Part 8: Roading

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8.1 Referenced Documents

Planning and Policy

> The *Christchurch District Plan* www.ccc.govt.nz/the-council/plans-strategies-policies-and-bylaws/plans/christchurch-district-plan

> Land Transport Act (1998)

> Traffic Regulations (1976)

> Christchurch City Council *Speed Limits Bylaw* (2010) www.ccc.govt.nz/the-council/plans-strategies-policies-and-bylaws/bylaws/

> Christchurch City Council *Traffic and Parking Bylaw* (2008) www.ccc.govt.nz/the-council/plans-strategies-policies-and-bylaws/bylaws/

> Christchurch City Council *Public Places Bylaw* (2008) www.ccc.govt.nz/the-council/plans-strategies-policies-and-bylaws/bylaws/

> Christchurch City Council *Equity and Access for People with Disabilities Policy* (2001)www.ccc.govt.nz/the-council/plans-strategies-policies-and-bylaws/policies/community-policies/

> Christchurch City Council *Policy on Structures on Roads* 2010www.ccc.govt.nz/the-council/plans-strategies-policies-and-bylaws/policies/streets-roads-and-pavements-policies/

> Christchurch City Council *Footpath Berm Policy* (1999) www.ccc.govt.nz/the-council/plans-strategies-policies-and-bylaws/policies/streets-roads-and-pavements-policies/

> Christchurch City Council *Waste Management Bylaw 2009 (Terms and Conditions)* www.ccc.govt.nz/assets/Documents/The-Council/Plans-Strategies-Policies-Bylaws/Bylaws/Waste-Management-Bylaw-2009-Terms-and-Conditions.pdf

> Christchurch City Council *Bus Stop Location Policy* (1999)www.ccc.govt.nz/the-council/plans-strategies-policies-and-bylaws/policies/transport-policies/

> Christchurch City Council *Intersection & Pedestrian Crossing Design for People with Disabilities Policy* (2016)www.ccc.govt.nz/the-council/plans-strategies-policies-and-bylaws/policies/streets-roads-and-pavements-policies/

> Christchurch City Council *Parking - Kerbside Parking Limit Lines Policy* (2010) www.ccc.govt.nz/the-council/plans-strategies-policies-and-bylaws/policies/streets-roads-and-pavements-policies/

> Christchurch City Council *Christchurch Transport Strategic Plan* (2012) www.ccc.govt.nz/the-council/plans-strategies-policies-and-bylaws/strategies/transport-strategic-plan-2012/

> Christchurch City Council *Christchurch Central Parking Plan* (2015) www.ccc.govt.nz/assets/Documents/Transport/Improvements-planning/CentralParkingPlan2015.pdf

> Christchurch City Council *An Accessible City:* Transport Chapter of the Christchurch Central Recovery Plan (2013) www.ccc.govt.nz/transport/road-improvement-projects/aactransportprojects/

> Christchurch City Council/ Canterbury Regional Council *Metro Strategy* (2010) www.ecan.govt.nz/

your-region/living-here/transport/public-transport-services/greater-christchurch-metro/

> Canterbury Regional Council *Canterbury Regional Public Transport Plan* (2014) www.ecan.govt.nz/your-region/plans-strategies-and-bylaws/canterbury-transport-plans/

> Land Transport NZ *Traffic Control Devices 2004 Rule* www.nzta.govt.nz/resources/rules/traffic-control-devices-index.html

> Land Transport NZ *Setting of Speed Limits 2017 Rule* www.nzta.govt.nz/resources/rules/setting-of-speed-limits-2017/

> New Zealand Transport Agency *Planning Policy Manual – for integrated planning and development of state highways* 2007 www.nzta.govt.nz/resources/planning-policy-manual/

> New Zealand Asset Management Support *New Zealand Infrastructure Asset Valuation and Depreciation Guidelines* (2006) www.ipwea.org/newzealand/bookshop/nzpubs/nzbookshop/2016-iavdg-nz

Design

> National Guidelines for Crime Prevention through Environmental Design in New Zealand www.mfe.govt.nz/publications/towns-and-cities/national-guidelines-crime-prevention-through-environmental-design-new

> Christchurch City Council *Waterways, Wetlands and Drainage Guide, Ko Te Anga Whakaora mō NgāArawai Rēpo (WWDG)* (2003) www.ccc.govt.nz/environment/water/water-policy-and-strategy/waterways-wetlands-and-drainage-guide/

> Christchurch City Council *Christchurch City Bus Stop Guidelines* (Feb 2009)

> Christchurch City Council *Guidelines of Transport and City Streets Unit for the Marking of Cycle Lanes on Urban Roads* (April 2006)

> Christchurch City Council *Regional Special Conditions (for Traffic Signals)* www.ccc.govt.nz/assets/Documents/Consents-and-Licences/construction-requirements/Traffic-Signals-design-requirements/Regional-Special-Conditions.pdf

> Christchurch Central *Streets and Spaces Design Guide* resources.ccc.govt.nz/assets/the-rebuild/StreetsAndSpacesDesignGuideJune2015.pdf

> Christchurch City Council *Christchurch Cycle Design Guidelines* Part A (2013) www.ccc.govt.nz/the-council/plans-strategies-policies-and-bylaws/strategies/transport-strategic-plan-2012

> Christchurch City Council *Major Cycleway Design Guide* Part B

> All New Zealand Transport Agency (NZTA) guidelines and the RTS series (including *Pedestrian Planning and Design Guide, Road Safety Audit Procedures for Projects, Cycling Network Guidance – Planning and Design, Guidelines for the Implementation of Traffic Controls at Cross Roads RTS 1, Guidelines for Street Name Signs RTS 2, Guidelines for Flush Medians RTS 4, Guidelines for Rural Road Marking and Delineation RTS 5, Guidelines for Safe Kerbline Protection RTS 8, Road Signs and Markings for Railway Level Crossings RTS 10, Guidelines for Facilities for Blind and Vision-Impaired Pedestrians RTS 14, Guidelines for Urban-Rural Thresholds RTS 15*)

> All New Zealand Transport Agency (NZTA) manuals and TNZ standards (including T/10 *Skid*

Resistance Investigation and Treatment Selection and the *Bridge Manual*)

- NZ Supplement to *Guide to Traffic Engineering Practice, Part 14: Bicycles*
- Austroads *Guide to Traffic Management Set* (including *Part 6: Intersections, Interchanges and Crossings, Part 8: Local Area Traffic Management*
- Austroads *Guide to Pavement Technology Set* and the New Zealand Supplements
- Austroads *Guide to Road Safety Set* (including *Part 6: Road Safety Audit, Part 8: Treatment of Crash Locations, Part 9: Roadside Hazard Management*)
- Austroads *Guides to Road Design Set* (including *Part 3: Geometric Design, Part 4: Intersections and Crossings, Part 4B: Roundabouts, Part 6: Roadside Design, Part 6A: Pedestrian and Cyclist Paths*
- NZS 4121:2001 *Design for Access and Mobility: Buildings and Associated Facilities*
- NZS 4404:2010 *Land development and subdivision infrastructure*
- AS 2890.5:1993 *Parking facilities - On-street parking*
- AS/NZS 1158 Set *Lighting for roads and public spaces - series*
- New Zealand *Code of Practice for Electrical Safe Distances* NZECP 34:2001
- NZUAG *The National Code of Practice for Utilities' Access to the Transport Corridors* nzuag.katipo.co.nz/wp-content/uploads/2018/02/NZUAG-Code.pdf
- New Zealand Heavy Haulage Association Road Design Specifications for Over Dimensions Loads. www.hha.org.nz/assets/Resources/NZHHA-Roading-Design-Spec-For-OD-Loads-Version-8.pdf

Construction

- Christchurch City Council *Civil Engineering Construction Standard Specifications Parts 1-7* (*CSS*) www.ccc.govt.nz/consents-and-licences/construction-requirements/construction-standard-specifications/download-the-css/
- All New Zealand Transport Agency (NZTA) manuals and specifications
- Road Safety Manufacturers Association *Compliance Standard for Traffic Signs* 2010
- NZS 8603:2005 *Design and application of outdoor recreation symbols*

Where a conflict exists between any Standard and the specific requirements outlined in the Infrastructure Design Standard (IDS), the IDS takes preference (at the discretion of the Council).

8.2 Introduction

This Part sets out Council's requirements for designing streets, and other access linkages, that not only function well but are also appropriate and safe environments.

This Part is **not** intended to be a detailed design guide or to replace the need for traffic and pavement engineering expertise in some areas of the design process.

8.2.1 Legal requirements

All traffic control devices, as defined in the Land Transport Act, on roads and rights of way, must comply with the:

> Land Transport Act;
> Traffic Regulations;
> *Traffic Control Devices 2004 Rule;*
> *Traffic and Parking Bylaw*.

8.3 Creating Good Urban Infrastructure

To create good urban structure, acquire a good understanding of the urban design principles which underlie the layout of blocks, streets and open spaces in new developments and the inter-relationship between them. While the focus is on new public spaces, also consider the three dimensional character of the spaces which are formed by buildings on private areas within the blocks. The relationship between public and private areas is an essential part of creating places for people.

Access to, and within, areas to be developed includes more than the road network that provides formal access to properties. It also includes public transport routes and green linkages that provide access for pedestrians and cyclists to use areas such as reserves and waterways.

The road network and associated linkages need to be highly connected, to reflect the desire lines and destinations within the area and also in surrounding neighbourhoods. This encourages people to walk or cycle where practicable, rather than using their car, particularly for shorter local trips. Figure 1 illustrates this interconnectedness. When this can be achieved, it results in energy savings and creates a safer and more pleasant neighbourhood.

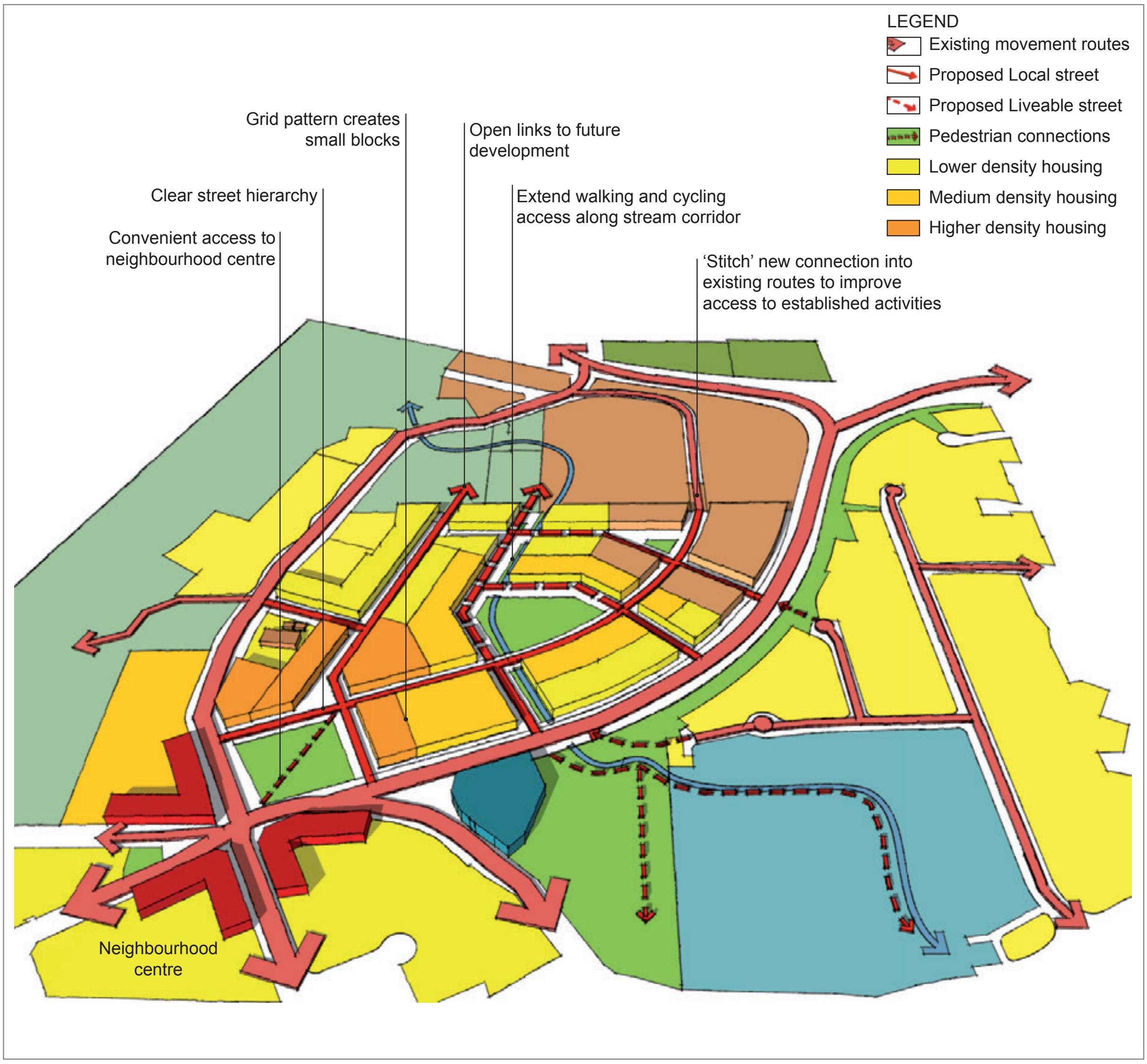


Figure 1 Streets and linkages arranged in an informal grid

Streets can serve a wide range of functions, whilst providing valuable and unique areas of community space (see Figure 2). Use the design process to challenge the assumption that motor vehicles have "automatic" priority (particularly on local roads) and consider all the demands and functions of the street space, in order to achieve a better balance for all those who use it.

