5. ROADS AND ACCESS

5.1 General

This section covers the Kaipara District Council requirements for the design and construction of roads, access ways, access lots, rights of ways, driveways, pan handles and associated infrastructure. Design and quality assurance shall comply with Sections 1 to 3 of these Engineering Standards.

The same standards apply whether an access way is vested with Council or maintained as a private way.

Almost two thirds of the Rural roads in Kaipara District are unsealed. The revised Engineering Standards includes design standards for unsealed roads based on surface friction factors appropriate to an unsealed surface.

The drawings provided in Appendix A detail the specific requirements for Roads and Accesses. The details provided on the drawings in Appendix A over-ride any specific requirement of any other reference document.

5.1.1 Road Vesting

The following requirements shall be met when subdividing land:

(a) Access ways serving 8 or more allotments shall be by public Road vested with Council.

(b) Design and construction shall be to a standard suitable for the number of Household Equivalents served in accordance Table 5.1.

(c) Roads to Vest shall have sufficient legal width in accordance with clause 5.2.4.

(d) A cul-de-sac in accordance with clause 5.2.17 shall be provided at the end of the public Road formation.

Guidance notes:

1. *Roads are required to be designed and constructed in accordance with Sections 5.2 and 5.3 of these Engineering Standards.*
2. *For the purposes of this clause, Road Vesting includes Road Dedication where a right of way or jointly owned access lot is transferred to Council as a public Road.*
3. *Private shared accesses are provided for under this document and are required to be designed and constructed in accordance with Sections 5.2 and 5.3 of these Engineering Standards.*

5.1.2 Use of 'Paper Roads'

On receipt of a written application, Council may allow the formation and use of an unformed legal Road ('Paper Road') to provide access to an existing property or new subdivision.

The following requirements shall be met:

(a) Design and construction shall be to a standard suitable for the number of Household Equivalents served in accordance Table 5.1 except that for a road serving up to 3 household equivalents, the maximum gradient shall not exceed 12.5%.

(b) Any section of Paper Road to be formed shall be connected to an existing Council maintained Road by a continuous road formed to Council standards within an existing legal Road or new Road to be vested with Council.

(c) A cul-de-sac in accordance with clause 5.2.17 shall be provided at the end of the public Road formation;

(d) All design, construction and supervision costs shall be met by the Applicant;

Guidance notes:

1. *Approval to form an unformed legal Road will be made by resolution of Council at a full Council meeting.*
2. *Roads are required to be designed and constructed in accordance Sections 5.2 and 5.3 of these Engineering Standards.*
3. *Single lane Roads (with appropriate passing bays) are allowed in accordance with Table 5.1.*
4. *Council's engineers and contractors will design the Road and carry out construction*
5. *In general, Council will maintain the Road once constructed.*

5.1.3 Work on Council Roads

Guidance notes:

Any construction or upgrading of a formed or unformed legal Road in Kaipara District, other than a State Highway, is subject to the control of Kaipara District Council under section 317 of the Local Government Act 1974. State Highways are under the control of the New Zealand Transport Agency.

Unless provided otherwise under a condition of a land use or subdivision consent, any person wishing to carry out work on a legal Road should obtain the prior written approval of the Road controlling authority.

The formation of an unformed legal Road and any upgrading work on existing Council maintained Roads required as a condition of subdivision or land use consent will be carried out by a Council appointed contractor under the supervision of a Council engineer.

5.2 Design Requirements

5.2.1 Road Standards

The following requirements shall be met:

(a) New Roads, private access ways, rights of way and driveways shall be designed and constructed and/or upgraded to the standards set out in Table 5.1: Roads and Private Ways Design Standards and the typical cross sections shown in drawings S01 and S02.

Table 5.1: Roads and Private Ways Design Standards

Household Equivalents	Minimum Legal Width (Note 1)	Minimum Carriageway Width (Note 2)	Surface (Note 3)	Min Design Speed (Note 4)	Minimum Radius (m)	Minimum SSD (m) (Note 5)	Minimum Crest K (m/%) (Note 5)	Minimum Sag K (m/%)	Maximum Grade
RURAL									
1 (Driveway)	9.0 m	3.0 m	metal		20 m	20 m	1.0	0.5	12.5%
	9.0 m	3.0 m	seal		15 m	20 m	1.0	0.5	20.0%
2 to 3	12.0 m	3.0 m	metal	20 km/h	20 m	40 m*	2.0*	0.5	12.5%
	12.0 m	3.0 m	seal	25 km/h	15 m	40 m*	2.0*	0.5	16.7%
4 to 6	18.0 m	3.0 m	metal	25 km/h	30 m	50 m*	2.5*	1.0	12.5%
	18.0 m	3.0 m	seal	30 km/h	20 m	50 m*	2.5*	1.0	12.5%
7 to 10	20.0 m	5.5 m	metal	35 km/h	55 m	40 m	3.2	1.0	12.5%
	20.0 m	5.5 m	seal	45 km/h	40 m	40 m	3.8	1.6	12.5%
11 to 30	20.0 m	5.5 m	metal	45 km/h	90 m	55 m	7.0	2.6	12.5%
	20.0 m	5.5 m	seal	55 km/h	60 m	55 m	7.0	2.6	12.5%
31 to 50	20.0 m	6.0 m	seal	65 km/h	90 m	75 m	12.0	4.5	12.5%
51 to 100	20.0 m	6.5 m	seal	70 km/h	100 m	85 m	15.0	6.0	10.0%
over 100	20.0 m	6.5 m	seal	80 km/h	160 m	105 m	25.0	10.0	10.0%
URBAN									
1	4.2 m	3.0 m	seal		15 m	20 m	1.0	0.5	20.0%
2 to 3	6.0 m	3.0 m	seal	20 km/h	15 m	30 m*	1.0	0.5	16.7%
4 to 6	12.0 m	3.0 m	seal	30 km/h	20 m	50 m*	1.4	1.0	12.5%
7 to 30	16.0 m	5.5 m	seal	40 km/h	30 m	40 m	3.0	1.5	12.5%
31 to 50	20.0 m	6.0 m	seal	40 km/h	30 m	40 m	3.0	1.5	12.5%
>50	20.0 m	6.5 m	seal	40 km/h	30 m	40 m	3.0	1.5	10.0%

Table 5.1 Notes:

(1). The legal width shall be sufficient for the carriageway (including widening on curves), cul-de-sacs, footpaths and cycleways (where appropriate), parking (where appropriate), public utilities, drainage facilities, grassed Berms, Swale Drains, amenity planting, sight benching and street furniture. Roads to vest shall have sufficient legal width for planned future development. Refer clause 5.2.4

(2). Carriageway width is exclusive of Berms, kerb concrete and parking. Carriageway widths should be increased by up to 1.0m where there is a high proportion of heavy traffic. Additional widening is required on curves in accordance with clause 5.2.5. Passing bays are required on single lane carriageways in accordance with clause 5.2.5.

(3). Carriageway surface shall be sealed in accordance with clause 5.2.6.

(4). Design speeds are based on rolling terrain typical in Kaipara District. Higher design speeds should be considered in flatter terrain.

