rural Roads**

The table sets out the requirements for carriageway and road reserve widths for all classifications of “Rural” roads (all Rural 1, 2, 3 and Rural Residential zones in Western Bay of Plenty District Council District).

Maintenance Group Category	Traffic Volume (PCE)	Road Reserve (m)	Carriageway width (m) Excl kerb and channel	Maximum Length	Maximum Gradient - %
7, 6	< 100	20	5	< 2km	12.5
7, 6	< 100	20	5.5	> 2km	12.5
5	100 - 200	20	5.5		12.5
4	201 - 500	20	6.5		12.5
3	501 - 1000	20	7.5		12.5
3	1001 - 2500	20	8.5		12.5
3	> 2500	20	Specific Design		
Cycle Lane within carriageway	Additional carriageway width as shown in Clause 4.2.3				
Reduced Public Road Reserve width, sealed with kerb and channel	4-10 lots	10	5.5	500m	20
Private Way, sealed or unsealed, without kerb and channel	1-3 lots	6.0	3.0	Lots up to 1ha – 250m; greater than 1ha – 500m	Permanent hard sealed surface – 20% Any other unsealed surface – 16.7%
Private Way, sealed or unsealed, without kerb and channel	4-6 lots	12	5.0		
Private Way, sealed, with kerb and channel	4-6 lots	8.0	5.0		

Rural roads with a volume count in excess of 2,500 pce shall be designed in accordance with the current State Highway Geometric Design Manual and shall be specifically approved by the Authorised Officer.





Road safety audits may be required by the authorised officer for any stage of design or concept. Safety audits will be at the applicant's expense.

#### **4.2.5 Cul-de-sac Design**

- i. The design of cul-de-sac turning areas shall be in accordance with the drawings provided in the construction specification.
- ii. Commercial and industrial areas the minimum radius shall be 15m.
- iii. Urban:  
Kerb and channelling, along with associated stormwater collection and disposal systems, shall be provided on all cul-de-sac heads to the tangent point
- iv. Rural 1 and 2 zones:  
Council may require kerb and channelling along with associated stormwater collection and disposal systems to be provided on cul-de-sac heads where conventional shoulder / berm surface runoff is unable to be achieved to Council's satisfaction.
- v. Rural 3 and Rural Residential: Refer to DS 13: Rural 3, Rural Residential Design Standard for additional level of service.

### **4.3 Geometric Design**

#### **4.3.1 General**

- i. All roads shall be designed in accordance with the widths and gradients detailed on Tables 1 and 2, and the Austroads publications "Guidelines to Traffic Engineering Practice".
- ii. All rural roads shall also be designed in accordance with Austroads Rural Road Guide "The Geometric Design of Rural Roads".
- iii. Design of road extensions shall take into account horizontal and vertical interface with the existing road alignment.
- iv. Stage Safety Audits of all designs shall be undertaken in accordance with LTNZ Road Safety Audit Procedures for Projects: November 2004. These shall be at the discretion of the Authorised Officer and at the applicant's expense.

#### **4.3.2 Road Design Criteria for Bus Operation**

The following additional criteria shall be taken into account when designing roads on potential bus routes:

- The minimum turning radius is 10.8m for a 12.5m ultra low-floor bus.



- No speed humps or other vertical deflections are to be placed along potential bus routes, unless with the approval of the Authorised Officer.
- The frequency of roundabouts on bus routes are to be limited to minimise bus running times.
- It is preferable for buses to make left hand turns at intersections. Where buses have to make right turns onto a main arterial then signals or some other traffic control shall be provided, at the discretion of the Authorised Officer.
- Designs should make provision for the front overhang to clear the area beyond the kerb where the front overhang of a bus sweeps beyond the pavement. An area for a distance of 2.0m behind the back of the kerb should not exceed 150mm above the pavement level or have any street furniture or utility poles on it.
- The design of features such as slow points, splitter islands, 'T' Intersection deviations shall give regard to the bus overhang.

### 4.3.3 Bus Priority

Any proposed bus priority measures shall be designed in conjunction with relevant WBOPDC and Environment Bay of Plenty transportation staff.

### 4.3.4 Gradients

- i. Gradients of all roads shall comply with the requirements of Tables 1 and 2 above. In specific cases, application for approval of steeper gradients may be made to the Authorised Officer, subject to special provisions relating to safety and drainage structures.
- ii. The minimum gradient for all roads with kerb and channel shall be 0.50% (1 in 200) on both sides of the road, other than on transitions to super elevations.
- iii. Gradients provided shall be as long as possible, with vertical curves provided to comply with this Code.

The gradient within 30m of an intersection on urban streets shall not exceed plus or minus 10% and should preferably be less than plus or minus 3%. Application for approval for steeper gradients shall be made to the Authorised Officer.

The gradient within 10m of an intersection on a rural road shall not exceed minus 3% or plus 5%.

Intersections are to be designed in accordance with the Austroads Guide to Engineering Practice Part 5 – "Intersections at Grade".



### 4.3.5 Horizontal Curves

i. Minimum Radii

Minimum horizontal curve radii shall be designed to reflect the intended road use and anticipated traffic speed environment. Horizontal curves shall not be out of context with the adjoining road sections. Transitional curves shall be used for rural road design.

Horizontal curves in urban zones shall be circular and comply with the requirements of Austroads Standards.

Specific design is required where operating speeds exceed 50km/h.

ii. Carriageway Widening

The need for extra carriageway widening on horizontal curves shall be assessed for both rural and urban roads as follows below. The road reserve may need to be increased accordingly.

**Rural Roads:**

Recommended values for curves widening for two traffic lanes

Curve Radius (m)	Total amount of widening in metres where normal width of two traffic lanes is:			
	< = 6.0m	6.5m	7.0m	7.5m
30 - 50	2.0	1.5	1.5	1.0
50 - 100	1.5	1.0	1.0	0.5
100 - 250	1.0	1.0	0.5	-
250 - 750	1.0	0.5	-	-
>250	0.5	-	-	-

**Urban roads:**

Extra widening is required on curves whose radius is less than 80m. The following table applies:

**Roads with a design speed 50 kph to 60 kph**

Widening on Horizontal Curves						
Two-Lane Carriageway Width (metres)						
Radius (metres)	6.0	6.5	7.0	7.5	8.0	8.5
Metres Widening						
<40	1.75	1.50	1.25	1.00	0.75	0.50
40 - 50	1.50	1.25	1.00	0.75	0.50	-
50 - 80	1.25	1.00	0.75	0.50	-	-



- iii. Reverse Curves  
Reverse curves shall be separated by a length of straight road as set out in Austroads "Guide to Traffic Engineering" or "Rural Road Design" to allow a satisfactory rate of super-elevation reversal.
- iv. At intersections the kerb line and cul-de-sac turning circles shall be designed in accordance with the drawings provided in the Construction specification. Specific design will be required at major intersections and round-a-bouts to meet the tracking requirements as set out in RTS 18 August 2007.

#### 4.3.6 Pavement and Berm Cross-falls

- i. Normal cross-fall shall be as shown on the drawings. However, when widening an existing carriageway or in steep terrain, cross-falls may vary from 2% to 4% in urban roads, and 5% in rural roads from the crown, coupled with a lateral shift in crown position of up to one quarter of the effective road width. Single cross-fall carriageways will be permitted to local roads and private ways only, subject to approval from the Authorised Officer.
- ii. The standard formation and cross-fall for berms and position of services shall be designed in accordance with the drawings provided in the Construction. Variations from standard berm cross-fall may be permitted in steep terrain or when widening existing carriageways, in accordance with the table below. Berm cross-falls in excess of 5% will be considered on a specific design basis with site access subject to individual design and approval from the Authorised Officer who shall take into account the future needs for pedestrians, cycling, equestrian access and/or the provision of utility services.

	Cross-falls
Berm	2% - 20%
Footpath	2%

- iii. Sight distance criteria at intersections as well as for stopping, overtaking, curves and obstructions shall be applied in accordance with Austroads "Guide to Traffic Engineering Practice Part 5: Intersections and Part 6: Roundabouts.

#### 4.3.7 Super –Elevation

For urban roads, super-elevation shall be applied to curves on all roads where the operating speed exceeds 70kph and to approved arterial roads in accordance with Austroads Urban Road Design, Guide to Design of Major Urban Roads. For rural roads refer to the Austroads Rural Road Design Guide to the Geometric Design of Rural Roads. Super-elevation shall be calculated using the appropriate standard quoted in Section 8.3.1 of the Design Guide.



### 4.3.8 Intersection Design

- i. All intersections are to be designed according with Austroads Guideline for Traffic Engineering Practice Part 5 – Intersections at Grade.
- ii. The separation between any two roads intersecting a collector road or higher classification or potentially serving >1000 pce shall be a minimum distance of 150m centreline to centreline. Two roads intersecting any other road shall be offset at least 60m centreline to centreline.
- iii. All rural intersections with an 8.0m carriageway and above shall have kerb and channelling.
- iv. Splitter islands shall be installed only with the approval of the authorised officer.
- v. All intersections with splitter islands shall have flag lights.
- vi. All rural intersections where a new road of  $\geq 100$  vehicles per day (vpd) meets a road of  $\geq 500$  vpd shall have a flag light. Where development will raise traffic volumes at an existing intersection above this threshold then a flag light will be installed.

### 4.3.9 Roundabouts

- i. Design of roundabouts shall comply with the Transit New Zealand Manual of Traffic Signs and Marking Part 2 and Austroads Guide to Traffic Engineering Practice Part 6: Roundabouts as amended for New Zealand conditions.
- ii. Asphaltic concrete shall be provided from the tangent point and the depth shall be in accordance with Section 8.6.4.2 of the Austroads Guide.