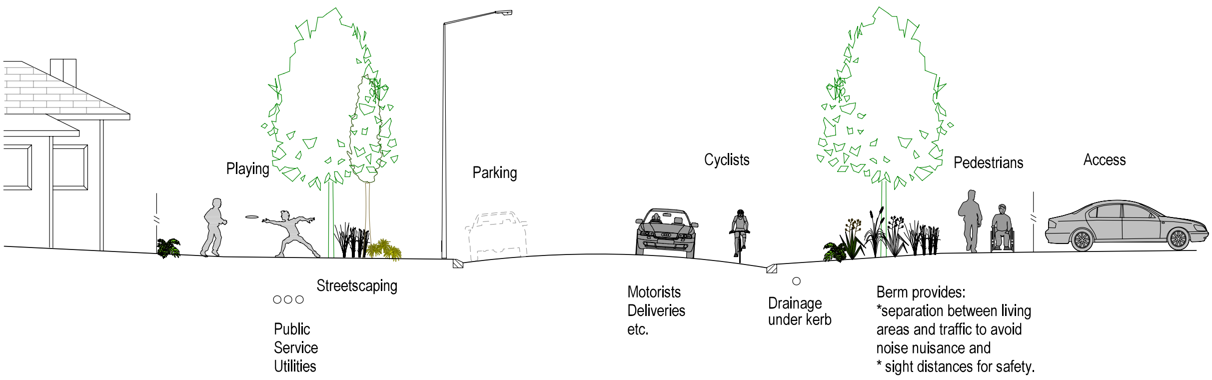


Figure 2 Street functions

The Council encourages innovative design, for access and roading, which satisfies the following objectives:

- safe – the layout must be safe for pedestrians, cyclists, public transport and motorists;
- secure – the design of the roads and other linkages must not compromise the personal security of the users;
- energy efficient – the layout should minimise the number and length of vehicle trips and promote alternatives to motor vehicle use;
- linked – the layout of a development should be extended on a hierarchical network basis for all modes. It should promote walking and cycling, particularly for short trips to local facilities, and should provide direct access to public transport routes. Linkages to existing areas of development must also be provided;
- suitable traffic speeds – the road design must encourage traffic speeds that are appropriate for the road classification and context;
- comprehensible – the road layout must be easy to read and follow, for both residents and visitors;
- accessible - the road design should incorporate footpaths and kerb cutdowns that provide easy access for all;
- enhances environment – the road design should incorporate carriageway and residential stormwater quality improvements or design features as part of the grass berm design e.g. encouraging sheet flow over grass berms, swales protected from traffic use;
- attractive – the design of the street landscaping, trees and other features can add significantly to the amenity, environment and character of the area.

Where the above objectives may be achieved through other mechanisms, the Council may reconsider applying the requirements of this Part of the IDS to a development.

Be familiar with the following documents when considering the design of the development:

- *Christchurch Transport Strategic Plan*
- *Metro Strategy*
- *Pedestrian Strategy*
- *Road Safety Strategy*
- *Christchurch Central Streets and Spaces Design Guide*
- NZS 4121 *Design for Access and Mobility: Buildings and Associated Facilities*
- AS/NZS 1158 Set *Lighting for roads and public spaces - series*
- In accordance with all other parts of the IDS

8.4 Quality Assurance Requirements and Records

Provide quality assurance records that comply with the requirements in Part 3: Quality Assurance, during design and throughout construction.

8.4.1 Design records

Provide the following information, to support the Design Report:

> a clear description of the purpose of the work;

> the scope of the work e.g. legal requirements for road elements such as the provision of appropriate transport facilities, suitable access to the existing transport network;

> transport infrastructure and services issues (e.g. vehicle, cycle, public transport, pedestrian);

> traffic-loading, traffic modelling and volume data and projections used and calculations;

> geometric data;

> geotechnical data, including site assessments, subgrade information and CBR's;

> pavement design methodologies used and corresponding metalcourse calculations;

> surface treatment information;

> road drainage control and edge treatment;

> hydraulic data (e.g. road level, flood level);

> slope stability (during construction and permanent) and retention details;

> utility service conflicts and programmed work issues;

> traffic safety audits;

> streetscape and amenity features.

8.4.2 Safety audit

Safety auditing is an important component in the design of all facilities on legal road. Safety audits provide a check that the proposed design is safe for all users. Safety audits should be integrated throughout the design of new transport facilities.

Provide an independent safety audit at the concept or subdivision consent stage, and for any Variations, which also considers the development's potential to generate high trip volumes requiring specific changes to the road infrastructure.

Provide an independent safety audit with the Design Report i.e. at the engineering acceptance stage for subdivisional works.

An independent safety audit of the constructed asset must also be undertaken and submitted as part of the as-built record. The 224 Certificate will not be issued until safety audit requirements have been addressed.

Carry out safety audits in accordance with *Road Safety Audit Procedures for Projects* and *Guide to Road Safety Part 6: Road Safety Audit*. Use the *Guide to Road Safety, Part 8: Treatment of Crash Locations*, for safe design practices.

8.4.3 Construction records

Provide the information detailed in Part 3: Quality Assurance and the *Construction Standard Specifications (CSS)*, including:

- material specification compliance test results;
- subgrade test results and corresponding recalculations of metalcourse depths;
- compaction test results;
- Benkelman Beam test results;
- as-built levels of the top of kerb, manhole covers and the road centreline;
- surface profile test results for roads and rights of way greater than 100m in length i.e. NAASRA/International Roughness Index;
- surface texture test results;
- concrete or asphalt core test results. Copies of concrete test results are not required for retaining walls;
- construction records and test results for retaining wall components;
- post-construction safety audit.

Provide details in a form complying with the requirements of Part 12: As-Builts.

8.5 Off Road Linkages

Linkages for pedestrians and cyclists must create an attractive, friendly, connected, safe and accessible environment. These linkages must ensure that people can move about the community freely in areas where there are no road linkages (e.g. at the end of cul-de-sacs) and provide direct pedestrian access to bus stops. Use green linkages between cul-de-sacs, through public reserves or adjacent to waterways, or other natural features. For durability it should be considered that linkages that will be used for access or traversed by maintenance vehicles should be constructed to the CSS SD607 commercial crossing detail.

Off road linkage (Brooker reserve)

Design the paths so that they are suitable for pedestrians, cyclists, skate-boarders, skaters, prams and people with disabilities. Motorised wheelchairs require 1.2m clear width.

The overall width of the linkage needs to be adequate for the path and appropriate landscaping. Historically, minimal width linkages of 2.5 to 3.0m had been provided with little or no landscaping. These are unattractive to use and in some cases have been closed due to perceived security problems associated with them. Therefore, providing wide, open and well-lit areas is extremely important to provide a secure and useable linkage.

The minimum clear width of formed paths in legal road is 1.5m for pedestrian-only paths and 2.2m (but a desirable width of 2.5m) for paths shared by pedestrians and cyclists. The formed width should be widened wherever a lot of people are expected to use the facility, as illustrated in Figure 3. Clause 10.8 – Pedestrian and Cycle Paths or Tracks (Reserves, Streetscape and Open Spaces) details requirements for paths in reserves. The Council must pass shared paths by resolution.

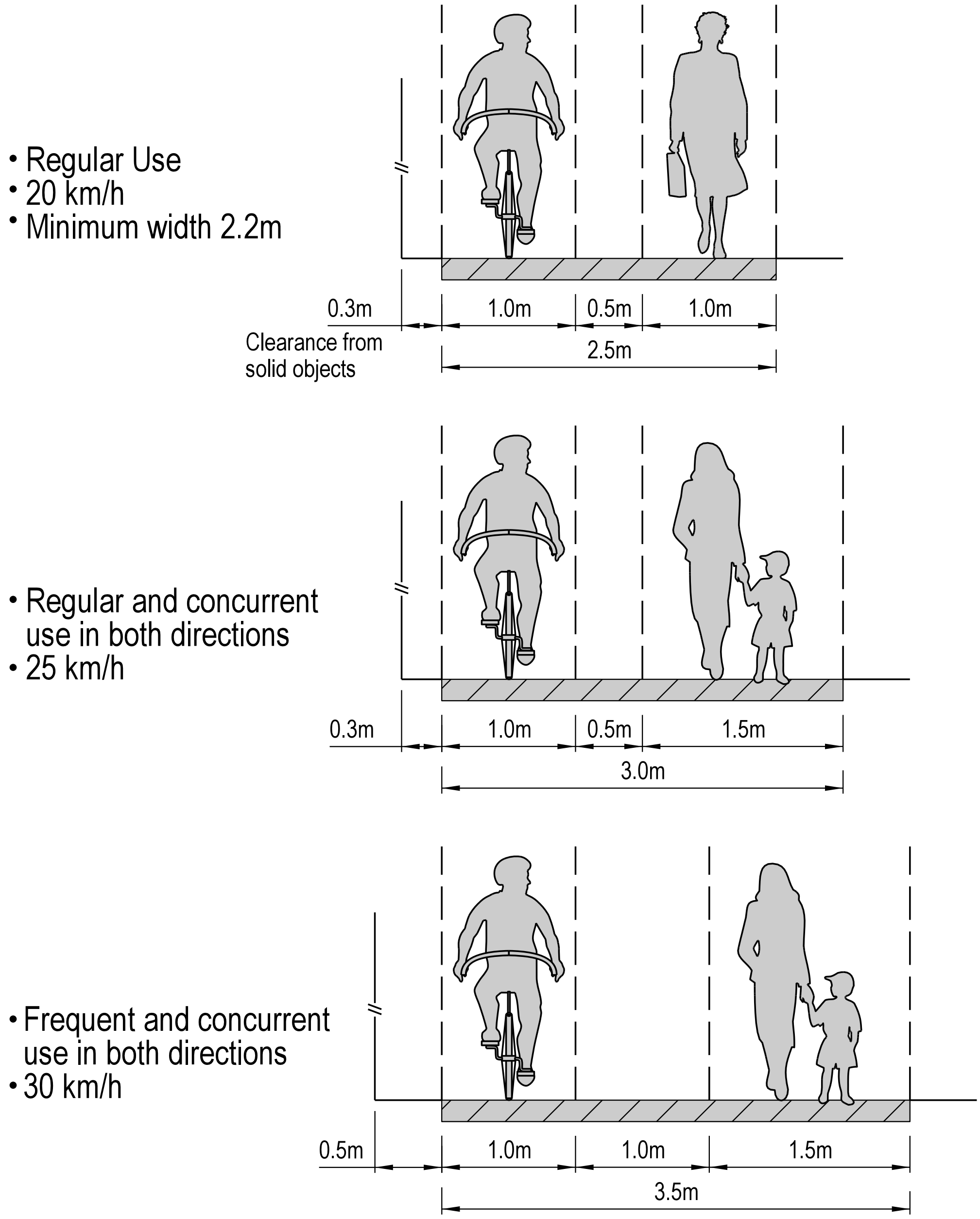


Figure 3 Pedestrian/shared path widths

Seal the path and landscape the remaining land in a manner that does not compromise the security of people using the facility. Part 10: Reserves, Streetscape and Open Spaces provides landscaping guidelines.

Use the following guidelines for the detailed design of off-road paths:

> *Christchurch Cycle Design Guidelines (Part A) and Major Cycleway Design Guide (Part B)*
> *Crime Prevention Through Environmental Design*
> *Guide to Road Design, Part 6A: Pedestrian and Cyclist Paths*
> the New Zealand Supplement to the *Guide to Traffic Engineering Practice, Part 14: Bicycles*
> AS/NZS 1158 Set *Lighting for roads and public spaces - series*

8.6 Cycle Facilities

Make provision for on-street and off-street cycle facilities, as required by the *District Plan* and indicated in the *Christchurch Transport Strategic Plan*, to facilitate an alternative to the car for short to medium length trips. Consider installing cycle parking facilities near bus stops, to ease the transfer between transport modes.

For local urban roads, cycle facilities may be provided through wide kerbside lanes. Ensure cycle 'Give Way' signs and any supplementary signs are located in a position which doesn't impede pedestrians.

Wherever off-road pedestrian and cycle paths are required, design them to the widths specified in Figure 3. *Christchurch Cycle Design Guidelines, Part 6A: Pedestrian and Cyclist Paths*, Part 10: Reserves, Streetscape and Open Spaces and Part 11: Lighting provide further information on off-road facilities.

The cycleway types (major, local and recreational) are defined in clause 1.2 of *Christchurch Cycle Design Guidelines*. Design major cycleways to the requirements in the *Major Cycleway Design Guide*. Design local and recreational cycle facilities to the requirements of the *Christchurch Cycle Design Guidelines*. Refer also to *Cycling Network Guidance – Planning and Design*, the *Guide to Road Design, Part 4: Intersections and Crossings* or *Part 6A: Pedestrian and Cyclist Paths*. Mark the roadmarking in accordance with *CSS: Part 6*.

8.7 Public Transport

Existing and planned or potential public transport routes and stops shall be shown on plans.

8.7.1 Bus routes

Consider the specific needs for public transport at an early stage of the design process to ensure that:

> roads can cater for the manoeuvring requirements of public transport vehicles (including turning around or U-turns at a terminus);
> termini of routes are identified;
> routes are efficient and easily accessible by public transport vehicles;

> proposed routes form a coherent new bus route or an extension to an existing route.

The provision of bus routes in new development areas must be discussed with Canterbury Regional Council (Environment Canterbury) staff. Refer to Environment Canterbury's *Regional Public Transport Plan* for further information.

Wherever there is an existing bus route which can service the area (as defined in the previous sentence), there should be easy and direct access to it for pedestrians. Wherever cul-de-sacs are used to provide access to properties, these should be extended where appropriate to provide direct pedestrian linkages to bus routes. Higher density housing and community facilities, such as schools, parks, shops or retirement villages, should be located close to existing or potential future bus routes to enhance access to the services and encourage use of sustainable transport.

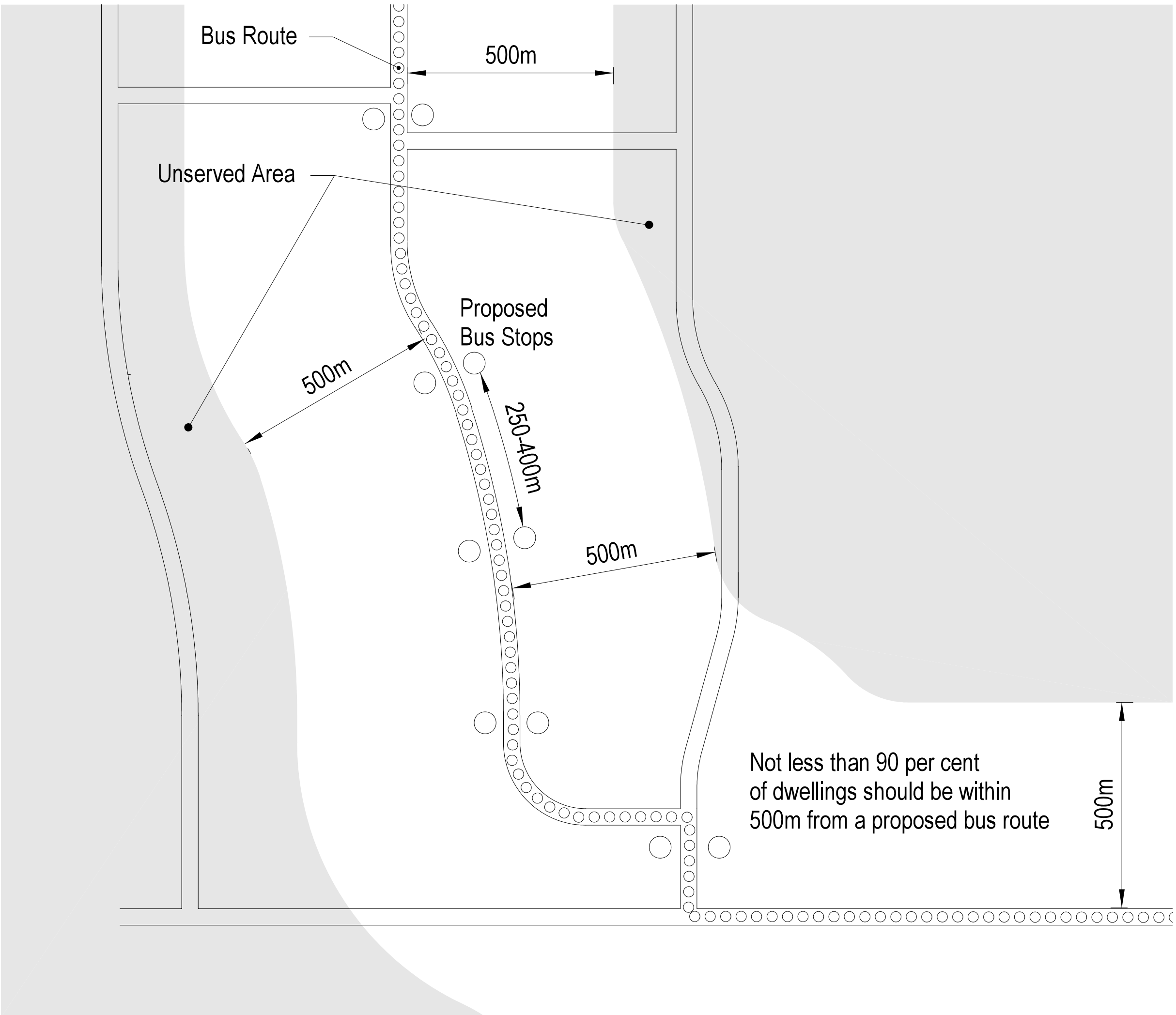


Figure 4 Example of bus routing

Wherever the bus route travels through a development, now or in the future, design the relevant roads to ensure that the bus can travel and manoeuvre along the proposed route easily, without obstructions and, ideally, without delaying other traffic.