(5). Safe stopping sight distances marked * have been increased to provide for two vehicles approaching each other on a single lane carriageway to stop before colliding. If a two lane carriageway is proposed for access ways serving 1 to 6 lots, sight distances may be reduced accordingly.
K value is the length of vertical curve (m) divided by the algebraic difference in gradients (%).

(6) Where there is potential for further development under the District Plan, the horizontal and vertical geometry and legal width shall provide for the Ultimate Development.

(7) Collector and Arterial Roads and Roads in Business Zones shall be designed to specific standards approved by Council.

5.2.2 Road Classification

Guidance note:

The width of carriageways will vary according to the traffic carrying capacity of the Road and the associated need for access and vehicle parking. As the traffic function of a Road becomes more important, it will be necessary to provide more specifically for access and vehicle parking so that moving traffic is not impeded. Roads can be classified in the following manner:

a) State Highways – Roads managed by New Zealand Transport Agency. The traffic function is dominant and access is generally restricted. In Urban areas, either a parking prohibition applies with parking on adjacent service streets or parking lanes are provided on both sides of the traffic lanes.

b) Arterial Roads - Traffic function is dominant. In Urban areas, either a parking prohibition applies with parking on adjacent service streets, or parking lanes are provided on both sides of the traffic lanes.

c) Collector Roads - Both traffic and property access functions are important. Traffic requirements are sufficient to justify 2.5 m wide parking lanes on each side of the traffic lanes in Urban areas.

d) Local Roads - Property access is dominant with low traffic volumes and low traffic speeds. In Urban areas, parking should be provided in accordance with clause 5.2.10. Parking areas need not be continuous but broken into parking bays separated by planted trees and shrubs.

e) Private Ways – Short shared accesses not owned or maintained by Council, but by the owners of the properties served. Private access ways can be either jointly owned access lots, or rights of way. Lane sharing by parked and moving traffic is generally acceptable. To enable moving vehicles to pass parked vehicles, a two lane width is provided where the number of households served warrants.

State Highways, Arterial and Collector Roads are shown in the Kaipara District Plan. All other public Roads are classed as Local Roads.

5.2.3 Traffic Volumes

Guidance note:

Traffic counts carried out on no-exit roads in Kaipara District indicate that Annual Average Daily Traffic (AADT) varies from 4 vpd per dwelling in Rural areas to 10 vpd per dwelling in Urban areas.

For residential subdivisions, in both urban and rural areas, Council will generally adopt an AADT of 8 vehicle movements per day for each lot.

Maximum permitted traffic movements to and from a site are specified in the 'District Plan.

5.2.4 Legal Width

The legal width of any Road is the width of any area of land which has been declared Road in accordance with section 114 of the Public Works Act 1981 or the width of private access way shown on the survey plan.

The following requirements shall be met:

(a) The legal width shall be sufficient for the carriageway (including widening on curves), footpaths and cycleways (where appropriate), parking (where appropriate), public utilities, drainage facilities, grassed Berms, Swale Drains, amenity planting, sight benching and street furniture.

(b) The legal width shall not be less than specified in Table 5.1.

Guidance notes:

1. Roads to vest should have sufficient legal width for planned future development in accordance with Council's structure plans.

2. *In Rural areas, the recommended legal width is based on a one or two lane carriageway with feathered shoulders and Water Tables on each side as detailed on drawing S01. Greater margins are provided on public Rural roads to accommodate earthworks, sight benching and future road improvements.*

3. *In Urban areas, the minimum legal width is based on a one or two lane carriageway with kerb and channel on each side and a footpath on one side as detailed on drawing S02. Greater margins are provided on major Urban roads to accommodate amenity planting, earthworks, sight benching and future road improvements. The minimum legal width shall be increased as necessary to provide for parking, cycleways, amenity planting and swale drains.*

4. *Alternative berm widths may be appropriate in some circumstances. An irregular shaped reserve may be required where a significant natural feature such as a large specimen tree is to be preserved.*

5. *Any strips of unused land between a Road and an adjoining property which are less than 5.0m wide, should be declared legal Road in accordance with Section 114 of the Public Works Act 1981.*

5.2.5 Carriageway Width

The following requirements shall be met:

(a) The minimum carriageway width shall be as specified in Table 5.1 plus additional widening on horizontal curves in accordance with drawing S04.

(b) Passing bays shall be provided on single lane carriageways no further apart than 100m and wherever sight distance along the access is less than the minimum safe stopping distance (SSD) specified in Table 5.1.

(c) Minimum passing bay dimensions shall be as shown on drawing S04.

Guidance notes:

1. *Each carriageway should be designed for two way traffic with lanes of sufficient width to carry heavy vehicles and prevent edge break where the road is to be sealed. The width of the carriageway is related to the volume of traffic expected to be carried, becoming progressively wider as volumes increase. This is to allow for greater clearances between passing vehicles and associated space.*

2. *Carriageway widths should be increased by up to 1.0m where there is a high proportion of heavy traffic to prevent shallow shear failure in the outer wheel tracks. Carriageway widths shall be as specified in Table 5.1 with additional widening on curves as detailed on drawing S04 to provide for the swept path of larger vehicles and wander space at higher speeds.*

3. *On low speed curves, the additional widening is based on the tracking width of an 11m rigid truck. On higher speed curves, additional widening is provided for vehicle wandering. The clearance beyond the vehicle width of 2.5m provided by the minimum specified carriageway width is maintained through the curve.*

4. *On two lane carriageways serving no more than 10 Household Equivalents, only one lane of widening need be provided as it is unlikely that two trucks will need to pass each other.*

5. *In residential areas the carriageway may be split into separate one-way lanes to preserve natural features such as trees or to minimise property access problems on steep terrain.*

5.2.6 Carriageway Surface

The following requirements shall be met:

(a) Urban Roads, Private Ways, rights of way and Driveways shall be sealed.

(b) Rural Vehicle Crossings off sealed roads shall be sealed as follows:

(i) At least to the tangent point / throat of the Vehicle Crossing curve (6m on residential crossings and 10m on commercial crossings) where the Vehicle Crossing is level or slopes down from the road; or

(ii) At least to the gate position (10m on residential crossings and 25m on commercial crossings) where the Vehicle Crossing slopes up from the road;

(c) Rural Roads, private shared accesses and Driveways shall be sealed as follows:

(i) Where the longitudinal gradient exceeds 12.5% (1 in 8);

(ii) For a distance of at least 50m from an existing sealed road where serving 9 to 30 Household Equivalents;

(iii) The entire length where serving 31 or more Household Equivalents (greater than 180vpd).

Guidance note:

1. *Concrete carriageways may be used in place of chip seal or hot mix surfacing on private Vehicle Crossings and accessways.*
2. *Standards for sealing are specified in clause 5.4.2 of these Engineering Standards.*
3. *Carriageways with a longitudinal gradient in excess of 12.5% are required to be sealed to provide sufficient traction and avoid corrugation and aggregate separation.*

5.2.7 Edge Treatment

The following requirements shall be met:

(a) Feathered shoulders, Watertables, kerb and channel and Berms shall be provided as detailed in Table 5.3 and on drawings S01 and S02.

Guidance note:

Alternatives to kerbs, such as dished drains and Swale Drains will be accepted provided that the stormwater design criteria in Section 6 are achieved.

5.2.8 Footpaths

The following requirements shall be met:

(a) Footpaths shall be provided on at least one side of new Roads in residential zones and for residential development in defined growth areas.