### 4.3.10 Standard Bus Stop Requirements

- i. On-Street Design

Bus stop infrastructure is to be designed for the use of 12.5 metre buses in order to future proof the asset. The on-street requirements are:

  - Every bus stop should be long enough to allow a standard bus to manoeuvre in, park and manoeuvre out of a stop.
  - Where the stop is located between parked vehicles the minimum distance is 26 metres (11 metres approach, 12.5 metres for the bus park and 4 metres to manoeuvre out).
  - Where the bus stop is located adjacent to an intersection the above requirements may be reduced accordingly.



ii. Signage and Road Markings

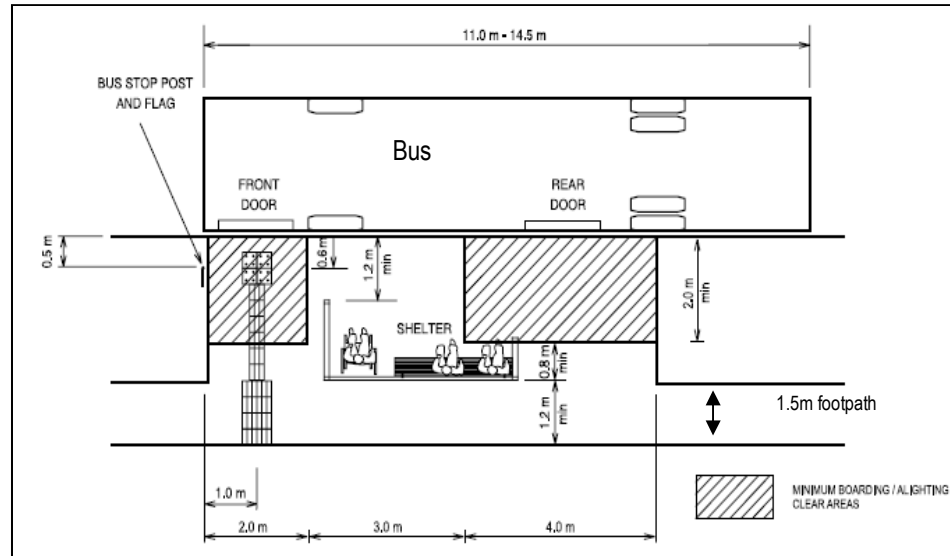
The requirements for signage at bus stops are set out by Traffic Regulations (1976) Guidelines and other subsequent edition, as follows:

- Bus stop locations will have a statutory bus stop sign (RP-5) as per the Manual of Traffic Signs and Markings, (MOTSAM).
- The sign is to be attached to its own pole to enable a timetable holder to be located at the stop.
- All bus stops will have timetable information displays - the information will be supplied by Environment Bay of Plenty.
- The outer perimeter of the stop shall be marked with yellow paint where the stop is located on an arterial or collector road, or where there are likely to be high levels of on-street parking such as adjacent to commercial areas.

iii. Bus Stop Layouts

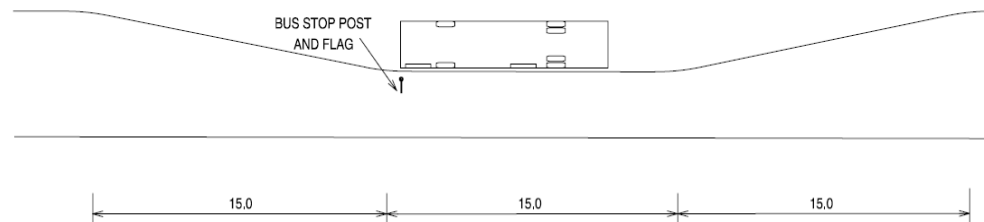
The minimum requirements to be maintained are as follows:

- A continuous accessible path 1500mm wide abutting the kerb is to be maintained throughout the bus stop.
- A width of 500mm from the back of kerb is to be free of fixed obstacles to allow for the overhang of the bus and its mirrors on entry and exit.
- The boarding and alighting areas, as shown in the typical bus stop layout, are to be kept free of fixed obstacles (It should be noted that the rear door location will vary with different bus lengths and designs).
- Bus shelters are to be sited at all in-stops and at locations where tactile strips, pram crossings and high numbers of "boarders" are anticipated e.g. adjacent to commercial areas and/or outside elderly housing developments. Locations are to be agreed with Council Officers.

**Typical Bus Stop Layout (Plan)**

## iv. Bus Bays

- Full width bus bays are to be avoided, other than when the stop is located along a stretch of road with a speed limit of 80kph or higher.
- Bus bays are not to be located where vertical or horizontal changes in alignment reduce visibility below safe sight distances.
- Where the location of a bus bay has been agreed with the Council it shall be designed in accordance with the drawings provided in the Construction specification.



## v. Bus Shelter Installation

For bus shelter installation refer to CS 4 Transportation Construction Standard.

**4.4 Pavement Markings and Traffic Signs**

- i. Where road marking, delineation, and signage are required as an integral part of the roading function, it is the consent holder's responsibility to provide these assets. Such road marking and signage shall be detailed and installed in accordance with Councils joint Pavement Markings and Traffic Signs Supplement (Appendix 1 of this section).



- ii. Where road marking and signage are required as an integral part of the roading function, it is the consent holder's responsibility to provide these assets. Such road marking and signage shall be detailed and installed in accordance with Appendix 1 of Section 4.4 DS4 of this Code "Pavement Markings and Traffic Signs Supplement"
- iii. Rural Lane Marking
  - a. For carriageways less than 5.5m wide no centreline is required.
  - b. For carriageways less than 7.2m wide no edge lines
  - c. For various lane widths the following dimensions are required:

Traffic Lane Width (metres)	Shoulder Width (metres)	Total Carriageway Width (Metres)
2.75	0.3 to 0.5	6.1 to 6.5
3.25	0.5	7.5
3.50	0.75	8.5

## 4.5 Structural Design of Pavements

### 4.5.1 Design Philosophy

- i. All roads shall be designed as structural pavements to have a minimum performance life of 25 years before pavement rehabilitation may be necessary.
- ii. The intent of roadway pavement design shall be:
  - To achieve a structurally sound pavement to prevent punching shear, horizontal shear, delamination and surface rutting.
  - To achieve a finished surface stiffness which ensures that the pavement design life and surfacing performance indicators will be met.
  - Sealed pavement surfacing shall be waterproof
  - To achieve an aesthetic surface that does not produce excessive tyre noise.

The design shall include an analysis of subgrade performance together with specified unbound pavement aggregates complying with the Transit New Zealand (TNZ) standard specifications that will provide adequate pavement strength.

The consent holder shall provide test results to show that the correct assessment of the subgrade characteristics and appropriate pavement design has been made to meet the requirements of this code.

- iii. The following information shall be submitted in conjunction with the engineering design drawings for approval:





- All soil test information obtained to provide a basis for the pavement design, with a reference to origin of design method. Important aspects for consideration are the soils density, moisture content and shear strength. Where substantial cuts and fill are anticipated, the range of CBRs is to be aligned with the Geotechnical Investigation Report. Final design shall be confirmed at subgrade approval.
- A copy of the design calculations used to determine pavement thickness.

When a stabilising agent is proposed to be used, the designer shall submit a range of relevant test results and calculations, including the percentage use of the stabilising agent and an indication of the likely CBR value to be achieved by the stabilisation.

- iv. For the purposes of pavement design the subgrade shall be taken as the inorganic material present to a depth of 500 mm below the sub-base or basecourse layers.
- v. All new and reconstructed roads shall be designed in accordance with Austroads pavement design parameters contained in:
  - “A Guide to the Structural Design of Road Pavements 2004” (referred to as the Austroads Guide).
  - AP-T36 – 06 Pavement Design for Light Traffic.
  - Transit New Zealand – New Zealand Supplement to the Document, Pavement Design – A Guide to the Structural Design of Road Pavements (AUSTROADS, 2004) and all subsequently issued amendments.
  - Design of roads by other methods is permitted only with the consent of the Authorising Officer. Where alternative design processes are proposed, consent to adopt the design method shall be “project specific” and be obtained prior to approval and shall include.
    - The basis of the pavement design approach and technical references in support of its use.
    - Commentary as to the reasons that the Austroads Guide is not considered appropriate and therefore not being utilised.
  - An outline of site data collection and schedule of field laboratory testing to be undertaken as appropriate.
  - An outline of design and construction compliance with the pavement stiffness characteristics given in section 8.1.9 of the Austroads Guide.



Acceptance or non-acceptance of the design proposal will be made on a “project specific” basis. The pavement design is based on the subgrade strength and an assessment of the effects that traffic loading will have on it.

The design process based on road types shall be:

Road Type	Design Process	Design Manual
Cul-de-sac Local Road Collector	CBR (%) method or deflection control based on design traffic ESAs	AP-T36-06 Pavement Design for Light Traffic
Heavy Industrial / Commercial Road Principal / Collector Arterial Road	Interlayer strain analysis by CIRCLY	Austrroads 2000– “Structural Design of Road Pavements”

ESAs per lane are to be assessed on the number of allotments served by the road. The initial construction traffic and the traffic once in use are to be included in the calculation of the number of ESA used for design.

The minimum values of design traffic for the design of flexible pavements are shown on the drawings.

- vi. The CBR method of pavement design is a well proven method and is based on the measurement of subgrade strength by California Bearing Ratio (CBR).

The design manuals listed above describe pavement depth as a function of subgrade strength, traffic loadings, and the properties of imported sub-base and basecourse materials. From the determination of subgrade CBR the pavement overlay should be derived from the design chart shown on the drawings.

- vii. The minimum pavement depth shall be **170 mm** for all cases shown in Table 1 above.

#### 4.5.2 Determination of Subgrade Characteristics

- i. Subgrade characteristics for pavement design are not determined until landform earthworks are undertaken and completed.

For the purposes of engineering approval assumed values can be applied based on judgment and experience on the basis that confirmation tests and/or assessments are made to confirm the design when the pavement subgrade is exposed. Council shall be notified when the sub-grade testing / assessments are to be made.



- ii. There are two predominant soil types in the District area:
  - Sands
  - Volcanic ash being pumiceous sands, silts and weathered silty loams.

Designers shall be fully conversant with the sensitive nature of the volcanic ash soils when subjected to traffic loading and shall take full account of these characteristics in designing pavement thickness.

