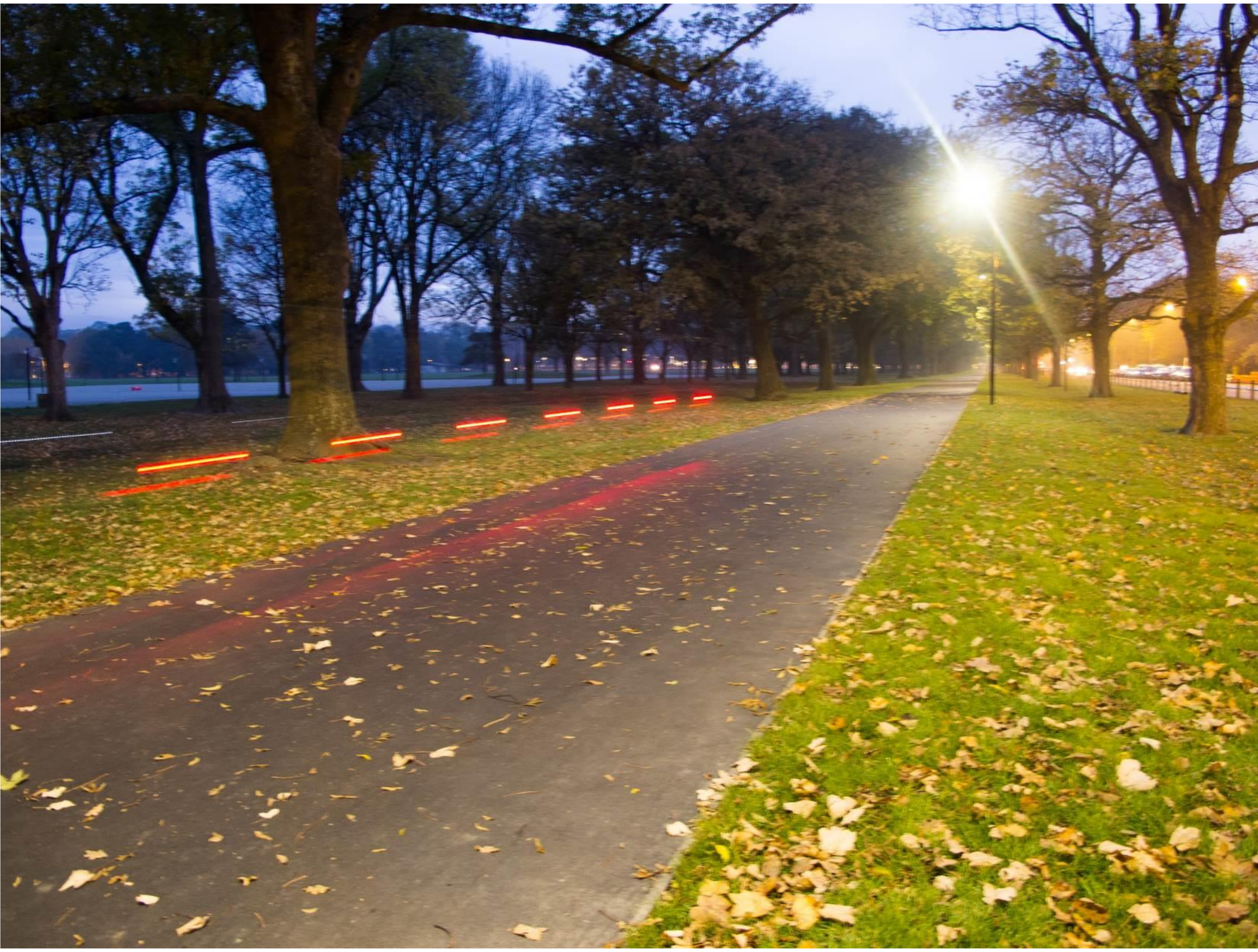
Christchurch Cycle Design Guidelines

Part B: Revision B

Design Principles Best Practice Guide



Christchurch City Council

July 2016

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REVISION SCHEDULE

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A		Draft for Comment				
B		Final Revision B	M Smith	MCR TAG		

FOREWORD

The guidelines outline the design principles and design concepts that will guide the implementation of the future cycle network outlined in the Christchurch Transport Strategic Plan. The principles represent best practice in cycle design and provide a starting point for all designs. The vision of the Christchurch Transport Strategic Plan is to keep Christchurch moving forward by providing transport choices to connect people and places. To achieve the vision, the Christchurch Transport Strategic Plan makes a strong statement about the importance of cycling in the city as it is rebuilt by creating a connected cycle network to make it easier for residents to cycle.

Major Cycleways are to cater for the 'Interested but Concerned' group[1] including both adults and children aged 10 years and over. Cycle routes should be safe and be perceived as safe, provide personal security and limit conflict between cyclists and other route users.

This document (Part B) of the Cycle Design Guide provides information on the detailed design requirements for the implementation of the Major Cycleways as initially described in Part A of the Christchurch City Council, Christchurch Cycle Design Guidelines, 2013. It looks to further develop the concepts provided and provide technical information for designers undertaking the detailed design of the Major Cycleway Schemes.

Structure of this document outlines the best practice guidelines for achieving desirable cycleway design. Initially the document outlines the option assessment for route alignment and design. The design process is then followed through the following chapters:

- Understanding the user
- Route option selection and assessment
- Typical Cross-sections
- Mid-block facilities
- Types of cycle paths
- Intersections and crossings
- Design and construction
- Facility lighting
- Refuse collection

"This is revision B of this Best Practice Guide (Part B) for the Major Cycleways and has some sections yet to be completed. When available these will be submitted for approval by Council and then added to this document."

This Best Practice Guide (Part B) forms part of the suite of guidance documents under the Christchurch City Councils Major Cycleway Design Guide (Part A). Components include:

Part A – Guiding Principles Christchurch Cycle Design Guide

Part B – Best Practice Design Guide

Part C – Wayfinding and Signage (non-regulatory)

[1] Geller, 2005 - Four Types of Cyclists
http://www.portlandonline.com/transportation/index.cfm?a=264746&c=44597

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1 INTRODUCTION

The vision of the Christchurch Transport Strategic Plan (CTSP) is to keep Christchurch moving forward by providing transport choices to connect people and places, create safe, healthy and liveable communities, support economic vitality and create opportunities for environmental enhancement. . To achieve the vision, the CTSP makes a strong statement about the importance of cycling in the city as it is rebuilt by creating a connected cycle network to make it easier for residents to cycle.

The proposed cycle network, as outlined in the CTSP provides the following key elements:

- A core network of 13 Major Cycleways to encourage the 'Interested but Concerned' group of cyclists to give cycling a go as a mode of transport.
- Local cycleways providing localised access and connections to the Major Cycleways.
- An Accessible City that strongly supports cycling in the central city.
- Other connections including northern link as part of Christchurch Northern Motorway connecting to Waimakariri District. Christchurch Southern Motorway connecting to Selwyn.
- Supporting a cycling culture by providing cycle parking facilities, and a targeted education and marketing programme.

The Cycleway Network will help deliver toward the goals of the CTSP by:

- Balancing the transport network – creating one network with investment in strategic roads, cycling, public transport and walking.
- Encouraging people to use a wider range of travel options by providing transport choice.
- Providing infrastructure, information and education to help travellers choose more efficient and healthier ways to travel thus ensuring better network efficiency
- Contributing to Safer systems and safer speeds – a safer system that contributes to network efficiency, saves lives and reduces injuries. These are two of the four key pillars of the Safer Journeys mandate from Central Government.

The core network of 13 Major Cycleway routes connect the central city in a mostly radial pattern to educational and recreational facilities, shopping and business centres, employment and residential areas, throughout Christchurch.

The Christchurch Cycle Design Guide principles represent the best practice in cycle design and provides a starting point for all designs. The guide established five key objectives, which are based on International Best Practice:

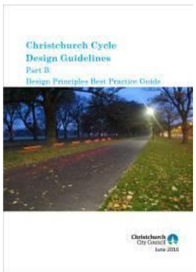
Through the development of best practice, and as a result of implementing the first of the schemes, it has identified that these five key objectives need to be expanded to incorporate other elements that will have an impact on the safe and effective delivery of the major cycle routes. These are explained further in Chapter 3.

On major cycleways, the priority of design is the need to providing space for the desired user groups such as people on bicycles (where appropriate), and as a result alternative routes may need to have remedial treatment to better accommodate other road users. This principle is supported by the Christchurch Transport Strategic Plan which promotes the use of a road user hierarchy (prioritising different road users on different routes). On some routes, people on bicycles have priority and on others motor vehicles or public transport might have priority. It is recognised that in some constrained situations, the design may have to balance the need of more than one key use group.

This approach acknowledges that it is not always possible to achieve desirable widths for all road users on one road. When preparing a cycleway design, consideration of the transport context is important. This includes the classification of the street, how it functions, which users have priority, and the places the route passes through. Designs need to consider the context and character of the neighbourhoods that it will travel through. This is made up of the legal road and the land use next to the road including buildings, local activities (eg: schools, parks, houses and shops), property access and landscaping. To achieve high quality cycleway designs a number of additional principles need to be considered including Crime Prevention through Environmental Design (CPTED), mobility access and the New Zealand Urban Design Protocol design qualities.