(b) Footpaths shall be provided on both sides of the Road in Business Zones and on Urban Strategic, Arterial, Collector Roads and Urban Roads carrying more than 500vpd.

(c) Footpaths shall be of concrete construction, 1.4m wide (exclusive of kerb and channel) and 100mm thick as detailed on drawing S02. On Vehicle Crossings, in Service Lanes and cul-de-sac heads, footpaths shall be 150 mm thick and reinforced as detailed on drawing S05 for Vehicle Crossings.

Guidance notes:

1. *Footpaths should be separated from the road and parking areas by non-mountable kerb and channel or a Swale Drain at least 2.0m wide.*
2. *In general footpaths should be at least 100mm thick to minimise the likelihood of damage. In Service Lanes and cul-de-sac heads, heavy vehicles are likely to mount the footpath occasionally.*
3. *In Business Zones and areas where the footpath extends from the kerb to the front boundary, the footpath may be laid in interlocking paving stones to facilitate ease of repair of buried utility services.*

4. *Footpaths constructed of alternative materials such as asphaltic concrete, masonry blocks or paving units may be permitted in certain circumstances. Early discussion with Council is advisable if any alternative to concrete is proposed.*

5. *A pram crossing shall be provided in the kerb line at all intersections as shown in drawing S15. Where possible, sumps shall be sited upstream of the crossing.*

6. *Where a new Road joins an existing Strategic, Arterial or Collector Road and is likely to generate a significant number of pedestrians who wish to cross the major Road, appropriate crossing facilities shall be discussed with Council prior to finalising the design. These may include pedestrian refuges at the centreline, or full pedestrian crossings, but need to be compatible with Council's strategy for such facilities.*

5.2.9 Cycle Path Guidelines

1. *Cyclists are generally expected to share the traffic lanes on roads. Separate cycle lanes at least 1.5m wide should be considered for Urban Collector, Arterial and Strategic Roads.*

2. *Cycle paths can be omitted from these roads if a satisfactory alternative cycle route exists (e.g. a nearby minor parallel street). If possible cycle paths should be physically separated from the main carriageway.*

3. *Cycle paths separated from road carriageways should be constructed to the standards specified for footpaths. Where used by pedestrians and cyclists, the minimum paved width should be 2.5m assuming no side obstructions or walls. Where these are present, additional clearances should be provided. Appropriate drainage, fencing, handrails and lighting should be provided as necessary for the safety of users, especially at night.*

5.2.10 Parking, Manoeuvring and Loading

The following requirements shall be met:

(a) The quantity and location of off street parking, manoeuvring and loading bays shall be provided in accordance with the District Plan.

(b) Adequate provision shall be made for access between the Road and parking area and for manoeuvring within the site so that vehicles do not reverse out on to the Road.

(c) On-street parking shall be provided for subdivisions in Urban areas. On access ways serving up to 20 dwellings, a 5.5m carriageway width is expected to provide for occasional on-street parking.

(d) On Roads serving more than 20 dwellings in areas zoned Residential; one on-street car park shall be provided for every two dwellings within 50m distance of the site boundary of any dwelling.

(e) Parking bay sizes shall comply with drawing S20, NZS4404:2010: Figure 3.2, AS2890.1 (Light vehicles) or AS2890.2 Commercial as appropriate.

(f) Loading bay sizes shall comply with AS2890.2 Commercial.

(g) On properties used mainly for residential purposes, manoeuvring areas shall be provided for a 5.0m standard car in accordance with drawing S18.

(h) On properties used mainly for business purposes, manoeuvring areas shall be provided for an 11.0m standard truck or articulated truck in accordance with drawing S19.

(i) The maximum longitudinal gradient and maximum crossfall on any area used for parking, loading and manoeuvring shall be 6%

(j) Pavements shall be formed and surfaced in accordance with clauses 5.2.6 and 5.2.13 respectively.

(k) Access and manoeuvring areas shall comply with the New Zealand Building Code acceptable solutions C/AS1 Part 8.1 (Fire Service Vehicular Access).

Guidance Notes:

1. *Parking may be provided either as continuous parallel parking bays on one or both sides of the carriageway or as angle parking bays at discrete locations. In Business zones, parking shall be provided in accordance with the District Plan.*

2. *Consideration should be given to parking alternatives as recommended in Chapter 4 of Auckland Regional Council TP 124 Low Impact Design Manual for the Auckland Region.*

5.2.11 Geometric Design

The following requirements shall be met:

(a) Design Methods

The horizontal and vertical geometry of Rural and Urban Roads shall be designed in accordance with the following paragraphs:

The design speed of a horizontal curve shall be calculated according to the formula:

$$V = [127\ R\ (e + f)]^{0.5}$$

Where V = vehicle speed (km/h)

R = curve radius (m)

e = superelevation (m/m)

f = side friction

Safe Stopping Distance shall be calculated according to the formula:

$$SSD = \frac{R_T . V}{3.6} + \frac{V^2}{254(d+g)}$$

Where R_T.= reaction time (seconds)

V = vehicle speed (km/h)

d = rate of deceleration

g = longitudinal gradient (m/m)

The minimum reaction time used in calculations shall be 2.0 seconds. On Arterial and Collector Roads the reaction time shall be increased to a minimum of 3.0 seconds.

Design values for side friction coefficients and rate of longitudinal deceleration shall be as follows:

Table 5.2: Design Side Friction and Rate of Longitudinal Deceleration

Design Speed	Side Friction		Rate of Longitudinal Deceleration	
(km/h)	sealed	unsealed	sealed	unsealed
<50	0.35	0.12	0.52	0.27
60	0.33	0.11	0.48	0.27
70	0.31	0.10	0.45	0.26
80	0.26	0.10	0.43	0.25
90	0.20	0.09	0.41	0.24
100	0.16	0.09	0.39	0.23

Vertical curves shall be designed for driver eye heights of 1.05m (crest curves) or 1.8m (sag curve with overhead obstruction) and an object height of 200 mm.

(b) Horizontal Alignment

Horizontal alignment of roads and access ways shall be designed in accordance with Table 5.1. Each horizontal curve shall consist of a single circular arc. Spiral transitions shall be provided on horizontal curves on Collector and Arterial Roads.

(c) Vertical Alignment

The vertical alignment on all roads shall be designed to provide gradients and minimum K values in accordance with Table 5.1. The design speed of the vertical alignment (based on Safe Stopping Sight Distances) shall match or exceed that of the horizontal alignment.

(d) Superelevation

The horizontal alignment of all new or upgraded Rural roads and Urban Collector, Arterial Roads and Right of Ways shall have superelevation which provides for the minimum design speed specified in Table 5.1.

Urban local Roads shall have, as a minimum, 3% normal camber.

Where superelevation is required, the rate of superelevation rotation shall be 0.035 radians per second for design speeds up to 70 km/h and 0.025 radians per second for design speeds of 80 km/h or higher.

(e) Sight Lines

Sight benching shall be provided within the Road reserve as required to provide at least stopping sight distances along the road. Stopping sight distance shall be calculated in accordance with clause 5.2.11(a), but shall not be less than as specified in Table 5.1.