Important factors are:

- The site subgrade material will be subjected to intensive construction traffic loads. Volcanic ash soils remould, lose shear strength and become more flexible with repeated loading by traffic.
- The volcanic ash soils have an ability to substantially regain shear strength and stiffness where, after remoulding, they are left in an un-trafficked state. The time required to achieve regain of strength and stiffness will vary according to the nature of the ash, its water content and permeability. An effect on the subgrade (which is negated in time) is due to the drainage of water used for basecourse preparation into the subgrade.
- Measurement of the subgrade soil characteristics whether by deflection or CBR shall reflect the disturbed remoulded characteristic.
- The CBR value shall be determined by soaked laboratory tests or field tests. (Note: Scala penetration test derived CBR parameters by reference to ad-hoc relationships between these properties are not acceptable to use in pavement design).

#### 4.5.3 Design Subgrade CBR

The roadway shall be considered in sections which are deemed to be homogenous with respect to subgrade type, topography and drainage. A design subgrade CBR shall be determined (separately) for each of these sections by the following procedure.

As a minimum, soaked CBR tests shall be taken in representative samples of the subgrade materials at intervals of not more than 100 metres along the road alignment as follows:

- a. Laboratory determination by soaked tests on disturbed or remoulded samples in accordance with NZS 4402:1986 (test 6.1.1) and NZS 4407: 1997 (test 3.15).
- b. Soil uniformity shall supplement the soaked CBR tests between the laboratory sample test sites described above by:
  - undrained shear strength using a calibrated Pilcon shear vane at a depth of 125 mm below subgrade level (for cohesive materials).



- scala penetrometer (for non-cohesive materials).

The Scala penetrometer is best used as a means of establishing comparative CBR results when correlated against tests undertaken as described above. The scala results shall be calibrated accordingly.

Scala, shear vane or Clegg hammer tests shall be taken at the following frequencies along the road alignment:

For carriageways 4m wide and less	- along the centreline
For carriageways 4.1m to 8.5m wide	- along the kerbside wheel tracks
For carriageways 8.6m and wider	- at the centreline and kerbside wheel tracks

The sites shall be at a maximum of 15m centres for each line or where 2 or 3 lines are required these may be staggered giving spacings of 20 and 30m for each line.

The CBR value used in the design shall be the 10 percentile value of the CBR tests taken on the subgrade material. A selection of tests shall be taken at 150, 300 and 450mm below final subgrade level.

Scala penetrometer testing can only be used in isolation of other testing methods where the proposed road is less than 30 metres in length. The penetrometer shall be calibrated in all other cases.

The designer should acknowledge that the use of a scala penetrometer provides very conservative values for in situ CBR based on the relationship shown on the drawings provided in the Construction specification. This occurs because of the sensitive nature of most volcanic ashes and the development of high pore water pressures at penetrometer tip. The designer should compare the cost of additional basecourse depths determined from low subgrade CBR values determined by a scala penetrometer against higher costs associated with the tests described above.

#### 4.5.4 Design Submissions

The following information shall be submitted in conjunction with the engineering design drawings for approval.

- All soil test information obtained to provide a basis for pavement design, with a reference to the origin of the design method. Important aspects for consideration are the soils density, moisture content, and shear strength. Where substantial cuts and fill are anticipated, the range of CBRs are to be aligned with the Geotechnical Investigation Report. Final design CBRs shall be confirmed at subgrade approval.



- Copy of design calculations used to determine pavement thickness.

When a stabilising agent is to be used, the designer shall submit a range of relevant test results, and calculations, including the percentage use of the stabilising agent and an indication of the likely CBR value to be achieved by the stabilisation.

## **4.6 Pavement Standards**

### **4.6.1 General**

Designers shall refer to the equivalent section in the construction specifications.

### **4.6.2 Sub-grade**

Refer to the construction specification and the section above for details on sub grade.

### **4.6.3 Sub Base Layer**

Refer to the construction specification for details of sub base materials.

### **4.6.4 Basecourse**

Refer to the construction specification for details of basecourse details.

The structural design of the carriageway shall be based on the use of TNZ M/4 basecourse with a minimum thickness of 170mm for all road types in accordance with the drawings.

### **4.6.5 Carriageway Surfacing**

- Carriageways may be surfaced with asphalt, or a two coat bitumen and chip seal. Alternative surfaces such as structural concrete or clay pavers may be constructed only with the approval of the Authorised Officer.
- All cul de sac heads, turning areas, roundabouts and approaches, and industrial intersections are to be surfaced with asphalt.
- Second coat chip sealing will be by WBOPDC forces, and will not be considered part of subdivision sealing.

### **4.6.6 Two Coat Chip Seal**

Except where otherwise required the basic carriageway surfacing shall be a two-coat chip seal complying with the specifications.



A grade 3/5 bi-couche seal is regarded as a single coat seal.

#### **4.6.7 Hot-laid Asphaltic Concrete (asphalt)**

All cul de sac heads, turning areas, roundabouts and approaches, and industrial intersections are to be surfaced with asphalt.

As asphaltic concrete is not in itself completely waterproof, a first coat seal or similar is required to provide an initial waterproofing layer. If an asphaltic blinding is used a minimum of 1.0 litre per square metre of residual penetration grade bitumen is required. The manufacturers recommended time is to elapse between the first coat seal and the laying of asphaltic concrete to ensure adequate curing of the blinder.

When using Transit New Zealand Specification M10 compliant mixes on roads with an ADT greater than 100vpd, Transit New Zealand guidelines on skid resistance and surface texture shall be incorporated in the mix design.

Asphalt layers less than 50mm thickness are not considered to be part of the structural pavement in terms of subgrade cover. However, the fatigue life of the asphalt layer still needs to be considered to ensure the fatigue life exceeds the minimum expected life for the AC surfacing.

#### **4.6.8 Urban Vehicle Crossings Accessways**

Asphaltic concrete, 2 coat chip seal, or cast in situ concrete may be utilised for urban vehicle crossing or accessways as shown on the drawing provided in the Construction specification.

Coloured concrete, exposed aggregate and decorative aggregate surfaces are acceptable upon application to Council. Stamped and imprinted concrete is not acceptable.

The shape and other details of an urban accessway shall be designed in accordance with the drawings provided in the Construction specification.

#### **4.6.9 Rural Vehicle Entrances or Accessways**

Rural accessways shall be surfaced with a two coat chip seal, or asphaltic concrete.

Where the District Plan permits and subject to appropriate approval from other users and adjacent property owners the carriageway surface may be formed from compacted basecourse and remain unsealed.

The shape and other details of a rural accessway shall be designed in accordance with the drawings provided in the Construction specification.



Where an accessway meets a sealed road then it shall be sealed from road edge to boundary as a minimum. If the access slopes down toward the road the Authorised Officer may require a greater length to be sealed to avoid metal being washed or tracked down onto the road.

If the accessway meets an unsealed road it may remain unsealed, however if the slope of the access will lead to metal being washed or tracked down onto the road the authorised officer may specify that a length be sealed

## 4.7 Private Ways (Rights of Way)

### 4.7.1 Urban Private ways (Urban Rights of Way)

- i. Urban Residential Private Ways shall be designed in accordance with the drawings provided in the Construction specification. Any variation shall be subject to the approval of the Authorising Officer.
- ii. Stormwater drainage shall be provided by use of 450 mm square berm pits or similar approved and 225mm discharge pipe so that the maximum "run of water" does not exceed 90m and the area served by each berm pit shall not exceed 300 m<sup>2</sup>. Specific design is required if road gradient exceeds 12%.
- iii. A standard vehicle crossing shall be provided for each residential private way and shall be designed in accordance with the drawings provided in the Construction specification.
- iv. Private ways (right of ways) shall have a properly formed and sealed carriageway. Kerbs may be mountable but provision must be made to control and dispose of stormwater. This may require non-mountable kerbs or raised berms to control overland flow paths between adjacent lots.
- v. For private ways serving up to three dwellings vehicular access may be provided by concrete strips. Two concrete strips 750mm wide by 130mm thick with a 750mm space between is acceptable. A compliant vehicle crossing shall be provided between the road carriageway and the boundary.
- vi. The maximum gradient of an urban private way shall be 20% (1 in 5).
- vii. Restrictions exist on the lengths and widths of urban private ways as in Table 1

Road Reserve Width (m)	Maximum Length (m)
2.7	35
3.0	100m, with provision at the midway point to allow vehicles to pass within its boundaries where the private way exceeds 70m in length.



#### 4.7.2 Rural Private Ways (Rural Rights-of-Way)

- i. Rural private ways shall be designed in accordance with the drawings provided in the Construction specification.
- ii. Where new private ways are created cut or fill batters and culverts are to be included in the Right-of-way width. For the formation of private ways in existing easements the formation should practically occur through the centre of the reserve, but all cut or fill batters steeper than 1 in 4 shall be contained within the existing easement.
- iii. Passing bays shall be formed at not more than 150 metre intervals and shall provide practical access for one 90 percentile car to park while another vehicle passes. These should logically be located at:
  - Entrances off the private way, or
  - At bends where sight distances allow, or
  - At widened sections of the carriageway to the dimensions shown on the drawings provided in the Construction specification.
  - And within the reserve width available.
- iv. The passing bay may be finished with a surface similar to the right-of-way surface. The surface crossfall from the passing bay shall be a continuation of the crossfall on the private way surface.
- v. Private way drainage shall be agreed with the Authorising Officer.
- vi. When a subdivision applicant claims the exemption from having to seal a private way under the District Plan; the applicant is still required to seal the first 10m of the private way, as measured from the edge of carriageway.





### 4.7.3 Rural Private Ways (Rural Rights-of-Way) - Minden Lifestyle Zone

- i To serve 0 – 3 lots – as per Code section 4.7.2
- ii Over 3 lots:

#### Alignment:

- Privateways shall be constructed / upgraded in accordance with the table below, standard drawing W439 (except where modified by other requirements as outlined below), resource consent conditions, engineers report recommendations and other relevant sections of this Code of Practice.
- Where new private ways are created, or existing alignments are up-graded, cut / fill batters, retaining structures and culverts are to be included in the privateway reserve width unless written permission is obtained from affected landowners.
- Passing bays shall be provided in accordance with DS4 4.7.2 and in addition shall also be provided at bends or other features where sight distances are below 30m. Passing bays (including those at entranceways) shall be constructed and sealed in accordance with diagram W 440.

