

PART C. ROAD DESIGN AND CONSTRUCTION

CONTENTS

OBJECTIVES	4
GENERAL PERFORMANCE CRITERIA.....	4
C.1 ROAD DESIGN.....	6
C.1.1 Road Categories	6
C.1.2 Road Widths	11
C.1.3 Road Network Pattern.....	13
C.1.4 Pedestrian Facilities.....	13
C.1.5 Cyclist Facilities	16
C.1.6 Public Transport.....	16
C.1.7 Tree Planting (Design)	17
C.1.8 Water Quality and Quantity	19
C.1.9 Traffic Calming Measures for Residential Areas	20
C.1.10 Intersections.....	23
C.1.11 Turning requirements.....	25
C.1.12 Gradients	26
C.1.13 Horizontal Curves	26
C.1.14 Vertical Curves.....	27
C.1.15 Superelevation	28
C.1.16 Rural Road Curvature and Sight Distance	33
C.1.17 Pavement Design.....	34
C.1.18 Safety Audit	35
C.2 CARRIAGEWAY CONSTRUCTION.....	35
C.2.1 Crossfall.....	35
C.2.2 Subgrade	35
C.2.3 Basecourse Layer	36
C.2.4 Kerb and Channel.....	36

C.2.5	Sumps.....	39
C.2.6	Traffic Islands.....	42
C2.7	Acceptance of Pavement Prior to Sealing.....	43
C.2.8	Sealing / Paving.....	44
C2.9	Pavers.....	46
C2.10	Special Surfaces.....	47
C2.11	Rural Road Construction.....	47
C.3	FOOTPATH CONSTRUCTION	47
C.3.1	General Requirements.....	47
C.3.2	Footpath Design.....	48
C.3.3	Widths.....	49
C.3.4	Gradients	49
C.3.5	Crossfall.....	49
C.3.6	Concrete Footpaths	49
C.3.7	Other Footpath Materials	50
C.3.8	Steps.....	52
C.3.9	Pedestrian Accessways and Amenity Tracks	52
C.3.10	Handrailing.....	52
C.4	ROAD AMENITY AND BERM CONSTRUCTION	53
C.4.1	Berm Design	53
C.4.2	Tree Planting (Construction)	55
C.4.3	Road Lighting.....	59
C.4.4	Road Name Signs.....	59
C.4.5	Trenching / Services	60
C.4.6	Concrete Mowing Strips.....	60
C.4.7	Road Markings.....	60
C.4.8	Bollards.....	60
C.4.9	Rubbish Bins.....	61
C.4.10	Bus Shelter Stops	61

C.4.11 Seating.....	61
C.4.12 Fencing	61
C.4.13 Traffic Signs	61
C.5 PRIVATE WAYS.....	61
C.5.1 Entrance / Exit.....	61
C.5.2 Minimum Widths	63
C.5.3 Curves	65
C.5.4 Gradients	65
C.5.5 Turning Areas	66
C.5.6 Crossfall.....	66
C.5.7 Kerb and Channel & Stormwater	66
C.5.8 Aggregate Depths	67
C.5.9 Sealing / Paving.....	67
C.5.10 Guard Rail or Fence.....	68
C.5.11 Parking Areas	69
C.6 ASBUILT REQUIREMENTS.....	69

OBJECTIVES

The objectives of the Roothing chapter of this Code are:

- To achieve a sustainable, efficient, safe and appealing roading corridor which maximises the needs of road users, including cyclists, pedestrians, carriers of goods, adjoining property owners, utility companies and other service providers,
- To ensure transport routes are physically resilient to natural and major disasters,
- To increase public amenity through provision of landscaped street environments, and the provision of street furniture,
- To support the Council's operative Transport Strategy which aims to provide a highly efficient interconnected road and street system that is easy to use, cyclist and pedestrian-friendly while minimising any adverse environmental effects associated with the activity.

GENERAL PERFORMANCE CRITERIA

Any constructed road needs to:

- be appropriate for its position in the road hierarchy,
- be of sound structure,
- provide a suitable skid resistant, waterproof running surface for traffic,
- manage surface and subsoil water so that long term pavement performance is assured
- minimise the area of impermeable surfaces associated with roading.

Having regard for the following criteria:

- limit the on-going maintenance costs of assets,
- provide for stormwater drainage and utility services,
- be durable and robust.

Provided the previous criteria are met, alternative, low impact design solutions, including permeable paving and swale use, may be proposed with appropriate engineering detail that will enable the Council to assess the viability of the proposal.

The Council's operative Transport Strategy identifies the development of a Travel Demand Management (TDM) Plan as a key priority. The TDM Plan aims to control road congestion, improve the performance of the city's transport system and moderate road space demand at peak times. A combination of measures has been adopted, including improving public transport priority, improving walking and cycling networks and travel behaviour change initiatives.

Any development that links into or impacts on the Council's existing assets (roading, footpath, drainage etc) must not be based on the premise that the Council's assets can be reconfigured to satisfy the requirements of the development. It is essential that the developer surveys the lines, levels and other relevant characteristics of the Council's affected assets in the vicinity and determines how the development will best connect with these assets, without requiring alteration to the Council's assets.

Except where the Council has planned works for the area which will modify the existing assets configuration, the existing footpath, kerb, channel, and carriageway levels, lines, crossfalls and gradients will need to be measured and documented, and the development designed to accommodate them. Where the Council has plans which will alter the layout of its assets, then the developer shall collaborate with the Council to accommodate these plans.

It is unacceptable to expect users of the Council's assets to be compromised in the interests of the new development.

C.1 ROAD DESIGN

C.1.1 Road categories

There are two main classes of road:

- 1) **Primary roads** – roads where the through vehicular flow is dominant,

Primary roads include:

- Motorways and State Highways - refer to C.1.1.1
- Arterial Roads – refer to C.1.1.2
- Principal Roads : including Central City Streets, Suburban Shopping Streets and Central City Shopping – refer to C.1.1.3 and C.1.1.4

- 2) **Secondary roads** – roads where the vehicular distribution and access function dominates.

Secondary roads include:

- Collector roads, residential or industrial – refer to C.1.1.6,
- Sub-collector roads, residential or industrial – refer to C.1.1.7,
- Local roads, residential, rural or industrial; and cul-de-sacs – refer to C.1.1.8
- Service lanes – refer to C.1.1.9
- Private ways, including rights-of-way – refer to C.1.1.10 and C1.1.11
- Access paths and Amenity tracks – refer to C1.1.12 and C1.1.13
- Rural Roads – refer to C1.1.14

NOTE: The principle of the road classification is that no street should be directly connected to a street more than two levels above or below it.

C.1.1.1 Motorways and State Highways

Motorways and State Highways have not been included in this Code, as they require specific design.

C.1.1.2 Arterial Roads

A high standard road designed to carry long distance through traffic.

Access is generally restricted, and direct access to property and parking on the carriageway is discouraged.

Where parking is allowed this should be provided on separate parking lanes or adjacent service streets.

C.1.1.3 Principal Roads

Principal roads provide access to arterial roads and to motorways.

They have a dominant through vehicular movement and carry the major public transport routes.

Access to property may be restricted and rear serving facilities may be required. Long distance vehicular traffic should be channelled on to arterial roads.

Parking is provided on separate parking lanes.

C.1.1.4 Central City Streets

Golden Mile

The Golden Mile is the main central city shopping street providing the main bus route through the central city and is the area of maximum passenger demand.

Other traffic may use most of the route for servicing, parking access and local traffic circulation. High priority is given to pedestrian amenity.

Shopping Streets

Shopping streets are inner city streets, not the golden mile, providing a primary retail function.

Priority is given to pedestrian access, to parking and to local traffic circulation/servicing.

Business Streets

Business streets are inner city streets providing primarily a business/commercial function.

Priority is given to frontage parking and servicing where this cannot be provided off street.

Traffic function is important also, where the street is an arterial or principal road.

C.1.1.5 Suburban Shopping Streets

Suburban shopping streets are lengths of Suburban Street whose primary function is to provide frontage shopping facilities.

It may be located on a principal, collector or local road.

Priority is given to a safe and convenient pedestrian environment.

Street parking is maximised as far as practicable.

High standard facilities are to be provided for public transport where the shopping street is on a bus route.

The street should be appropriately calmed and through traffic speeds managed.

C.1.1.6 Collector Roads

Residential collector roads distribute the vehicular traffic between and within local areas and form a link between principal roads and secondary roads.

Residential collector roads are permitted to serve up to 500 household units for a journey to the Wellington CBD.

Where residential development continues in an area that requires a collector road to serve more than 500 household units (both existing households and the new development) then additional collector roads must be provided to access the residential area.

Industrial collector roads serve the same function in industrial and commercial areas.

C.1.1.7 Sub-collector Roads

Residential sub-collector roads distribute the vehicular traffic within the local areas and form the link between collector roads and local roads.

Residential sub-collector roads are permitted to serve up to 150 household units for a journey to the Wellington CBD.

Where residential development continues in an area that requires a sub-collector road to serve more than 150 household units (both existing households and the new development) then additional sub-collector roads must be provided to access the residential area.

Industrial sub-collector roads serve the same function in industrial and commercial areas.

C.1.1.8 Local Roads Including Cul-de-sacs

Local roads have the primary function of providing direct access to properties fronting the road and through which only traffic having origin or destination in that locality there will pass.

Pedestrian and local amenity values are predominant.

No provision for separate parking is made; traffic lanes may be shared with parked vehicles.

“Short cul-de-sacs” are up to 100m long. “Long cul-de-sacs” are generally between 100m and 200m long.

C.1.1.9 Service Lanes

Service lanes are for the purpose of providing side or rear access for vehicular traffic to any land from principal to sub-collector roads in industrial or commercial areas.

When their construction has been completed they may be made into private rights-of-way.

No parking or pedestrian facilities provided.

C.1.1.10 Private ways

Private ways include rights-of-way, access lots and private driveways; which provide access over private land to private property, are not in the ownership of the Council and to which the public does not have access.

Management and up keep are the responsibility of the owners.

C.1.1.11 Access Paths

Access paths are footpaths providing pedestrian access between two or more public streets or a high/low level footpath parallel to a public road.

It may service a number of properties along its length.

C.1.1.12 Amenity Tracks

Amenity tracks are pedestrian access ways that are predominantly for pedestrian access to reserve areas.

C.1.1.13 Rural Roads

Rural roads are within the area designated "rural" on the District Plan.

Primary function is to provide access to rural properties.

Parking provision, footpaths, and street lighting are not normally required if both residential areas are distant, and individual properties are few or large.

C.1.2 Road Widths

Carriageway and road reserve widths and gradients shall be provided in accordance with Table 1: Road Widths.

Design of all roadways and intersections shall allow for the safe movement of the design vehicle.

The minimum road and carriageway widths for different types of road are shown Table 1, below. The table also makes allowances for the widths required for cycle lanes.

All berms, kerb extensions and traffic islands shall have sufficient space to allow positioning of necessary signs and other street furniture for adequate vehicle clearance.

Alternative solutions which increase permeability of areas used for parking, without compromising widths prescribed in Table 1, will be considered.

Some variation in the road boundary to boundary width may be required to accommodate the street planting, increase permeability, allow filtration and increase retention time of road runoff. This will also increase pedestrian amenity.

Carriageways and footpaths shall be widened at local shopping areas where possible for additional parking and pedestrians respectively.

Carriageways shall also have a minimum width on bus routes, refer Section C.1.5.