Bus routes are generally along collector or arterial roads. Routes need to be as direct as possible to reduce travel times and should avoid or minimise complicated turning manoeuvres at intersections. In particular, avoid right turns when accessing arterial roads. As explained above, Environment Canterbury plan and manage the public transport network, so discuss potential routes with their staff.

Bus priority measures such as bus lanes may be required in certain locations. Consult with Christchurch City Council before submitting engineering drawings to ensure that intersections conform to the Council's requirements.

8.7.2 Bus stops

Plan and co-ordinate the bus stop locations and associated infrastructure on the street with Christchurch City Council at the consent stage. Extra space may be required to site bus shelters or other required infrastructure, which can be incorporated in the engineering design.

Bus stops must be located in accordance with the *Bus Stop Guidelines*. Bus stops should be located close to key facilities to enhance accessibility for the community.

If the width of the roadway does not provide for roadside parking, allow for the construction of inset bus bays or bus boarders. Construction details for bus stops may be found in *CSS: Part 6*.

8.8 Road Classification

The road network is the system of interconnected road links that provides for the movement needs of people and goods, property access and servicing needs. It is usually arranged and operated in a manner to recognise and best serve the varying demands expected of different elements (usually using a hierarchical classification system). Developments must provide road networks internally to achieve these purposes, and connect appropriately to the existing network.

The length and arrangement of these roads within the development and connections to the existing network determine the amount of traffic each element is likely to carry and the role it plays in providing for property access or longer journeys.

The place function and movement function of each link, determines its classification, and therefore its geometric characteristics and preferred speed regime. See the *District Plan, Appendix 8.6.3*.

The classifications of existing roads in Christchurch are listed in the *District Plan, Appendix 7.12*.

Be aware of any local area traffic management schemes or neighbourhood improvement plans which may incorporate street requirements for the area.

8.8.1 Local roads

The primary purpose of local access roads is to provide access to properties. These are not intended as a through road for vehicles to other streets. Design such roads to provide an environment where pedestrians and cyclists can mix with vehicular traffic, so that the road becomes a useable public space. These roads could be a cul-de-sacs or a short access road with a minimal width and a low speed environment, preferably 30kph or less. Typically, access is provided for not more than 25 households, meaning that traffic volumes are not usually more than 250 vehicles per day (vpd).

Other local roads provide access to properties and local streets. Their design should encourage a low speed environment of 30-40kph. These roads are likely to be closer to areas of demand such as shops and schools. The traffic volumes will be higher with an expected range for traffic volumes of 250 to 2,000 vpd.

Local roads should not generally connect to major or minor arterials, except in exceptional circumstances and with the Council's approval.

8.8.2 Collector (Distributor) roads

The function of collector roads is to provide the link between the local roads and the arterial roads. Collector roads should not generally connect to major arterials, except in exceptional circumstances and with the Council's approval. Collector roads on Banks Peninsula generally have equivalent car movements (as defined in the *Banks Peninsula District Plan)* of over 750 in the urban areas and over 200 in the rural area.

In the urban area, collector roads usually have predominantly residential frontage and will often contain the bus routes within the neighbourhood. A speed environment of up to 50kph with traffic volumes of up to 6,000 vpd is expected.

8.8.3 Arterial roads

Arterial roads cater primarily for traffic movement, and property access is a secondary function. Traffic volumes are normally more than 6,000 vpd in Christchurch City. Major arterial roads are the dominant elements of the roading network connecting the major localities of the region, both within and beyond the main urban area. They are constructed and managed to minimise their local access function. Minor arterial roads provide the connections between major arterial roads and inter-connect the major rural, suburban, commercial and industrial areas. Generally, they cater for trips of intermediate length and some are essential routes to more remote parts of the region.

These roads must be designed in conjunction with the appropriate roading authority. Discuss access to the existing road network with the Council and the New Zealand Transport Agency at the consent stage, if a State Highway will be affected. Use the *Planning Policy Manual* for the design of any works on or adjacent to a state highway.

8.8.4 Classified roads

Classified roads are a subgroup, comprising collector and both minor and major arterial roads. Selecting this classification influences the traffic network so consult with the Council about the location of these roads.

8.8.5 Traffic volumes

Identify the likely volumes of traffic that will be generated by a development, using the following average household trip generation rates.

Table 1 Household trip generation rates

Flat urban areas	10 trips/household/day
Hillside & rural areas	8 trips/household/day

If surveyed data is available for areas with similar characteristics, use this in preference to the values above, due to the variation in generation rates throughout the city. Some traffic count data is available on the council websitewww.ccc.govt.nz/transport/road-improvement-projects/traffic-count-data.

8.9 Speed Environment

The speed environment of roads can have a huge impact on the actual and perceived safety of the facilities; therefore it is important to design for the appropriate speed of the roads involved. Determine the speed environment for the road classification first as it is the primary design control. All other factors relate to and can reinforce the design speed e.g. road alignment, width, intersection location and treatment, landscaping. Ensure that the speed environment is consistent along the road section.

Traffic management devices should not be installed where the speed environment does not require alteration. Use the process in the flow chart in Figure 5 for determining alternative design options.

Traffic speed for lower speed environments may be controlled, so that it is conducive to a mixed use street environment and function, through a variety of means:

> roadway width – a narrow roadway may provide space for only one vehicle at a time. Parked vehicles reduce the available space for moving vehicles so that there may only be a single usable lane. If cyclists use the road, their presence may control the traffic speed and the design requirements of the road.

> landscaping – appropriately designed on-street landscaping can visually narrow the road. It can also be used with changes to the kerb alignment to physically narrow the roadway.

> corners – the use and spacing of tight corners to maintain short lengths of straight road makes it difficult to gain speed.

> intersection spacing – short lengths of road between intersections make it difficult to reach high speeds.

> intersection design – tight kerb radii force motorists to slow down when entering an intersection. This can be combined with an intersection treatment (e.g. change in road width or surfacing) to indicate a change in the speed environment to drivers.

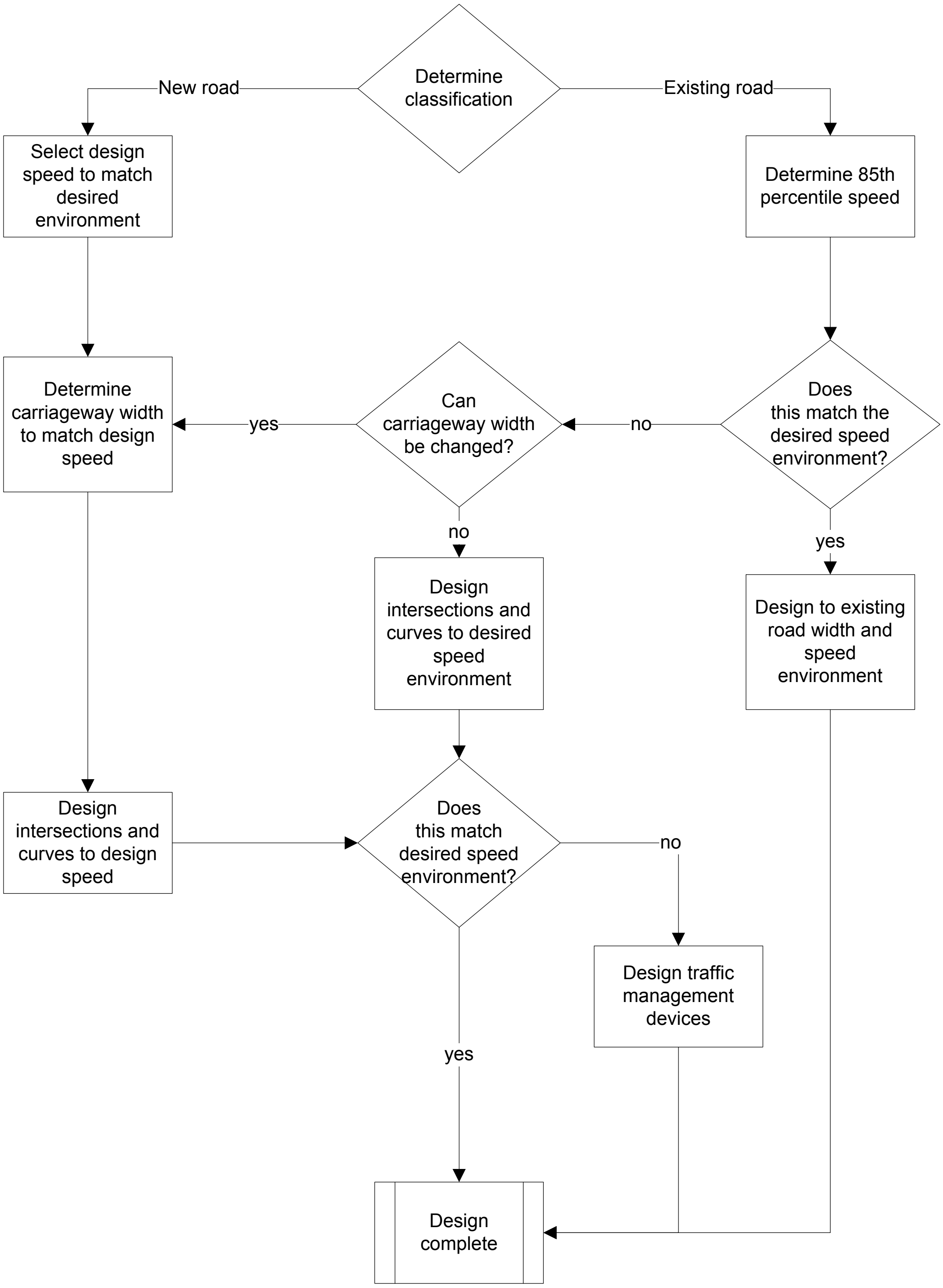


Figure 5 Application of traffic management

- traffic calming – localised road narrowing, changes in road texture, changes in the road alignment (both horizontal and vertical) can all be used to reduce speeds on local roads and to create safe crossing points for pedestrians and cyclists.
- rural thresholds – localised narrowing of the road through kerbs, road markings, signage and/or roadside planting can provide a signal to drivers that they are entering a residential area with lower speed limits.

Find standards for the design of higher speed environments, such as are appropriate on various classified and rural roads, in the *Austroads* series and TNZ manuals.

8.10 Road Design

Areas that require particular attention during the road design are:

> speed environment;
> intersection design and spacing;
> connections and intersections with the existing transport network;
> future road linkages to unzoned land;
> bus movement requirements and bus stop locations and facilities;
> pedestrian and cycle facilities;
> parking requirements;
> road crossings for pedestrians;
> access requirements of mobility impaired pedestrians;
> the connection of off-road facilities to roads and property access;
> lighting;
> road surfacing;
> Over Dimension and Overweight Vehicles.

Minimise life cycle costs and benefits for all new road elements. When choosing materials in particular, consider the replacement and maintenance cost whilst ensuring levels of service are met.

Council allows over-dimension and over-weight vehicles to operate on limited sections of the road network by permit, as shown in the Over Dimension Route Maps. The maximum dimensions for which permits are normally issued are:

> Width: up to 11 m
> Height: up to 6.5 m
> Length of vehicle combination: up to 35 m.

Avoid detailing permanent objects within the streetscape that will conflict with the over-dimension envelope on these routes.

Refer to New Zealand Heavy Haulage Association Road Design Specifications for Over Dimensions Loads. www.hha.org.nz/assets/Resources/NZHHA-Roading-Design-Spec-For-OD-Loads-Version-8.pdf

For route maps and permit applications refer to www.ccc.govt.nz/transport/legal-road/over-dimension-permits

8.10.1 Access to existing roads

Discuss access to the existing road network with the Council, and also the New Zealand Transport Agency, if a State Highway is to be affected.

The safety and efficiency of the existing roads must be maintained, when considering connections or accesses from the development.

8.10.2 Cul-de-sacs/Hammerheads/No exit streets

Cul-de-sacs can provide pleasant residential environments with a sense of community and little traffic but a balanced approach to their use is required. Refer to the District Plan for further information.

Where possible, provide walking and/or cycling linkages at the end of cul-de-sacs to parks, reserves or other roads. When designing large cul-de-sac heads, consider incorporating islands or other measures to break up large expanses of seal. Surface all turning heads and hammerheads with asphaltic concrete.

NZS 4404 details hammerheads.

8.10.3 On-street parking

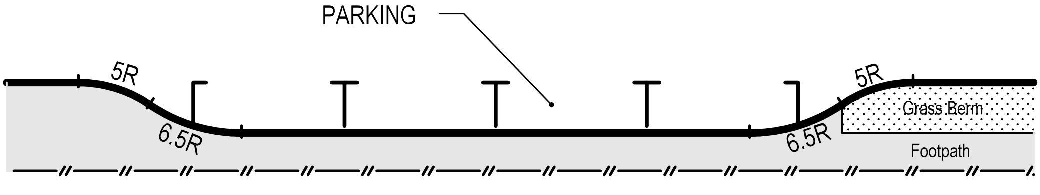
The off-street parking requirements for various activities are listed in the *District Plan*. Refer also to the *Parking Strategy for the Garden City*.