Category	No. of lots served	Minimum privateway reserve widths (m)	Carriageway width (excl kerb and channel and passing bays)	Maximum length (including combinations of intersecting privateways)	Maximum gradient (sealed)
Sealed without kerb & channel	4 - 14	8	3.5m	1200m	20%
Sealed with kerb & channel	4 - 14	6	3.5m	1200m	20%

Note: The minimum privateway reserve widths in the above table are to be increased as may be necessary to accommodate passing bays, cut/fill batters, curves and other important features.

#### Formation:

- Privateways shall be constructed / upgraded in accordance with the table below, standard drawing W439 (except where modified by other requirements as outlined below), resource consent conditions, engineers report recommendations and other relevant sections of this Code of Practice. A vehicle crossing shall be formed and sealed to serve the privateway in accordance with standard drawing W437 with sizing (diagrams A, B & C) to suit the expected lot usage and mail box access.
- Sight distances at the intersection of the privateway with Councils road shall comply with standard drawing W415 except they shall default to the next highest speed and distance in table A.
- Privateway surfacing shall be subject to a pavement design on an assumed (unless otherwise known) CBR strength sub-grade as per section DS4 – 4.5 of this Code. The CBR strength of the sub-grade shall then be tested in-situ and the pavement design modified accordingly, except that the minimum pavement thickness shall be 170mm. Alternative pavement design (eg.. shear-vane testing to determine sub-grade strength) will be considered.



- Privateways shall be designed and constructed to a double coat sealed standard as per section DS4 - 4.6.6 and CS4- H4.2 of this Code.
- Bulk earthwork fills shall be designed, placed, compacted and tested in accordance with sections DS10 and CS10.
- Sub-grades and pavement shall be constructed in accordance with section CS4 – A4.2, A4.5 (if sub-base is required) and A4.6 of this Code, except that base-course can be GAP40.
- Sub-grades and pavement shall be tested in accordance with section CS4 B4.1 and B4.2. of this Code. Alternative methods of testing eg.. shear-vane testing to determine sub-grade strength) will be considered.
- Batters and embankments shall be constructed as per section DS 4.15.2 of this Code.
- All testing and Quality Assurance records shall be supplied to Councils officers for acceptance prior to section 224 approval.

### Stormwater Control:

- Regional Council consents shall be sought and approved where required
- Discharge consents and/or easements shall be provided from affected landowners
- Culverts and bridges shall be designed or upgraded in accordance with section DS 4.16 of this Code and to a design life of not less than 50 years.
- The minimum culvert pipe diameter is 300mm.
- Culverts with diameters  $\geq 1000\text{mm}$  may be subject to a building consent.
- All culverts shall be rubber ring jointed, reinforced concrete (RCRRJ) and of a class suitable to accommodate surcharge fill loads and expected live axle loads, unless otherwise approved.
- Existing culverts shall be upgraded or certified as being of sound condition and quality, having the required capacity, having the required bedding and backfill and an expected life of 50 years.
- Culverts shall be bedded and haunched in accordance with section CS5/6.7.2 of this Code, except the bedding and haunching material shall be granular material. Local ash or other cohesive material will not be acceptable as bedding or haunching.
- Culverts shall be backfilled in accordance with section CS5/6.8 of this Code.
- Culverts inlet / outlets shall be located at least 1.5m beyond the feather edge. Culvert inlets / outlets can be served by headwalls, inlet sumps or drop structures in accordance with standard drawings W430, W524, W526 & W 428.
- Existing culvert inlet / outlets not already protected by other approved structures shall have pre-cast concrete or other pre- approved headwalls installed.
- Rock rip-rap or similar channel protection shall be installed in all water-table drains where the longitudinal gradient is  $\geq 12\%$ . The rock rip-rap shall have a minimum diameter of 100mm.
- At Councils discretion, kerb and channel may be required where necessary to control stormwater runoff. Generally it may be considered where berms are too narrow to accommodate practical water-tabling.
- Flows from culvert outlets discharging over steep or potentially un-stable embankments shall be via pipe, flume or other approved structure to the toe of the embankment. The final discharge point shall be protected by rock rip-rap or similar approved structures. Energy dissipation may need to be considered.
- Culverts shall be located as follows:
  - On longitudinal gradients  $\leq 12\%$  a maximum channel run of 100m
  - On longitudinal gradients  $> 12\%$  a maximum channel run of 80m
  - At changes of gradient or direction in the channel where there could be a tendency for water to leave the channel.
  - Where there is a low point or at the lowest point in a sag vertical curve where the upstream gradient exceeds 12% or there is insufficient overland flowpath capacity.
  - Reference document "Minden Rural 3 Zone Structure Plan Geotechnical Appraisal" by Beca Carter Hollings & Ferner Ltd (Beca) dated 31 August 2009 reference 4252349 // NZ1-2101216-2 1.1



## 4.8 Kerb and Channel

### 4.8.1 Urban Roads

- i. Kerb and channel shall be provided on both sides of the carriageway in all urban subdivisions and shall be designed in accordance with the drawings provided in the Construction specification.

The type of kerb and channel (mountable or non-mountable) shall be agreed with the Authorising Officer.

- ii. Under-channel drains shall be provided along kerb lines including medians, roundabouts and traffic control islands in accordance with the drawings provided in the Construction specification, except where the designer can demonstrate that they are not necessary (for example where the underlying soil has a high porosity or at high points in the topography).

Water table fluctuations are to be considered

Additional subgrade drainage may be required as identified in the Geotechnical Investigation Report and by the Authorising Officer.

### 4.8.2 Rural Roads

Kerb and channel will be required where necessary to control stormwater runoff.

Generally it may be considered for construction adjoining cut and fill batters to control potential scouring of the water tables and embankments.

Subsoil drains shall be installed adjoining all cut batters.

### 4.8.3 Sumps

- i. Sumps shall be designed in accordance with the drawings provided in the Construction standard.

Sumps shall be located as follows:

- On roads having a carriageway up to and including 11m wide and a maximum channel run of 100m; and on all roads with carriageway greater than 11m wide and a maximum channel run of 80m.
- On the high side of intersections, located at the kerb line tangent point.
- At changes of gradient or direction in the channel where there could be a tendency for water to leave the channel.



- A double sump, shall be installed to minimise the risk of ponding, at cul-de-sac heads where there is a low point or at the lowest point in a sag vertical curve where the gradient exceeds 12% or there is insufficient overland flowpath capacity.
  - Where longitudinal gradients of the carriageway exceeds 12% sumps shall be located at a maximum of 80m intervals for carriageways up to and including 10m wide and 65m intervals on wider carriageways and in all cases should be super catch pit or similar design.
  - Sumps should not be located at the apex of a bend.
- ii. Single sumps shall be connected to the primary stormwater system by a 225mm minimum diameter connection to an adjacent manhole. A 300mm diameter connection shall be used for a double sump. If the adjacent stormwater system is of greater size than 600 diameter and the manhole is not conveniently located, the sump lead may be saddled directly to the pipe. If connected directly to a pipe the connection shall be a minimum of 300mm diameter.

Individual sumps or interconnected double sumps shall be connected separately to a manhole and not through a second sump system.

- iii. Roads without kerb and channel shall have sumps constructed as shown on the drawings, and shall be placed as above.
- iv. Unless specific capacity of a sump is known or derived from first principles, the design capacity of a single back entry sump with standard grating shall be limited to 28 l/s.
- v. At all points where sump blockage or under-capacity could lead to overflow into private property, the provision of designed secondary flow paths protected by public ownership or easements shall be made.
- vi. Swale drains may be provided in combination with reticulated drainage.

## 4.9 Footpaths and Berms

- i. Footpaths and combined footpath/cycleways shall be provided in urban areas on the sides of all streets as shown in Tables 3 and 4.

Table 3: Urban Footpath location

House-hold Equivalents	Footpath location	Width (m)
0 – 30	1 Side only	1.5
>30	Both sides	1.5

Table 4: Combined Urban Footpath/ Cycleway location (when specified)



Classification	Combined Footpath / Cycleway location	Width (m)
Local/Cul de Sac	Not required (Footpaths only)	1.5
Collector with < or = 200 household equivalents	Not required (Footpaths only)	1.5
Collector with > 200 household equivalents	Single side	2.5 (opposite side 1.5m)
Arterial	Both sides	2.5

- ii. The footpath shall be located in accordance with the drawings provided in the Construction Standards. Additional width may be required where angle parking adjacent to the footpath is anticipated.

Alternative surfacing materials may be used for footpaths only where approved by the Authorising Officer. Alternative materials may include concrete pavers and asphaltic concrete to a minimum thickness of 25mm. Any alternative surfacing material must be demonstrated to be appropriate to the surrounding environment.

Footpaths are to be clear of all obstructions, i.e., light standards, street and traffic signs. Extra widening may be required at the request of Council.

- iii. Footpaths in industrial and commercial areas may be constructed of concrete by Council after the building development has taken place. To facilitate this, the consent holder shall pay to the Council a sum of money as may be determined by Council to cover the cost of providing the concrete footpaths as required.
- iv. All areas between the kerb-line and the boundary that are not paved shall have a minimum cross-fall of 2% falling towards the kerb and shall be finished with topsoil and sown with grass in accordance with DS 2 Streetscape.

A pram/wheelchair crossing as detailed on the drawings provided in the Construction specification shall be provided at all road intersections and such other locations so as to provide for logical and safe movements of pedestrians. The maximum gradient of any pram crossing shall be 1 in 12 in accordance with SNZ 8630:2004 to provide for access for disabled people.

Where vehicle crossings cross footpaths, the vehicle crossing shall take precedence but shall recognise a maximum cross fall of 3% in the footpath.



## 4.10 Guard Rails & Traffic Calming

- i. Where roads, private ways or other vehicular or pedestrian access, whether public or private, run parallel with land which drops on one or both sides, and if deemed necessary in a safety audit, the sides shall be provided with safety barriers to protect pedestrian or vehicular traffic.

Safety barriers for pedestrian access shall comply with the design requirements of the Approved Document D1 of the NZ Building Code as referred to in NZS 4404.