Designers should refer back to Section 1.4 of the Christchurch Cycle Design Guide for further information on the spatial environment.

Christchurch
Cycle Design Guidelines
Part A



Design Principles Best
Practice Guide
Part B. RevB

Bicycle Network
Sign Design Manual
Part C

This document (Part B) of the Cycle Design Guidelines provides information on the detailed design requirements for the implementation of the Major Cycleways, as initially described in Part A of the Christchurch City Council Christchurch Cycle Design Guidelines, 2013. It further develops the concepts and provides technical information for designers undertaking detailed design of Major Cycleway Schemes. It is intended to assist with decision making based on the overall design principles. Guidance, solutions and treatments provided within the document are based upon local experience and on design guidance and examples from Australasia, Europe and America.

These design principles apply to Major Cycleways only and are not intended to be used on the wider local cycle network.

The document is broken down into the following sections:

- Understanding the user
- Route option selection and assessment
- Mid-block design
- Intersections and crossings
- Design and construction
- Lighting
- Refuse collection

2 Understanding the User

2.1 Understanding the target user

Major Cycle Routes (MCRs) cater for both adults and children aged 10 years and over and aim to:

- Encourage new users
- Be suitable for children aged 10 years and over
- Improves the Level of Service for people cycling
- Provides an enjoyable experience so more people cycle more often

This chapter looks at the characteristics of a cycle and a rider. This cross-section is interesting for not only the cross-sections but also for intersections.

Austroads guides (2014) – Part 6A – Pedestrian and Cyclist Paths

CROW Design Manual for Bicycle Traffic

2.2 Bicycle Characteristics

Relevant Reference Documents:

Austroads guides (2014) – Part 6A – Pedestrian and Cyclist Paths

CROW Design Manual for Bicycle Traffic

The Austroads Cycling Aspects of Austroads Guides (2014), provides the following dimensions for cycle operating space. The CROW manual suggests a similar envelope for a cyclist including allowing for sideways movements. A 1 metre envelope is therefore proposed as the maximum cycle envelope for design. However, it should be recognised that cargo bikes (1.5 metres wide), trailers and tri-cycles are also likely to use this facility. Consideration should be also be given for flexible design should the e-bikes become more popular (same dimensions but speed profile is higher).

Sizes of various cycle types are specified in Chapter 3 including: adapted bicycles, cargo trailers etc. (for radii when turning corner important for turning from one separated path into another separated path).

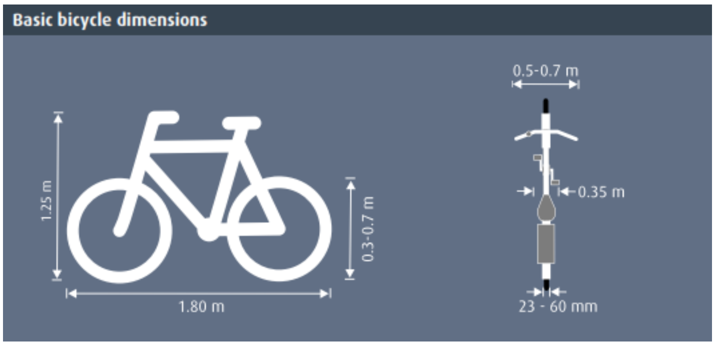
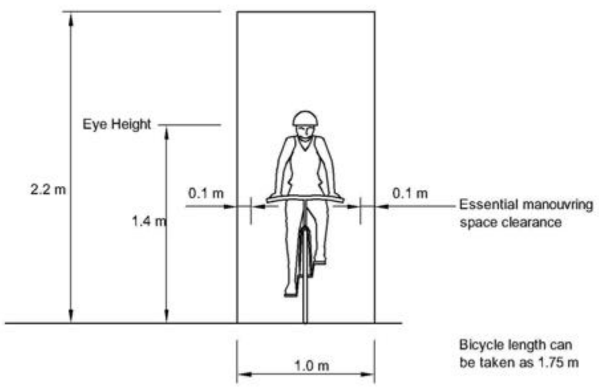
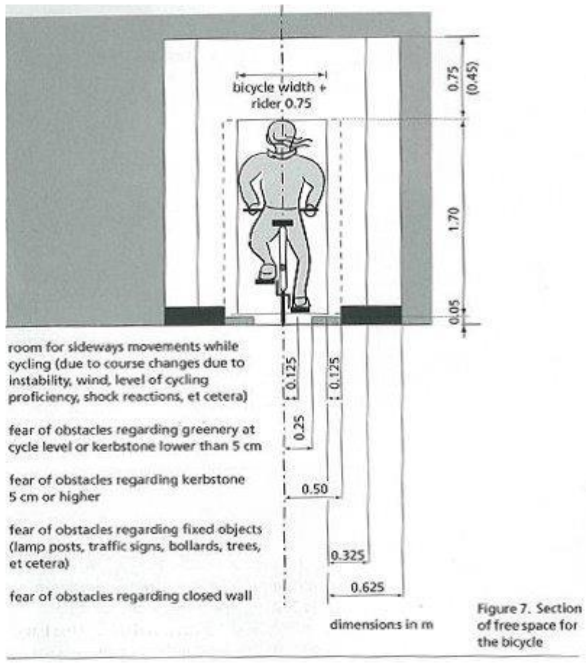


Figure 2-1: Cycle Envelopes (*Source: DK DCF Bicycle Parking Manual*)



Source: Austroads



Source: Crow

Figure 2-2: Comparative Cycle Envelopes (AUSTROADS / CROW)

Additional bicycle characteristics such as, speed (and accelerating), movement and stability and visibility also have been taken account of in developing this guide:

- The bicycle is driven by the rider's muscle power and the capacity a cyclist can generate is limited. Extra resistance has to be compensated for with extra physical effort. A bicycle-friendly road design, therefore, causes as little energy loss as possible. For more information about this, see the Design Manual for bicycle traffic -CROW, et al.2007.
- The pedalling frequency of about 70 rpm produces a 'normal' speed of 15 to 20 km/h. For normal situations a design speed of about 20 km/h is recommended. It is recognised that speeds are variable amongst different people who ride bikes and that some people will ride above 20km/hr and up to 30km/hr (the designer could give consideration to 85%ile speeds).
- Accelerating from standstill: 0.8 to 1.2 m/s^2. Braking: 1.5 m/s^2(comfortable) to 2.6 m/s^2 (emergency stop).
- Bicycles are unstable: crosswinds, large mass vehicles such as Buses cause slipstreams, uneven riding surface and holes in the road surface have high influence. When trying to retain balance, cyclists move from side to side slightly, which is called zig-zagging. At normal cycling speeds in normal conditions, the zig-zag movement is about 0.20 m. However, different figures may apply to specific groups. Sometimes the track width is up to 0.80 m. A relatively wide track is also necessary for stopping and dismounting.
- Apart from zig-zagging, this guide has taken account of cyclists' fear of obstacles into. This could be 0.2-0.5m depending on the obstacle.
- The section of free space is larger in curves than in straight lines, particularly at high speeds. It is advisable to take account of additional space of about 0.50 m, depending on the speed.
- The radius of a curve affects the speed at which cyclists can travel where the curve occurs. The minimum curve radius is 5, metres. Cycle connections that form part of the basic network should have a radius of ≥ 10 metres. Cycle routes and main cycle routes should have a radius of ≥ 20

metres. Consideration should be given to rear loads also when designing curves and corners for cycles.

- To be able to participate in traffic safely, cyclists must have a sufficient level of visibility. There are three kinds of visibility:
    - Riding visibility: a good view of enough of the road, cycle track or intersection;
    - Braking visibility: the distance covered during a braking manoeuvre (consider volume of cyclists on path);
    - Approach visibility: to cross a carriageway safely, cyclists must have sufficient visibility of traffic on the road or pedestrians on a footpath to cross.

2.3 E-bike

E-bikes (an electric bicycle) generally travel at a speed greater than normal bikes, and could present a safety concern for confined cycle facilities. E-bike have greatly different acceleration and stopping characteristics than normal bikes.

There is a great variety of different types of e-bikes available worldwide, from e-bikes that only have a small motor to assist the rider's pedal-power (i.e., pedelecs) to somewhat more powerful e-bikes which tend closer to moped-style functionality: all, however, retain the ability to be pedalled by the rider and are therefore not electric motorcycles.

E-bikes use rechargeable batteries and the lighter varieties can travel up to 25 to 32 km/h (16 to 20 mph), depending on the laws of the country in which they are sold, while the more high-powered varieties can often do in excess of 45 km/h (28 mph). In some markets, such as Germany, they are gaining in popularity and taking some market share away from conventional bicycles, while in others, such as China, they are replacing fossil fuel-powered mopeds and small motorcycles.