Design parking lanes widths from 2.2 - 2.5m. Increase stall lengths to 6.5m in high turnover areas.

Provide mobility car parks which meet the requirements of NZS 4121 where required by the brief or resource consent.

Wherever reconstructed street-side parking in residential areas is provided in bays, rather than as part of the carriageway, it should be at the minimum rate of one space per three residential units and evenly distributed along the street. Construct all parking bays to the same design loading as the adjacent road pavement and with a minimum width of 2.5m for parallel parking. Radii should match those shown in Figure 6.

Figure 6 Parking bay



When parking bays are located in front of properties, consider the possible location of the property access, which may need restriction by a Consent Notice.

Design angle parking to *Parking facilities - On-street parking*. Wherever parking is provided at 90 degrees to the kerb line, a minimum stall depth of 5.0m and a stall width of 3.0m are required. Make allowance in the footpath width or location for a 0.8m overhang wherever the kerb is to act as a wheel stop (included in the 5.0m stall depth).

Mark the parking lane or spaces in accordance with the *Kerbside Parking Limit Lines Policy*. Marking is required for all angle parking and where parking restrictions are in place. Mark mobility car parks in accordance with the *Manual of Traffic Signs and Markings* Part 2. There will also be other circumstances where roadmarking of parking is advisable e.g. outside schools and on arterial roads.

The Council has delegated the approval of the installation of parking signs to the Community boards. This is separate from and additional to engineering acceptance.

8.11 Intersection Design

The potential for crashes to occur at intersections is higher than other areas of the road network, due to the number of conflicting vehicle, cycle and pedestrian movements. Proper design of intersections can reduce the number of conflicts, while providing for a range of turning movements at the intersection.

Consider traffic safety issues due to the location of existing above-ground structures e.g. columns/poles or trees, at the time of design.

8.11.1 Comprehensibility

Comprehensibility of the network improves the ease with which people can negotiate their way through and around an area.

Generally, the geometry of any road intersection should be designed so that the major route is the through road and has traffic priority. Wherever the roads are of equal classification or one classification different, a roundabout may be used. This can also limit vehicle speeds. Wherever a local road intersects with a classified road, a perimeter threshold treatment may be appropriate to reinforce traffic priority and assist with comprehending the layout.

Improve comprehension by designing each classification of road to reflect its function, through consistency of appearance, width and geometric design of the road; e.g. the main arterial roads may have a central median. Reduce confusion by minimising the use of cul-de-sacs and, in particular, cul-de-sacs accessing other cul-de-sacs. See clause 8.10.2 - Cul-de-sacs/Hammerheads/No exit streets above.

8.11.2 Intersection types and controls

To support the safety and efficiency of the road network, roads should preferably only intersect if they are classified the same or are one level different in status. If it is unavoidable that roads more than two classification levels apart must intersect, then the Council may consider applying movement controls such as left in/out only or entry only.

Within new residential areas, appropriate intersection types include:

> Priority, roundabout or signal controlled T or Y-intersections (3-way), depending on the balance of traffic flows and classification of the approach roads. All approach legs to Y junctions should be separated by 120 degrees and T junctions by 90, 90 and 180 degrees.

> Four-way intersections at grade must be roundabout or signal controlled due to their high crash risk. Local roads should not intersect with the main road network as cross roads and should only form cross junctions with themselves where necessary. Where unavoidable and a reasonable volume of traffic across the busier road is anticipated, offset the quieter roads as a left – right stagger, to minimise the risk of crashes.

Wherever traffic from the planned roading network for a development will access a classified road, the intersection may require roundabout or traffic signal control or have certain movements restricted. Consult with the Council before submitting the Design Report, to ensure that the intersection conforms to the Council's requirements.

8.11.3 Unsignalised urban intersection spacing

Locate intersections sufficiently far apart to separate their traffic movements and provide drivers with sufficient lead-time for decision making. The minimum spacing requirements must be the greater of those listed in Table 2 or the spacing necessary to meet the requirements of the *Guide to Road Design, Part 4: Intersections and Crossings - General*. Discuss spacings for arterial – arterial intersections with the Council before the Design Report is submitted.

Table 2 Minimum intersection spacing in urban areas

Classification	Minimum spacing
Arterial - Collector	150
Arterial - Local	150
Collector - Collector	150
Collector - Local	150
Local - Local	40

Note:

1) Distances are measured centreline to centreline.
2) Double these distances to allow for future intersections into undeveloped land adjacent or opposite to this development.
3) Where the frontage road is divided by a median, intersection spacing may need to be increased to provide for construction of adequate-length turning bays
4) This table is derived from Austroads.

Use the following standards and guidelines for the design and operation of intersections and vehicle crossings:

> *Guidelines for the Implementation of Traffic Controls at Cross Roads, RTS 1*
> *Guide to Traffic Management, Part 6: Intersections, Interchanges and Crossings*
> *CSS: Parts 1-7*

8.11.4 Sight distances

Adequate sight distances at an intersection must be provided as sight distance is fundamental to safe intersection design. When designing intersections and/or small radius curves, use the *Guide to Road Design, Part 3: Geometric Design*, which provides guidance on the minimum sight distance requirements. Refer to *Banks Peninsula District Plan, Appendix XIV – Standards for Vehicle Access and Loading* for requirements in Banks Peninsula.

8.11.5 Permanent signs and markings

Locate street name signs between 450mm and 1500mm behind the new kerb or 600mm and 1500mm behind the new shoulder and within the area formed by the intersecting legal road boundaries, as specified in *RTS 2*. Ensure that reconstruction projects include the relocation of the street name sign, if the works make its old position inappropriate. Position signs at least one metre away from a vehicle entrance or kerb cutdown where possible.

Consider the proximity of overhead power lines: design signs and other infrastructure to provide the clearances required in the *Code of Practice for Electrical Safe Distances*.

When signs are used within the road corridor, they must comply with the following standards and guidelines:

> *Setting of Speed Limits 2003 Rule*
> *Traffic & Parking Bylaw*
> *Guidelines for Street Name Signs, RTS 2*
> *Road Signs and Markings for Railway Level Crossings, RTS 10*
> NZS 8603 *Design and application of outdoor recreation symbols*
> *CSS: Parts 1-7*
> *Compliance Standard for Traffic Signs*
> *Manual of Traffic Signs and Markings Part 1*

The Council has delegated the approval of the regulatory signage and roadmarking on existing roads to the Community boards. This is separate from and additional to engineering acceptance.

8.11.6 Signalised Intersections

If the road controlling authority decides that traffic signals are necessary to provide safe and efficient access to the area, use the guidelines in:

> Austroads “Guide to Traffic Management, Part 6: Intersections, Interchanges and Crossings”

> NZTA "P43 Specification for Traffic Signals"

> Christchurch City Council Regional Special Conditions for Traffic Signals for the design and operation of the traffic signals. The location and design of each installation must conform to the requirements and approvals set by the Council, to enable coordination of the traffic signals.

for the design and operation of the traffic signals. The location and design of each installation must conform to the requirements and approvals set by the Council, to enable coordination of the traffic signals.

8.11.7 Roundabouts

Roundabouts provide control at intersections in a variety of circumstances e.g. they can control speeds or improve traffic flows. Their location must be agreed with the Council at the consent stage.

Consider these issues in the design:

> the classification of the intersecting roads;

> the vehicle types expected to use the intersection;

> the speed environment;

> the distribution of turning traffic;

> pedestrian and cyclist safety;

> landscaping;

> heavy vehicle access requirements.

Roundabouts at the intersection of local roads can be used to control speeds, and may be designed with semi-mountable aprons for effective traffic calming. The semi-mountable apron slows cars (it must be high enough to discourage drivers from over-running it), whilst providing for the larger turning requirements of vehicles such as rubbish trucks and emergency vehicles. Discuss the geometric design of such roundabouts with the Council.

Roundabout with mountable apron (Hawford/Ford intersection)

Use the following standards and guidelines for the design and operation of roundabouts:

> *Guide to Road Design, Part 4: Intersections and Crossings*
> *Guide to Road Design, Part 4B: Roundabouts*
> *Guide to Road Design, Part 6A: Pedestrian and Cyclist Paths*
> *CSS: Parts 1-7*

Refer to clause 10.9.12 - Protection of sightlines (Reserves, Streetscape and Open Spaces) for planting in roundabouts.

8.12 Service Lanes, Private Ways and Access Lots

Access to a site (or sites) that will be provided by a private way must comply with the requirements of the *District Plan*.

Accessway design and construction standards, including drainage, for service lanes, private ways and access lots must comply with the requirements for an equivalent construction within legal road, including the 50-year design life. This includes the provision of a secondary flowpath for stormwater, as detailed in clause 5.6.2 - Secondary flow paths (Stormwater and Land Drainage). When designing accessways, balance the long term maintenance costs for the residents against the benefits of providing access through a vested road.

Use the Waste Management Bylaw 2009 (Terms and Conditions), see Section 17 of the document: www.ccc.govt.nz/assets/Documents/The-Council/Plans-Strategies-Policies-Bylaws/Bylaws/Waste-Management-Bylaw-2009-Terms-and-Conditions.pdf to determine the requirement for either refuse truck access or refuse container storage areas at the road boundary. Where there is insufficient space, clear of the footpath and within the legal road, for the short-term storage of refuse containers, provide a collection point within the accessway but close to the road boundary.

As work within private ways, service lanes and accessways will not be taken over by the Council upon completion; the Council will be placing the onus for confirming both the suitability of design and construction on the developer.

These works must comply with the requirements of Part 3: Quality Assurance.

8.13 Geometric Design

8.13.1 Design speed

Classified roads are typically designed to a higher speed than local roads. The *Guide to Road Design, Part 3: Geometric Design* states that major urban roads should be designed for an operating speed 10km/hr above the legal speed limit. The desired speed environment or target speed for local urban roads may determine the design speed. Refer to *Guide to Traffic Management, Part 8: Local Area Traffic Management* clause 3.3.

The *Guide to Road Design, Part 3: Geometric Design* states that rural roads should be designed for the 85th percentile operating speed.

The *Speed Limits Bylaw* and its related register of speed limits, found at www.ccc.govt.nz/environment/speedregister/registerofspeedlimits.pdf, set out the speed limits for the listed roads. Use the *Speed Limits New Zealand Schedule 1* incorporated in the *Setting of Speed Limits Land Transport Rule* to estimate the relevant speed limit for new or reclassified roads in Christchurch. The Council will determine the relevant speed limit using the *Setting of Speed Limits Land Transport Rule*.

8.13.2 Horizontal alignment

Generally, horizontal curves conform to the *Guide to Road Design, Part 3: Geometric Design*. Design the elements of the road network for the appropriate design speed.

Design the kerb radii at local road intersections for a 2 axle truck, as detailed in *Guide to Road Design, Part 4: Intersections and Crossings - General*, whilst minimising pedestrian crossing distances.

Design intersections of a collector or arterial road to meet the tracking curve requirements in *RTS 18 New Zealand on road tracking curves for heavy vehicles*.

Avoid reverse curves where possible. If they are necessary, balance and separate them by a sufficient length of straight road to allow for a satisfactory rate of superelevation reversal (where the design speed is greater than 50kph).

Curves in the same direction in close proximity must be compounded. Avoid “broken back” effects.

Where horizontal curves of less than 60m radius are necessary for topographical or other reasons, extra widening of between 0.5 and 1.5m may be required, according to the width of carriageway available to moving traffic, the radius of the curve and the classification of the street. The *Guide to Road Design, Part 3: Geometric Design* Table 7.11 provides further information to calculate this extra widening.

Horizontal curves in 50kph areas are usually circular with a minimum centreline radius of 80m for through streets, reducing to 20m for cul-de-sacs.

8.13.3 Vertical alignment

Gradient lengths must be as long as possible, with vertical curves provided in compliance with the *Guide to Road Design, Part 3: Geometric Design*.

Gradients at any point on the kerb line should not exceed 1:6 or be less than 1:500, with a minimum gradient of 1:300 on the outside kerb line of any curve. Kerb grades less than 1:500 may be acceptable in conjunction with underchannel piping or frequent stormwater outfalls.

Where the change of gradient exceeds 1%, generally join the change with appropriate vertical curves of not less than 30m for through roads and 20m in cul-de-sacs.

Design the crown line at intersections to ensure a smooth ride on the main road. Normally, this means running the crown of the minor road into the nearside edge of the main road lane line or quarter point.

Wherever a roadway crosses a waterway or a drainage path, a conveyance system such as a single culvert structure (or multiple parallel pipes) is required. These drainage structures shall be designed and specified in accordance with Chapter 13 – Waterway Structures, Part B: Design, Christchurch City Council Waterways, Wetlands and Drainage Guide, Dec 2011. The new structures shall consider all aspects (waterway configuration, hydraulic capacity, depth of cover, secondary flow path etc.) to avoid exacerbating the existing flood prone areas or create new flooding issues. The designer shall also be aware that raising the road crown in an existing secondary flow path will increase the ponded flood water height and flood risk for upstream properties.

8.13.4 Crossfalls

Normal carriageway crossfalls should be 3% for urban roads and unsealed crossfall should not exceed 4%. The carriageway crossfall must be formed in accordance with the *CSS: Part 6* camber detail, SD 623.

Some variation from this requirement may be necessary in cases where a differential level between kerb lines is adopted and/or the crown is offset from the centreline.

Design turning circles to avoid an excessive differential between the crown and fender. Minimum crossfall must be 2% for asphaltic concrete and 2.5% for chipseal. Wherever an off-centre cul-de-sac head is used, offset the road crown to create symmetrical crossfall conditions.

Generally, crossfall should not exceed 6%, when measured from the carriageway edge to the crown.

8.13.5 Superelevation

Normally superelevation is not applied to urban local roads. For speed limits over 50kph, specific design of superelevation will be required. Where superelevation is required, the maximum value on local and collector roads is 5%.

8.13.6 Cross-section design

For new roads, provide carriageway and legal road widths that comply with the *District Plan*. Use table 3 when altering existing roads. Design widths as part of an optimal road cross-section, to achieve the following objectives:

- Minimise the capital costs of construction by not exceeding the desirable widths for high cost elements like carriageway, cycleway and footpath;

- Minimise the ongoing maintenance costs by designing and constructing elements to achieve their design life;
- Provide all the specified roadway elements;
- Provide bus lanes or bus priority measures where required;
- Reinforce the speed environment through appropriate lane and carriageway widths;
- Provide an attractive streetscape, adding to the amenity and character of the area;
- Facilitate a safe, efficient and effective drainage system by ensuring that the new works do not detrimentally affect the existing drainage pattern or road users;
- Provide a safe layout for all users.