Guardrails shall be designed by an experienced Chartered Professional Engineer in accordance with the current Transit New Zealand specification M23 and the current State Highway Geometric Design Manual. The end assembly shall comply with NZHRP 350 TL-3 unless specifically approved by the Authorising Officer

- ii. In residential streets traffic calming measures may be required to ensure the design speed regime cannot be significantly exceeded and that through traffic is discouraged from residential roads.

Traffic calming should be based on relevant current practice and may incorporate such measures as providing horizontal bends of significant deviation (45° or more) at distances of not more than 100metres between tangent points, traffic islands; raised pedestrian crossings, lane deflections, local lane narrowing etc.

Where a street forms, or may form, part of a designated heavy vehicle or bus route, vertical traffic calming mechanisms such as speed humps, raised platforms or similar devices shall not be utilised for traffic calming.

- iii Rails and barriers shall be in accordance with WBOPDC guard rail policy

## 4.11 Vehicle Crossings

An Integrated Transportation Assessment (ITA) shall be submitted where the vehicle crossing is onto a Strategic Road, in accordance with the requirements of Section 4B –Transportation, Access Parking and Loading of the District Plan.

### 4.11.1 Urban Crossings

A vehicle crossing shall be provided between the kerb line and the boundary at the entrance to all entrance strips to rear lots, private ways and service lanes and where the proposed lot has less than 10 metres of complying road frontage.



The entranceways for sites or lots not requiring construction at consent stage will then be constructed to the standard in this Code at the time of the future housing or site development, in conjunction with the building consent process

Crossings shall be designed in accordance with the drawings provided in the Construction specification.

#### 4.11.2 Rural Crossings and Entrances

- i. The principles to be adopted for rural entrances are:
  - Safe passage for vehicles entering or leaving the property and for through traffic. This requires compliance with sight and separation distances and entranceways pavement gradients as described be designed in accordance with the drawings provided in the Construction specification.
  - The protection of the road seal edge by the continuation of the road seal into the entrance area. The width of the edge protection is determined by the type of traffic likely to traverse the entrance. Three different entrance widths are shown on the drawings provided in the Construction specification, relating to:

Diagram A	Lots greater than 10ha.	The maximum sized vehicle using the entranceway is a semi-trailer.
Diagram B	Lots between 1.0ha and 10ha where the entrance could be used by occasional stock trucks.	
Diagram C	Lots less than 1.0ha where the predominant use is residential and the entrance is likely to be used for light vehicles.	
  - Vehicle entrances across kerb and channel shall be industrial design.
- ii. All proposed private access is to be reported upon, upgraded or constructed in accordance with District Plan rules. The entranceways for sites or lots not requiring construction at consent stage will then be constructed to the standard in this Code at the time of the future housing or site development, in conjunction with the building consent process.
- iii. If the road across the front of the property is constructed with kerb and channel the vehicle entrance shall be constructed with a concreted apron.
- iv. Where the road fronting the property is not sealed the entrance may be formed to an all weather metalled standard with adequate provision for stormwater disposal. The entranceway shall comply in all other respects with the drawings provided in the Construction specification.
- v. Culvert pipes shall be at least 300 mm diameter. Pipes shall be RCRRJ with a minimum cover of 150 mm to class 4 pipes laid on Type B bedding. Culvert pipes installed in rural vehicle crossings will not be maintained by Council and therefore it is in the property owner's interests to install a durable and serviceable culvert pipe.



The pipes shall extend to the limits of the cleared area as defined on the drawings provided in the Construction specification and shall be fitted with concrete or timber headwalls, or shall project from an extension of the entrance shoulder batter down to the culvert invert level in accordance with sound engineering practice. The culvert will be set back at least 3metres away from the edge of the pavement and the water tables realigned.

- vi. Where the entranceway occurs at the crest of a vertical curve in the roadway or it is clear that the water table flows are diverted immediately upstream of the entranceway site or the construction of the entranceway creates a diversion, the culvert pipe may be omitted at the direction of the Authorised Officer.
- vii. Council may accept a sealed depression across the crossing constructed to the contour of the table drain. The concession will be on a site by site basis.
- viii. The centreline alignment of the entrance shall be at an angle not less than 80 degrees from the edge of road seal. For centreline alignments less than 90 degrees to the road seal appropriate modifications to the entrance edge radii will be required to allow compliance with the appropriate tracking curves as defined in the Austroads Guide.
- ix. All existing vehicle entrances located on unsealed roads shall be re-constructed at the existing location and grades in accordance with Council's standard specification, unless specific agreements for relocating those vehicle entrances are negotiated between the subdivider or the existing landowner, and the authorised officer.
- x. All fences and gates shall be located setback from the vehicle entrance to ensure that a 90<sup>th</sup> percentile truck can be parked off the road carriageway while the gate is being opened. The swing radius of the gate shall be added if it will affect the parking location, e.g. access uphill.
- xi. Entranceways must be contiguous or separated by a minimum distance of 5m between the edges.
- xii. Entranceways shall conform to those shown on the drawings unless agreed otherwise with the authorised officer.

## 4.12 Parking Bays / Pedestrian Accessways

- i. Parking bays shall be constructed to the same structural standard as the adjacent road pavement. It is recommended that the surface of the parking bay be treated differently from that of the street to differentiate its use.

A reinforced concrete dish channel constructed in accordance with the drawings provided in the Construction specification shall be used where the parking bay falls to the carriageway.





Parking bays shall be constructed and designed in accordance with AS2890.1 1993 and in accordance with the drawings provided in the Construction specification.

Secondary overland flowpaths can be combined where practical with pedestrian access in accordance with District Plan rules 15.6.6.1 (f) and (g). Overland flow paths shall comply with DS5 – Stormwater.

- ii. Pedestrian accessways should not be steeper than 12.5%. Where the ruling gradient is steeper, steps and combinations of steps and a graded path may be necessary.

Pedestrian accessways shall be in accordance with walkways in DS5 – Reserves. Provision shall be made for disposal of stormwater flowing down the length of the accessway to prevent discharge across the road footpath.

Where a significant amount of surface water will be concentrated by the footpath in a pedestrian accessway (where the length of footpath exceeds 10m), it shall be collected by a dished channel and disposed of through a 450 mm x 450 mm sump(s) or an approved alternative with a maximum run of 60m.

- iii. The accessway detail on the drawings provided in the Construction specification represents a minimum standard. Alternative specific designs for both the path and fencing are encouraged to enhance the development.

#### 4.13 Cycle Paths

Off-road paths for bicycle use shall generally be provided as shared pedestrian / cyclist facilities and shall be to standards specified for footpaths. Width requirements shall be as shown on table 5. The shared path shall be at a maximum gradient of 12.5% and have a minimum lateral clearance of 0.70 m and a minimum overhead clearance of 3.0m to any fixed object (including trees). Stormwater disposal, fencing, handrails, lighting shall be provided as appropriate to each specific situation.

**Table 5: Pedestrian/Cycleways (Walkways) Width Requirements**

Classification	Minimum Width - m		Max Grade - %
	Width between Boundaries	Carriageway	
Pedestrian/Cycleways (Walkways)	7.0	2.5	12.5

The design shall also comply with Austroads Guide to Engineering Practice Part 14 "Bicycles".



Note: When planning and/or designing cycle routes the following guideline should be utilised:

- Cycle network and Route Planning Guide: LTNZ

## **4.14 Service Lanes**

### **4.14.1 Commercial Service Lanes**

- i. A minimum compacted depth of basecourse of 170mm on a subgrade with a CBR of 7 or more and a 2 coat seal is required.
- ii. For swept path design criteria refer to RTS 18 August 2007.

### **4.14.2 Industrial Service Lanes**

- i. Where commercial development is to be provided with access by means of a service lane it should consist of a minimum carriageway shown on table 1, with kerb and channel both sides. Kerb and channel may be mountable with provision for sumps for stormwater removal.

A minimum compacted depth of basecourse of 170mm shall be constructed on a subgrade with a minimum CBR of 7.

- ii. Specific requirements may also call for the provision of passing bays and/or turning circles.
- iii. Maximum grades shall not exceed 12.5% (1 in 8) and a minimum grade shall not be less than 0.5% (1 in 200).
- iv. For swept path design refer to RTS 18 August 2007.

## **4.15 Cuttings and Embankments**

### **4.15.1 Batters in Urban Areas**

- i. Urban cut road batters for cuttings and embankments shall normally be constructed inside the road reserve and any batters encroaching the street boundary may only be allowed at the discretion of the Authorising Officer, provided that where such dispensation is permitted, the face of the batter shall be protected as directed by the Authorising Officer.
- ii. Where possible batters shall not be steeper than 20% (1:5) with a provision for forming a vehicular entrance into each lot at a gradient not steeper than 20% from the back of the footpath, and making provision for retention of s/w in the road channel.



- iii. Where, in the opinion of the Authorising Officer the stability of any embankment as planned is in doubt the developer may be required to provide a stability analysis of the slope under saturated conditions.

#### **4.15.2 Batters and Embankments on Rural Roads**

- i. Rural batters for cuttings and embankments shall be constructed within the road boundaries.
- ii. Batters less than 750 mm high shall be cut at 1V in 4H and shall be topsoiled and grassed.
- iii. Batters more than 750 mm high shall be cut at 2V in 1H and shall be protected from face erosion by hydroseeding or similar. Batters (or multiple benches) in excess of 4.5 metres high and more than 20m long (over 4.5m long) shall be checked, and where necessary designed by the soils engineer. In undertaking this check the soils engineer shall take onto account:
  - The type of soils present in the cutting.
  - The degree of possible erosion and its effect on long term stability and the safety of road users and adjacent property owners.
  - A stability check based on effective stress analyses and appropriate ground water conditions.
  - Hydroseeding design shall be agreed with the Authorising Officer.
- iv. For fill batters or embankments finished slopes shall be grassed or landscaped to prevent erosion. Filled slope stability shall be checked by the soils engineer who shall take into account the parameters listed in Section 8.16.1(iii) of the Austroads Guide.
- v. Stormwater disposal from cut or fill batter benches shall be by pipe, flume or other approved structure.