Guidance Notes:

1. *These design principles are consistent with Austroads Rural Road Design: Guide to the Geometric Design of Rural Roads and Australian Road Research Bureau Unsealed Roads Design Guidelines. Further design guidance may be obtained from these documents.*
2. *The minimum sight distances in Drawing S10 are based on 85 percentile operating speeds, 2.0 second reaction time and level gradients.*
3. *The horizontal alignment should be designed to guide drivers into choosing an appropriate speed for the environment. The design should provide for a consistent standard of alignment with no curve less than 15 km/h lower than the 85th percentile operating speed at the site.*
4. *Minor adjustments to kerb levels to provide an evenly sweeping kerb line are acceptable. If necessary a graphical plot of each kerb profile, using a horizontal/vertical scale ratio of the order of 10 to 1, shall be used to ensure even profiles. Care shall also be taken to ensure that gradients along the inside kerb are acceptable. Where applicable, superelevation can be added to the inside profile to obtain acceptable gradients.*

5.2.12 Traffic Calming Guidelines

On Local Roads and private ways, lower traffic speeds are desirable for the safety of pedestrians and turning traffic.

Traffic speed is influenced by a number of factors including:

- *Horizontal alignment*
- *Sight distance along the road*
- *Lane width*
- *Line markings*

- *The degree of built environment*
- *Vertical elements close to the road*
- *Physical restrictions such as chicanes and speed humps.*

The carriageway widths and design speeds (horizontal and vertical alignment) specified in Table 5.1 for local roads (up to 30 Household Equivalents) are towards the lower end of national and international roading standards and therefore promote lower traffic speeds.

Higher vehicle speeds may result when the horizontal alignment is inconsistent with the function of the road, such as long straight sections of road in a Rural-residential subdivision. In these cases, it may be appropriate to introduce additional horizontal curves, particularly if these follow the contour of the land.

Trees or road cuttings on the outside of curves help to provide visual clues to the curve alignment for approaching traffic and can slow traffic speeds without compromising sight distances along the road.

'Threshold' or 'gateway' treatments may be appropriate where a change in the built environment needs to be reinforced by specific traffic calming measures.

Whenever traffic calming measures are proposed, care must be taken to maintain safe stopping sight distances consistent with the likely operating speed.

Further guidance on traffic calming can be obtained from the Land Transport New Zealand Research Report 300 'Speed Change Management for New Zealand Roads' 2006 available from the New Zealand Transport Agency website.

5.2.13 Pavement Structural Design

The following requirements shall be met:

(a) Pavements shall be designed for a life of at least 25 years.

(b) For roads and access ways serving up to 100 Household Equivalents, 25 year design loads shall be as specified on drawing S03.

(c) The minimum design loads for sealed pavements shall be as specified on Table 5.7.

(d) The design loads for concrete pavements shall be based on the estimated traffic volume of the potential development.

(e) Design loads for major roads (greater than 600vpd) shall be determined from the known heavy vehicle usage of the road, or, in the absence of such information design loading may be calculated according to the formula:

Equivalent Standard Axles (ESAs) per lane = 400 x AADT,

where AADT is the Annual Average Daily Traffic Volume (including cars) in both directions. An AADT of 6vpd / Household Equivalent shall be used for pavement design.

(f) The minimum basecourse (top layer) depth on sealed pavements shall be:

(i) 150mm for lime stabilised pavements

(ii) 250mm for TNZ M/4 basecourse.

(g) Unsealed road pavements shall include an upper layer of well graded running course aggregate of maximum particle size 20mm, minimum layer thickness 50mm and containing sufficient fine material to bind the layer and confine larger particles in the underlying structural pavement layer.

(h) Concrete or sealed carriageways shall be provided wherever the gradient exceeds 12.5%.

(i) Subgrade and pavement testing shall be carried out in accordance with Table 5.7 and drawing S03. The depth of subgrade tested shall be from 0 to 1.0m below

design subgrade level. The lowest CBR recorded in this depth range shall be the CBR value recorded at that test location. The design CBR for each uniform pavement design shall be the 10 percentile CBR value; that is the value exceeded by 90% of the test results.

Guidance notes:

1. *Further guidance on pavement design can be obtained from the Austroads Pavement Design Manual (including New Zealand supplement); 90% confidence level charts.*
2. *The minimum basecourse (top layer) depth of 250mm on sealed pavements is to minimise the creation of perched watertables in the pavement.*
3. *The minimum standard design loadings are based on 10%HCV, 0.9 ESA/HCV or 400 x AADT ESAs per lane on a 2 lane carriageway. An AADT of 6vpd / Household Equivalent shall be used for pavement design.*
4. *The minimum design loadings for sealed pavements are based on occasional use by heavy vehicles.*
5. *Where the gradient is between 16.7% and 20%, concrete carriageways are recommended. Concrete carriageways should be designed in accordance with Section 9 of the Austroads Pavement Design Manual (including the New Zealand supplement). Access ways with a gradient greater than 20% require specific Council approval.*
6. *Solid masonry paving units may be used on private Urban accesses and may also be an alternative in light duty areas such as shopping malls and courtyards, where a surface appearance is a consideration. Masonry units should be readily available standard units, and should comply with NZS 3116:2002. These pavements shall be designed to have a 25 year life under all expected local conditions. The edges of the paved areas should be adequately confined, normally by concrete nibs.*

5.2.14 Bridge Design

The following requirements shall be met:

(a) All Bridges shall:

- (i) be designed in accordance with the Transit New Zealand Bridge Manual;
- (ii) Have 600mm clearance above the 1% AEP flood level on Arterial Roads. For other roads, be at or above the 1% AEP flood level during that flood;
- (iii) Provide an 8.0m clear width between rails if located on a bend with a radius less than 300 metres or on any road with traffic volumes greater than 500 vehicles per day. Otherwise a 4.5m clear width between rails is acceptable.
- (iv) Have W-section bridge steel guard-rail across the bridge and on the approaches for a minimum distance of 20m from each abutment, terminating in breakaway cable terminals. This requirement can be waived if there is less than a 3.0m drop below the bridge deck and the formation width required for the applicable road type is provided.
- (v) Have resource consent from the NRC if required by the Regional Water and Soil Plan.
- (vi) Have a Building Consent unless exempted under Schedule 1(k) of the Building Act 1994.

Guidance note:

1. *Bridges should be designed taking into account average annual daily traffic volumes and associated heavy vehicle requirements.*

5.2.15 Culvert Design

The following requirements shall be met:

(a) All culverts shall be designed to ensure:

(i) There is no flooding of the road Carriageway in a storm event of 10%AEP or less;

(ii) On Arterial and Collector Roads, the depth of flood water measured at the road centreline shall not exceed 100mm during a 1% AEP storm event;

(iii) On Local Roads and private access ways, the depth of flood water measured at the road centreline shall not exceed 200mm during a 1% AEP storm event.

(b) The culvert shall also have resource consent from the Northland Regional Council if required by the Regional Water and Soil Plan.

5.2.16 Intersection Design

The following requirements shall be met:

(a) The intersection of public Roads and private access ways serving more than 30 Household Equivalents shall be sealed intersections designed in accordance with Austroads Guide to Traffic Engineering Practice Part 5: Intersections at Grade: 2005 (Austroads Intersections at Grade) and the New Zealand Transport Agency Manual of Traffic Signs and Markings (MOTSAM).