Table 3 Carriageway elements

Road classification	Indicative total daily traffic flows (VPD)[1]	Min traffic lanes[2]	Cycle facilities[3]	Shoulder / parking lane[4]
Major arterial - Urban	>12,000	4	separate	parking lane / none
Major arterial - Rural	>10,000	4	separate	shoulder
Minor arterial - Centres	>10,000	2	marked in c/way	parking lane/ none
Minor arterial - Urban	3,000 to 15,000	2	marked in c/way	parking lane/ none
Minor arterial - Rural	2,000 to 12,000	2	separate	shoulder
Collector - Urban	1,000 to 6,000	2	marked in c/way	parking lane/ none
Collector - Industrial	1,000 to 6,000	2	marked in c/way	parking lane/ none
Collector - Rural (Christchurch City)	100 to 2,500	2	marked in c/way	shoulder
Collector - Rural (Banks Peninsula)	>200	2	within traffic lane	shoulder
Local - Industrial		2	within traffic lane	parking lane
Local - Urban	>250	2	within traffic lane	parking lane
Local - Centres	>250	2	within traffic lane	parking lane
Local - Urban	<250	2	within traffic lane	parking lane
Local - Rural	25 to 200		within traffic lane	shoulder
Local - Rural	<25		within traffic lane	shoulder

Notes:

1) These volumes are indicative only, and should not be used as a reason for changing classification of any road.
2) Design traffic lane widths to the Guide to road Design, Part 3: Geometric Design.
3) Design cycle facilities in accordance with clause 8.6 - Cycle Facilities.
4) On higher category roads the movement function of the route becomes more critical. Therefore, consider the removal of on-street parking where indicated by capacity/road safety/road space allocation requirements.
5) Mark parking lanes in accordance with clause 8.10.3 – On-street parking.
6) Provide swales where required by the project brief or subdivision consent.

The desirable traffic lane width excluding in local roads is 3.5m. This width is only appropriate where a discrete cycle facility is provided e.g. a marked or separated lane. The lane width may be increased to 4.2 – 4.5m, to provide shared wide kerbside lanes, where parking is not provided. Do not design widths between these values as they cause cyclist/vehicle conflicts. Where cyclists are expected to mix with general traffic, refer to the guidance for mixed lanes in the *Cycling Network Guidance*.

When proposing narrower widths or where all elements may not be provided, carefully consider the reasons and balance them against the above objectives. Submit a non-conformance report detailing the process of trading off these objectives to arrive at the non-complying design widths, as part of the Design Report.

Refer to *Streets and Spaces Design Guide, Chapter 5 - Streets* for guidance within the central city.

8.13.7 Shoulders

The *Guide to Road Design, Part 3: Geometric Design* states that the minimum formed shoulder width for a rural road with traffic volumes over 150 vpd is 1.5m. Make an allowance for off-road parking areas on roads with 1.0m shoulders.

Table 4 Shoulder width

Design Traffic Volume (AADT)	Formed Widths (m)	Sealed widths (m)
Single lane road <150vpd	2.0	0.5
<500	1.5	0.5
500-1000	1.5	0.5
>1000	2.0	1.0
>3000	2.5 – 3.0	2.0

Note: This table is derived from *Guide to Road Design, Part 3: Geometric Design*.

Sealing of the shoulder varies from 0.5 – 2.0m, depending on traffic volumes and site conditions. Mark edgelines to prevent shoulders being incorporated in the traffic lane. On local rural roads, the shoulder widths may be determined by the width required to provide cycle facilities.

8.13.8 Medians

The *District Plan* sets out requirements for the installation of medians in new roads.

Determining median widths is typically dictated by the function of the road, the type of median and intersection details. The *Guide to Road Design, Part 3: Geometric Design* clause 4.7 provides guidance on median functions, types and widths.

8.13.9 Hillside construction

Where the road is or will be constructed on a slope, this can affect the ability to provide all the required elements of a streetscape and therefore impact on the achievable widths for some or all of those elements. Consider batter stability and property access, in addition to issues detailed in clause 8.13.6 - Cross-section design.

Options available for hillside construction:

> Design narrower legal road widths. Wider widths may be impracticable as it may be impossible to utilise more than a certain width due to crossfall restrictions. Property access may also be compromised if wide roads require high cuts or retaining walls.

> Use localised widening to construct passing or parking bays or to accommodate heavy vehicles.

> Provide a lesser standard of elements; through restricted parking, constructing only one footpath or combining elements e.g. shared cycle paths and footpaths.

> Construct retaining walls(the installation of new concrete crib retaining walls will not be approved by CCC).

> Locate pedestrian and cycle facilities separately from the carriageway.

8.14 Traffic Management Devices

Initiatives to enhance road safety are built around the three E's – engineering, education and enforcement. Engineering the environment to 'solve' a problem may not always be the most efficient solution but is likely to be the most expensive. Consider education or enforcement as well as engineering in the design process.

Design a road at the outset for its environment and function, as it is difficult to retrospectively alter the speed environment. Analyse the existing speed environment, including the 85th percentile speeds, for assessment against the design operating speed and comparison to the constructed speed environment.

The installation of traffic management devices (TMD) is most appropriate to local residential streets where:

> the posted speed limit < 85th percentile operating speed < posted speed limit + 20km/hr;

> peak hour traffic volumes exceed 60 vehicles (equivalent to approximately 600 vehicles/day);

> the length of the road segment under consideration > 250m;
> the road has a documented crash history of the type that could be corrected by the devices considered for implementation;
> there are significant pedestrian safety issues.

Install TMD in classified or rural roads:

> at the transition from the open road to a lower speed limit;
> to enhance pedestrian safety;
> to reduce conflict points.

Use the following standards and guidelines for the design and operation of traffic management devices:

> *Road Safety to 2010 Strategy*
> *Guidelines for Urban-Rural Thresholds, RTS 15*
> *Guide to Traffic Management, Part 8: Local Area Traffic Management*
> AS/NZS 1158 Set *Lighting for roads and public spaces - series*
> *CSS: Parts 1-7*
> *Manual Of Traffic Sign and Markings Part 2*

8.14.1 Device selection

When designing traffic management, be clear about the objective of the measure's installation and the strategy or strategies that the device should achieve. Make the differentiation clear between "neighbourhood improvement" type works and traffic management works, to ensure the measures don't have unexpected effects. Wherever possible, make the objective measurable, to allow an assessment of its effectiveness.

Both the street environment and traffic control must be in tune with each other, and compatible with the desired character of the street. Select traffic management devices which reinforce the road function, through inhibiting inappropriate behaviour or through changing the user's perception of the environment. Where alternative devices support the same objectives, consider the degree of effectiveness required and the likely environmental effects. Ensure that alternative devices do not create inequitable barriers for disabled people.

Factors such as traffic noise and air pollution can have significant impacts both locally and remotely. When selecting the device, consider other environmental effects e.g. noise from deceleration and acceleration, increases in travel distances or traffic volumes on arterial roads.

The four main types of measure are listed in Table 5, with an indication of the objectives to which they are most applicable and of their degree of effectiveness. The environmental effects are also indicated.

Refer to *Guide to Traffic Management, Part 8: Local Area Traffic Management* for an in-depth examination of these devices, their application, advantages and disadvantages.

Table 5 Traffic Device Measures and Objectives

Traffic Device Measures and Objectives The number of ticks indicate the degree of effectiveness. The number of crosses indicate their negative impact.		**Objectives**				
Measure		**Reduce speeds**	**Reduce traffic volume**	**Increase pedestrian safety**	**Reduce crash risk**	**Traffic related environmental effects**
Vertical Deflection Devices	Raised mid-block tables	√√	√√	√	√√	XX
	Wombat crossings	√√	√√	√√√	√√	X
	Road humps	√√√	√√	√	√√	XX
	Road cushions	√√	√√	√	√√	X
	Raised intersection platforms	√√	√√	√	√√	XX
	Perimeter threshold treatments with hump	√√	√√	√	√√	XX
Horizontal Deflection Devices	Lane narrowings / kerb extensions	√		√√√	√	
	Splitter islands	√		√√√	√X	
	Slow points – one-lane	√√√	√√√	√	X	
	Slow points – two-lane	√	√			
	Blister (wide) islands	√	√	√		
	Driveway links	√√√√	√√√√	√√√√	X	√√
	Mid-block flush median treatment	√		√√	√√√	
	Mid-block raised median treatment	√		√√√	√√√	
	Roundabouts	√√√		√	√	XX
Diversion Devices	Full road closure		√√√√√	√√√√√	√√√√√	XX√√
	Half road closure	√√√	√√√	√√√	√√√	X√√
	Diagonal road closure	√√	√√√√	√√√√	√√√√	X√
	Modified T intersection	√√	√√		X√	
	Left in/Left out islands		√√√	√√√	√√√	X√
Signage, Road marking and Other treatments	Speed limit signs	√		√	√	
	Prohibited traffic movement signs		√√√√	√√	√√√√	X√√
	One-way signs	X	√√√	√√√	√√√	X
	Stop signs/ Give way signs	√	√	√	√	
	Pedestrian crossings	√		√√√	√	X√
	Perimeter threshold treatments			√		√√
	Rural threshold	√				√√
	Tactile surface treatments	√				XX√√
	Bicycle facilities				√√	√√
	Bus only treatments		√			√√√
	Shared zones	√√√	√√√	√√√	√√√	√√√

8.14.2 Design considerations

Overuse of devices will reduce their effectiveness globally, as will the passage of time reduce it locally, as drivers become familiar with them. Regardless of this, ensure a degree of consistency in the use of traffic management devices:

> Use similar devices in similar ways.

> Design devices so that drivers can recognise and react to them appropriately both in approach speed and alignment.

> Provide roadmarking, signage and lighting to support the device's purpose.

> Ensure sight distances comply with clause 8.11.4 - Sight distances and the *Guide to Road Design, Part 3: Geometric Design*.

> When designing the device layout, first consider where in the street the device is best placed to achieve the objectives.

> Design longitudinal vertical gradients under 3% at intersections where traffic management devices will be installed.

Install devices with operating speeds that are within 20km/hr of the speed environment. Commentary 18 Figure C18.2, in the *Guide to Traffic Management, Part 8: Local Area Traffic Management*, has a range of indicative operating speeds for various devices. Space devices with a high degree of restraint, like road humps, 80 -120m apart.

Design devices to remove any confusion with pedestrian crossings. Surface footpaths and traffic devices in different colours, to help define their limits. Use tactile surface treatments where there is no level difference between the footpath and the road.

Use landscaping or different surfacing to clarify pedestrian routes and to enhance the effectiveness and safety of the devices. Where devices are used as pedestrian or cycle refuges, ensure that landscaping does not obstruct sightlines.

Select lane widths carefully. Generally only either a vehicle or bicycle can use a 3.0m lane. Both cars and bicycles can use wide kerbside lanes (3.7m or over) at the same time, which are best for roads over 60km/hr or where devices must cater for buses or heavy vehicles. Avoid intermediate widths as these can create squeeze points for cyclists.

8.14.3 Vertical deflection devices

Design the type of treatment stated in Table 6 for the intersection of a local street with the relevant through-road classification. Figure 9 illustrates how this hierarchy of treatments may be applied.

Table 6 Intersection treatment types

Through-road classification	Threshold type
Local	Raised Platform
Collector	Threshold Type B
Minor Arterial	Threshold Type C
Major Arterial	Threshold Type C with median island closure on arterial

Notes: 1) Thresholds Type B and Type C are shown in Figures 10 and 11.
2) Type A is obsolete.

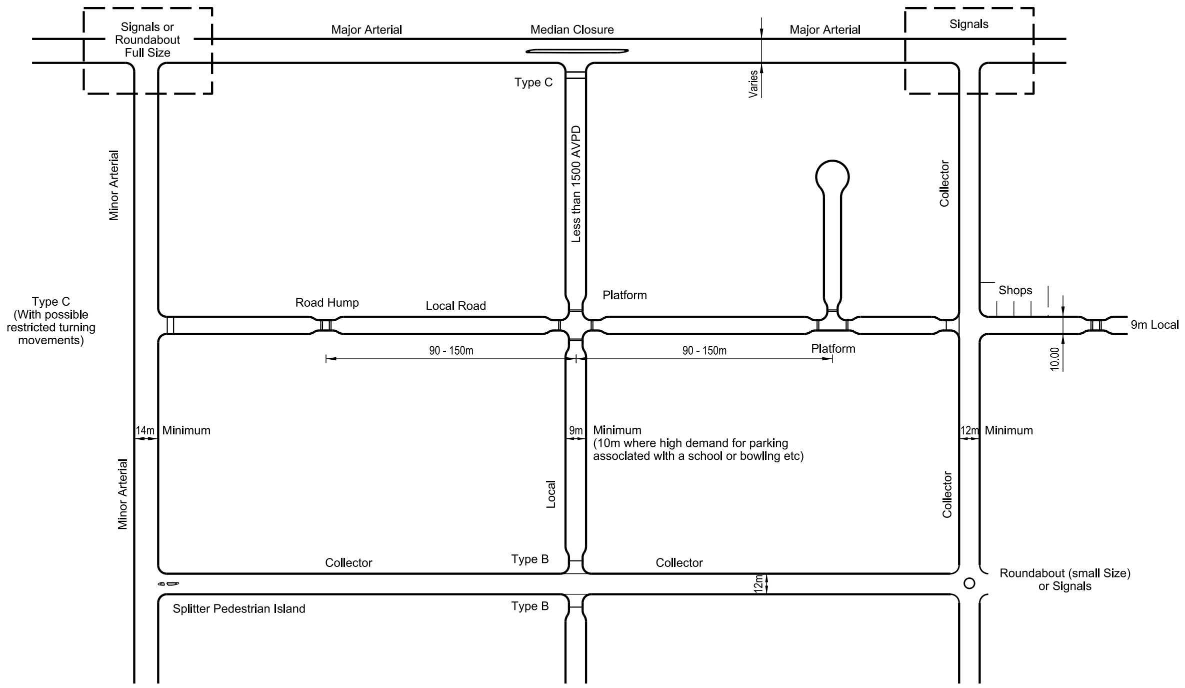


Figure 7 Roading Hierarchy

Locate mid-block devices on local roads that are intended to deter traffic and to control speed between 90m and 150m from intersections. They may be shifted around 30m in either direction without affecting their effectiveness, if their location conflicts with vehicle entrances or to position the device under an existing street light.

Design raised tables and platforms to be 75 – 100mm above the road surface, with flat platforms between 2 – 6m long. The design height of the table or platform should be related to the type of transition from the ramp to the platform or road surface. Rounded transitions are smoother to travel over than sharp transitions so may require a greater height increase. Also examine the longitudinal profile of the adjacent centreline to ensure that it doesn't amplify or nullify the vertical deflection experienced by the vehicle.

Install road humps constructed in accordance with *CSS: Part 6* SD 631.

Consider the types of traffic which will negotiate these devices. Where buses and heavy vehicles will regularly negotiate devices, specify flatter ramps (1 in 20) and longer platforms (6.0m). Cyclists also prefer longer ramps (1 in 15) but these do not reduce speed as effectively as short ramps (1 in 12).