Depending on local laws, many e-bikes (e.g., pedelecs) are legally classified as bicycles rather than mopeds or motorcycles, so they are not subject to the more stringent laws regarding their certification and operation, unlike the more powerful two-wheelers which are often classed as electric motorcycles. E-bikes can also be defined separately and treated as a specific vehicle type in many areas of legal jurisdiction

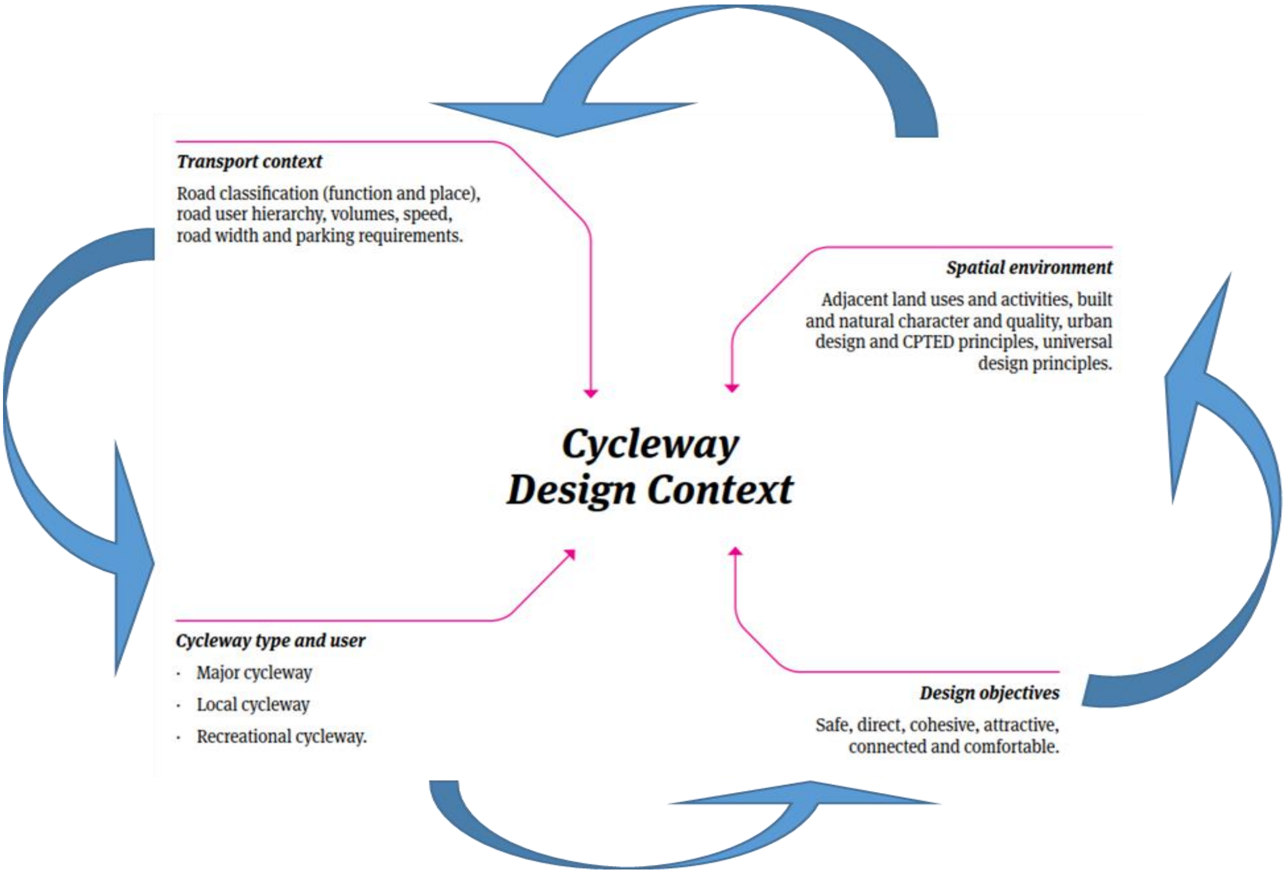
When there is an improved understanding of their characteristics, the document will be updated.

https://www.google.com.au/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=0ahUKEwjIzIn7p6bNAhVlLMAKHV72BhgQFgghMAE&url=http%3A%2F%2Fcontent.tfl.gov.uk%2Flcds-chapter1-designrequirements.pdf&usg=AFQjCNGQiGMZiE8D3N_7AFfW5aDzu5MvFg&sig2=ExQNWevLpjGuBLgHlMNS1g&bvm=bv.124272578,d.ZGg&cad=rja

3 Options Assessment for Route Alignment & Design

3.1 Guiding Principles

The Christchurch Cycle Design Guidelines document outlines the design principles and concepts that will guide the implementation of the future cycle network outlined in the Christchurch Transport Strategic Plan. This Chapter of the Best Practice Design Guide should be read in conjunction with the Christchurch Cycle Design Guidelines (Part A), Christchurch Transport Strategic Plan, Christchurch Network Management Plan, and Urban Design and CPTED best practice guidance that is referred to in Stages 1 and 2 of the multi-criteria analysis, which is further discussed below. The cycleway design context shown below was established in the Christchurch Design Guidelines and should be used as a starting point to guide route options and choices.

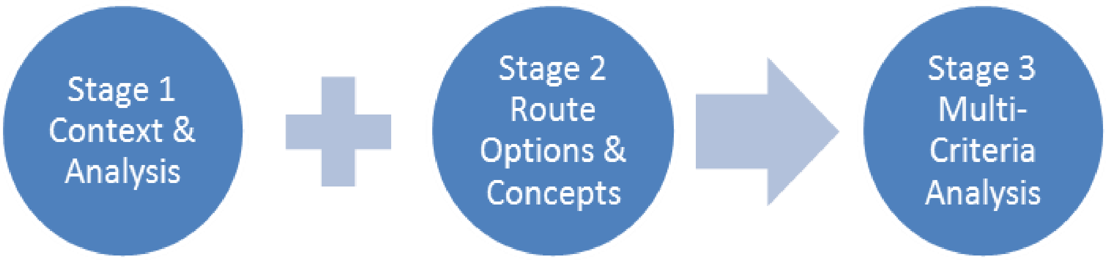


The design objectives from the design context can be defined further as:

Design Outcome	Description
Safety	Cycle routes should be safe, provide personal security, and limit conflict between cyclists and others. ○ Consideration of volume, speed and mass differentials is key to the safety aspect of the cycleway design. ○ Acknowledgement of the Safer Journeys and the Safe System approach. The approach aims to create a forgiving road system based on four principles (people make mistakes, people are vulnerable, need to share responsibility, strengthen all parts of the system) A Safe System is greater than the sum of its parts. ○ Design should be predictable, self-explaining and consistent as possible across the network. ○ Reflect the context of the area the cycleway passes through.
Directness	Cycle routes should be direct with minimal need to slow or stop, based on desire lines and result in few delays door to door. Cycle parking facilities should be in convenient locations.
Coherence	Cycle routes should be continuous, recognisable, link potential origins and destinations, and consider standard of protection throughout.
Attractiveness	Cycle routes should integrate with and complement their surroundings, enhance public security, look attractive and contribute in a positive way to a pleasant cycling experience. They should connect with urban landmarks and places to provide both markers that reduce the perception of distance as well as make more useful cycle connections.
Comfort	Cycling routes should be smooth, non-slip, well maintained and free of debris, have gentle slopes, and be designed to avoid complicated manoeuvres and to allow cyclists to feel comfortable with their position whilst riding or waiting.

3.2 Developing the route options

A three stage approach is proposed for the route options stage. The options assessment should be undertaken by a team of 4 to 5 people, including a range of skills such as traffic engineers, transport planners, urban designers, landscape architects, specialist engineers, and if required heritage and cultural advisors. This will allow for a robust analysis by ensuring that a wide range of issues are considered and tested. The multi-criteria assessment is a tool that requires consistent professional judgement through the assessment. It is also a flexible tool so that should additional criteria be required this can be incorporated and an explanation provided as to why these criteria have been selected.



Stage 1 - Context and Analysis

The first stage of the route options assessment is to undertake a contextual analysis to become familiar with the area that the cycleway will pass through. This exercise should describe and analyse the environment that the routes may pass through and should be plotted to form a base map to clearly show what issues and opportunities there are for the Major Cycleway Route.

Movement & Circulation	Built environments & Activities	Natural environment & Landscape	Heritage & Culture
• Priority routes from the CTSP and connections into central City (an Accessible City) • Road hierarchy from the District Plan • Barriers (railways, major roads, district arterials & State Highways), one-way roads, utilities • Traffic volumes, speeds (high speed & low speed areas), bus routes, traffic composition • Existing road safety issues and black spots • Existing desire lines for people travelling on foot and by bicycle • Corridor widths	• Key activity centres, local centres, education facilities (from pre-school to University / Higher Education), community facilities, churches • Major trip generators • Identify neighbouring and underlying land uses • Planned developments and growth areas • Master plans • Character areas • Street types	• Parks and reserves • Areas of interest • Landscape character • Constrained widths / corridors • Natural environment – Topography, watercourses • Attractive streets (high level of amenity) • Landmarks • Aspects and views • Sun exposure • Visual quality	• Heritage sites and features • Special amenity areas • Cultural features & areas of significance

Stage 2 - Route options and Concepts

After completing the context analysis in Stage 1, the urban design objectives and principles should be set. The NZTA Urban Design Guide, the NZ Urban Design Protocol and the National Guidelines for Crime Prevention through Environmental Design in New Zealand, should be referred to for this task. This will assist in the recognition that corridors will route through different communities and landscapes, and this will ultimately affect the user experiences along the route and over the network.