### **4.16 Bridges, Culverts and Guardrails**

#### **4.16.1 Design**

##### Bridges

Bridging shall be necessary where defined by this Code and approved by Council, early discussions shall be held with the Authorising Officer.

Bridge design shall conform to the technical requirements of Transit New Zealand's Bridge Design Manual and be undertaken by an appropriately qualified Chartered Professional Engineer.

The width between kerbs and wheel guards shall be in accordance with the TNZ Bridge Design Manual.



All bridges, box culverts and other culverts over 1 m diameter shall be subject to a Building Consent under the Building Act 1991.

Bridges shall be designed to be:

- a. Capable of carrying a design loading of HN-HO-72 (public road bridges).
- b. Capable of carrying a design loading of 0.85 (HN-72) (private road bridges) and as shown in the TNZ Bridge Manual: Appendix D: Lightly Trafficked Rural Bridges, June 2003).
- c. Bridge clearances to waterways and all other hydrological design details shall be approved by Environment BOP.
- d. When bridges are provided above traffic lanes, full clearance for the passage of all vehicles permitted to operate on public roads under the Land Transport Act 1998 and subsequent amendments shall be provided for.

Where bridges exist along private way alignments that are to be upgraded for private ways (rights-of-way) approved as a condition of resource consent the bridge shall be examined by a Chartered Professional Engineer who shall determine:

- The capability of the bridge structure and foundations to support the design loadings (or restricted loadings).
- The serviceability of the structure and what measures may be required to upgrade the bridge to a future serviceability of at least 50 years.
- Appropriate signage to advise of loading and speed limitations.

In some circumstances on private ways an alternative crossing such as a ford may be required for vehicles which exceed width or loading limitations.

### Culvert

For a culvert, the design shall allow for the passage of the 10 year flood without heading up. The design shall allow for the passage of the 100 year flood by heading up to a maximum level 0.5 m below the road surface, as per the TNZ Bridge Manual.

Where the road crosses a defined flood plain and overtopping is to be provided for, specific design shall be provided to the satisfaction of the Authorised Officer. If the heading up condition is considered, the design shall ensure embankment stability under flood conditions, and adequate protection to safeguard against piping. This clause includes accessways and rights of way. The heading up condition is to be considered in all cases where blown down trees and debris are able to enter the water course.



In all cases where heading up or overtopping is a design feature, attention shall be given to back water effects upstream to ensure that adjoining land is not adversely affected by flooding.

Culverts beneath carriageways shall not be less than 300 mm diameter.

Installation of bridges or culverts on natural watercourses is generally subject to a Resource Consent from EBOP. The design and construction shall comply in all respects with the requirements of the Consent. The advice of EBOP should be sought at an early stage.

For roads to be vested in Council existing bridges or culverts not meeting this standard shall be upgraded or replaced with structures complying with the standard.

#### **4.16.2 Culverts**

Culverts shall cross the road as directly as possible and in no case at less than 60 degrees to the road centreline. The inlet and outlet of the culvert should be at least 1.5 metres beyond the feather edge and preferably further to reduce the traffic hazard and provide adequate support to the road shoulder.

Culverts shall be reinforced concrete.

Design measures shall be incorporated to prevent scour in channels downstream of culvert outfalls and the construction of stormwater fluming may be necessary. Where culvert or road cut out discharges are to occur into private land the written consent of the private land owner shall be obtained prior to construction.

If necessary a stormwater treatment device designed and installed in accordance with the Auckland Regional Council Technical Publication 10 "Design Guidelines for Stormwater Treatment Devices" or other accepted design procedures may be necessary until the upstream catchment road works have stabilised.

#### **4.16.3 Guardrails**

Guardrails shall be designed and installed in accordance with WBOPDC policy on Guardrails and sight rails.

#### **4.17 Broadband Ducting**

Broadband ducting shall be installed in accordance with this Code when roads are upgraded or constructed, or any pipe trenching is undertaken. Dispensation from this requirement may be sought from the Group Manager Assets and Engineering.





## **Appendix 1    Pavement Markings and Traffic Signs Supplement**



*Western Bay of Plenty  
District Council*

# **Pavement Markings and Traffic Signs Supplement**



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## 1. INTRODUCTION

The aim of this document is to promote a consistent standard of traffic service between Western Bay of Plenty District Council, Tauranga District Council, and the New Zealand Transport Agency controlled regions. This document has been amended to reflect the specific needs of Western Bay of Plenty District Council.

This document is a stand-alone document. For anything not covered in this document, refer to the following:

Transit New Zealand/LTSA Manual Of Traffic Signs And Markings: Part I and II (MOTSAM)  
Road and Traffic Standards Series (RTS), particularly:

- RTS 2: Guidelines for Street Name Signs
- RTS 4: Guidelines for Flush Medians
- RTS 5: Guidelines for Rural Road Marking and Delineation
- RTS 15: Guidelines for urban-rural speed thresholds
- RTS 17: Guidelines for Setting Speed Limits

Austrroads Guide to Traffic Engineering Practice, in particular:

- Part 5: Intersections at Grade
- Part 6: Roundabouts

Austrroads Guide to the Geometric Design of Rural Roads:

- Rural Design Guide

New Zealand Standards

- NZS 1158:1997 - Road Lighting
- NZS 1906:1993 - Retroreflective Materials and Devices for Road Traffic Control Purposes. Part I: Retroreflective Materials
- NZ Standard for Erection of Traffic Signs

plus any amendments of documents that supersede those listed.

### **Road hierarchy**

The road hierarchy as shown in the WBOPDC's District Plan 2009 applies throughout this document.

### **Definition of urban and rural areas**

Rural roads are those with posted speed limits of >70 km/h, all other roads are urban.

## **2. SIGNS**

For general information refer to MOTSAM Part I: Traffic Signs. Where discretionary dimensions are given, the maximum dimensions will be adopted as the standard.

### **2.1 General**

Traffic signs are provided to aid the safe and orderly movement of traffic. Clear and efficient signing is essential. Signs should be erected only where there is a demonstrated need, because unnecessary signs detract from the effectiveness of those that are required.

#### **2.1.1. Sign Specifications**

For sign specifications regarding:

- type
- size
- mounting height
- orientation
- location, or
- supports

refer to MOTSAM Part I, Section 1: Introduction.

### **2.2 Sign logos**

A logo may be displayed on the face of the sign by the road controlling authority only. The logo may appear on all signs other than regulatory (RG, RH), parking (RP) or street name (SN) signs.

Only one logo may appear on any sign. The size of the logo shall not exceed 30 cm<sup>2</sup> on a sign less than 1 m<sup>2</sup> in area, or 100 cm<sup>2</sup> on larger signs.

The logo shall be in the form of a self adhesive label that is located in a corner of the sign where it does not obscure any part of the symbol or legend, is not reflectorised and is removable without damage to the sign.

### **2.3 Reflectivity class**

#### **2.3.1. Reflectorisation**

Further to requirements set out in MOTSAM Part I Section1, signs shall be reflectorised as tabled below:

	<b>Reflectorisation**</b>
Regulatory	Class 1*
Warning Signs	Class 2*
Information Signs	Class 2
Chevron Boards	Class 1
Street Signs	Class 2
Parking Signs	Class 2

\* All signs used at Railway crossings are to be as specified in MOTSAM

\*\* Minimum requirements for compliance.

Common terms for retroreflective sheeting are:

Class 1            High intensity grade

Class 2            Engineering grade

Use of Class 1A Fluorescent material may be used on State Highway's, Collectors and Arterial roads only at the discretion of the Road Controlling Authority (RCA), and in accordance with LTSA Traffic Note 32.

## **2.4 Number of signs on any one pole**

As stated in Part I Section 1 of MOTSAM generally only one sign or sign combination may be erected on one pole with some exceptions listed. Further to these requirements, where exceptions apply a maximum of 10 signs may be placed on one pole with a maximum of 5 facing signs.

## **2.5 Street name signs**

All street name signs are to be in accordance with MOTSAM Part I Section 7: Guide Signs, and set out according to RTS 2: Guidelines for Street Name Signs, with the following additions:

### **2.5.1. Sign colours**

Standard street name signs shall be reflectorised white on blue backgrounds.

### **2.5.2 Lettering types**

Lower case lettering shall be used for street name signs<sup>1</sup> with a maximum of 13 characters.

### **2.5.3 Street number supplementary plates**

Supplementary signs mounted below the street name sign can be used to indicate street numbers. The supplementary sign shall have the same letter type and colour combination as the main sign with a letter size of 100 mm. The supplementary plate will be of the same size and type as the "No Exit" supplementary sign specified in MOTSAM Part I Section 7: Guide Signs.

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<sup>1</sup> Effective from January 2003

#### **2.5.4 Stacking of Street Name Signs at Intersections**

A double-sided sign showing side road name and a single sided sign showing through road name shall be installed at the head of the T-intersection. The side road sign shall be mounted above the through road sign. Note that the requirement for one facing street name still applies.

#### **2.5.5 No Exit signs**

The use of “No Exit” signs shall be limited to the following circumstances:

On rural roads:

- An IG-1 type sign shall only be placed on “No Exit” roads at a point where there is no ability to safely turn around a single axle truck.

On urban roads:

- A street name supplementary plate type “No Exit” sign shall be placed on roads where there is not a direct connection to another link. An IG-1 type “No Exit” sign may be placed on “No Exit” roads, at the discretion of the RCA.



*Typical street name sign combination at a T-intersection.*

#### **2.5.6 Sign Mounting Height and Clearances**

Signs shall have a minimum clearance of 3.0m to the ground in all cases.

## 2.6 RG-6 Give Way signs

For general information and specifications regarding RG-6 Give Way signs, refer to MOTSAM Part I Section 2: Regulatory Signs – General.

### 2.6.1 RG-6 at intersections

When appropriate, a supplementary RG-6 sign may be mounted on the splitter island facing the approach. The sign must be mounted either at 1m or 2.5m in height above the adjacent pavement surface. However, on multi-lane approaches, the supplementary sign is mandatory and should be mounted at the normal height.