(b) Intersections shall be designed and located such that the Approach Sight Distance (ASD) and Safe Intersection Sight Distance (SISD) in Tables 6.3 to 6.4 of Austroads Intersections at Grade: 2005 are achieved. In both cases the visibility shall be measured from a location 7.0m back from the intersection limit lines.

(c) Intersections shall be designed in accordance with Austroads Intersections at Grade to accommodate, at the carriageway level, a turning circle with a 15.0m outside radius and swept path 6.0m wide. An additional 1.0m overhang shall be accommodated outside this circle at a height 1.0m above the Carriageway surface.

(d) Left and right turn bays shall be provided where turning movements comply with the auxiliary lane warrants in Austroads Intersections at Grade: 2005 Figure 6.41.

(e) Longitudinal gradient and crossfall at intersections shall comply with the following:

- The crossfall shall not exceed 8%
- The adverse crossfall shall not exceed -6%
- The effective crossfall (vectorial sum of the longitudinal gradient and crossfall) shall not exceed 6%

Guidance notes:

1. The number of intersections should be minimised.

2. The preferred angle of intersection is 90 degrees, with a minimum angle of 80 degrees: Carriageway alignment may be offset from the Road reserve alignment to improve the intersection angle. Acute angle, 'Y' and multi-leg intersections are not acceptable.

3. Non-priority intersection legs should be offset from each other by a minimum of 15m so that they do not form a straight route through the intersection. In this case the intersection of each minor road leg should be designed as a separate intersection. Exceptions to this are roads which are legs of a roundabout or intersections that are controlled by traffic signals.

4. Austroads Intersections at Grade:2005 Entering Sight Distance (ESD) is rarely achievable and need not be provided.

5. *Intersections which have ultimate peak daily traffic flows greater than 1,000 vehicles per day through them should have a safety audit carried on them by an experienced traffic safety auditor as part of the design certification.*

6. *Where appropriate and with the written approval of Council's Asset Manager, intersections on public Roads may be constructed as roundabouts. The design of roundabouts should be in accordance with Austroads Guide to Traffic Engineering Practice Part 6: Roundabouts and the New Zealand Transport Agency Manual of Traffic Signs and Markings (MOTSAM).*

5.2.17 Cul-de-Sacs

The following requirements shall be met:

(a) Cul-de-sacs shall be provided in accordance with drawing S16 at the end of any no-exit public Road or private access way serving 4 or more lots.

(b) Longitudinal gradients and crossfalls at the cul-de-sac shall comply with the following:

- The crossfall shall not exceed 8%
- The adverse crossfall shall not exceed -6%
- The effective crossfall (vectorial sum of the longitudinal gradient and crossfall) shall not exceed 6%

Guidance Notes

1. *Each cul-de-sac should be provided with a place where light vehicles may turn without reversing. Provision should also be made, near the end of a cul-de-sac of such length as to preclude "backing up" of larger vehicles, for three point or two point turning utilising insets in the kerb line or kerb crossings. The principal design features of a short cul-de-sac are illustrated in drawing S16.*

2. *Kerb and channel grading around the cul-de-sac should be based on the adoption, as far as practical, of the standard 1 in 30 (3%) carriageway cross fall at critical points in the arc length with easing of changes in grade by designed vertical curves as required. Off centre cul-de-sac heads should be designed by offsetting the road carriageway crown to create symmetrical conditions with the channel being designed accordingly.*

3. *In industrial areas "no exit" roads should be avoided wherever possible. Where they cannot be avoided a turning circle radius of 15m (excluding the footpath) should be provided.*

4. *For roads which are likely to be continued at a later date, including roads which end at land zoned Rural in the District Plan, an all-weather vehicle-turning area of minimum diameter 20m shall be provided.*

5.2.18 Vehicle Crossings

5.2.18.1 Obligation to Provide and Maintain Vehicle Crossings

The following requirements shall be met:

(a) The consent holder, owner or occupier of each site shall provide and maintain at least one Vehicle Crossing so as to enable vehicles to pass freely to and from the site. Each Vehicle Crossing shall be formed with an all weather surface between the edge of the road carriageway and boundary of the site, and have associated stormwater drainage facilities.

(b) The crossing shall be maintained by the owner or occupier of the site in such a condition as to ensure that stormwater and detritus including gravel, dirt and other materials do not migrate onto the road surface.

5.2.18.2 Location of Vehicle Crossings

The following requirements shall be met:

(a) Each Vehicle Crossing shall be located in such a position as to provide motorists entering and leaving the site with adequate visibility and not adversely affect the free flow of traffic on the adjoining road, provided that the following minimum requirements shall be met:

(b) Sight distances at the Vehicle Crossing shall comply with the sight line provisions shown on drawing S10. Sight lines shall be contained within the Road reserve legal boundaries.

(c) In Rural areas, the following minimum distances shall apply:

  (i) No Vehicle Crossing onto any Collector or Arterial Road shall be situated within 60m of any road intersection (as measured from the nearest road boundary).

  (ii) No Vehicle Crossing onto any Local Road shall be situated within 30m of any intersection (as measured from the nearest Road boundary).

  (iii) The minimum spacing between Vehicle Crossings on the same side of any Collector or Arterial Road shall be 60m unless the consent of the Road controlling authority is otherwise obtained.

  (iv) The minimum spacing between Vehicle Crossings on the same side of any Local Road shall be 30m unless the consent of the Road controlling authority is otherwise obtained.

(d) In Urban areas, the following minimum distances shall apply:

  (i) No Vehicle Crossing shall be situated within 20m of any road intersection (as measured from the meeting point of the main kerb alignments).

  (ii) The minimum spacing between Vehicle Crossings on the same side of any road shall be 10m unless the consent of the road controlling authority is otherwise obtained.

(e) No more than two crossings shall be provided on any site which has a street frontage of 40m or less.

(f) The total crossing width of any front or corner site shall not exceed 50% of its street frontage, except for service stations and other similar activities where the standards in the Ministry of Transport's Traffic Engineering Information Bulletin No 1 Standard For Service Stations 1963 shall apply.

(g) Written approval shall be obtained from the New Zealand Transport Agency for any new Vehicle Crossing or change in use of an existing Vehicle Crossing on a State Highway.

Guidance Notes:

Access on to State Highways is controlled by the New Zealand Transport Agency. Vehicle crossing standards on state highways are higher than for local roads and must be compiled with.

5.2.18.3 Design and Construction of Vehicle Crossings

The following requirements shall be met:

(a) Each Vehicle Crossing shall be designed and constructed to the relevant design specified on drawings S05 to S09.

(b) Vehicle Crossing pavements shall be designed for the number of Household Equivalents served in accordance with clause 5.2.12, Table 5.6 and drawing S03

(c) All Vehicle Crossings shall be sealed as specified in clause 5.2.6 except Vehicle Crossings in Rural areas where the main road is unsealed and the crossing serves no more than 30 Household Equivalents.

(d) Vehicle Crossings shall comply with the breakover and departure angles specified on drawing S17.

(e) Vehicle Crossings on state highways shall comply with NZTA requirements.