Route options should have clear origin and destination points defined (to consider directness and desire lines) and connections between the attractors and the origin/destination points marked. Route identification is an iterative process in which site visits by all modes and at varying times of the day and week should be undertaken.

To support the route options, the design principles should be provided in a supporting statement to show:

1) Clearly document WHY and WHY-NOT routes were selected.
2) What is trying to be achieved? What is being connected?
3) Opportunities and constraints identified.
4) What are the identified high level risks, how they to be mitigated are and what will the residual risk(s) will be.
5) Experience analysis, what will the rider experience when they use the route(s)?

6) Are there opportunities to add character to the route(s)?
7) Will it meet the expectations of the target user?
8) When site visits were undertaken to determine if criteria is affected at different times of the day.

Stage 3 - Multi-Criteria Assessment

The suitability of each route, and for comparative purposes, is to be assessed through a multi-criteria analysis. This is to ensure that the assessment has robustly established the best option of the possible options for road users, including an assessment of risk, which considers potential affects, costs etc.

The MCA tool will be applied in two stages:

- Stage 3-1: To establish the best route from a list of possible routes and sub routes within the route corridor (i.e. for Route Selection). There will be some high level consideration during the route stage as to what facility types could be appropriate for the link given the data that has been collected in Stage 1 and 2 (could also affect design outcomes and facility types in Stage 3B).
- Stage 3-2: To confirm the preferred option (facility type) along a preferred route (i.e. for the Preferred Scheme).

The multi-criteria analysis is divided into the three main sections below, but the urban design objectives and principles should be applied through these sections also:

- Design context
- Community issues and opportunities
- Risks

3.3 Design context

The assessment criteria relating to the design context looks at the five primary design objectives plus urban design, landscape values and crime prevention through environmental design along the corridor.

3.3.1 Safety Criteria:

In regards to safety, the assessment process will require the design team to consider options for each section of the route that deliver a "Safe" outcome, which may require numerous iterations to determine if the route can be made safe.

If a route cannot be made safe, or the cost of making this route safe is unacceptable, then the route fails (marked as red) and further investigations on this route are no longer required. However, it is at the discretion of the project team if they choose to complete the other assessment matters for a route. To assess the varying degrees of safety and perceived levels of safety in the assessment of the remaining options.

3.3.2 Design Criteria

In addition to the five design principles, urban design/landscape values along the corridor should be assessed in the multi-criteria analysis. This is to include:

- Context - community, receiving environment, catchment area
- Amenity and landscape values - natural or physical qualities, character, aesthetic coherence, opportunities to benefit, cultural and recreational attributes.
- CPTED - Achievement and perception of safety, natural surveillance and positive activation.

Context should be considered across all five primary objectives (safety, directness, coherence, attractiveness and comfort) as this has wide ranging influences on route choice. Amenity and landscape values are included within the attractiveness column with CPTED as an individual assessment matter.

It is important to provide all key findings/assumptions in the text boxes of the multi-criteria analysis with comparisons to other routes. Assessment matters for the design context are provided in **Appendix A**.

3.4 Community and Stakeholder Interest

Community and Stakeholder Interests are to be considered through the MCA process to allow for robust discussion. The criteria are split into three groups:

- Residents
- Business and commercial activity
- Operational and Network Effects

It is important to note positive as well as negative effects to the communities that the cycle route passes through. For benefits, route planners and designers are also referred to the NZTA document, '**Benefits of Investing in Cycling**'. Assessment matters for the design context are provided in **Appendix B,** which also includes supporting Council programmes for mitigating or addressing outcomes.

If required additional information should be sought to assist with undertaking a robust analysis this could include parking and shopper surveys, economic spend etc.

3.5 Cost and Programme Risk

This section of the Multi-Criteria Analysis considers risks to construction costs and programme. The assessment matters for the design context are provided in **Appendix C**. This section should also consider value for money.

Los / Cost trade-off – is the incremental rise in LOS worth the cost to achieve an acceptable level of safety.

3.6 Other Criteria

It should be noted that other multi-criteria analysis criteria may be applicable to specific projects that have not been identified above (for example if heavily influenced by heritage settings, it may be appropriate to incorporate a column for specifically heritage). It is recommended a review of other criteria (that may be critical to a specific scheme) should be undertaken and discussed early in the assessment phase.

Additional elements (columns) can be added to the analysis if required. This should be discussed at the end of Stage 2 with the CCC Technical Advisory Group, with approval being required for adoption of additional elements.

Where appropriate, independent outside advice should be sought to ensure that the elements are suitable for evaluation and inclusion in the results.

3.7 Criteria Weightings

The initial weighting applied to the Criteria are as follows. Seven of the nine criteria carry the same weight of 10% of the total score, with Safety and Land Requirements/Easements carrying a 15% weighting:

- Safety in recognition of the primary function of these facilities to provide a safer journey as an attractor for the “interested but concerned” cyclist group; and
- Land Requirements /easements/other agreements recognising the impact timing issues can have on the overall delivery of the cycle facilities.

Criteria weightings may be adapted to suit particular project. This should be discussed at the end of Stage 2 with the CCC Technical Advisory Group, with approval being required for adoption of additional elements.

Where appropriate, independent outside advice should be sought by the teams to ensure that the elements are suitable for evaluation and inclusion in the results.

3.8 Sensitivity Analysis

A sensitivity analysis can be used to differentiate between 2 or more routes or route options (facility types) if extremely close. However, it could be that both routes are consulted on to give the community choice. Sensitivity analysis is applied to the MCA Assessment using various weightings to the criteria to establish demonstrate sensitivity of option for a preferred route.

The following weighting scenarios are suggested as a starting point. Note sensitivity weighting may be adapted to suit a particular project and should be discussed at the end of Stage 2 with the CCC Technical Advisory Group, with approval being required for adoption of a change of weighting.

	Sensitivity - Weighting (%)								(can exceed 100%)		
Scenario	Safety	Directness	Coherence	Attractiveness (inc landscape & UD)	Comfort	CPTED	Local Business Impact	Local Resident Impact	Operational and Network Impacts	Ease of Construction and costs	Land Required /Easements /Other Agreements
Normal Weighting	15	10	10	10	10	10	10	10	10	10	15
Un weighted	10	10	10	10	10	10	10	10	10	10	10
Cycle weighted	20	20	20	20	20	20	10	10	10	10	10
Impact weighted	10	10	10	10	10	10	20	20	20	10	10
Prog/cost weighted	10	10	10	10	10	10	10	10	10	20	20

The results from a sensitivity analysis should be reviewed to ensure they are intuitive.

3.9 Multi-criteria Analysis Scoring

The scoring of each criteria needs to be objective and qualitative wherever possible. This allows scores to be reviewed and justification of the score demonstrated. The scoring is on a comparison basis in how each option ranks relative to other options for the route being assessed. While individual scores may be easily challenged the relative score should be more definitive.

3.10 Audit / Reviews

Council has, in discussion with The New Zealand Transport Agency (Transport Agency) safety and cycling staff, given consideration to this new approach integrating both the traditional safety audit and new network functionality assessment and has had approval for use of the SANF process for a twelve-month trial (ending June 2017).

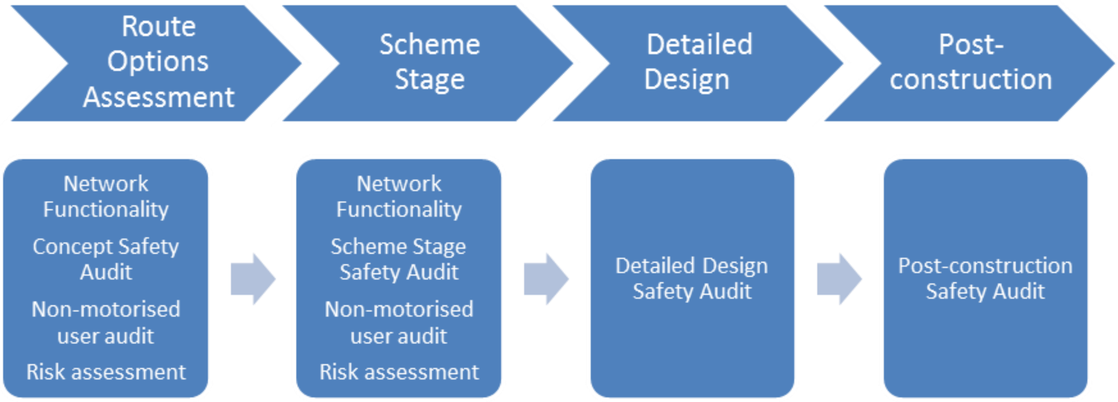
The existing Transport Agency traditional Road Safety Audit (RSA) process guide did not adequately deal with these network functionality issues. The RSA guide is primarily focused on the design and its safety impact on the road environment and specifically excludes the auditor from considerations of network functionality.