Vehicle Category		No. of units served	Traffic volumes (vpd)	Design Speed (km/h)		Road reserve width(m)	Min carriageway width (m)					Footpath number and width (m)	Berm (m) ⁶	Min/max gradient	Normal camber	Max super elevation		
District Plan Classification	Infrastructure Classification			Flat or rolling	Hilly		Parking ³	Traffic	Cycles ¹	Bus lane	Total							
Primary	Motorway	Motorway	Specific design															
		State Highway																
	Arterial Road	Arterial	>500	>7000	50	50	33	2 x 2.5	1 x 2.0 ² 4 x 3.5	2 x 1.5		24	2 x 2.5	4 x 1.0	5% max. 0.4% min	3%	8%	
	Principal Road	Principal	>500	3000-7000	50	50	25	2 x 2.5	1 x 2.0 ² 2 x 3.5	2 x 1.5		17	2 x 2.0	4 x 1.0	6.7% max. 0.4% min	3%	8%	
	Principal	Central City Golden Mile									Specific design	2 x 5.0	Specific design					
		Central City Business										2 x 3.0						
		Suburban Shopping Street										2 x 4.0						
		Central City Shopping										2 x 4.0						
Secondary	Collector Road	Collector	Residential	150- 500	1000-3000	50	40	22	2 x 2.0	2 x 3.5	2 x 1.50		14	2 x 2.0	4 x 1.0	10% max 0.4% min	3%	8%
			Industrial/commercial	>40	>1000			22	2 x 2.50	2 x 4.50	0		14	2 x 2.0	4 x 1.0		3%	8%
	Sub-collector Road	Sub-Collector	Residential	75-150	500- 1000	40	40	18	2 x 2.0	2 x 3.5	0		11	2 x 1.5	4 x 1.0		3%	7%
			Industrial/commercial	-	200 -1000			19	2 x 2.50				12	2 x 2.0	2x1.0 2x0.5	3%	6%	
		Local	Residential	40-75	250 - 500	40	40	18					11	2 x 1.5	4 x 1.0	3%	7%	
			Industrial/commercial	20-40	200- 500			18	2 x 2.0	2 x 3.5	0	-		2 x 2.0		3%	6%	
		Local Road	Residential cul de sac long (100-200m)	<40	<250	30	30	15	2 x 2.0	2 x 2.5	0	-	9	2 x 1.5	2x1.0 2x0.5	3%	6%	
			Residential cul de sac small (<100m)	<20	<100	20	20	11	1 x 2.0	1 x 3			5	2 x 1.5		3%		
		Service Lane	Commercial (Parking Precinct)	-	<200	30	30	13.5 ³	1 x 2.5	2 x 3.0	0	-	8.5	2 x 1.5	2 x 1.0	10% max 0.4% min	2%	n/a
			Access only	-	n/a	n/a	n/a	7.0	0 ⁴	2 x 3.0			6.0	0	2 x 0.5		3%	
		Private Way	Small	1 to 3	n/a	n/a	n/a	3	0 ⁴	1 x 2.7	0	-	2.7	0	2 x 0.15	20% max. 0.4% min	3%	n/a
			Large	4 to 6				5.5	1 x 2.0	1 x 3			5	0	2 x 0.25		3%	n/a
		Rural 1	Rural Roads shall have a 20m road reserve width (all levels) and shall be designed and constructed in accordance with the requirements of NZS 4404: 2010															
	Rural 2																	
	Rural 3																	

Table 1: Road widths (refer to notes below)

Notes relating to Table 1: Road widths

- 1 Where Council gives approval to remove cycle lanes, each traffic lane shall be increased to width required by Council
- 2 Painted median occupies 2m of the traffic lane
- 3 Where Council gives approval, berm may be increased to accommodate parking bays
- 4 No parking both sides
- 5 Where tree planting areas or traffic calming measures significantly reduce parallel parking space, additional width for angle parking should be provided.
- 6 Planting and utilities services are to share the berm space with neither monopolising the space. Plans will need to demonstrate how planting and utilities will share the space for these requirements to be met.

C.1.3 Roding Network Pattern

Public roads, private ways, service lanes and access ways, shall be laid out to fit in with the general roding requirements of the locality and the topography/natural landform in which they are situated.

They shall conform to the operative District Plan which the Council has for the area and have character and appearance in keeping with that role.

Due regard shall also be made for any road widening or upgrading proposals which the Council may have.

Cut and fill shall be kept to a minimum to avoid earthworks altering the natural land form and removal of natural features, i.e. landform and vegetation.

Except for motorways, the design of all roads and intersections shall provide for the safe and convenient movement of pedestrians and cyclists.

All roads classified collector or above shall be suitable for use as a bus route.

Key aspects that should be considered in developing the roding pattern are as follows:

1. The length of any single road segment that forms a cul-de-sac shall not exceed 200m, except that where topography absolutely precludes interconnection, this may be extended up to 400m with the approval of the Council,

2. The length of any combination of continuous local road segments with only a single exit shall not exceed 500m,
3. Streets that are approximately parallel with an average separation of 200m or less shall be connected by streets at intervals no greater than 600m,
4. Collector roads that provide access to the central city are permitted to serve no more than 500 household units each. Sub-collector roads that provide access to the central city are permitted to serve no more than 150 household units each.
5. Access paths of 2.1m minimum width shall connect approximately parallel streets (with an average separation of 200m or less) and cul-de-sac heads at intervals no greater than:
 - a) 200m where one street is or could be on a bus/train route, or
 - b) 300m in remaining cases.
6. Areas where residential subdivisions have aggregated to 150 household units or more shall be provided with a convenient and direct through route at least 11.0m in kerb to kerb width.

Where demand will be less, a narrower width may be acceptable.

This route should be located to ensure traffic does not unnecessarily divert to other residential streets when seeking to access the subdivision. Nor should the route be designed to be so attractive as to divert people from outside the immediate area to travel through the subdivision as a means to get to some other place.

This route should be designed to provide a highly accessible bus route for the subdivision where 90 percent of the subdivision's households lie within 400m walking distance of the route.

Other suburban facilities that are likely to attract significant groups of people (schools, shops etc.) should be sited on the route but certainly within 200m walking distance of the route.

7. All footpaths and walkways, where provided, shall apply the principles of "Crime Prevention through Environmental Design" (CPTED) to their design.

The Council may consider variations from the requirements in this section where it is satisfied that the variations are justified in terms of the following criteria:

- The need for pedestrians, cyclists, public transport and frontage activity is likely to be permanently lower than would normally be required,
- Design is constrained by topography or existing development,
- Where compromises are desirable in order to maintain integrity of the network, to establish effective connections or maintain continuity along a route.

C.1.4 Pedestrian Facilities

The Council has adopted a Walking Policy, a copy of which is available on the Council's website.

Care should be taken to ensure a street environment is designed for use by pedestrians. (Refer Traffic Calming Measures Section C.1.8).

Development of land in regard to the roading pattern should include a plan showing pedestrian movements related to key features such as bus stops, schools and shopping areas.

Footpath width, and the number of, shall be provided in accordance with Table 1, in section C.1.7

Berms of a suitable width and specification to provide for street tree planting allowing for future growth and health of the trees shall be provided in accordance with Table 1 (also see section C1.7 (berm width) and section C4.6 (berm specifications)).

Preferred road crossing locations should be identified in the plan.

To increase connectivity the number of crossings shall be maximised and at positions well-located for efficient and effective pedestrian movement. At a minimum, these locations should provide 60m unobstructed visibility in 50km/h roads, 105m in 70km/h roads and 190m in 100km/h roads. Road crossing locations should require no more than 10m of carriageway to be crossed by the pedestrian in any single situation.

The preferred design of a road crossing location would provide a median island of a minimum of 2.0m width with a maximum crossing distance of 5.0m of carriageway on either side of the road.

In the vicinity of high pedestrian trafficked areas such as schools, commercial centres, bus stops and hospitals, footpaths and crossings should be of a higher standard. In these locations, the minimum footpath width should be 3.5m.

C.1.5 Cyclist Facilities

The Council has adopted a Cycle Policy, a copy of which is available on the Council's website.

Where provision is to be made for cycle movement, reference shall be made to Table 1, in section C.1.

C.1.6 Public Transport

The design of the development of urban land must attempt to maximise the convenient access of public transport.

To achieve this requirement, in areas where residential subdivisions have aggregated to 150 household units or more are required to produce a plan to demonstrate public transport accessibility.

Elements in this plan will include the following:

1. The provision of a continuous through route classified as a collector road or higher, for public transport to use.

The use of streets classified as less than a collector may be approved by Council at the limits of a residential area.

This requirement may be varied in the case of the land development being located near a railway line.

The road shall have a minimum carriageway width of 11.0m (this includes an allowance of 2.0m on each side of the road for parking).

If no parking is allowed or parking is provided in indented bays then the carriageway width may be reduced to 7.0m.

The gradient shall be as specified in C.1.11.

2. High transport intensity land uses (such as schools, tertiary institutions, hospitals, medical facilities, shopping areas, retirement villages and community facilities) should be located with frontages along the public transport route.
3. Land development should be otherwise designed to maximize the number of sites within 400m walking distance of a designated public transport stop.

At least 90 percent of dwellings are to be within 400m of a proposed bus route.

4. Land development that does not have a frontage on the public transport route shall be provided with convenient access to that route.
Road or suitably designed walkways access shall be provided to the public transport route at intervals not exceeding 200m.

C.1.7 Tree Planting (Design)

Trees shall be planted in all public roads (except service lanes) to create a better environment for street users, residents and the travelling public.

In addition, the Council's Public Space Design Manual, the Residential Design Guide, and the Open Spaces Strategy for Wellington provide guidance on streetscape design and amenity and the importance of trees in the road reserve to Wellington city.

Trees and other planting shall be positioned to minimise obstruction of vehicular accessways and provide good visibility for the travelling public. Consideration shall also be given to positioning trees to avoid conflict with underground utilities, and overhead services such as street lighting, overhead cabling and street signs. Table 1 in section C1.2 and drawing R2-704 in appendix C provides guidance on adequate berm width and configuration to best avoid potential conflict with underground utilities.

During the planning and design phase, the Council's Parks and Gardens Unit shall be consulted to determine suitable species and agree a maintenance regime for the site (refer to C4.1.5 for minimum maintenance requirements).

All planting design proposals must be able to adhere to the Council's planting requirements outlined at section C4.0 and section C4.1.

Avenue planting or trees on one side of the road (as provided for by berm widths at Table 1, C1.7) is a minimum requirement but groups of trees and amenity planting and other forms or streetscape treatment may be suitable as part of comprehensive subdivision or

road design assessment that reflects or improves the existing environment and complements the development characteristics.

Any proposal different to avenue type planting must include details of non-standard berm widths and design, specifications and maintenance details.

Avenue type planting (trees in the grass berm) is a minimum requirement for all streets however special requirements and standards for streetscape planting may be required. For more information reference should be made to the Council's Subdivision Design Guide, other relevant District Plan provisions and similar plans that guide best practice roading design.

Median planting is dependant on the road's position in the vehicle network category (section C.1) and will be subject to the approval of the Council.

Road tree planting is not required for rural developments.

Species to be planted should be with the agreement of the Council arborist.

The centre of the trunk shall be at least 1.0m from the kerb.

Where topography and soils permit; rain gardens, soak pits or similar vegetated channels should be considered for tree planting and the retention and dissipation of storm water run-off.

Where topography and soils permit; permeable surfaces, rain gardens, soak pits or similar vegetated channels are required for street planting and the retention and dissipation of stormwater run-off and enhancement of biodiversity and amenity.

C.1.8 Water Quality and Quantity

Runoff from roads contains contaminants from vehicles (zinc, copper and alumiosilicates from tyres and brakes of vehicles and sulphur from the fuel) and PCB's from road materials and maintenance. Contaminants also come from paint, fuel, and other spillages on the road. Road run-off is also heavily influenced by surrounding landuse (especially unpainted galvanised iron rooves).and activities more than by variation and loadings in traffic. The sources of contaminants are diffuse.

In Wellington and Porirua Harbours there is data showing ecotoxic¹ contaminants carried by stormwater in bottom sediments at concentrations that exceed guidelines for aquatic life.

¹ Ecotoxic contaminants are substances that are capable of causing ill health, injury or death to any living organism – such as heavy metals, polycyclic aromatic hydrocarbons, organochlorine pesticides and antifouling compounds. Carried in

Roads are recipients and conveyors of stormwater and contaminants from adjacent and often extensive contributing areas. Roads, whilst not the sole source of contaminants, may be the most appropriate place to treat stormwater.

Sediment and associated contaminants in stormwater can be removed by a range of treatments, including directing runoff to vegetated swales and infiltration trenches along the road corridor, through to interceptor and treatment structures

The Council seeks to promote low impact design to both improve water quality and curb peak runoff volumes.

Permeable or porous paving, and retention and detention devices may be effective means for controlling peak flows of road runoff. These devices capture runoff and release it at slow rates to filter out contaminants at source and significantly reduce the effects of discharge into receiving environments. They allow suspended solids to settle, and in some instances, runoff to be absorbed (infiltrate) through to the ground, thereby reducing the risk of flooding.

Permeable and/or porous paving will be permitted (for parking areas, access ways and footpaths) where it complies with the following principles:

- The subbase of the paved area, and any adjacent paved area, must be water proofed and well drained to ensure against saturation compromise of the cohesive strength of the subbase.
- The gradient is to be less than 1:8 (12.5%), to prevent surface runoff as opposed to infiltration into the permeable paving.