Guidance Notes:

1. *These standards are designed to ensure that the 90th percentile vehicle does not "bottom out" when using them and the design vehicles do not cross the centreline when turning left into the side road.*
2. *Where a Vehicle Crossing is removed the area concerned should be reinstated as verge and any footpaths and kerbs replaced within 6 months of the crossing point removal. The cost of such work will be borne by the owner or occupier of the site concerned.*

5.2.18.4 Loading Ramps

The following requirements shall be met:

(a) No loading ramp shall be located within 25m of the edge of a traffic lane.

5.2.19 Driveways

The following requirements shall be met:

(a) The owner or occupier of each site shall provide and maintain a Driveway for the purposes of providing safe and convenient vehicular access from the road to on-site loading and parking spaces where such are required under the District Plan.

(b) Driveways shall be formed and maintained with an all weather surface and provided with associated stormwater drainage so as to minimise soil erosion.

(c) Minimum Carriageway width - The minimum Carriageway width of any Driveway shall be 3.0m

(d) The maximum gradient of any Driveway shall be 1:5 (20.0%) for any sealed Carriageway and 1:8 (12.5%) for any metalled Carriageway provided that all Driveways shall be designed to meet the break over and departure angles shown on drawing S17.

(e) All properties shall have a turning area on site so that vehicles do not need to reverse on to a Road or shared private way.

(f) Accessways serving more than one Household Equivalent shall be designed and constructed in accordance with Table 5.1 and clause 5.2.1 of these standards.

(g) Access and manoeuvring areas shall comply with the New Zealand Building Code acceptable solutions C/AS1 Part 8.1 (Fire Service Vehicular Access).

5.2.20 Gates

The following requirements shall be met where a private access joins a public Road with an 80 or 100km/h speed limit:

(a) Where a private access way is gated, the gates shall be located at least 13m from the edge of the public Road Carriageway where the gate opens away from the Road or 13m plus the gate width where it opens towards the Road.

(b) All gated accesses shall be provided with turning provisions, such that a 90th percentile car may enter the access way and turn around, without passing the gates or affecting through traffic on the public Road.

Guidance Notes:

1. *Gates or cattle stops are not permitted on public Roads unless the written permission of Council has been obtained under section 344 of the Local Government Act 1974.*
2. *Access on to State Highways is controlled by the New Zealand Transport Agency. Standards for gate setbacks on state highways may be higher than for local Roads and must be compiled with.*

5.2.21 Road Drainage

The following requirements shall be met:

(a) Stormwater drainage on roads shall comply with the permitted activity rules of the Regional Water and Soil Plan for Northland or have a resource consent from the Northland Regional Council;

(b) Stormwater drainage on roads shall provide positive drainage from the road surface such that ponding does not occur, the pavement does not become saturated, scour is avoided and discharges do not result in adverse effects on private property.

(c) Stormwater side drains and culverts under roads and entranceways shall be designed for at least a 10% AEP rainfall event. The minimum pipe size shall be 375mm diameter under roads unless the entry is protected by a sump, in which case, the minimum diameter is 300mm. The minimum pipe size under Vehicle Crossings shall be 300mm diameter.

Guidance Notes:

1. *In general, Rural roads should be built higher than the adjacent flood levels and Urban roads should be built lower than the adjacent flood levels.*
2. *Stormwater runoff from roads should be controlled within the Road reserve to discharge to natural drainage paths. Stormwater runoff should not flow overland over the footpath or through Urban properties.*
3. *Stormwater drainage on roads should comply with Section 6 of these Engineering Standards.*
4. *Stormwater drainage on roads should be designed in accordance with New Zealand Transport Agency's guideline document "Highway Surface Drainage; Design Guide for Highways with a Positive Collection System" for applicable roads, except that stormwater runoff should not be discharged into any sewers;*
5. *Unless otherwise Approved by Council, stormwater control in Urban areas should comply with Table 5.3.*

Table 5.3: Specific Area Requirements for Stormwater Control

Area	***Stormwater Control Method***
Dargaville *Paparoa* *Maungaturoto* *Kaiwaka*	*Kerb and Channel*
Mangawhai *Te Kopuru* *Baylys Beach* *Glinks Gully* *Tinopai* *Pahi / Whakapirau*	*Concrete Edging and Swale Drains or modified piped swale drains*

6. *Concrete kerb or kerb and channel can be either cast in situ, slip-formed or constructed with kerb blocks in accordance with drawing S12. This includes kerbing on traffic islands. Heavy duty kerb and channel should be constructed in all commercial and industrial Roads, Service Lanes and commercial rights of way and where directed by the Council.*

7. *Swale drains or modified piped swale drains constructed in accordance with drawing S13 should be installed in Rural and semi-Urban areas and can be used in moderate development areas.*

8. *On all surface water channels where the gradient is steeper than 1V:15H, scour protection should be provided in accordance with Section 6 of these Engineering Standards.*

9. *Any groundwater which can reach the road subgrade, e.g. from cut slopes above the road, should be cut off with an approved filter drain pipe such as perforated HDPE 50-100 mm diameter, in a trench backfilled with 20/17 aggregate, and discharged into the nearest stormwater system.*

10. *In addition to the requirements of the NZTA Highway Drainage Guideline, sumps should be provided at the following locations:*

    - *at intersections at the tangent points of kerb lines;*
    - *on the high side of pram crossings;*
    - *At changes of gradient or direction in the channel where there may be a tendency for water to leave the channel.*

11. *If the nearest associated stormwater Drain has a diameter greater than 600 mm and a manhole is not conveniently located, the sump lead may be saddled directly to the pipe. If sumps are discharged into open drains, then an outlet structure in accordance with drawing S11 should be provided.*

12. *Where possible, inset parking bays should have the same cross-fall as the associated road. Where this is not practical, a 600 mm wide dish channel should be constructed as shown in Drawing S12.*

5.2.22 Road Signs and Markings

The following requirements shall be met:

(a) Signs and roadmarking shall be provided on public Roads in accordance with New Zealand Transport Agency's "Manual of Traffic Signs and Markings" and NZS 5414:1977 Specification for Construction of Traffic Signs.

(b) Rural Roads shall be marked with edge lines, a dotted centreline and white raised pavement markers at 20m intervals along the centreline. Edge marker posts are not required. Traffic lanes shall be half the Carriageway width or 3.5m wide, whichever is less.

Guidance Notes:

1. *Edge marker posts are appropriate on sealed Arterial and major Collector Roads.*

2. *All warning signs on Urban Arterial Roads should have Class 1 sheeting in accordance with AS/NZS 1906.1. All other signs should have Class 2 sheeting. The sign sheetings should be designed to adhere fully to the backing for at least ten years.*

3. *Sign supports on traffic islands should be a recoverable or breakaway type.*

5.2.23 Road Names

The following requirements shall be met:

(a) Road names shall be as determined by Council.

(b) Road name signs shall be in accordance with the Table 5.4 below:

Table 5.4: Road Name Signage

Parameter	Rural Roads	Urban Roads	Private Ways
Background Colour	Blue	Blue	White
Letter Colour	White	White	Blue
Letter Height	100mm	75mm	75mm
Letter Type Series	Transport	Transport	Transport

(c) Road name, walkway and Service Lane signs shall be erected at all intersections as appropriate.