While it would be possible to conduct a safety audit and a separate audit of the other out of scope network functionality matters, it is more efficient and effective to combine these into one review, which also means that these other matters need to be systematically considered, a formal decision made on them, and the response documented, in the same way as is required for safety matters. Therefore, Council is now using the SANF process for all its MCR projects.

Following completion of the multi-criteria analysis a Safety Audit and Network Functionality Review (SANF) is to be completed. The SANF process is detailed in the document "Safety Audit and Network Functionality"; CCC, 2016.

The pre-consultation RSA and scheme report of Papanui Parallel and in particular the Rutland Street section, revealed that there is a strong relationship between safety, capacity and network functionality. The traditional RSA process on its own, did not identify these issues, with sufficient clarity and early enough, to make an informed decision. Subsequently significant changes to the original scheme were required to address network functionality issues identified through an extended consultation and investigation process.

As the project progresses the level of the network functionality reduces and following approval by Council of the scheme, the process at the detailed design stage and post-construction follows the same as the existing safety audit process in line with the NZTA Road Safety Audit Guidelines.



The audit should be undertaken by a team that is independent of the client, designer and contractor. The team should be a multi-disciplinary team and cover a wide range of skills from Traffic Engineering, Transport Planning, Civil Engineering, Landscape Architecture and Urban Design.

The SANF review is recommended be undertaken following completion of the multi-criteria analysis and then at scheme stage prior to public consultation.

Professionals can use this guideline as a step by step process to follow for undertaking a SANF review.

A SANF process provides a combined network functionality and road safety audit review of a MCR project at scheme stage, prior to public consultation, to assess the projects overall suitability ensuring that all road user's needs are considered.

3.11 Road Safety Audit Process & Safety Audit and Network Functionality (SANF)

A safety audit and network functionality review is an integrated approach to road user safety and network functionality through a process to ensure a proposed major cycleway meets both a good level of safety whilst taking into account the overall functionality of the transport network for all road users.

The network functionality of all users considers many competing factors, which can include:

- Public transport system
- Urban design
- Pedestrian use, total mobility and public safety
- Adjacent land use including commercial and residential property access
- Operation and maintenance activities
- Parking including commercial and public amenity parking
- Local community issues and values e.g. local school routes and verge planting
- Utilities
- School operation
- Intersection operation and safety
- Future land use and growth (where known)

The network functionality is important for MCR project at scheme level, as these impacts and concerns are often raised or highlighted through the Council's scheme plan approval process and public consultation.

3.12 Modal Prioritisation

On major cycleways, the priority needs to be providing space for cycling and as a result alternative routes may need to be provided for other road users. This principle is supported by the Christchurch Transport Strategic Plan which promotes the use of a road user hierarchy (prioritising different road users on different routes). On some routes cycling has priority and on others motor vehicles or public transport might have priority. This approach acknowledges that it is not always possible to achieve desirable widths for all road users on one road. When preparing a cycleway design, consideration of the transport context is important. This includes the classification of the street, how it functions, which user has priority, and the places the street passes through. On high mass vehicle routes, over dimension routes and routes with high traffic volumes cycleways will not have priority. Major cycleway routes selection shall take into account the spatial environment around the cycleway; and how the cycleway fits within the wider transport system and road user hierarchy (the transport context). In addition, the design should also consider cycleway type and user and design objectives. Refer to CCC Transport Plan and Council Process.

3.13 MCA Analysis Process

The multi-criteria analysis (MCA) process for the Christchurch MCR programme is continuously being refined. An example of the current MCR criteria (March 2016) is shown in Table 3-1 below.

Table 3-1: Modal Prioritisation Considerations and Factors (To be updated)

Design Context 50%			
Safety **15%**	**Directness and Coherence** **15%**	**Connectivity to Amenity within the corridor** **10%**	**Attractiveness, Social Safety and Comfort** **10%**
❖ Safety over route for cyclists GO/NO GO CRITERIA ❖ Safety and conflict potential along route for all users: ❖ pedestrians volumes; traffic volumes; resident accesses; business access, intersections	❖ Limited changing of facility types ❖ Few complicated manoeuvres: o Match to desire lines; o Time and distance to travel; o Number of turns.	❖ Good connection to: o Local schools o Shops o Parks o other public spaces/buildings	❖ Greenspace routes need open aspect ❖ Consider CPTED for routes off-street ❖ Pleasantness of cycling experience ❖ Lighting where off-road ❖ Comfort of users experience: ❖ perceptions of risk; o noise; o CO2 o slope
Score 2 to -2	*Score 2 to -2*	*Score 2 to -2*	*Score 2 to -2*

Community/Stakeholder Interests 30%		
Local Business Impact **10%**	**Local Resident Impact** **10%**	**Operational and Network Impacts** **10%**
❖ Impact on local business interests? ❖ Loading Zone loss ❖ Effects on access ❖ Parking spaces los is offset possible ❖ Estimated effect on patronage	❖ Impact on local residents? ❖ Access to properties ❖ Impact on on-street parking ❖ Impact on journey time if route changes network.	❖ Effect of changes to the network (signals, cul-de-sacs) ❖ Public transport routes affected? ❖ Operation costs for street cleaning, rubbish collection? ❖ Effect on maintenance operations?
Score 2 to -2	*Score 2 to -2*	*Score 2 to -2*

Project Costs and Programme Risks 20%	
Budget Risks **10%**	**Timing Risks** **10%**
❖ Increased costs due to: o Property purchase o Complicated facilities o Requires supporting asset replacement (Budget Risk)	❖ Programme delays due to: o Land/property acquisition o Legal processes – consents o Legal processes - access (Timing Risk)
Score 0 to -2	*Score 0 to -2*

4 Level of Service Assessment

The use of Level of service can assist the network operations and design teams in the determination of a suitable route and facility type. The Austroads document AP-R475-15 Level of Service Metrics (For Network Operation Planning) offers a guide into the evaluation of proposed routes to be considered for cycle facilities.

[Current work is underway reviewing levels of service by NZTA and this will be included once the work is complete.]

5 Mid-Block Treatments Cross-sections

This chapter looks at the cycleway cross-sections and link types for midblock and intersections by providing the desirable design objectives process guidelines for cycle facility options.

5.1 Relevant Reference Documents for all mid-block designs:

Christchurch City Council Cycle Design Guidelines, 2013

CCC - Infrastructure Design Standard

Austroads guides (2014) – Part 6A – Pedestrian and Cyclist Paths

NACTO – Urban Bikeway Design Guide (online)

CROW (2006) - Design Manual for Bicycle Traffic

Transport for London (2016) – Cycling Design Standards

Traffic Control Devices Manual – NZTA

MOTSAM

VicRoads (2010) - Technical Note 21: Widths of Off-Road Shared Use Paths

Clause 11.1A Land Transport Amendment Rule 2009

Austroads guides (2006) Research Report: Pedestrian and cyclist conflict minimisation on shared paths

Crime Prevention through Environmental Design (CPTED)

NZTA Urban Design Guidelines (October 2013)

5.2 Description

When developing cross sections for street design the dimensions of all road users and the surrounding land uses has been taken account of. In many instances, there will not be the capacity to acquire land for the proposed facility, therefore it is essential to consider facilities appropriate to the adjacent land use as discussed through the multi-criteria analysis.

This is important when considering neighbourhood greenways[2] because if the dimensions are incorrect it could compromise the safety of a person riding a bicycle in the carriageway. This is a critical width, the lane needs to either wide enough to allow for a car to pass a cyclist or narrow enough that a vehicle would wait behind a cyclist. On local roads, centre lines should not be marked so that all the space is available for users and reflect the character of the street.

Figure 5-1 below shows vehicle dimensions including side mirrors (not lane widths) that need to be considered when designing a road or specific lane width. Surrounding land use and the nature of the corridor must be considered (i.e. is it a bus route, is it industrial or residential) in addition to the speed of the road. It is suggested that a minimum 0.5 metres gap is provided for a vehicle to pass an oncoming vehicle. In the case of neighbourhood greenways this dimension can be reduced, but if the slow street passes through suburban centres or areas of commercial activity, sufficient room should be allowed for

[2] *Neighbourhood Greenways – Residential streets with low volumes of vehicle traffic and low speeds where cyclists mix with traffic in the carriageway (not doing shared spaces)*

service vehicles and this may be accommodated through wider parking bays to ensure a clear lane width is retained.