Refer to the Drainage section for more detail where porous/semi-porous paving, soak pits or similar vegetated channels may be used.

The successful implementation of porous paving depends on individual circumstances; the final decision rests with the Council.

C.1.9 Traffic Calming Measures for Residential Areas

Roads shall comply with the following requirements:-

- Carriageway and alignment of traffic calming measures shall discourage motorists from travelling above the intended speed,

stormwater, ecotoxic contaminants can bind with sediment and accumulate where the sediment settles, on the seabed or the bed of a freshwater body, particularly in low energy aquatic receiving environments

- Local roads shall not provide routes which are more convenient for through traffic than roads higher in the network category.

The street design and environment should be designed to encourage a speed regime appropriate to the use of that street.

The design speed environment is related to the classification of that street and is presented in Table 1, in section C.1.

Street design and layout including bends, vertical curves and junctions are based on that speed being the maximum design speed.

The following design principles, C.1.8.1 to C.1.8.4, should be pursued to produce the desired street environment.

C.1.9.1 Control of Vehicle Speeds

Traffic calming measures may be required to ensure the design speed cannot be significantly exceeded and/ or to discourage through traffic.

Maximum vehicle speed reduction can be achieved using traffic calming devices which shift vehicle paths:

- laterally (slow points, bends, roundabouts, street narrowing, median islands), (Refer to drawing R-45-703 Central Islands, Kerb Extensions and Chicanes in Appendix C), or,
- vertically (humps, platform intersections, platform pedestrian crossings, school crossings, and bicycle crossings). (Refer to drawing R-45-702 Standard Speed Hump Details in Appendix C).

Slowing devices should be located at distances not exceeding those prescribed in Section C.1.3 and should be designed to ensure the correct speed environment is produced. Allowance for increased speeds due to a downhill gradient as shown in Section C.1.3 should be made.

Speed reduction can be assisted by involving the design of the whole street environment, including pedestrian amenity, planting, and street furniture in creating a visual environment conducive to lower speeds such as (but not limited to) the elements covered by section C.4.

The maximum carriageway gradient, on which speed humps are permitted, is 1 in 12 (8%).

C.1.9.2 Visibility Requirements

- i) Adequate critical site distances are to be provided such that in a potential conflict, evasive action can be taken by either party. The sight distances are determined by the design speed for the street and are stated in Table 2: *Minimum Stopping Distances*

Design speed (km/h)	Stopping sight distance (m)
10	10
20	20
30	30
40	45
50	60
60	80

Table 2: Minimum Stopping Distances

- ii) Night time visibility of street features must be adequate. Speed control devices particularly, should be well provided for in terms of street lighting,
- iii) All speed control devices shall be signposted (including the negotiation speed) and provided with appropriate lane marking.

C.1.9.3 Specific Design Details of Speed Control Parameters

Speed control devices shall be designed for their normal use by motor cars, but with provision (such as mountable kerbs) for larger vehicles.

Design of speed control devices shall comply with the following parameters:

- Speed at slow points of bends and length of street between slow points or bends – refer to Table: 3
- Effect of downhill gradient on speed – refer to Table: 4
- Radius of Slow Points (Bend to be 45° deflection or more) – refer to Table: 5

- Deflection Angle for Design Of 20 Km/h Bends – refer to Table:6
- Design of 20/Km/H Street Narrowing – refer to Table: 7
- Design of 20km/H Plateau Or Platform Areas – refer to Table: 8

Speed at slow point (km/h)	Length of street (m) to limit maximum speed to (km/h):					
	25	30	35	40	45	50
20	40	75	100	120	140	155
25	-	45	60	80	100	135
30	-	-	45	65	80	115
35	-	-	-	50	65	100
40	-	-	-	-	55	80
45	-	-	-	-	-	60

Table 3: Speed at slow points of bends and length of street between slow points or bends.

Gradient (%)	Increase in speed (Km/h)
< 5	0
5 - 10	5
> 10	10

Gradients should not exceed 20%

Table 4: Effect of downhill gradient on speed

Design speed (km/h)	Radius of continuous bend (m)	Radius of isolated bend or chicane (m)
20	15	10
25	20	15
30	30	20
35	50	30
40	90	40
45	105	50
50	120	60

Table 5: Radius of Slow Points (Bend to be 45° deflection or more)

Carriageway width (m)	Single bend	Chicane (two reverse bends)
3.5	60°	30°-30°
5.0 – 5.5	70°	45°-45°
6.0 – 6.5	80°	55°-55°
7.0 – 7.5	90°	60°-60°

Table 6: Deflection Angle for Design of 20 Km/h Bends

Number of lanes	Carriageway width (m)
Single lane	2.5
Two lanes	4.5 (over minimum length of 3 m)

Table 7: Design of 20/Km/H Street Narrowing

Height	Ramp Slope
75mm to 150mm	1 in 15 (6.7%).

Table 8: Design of 20km/H Plateau or Platform Areas

C.1.10 Intersections

Intersections within the residential areas should be primarily T-junctions for safety reasons. To improve connectivity, roundabouts or four-way intersections will be

considered if traffic volumes are sufficiently low and/or safety measures are included in the design. However these features are more difficult for pedestrians to navigate safely.

The preferred angle of intersection is 90°; the minimum angle of carriageway intersection should be 70°. Carriageway alignment may be offset from the road reserve alignment to improve the intersection angle. Two roads intersecting the same road (T-intersections) should be offset at least 40 m where practicable.

The kerb line radius at intersections should be kept as short as possible consistent with likely vehicle and pedestrian usage, but in any case shall not be less than 4.0m. Major intersections such as the junction of secondary roads with principal roads or greater, shall be specifically designed to provide for bus and heavy vehicle usage.

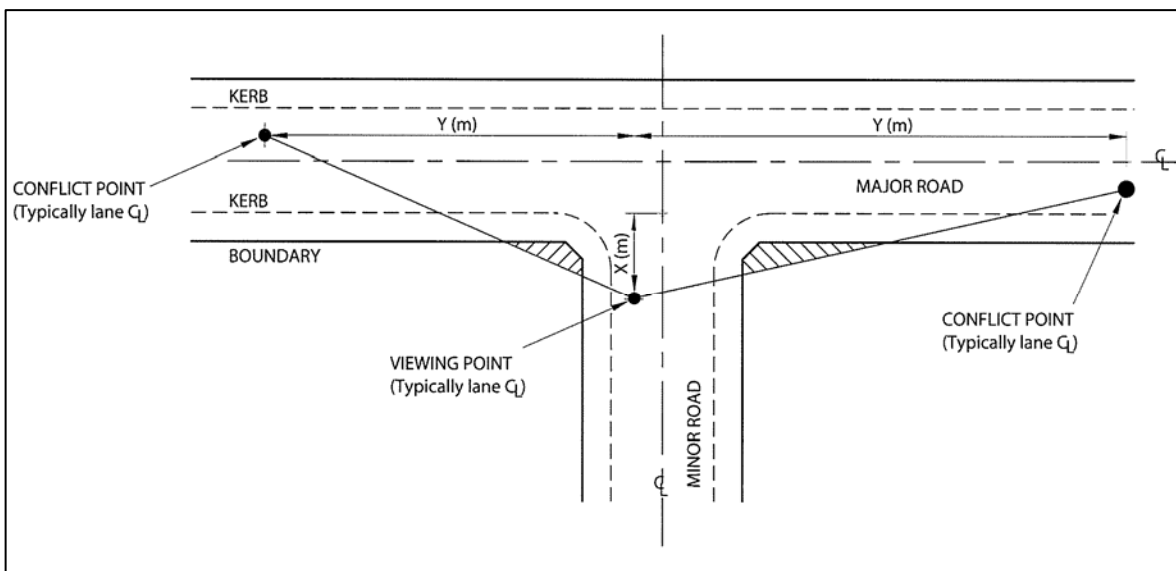
Where practical the gradient within 30m of intersections in local roads should not exceed 1 in 10 (10%) and should preferably be less than 1 in 33 (3%).

Also, where practical, intersections on all other roads should not exceed 1 in 50 (2%) and preferably be less than 1 in 100 (1%).

Grading at intersection approaches shall take into account the provisions of *Guide to Road Design – Part 4: Intersections and Crossings – General* (Austroads 2009a)

For minimum traffic sight lines at intersections refer to Figure 1 below and its corresponding table, Table 9: Traffic Sight Lines at Non-signalised Intersections

Figure 1: Traffic Sight Lines at Non-signalised Intersections



Major Road		Side Road Distance X (m)		
Design Speed (km/h)	Distance Y (m)	Principal to Sub-collector Road	Local Road Cul-de-sac Major Private Way	Service Lane Minor Private Way
100	170	7	5	2.5
70	70	7	5	2.5
50	40	7	5	2.5
40	30	7	5	2.5
30	20	7	5	2.5
20	12	7	5	2.5

Table 9: Traffic Sight Lines at Non-signalised Intersections

Note.1: Within the areas represented by the visibility splays, full visibility will be needed above a level of 1m above the level of the adjacent carriageway. For one way roads and dual carriageways, visibility will only be required in the direction of the approaching traffic.

Note.2: These dimensions are based on Austroads Guide to Traffic Engineering Practice Part 5, intersections at Grade, Page 24, Table 5.1. and AS/NZS2890.1:2004. Lower speed values have been extrapolated.

Standard wheelchair friendly kerb ramps must be provided at all road intersections, refer to drawing R-24-727 in Appendix C.

C.1.11 Turning Requirements

A turning facility shall be provided at the end of all no exit roads.

Turning circles at the end of residential cul-de-sacs shall have a minimum kerb radius of 7.0m, while industrial and commercial cul-de-sacs shall have a minimum kerb radius of 12.5m.

Turning areas of other shapes for difficult situations are acceptable if it can be shown they will work satisfactorily.

Examples of turning areas are given in drawings R-9-705, R-9-706 and R-9-707, in Appendix C.

C.1.12 Gradients

Gradients on the inside kerb shall be as shown in the Table 10: *Maximum Street Gradient*.

Street classification	Maximum gradient
Arterial	1 in 20 (5.0%)
Principal	1 in 15 (6.7%)
Collector	1 in 10 (10.0%)
Sub-collector	1 in 10 (10.0%)
Local	1 in 8 (12.5%)

Table 10: Maximum Street Gradient

NOTE: Gradients shall be not flatter than 1 in 200 (0.5%).

Gradients shall be minimised at intersections as described in Section C.1.9.

Bus route gradients shall be not steeper than an average of 1 in 15, (6.7%), measured over 200m; and an instantaneous maximum of 1 in 12, (8.3%). Approval may be considered for steeper gradients in special circumstances.

C.1.13 Horizontal Curves

Horizontal curves in 50km/h zones may be circular, with a minimum centreline radius of 80m for all industrial roads and for residential, sub-collector, collector and primary roads.

For local streets the radius may be reduced progressively to a minimum of 15m as the traffic volume decreases. Spiral transition curves shall be included in curves on primary roads with a speed limit greater than 50km/h.

Extra widening shall be provided in accordance with tables 11 & 12.

Radius (m)	Widening for a two lane pavement width of:		
	6.0 m	7.0 m	8.0 m
30-40	1.75	1.25	0.75
40-50	1.50	1.00	0.50
50-80	1.25	0.75	0.00
80-150	1.00	0.50	0.00
150-200	0.75	0.00	-

Table 11: Widening On Horizontal Curves for Primary, Collector and Sub-collector roads (50km/h design speeds)

Radius (m)	Widening for a two lane pavement width of:
	5.5m
15-20	2.00
20-25	1.60
25-30	1.30
30-40	1.10
40-50	0.80
50-60	0.70
60-80	0.60
80-100	0.40
100-200	0.20
200-200+	0.00

Table 12: Widening On Horizontal Curves for Local roads (less than 50km/h design speeds)

C.1.14 Vertical Curves

To ensure reasonable standards of comfort, appearance and visibility, vertical curves should be not shorter than those shown in table 13: *Vertical Curves*.