8.14.4 Horizontal deflection devices

Design bicycle lanes to bypass horizontal deflection devices where demand warrants it. If cycles use the traffic lane, eliminate squeeze points in, before and after devices.

Assume operating speeds of 10-20 km/hr for slow points and design them with deflection angles between 10 to 30 degrees. Where bicycle usage is not significant, design lane widths between 2.8 and 3.0m.

Detail blister islands at least 2.0m wide and 3.0m long.

Roundabouts are also horizontal deflection devices and are discussed in clause 8.11.7 - Roundabouts.

Reducing traffic speed through traffic calming (Geraldine/Gresford intersection)

8.14.5 Diversion devices

Construct pathways through diversion devices for bicycles and pedestrians and ensure that the devices can cater for the permitted users.

Carefully consider the use of full road closures and design them to minimise disruption. Design half road closures to make prohibited manoeuvres difficult. Provide turning facilities for both forms of road closure. Maintain two way movement through diagonal closures for all users.

Design modified 'T' intersections with mountable kerbs and reinforce changed priorities where appropriate. Combine left in/left out islands with central median islands to improve efficiency.

8.14.6 Thresholds

Detail the continuous kerb across the front of a threshold as a cycle cutdown.

Design perimeter thresholds which are at least 5.0m long and entirely flush with the road. Provide for the turning movements of commercial vehicles and buses.

Install rural thresholds only where there is more than 20km/hr between the posted speed limits on each side of the threshold site and where there are no existing constraints which reduce the speed environment. Vertical design elements are an essential component of rural thresholds and include evergreen planting, signs, lights and their columns. Utilise horizontal design elements like planting, medians and lane narrowing. Refer to *Guidelines for Urban-Rural Thresholds* for widths in differing traffic conditions.

Where designing Type B or Type C thresholds to deter through traffic, the maximum width should be 7.0m. Where designing these thresholds to accommodate full access, the minimum width should be 9.0m.

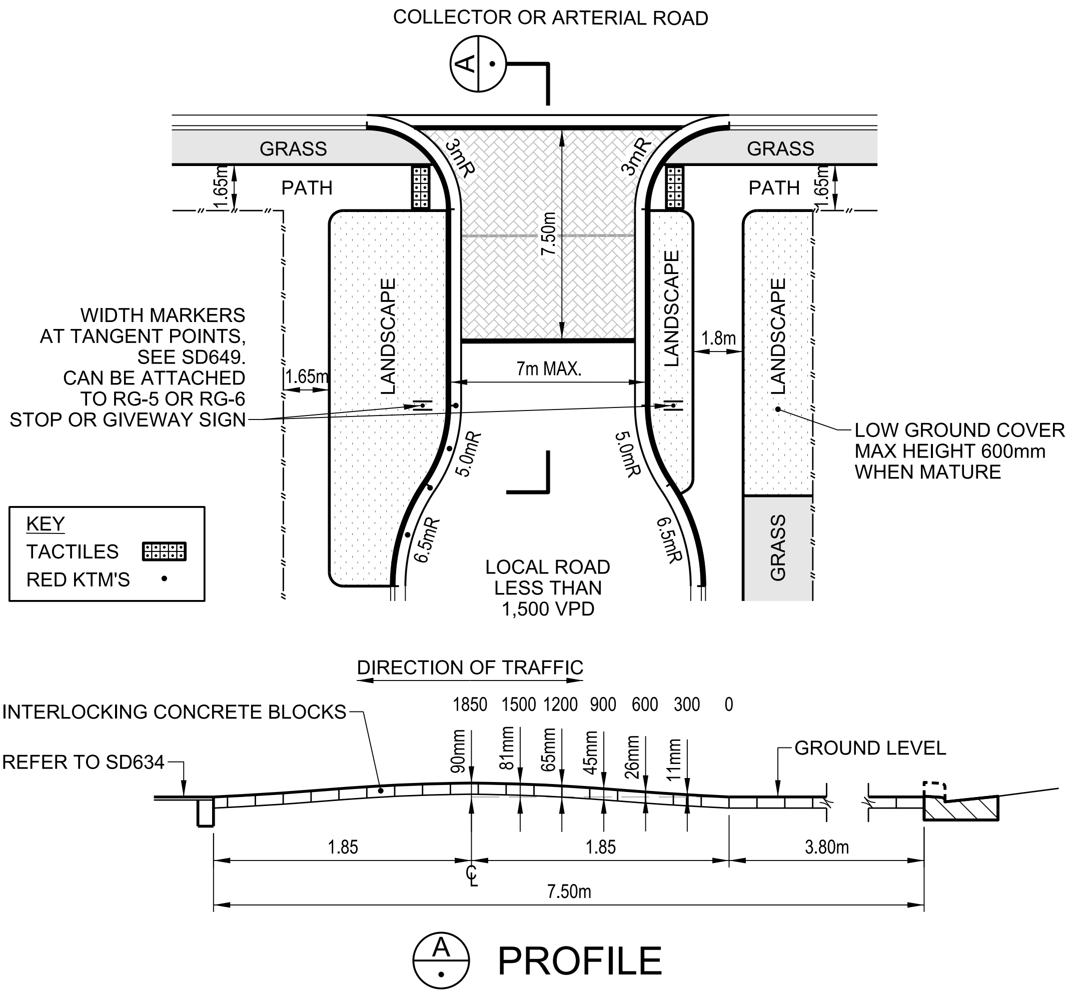


Figure 8 Type B threshold

Where buses and heavy vehicles will regularly negotiate Type C thresholds, the rise in the road hump may be reduced to 50mm.

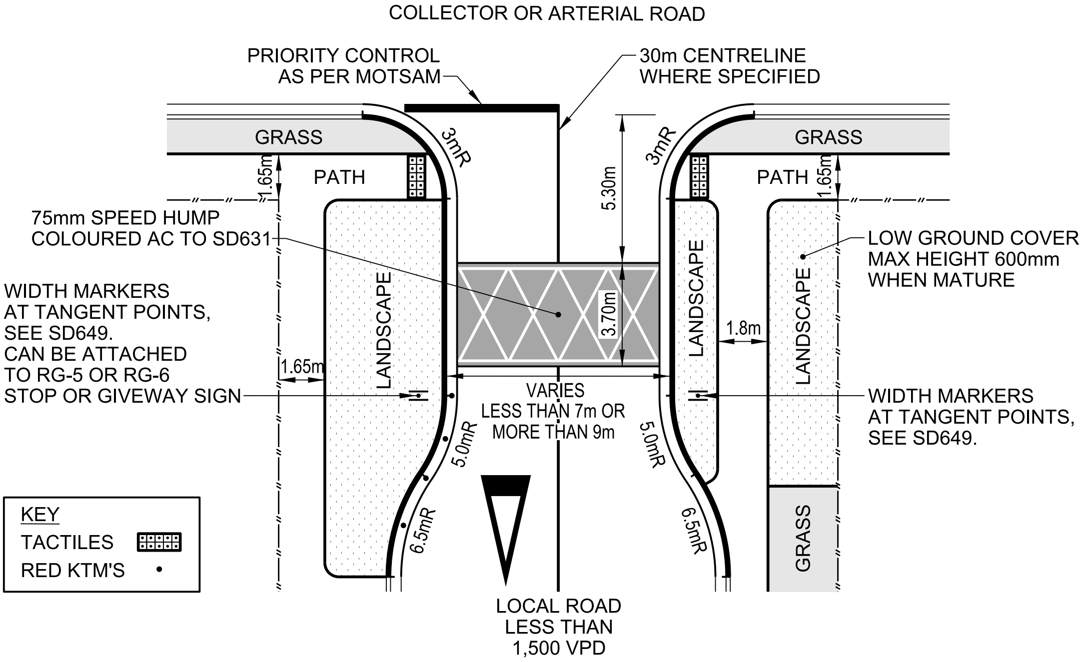


Figure 9 Type C threshold

These thresholds do not require road hump or speed advisory signs. Detail width or hazard markers where the kerb build-out exceeds 1.5m and red kerb top markers (KTM) on the left hand approach only to the tee. Space them evenly around the curves at the curve tangent point (CTP), both mid tangent points (TP) and the outside TP, as shown. They should not be placed on cutdowns.

Design modified versions of the Type B and C thresholds, shown in Figures 10 and 11, where there is known heavy vehicle or bus use of the local road. Compound curves shown in Figure 14 should be used for light 'trucks' or buses and heavy vehicles respectively.

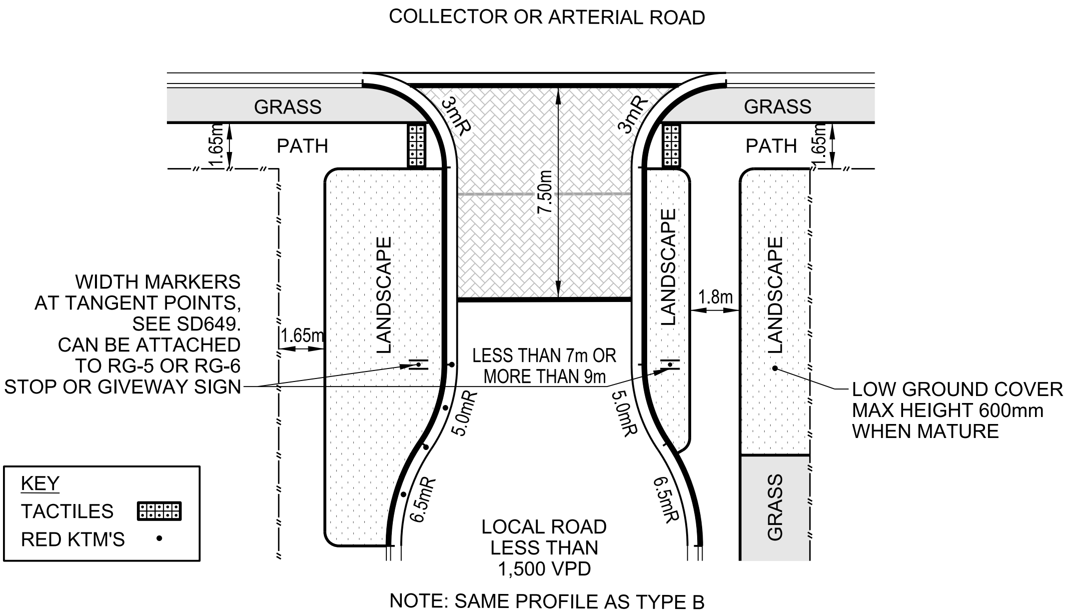


Figure 10 Type B modified threshold

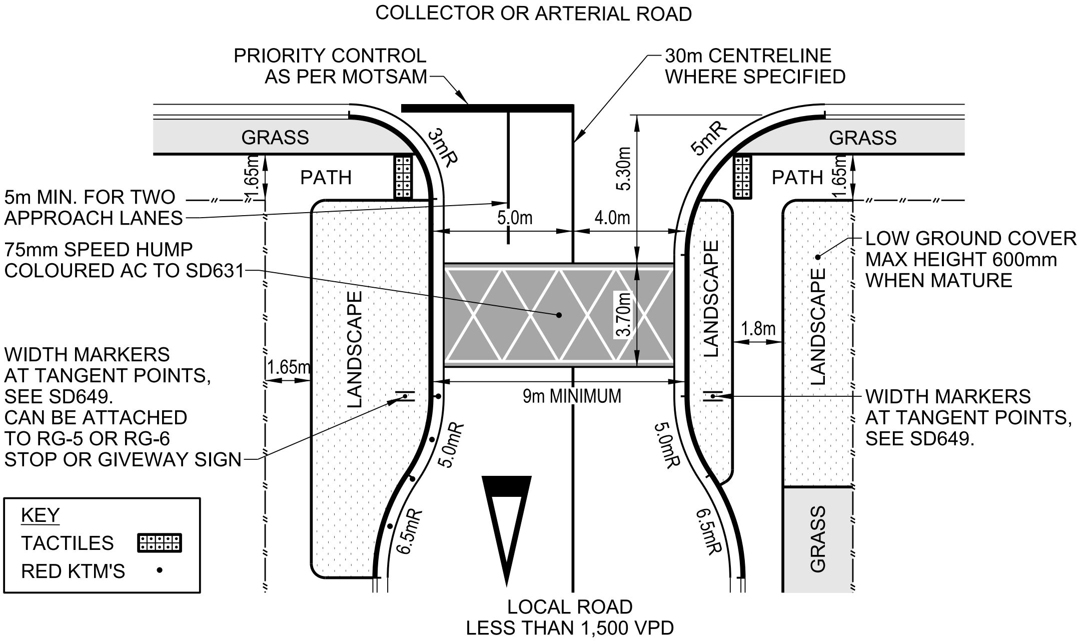


Figure 11 Type C modified threshold

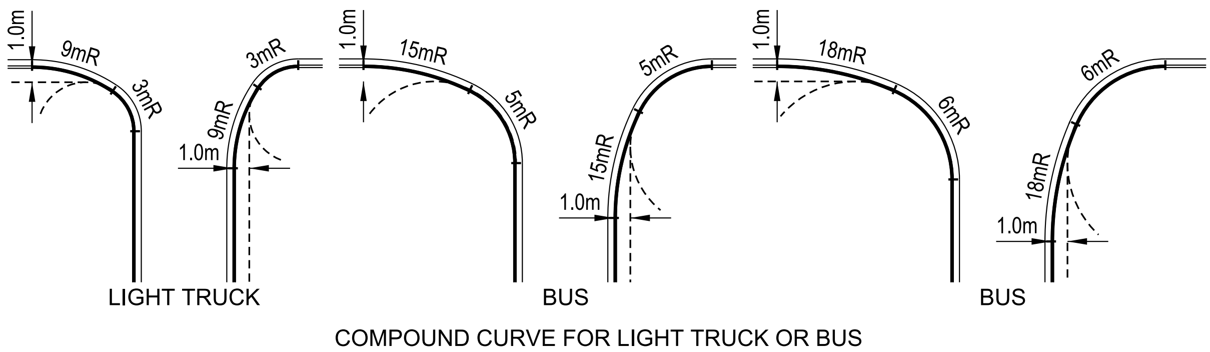


Figure 12 Compound curves

8.14.7 Signage

Reinforce the effectiveness of signage by combining it with other devices. Install zebra crossings or signalised pedestrian crossings only where there is a warrant for it, as defined in NZTA *Pedestrian Planning and Design Guide.*

Ensure that all the traffic control devices are visible. Signs or raised studs, which comply with *CSS: Part 6*, or supplementary lighting, may be required. For lighting, refer to Part 11: Lighting.

The Council has delegated the approval of the installation of regulatory signs and roadmarking, including stop, give way and prohibited traffic movement signs, to the Community boards. This is separate from and additional to engineering acceptance.