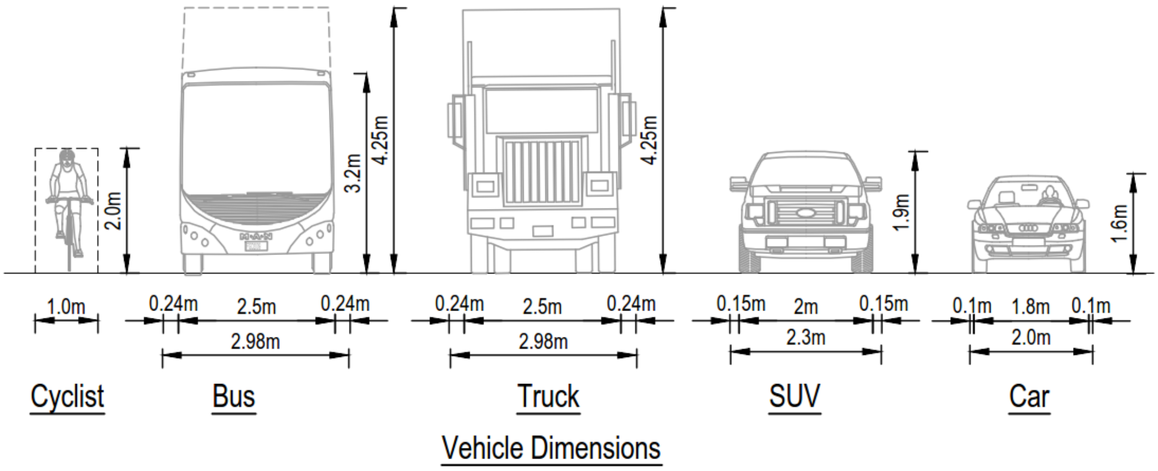
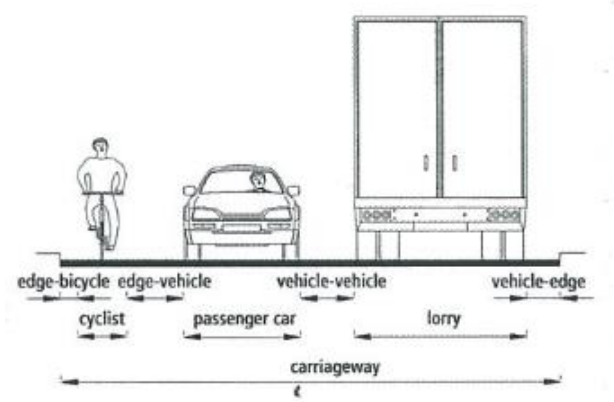


Figure 5-1: Vehicle Dimensions

The following safety clearance between different road users and structures / objects proposed are shown in Table 5-1 below.

Table 5-1: Safety Clearance between road users and objects

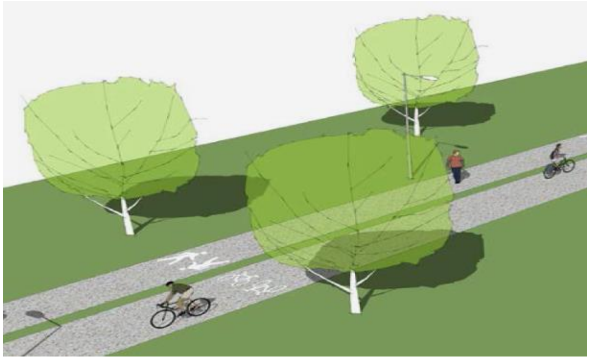
Dimensional segment	Christchurch required width profile (m)
Cyclist / edge (kerb)	0.38 (flat channel width)
Cyclist / parked vehicle	0.8
Cyclist / cyclist (both riding)	0.8
Cyclist / driving vehicle	0.85 (consider forces of Large mass vehicles passing)
Vehicle / vehicle (both driving)	0.5 at 50km/hr
Cyclist - central islands / dividers	0.4
Cycle lane separators	0.3



5.3 Link Types

The link types shown in Table 5-2 are considered in the following sections (not in any preferred order):

Table 5-2: Link Types Matrix



Paths – Shared and separated

Separated 2-way cycle path/lane (Matai St west)

Separated cycle lane (Ilam Road and to include Copenhagen Style)

Neighbourhood Greenways

Guiding information can be found in the Christchurch City Council Cycle Design Guide (2013) for the design principles for each of the link types for Major Cycleway Routes. Each of the facilities has desirable design objectives detailed in Table 6-3 and should a design not be achievable then a minimum desirable design needs to be agreed by the TAG Group with justification for the proposals is suggested.

When a design option does not meet the minimum desirable design, approval from the Major Cycleway Steering Board is needed. It is paramount that all decisions get documented at each decision.

This process is outline in Figure 5-2 below, and is presented in larger format in Appendix F.

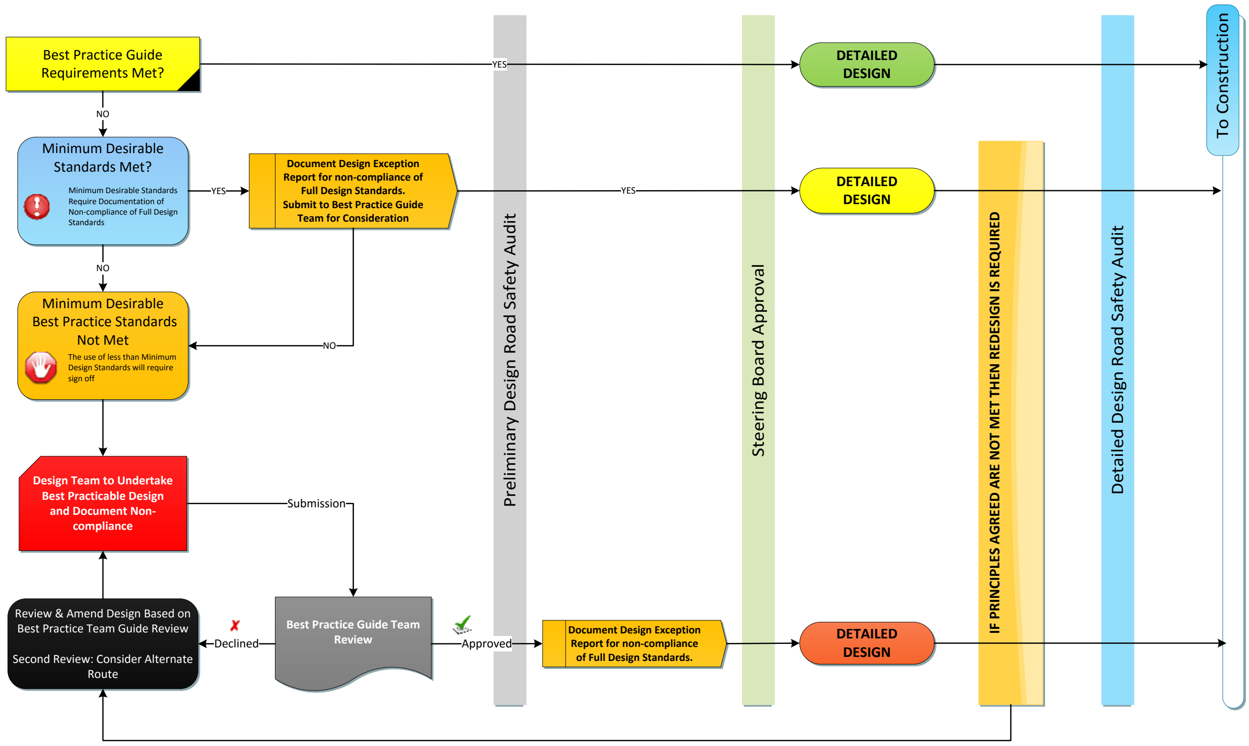


Figure 5-2: Best Practice Design Guide Process

When considering the type of facility for a link the designer needs to consider the volume, speed and mass differential by vehicles and cyclists. This will dictate if separation is required, and what width of separation is required.

Table 4 below shows typical cycle provision for different links and places. As these are Major Cycleway Routes, the target user should always be considered through the design process. It is important to distinguish between cycle infrastructure in urban and rural areas and also to different types of links (routes/streets/ways) and places (residential/centers/industrial/Central City).

The following table gives some indicative ideas for scheme design based on flows, speeds and vehicle mass.