*Typical RG-6 layout at single lane roundabout.*

## 2.7 Permanent warning signs

For general information and specifications, refer MOTSAM Part I Section 6: Permanent Warning Signs. Where MOTSAM includes the discretion of the Road Controlling Authority, the following applies:

### 2.7.1. PW-26 Concealed Exit on Curve

In addition to the warrants specified in MOTSAM Part I Section 6, the following requirements must also be met:

- Concealed roads are confined to legal, formed roads only

### 2.7.2 PW-29 Pedestrians

In addition to the warrants specified in MOTSAM Part I Section 6, the following requirements must also be met:

- The traffic volume exceeds 200 vpd
- There is a pedestrian generator nearby (eg a beach, school, park etc)
- The number of pedestrians at any one time exceeds 10 on a daily basis or exceeds 25 on a weekly basis

### 2.7.3 PW-31 Children

In addition to the warrants specified in MOTSAM Part I Section 6, the following requirements must also be met:

- The traffic volume exceeds 200 vpd
- There is a pedestrian generator nearby (eg a beach, school, park etc)
- The majority of pedestrians are likely to be under 16 years of age
- The number of children exceeds 10 on a daily basis

### 2.7.4 PW-34 School Bus Route (Turns)

Required where the traffic volume is greater than 200 vpd and the other warrants as specified in MOTSAM Part I Section 6 are met.

### 2.7.5 PW-35 Cyclists

Required where cyclist numbers exceed those values in the matrix below, and the other warrants as specified in MOTSAM Part I Section 6 are met.

Road type	Number of cyclist per day <sup>2</sup>
Urban	200
Rural	20

### 2.7.6 PW-36 Horses

In addition to the warrants specified in MOTSAM Part I Section 6, the following requirements must also be met:

- The traffic volume exceeds 200 vpd
- There is a horse movement generator nearby (eg a horse riding school, gymkhana, etc)
- The number of horses with riders exceeds two at any one time on a daily basis or exceeds 10 at any one time on a weekly basis

### 2.7.7 PW-37 Cattle

Required where there are regular movements of a herd of more than 10 stock across or along a fenced roadway and the other warrants as specified in MOTSAM Part I Section 6 are

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<sup>2</sup> This value relates to a consistent number per day averaged over a 5-day period.

met. 'Regular' in this case refers to daily movements for a minimum period of one week in any three week period during the milking season.

### **2.7.8 PW-43/PW-43.1 Road Narrows**

Required where the traffic volume exceeds 200 vpd and the other warrants as specified in MOTSAM Part I Section 6 are met.

## **2.8 Public amenity and information signs**

Public Amenity and Information Signs are covered in three Sections within the MOTSAM manual. These are; Part I Section 8: Motorist Service Signs, Part I Section 9: Tourist Signs and Part I Section 10: General Information Signs.

Signs indicating public amenities and items of local interest should conform to the IG-12 fingerboard layout and have black lettering on yellow background except for Motorist Service and Tourist Signs, which are to comply with MOTSAM.

### **2.8.1 Motorist service signs**

For general information refer to MOTSAM Part I, Section 8.

The use of trading names is not allowed on the blue Motorist Service Signs<sup>3</sup>. Under MOTSAM specifications only symbols (and under certain circumstances a single word descriptor) are to be used. See Figure 1.0 for a typical Motorist Service Sign.

### **2.8.2 Tourist signs**

For general information refer to MOTSAM Part I, Section 9.

Trading Names are allowed on the brown Tourist Signs. MOTSAM sets out the criteria to be met by the company/facility applying for the signage and this must be adhered to. See Figure 1.0 for a typical Tourist Sign.

### **2.8.3 Community organisation and clubs**

Signs are not normally provided for such organisations as:

- (a) Sports Clubs
- (b) Schools, play-centres and kindergartens etc

The rationale for the above is:

- (a) A need exists to control the number of signs adjacent to the road to ensure the effectiveness of the important signs
- (b) Community and sporting organisations have a membership, all of which should know the location of their particular facility
- (c) It is for that organisation to advise visiting teams etc of the location of the facility by means of internal club administration

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<sup>3</sup> Note that this policy is currently under review by Transit New Zealand.



On receipt of a request from an organisation, the RCA may install an IG-12 “finger-board” in compliance with MOTSAM and this document. The installation of these signs is limited to State Highway’s, Collectors and Arterial roads only.

### **2.8.4 Neighbourhood Watch / Neighbourhood Support / Civil Defence Signs**

Nationally, standardised Neighbourhood Watch / Civil Defence signs are permitted. They must comply with the following criteria:

- (a) In accordance with current Traffic Regulations
- (b) Maximum size either 400mm diameter or 300mm x 400mm rectangular
- (c) Signs are to be provided and maintained by the appropriate organisation

### **2.9 Advance direction signs**

Advance Direction Signs (ADS) are covered in Part I Section 7.2 of MOTSAM. In addition, ADS must be used where the population of a town down a side-road exceeds 500 permanent residents.

### **2.10 Intersection direction signs**

Intersection Direction Signs (IDS) are covered in Part I Section 7.4 of MOTSAM. In addition, the following requirements apply:

- ID-1, ID-2 or ID-4 type sign required when the town population down side-road exceeds 500 permanent residents
- ID-6 fingerboard type sign required when the town population down side-road exceeds 200 permanent residents

### **2.11 Place name signs**

In addition to Part I Section 7.7 of MOTSAM, place name signs must be placed on the approach to towns where the town coincides with a reduction in the speed limit.

### **2.12 Sign funding**

For the purpose of funding requirements the road signs have been arranged into four separate groups. These groups are indicated below:

	<b>GROUP A</b>	<b>GROUP B</b>	<b>GROUP C</b>	<b>GROUP D</b>
Land Feature	District Boundary Scenic Highway or Route Scenic Lookout Seaside Towns Street/Road Names	Caves Dam Elevation Waterfalls Forest Historic Place Hot Springs Lake Mountain		

	<b>GROUP A</b>	<b>GROUP B</b>	<b>GROUP C</b>	<b>GROUP D</b>
		Photo-scenic sign Rapids River Stream Summit Thermal Area Water Reserve Wildlife Reserve		
Accommodation	Information	Camping Ground Caravan Park Lodge Hotel Motel Motor Camp Tourist Flat YHA		
Food etc	Rest Area Toilets	Café Grill Room Restaurant Tea room		
Vehicle	Car Park Parking Building			Garage
Public Societies and Associations		Senior Citizens Club Church	Ceramics Guides Lions Little Theatre Repertory Theatre Rotary Scouts RSA	
State or Local Authority	Weigh Stations	Art Centre Art Gallery Garden/Parks Bus Station Cemetery School Civil Defence Hall Hospital Library Museum Power Station School Telephone Wharf Airstrips		

	<b>GROUP A</b>	<b>GROUP B</b>	<b>GROUP C</b>	<b>GROUP D</b>
		First Aid Post Railway Station Vehicle Testing Station Fire Station Police Station Emergency Medical Services		
Sport and Recreation	Boat Ramp		Athletic Ground Cricket Ground Park Hockey Ground or Rugby Ground Res. Soccer Ground Name Softball Ground Bowling Green Tennis Courts Golf Course Motor Circuit Archery Club Badminton Club Boating Club Car Club Croquet Club Curling Club Pony Club Rifle Club Rowing Club Squash Club Yacht Club Fishing Pools Rodeo Ground Showground Swimming Pool Forest park YMCA YWCA	
Industrial and Commercial		Motor Fuel Shelter Potteries Winery Sale yards Historic Homes Craft Centres Galleries LPG/CNG		Freezing Works Fruit, Vegetables, Horticulture Shrubs Kennels Stud Farm Timber Mill

	<b>GROUP A</b>	<b>GROUP B</b>	<b>GROUP C</b>	<b>GROUP D</b>
		Refuelling Station		Poultry Farm Orchard Nursery

*Note that this list is not exhaustive but is to instead act as a guide. Contact the Road Controlling Authority for advice in situations not included.*

The full cost of signs installation shall be as follows:

	<b>GROUP A</b>	<b>GROUP B</b>	<b>GROUP C</b>	<b>GROUP D</b>
Land Features	RCA	RCA	-	-
Accommodation	RCA	Commercial Concern	-	-
Food	-	Commercial Concern	-	-
Vehicle	RCA	-	-	Commercial Concern
Public Societies and Associations	-	Society/Association	Society/Association	-
State or Local Authority	RCA	State Authority/ Organisation	State Authority/ Organisation	-
Sport and Recreation	RCA	Club	Club	-
Industrial and Commercial	-	Commercial Concern	-	Commercial Concern

*Note: RCA = Road Controlling Authority*

The ongoing maintenance of the signs will be covered by the RCA.

### **3 PAVEMENT MARKINGS AND DELINEATION**

For general information and for markings for state highways refer to MOTSAM, Part II: Markings. Where discretionary dimensions are given, the maximum dimensions will be adopted as the standard. In addition to these specifications, the following applies to all non-state highway roads:

#### **3.1 No passing lines**

No passing lines are only used when Traffic flow >100vpd and the other requirements as specified in MOTSAM Part II Section 2 & 3 are met.

#### **3.2 Edgelines**

Edgelines shall only be required on roads classified as Primary or Secondary Arterials where the carriageway width exceeds 7.2m, and where they meet the other requirements in MOTSAM Part II Section 2.

#### **3.3 “School” pavement marking**

The word message “School” should only be marked on the pavement (on the approach to schools) when the standard warning signage (PW-32 or PW-33) is not able to be located in accordance with the location and sight distance requirements specified in MOTSAM Part II. In addition, under certain instances the RCA may allow the words to be added to the roadway surface to improve safety.

#### **3.4 Reflectorised raised pavement markers**

Reflectorised raised pavement markers are only used when Traffic flow >500vpd. Refer to MOTSAM Part II Section 2 & 3 and Section 4.06: Raised Pavement Markers for further details.

In addition to these specifications, reflectorised raised pavement markers (RRPM's) shall be placed on right turn bay lane lines if they have already been placed on the centreline to either side of the intersection to which the right turn bay is associated. They are only to be used in specific cases, within rural areas, where head to head right turn bays are not offset, as shown in Figure 2.0.