(d) “No Exit" signs shall be erected on all cul-de-sacs or dead-end roads

Guidance Notes

1. *New Roads will be named by Council in accordance with Council’s Road naming policy. Copies of the policy are available from council offices and website.*

2. *The Applicant should select a choice of 3 names for each new public Road being constructed and forward them in order of preference to the Council with the application for resource consent. A brief explanation of the reasons for the selection should also be submitted. The Council's decision will be notified to the Applicant so that provision of Road name signage can be made.*

5.2.24 Roadway and Intersection Lighting

The following requirements shall be met:

(a) Roadway lighting shall be provided on Urban Roads in accordance with NZS 6701:1983: Engineering Standards for Road Lighting and AS/NZS1158:2005. For the purposes of that standard, Kaipara District Arterial Roads shall be classified as intermediate roads and all other roads shall be classified as minor roads.

(b) Rural road intersections shall have a low intensity "flag" light installed in line with the intersecting road on the opposite side of the priority road.

(c) Cabling shall be taken to the closest pillar box and a fuse shall be provided at this location. Lighting columns shall be either reinforced concrete or galvanised hollow steel, and be of the breakaway type. Lamps shall be down facing on outreach arms and comply with NZS 6701:1983.

Guidance Notes:

1. *Intersections which have ultimate peak daily traffic flows greater than 1,500 vehicles per day through them should be fully lit as set out in Austroads Guide to Traffic Engineering Practice, Part 12 : Roadway Lighting, including a minimum luminance of 10 lux on the edges of roundabouts and the noses of all other islands.*

5.3 Unsealed Road Guidelines

1. *Guidelines for the design and construction and maintenance of unsealed roads are contained in Australian Road Research Bureau Unsealed Roads Design Guidelines.*

2. *The key factor in maintaining unsealed roads is good drainage. All sections of carriageway should have a crossfall of at least 6%. Feathered shoulders and Watertables should be provided as shown on drawing S01.*

3. *Particular care is required on the top side of superelevated curves and on the transitions between superelevated curves to avoid 'flat spots'. Bridge approaches may need to be sealed if 6% crossfall cannot be achieved.*

5.4 Construction Requirements

5.4.1 Pavement Materials

5.4.1.1 Quarry Aggregate

The following requirements shall be met:

Quarry aggregate used in shoulder checkouts, under cuts and general filling operations shall have the following properties:

(a) A crushing resistance of between 100kN and 200kN when tested in accordance with NZS 4407:1991 Test 3.10.

(b) Grading such that 100% of the material is less than 100 mm maximum size with no more than 65% passing a 19.0 mm sieve and 3%-18% passing a 1.18 mm sieve (when delivered).

(c) Clay Index greater than 3.5 and less than 8.0 when tested in accordance with NZS 4407:1991 Test 3.5.

5.4.1.2 GAP 65 Subbase

The following requirements shall be met:

The GAP 65 subbase shall have the following properties:

(a) A crushing resistance of at least 120 kN when tested in accordance with NZS 4407:1991 Test 3.10.

(b) Grading such that 100% of the material is less than 65 mm maximum size with between 70 – 85% passing a 37.5mm sieve, 50 – 64% passing a 19 mm sieve and 10 - 20% passing a 1.18 mm sieve (when delivered and following compaction).

(c) Clay Index greater than 3.5 and less than 8.0 when tested in accordance with NZS 4407:1991 Test 3.5.

(d) Lime reactivity when tested by the Soaked CBR Test 3.15 of NZS 4407:1991 for 0% and 3% of lime (calcium oxide) by weight with NZ vibrating hammer compaction. The soaked CBR of the 3% lime sample shall:

  (i) exceed the soaked CBR value of the 0% lime sample by more than 150% and

  (ii) have a CBR value greater than 170%.

5.4.1.3 GAP 40 Ordinary Basecourse

The GAP 40 ordinary basecourse shall have the following properties:

- A crushing resistance of at least 120 KN when tested in accordance with NZS 4407:1991 Test 3.10.
- Grading such that 100% of the material is less than 37.5 mm maximum size with between 63-81% passing a 19 mm sieve and 12-25% passing a 1.18 mm sieve (when delivered and following compaction).

- Weathering Quality index in accordance with the TNZ M/4 Basecourse Specification.
- Clay Index greater than 3.5 and less than 8.0 when tested in accordance with NZS 4407:1991 Test 3.5.
- Lime reactivity when tested by the Soaked CBR Test 3.15 of NZS 4407:1991 for 0% and 3% of lime (calcium oxide) by weight with NZ vibrating hammer compaction. The soaked CBR of the 3% lime sample shall:

  i. exceed the soaked CBR value of the 0% lime sample by more than 150% and

  ii. have a CBR value greater than 170%.

5.4.1.4 Quality Basecourse Material

The basecourse is the top layer of the pavement and is required in the layer described as "base material" in Figure 8.4 of Austroads Pavement Design Manual.

Two types of crushed rock material are acceptable for use as pavement basecourse:

- AP40 complying with NZTA M/4 Specification, or
- lime/cement stabilised GAP 40 aggregate.

PAP40 may be used in place of NZTA M/4 basecourse where M/4 is unavailable.

The following requirements shall be met:

PAP40 shall comply with NZTA M/4 AP40 specification, except for the following properties:

Table 5.5: PAP 40 Premium Quality Basecourse

Sand Equivalent	Plasticity Index	Clay Index
Minimum 36	Maximum 6	Maximum 4

GAP 40 aggregate used in lime stabilised basecourse shall have the following properties:

(a) A crushing resistance greater than 130 kN when tested in accordance with NZS 4407:1991 Test 3.10.

(b) Grading and Weathering Quality index in accordance with the NZTA M/4 Basecourse Specification.

(c) Clay Index greater than 3.5 and less than 8.0 when tested in accordance with NZS 4407:1991 Test 3.5.

(d) Lime reactivity when tested by the Soaked CBR Test 3.15 of NZS 4407:1991 for 0% and 3% of lime (calcium oxide) by weight with NZ vibrating hammer compaction. The soaked CBR of the 3% lime sample shall:

  (i) exceed the soaked CBR value of the 0% lime sample by more than 150% and

  (ii) have a CBR value greater than 170%.

5.4.1.5 Running Course

(a) The running course on an unsealed pavement shall consist of GAP 20 or GAP25 aggregate with the following properties:

- A crushing resistance of 110kN to 230kN when tested in accordance with NZS 4407:1991 Test 3.10.
- Clay Index greater than 3.5 and less than 10.0 when tested in accordance with NZS 4407:1991 Test 3.5.

- Grading as follows:

Table 5.6: GAP 20 and GAP 25 Running Course Grading

Aggregate Type	Sieve Size mm	26.5	19.0	9.5	4.75	2.36	0.425	0.075
GAP 25	Percentage passing	100	80-90	58-75	37-56	29-42	11-20	4-11
GAP 20	Percentage passing	100	93-100	64-85	44-64	32-47	13-22	3-11

- The ratio of Fines to Sand shall lie within the range:

$$0.2 < \frac{\%\text{ less than 0.075 mm}}{\%\text{ less than 2.36 mm}} < 0.4$$

- Aggregate sources that produce stones that are hard, elongated, and with sharp cutting edges capable of puncturing car tyres shall not be used for maintenance aggregate.

(b) The running course used on a pavement prior to sealing shall be grade 5 sealing chip in accordance with the TNZ M/6 Specification.