Table 4: Typical Cycle Provisions

Cycle Design Concept	Urban Centres				Urban Residential				Urban Industrial				Rural				Parks, coastal edge, greenspace, rail and river corridors.
	Major/Minor Arterial	Collector (2000 - 8000vpd)	Local (2000vpd-5000vpd)	Local (2000vpd or less)	Major/Minor Arterial	Collector (2000 - 8000vpd)	Local (2000vpd-5000vpd)	Local (2000vpd or less)	Major/Minor Arterial	Collector (2000 - 8000vpd)	Local (2000vpd-5000vpd)	Local (2000vpd or less)	Major/Minor Arterial	Collector (2000 - 8000vpd)	Local (2000vpd-5000vpd)	Local (2000vpd or less)	
Shared paths	Context specific, consider alternative treatment in high pedestrian demand areas.				Context specific, consider alternative treatment for residential streets.				Context specific, consider alternative treatment for industrial streets.				Subject to number & design of driveways				Some separation from pedestrians when located on high volume pedestrian or cycle routes.
Neighbourhood greenway (30km/hr low volume streets. Use traffic management devices to control volume & speed)												No through roads only	Unlikely to achieve low speed streets for mixing traffic and people on bicycles.				N/A
Slow streets (urban centres only)	Subject to traffic flow, speed & composition. Combination of low speed and medium/high traffic may require segregation to minimise conflicts.				Urban centres only												
Dedicated on-road lanes (painted/light separation including painted buffers etc)									Due to vehicle composition, provide separation between large vehicles and people on bicycles.								
Fully separated cycle path (fully separated bi-directional cycleways). Consider number of driveways, intersection forms, adjacent land-use, and provision of flush medians for turning traffic.									Due to vehicle composition, blind spots for large vehicles, turning circles etc it is preferable to provide cycle faciltieis in the direction of travel on each side of the road.								
Fully separated cycle path (fully separated uni-directional cycleways)													Higher speeds will require greater separation				

The Best Practice Design Guide assessment process provides informed desirable design practice. This process starts at the best practice or desirable design working towards the less than minimum desirable design solution documenting every decision through the entire process. The minimum desirable design must be approved by the TAG Group, and the use of less than minimum desirable design standards must be approved by the Major Cycleway Steering Board.

6 Paths (Shared and Separated)

This chapter looks at the best practice design process for shared and separated paths. Path types and definitions are explained to help the designer meet the design objectives outlined in this chapter.

6.1 Relevant Reference Documents:

Traffic Control Devices Manual - NZTA

Austroads guides (2006) Research Report: Pedestrian and cyclist conflict minimisation on shared paths

Austroads guides (2014) – Part 6A – Pedestrian and Cyclist Paths, Sections 7.7.1 and 7.7.2.

Clause 11.1A Land Transport Amendment Rule 2009

Austroads guides (2006) Research Report: Pedestrian and cyclist conflict minimisation on shared paths

6.2 Definitions

This section of the Design Principles Standards provides recommended guidance for Shared Paths in Christchurch and for additional information refers to Austroads Guide Part 6a.

The Traffic Control Devices Manual defines a Shared Path as:

"A path intended to be used by both pedestrians, cyclists, mobility devices and wheeled recreational devices."

Austroads Guide Part 6a defines a Separated Path as:

"A path on which cyclists and pedestrians are required to use separate designated areas of the path."

Clause 11.1A of the Land Transport (Road User) Amendment Rule 2009 (Use of a Shared Path) provides the following legal definitions for a shared path, states that a person using the path must use it in a careful and considerate manner; and must not use it in a manner that constitutes a hazard to other persons using it.

It follows by stating that a rider of a cycle, mobility device, or wheeled recreational device on the path must not operate the cycle or device at a speed that constitutes a hazard to other persons using the path.

In terms of priority, if a sign or marking on the path applied, the following rules (Land Transport Rule) as shown in Table 6-1 below apply on the path:

Table 6-1: Land Transport Rules

Cycle Sign / Marking	pedestrians, riders of mobility devices, and riders of wheeled recreational devices must give priority to cyclists if the sign or marking gives priority to cyclists
Pedestrian Sign / Marking	cyclists must give priority to pedestrians, riders of mobility devices, and riders of wheeled recreational devices if the sign or marking gives priority to pedestrians
Unmarked	no user may unduly impede the passage of any other user, whatever priority the sign or marking gives

6.3 Design Approach

The MCA process is undertaken using the key design requirements for a variety of path types. (Refer Section 3.13). Cycleways should be safe and perceived to be safe and this factor is the most important factor in the MCA process and is required to pass the "safe" test. Once the shared and separated path type is chosen through the MCA process the best practice design guide is applied. (Refer Section 6.4)

Table 6-2 below sets out the design approach for the key design requirements for shared and separated paths:

Table 6-2: 5 Key shared and separated path design requirements

Main Requirement	Important Aspect	Design Applicable to Shared and Separated Paths
Safety	Crash risk	Minimise interaction with traffic, especially in high speed environments.
		Preferred location for this facility is when the path only has to cross a limited number of intersections and driveways. Consideration is to be given to the buffer distance from the driveway, intervisibility[3] between pathway users and drivers entering/exiting, fence and boundary vegetation heights, the layout and locations of buildings, including auxiliary buildings such as garages, high volume driveways and density of land use.
		Recognise the place function and path setting when passing through Suburban Centres, parks, coastal areas, and along the riverside. When passing through Suburban Centres consider: • The effect of a shared use proposal on retail frontages and/or significant pedestrian attractors and pedestrian desire lines; • Whether heavy cycle flows pass close to the front doors, windows or driveways of residential dwellings (especially where visibility is limited and/or high density development etc); and • Consider raised adjacent footpath and/or reducing speed differential through cycle calming.
		Cyclists should have right of way over minor roads at T-intersections and cross-roads or appropriate signage and marking is provided to ensure path users are clear on priority. Designers must check volumes of turning movements at intersections. Consistency in intersection design along a route is required.
		Consider needs of visually impaired pedestrians on a shared path.
	Legible & Predictable	Ensure the design is self-explanatory to all path users.
		Ensure markings are in place to encourage users to keep left unless passing.
	Visibility	Shared path users have full visibility of pathway in front of them.
		The path is visible both during the day and at night in terms of passive surveillance and lighting, where appropriate as per CPTED guidelines.
		The shared path needs to be visible to motor vehicles if in the road corridor.
Directness	Distance	Average detour time is minimised.

[3] Intervisibility – A sightline that is unobstructed between an intended observer and the object.

Main Requirement	Important Aspect	Design Applicable to Shared and Separated Paths
		Avoid unnecessary winding of pathway, and address desire lines.
		Respond to the environment, a meandering path may be more desirable through parks, reserves and along waterways.
		Access to paths is maintained during Special Events such as those in Hagley Park. When Access to paths is maintained during Special Events such as those in Hagley Park, an alternate path must be provided and be suitable to the target audience of the major Cycleway. The surface must be suitable also for cycle traffic. Advance notice is required and signage must be installed to alert cyclists to the diversion.
	Time	Cycle design speed on links and at corners. Blind corners should be avoided.
		Minimising stops/starts
Comfort	Width	Paths and lanes are wide enough for anticipated volumes. Where shared paths are provided in corridors (such as railways) it is expected that a 0.5 metre buffer is provided between the path and the fence line on each side. However, to future proof the corridor it is desirable that a wider corridor is acquired. Additional widths may be provided on inclines, which should be built to standard grades.
		If adjacent to water suitable protection or distance is provided.
		Consider ease of uphill travel and the safety on downhill travel on paths.
		Ensure suitable radii are provided on corners to ensure they can be negotiated comfortably (consider with and without superelevation).
	Construction	Path should be wide and strong (construction depth) enough to allow service vehicles access for maintenance.
		Paths should be able to be widened in the future.
		Minimise shading that may cause frost/ice.
		Remove potential for ponding on paths. Ensure adequate crossfalls are provided and if it is a shared path consider other path users (pedestrians, wheelchair users).
	Clear of obstacles	Either side of the path/lanes should be clear of obstacles to allow for overtaking and to minimise the impact of any cycling errors especially at times of high use (approximately one metre either side of the path). This extra space can be provided by using more permeable surfaces at the edges (turf cells etc, but consider use of joggers/runners using softer ground to the side of the path).
		Fences may be desirable where there is a steep batter or vertical drop close to the path, or there is a bridge or culvert exists on the path.
		Street trees are limbed up where required.
		Where fencing is required ensure that it does not create safety and security issues for users i.e. entrapment areas.
		Signage needs to be at an appropriate and consider regulatory signage and information signage (ensure high enough or at cyclist level). Minimise unnecessary signage to avoid visual clutter particularly in sensitive environments such as parks.
	Smoothness	Surface types need to be smooth while retaining traction. Smooth sealed paths are preferred. Materials other than asphalt could be considered, in addition to adjacent pedestrian paths (crusher dust etc).

Main Requirement	Important Aspect	Design Applicable to Shared and Separated Paths
		Minimise longer undulations if following ground terrain.
Coherent/Connected		Signs and markings compliant with Traffic Control Devices Manual.
		Crossing of roads has consistent treatment. The Traffic Control Devices Rule (11.4 (5)) states that when a cycle path or shared path used by cycles crossing a roadway, the road controlling authority may, as appropriate, control either the movement of users of the path or traffic along the roadway by means of stop or give-way signs or by the installation of traffic signals.
		Use of green coloured surfacing to highlight conflict points.
Attractiveness		Good lighting, where appropriate as per CPTED guidelines, consider white light.
		Ideal for connecting people and places through parks and reserves, alongside waterways and the coast.
		Sensitive to the context and setting.
		Enhance by adding plantings, artwork and points of interest.
		Passing through interesting and beautiful places and provide opportunities to interact with activities.
		Add rest areas with seats and bike stands, bike repair stands and maybe an information board.
		Provide regular shelter (either trees or manmade if necessary to protection during rain events.
		Locate routes past public conveniences such as toilets and water fountains.
		Separation can be achieved by a landscaped area or contrasting surface texture separating the cycle and pedestrian paths.