Curve length can be determined using the formula below:

Equation 1:
$$L = K \times A$$

where:

- L** = the curve length in metres but not less than $0.815 \times V$ metres - where V is the design speed in km/h.
- K** = value from table13 below (dimensionless)

A = algebraic difference in grade (expressed as percentage)

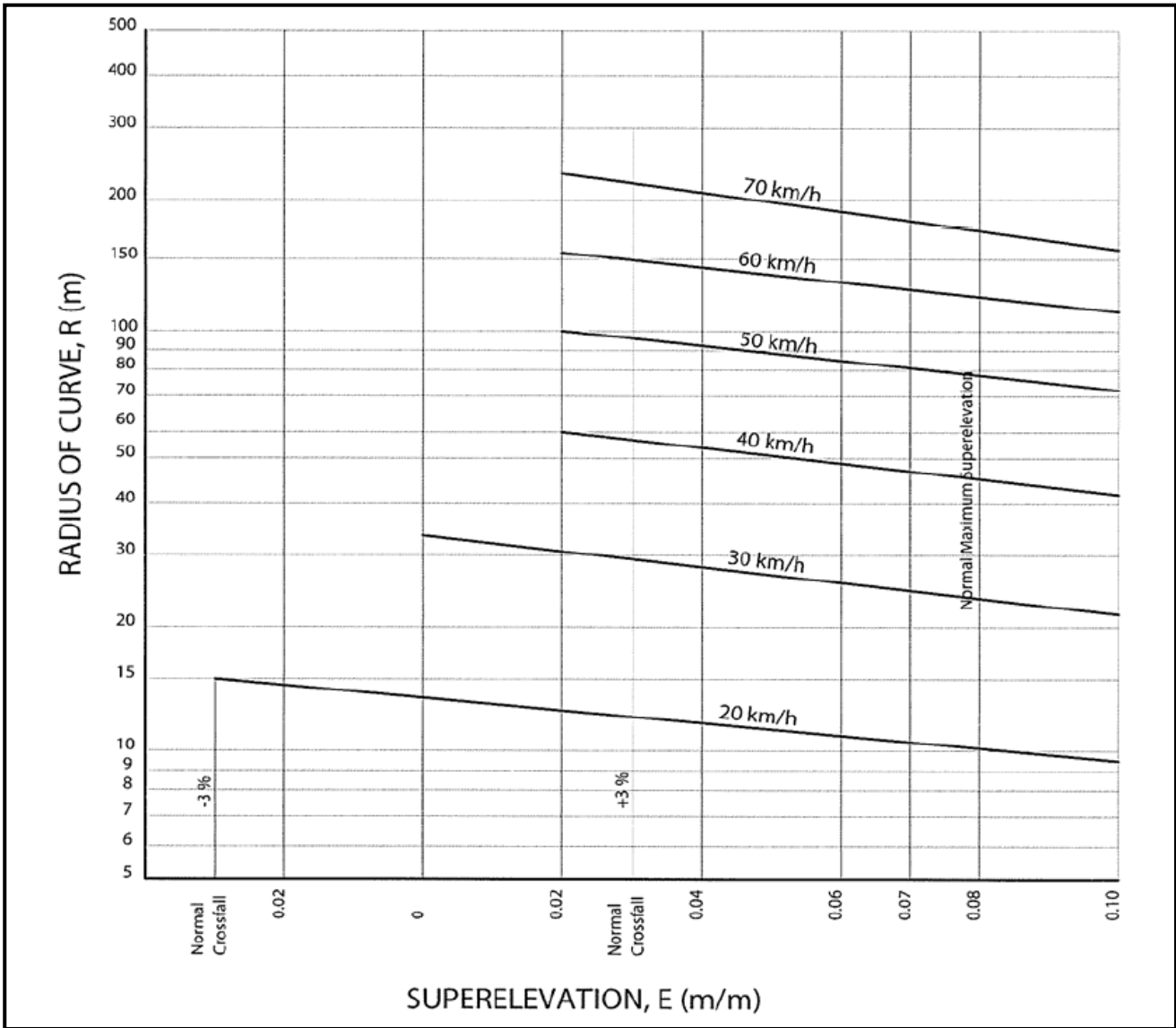
Design Speed V (km/h)	Standard K Values		Minimum K for Stopping and Comfort	Absolute minimum Curve Length, L(m)	Safe Stopping Distance (m)
10	0.5	1.2	0.5	8.0	7.0
20	1.9	4.0	1.7	16.0	16.0
30	4.0	6.0	3.0	25.0	25.0
40	7.0	9.0	5.0	30.0	40.0
50	10.0	12.0	7.0	40.0	60.0
60	14.0	15.0	9.0	45.0	75.0
70	18.0	18.0	11.0	50.0	95.0
80	23.0	21.0	13.0	60.0	120.0
90	28.0	24.0	15.0	70.0	140.0
100	33.0	27.0	18.0	80.0	170.0

Table 13: Vertical Curves

C.1.15 Superelevation

Superelevation and runoff lengths shall be derived from the following:

- Graph 1: *Radius of Curve vs. Superelevation*
- Equation 2: *calculating Radius of Curve*
- Table 14: *Determining friction factor(f), knowing Speed (V)*
- Table 15: Superelevation Table
- Equation 3: Calculating Runoff length
- Table 16 : *Deriving suitable values of G (%), knowing Speed*
- Table 17: *Runoff lengths for pavement widths up to 7m*



Graph 1: Radius of Curve vs. Superelevation

Radius of curve can be calculated using the following formula:

Equation 2:

$$R = \frac{V^2}{127(e + f)}$$

where:

- R** = Radius of curve (metres)
- V** = speed (km/h)
- e** = Superelevation rate (m/m) – from table 15
- f** = friction factor (dimensionless) – from table 14

NOTE: Negative crossfall should not be used where this is avoidable.

Speed - V (Km/h)	10	20	30	40	50	60	70
Friction factor (dimensionless)	0.26	0.24	0.22	0.20	0.18	0.16	0.15

Table 14: Determining friction factor (f), knowing Speed (V)

For circular curves used without transitions:

- Use 60% to 66% of the maximum Superelevation at the tangent points,
- Use 90% of the maximum Superelevation at the $\frac{1}{4}$ and $\frac{3}{4}$ points, and
- The maximum Superelevation at the $\frac{1}{2}$ point.

NOTE: Intended for use in urban roads. For higher speeds use NZTA guidelines which can be used for any design speed.

Radius	Principal Streets			Collector Streets					Local Streets						
R (m)	Super (e m/m)	Friction (f)	Speed (v km/h)	Super (e m/m)		Friction (f)		Speed (v km/h)		Super (e m/m)		Friction (f)		Speed (v km/h)	
15				0.07	0.12	0.14	0.09	20		0.06	0.12	0.15	0.09	20	
20				0.07	0.12	0.09	0.04	20		0.06	0.12	0.10	0.04	20	
25				0.07	0.12	0.21	0.16	30		0.06	0.12	0.22	0.16	30	
30	0.08	0.16	30	0.07	0.12	0.17	0.12	30		0.05	0.12	0.19	0.12	30	
35	0.08	0.12	30	0.07	0.12	0.13	0.08	30		0.05	0.12	0.15	0.08	30	
40	0.08	0.10	30	0.07	0.12	0.11	0.20	30	40	0.05	0.12	0.13	0.20	30	40
45	0.08	0.20	40	0.06	0.12	0.10	0.16	30	40	0.05	0.10	0.11	0.18	30	40
50	0.07	0.18	40	0.06	0.12	0.19	0.13	40		0.05	0.08	0.20	0.17	40	
60	0.07	0.14	40	0.06	0.12	0.15	0.09	40		0.04	0.06	0.17	0.15	40	
70	0.07	0.11	40	0.06	0.12	0.12	0.16	40	50	0.04	0.05	0.14	0.13	40	
80	0.07	0.18	50	0.05	0.12	0.11	0.13	40	50	0.04		0.12		50	
90	0.06	0.16	50	0.05	0.12	0.17	0.10	50		0.04		0.18		50	
100	0.06	0.14	50	0.05	0.12	0.15	0.16	50	60	0.03		0.17		50	
120	0.06	0.10	50	0.05	0.10	0.11	0.14	50	60	0.03		0.13		50	
140	0.05	0.15	60	0.04	0.10	0.16	0.10	60		0.03		0.11		50	
160	0.05	0.13	60	0.04	0.09	0.14	0.15	60	70	0.03		0.09		50	
180	0.05	0.11	60	0.04	0.06	0.12	0.15	60	70	0.03		0.08		50	
200	0.04	0.15	70	0.04		0.15		70		0.03		0.07		50	
250	0.04	0.12	70	0.03		0.13		70		Normal chamber		0.11 max		50	
300	0.03	0.14	80	0.03		0.10		70							
350	0.03	0.11	80	0.03		0.08		70							
400	0.03	0.10	80	0.03		0.07		70							
500	0.03	0.07	80	Normal Chamber		0.11 max		70							
600	Normal chamber	0.11 max	80					70							

Table 15: Superelevation

Note: Use 1st column of lower values of Superelevation in densely built up areas. Use 2nd column with sharp curves in hilly but more open spaces.

Runoff length can be calculated using the following formula:

Equation 3:

$$L = \frac{100We}{G}$$

where:

- L** = Runoff Length (metres)
- W** = Pavement Width (metres)
- e** = Superelevation rate (*m/m*) – from Table 15
- G** = Percentage Difference in Longitudinal Grade between the pavement edges – from Table 16

Speed Km/h	20	30	40	50	60	70	80
Suitable Values of G - %	1.95	1.80	1.65	1.50	1.35	1.20	1.10

Table 16: Deriving suitable values of G (%), knowing Speed

Or using table 17

Superelevation Rate (e m/m)	Minimum Runoff Length L metres for Speed (km/h) of:						
	20	30	40	50	60	70	80
0.06	22	23	25	28	31	35	38
0.07	25	27	30	33	36	41	45
0.08	29	31	34	37	42	47	51
0.09	32	35	38	42	47	53	57
0.10	36	39	42	47	52	58	64
0.12	43	47	51	56	62	70	76
Absolute Minimum	20	20	25	25	30	30	35

Table 17: Runoff lengths for pavement widths up to 7m

NOTE: For pavement widths 7m to 10m multiply the above runoff lengths by 1.2

For pavement widths 10m to 14m multiply the above runoff lengths by 1.5

Theoretical superelevation requirements may require adjustments to ensure flowing kerb profiles.

Generally the best results are obtained from a graphical plot of each kerb profile using a horizontal/vertical scale ratio of the order of 10 to 1. The ruling profile gradient is to be redeveloped along the shortest or inside kerb. Generally, superelevation is added to the inside kerb profile to obtain the profile of the outside kerb, and with the simple horizontal curves. Two-thirds of the maximum superelevation is applied at the tangent points.

For existing situations, superelevation on curves of arterial and principal roads shall be designed for the 85th percentile of the actual observed speed at the particular location (refer to the Austroads 'Guide to Road Design Part 3: Geometric Design').

Horizontal and vertical curves in the same direction may be connected with large radius curves in place of straights, with superelevation maintained around the curve combination.

Reverse curves are to be separated by a sufficient length of straight to allow for a satisfactory rate of superelevation reversal.

Alignment and profiles of kerbs at intersecting roads require detailing to permit the accurate location of stormwater sumps, and to check crossfalls.

C.1.16 Rural Road Curvature and Sight Distance

The table below states acceptable safe stopping sight distances for various speeds.

Design speed (km/h)	SSSD ² (m)
50	60
70	96
80	115
100	170

Table18: Safe Stopping Sight Distances (SSSD)

² The safe stopping sight distance is the desirable minimum sight distance in metres measured from driver's eye at 1m above road level to a point 150mm above road level situated in the centre of the same traffic lane.

In hilly terrain it is likely for low-volume roads that horizontal sight distances will govern over vertical sight distances. The designer should be prepared for this, especially on narrow roads. In such cases a single-lane width can be adopted in difficult situations as long as there is clear sight distance sufficient for opposing vehicles to see each other and stop. One can wait where width permits passing to let the other through.

If adequate sight distance cannot be provided, then there must be sufficient width provided to permit vehicles to pass safely.

A further point requiring particular attention in hilly areas is that the minimum radius of curvature should be sufficiently large that truck and trailer combinations can safely negotiate curves in one pass. Minimum radius curves will normally require extra widening because of the needs of such vehicles. Tracking curves for various classes of heavy vehicles are published on the NZTA website:

<http://www.nzta.govt.nz/resources/road-traffic-standards/rts-18.html>

Lane widths should provide additional width for clearances of at least 0.9m more than the appropriate tracking width.

C.1.17 Pavement Design

Pavement designs shall be determined in accordance with the procedures outlined in the Austroads 'Guide to Pavement Technology Part 2: Pavement Structural Design'.