Blue RRPM's shall be placed at all fire hydrant locations, regardless of the AADT.

## 4 PEDESTRIAN REFUGES

Pedestrian Refuges should be installed where there is a need for pedestrians to cross the road.

Pedestrian Refuges are generally used where it is difficult to cross the full width of the roadway in one stage. The provision of a refuge enables the pedestrian to wait safely in the middle of the roadway and cross one direction of traffic at a time.

The typical Pedestrian Refuge design to be used is shown in Figures 3.1 to 3.2. Lighting is to be to the standard specified in NZS 1158:1997.



*Typical pedestrian refuge layout. (Note, Highway lighting not included in photo)*

## 5 SPEED LIMITS

Speed restriction road markings, which comply with MOTSAM, must be marked on the road at locations where there are changes in the speed limit, on the decreasing speed limit lane only. Speed restriction road markings are optional where speed limit repeater signs occur.

When reviewing a speed limit, or considering imposing a new speed limit a number of steps are required to be undertaken. These are detailed in the LTSA publication RTS 17: Guidelines for Setting Speed Limits.

In addition to these guidelines, the following requirements apply.

The Council shall review road speed limits as follows:

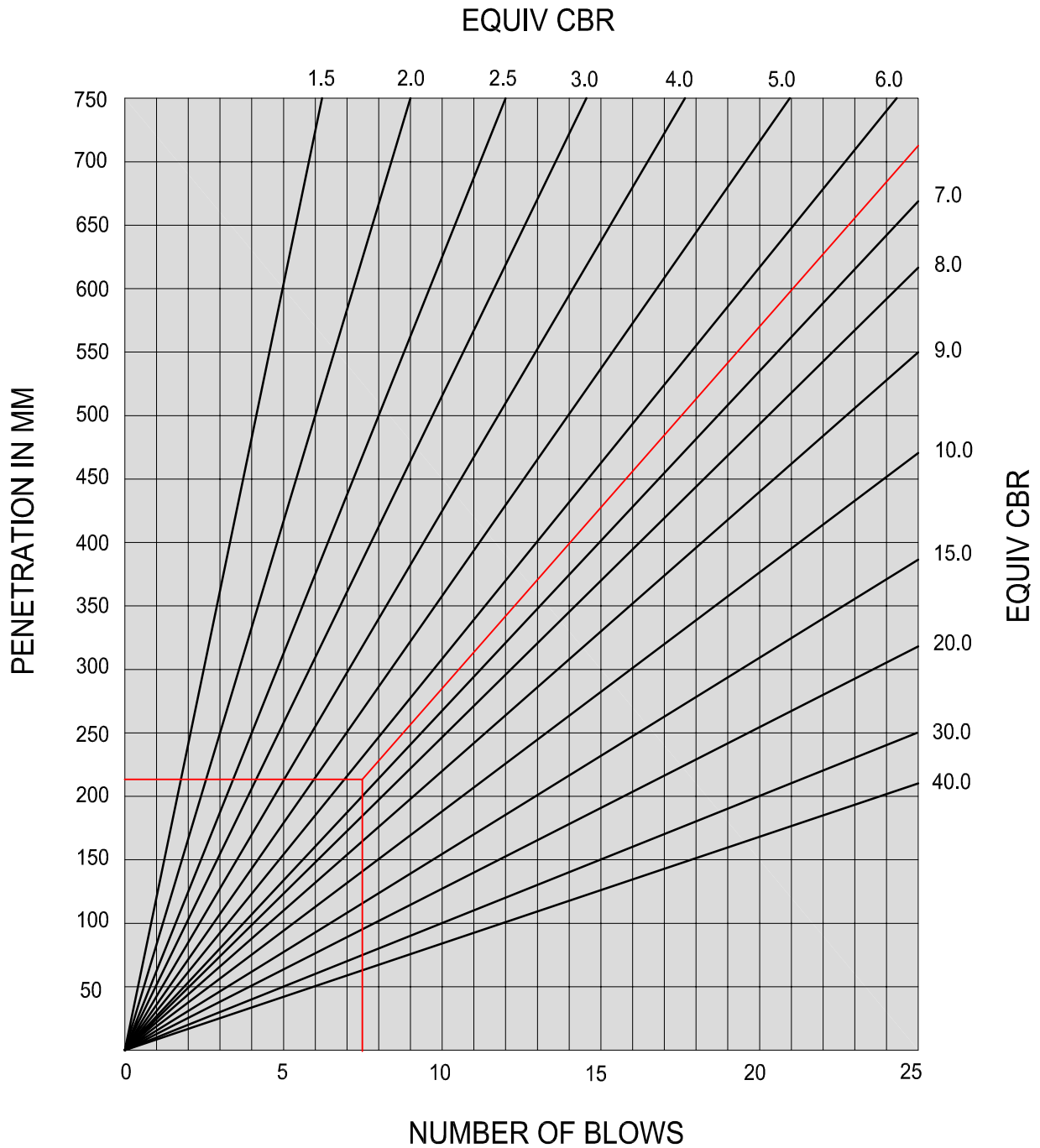
- (a) At least once in every five years
- (b) When there is a significant change in the nature, scale or intensity of land use adjacent to the road. LTSA uses a rating system whereby each adjacent development is awarded points – refer RTS17.
- (c) When a Council receives a written request from one of the following persons:
  - The adjacent District Council in the case of roads subject to a boundary agreement.
  - The District Commander of the NZ Police.
  - The Secretary General of the New Zealand Automobile Association.
  - The Land Transport Safety Authority.





**Appendix 2: APP.2 - Scala Penetrometer CBR Conversion Chart**

**Appendix 3: APP.3 – Flexible Pavement Design Chart**

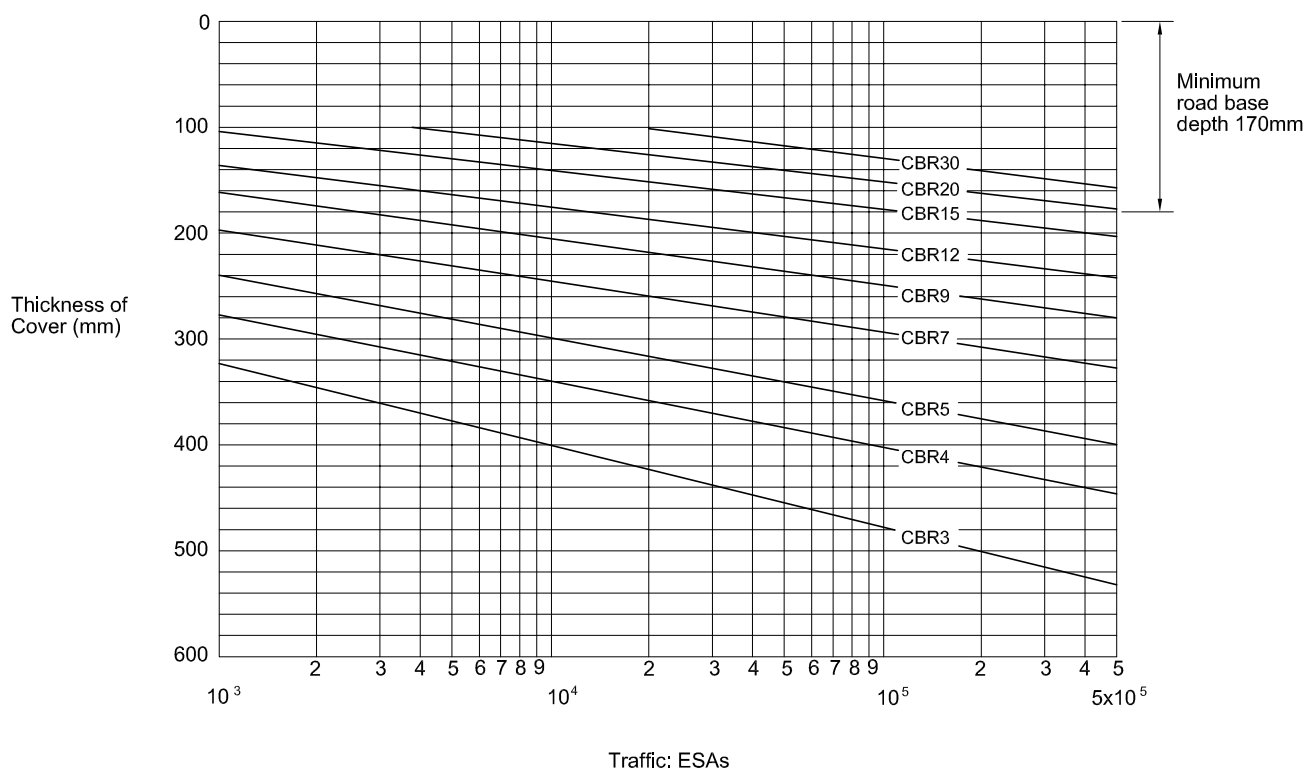


**SCALA PENETROMETER  
CBR CONVERSION CHART**

**APP. 2**

Street Type	Design Period Years	Annual Growth %	Cumulative CV's	Average ESA/CV	Design Traffic (ESAs)
Minor Residential & Cul-de-sacs	25	0	12310	0.2	$2.5 \times 10^3$
Minor Residential	25	1	82340	0.3	$2.5 \times 10^4$
Major Residential subcollectors	25	1.5	263676	0.5	$1.5 \times 10^5$
Minor industrial commercial	25	1	by specific design		
Principal collector	25	5	by specific design		
Major Industrial Arterial & Rural	by specific study				

Adaptation from Austroads Design of New Pavement for Light Traffic.



**NOTES:**

1. The curves give minimum covers required above the subgrade. Allowance must be made for loss of material through penetration into soft subgrades and construction tolerances. Materials for use in 170mm zone must satisfy permeability requirements  $SE > 40$
2. If subgrade CBR exceeds 25 it shall be taken as 25.
3. Where a subbase thickness less than 50mm would be indicated, use full depth basecourse (M4 or GAP40).
4. The minimum pavement depth for public roads shall be 170mm.
5. Rural road pavements shall be specifically designed using this chart based on traffic ESAs.
6. The data shown in the above chart are minimum pavement depth values.