8.14.8 Road markings

Install centrelines on rural roads with an AADT over 250 or where a road with an AADT over 100 has frequent or substandard horizontal or vertical curves. Install centrelines on classified urban roads carrying substantial volumes of non-local traffic.

Install lane lines wherever there is more than one lane in the same direction. Replace centrelines and lane lines with raised pavement markers on roads with a fine textured surface.

Install edge lines on rural roads with an AADT over 750 or where a road with an AADT over 250 has frequent or substandard horizontal or vertical curves. Install edge lines on urban arterial roads and where the lane requires definition or may conflict with parking.

Consider the requirement for no overtaking and no stopping lines. Install no-stopping lines adjacent to the kerb where a cycle lane is located against the kerb. The Council has delegated the approval of no stopping line installations to the Community boards. This is separate from and additional to engineering acceptance.

Where road markings are required, use the following standards and guidelines:

> *Guidelines for Flush Medians, RTS 4*

> *Guidelines for Safe Kerbline Protection, RTS 8*

> *Guidelines for Rural Road Marking and Delineation, RTS 5*

> NZ Supplement to *Guide to Traffic Engineering Practice, Part 14: Bicycles*

> *CSS: Parts 1-7*

> *Manual Of Traffic Signs and Markings* Part 2

8.15 Streetscape

The streetscape elements include paths, grassed berms, trees, shrub beds, streetlights, structures and hard landscaping. These can provide various benefits including:

> a network of safe, pleasant, comfortable, convenient and efficient paths.

> positive guidance for pedestrians and/or cyclists.

> seats, lighting, litter bins (where required) and other facilities.

> enhancement of the street environment by the inclusion of grassed areas, specimen street trees and plant beds, built structures e.g. fences, low walls, art works.

> attractive 'rain gardens' with safe overflow provision, which can provide a water quality and air quality improvement component for air and water borne vehicle pollutants.

Discourage vehicle access to berms, footpaths and swales by using landscape elements (e.g. kerbing, bollards, planting or fences).

Detail surfacing or treatment interfaces, e.g. where a path/berm intersects with a kerb, to avoid acute angles and so facilitate compaction and reduce maintenance issues.

Bollards prevent vehicles parking in the swale (Waiwetu St)

8.15.1 Footpaths

The number of footpaths required for each road classification must comply with the requirements in the *District Plan*.

Footpath widths are measured from the footpath edge of the kerb or service strip. The service strip may be sealed with the path. The minimum widths set out in Table 7 must be **clear of all obstructions** such as vegetation when fully mature, light standards, traffic signs, utility furniture and bollards. The building or fence line is the preferred path of travel for the majority of pedestrians who have a vision impairment and should always be prioritised as the continuous accessible path of travel (CAPT). Extra widening will be required wherever such obstructions cannot be avoided or relocated. Figure 15 indicates situations where extra widening is required.

Table 7 Minimum footpath widths

Adjacent land use	Minimum width (m)	Preferred location
Residential	1.5	Adjacent to boundary
Retail/town centre	2.5	Adjacent to kerb
Industrial	1.5	Adjacent to kerb

Notes:

1) Residential footpaths are normally separated from the kerb by a grass berm and from the road boundary by a service strip.
2) Allow for any planting (e.g. trees) between the footpath and the kerb.
3) On slopes, it is most practicable to construct the footpath against the kerb.
4) Transitional widths may be required on the boundary between residential and retail/town centres.

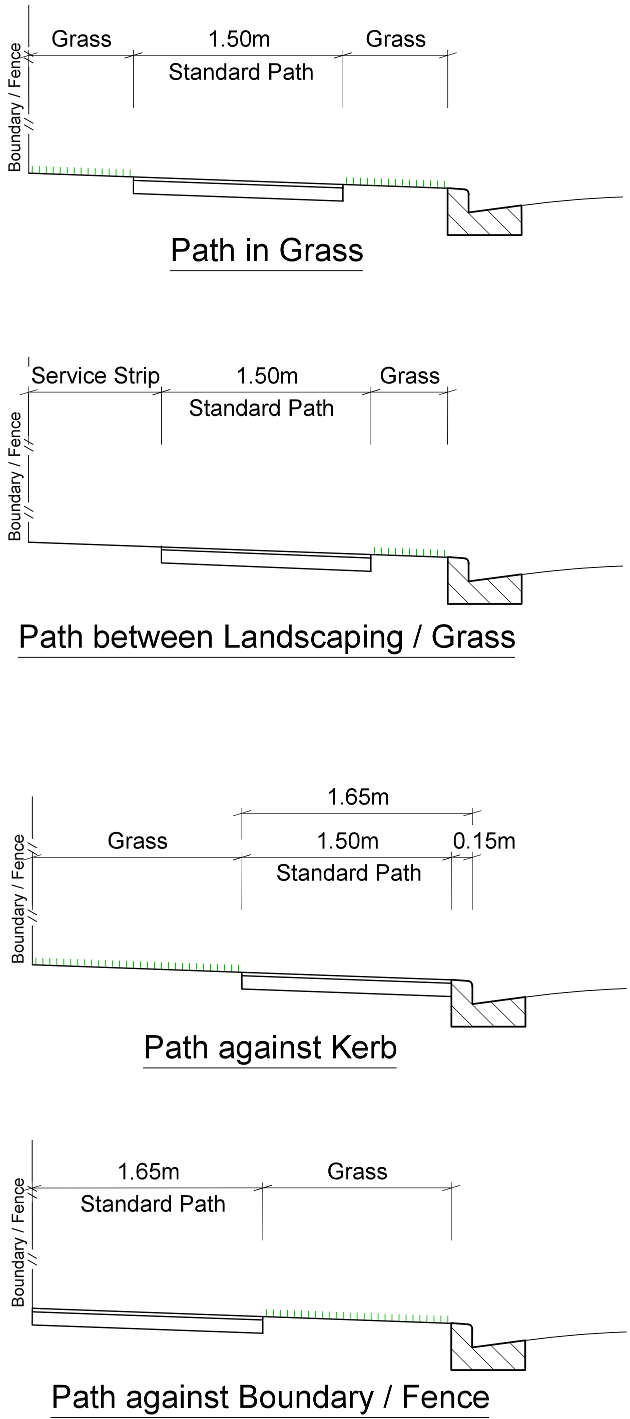


Figure 13 Extra footpath widening

Where topography or existing features preclude providing the minimum widths, discuss options with the Council.

Lateral changes of the footpath direction should normally be achieved using smooth continuous curves. This is particularly relevant where the path deviates around obstacles (e.g. utility boxes, columns/poles) or adjacent berm areas (e.g. trees, shrubs or structures) or shifts laterally to join another footpath.

Wherever the footpath deviates from pedestrian desire lines and positive guidance is required, install plant beds, fences or comparable barriers. Wherever possible, plant shrubs to soften the appearance of the guidance element. Also consider the needs of people with disabilities e.g. mitigate the possible safety risks for a person with a visual impairment by indicating the change.

Path deviates around an obstruction (Carlton Mill Rd)

Use the *Footpath Berm Policy* when designing a footpath. The following documents should also form the basis of the design:

> *Equity and Access for People with Disabilities Policy*
> *Guidelines for Planting for Road Safety*
> *NZS 4121 Design for Access and Mobility – Buildings and Associated Facilities*
> *CSS: Parts 1-7*

For residential areas the Council's preference for footpath and vehicle crossing pavement type is asphalt. An NCR for any alternative footpath and vehicle crossing pavement construction will be required for Council consideration.

8.15.2 Crossfalls and gradients

The optimum crossfall for sealed footpaths is 2.0%, with a minimum of 1.25% and a maximum of 3%. Grass areas and plant beds between the footpath and the carriageway or on median islands must have crossfalls flatter than 6%.

To provide access for wheelchairs and prams, steps must not be used on footpaths within public roads, unless approved by the Council.

Grassed areas for tree planting, which are additional to the minimum berm width, must be specifically designed. In these areas, steeper slopes may be permitted provided that the area can be mown or otherwise easily maintained. Gradients up to one in two may be planted. The treatment of all gradients steeper than one in four requires Council approval.

8.15.3 Grassed berms

Install berms where specified in the *Footpath Berm Policy*. Berms could be planted in selected areas. Where the width from the legal boundary to the kerb or road edge exceeds 2.5m in residential areas, install a berm.

Squaring the point of a berm (Richardson Tce)

The minimum width for grassed berms is 0.7m. Typical cross sections, showing minimum berm widths, are shown in *CSS: Part 6*. The width of service strips against property boundaries shall be set to accommodate service and utility cabinets and structures. The smallest area of berm permitted is 2m² and areas smaller than this must be formed and sealed/paved as footpath.

Where adjoining pavement surfaces meet, forming a point in the grass area with an angle of less than 60 degrees, square or round off the point of the grass berm to be no narrower than 0.7m.

8.15.4 Batters

Generally, batters should match any existing stable slope of similar material. Flatter slopes that are integrated into the natural landscape are preferred.

Where the formed batter is not required to cater for foot traffic, grassed batters are permitted, to a maximum of one in four. These must be mowable, as defined in clause 10.9.17 – Reducing grass maintenance (Reserves, Streetscape and Open Spaces).

The top edge of every fill, and the toe of every cut, must have a crossfall of 3% and extend at least 500mm beyond the outside edge of the footpath. If there is no footpath, measure this dimension from the back of the kerb or the outside edge of the trafficable shoulder as applicable.

Retain all new cut faces or stabilise with vegetation. Slopes steeper than one in two must be retained. Structures supporting the road must be located on legal road. Locate stabilised faces or retaining structures that support private assets or property outside of the legal road. Refer to clause 8.20 – Retaining walls for design criteria.

Some of these structures may require building consent.

8.15.5 Utilities

Show any existing utilities and services on the drawings.

Both existing and proposed underground and above-ground utility services can impact on the design through conflicts with the proposed carriageway elements. The cost of relocating existing utilities is significant and may therefore not be a viable option. Existing roads are often reconstructed at a lower finished level but restrictions on lowering carriageways, and the corresponding kerb, due to the presence of utilities can lead to property and upstream drainage problems.

To ensure there is no conflict with the road geometrics or between any utilities and proposed street features or planting, become familiar with the required clearances from both existing and proposed above-ground and underground utilities. Ensure they do not create a safety risk for people who are blind or visually impaired. Refer to clause 9.5.3 – Typical services layout and clearances (Utilities) for guidance and standards for the work. Any conflicts should be resolved during the design process.

Pothole existing underground services, to confirm both their location and depth. When utilities constraint the design, there are a range of solutions available:

- Consider moving the carriageway alignment. This can allow either underground utilities to be positioned towards the centreline or underground utilities and columns/poles to be positioned outside of the carriageway or footpath.
- Design element widths to achieve the same result as moving the carriageway alignment.
- Provide a lesser standard of elements, through restricting parking or constructing only one footpath.

8.15.6 On-street planting

Plant beds are generally used to soften the street environment and to provide visual guidance to pedestrians, cyclists and drivers. Landscaping is also an important component of traffic management devices but must be carefully designed to enhance the safety and effectiveness of these devices. The location of streetlights, sight line visibility and hazard criteria are critical when designing the on-street planting.

Must refer to clause 10.9 - Landscape Planting, before designing plant beds or street trees.

Planting that obstructs the visibility of approaching traffic

8.15.7 Street furniture

Landscaping structures such as planter boxes, seats, bins, sculptures, memorials and entrance structures on legal roads must be constructed in long-life materials (20-year minimum). Refer to the *Public Places Bylaw* and clause 10.6.4 – Structures (Reserves, Streetscape and Open Spaces) for further information. Some of these structures may require building consent, which the developer must obtain.

In low speed environments, locate continuous structures like low walls at least 450mm behind the kerb, with a maximum height of 700mm if adjoining the footpath.

Locate them so that they do not obstruct the sightlines of intersections, pedestrian crossings or signs. Ensure they do not create a safety risk for people who are blind or visually impaired.

Refer to *Streets and Spaces Design Guide, Chapter 4 - Street Furniture* for work within the central city.

8.15.8 Road crossings for pedestrians

Provide pedestrian crossing facilities that comply with the *Intersection & Pedestrian Crossing Design for People with Disabilities Policy* and *CSS: Part 6* at all road intersections and other locations, wherever these will provide logical and safe movement of pedestrians. Mid-block crossing facilities may be combined with kerb build-outs and pedestrian islands, to minimise the crossing distance for users.

Provide a one metre separation between new pedestrian cutdowns and existing columns/ poles or signs.

Pedestrian islands or other facilities, to aid safe crossing of roads, may be required in areas where high numbers of pedestrians are expected to be crossing (e.g. local commercial areas, reserves, schools, retirement homes, public facilities).

Provide tactile warning pavers or tactile ground surface indicators (TGSI) for vision-impaired pedestrians on public footpaths at all pedestrian crossing kerb cut-downs. Specify tactile types, preferably pavers, which will achieve the 20 year operational life of the contrast between the path surface and the tactile. Plastic TGSI are not permitted in Council paths.

Avoid designing pedestrian crossing facilities that can be interpreted by pedestrians as official zebra crossings.

Use the following standards and guidelines for the design and operation of pedestrian crossing facilities:

> *Guidelines for Facilities for Blind and Vision-Impaired Pedestrians RTS 14*

> *CSS: Parts 1-7*

> *Guide to Road Design, Part 4: Intersections and Crossings -General*

> *Guide to Road Design, Part 4a - Unsignalised and Signalised Intersections*

> *Guide to Traffic Management, Part 6 - Intersections, Interchanges & Crossings*

Tactile pavers at a pedestrian crossing cut-down (New Brighton Mall)

8.15.9 Site access

Design all kerb crossings and cut-downs to chapter 7 of the *District Plan*.

Design residential vehicle crossings in accordance with Christchurch District Plan-Planning Maps- Chapter 7 - Appendix 7.5.7 Access Design and Gradient table 7.5.7.1. Also refer to the CSS Part 6 standard detail SD 606 for vehicle crossing and typical footpath geometry.

Design commercial crossings with a maximum width of 9.0m at the boundary. The designs shown in *CSS: Part 6* are acceptable design solutions. Wherever access to property is required across a swale, the crossing design must be specific for the affected site(s).

Use the following standards and guidelines for the design and operation of intersections and vehicle crossings:

- *Guide to Road Design, Part 4: Intersections and Crossings -General*
- *Guidelines for the Implementation of Traffic Controls at Cross Roads, RTS 1*
- *CSS: Parts 1-7*

8.15.10 Clear zones

The clear zone is the width from the edge of the traffic lane in which an errant vehicle can recover. To provide this zone, locate new hazards e.g. above-ground utilities, street furniture and trees, streetlights, at a distance from the edge of the traffic lane greater than the widths in Table 8. Remove or treat existing roadside hazards within this distance.