5.4.2 Carriageway Sealing

The following requirements shall be met:

(a) The following Roads shall be sealed in accordance with Section 5.2.6:
  (i) All Urban Roads; and
  (ii) Rural Roads as specified in clause 5.2.6

(b) The full carriageway width of Roads listed in clause 5.2.6 shall be sealed. Specific Seal design shall be carried out for each road in accordance with the New Zealand Transport Agency Guideline: "Bituminous Sealing Manual". The following paragraphs describe the minimum requirements for the various road types. These may not be suitable in unusual or high-stress situations (e.g. steep intersections, tight bends on steep hills) in which case more robust systems shall be used.

(c) Seal binder and chip shall be in accordance with NZTA Specifications M/1, M/6 and M/13 and applied in accordance with NZTA P/3 with a distributor which is certified in accordance with NZTA E/2. A two coat bitumen seal is required for all chip sealed surfaces.

(d) Rural Roads shall be sealed with a Grade 3 chip seal followed by a Grade 5 wet lock coat within 5 hours of sealing.

(e) Urban Roads shall be two coat sealed with a Grade 3 chip followed by a Grade 5 chip. In cul-de-sacs, Grade 4 chip seal followed by a Grade 6 chip is acceptable, to be sealed on the same day.

(f) Urban Collector, Arterial and Strategic Roads shall be two coat sealed with pre-coated Grade 2 chip followed by pre-coated grade 4 chip.

5.4.3 Reinstatement and Berms

The following requirements shall be met:

(a) On completion of all other works, the Berms shall be spread with clean topsoil which is lightly compacted to a depth of 100 mm. The topsoil shall be graded to kerb top and footpath edges, and may be finished 15 mm high to allow for settlement except on the low side of the footpath where the topsoil shall be finished flush to prevent water ponding.

(b) After top soiling, the Berms shall be sown with a seed mixture for grass which is low growing, with a robust and deep rooting characteristic, and well suited to the soil conditions. An 80% grass strike shall be achieved and the grassed areas shall be maintained free of excessive weed growth and shall be kept mown throughout the maintenance period. Vehicles shall be prevented from using the Berm until the grass has become established.

(c) All poles, sign posts, light standards, markers, power transformers, boxes etc, set in grassed Berms shall be finished off with a concrete mowing strip surrounding the base, flush with finished ground level, 150 mm (minimum) wide and 75 mm thick on firm base.

5.4.4 Construction and Quality Control Guidelines

1. *All construction works should be in accordance with an Approved Construction Management Plan as detailed in section 3.3.*

2. *Subgrade and pavement construction and quality control requirements vary widely depending on the type of pavement. These are general requirements only, rather than full specifications and should not be considered to be comprehensive. Construction should be controlled by comprehensive specifications which have been prepared by the IQP responsible for pavement design. IQPs should have appropriate experience in the design and construction of these pavements.*

3. *Subgrade may be fill or undisturbed material, but should be free of organic matter or other harmful material. It should be prepared in accordance with NZTA F/1, taking particular care to avoid compacting material which is weaving due to excessive moisture. Such material should be removed and replaced.*

4. *The subgrade surface should be trimmed to grade and cross fall and tested to ensure compliance with specified requirements before the pavement construction commences.*

5. *Control of subgrades should be carried out using in-situ density testing by nuclear densometer, which is correlated with compacted laboratory strength testing of the same material. Compaction should be to at least the dry density obtained in the laboratory at optimum moisture content under NZ standard compaction in accordance with NZS 4107 Part 4.*

6. *Any weak areas of the subgrade that are identified should be improved by replacement of the weak material or specific design using a geotextile. Placement and compaction of any granular subgrade fill should be in accordance with NZTA B/2.*

7. *If stabilised subgrades are used, care should be taken to allow appropriate curing before spreading the pavement aggregate. No vehicles should be permitted to run on the stabilised layer until the full pavement thickness is available above it.*

8. *The subbase and basecourse layers should be spread, graded and compacted to the correct formation level in accordance with NZTA B/2. The basecourse should be compacted to achieve a maximum of 20% total voids, with a clean-stone mosaic surface, prior to sealing.*

5.4.5 Final Acceptance

The following requirements shall be met:

(a) All subgrade, sub-base, basecourse and final seal testing (as applicable) shall comply with the minimum Pavement Quality Standards specified in Table 5.7.

(b) For all subdivisions serving more than 7 allotments with a sealed surface, the final pavement shall pass a Falling Weight Deflectometer (FWD) test 3 months prior to the expiry of the defects liability period. For avoidance of doubt, the works will be considered to be defective until the FWD testing of the completed

pavement in the spring following completion of the construction works demonstrates a residual life of at least 25 years.

(c) For all subdivisions serving 2 to 6 allotments for both a sealed and unsealed surfaces, and 7 to 30 allotments for unsealed surfaces only, the final pavement shall pass a Benkleman Beam test 3 months prior to the expiry of the defects liability period.

Table 5.7: Roads and Private Ways: Pavement Quality Standards

Household Equivalents	Surface	Minimum Design ESA/lane	Subgrade Strength Test	Sub Base Clegg Test	Top Layer Clegg Test	Top Layer Total Voids	Construction 95%ile	9-12 Month 95%ile Residual Life FWD/BB
1 Driveway	metal	5×10^3	90%ile scala	No	All>clegg 25	No	N/A	N/A
	seal	5×10^4	90%ile scala	All>clegg 20	All>clegg 40	No	N/A	N/A
2 to 3	metal	1.5×10^4	90%ile scala	No	All>clegg 25	No	2.3mm BB	N/A
	seal	5×10^4	90%ile scala	All>clegg 20	All>clegg 40	No	1.8mm BB	1.8mm BB
4 to 6	metal	3×10^4	90%ile scala	No	All>clegg 30	No	2.1mm BB	N/A
	seal	5×10^4	90%ile scala	All>clegg 20	All>clegg 40	No	1.8mm BB	1.8mm BB
7 to 10	metal	3×10^4	90%ile scala	All>clegg 15	All>clegg 30	No	1.9mm BB	N/A
	seal	5×10^4	90%ile scala	All>clegg 20	All>clegg 40	No	1.8mm BB	FWD
11 to 30	metal	7×10^4	90%ile scala	All>clegg 15	All>clegg 30	No	1.7mm BB	1.7mm BB
	seal	1×10^5	95%ile scala	All>clegg 20	All>clegg 45	All<21%	1.6mm BB	FWD
31 to 50	seal	1.5×10^5	95%ile scala+lab soaked CBR	All>clegg 20	All>clegg 45	All<20%	1.5mm BB	FWD
51 to 100	seal	2.5×10^5	95%ile scala+lab soaked CBR	All>clegg 20	All>clegg 45	All<20%	1.3mm BB	FWD
over 100	seal	400 x AADT	95%ile scala+lab soaked CBR	All>clegg 20	All>clegg 50	All<19%	KDC determination	FWD

Testing Methods:

- Clegg Impact Hammer (clegg) value
- Benkleman Beam (BB) deflection
- Falling Weight Deflectometer (FWD) remaining life greater than 25 years

Testing frequency shall be in accordance with drawing S03.
Minimum design loadings (ESA/lane) for 1 to 6 Household Equivalents are based on single lane carriageways.