This manual is broadly based and covers the assessment needed for the design of flexible and rigid pavements as well as overlays and gives guidance to the economic comparisons of alternative pavement designs.

Where existing roads are to be reconstructed, designs shall be based on the worst case scenario of the underlying subgrade.

Pavement composition shall be related to the availability of materials and knowledge of their performance.

C.1.18 Safety Audit

A safety audit shall be carried out for all roads to be vested in the Council except for service lanes.

As a minimum requirement a Stage 3 “Final Design” audit shall be carried out in accordance with the operable NZTA Road Safety Audit Procedures for Projects Manual. The Council reserves the right to also require a Stage 4 “Pre-opening” audit.

Members of the proposed safety audit team shall be qualified and experienced in safety audit work. The Council may also nominate an additional person as a member of the team.

A copy of the safety audit report shall be supplied to the Council, together with any comments on the report’s recommendations.

The Council will not accept roads for vesting until it is satisfied that all issues raised in the audit have been adequately resolved.

C.2 CARRIAGEWAY CONSTRUCTION

C.2.1 Crossfall

The normal camber or crossfall shall be 1 in 33 (3%).

C.2.2 Subgrade

CBR tests shall be carried out to confirm whether or not the subgrade is satisfactory.

Subject to correlation by laboratory tests, dynamic cone penetrometer tests (Scala- penetrometer) may be used to determine subgrade CBR values using industry standard correlation charts.

Soft areas shall be brought up to strength and retested.

Subsoil drains are required to drain any wet areas and also under the kerb and channel as indicated in C.2.4.

C.2.3 Basecourse Layer

Basecourse shall extend 300mm behind the kerb face (or 150mm behind the back of the kerb where a wider kerb profile is used).

All basecourse shall be to NZTA Standard Specification, M/04 or M/05 (Wellington 1) 1984.

Material used for choking the surface to obtain a clean stone mosaic surface shall be kept to a minimum and shall be free of clay.

C.2.4 Kerb and Channel

Kerb and channelling is required on both sides of sealed carriageways in order to achieve the following:

- Collection and control of roading stormwater run-off
- Demarcation between trafficked and non-trafficked areas within the road reserve

The Council's standard 135mm near vertical face kerb profile shall be used to achieve these outcomes.

However there are situations where mountable kerbs may be more appropriate. Situations include:

- Traffic islands that require vehicles to deviate
- Designated turning areas where larger vehicles need additional space
- High speed roads, greater than 70km/h, where a mountable kerb may be safer

For situations in which mountable kerbs are used, the following needs must be satisfied:

- Provision must be made to ensure all adjoining property stormwater is discharged to an approved stormwater system, not to the surface channels within the road reserve
- Street sumps shall have overflow capacity equivalent to the overflow capacity of conventional standard kerb sumps
- Critical sumps where overflow may discharge onto a private property must also have the same on-street storage capacity as standard kerb critical sumps
- Carriageway widths must be sufficient to accommodate on-street parking to avoid driver concern that vehicles will be side-swiped
- Footpath pavements alongside mountable kerbs must be constructed to the strength of heavy duty vehicle crossings to withstand vehicle use.
- Berm areas adjoining mountable kerbs should include trees or other physical features to discourage parking or manoeuvring on the berm
- Driveways must be clearly defined, without using carriageway or footpath markings, to allow compliance with parking regulations

RTS 14 (Guidelines for Facilities for Blind and Vision-impaired Pedestrians) highlights the importance of full height kerbs to vision impaired pedestrians. *“Overseas research has shown that the full vertical upstand of a kerb is the single most reliable cue for blind and vision-impaired people in detecting roads”*. Any use of mountable kerbs must take this into consideration.

The standard profiles for both the standard and the mountable kerbs are shown on drawing R-22-700.

Subsoil drains shall be placed under kerb and channel for a length of 15m from the sump on the high side. Where the sump is located in the valley position, the subsoil drains shall extend 15m on both sides. Refer to drawings R-39-749 and R-39-750, in Appendix C, for details of a subsoil drain.

The kerb and channel foundation shall be formed with a basecourse complying with C.2.3 above and shall be compacted in layers not exceeding 100mm in loose thickness to achieve a Clegg Impact Value, CIV, of not less than 25. Alternatively, compaction of the basecourse may be assessed using a Scala-Penetrometer and shall be considered satisfactory provided there is not less than 4 blows per 50mm of penetration.

Kerb and channelling shall be laid in one operation in accordance with the profile in drawing R-22-700, in Appendix C. Construction joints are required at 6.0m intervals maximum and shall comprise a shallow 20mm cut in the open face of the kerb and channel. Construction joints shall align with construction joints in adjacent surfaces (eg concrete footpaths).

Concrete shall have a minimum compressive strength of 20MPa at 28 days and shall be constructed in accordance with the requirements of NZS 3109: 1997.

In-situ, boxed and precast kerb and channelling to the profiles shown on drawing R-22-700, in Appendix C, may be used where it is not practical to slipform or extrude the concrete. Construction joints are required at 6.0m intervals maximum and shall comprise a shallow 20mm cut in the open face of the kerb and channel.

All kerbing around traffic islands shall be of a mountable type. Refer to drawing R-22-700, in Appendix C.

Standard disability and wheelchair friendly kerb ramps shall be provided at all road intersections. Refer to drawing R-24-727, in Appendix C.

For details on vehicle kerb crossings refer to Section C.5.1.

Where topography and soils permit, runoff shall be directed from the road surface or car park to soak pits or similar vegetated channels as specified in Section C.1.17.

Refer to the Drainage section for more detail where porous/semi-porous paving, soak pits or similar vegetated channels may be used.

C.2.5 Sumps

The Wellington City Council standard (single) sump has a design inlet capacity of 30litres/sec.

The Councils standard sump grate provides protection for the cyclist while at the same time delivering the design inlet flows.

Sumps, double sumps and half boxes shall be constructed in accordance with drawings R-41-740 to R-41-747 inclusive, in Appendix C.

The lead from a private sump will remain a private lead. The length of this lead from the sump to a public main should be as short as practical and shall not exceed 5.0m in length.

For maintenance and renewal purposes, the Council requires all sump grates and frames to be to the standard dimensions shown on the drawings.

Sumps shall be built so that the grating is 70mm below the line of the entry channel.

C.2.5.1 Sump Location in Carriageway

Sumps shall be located in carriageways at:

- 1) Intervals governed by the design contributory flows but not exceeding 100m
- 2) Intersections at the upstream tangent point (may have to be positioned further upstream to accommodate a pedestrian ramp),
- 3) Changes of direction, gradient, or superelevation in the channel where there could be a tendency for the water to leave the channel,

- 4) Where water would leave a public road and flow onto a private road or property,
- 5) Any other point required to eliminate surface ponding.

Sumps shall not be located in front of a property where the property's frontage is narrow. A minimum 4.0m length of standard kerb shall exist in front of every such property to provide for future kerb crossing purposes.

C.2.5.2 Discharge of Sumps

Public sumps shall discharge via a minimum 225mm diameter pipe into either:-

- 1) A stormwater manhole, or
- 2) A clearly defined open watercourse, with adequate erosion control and protection to prevent scour, or
- 3) In special circumstances, and provided that the lead does not exceed 3.0m in length, through a saddle into a pipe of diameter no less than the diameter of the sump lead. or
- 4) Where conditions allow, sumps may discharge to soak pits or similar vegetated channels as specified in section C1.17.

Note: Connections to a stormwater network (manhole or pipe) require a Public Drainage permit. Work near or in watercourses will require a consent from Greater Wellington Regional Council and/ or Wellington City Council.

Any connection other than a minimum 225mm diameter outlet pipe will be at the discretion of the Council's Drainage Engineer, or his nominee.

C.2.5.3 Connections to Sumps and Sump Leads

Connections into public sumps or public sump leads are not permitted.

C.2.5.4 Types of Sumps

The Council's standard single sump is detailed in drawing R-41-740, in Appendix C. A sump has one chamber, one baffle, one grating and one minimum 225mm diameter sump lead.

Attention is drawn to the necessity for providing adequate stormwater disposal at the end of cul-de-sacs where single sumps are frequently inadequate and there are often a large number of kerb crossings within a short distance. Kerb crossings immediately before or over a sump usually prevent the sump from operating as designed. In these situations double sumps may be more effective and should be provided.

High flow areas may require the use of new 'super sumps' – this would need to be discussed with the Council.

C.2.5.4.1 Duplicate Sumps

Two independent sumps and leads shall be provided in critical situations to provide surplus capacity in the event that one of the sumps (including its lead), becomes blocked. Such situations may include low spots where any concentration of runoff could cause flooding, especially of private property.

Each sump of a duplicate set shall have a minimum capacity of 30litres/sec.

C.2.5.4.2 Double Sumps

A double sump comprises, two single sumps back to back connected via a single minimum 225mm lead, with one of the sumps discharging via a 300mm lead to the outfall.

Double sumps (or duplicate sumps and leads) shall be provided:

- a) Where a single sump has insufficient intake capacity,
- b) On grades steeper than 1 in 12 (8.3%),
- c) Where two sub-catchments meet.

C.2.5.4.3 Deflector Sump Tops

On grades steeper than 1 in 20, a deflector sump top and a vane in the channel, drawing R-41-747, in Appendix C, shall be used on:

- a) Single sumps,
- b) The first sump of duplicate sumps,
- c) The first grating of double sumps.

C.2.5.5 Cleaning Eyes

Cleaning eyes are integral to Wellington City Council standard sumps. Cleaning eyes are detailed on drawing R-41-743, in Appendix C.

Any proposed alterations to the sewer and/or stormwater networks, including variations to the above clauses, shall be approved by the Council's Drainage Engineer.

C.2.6 Traffic Islands

All kerbing around traffic islands shall be of a mountable type. Refer to drawing R-22-700, in Appendix C.

Traffic islands shall be designed in accordance with the '*Guide to Road Design – Part 4: Intersections and Crossings – General*' (Austroads 2009a).

The minimum island widths shall be determined using Table 19.

Functional Requirement	Minimum width (m)
To shelter a crossing vehicle	7.0
Median with turn lane	3.0
Pedestrian refuge	2.5
Signal or lighting poles	2.0
Small sign	1.2

Table 19: Minimum Traffic Island Widths

The mountable face shall be painted white.

Traffic islands may be:

- Infilled with exposed aggregate,
- Surfaced in permanent materials, such as a concrete footpath type pavement, as specified in section C.3.6 and C.3.7,
- Approved as a planted area which must include soakage for runoff detention where conditions allow.

Refer to the Drainage section for more detail where porous/semi-porous paving, soak pits or similar vegetated channels may be used.

C.2.7 Acceptance of Pavement Prior to Sealing

Before sealing takes place the pavement shall be Benkelman Beam tested in accordance with NZTA T/01. The deflections shall not exceed:

Before sealing takes place the pavement shall be Benkelman Beam tested in accordance with NZTA T/01.

The deflections shall not exceed Table 20: Maximum Pavement Deflection.

Roadway	Maximum Deflection (mm)
Principal Roads	0.5 mm
Collector Roads	0.8 mm
Sub-collector Roads	0.8 mm
Local Roads	1.0 mm
Cul-de-sacs	1.0 mm
Service Lanes	1.0 mm
Private ways :	1.0 mm
Private ways on a proposed bus route	0.8 mm

Table 20: Maximum Pavement Deflection

A sample Benkelman Beam Test Record report form is included in Appendix C.

C.2.8 Sealing / Paving

C.2.8.1 General

All road surfaces shall be sealed with a grade 4 chip seal and overlaid with an asphaltic concrete surface unless approved otherwise by the Council's Roading Engineer.

C.2.8.2 Chip Seal

The basecourse surface must be inspected and passed by the Council's Roading Engineer prior to any first coat sealing being carried out.

A clean dry stone mosaic surface shall exist before the first coat seal is applied and if an adhesion agent is not used the seal should be applied only during warm dry settled weather between 1 October and 15 March. If a suitable adhesion agent is used, sealing may be carried out outside these dates.

On no account must sealing or paving or preparatory work be carried out if there is not to be warm (i.e. not less than 10°C) settled weather for the next 48 hours.

A sample Sealing Report is included in Appendix C.

First coat seal shall be applied using a bitumen cut-back binder at 1.8 - 2.0 L/m² covered with a grade 4 sealing chip.

Sealing shall be carried out in accordance with the NZTA specifications M/01, M/06, M/13, P/03, P/04 and Q/1.