Table 8 Clear zone widths

One way AADT	≤ 50km/hr	70km/hr	100km/hr
≤ 1000	3.0m[1]	3.4m	6.0m
>5000	3.0m[1]	5.4m	9.0m

Note:

1) Where the above setbacks are not achievable, discuss alternative options with the Council early in the design process.
2) Interpolate between the given values for AADT between 1000 and 5000.
3) This table is sourced from the *Guide to Road Design, Part 6: Roadside Design*

Street trees planted within clear zones should have frangible trunks.

Some on-street structures in urban areas cannot feasibly be relocated. If they are not frangible, they should be protected. Formal barriers may not be the best option. Alternatives to barriers that could be considered in low speed urban areas include frangible planting and bollards.

When providing a barrier to a hazard within the clear zone, include the barrier deflection when determining the offset between the edgeline and the structure.

Guide to Road Safety, Part 9: Roadside Hazard Management provide details on clear zones, hazards and safety barriers.

8.16 Pavement Design

8.16.1 Pavement and surface treatment design

Design roads to have an infinite life for the subbase and a 50-year life for the basecourse. Use a traffic growth rate of 2% per annum for design purposes.

Design roads to preferably be flexible pavements, with a 50-year life, using the general principles of the current New Zealand Supplement of the *Guide to Pavement Technology*.

All roading and private access rights of way must comply with the Benkelman Beam criteria shown in Table 9. Refer to CSS: Part 6 clause 11.6.3 – By Benkelman Beam for more detail on analysing test results.

Table 9 Benkelman Beam criteria

Traffic Loadings (heavy vehicles/day)	95% of readings (mm)	Maximum (mm)
>500, top basecourse* prior to structural AC	<1.5	1.7
>500 top of AC	<1.0	1.0
>500	<1.2	1.5
100-499	<1.6	2.0
<99	<2.0	2.5

Note: *or existing surfacing/pavement

The pavement design must detail the:

- asphaltic mix type and layer thickness. Refer to NZTA M/10 for further information;
- geotechnical requirements – test the subgrade and establish an in-situ or soaked CBR. Establish a correlation between the local soils and the test methods used;
- structural design – design pavements to meet the (modified) life-cycle requirements of the *New Zealand Infrastructure Asset Valuation and Depreciation Guidelines* as modified by the Council. The pavement designs are, however, restricted to a 50-year life for the basecourse layer.

Other considerations in the design may include, but should not be restricted to:

- type of edge restraints – in most urban environments a concrete edge restraint or kerb and channel must be provided. In other areas, provide road shoulders, as defined in clause 8.13.7 – Shoulders, to prevent edge break.
- semi-rigid and rigid pavements – semi-rigid and rigid pavements (e.g. those that require structural layers of asphaltic concrete, cement or bitumen stabilised metalcourses, concrete roads and similar) require specific design.

> coal tar - determine its presence through testing for PAHs and either specify to dispose of, encapsulate or reuse on site, whilst applying contaminated material handling methodologies.

> specifying the asphaltic mix type under the TNZ specification e.g. PA15HS for high traffic shear stress or PA20 otherwise.

> the local subgrade – many sites have subgrades where the CBR values are so low that the pavement design requires a sacrificial layer of aggregate, sand or the use of geotextiles.

> the subsurface drainage – the Council recognises that the lack of subsurface drainage outfalls often results in the inability to avoid a “bath-tub” design where the pavement materials will, at times, become saturated. However, the acceptance criteria related to life-cycle traffic loadings still apply.

> the local water table – basecourse layers must be above the water table during a 1 in 10-year flood event.

> cover to underground services – maintain adequate cover to utilities when the project proposes lowering the road level or crown.

8.16.2 Reducing waste

When designing the development, consider ways in which waste can be reduced.

> Plan to reduce waste during demolition e.g. minimise earthworks, reuse excavated material elsewhere.

> Design to reduce waste during construction e.g. prescribe waste reduction as a condition of contract.

> Select materials and products that reduce waste by selecting materials with minimal installation wastage.

> Use materials with a high recycled content e.g. recycled concrete subbase, foamed bitumen. Proposed recycled materials will need approval from the Council to ensure that environmental contamination does not occur.

See the Resource Efficiency in the Building and Related Industries (REBRI) website for guidelines on incorporating waste reduction in your project www.rebri.org.nz.

8.16.3 Pavement materials

The design and construction of the road must comply with the following criteria:

> materials – see *CSS: Part 1* for details of approved pavement materials, gradings, etc. Any proposed variations from these materials, such as the use of cement- stabilised metalcourses or concrete roads, will require specific design;

> the extent of work – pavement materials must extend at the same thickness beyond the edge control devices, such as kerb and channel or the concrete edge restraints, as detailed in *CSS: Part 6*.

8.16.4 Surfacing

All surfacings must meet site-specific traffic loading requirements including skid resistance requirements as defined in TNZ T/10 *Skid Resistance Investigation and Treatment Selection*. Skid resistance should exceed either the values in Table 10 or a British Pendulum number of 50.

The selection of surfacing material is critical. Consider the benefit, performance and life-cycle costs of the material, particularly for pavers as these surfaces have higher maintenance costs i.e. select pavers for traffic management purposes, not just aesthetic reasons. Do not use pavers in narrow road medians or small islands as this location significantly increases maintenance difficulties.

Table 10 Skid resistance criteria

Site Category	Site Definition	Sideways Force Coefficient (SFC)
1	Approaches to railway level crossings, traffic lights, pedestrian crossings, roundabouts.	0.55
2	Curve < 250m radius Down gradients > 10%	0.50
3	Approaches to road intersections Down gradients 5 – 10% Motorway junction area	0.45
4	Undivided carriageway (event – free)	0.40
5	Divided carriageway (event – free)	0.35

Note: This table is sourced from TNZ M/10:1998.

All newly constructed road surfaces must comply with the NAASRA roughness counts in Table 11.

Table 11 NAASRA roughness criteria

Surfacing	Average (mm/km)	Maximum (mm/km)
All new asphaltic concrete and open graded porous asphalt surfaces	55	75
Asphaltic concrete and open graded porous asphalt overlays and shape corrections	65	90
Chipseal through streets with 10,000-20,000+ vehicles per day (Pavement Use T6 and T7).	60	80
Chipseal through streets with 2,000-9,999 vehicles per day (Pavement Use T4 and T5).	65	85
Chipseal through streets, cul-de-sacs and rights of way with 0-1,999 vehicles per day (Pavement Use T1-T3).	70	90

Note:

1) See *CSS: Part 6* clause 11.7 – Testing for more detail on analysing test results.
2) Pavement use codes refer to RAMM categories.

All surfacing materials must meet the appropriate *CSS* requirements.

The general minimum surfacing requirement is a two-coat (wet lock) chipseal – grade 4 and grade 6. At the head of a cul-de-sac, the minimum surfacing requirement is a 30mm layer of paver-laid AC10 laid over a Grade 5 chipseal.

Skid resistance on the new surface through all intersections must match that of the existing road, particularly back to the transition point (TP) of the road. Skid resistance can be improved through grooving in asphaltic concrete.

8.17 Drainage Design

8.17.1 Road drainage control

All road runoff must be contained in the legal road or within land over which drainage easements have been created in favour of Council. Take into account the road hierarchy when assessing the possible use of the legal road as a secondary flow path.

Guidance and standards for the work can be found in:

> Integrated Catchment Management Plans (ICMP) for the development area

> Part 5: Stormwater and Land Drainage

> *CSS: Parts 1-7*

8.17.2 Primary stormwater treatment

On-street treatment of stormwater is a required part of the design. Design for the removal of contaminants throughout the stormwater system, but particularly before the stormwater enters existing open water-bodies.

Collect surface water in kerbs and channels or within grassed swales. Provide on-street stormwater treatment depending upon the requirements of that particular water catchment area, as detailed in the resource consent or project brief. *WWDG Part B* chapter 6 suggests macropollutant traps, swales and bio-retention devices (rain gardens and stormwater tree pits) as on-street stormwater treatment options. Council may also consider proprietary devices on a case by case basis. Refer to clause 5.6 - Drainage System Design for further information.

Do not detail sumps in kerb crossings. Where sumps are located in this position, consider the relocation of either the sump or crossing or detail the installation of a corner sump top and provide additional drainage capacity elsewhere if necessary.

All pipework downstream from sumps contained within the carriageway must have a minimum internal diameter of 225mm. Sump or access chamber spacing must not exceed 100m, for maintenance purposes.

Provide a stormwater outfall in classified roads whenever the channel flow exceeds 25 litres/sec at a grade of 1in 500 for a 5 year event. Provide a stormwater outfall in local roads whenever the channel flow exceeds 50 litres/sec at a grade of 1 in 500 for a 5 year event. Refer to *WWDG Part B* chapter 22.10.

8.17.3 Subsoil drainage

In areas of high groundwater, install subsoil drainage to protect the carriageway subgrade and/or metalcourse.

The subsoil drainage pipework must be drilled PVC or other approved perforated pipe.

8.17.4 Swales

Design swales for temporary water storage or retention as this provides attenuation of stormwater peaks. It may also reduce the downstream flood peak. Normally this design consists of shaped grass berms, with no permeability built in to the construction materials.

Primary treatment is achieved by a detailed design that uses suitable permeable material to allow soakage to subsoil levels. Volumes undergoing primary treatment through infiltration can be increased through longer resident times in permeable swales. Provide opportunities for sediment to settle out in swales through slower velocities, longer resident times and dense grass cover, as these all slow overland flows.

Planting installed in the swale should not include bark, similar organic mulch or other loose easily transported material.

Note that repeated use of vehicles or the heavier ride-on mowers will substantially reduce the permeability of swales that have been constructed for primary treatment - take this into account. See Part 5: Stormwater and Land Drainage and Part 10: Reserves, Streetscape and Open Spaces, for guidance on design.

Temporary stormwater retention swale (William Brittan Ave)

8.17.5 Drainage patterns

The existing drainage pattern may provide a constraint on possible design solutions. Ensure that the upstream catchment, including existing channels, can drain through the new works without ponding and that property outfalls, either at the kerb or at the boundary, are not raised above inlet levels. Thoroughly investigate the catchment around the project area, to determine accurate falls, transition levels and the most effective outfall.

8.18 Street Lighting

Refer to Part 11: Lighting for street lighting requirements.

8.19 Bridges, Culverts and Other Structures

Bridges, culverts and other structures within the legal road perform a key role in ensuring continuity of access for the public. Design these items to ensure their continuous function (including during extreme events) throughout their design life. For timber bridges, this is 75 years. For steel or concrete bridges and all culverts, this is 100 years. For all other structures, this is 50 years. Refer to the *Bridge Manual* for specific design information.

Determine the width of bridges and culverts in conjunction with the site-specific current and future road requirements for carriageway widths. Take into account the land drainage requirements, as set out in clause 5.6.5 - Bridges and culverts (Stormwater and Land Drainage) and Chapter 13 of the *WWDG*. The length of these structures is also site-specific and must make allowance for waterway requirements during extreme events and the requirement for footpaths. Design the wing wall and anti-scour structures to provide support and to prevent scour, as required.

Design guardrails generally in accordance with the *Bridge Manual* except that:

> side protection in low speed environments (under 50km/hr) is not always required to comply with Appendix B of the *Bridge Manual*. Where Appendix B requirements are not achieved, provide a road safety audit or assessment with the site specific design in the design report, confirming the design impact speed used in the guardrail design.

> guard rail transition distances in speed zones of 50km/hr or less may be reduced.

Design barriers for cycle or shared paths to be 1.4m high and in accordance with the *Bridge Manual*. Design the barrier to resist the loads detailed in Appendix B clause B6.4 of the *Bridge Manual*. The application of *CSS: Part 6* SD 621 Pedestrian Safety Fence is still appropriate for situations where the impact from cars and cycles is not being mitigated.

Other design issues include, but are not limited to:

> legal compliance – building and resource consents are required for bridges, culverts and other structures, as appropriate. The *Policy on Structures on Roads* details the requirements for the Deed of Licence;

- technical requirements – provide space on bridges and culverts for cyclists. The surfacing of bridge decks must meet the site-specific traffic loading requirements including skid resistance requirements. Footpaths must be separated, where they are specified;
- waterway requirements - consider the effect of the road on the secondary flow path for any waterway crossing. Refer to clause 8.13.3 – Vertical alignment;
- aesthetic contribution – use the design of the new structure to enhance the attractiveness of the built environment. Refer to *WWDG* clause 13.2.2.1 – Appearance;
- services using a bridge for support – *WWDG* clause 13.2.2.1 – Appearance and clause 3.4.3 of *The National Code of Practice for Utilities' Access to the Transport Corridors* provide guidance on the installation of services on bridges. Obtain the Council's approval for the installation of services on bridges.
- existing structures – ensure lane widths are not compromised when retrofitting existing structures to cater for future traffic needs.

8.20 Retaining Walls

Only retaining structures that will be vested in Christchurch City Council may be located on legal road. Retaining structures that support private assets or private property e.g. driveways, must be located outside of the legal road unless approved otherwise by Council.

Design guardrails generally in accordance with the *Bridge Manual* except that:

- side protection in low speed environments (under 50km/hr) is not always required to comply with Appendix B of the *Bridge Manual*. Where Appendix B requirements are not achieved, provide a road safety audit or assessment with the site specific design in the design report, confirming the design impact speed used in the guardrail design.
- guard rail transition distances in speed zones of 50km/hr or less may be reduced.

The application of *CSS: Part 6* SD 621 Pedestrian Safety Fence is still appropriate for situations where the impact from cars and cycles is not being mitigated.

Other design issues include, but are not limited to:

- safety in design - including throughout the life cycle of the constructed works.
- legal compliance – building and resource consents are required for retaining walls. The *Policy on Structures on Roads* details the requirements for the Deed of Licence;
- aesthetic contribution – use the design of the new structure and any fall protection to enhance the attractiveness of the built environment;
- heritage – protect and retain existing historic retaining walls and design adjacent structures in context with these features;

- existing structures – ensure lane widths are not compromised when retrofitting existing structures to cater for future traffic needs.
- maintenance – ensure access for mowing and other maintenance activities.

Design retaining walls to ensure their continuous function (including during extreme events) throughout their design life as detailed in Table 12.

Table 12 Design and durability

Wall Type	Design Life (years)
A: Uphill of road	75
B: Uphill of road directly supporting infrastructure to be vested or existing private buildings, structures and urban gardens	100
C: Directly supporting road	100*
D: Not directly supporting road	75

Note*: The design life of minor walls (less than 1.5m height that can be maintained or replaced without impeding the function of the adjacent road) may be reduced to 50 years with the approval of Council.

State the key achievement criteria and assumptions in the Design Report, as detailed in clause 3.3.2 – Design Report. Specify hold points for construction, for inclusion in the Contract Quality Plan and required material or performance tests to be included in the Contractors Inspection and Test Plan.

8.21 As-Built Information

Provide as-built information as set out in Part 12: As-Built Records, including a safety audit of the constructed works.