Further to clause 26 of the NZTA specification P/03, the developer shall control traffic such that the full width of new seal is trafficked evenly.

The Polished Stone Value (PSV) shall be a minimum of 59 for all sealing chip.

C.2.8.3 Asphaltic Concrete

Asphaltic concrete paving shall be carried out in accordance with the NZTA specifications M/01, M/10, M/10D, P/09, and Q/2.

Asphaltic concrete mixes shall conform to the following mix type and design as stated in Table 21;

Mix	Application	Specified Marshall Flows	Air Voids %	Minimum Compaction Index	Minimum VMA (voids mineral aggregates)
10	Roads	75	3.0 – 4.0	0.09	16

Table 21: Roading Asphaltic Concrete Mix type and design

Immediately prior to the Asphaltic Concrete surface work:

- a strip 600mm wide and adjacent to each channel shall be sprayed with an approved ground sterilising weed killer at the manufacturer's recommended rate of application
- the chip seal surface must be clean and have a tack coat of 0.3L/m² of residual bitumen applied by spraying

Asphaltic concrete must be laid with a paving machine and compacted to a minimum depth of 40mm.

For private ways and residential cul-de-sacs and parking areas, excluding bus stops, the minimum depth of asphalt paving may be reduced to 30mm, using mix 10.

C.2.8.4 Additional Slurry Seal

Existing asphalt and concrete paved surfaces on roads, cul-de-sacs, service lanes and rights-of-way may be maintained by resurfacing with a slurry seal complying with the requirements of ISSA A143 (revised) January 1991, Recommended Performance Guidelines for Micro-Surfacing.

The slurry shall be an ISSA Type II or III and meet the following additional requirements:

- Minimum final compacted depth of slurry is to be determined using table 22.

Minimum Final Compacted Depth of Slurry	
Type II	7.5mm +/- 1mm
Type III	10.0mm +/- 1mm

Table 22: Minimum final compacted slurry depths

- Maximum break time of 30 minutes at air and ground temperature of 10 degrees Celsius,
- The slurry shall be designed to allow pedestrian traffic on the surface after a period of 15 minutes,
- Testing shall be carried out in accordance with procedures outlined in ISSA A143 (revised) January 1991.

C.2.9 Pavers

Interlocking Concrete Block Paving

The use of interlocking block paving may be approved on local roads, service lanes and private rights-of-way.

Paving shall be designed and constructed to the manufacturer's proven specifications and shall comply with NZS 3116:2002 'Concrete Segmental and Flagstone Paving'.

Blocks shall have a thickness not less than 80mm. Blocks shall have nominal thickness, strength characteristics, dimensional tolerances and skid resistance which comply with the guidelines in the NZS 3116: 2002 and shall be specific to the in-service situation in which they are used.

A water proofing membrane shall be applied over the road formation and subsoil drains installed to divert surface water penetration away from the carriageway into adjacent sumps or drainage structures.

Where interlocking block pavements are installed, 24 month maintenance periods shall be specified whereby the contractor shall be responsible for correcting all defects during this period.

NOTE: The use of clay brick paving for road surfaces will not be approved.

C.2.10 SPECIAL SURFACES

The roads of the CBD and suburban centres may have specific finishes required.

For further information and standards refer to the Council's operative Public Spaces Design Guide.

C.2.11 Rural Road Construction

Construction shall be as for urban roads except as may be indicated otherwise on the drawing R-9-708, in Appendix C, and as below.

For developments in which water tables, side drains and culverts are used for the collection and management of stormwater runoff, design calculations and a management plan showing how the water will be collected channelled/ dissipated, and discharged shall be submitted for the approval of the Council's Public Drainage Engineer.

Culvert inlets shall be identified with an off-set marker post as shown in drawing R-12-785 in Appendix C.

Sometimes it is customary to move fences in towards the carriageway from the road reserve boundary. This practice may be acceptable provided that pavement and drainage maintenance are not compromised.

As a minimum, fences should not be closer than:-

- 5m from the carriageway, or,
- 3m from roadside drains.

C.3 FOOTPATH CONSTRUCTION

C.3.1 General Requirements

Design and construction of all footpaths, pedestrian accessways, steps, footbridges and amenity tracks shall meet the following requirements:-

- All pedestrian facilities shall be durable and require a minimum of maintenance,

- All surfaces shall be adequately drained so as to prevent ponding, and designed and built so they do not cause runoff problems for adjoining properties,
- Lighting shall be provided for all walkways except amenity tracks,
- Wherever practical, security hazards for users shall be avoided. Accessways must be well lit and where possible should have a clear line-of-sight between streets,
- All walking surfaces must provide minimum in service slip resistance of not less than British Pendulum Value BPN 50 measured on a wet surface,
- Timber on footbridges, boardwalks and steps may be accepted by the Council provided the surfaces have securely fastened wire netting to provide slip resistance or some other approved treatment,
- Gravel surfaces may be accepted on amenity tracks.

C.3.2 Footpath design

Public footpaths shall where appropriate, accommodate the access and mobility requirements of AS/NZS 4121, Design for Access and Mobility – Buildings and Associated Facilities.

The Council has identified streets where special footpath surfaces are required. For more information on these surfaces reference should be made to the Council's operative Public Spaces Design Guide and similar Plans for the suburbs.

Footpaths are to be between two berms and level with the kerb. The width of the grassed strip shall be provided as per Table 1, in section C.1.

The Council may approve footpaths adjacent to the kerb where topography would make a footpath in the preferred position problematic. Where this occurs and it results in only one berm, provision must be made for both street planting and underground services to be appropriately accommodated. Additional footpath width shall be provided at locations where signs or other furniture need to be erected.

Footpaths shall generally be at least 100mm higher than the edge of the adjacent carriageway.

Two footpaths are required, one either side of the road. Where the topography is such as to preclude the construction of more than one, permission of the Council's Roading Engineer is required, in which case the path shall be located adjacent to walling or on the house side of the carriageway.

Consideration should be given to minimising the amount of impervious surfacing, whilst still meeting pedestrian demands.

Where practical, consideration should be given to pavements sloped in such a way that they drain to a pervious surface to allow the water to infiltrate.

C.3.3 Widths

The minimum public footpath width shall be as specified in Table 1, in section C.1, as measured from the back of the kerb.

Private ways footpath widths shall be as specified in Section C.5.2.

Footpaths are to be widened at shopping areas and at any other high pedestrian trafficked areas as per Table 1, in section C.1.

C.3.4 Gradients

Gradients shall be not steeper than 1 in 5 (20%) or with intermittent steps and then not steeper than 1 in 6 (16.7%) between flights of steps.

A handrail as per drawing R-19-760 in Appendix C is required on all footpaths steeper than 1 in 7 (14.3%).

C.3.5 Crossfall

The crossfall shall be between 1 in 50 (2%) and 1 in 33 (3%).

This crossfall shall be to the street kerb unless there is an alternative drainage facility such as a roadside swale or rain garden.

C.3.6 CONCRETE FOOTPATHS

Footpaths alongside new roads shall be constructed in concrete.

Concrete footpath foundations shall be formed with a compacted basecourse material with a minimum depth of 75mm and complying with NZTA Standard Specification, M/04: 1995 (Wellington 1) AP20 basecourse. The sub-base material shall be compacted to achieve a Clegg Impact value, CIV, of not less than 25.

Concrete shall have a minimum 28 day compressive strength of 20MPa and shall be given a light brush surface finish. The concrete shall be 150mm thick with 665 mesh in industrial streets, 115mm thick in residential cul-de-sac turning areas, and 100mm thick elsewhere. Transverse construction joints shall be formed at spacing not greater than 6.0m.

C.3.7 Other Footpath Materials

New footpaths are to be constructed in concrete however there may be circumstances in which asphalt or feature pavements are appropriate.

Construction of footpaths in materials other than concrete is subject to the approval of the Council's Roading Engineer.

In these situations, subject to adequate subgrade strength as approved by the Roading Engineer, asphalt footpaths shall be constructed as follows:-

- a) For principal, collector and sub-collector roads, local roads and cul-de-sacs asphalt footpath construction consists of a compacted AP20 basecourse depth of 75mm, and compacted asphalt depth of 25mm, finished level with the top of the kerb,
- b) Around residential turning areas and in industrial streets, asphalt footpath construction consists of a compacted AP40 basecourse depth of 150mm and 200mm respectively, and compacted asphalt depth of 25mm, finished level with the top of the kerb.

A tack coat of bitumen emulsion shall be applied to the compacted basecourse surface and all sloped/vertical faces to be in contact with the asphalt, at a residual bitumen rate of 0.3L/m² prior to the asphalt paving.

The asphaltic concrete shall be Mix 6.

Asphaltic concrete mixes for footpath construction shall comply with the NZTA specification P/09 "Construction of Asphaltic Concrete Paving" and conform to the mix design properties in Table 23:

Mix	Application	Specified Marshall Flows	Air Voids %	Minimum Compaction Index	Minimum VMA (voids mineral aggregates)
6	Footpaths	35	3.0 – 4.0	0.09	17

Table 23: Footpath Asphaltic Concrete mix and design

C.3.7.1 Interlocking Concrete Block Paving

Footpaths constructed in interlocking concrete block paving shall be designed and constructed to the manufacturer's proven specifications and shall comply with NZS 3116:2002 'Concrete Segmental and Flagstone Paving'.

Blocks shall:

- have a proven abrasion resistance,
- have a skid resistance not less than a British Pendulum Value of 50 using a RAPRA 4S rubber foot on a wet surface,
- have a thickness not less than 60mm, and not less than 80mm at heavy duty crossings, around residential turning areas and in industrial streets,
- be appropriate for the situation.

Where interlocking block pavements are installed, a 24 month maintenance period shall be specified whereby the contractor shall be responsible for correcting all defects during this period.

C.3.7.2 Clay Brick Paving

Clay brick paving is not to be used for new subdivision development. The use of clay brick paving will only be approved when upgrading existing clay brick paved footpaths.

In situations where clay brick paving may be used, such paving shall be designed in accordance with the requirements of the Australia Brick and Paving Institute's Design Manual 1, January 1989, shall satisfy all the requirements of the Institute's Clay Paver Note 1, July 1993 and with reference to CBPI publication *Design Manual 1, Clay Segmental Pavements – A Design and Construction Guide for Sites Subjected to Vehicular and Pedestrian Traffic*.

C.3.8 Steps

Concrete steps shall be constructed in accordance with drawing R-17-763, in Appendix C.

The maximum rise between landings shall not exceed 2.5m.

A stormwater channel shall be provided alongside steps and landings, which shall drain to a sump and thence by pipe to an approved discharge outlet.

C.3.9 Pedestrian Accessways and Amenity Tracks

Pedestrian accessways should be constructed where they would provide pedestrians with a significantly shorter route between different roading locations and where areas of interest are involved such as schools, shops, reserves and bus routes.

Such land is to be vested in the Council as either a pedestrian accessway or, in the case of an Amenity track, as a Reserve (refer section F.5.1).

Pedestrian accessways shall be constructed in concrete.

The minimum boundary to boundary width shall be 2.1m.

The gradients and construction shall be as for footpaths, Section C.3, except that the minimum surface width shall be 1.5m.

Where stormwater is likely to flow along the accessways an adjacent stormwater channel shall be provided, outside the 1.5m width, which shall drain to a sump and thence by pipe to an approved discharge outlet.

Both sides of a pedestrian accessway shall be bounded by a fence in accordance with the Council's standard, see drawing R-19-760 in Appendix C.

C.3.10 HANDRAILING

Handrailing is required on the outer edge of roads or footpaths where there is a:

- drop due to a retaining wall, or,
- drop due to a batter face greater than 2.0m vertical height and steeper than 1.5 horizontal to 1.0 vertical, or,
- footpath gradient steeper than 1 in 7 (14.3%).

Any constructed barrier needs to be compliant with the New Zealand Building Code Clause D1.

Designers should note that in some situations a more substantial barrier will be required to meet the requirements of the Building Act.

Handrailing shall be constructed in accordance with drawing R-19-760 in Appendix C.

Handrail posts shall be embedded at least 800mm into firm, stable and level ground, and backfilled with 500mm compacted basecourse capped with a 300mm concrete backfill.

Specific design is required where the ground is neither level, stable, nor firm, and for situations in which the handrail may be subjected to higher loads.

C.4 ROAD AMENITY AND BERM CONSTRUCTION

Road design shall provide a high standard of visual amenity. The design proposal shall include a landscaping plan which provides for vegetation, street furniture and road elements, and which takes into account the following:

- the desirability of a visually attractive and comfortable street environment,
- provision of street trees that will remain healthy and able to mature in the space and location provided
- safety for road users, with the avoidance of unnecessary visual and physical obstacles,
- security for pedestrians,
- the potential for roadside landscaping treatments to influence vehicle speeds,
- the need to minimise on-going maintenance requirements,
- protection of services.

When an existing street is extended into or through a new subdivision, its streetscape (road width, footpaths, street trees, etc.) should also be continued or improved.

The CBD and suburban centres have special requirements and standards for street furniture. For more information reference should be made to the Council's operative Public Spaces Design Guide.

Avenue type planting (trees in a grass berm) is a minimum requirement for all streets however special requirements and standards for streetscape planting may be required. For more information reference should be made to the Council's Subdivision Design Guide, other relevant District Plan provisions and similar plans that guide best practice roading design.

C.4.1 Berm Design

Berms provide a range of ecological and functional services;

- Provides, protects and maintains biodiversity and habitat
- Location for gas, electrical and telecommunication utilities
- Reduces the visual impact of the road as it softens hard surfaces

No utility, including planting, can monopolise the berm space. Preference for some services to be back against the boundary

Infrastructure and utility services should be planned at the same time as the street planting so tree and a garden planting does not, and is not, compromised by the provision of services.

Planting and utilities provision should be designed to respond to the local road geometry and road reserve design.

Berms must be adequately designed, constructed and prepared by the developer as outlined in Section C1.6 and Table C1.

Layout plans and locations of street planting provisions must be discussed with the Council in the planning stages prior to the lodging of finalised plans.

Appropriate planting shall be included in accordance with the Councils plans and policies.

Trees and other planting shall be positioned to minimise obstruction of vehicular accessways and provide good visibility for the travelling public.

In streets with retaining walls (those below the road in particular) there is likely to be limited space in the berm for utilities and trees. Alternative location and design proposals may be considered at the discretion of the Council.

Berms, tree pits swales and rain gardens will be sufficient width to allow for adequate growth of plants and ease of maintenance. It is important to provide adequate means for tree growth and on going tree health, at the same time allowing for the infiltration of water.

Street planting proposals and considerations will be assessed through the resource consent process.

Where slope, topography and soils permit, and where the pavement foundation will not be adversely affected by high water tables, vegetated open channels or retention swales should be located in the berm area to convey and dissipate stormwater. New Zealand Water and Environmental Research Foundation's (NZWERF) On-Site Stormwater Management Guideline provides the information needed to select and design appropriate on-site stormwater management devices for application in New Zealand.

The design guide SNZHB44:2001, Subdivision for People and the Environment promotes innovation in developments and provides alternative methods of compliance in on-site stormwater management.

As built plans are required for all street planting features, including tree pits, rain gardens and swales.

A 12 month maintenance period shall be specified whereby the contractor shall be responsible for ensuring an adequate grass strike, maintaining and mowing the berm, and correcting all defects during this period. Where trees or amenity planting is carried out in the berm, a 36 month maintenance period must be specified (refer Tree Planting (Construction) section below).

Street furniture must be robust and durable and meet the Council's standards and specifications where available.

C.4.2 Street Planting (Construction)

Trees will be planted in all public roads to create a better environment for neighbouring residents and road users and to provide wider environmental and social benefits.

The Council would rather carry out street tree planting on behalf of the developer but understands there are circumstances where developers may wish to carry out the planting themselves. Where a developer

carries out the planting a Council recommended contractor must be used.

Where the Council is to carry out the planting, a payment to the Council's Parks and Gardens unit will be required for tree planting to occur once the development has been completed (i.e. after all construction is finished) and to provide for ongoing maintenance for a three year establishment period. The payment will be a minimum based on an average of provision of one tree per allotment but final tree numbers planted will depend on practicality of planting and any designs details required by the Resource Consent Process or District Plan if relevant.

Planting of trees by developers is subject to prior approval by the Council. (refer to details below and section C1.6).

All road berm areas shall be top soiled to a lightly compacted minimum depth of 75mm, and sown with grass.

At tree planting locations, suitable topsoil depth will be provided (minimum 600mm, actual determined by tree type, size and soil condition) across the complete berm width and along the berm length twice the distance of the width. (i.e if the berm is 1.5m wide, topsoil to a suitable depth for tree planting will be provided that is 1.5m wide and 3m long).

All street planting shall be carried out in the following manner with appropriate detail provided to ensure:

- planting is well planned and integrated into the rest of the street environment in such a way that it can continue to mature without disturbance to other road infrastructure (both above and below ground) and minimum ongoing maintenance
- best practice planting specification are used (for example, the ground is properly prepared, plants are in good health etc)

A complete list of all landscaping in the road reserve (including for example tree species and numbers, irrigation equipment, tree stakes, square metre areas and species/numbers of any planting other than street trees such as amenity type planting or grass) must be provided to enable the Council to plan for ongoing service level requirements and maintenance costs.

C.4.2.1 Tree Sizes

Trees shall be between 1.0m and 1.5m in height (planted) and preferably in Pb 40 – Pb 95 containers at the time of planting.

C.4.2.2 Tree Types

Prior to purchase of plants, the Parks and Gardens Unit of the Council shall be consulted to determine suitable species.

C.4.2.3 Positioning of trees and other vegetation

Positioning will depend of street design detail. Table 1 in section C1.7 describes minimum berm widths for standard planting in the berm.

Trees will be located centrally within the berm width and appropriately spaced along the berm length depending on the species of tree used and street character desired.

Other types of planting will be positioned to ensure appropriate space for the plants to mature without interfering with the functioning of the street (i.e maintaining traffic site lines, avoiding pedestrian trip hazards etc) and to minimise ongoing maintenance requirements.

Where possible, trees and underground services should be located away from each other. Table 1 in section C1.7 outlines the ideal scenario of separation into two berms. Where two berms on each side of the road is not possible, then ducts must be provided.

C.4.2.4 Planting

Tree planting is to occur in a subdivision development after the houses are built.

Planting must take place from late autumn (May) – early spring (Sept).

Planting shall be carried out by a Council recommended horticultural supplier or contractor.

When planting, holes are to be dug at least twice the diameter and 100mm deeper than the height of the container the plant is supplied in. The plant shall be positioned in the hole at the depth it was container grown, and backfilled with topsoil, progressively lightly compacted to surrounding finished soil level.

A proven root guard material for trees shall be placed to line the sides of the hole to a depth of 750mm. In areas of tree groups the root guard material may alternatively extend around the perimeter of the area.

The resident subsoil in the bottom of each hole is to be thoroughly broken up to a depth of 250mm to allow percolation of water.

The planting medium is to be high quality loam, free from roots, weeds and other rubbish and from gravel and stones greater than 20mm in diameter.

Low vegetation close to walkways or the street edge should be below the level of a driver's eye-line and not interrupt sightlines.

Generally when a high vegetation tree matures it should be at least 2.0m above ground level to maintain motorist and pedestrian sightlines.

C.4.2.5 Staking

Each tree shall have a minimum of two stakes (generally not less than 1.2m) located 50mm away from the base and driven securely into the ground with one on the prevailing windward side of the plant and the other opposite.

The stake shall protrude at least 600mm above ground.

An approved cloth tie shall be used to attach the stem to the stake. Stakes are to be removed once the tree is established or after three years (whichever is sooner).

C.4.2.6 Weed Control - (in cluster areas)

The entire planted area or tree pit area shall be covered with bark mulch to a depth not less than 100mm and across the berm width and length twice the distance of the width

C.4.2.5 Maintenance

A 36 month maintenance period is required for all trees and planting in the road reserve. During this period minimum requirements are:

- Plants shall be watered and cared for to ensure they are still healthy during and at the end of the maintenance period. A watering schedule shall be provided and implemented.
- Annual mulching

- Check and replace stakes as required
- Weeding if necessary
- If tree fails or dies, record death, replace tree and begin three year period again.
- Refer also to Section A.18.

C.4.3 Road Lighting

Lighting is required on public roads and pedestrian access ways. The lighting is to meet all requirements of the AS/NZS 1158 "Road Lighting" Standard, including design to an appropriate lighting category.

Street lighting equipment (poles, outreach arms and lanterns) is to be consistent with the types and sizes commonly in use by the Council.

Underground power supply reticulation is to be provided and must meet all the requirements of the network provider.

The Council does not supply power to, and does not maintain, lighting equipment on private ways. The developer is to make arrangements directly with an energy retailer for power supplies to lighting on private ways.

Lighting is not normally required for rural situations. However, road side delineator posts in accordance with the NZTA Manual of Traffic Signs and Markings (MOTSAM) are to be provided.

C.4.4 Road Name Signs

Road name signs shall be mounted on 60mm O.D. galvanized steel posts painted or finished in white.

Signs are to be manufactured and erected in accordance with drawing R-44-780 in Appendix C and the Council's Specification RT 600-010, Signs.

Road name signs shall be erected at all road intersections. "No Exit" signs shall accompany them if applicable.

For each T intersection, both a double sided name plate indicating the side road, and a single sided name plate indicating the through road, shall be mounted on a single pole in the berm of the through road and opposite the side road.

To minimise future maintenance obligations, entrance signs to subdivisions shall not be erected.

C.4.5 Trenching / Services

A suggested location for the services under the road is given on drawing R-2-704, in Appendix C.

Trenching work in legal road shall be carried out in accordance with the Council's operative Code of Practice for Working on the Road. This requires a "Road Works Notice" to be obtained and any associated fees paid.

C.4.6 Concrete Mowing Strips

All poles, sign posts, light standards, power transformers, boxes etc. set in the grass berm shall be surrounded with a concrete mowing strip.

The mowing strip shall be flush with the finished berm level and provide a 150mm wide concrete surround to the base of the item.

C.4.7 Road Markings

Road markings, including reflective raised pavement markers (RRPMs), if required, shall be installed in accordance with the following NZTA documents:

- Traffic Control Devices Rules Ministry of Transport 2004,
- Manual of Traffic Signs and Markings (MOTSAM); Part 1 Traffic Signs; NZTA/Ministry of Transport, 1992,
- Manual of Traffic Signs and Markings (MOTSAM); Part 2 Markings; NZTA/Land Transport Safety Authority, 1994,

All lines other than parking markings shall be reflectorised.

Road marking paint and its application shall be in accordance with the Council's Specification RT 800-003, Road Marking.

C.4.8 Bollards

Bollards, if required, shall be installed in accordance with the Council's standards.

C.4.9 Rubbish Bins

Rubbish bins, if required, shall be installed in accordance with the Council's standards.

C.4.10 Bus Stop Shelters

Bus Stop Shelters, if required, shall be installed in accordance with the Council's standards.

C.4.11 Seating

Seating, if required, shall be installed in accordance with the Council's standards.

C.4.12 Fencing

Fencing in the residential zoned areas shall be in accordance with the ruling in the current District Plan, and the Fencing Act 1978.

C.4.13 Traffic Signs

Traffic signs must be approved by Council Resolution and installed in accordance with the drawing R-44-782 in Appendix C and the Council's Specifications RT 600-010 Signs, and RT 600-011 Sign Poles.

C.5 PRIVATE WAYS

Private ways include rights-of-way, access lots and driveways.

Table 1, in section C.1 has been updated and now limits the number of household units a private way can serve. A private way is not allowed to serve more than 12 household units or 6 properties.

C.5.1 Entrance / Exit

The entrances/exits of private ways are to be positioned such that accident problems are not created. In this respect sight distances given in figure 1 and Table 9 in section C.1.9, shall be used as a guide.

For private ways where existing road geometry precludes the use of the data in table 9, then the Land Transport Safety Authority Guidelines for Visibility at Driveways RTS6 may be used.

Attention is also drawn to requirements in the District Plan controlling visibility and distances from intersections.

NOTE: The minimum distance for an entrance/exit from an intersection shall be determined using table 24. These determined distances are as measured at right angles from the projected property boundary of the intersecting road.

Classification of street which the access joins	Central City (m)	Other areas (m)
Arterial	20	20
Principal	20	20
Collector	20	15
Other streets	15	10

Table 24: Minimum Distance of Vehicle Access from Intersections

All entrances to private ways shall be constructed as a footpath crossing facility giving priority to pedestrians. This will require the vehicle crossing to:

- Be at a right angle to the footpath,
- Be as narrow as possible,
- Not affect the grade, crossfall, colour and texture of the footpath.

There are two types of vehicle crossing:

1. **Light duty vehicle crossing** : for up to two single residential properties or four dwelling units
2. **Heavy duty vehicle crossing** : for three or more residential properties or 6 or more dwelling units and any commercial or industrial properties

Vehicle crossings may be constructed either in conjunction with the original kerb and channel installation, or at a later stage once vehicle access locations have been determined, or as and when crossings require modifications.

Construction details for both light and heavy duty crossings are shown on plan number R-24-721. This plan allows for a number of options, depending on the extent of the works required, and whether the crossing is light duty or heavy duty. Where a grass berm separates the footpath from the kerb, the crossing ramp shall extend from the kerblines to the edge of the adjacent footpath, or 500mm, whichever is the greater.

The splay length along the kerblines, either side of the crossing, shall be 500mm.

In situations where excessive road camber, kerb height, or footpath crossfall exist, approval may be given for more extensive work to modify the surrounding features to achieve a functional vehicle crossing. Drawing R-24-720 "Vehicle scraping Mitigation" shall be used to identify such situations.

Modifications may include:

- Raising the channel (refer drawing R-24-722)
- Lowering the footpath (refer drawing R-24-723)

Note - Both these situations require detailed design and the approval of the Council's Roading Engineer.

C.5.2 Minimum Widths

The minimum widths shall be as follows except that additional width shall be provided to accommodate widening on horizontal curves.

C.5.2.1 Residential private ways:

For residential private ways minimum widths are determined by the number of properties served:

- i) Serving 1 to 3 properties (not more than 6 household units), 2.7m for carriageway, no footpath, 3.0m boundary to boundary.

More width may be needed when retaining walls are required. On curved sections of road, additional carriageway width is needed.

In situations where more than 1 housing unit uses a private way and where the private way is more than 50m long a passing bay shall be provided at least once every 50m.

Passing bays shall be positioned within those lengths to achieve a clear line of sight from the passing bay to the start and end of the private way or to the next passing bay.

The width of the carriageway at a passing bay shall be not less than 5.5m for a minimum 5.0m length with a further minimum 4.0m taper at each end.

- ii) Serving 4 to 6 properties (7 - 12 household units), 5.0m carriageway. This allows for a 3.0 metre carriageway and a 2.0 metre parking lane. Parking is not generally permitted in a right of way. An appropriate easement must then be used to allow for parking to be permitted.

More width may be needed when retaining walls are required. On curved sections of road, additional carriageway width is needed.

The minimum boundary to boundary width shall be 7.5m for the first 12m and 6.5m thereafter. The widening for the first 12m is for passing so as to minimise queuing on the road.

Where the private way is more than 50m long a passing bay shall be provided at least once in every 50m length. This is in addition to any parking lane. The legal width will need to be increased above the minimum width indicated in Table 1.

Passing bays shall be positioned within those lengths to achieve a clear line of sight from the passing bay to the start and end of the private way or to the next passing bay.

The width of the carriageway at a passing bay shall be not less than 5.5m for a minimum length 5.0m with a further minimum 4.0m taper at each end.

C.5.2.1 Non Residential private ways:

For non residential private ways minimum widths are determined by the number of lots served and estimated number of trips per day:

- i) Serving a single unit where the estimated number of trips/day does not exceed 100, 3.5m for carriageway, no footpath, 4.0m boundary to boundary.

Where the private way is more than 50m long a passing bay shall be provided at least once in every 50m length.

Passing bays shall be positioned within those lengths to achieve a clear line-of-sight from the passing bay to the start and end of the private way or to the next passing bay.

The width of the carriageway at a passing bay shall be not less than 6.0m for a minimum length 6.0m with a further minimum 4.0m taper at each end.

- ii) Serving more than one unit, or where the estimated number of trips/day exceeds 100, 5.5m for carriageway, 1.0m footpath, 7.0m boundary to boundary.

Note: For private ways some flexibility can be exercised in achieving physical separation of the footpath from the road with other techniques other than the standard kerb and channel detail. Any change will need prior approval.

C.5.3 Curves

Horizontal curves with an inside kerb radius of less than 4.0m on residential private ways, and 4.5m on non-residential private ways should be avoided where possible.

C.5.4 Gradients

The centre-line gradient shall generally be not steeper than 1 vertical in 5 horizontal (20%) except that in special circumstances a steeper gradient may be permitted subject to specific design and safety considerations.

A driveway serving 6 or fewer household units, a gradient of up to 25% (1 in 4) may be approved for the straight line or the inside of any curve on the driveway.

Transitional grades are required at both ends. At the street end the transition gradient shall not exceed 1 in 8 (12.5%) up (above the street) or, 1 in 12 (8.3%) down (below the street), for a length of at least 2m from the back of the footpath.

Note that the District Plan requires a gradient of 1 in 10 (10%) for the first 5.0m beyond a footpath. This is particularly important where driveways fall from the road. If a steeper gradient is used, resource consent will be required.

All trafficable surfaces shall comply with the ground clearance template in AS/NZS 2890.1 :2004 Parking Facilities Part 1: Off-street car parking Appendix C.

The preferred means of compliance is to insert transition grades as outlined in AS/NZS 2890.1 :2004 Parking Facilities Part 1: Off-street car parking, Section 2.5.3 (d).

C.5.5 Turning Areas

A turning area shall be provided in private ways where either:

- a) there are more than 2 properties (4 household units maximum) served, or,
- b) the sight distances at the entrance/exit are substandard or marginal compared to those in figure 1 and table 9 in section C.1.9, or,
- c) the private way is longer than 50m, or,
- d) the gradient of the driveway exceeds 1 in 5 (20%) uphill when exiting.

Turning areas shall generally be either a “Circular”, “Y”, or “T” shape. Examples are given in drawings R-9-705 to R-9-707 inclusive, in Appendix C.

The gradient on a turning area shall be not steeper than 1 in 10 (10%).

C.5.6 Crossfall

The crossfall shall be 1 in 33 (3%) to provide sufficient slope for stormwater discharge into the adjacent private way channel without ponding.

C.5.7 Kerb and Channel & Stormwater

Kerb and channel is used to confine stormwater runoff to the private way, and to protect the edge of the private way.

A standard kerb and channel shall be constructed on both sides (where stormwater outlets are on both sides) or standard kerb and channel on one side and standard kerb (or similar support edging) only on the other.

Suitable provision shall be made for the disposal of stormwater from the private way.

Stormwater may be directed across a public footpath only where the paved area of the private way is less than 30 square metres, and the public footpath has an impervious surface.

Private way stormwater control is required where the paved area exceeds 30 square metres (30m²).

No stormwater shall discharge onto neighbouring property (including legal road and other Council land), except as noted above.

In rural situations where the access to a private way crosses the street drainage channel a minimum 300mm internal diameter reinforced concrete pipe culvert shall be installed.

The culvert shall be laid with the invert level aligned with the design invert level of the drainage channel. (Also see section F.3 Streams).

C.5.8 Aggregate Depths

As a general guide for residential use:

- Serving up to two properties – compacted basecourse depth of 100mm.
- Serving three or more properties – compacted basecourse depth of 150mm.

These depths are based on the subgrade having a minimum soaked CBR strength of 7. Subgrade improvement may be necessary to achieve this strength.

Basecourse depths for non-residential use shall be determined by specific design.

C.5.9 Sealing / Paving

Rights-of-way and shared accessways must be sealed or paved for their entire lengths.

The carriageway may be surfaced with one of the following methods except that where a private way has a gradient steeper than 1 in 8 (12.5%) the carriageway shall not be surfaced in sealing chips:

- a) A suitable bitumen cut-back binder covered with Grade 4 sealing chip followed by a second coat seal, consisting of a suitable bitumen cut-back

binder covered with grade 3 sealing chip. Both grades are to be in accordance with NZTA specification M/06.

- b) A minimum thickness of 25mm of asphaltic concrete on a basecourse primed with bitumen at a residual rate of 0.3L/m². The asphaltic concrete shall comply with NZTA specification M/10, Mix 10.
- c) An interlocking block paving designed and laid to manufacturer's specifications and in accordance with NZS 3116: 2002.
- d) Porous/semi-porous paving may be used where drainage is provided for and soils and slope allow. The successful implementation of porous paving depends on individual circumstances; the final decision rests with the Council's Roading Engineer.
- e) Residential private ways may be constructed in 100mm of reinforced concrete with a 28 day compressive strength of 20MPa. The reinforced concrete shall be placed on a 75mm compacted basecourse layer, or 150mm of unreinforced concrete on the same base.
- f) Non-residential private ways constructed in concrete shall be specifically designed.
- g) Residential private ways carrying more than an estimated 100 vehicle movements/day constructed in concrete shall be specifically designed.

In rural situations only, where the street carriageway is not sealed and is unlikely to be sealed in the near future, the private way may remain unsealed. Otherwise the first 15m of the private way shall be sealed.

In rural situations where the grade is greater than 1 in 8 (12.5%) the private way must be sealed for its entire length.

Sealing should be carried out only during warm dry settled weather between 1 October and 15 March. If a suitable adhesion or emulsion agent is used, sealing may be carried out outside these dates. On no account shall sealing or paving or preparatory work be carried out if there is not to be warm (i.e. not less than 10°C) settled weather for the next 48 hours. A report shall be provided for each day's sealing activity. Refer sample proforma Sealing Report in Appendix C.

C.5.10 Guard Rail or Fence

A guard rail and / or fence are required where a danger or hazard would otherwise be presented for neighbours or to the public.

The barrier must be designed and of sufficient strength to resist the vehicle loads as indicated in standard AS/NZS1170:2002 Part 1 “Structural Design Actions” for vehicles for direct impact.

C.5.11 Parking Areas

A single car parking area shall have a minimum length of 5.4m and a minimum width of 2.4m, with an additional 300mm clearance on each side where there is an obstruction to vehicle door opening.

The gradient of the parking surface shall not exceed 1 in 20 (5%) in any one direction.

Where practical, the use of pervious materials for parking areas is encouraged, provided the strength of the underlying pavement is not compromised by the high water table and saturated foundation.

Where soils, topography and slope permit, runoff shall be directed from the parking area to rain gardens, soak pits or similar vegetated channels. The successful implementation of alternative solutions depends on individual circumstances; the final decision rests with the Council's Roading Engineer.

On no account shall material be permitted to be “tracked out” from unsealed roads to sealed roads.

C.6 AS-BUILT REQUIREMENTS

Council requires the following information concerning new road construction.

- Benkelman Beam test report prior to sealing the road pavement, refer to clause C.2.7
- Road pavement Sealing report, refer to clause C.2.8
- Certificates of the concrete strength of all concrete used in the footpaths.

Dimensions and other information relating to Transportation shall be provided for all assets within the road reserve, accessway or service lane:

- 1) Length, width and number of lanes within the carriageway section
- 2) Total area of parking bays and bus bays within the carriageway to the nearest 0.1m².

- 3) The total area at intersections less the area associated with length x width, to the nearest 0.1m².
- 4) The total area associated with the traffic islands within the carriageway section, to the nearest 0.1m².
- 5) Road names - of the road constructed and any other roads intersecting
- 6) Designated public transport stops, including location, bus routes, shelters, seats, bins, pads, timetables, signs, sign mounting, road marking, bus lanes, park and ride sites, and any pedestrian through paths leading to railway stations.
- 7) Pedestrian and cycle movements related to key features such as bus stops, schools and shopping areas. Road crossing locations should be identified in the plan including any median islands.
- 8) Traffic calming measures; showing street design and layout including; bends, vertical curves, junctions and the control of vehicle speeds both laterally (slow points, roundabouts, street narrowing, median islands), vertically (humps, platform intersections, platform pedestrian crossings, school crossings, and bicycle crossings), signposting (including the negotiation speed), and lane marking.
- 9) Footpaths, accessways, amenity tracks, kerb ramps for prams and disabled people, vehicle crossings, lighting, steps, safety rails.
- 10) All signage
- 11) Street furniture, including litter bins, bollards, sign posts, pedestrian and cycle movements, designated public transport stops and other lane markings, street and/or path lights, trees, signal areas paved area
- 12) Details of kerb and channel, subsoil drains, intakes, sumps (including capacity) and leads.
- 13) Gradients on the inside kerb, horizontal curves, vertical curves, and super-elevation
- 14) Road reserves assets including, grass berms, rain gardens, soak pits or similar vegetated channels etc, mowing strips and Trenching/Services.