6.4 Best Practice Design Guide

The Best Practice Design Guidance assessment process provides informed desirable design practice. This process starts at the best practice or desirable design working towards the less than minimum desirable design solution documenting every decision through the entire process. The minimum desirable design is approved by the TAG Group and less than minimum desirable design is approved by the Major Cycleway Steering Group. This process guides personal in making safety viable design options (Refer Figure 5-2).

Taking account of the design approach detailed in Table 6-2 above the optimal for this facility type are set out in Table 6-3 below.

Table 6-3: Shared and Separated Path Desirable Design objectives

Design Attribute	Desirable Design	Minimum Desirable (to be agreed by exception by the TAG Group)*
Shared Pathway: Width for 50/50 directional split (peak ped+cyc two-way volumes >500/hr)	3.0m bike path with 2m footpath	4.0m

Design Attribute	Desirable Design	Minimum Desirable (to be agreed by exception by the TAG Group)*
Shared Pathway: Width for 90/10 directional split (peak ped+cyc two-way volumes >500/hr)	2.5m bike path with 1.8m footpath	3.0m
Shared Pathway: Width for 50/50 directional split (peak ped+cyc two-way volumes >250/hr)	4.0m combined path or 2.5m bike path and 1.5m path	3.0m
Shared Pathway: Width for 90/10 directional split (peak ped+cyc two-way volumes >250/hr)	3.0m shared	3m
Shared Pathway: Design Speed for Alignment	25km/h	20km/h

*and ratified by the MCR[4] Steering Group.

[4] *MCR – Major Cycleway Routes*

7 Separated Cycle Paths On-Street (2-way)

This chapter looks at the best practice design process for separated cycle paths on-street (2-way). Description of path type and cross-sections are explained to help the designer meet the design objectives outlined in this chapter.

7.1 Relevant Reference Documents:

Austroads guides (2014) – Part 6A – Pedestrian and Cyclist Paths

Traffic Control Devices Manual - NZTA

Crime Prevention through Environmental Design (CPTED)

7.2 Description

A separated cycle path is set aside for exclusive use by cyclists. Cyclists will prefer riding on the exclusive cycle paths to on-road lanes and shared paths where the level of service is similar. Cycle paths are most appropriate where there is a significant cycling demand and very few pedestrians, limited motor vehicle access across the path and alignment that generally allows cyclists uninterrupted and safe travel at a constant speed.

This section of the Design Principles Standards provides recommended guidance for separated cycle paths on-road (2-way) as shown in **Photo 1** below.

Photo 1: Matai Street West (Christchurch) example

A recommended cross-section for Christchurch is shown below.

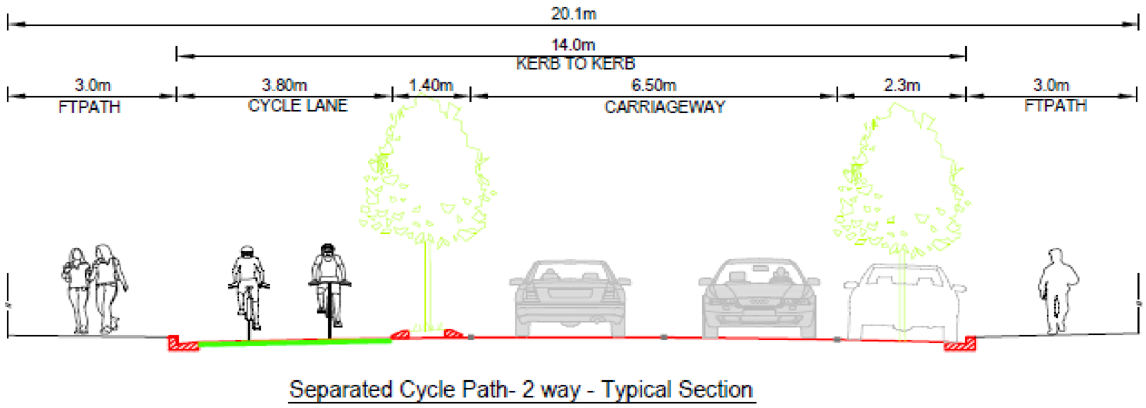


Figure 7-1: Proposed cross-section for 2-way (bi-directional) path for 14 metres wide kerb to kerb width (parking preferred on off-side of road)

7.3 Design Approach

Table 7-1 below sets out the design approach for the key design requirements for separated cycle paths on-street (2-way). These are the cycleway design elements and need to be considered along with the other elements as defined in the MCA analysis:

Table 7-1: 5 Key Separated Cycle Paths On-Street (2-way) Design Requirements

Main Requirement	Important Aspect	Design Applicable to Separated Cycle Paths On-Street (2-way)
Safety	Crash risk	Minimise interaction with traffic. The facility can connect people and places in the road corridor by providing dedicated space for cyclists. Can be road level, intermediate level or footpath level).
		Only to be used on streets with limited conflicts, driveways and intersections.
		Requirements for sight and visibility (including vertical level differences) are met. There should be no parking within 5 metres of a driveway to ensure cyclists can be seen (if parking is on the same side as cycle facility).
		Where parking is provided on the side of the street with the cycle facility ensure there is sufficient protection for cyclists from dooring[5] (0.8m minimum).
		Cycle paths designed on anticipated volumes ensure sufficient width is provided.
		Cyclists should have right of way over minor roads at T-intersections or appropriate signage and marking is provided to ensure path users are clear on priority. Designers must consider the number of turning movements into and out of the intersection and volumes on the main roads (gap acceptance by drivers).
	Legible & Predictable	Ensure the design is self-explanatory to all path users. There should be consistency in lighting.

[5] Dooring – The door zone is the space in which a cyclist is in danger of getting hit by a car door.

Main Requirement	Important Aspect	Design Applicable to Separated Cycle Paths On-Street (2-way)
	Visibility	Cycle path users have full visibility of driveways, and be set at least 3 metres from the property boundary to increase intervisibility.
		The path is visible both during the day and at night in terms of passive surveillance and lighting. There is consistency of lighting.
Directness	Distance	Average detour time is minimised.
	Time	Cycle design speed on links and at corners. Blind corners should be avoided.
		Minimising stops/starts
Comfort	Width	Paths and lanes are wide enough for anticipated and future volumes. A sufficient delineation width is provided between driving traffic and the cyclist closest to the road.
	Construction	Path should be wide and strong (construction depth) enough to allow service vehicles access for maintenance (i.e. street sweeper if kerb present).
		Consideration of vertical cross-section to determine shoulder gradients.
		No seal joints should be provided within the cycle lane.
	Clear of obstacles	Street furniture should be set back from the cycle path. Street trees should be limbed up.
		Ensure there is sufficient width to allow for refuse collection from the delineator[6] (between cycle track and traffic lane).
	Smoothness	Surface types need to be smooth while retaining traction. Smooth sealed paths (using universal building materials such as asphalt or aggregate concrete) are preferred.
Coherent		Signs and markings compliant with Traffic Control Devices Manual.
		Crossing of roads has consistent treatment. The Traffic Control Devices Rule (11.4 (5)) states that when a cycle path or shared path used by cycles crossing a roadway, the road controlling authority may, as appropriate, control either the movement of users of the path or traffic along the roadway by means of stop or give-way signs or by the installation of traffic signals.
		Use of coloured surfacing to highlight conflict points.
Attractiveness		Good lighting, where appropriate as per CPTED guidelines, consider blue and white light.
		Sensitive to the context and setting.
		Enhance by adding plantings, artwork and points of interest.
		Add rest areas with seats and bike stands, bike repair stands and maybe an information board.
		Locate routes past public conveniences such as toilets and water fountains.
		Separation can be achieved by a landscaped area or contrasting surface texture separating the cycle and pedestrian paths.

[6] *Delineator – Designed to define traffic spaces and protect the safety of cyclists.*

7.4 Best Practice Design Guide

The Best Practice Design Guidance assessment process provides informed desirable design practice. This process starts at the best practice or desirable design working towards the less than minimum desirable design solution documenting every decision through the entire process. The minimum desirable design is approved by the TAG Group and less than minimum desirable design is approved by the Major Cycleway Steering Group. This process guides personal in making safety viable design options (Refer Figure 5-2).

Taking account of the design approach in Table 7-1 above the optimal for this facility type are set out in Table 7-2.

Table 7-2: Separated Cycle Paths On-Street (2-way) Desirable Design Objectives

Design Attribute	Desirable Design	Desirable Minimum (to be agreed by exception by the TAG Group)*
Path width for two-way cycling	3.5 m (allows for a cyclist to overtake or a child to ride alongside a parent)	3 m Recommended minimum Design Should there be small sections where 3 metres cannot be achieved as a minimum, the designer needs to justify the non-compliance and provide mitigation measures to ensure safety of users is maintained. Full safety assessment for use of minimum standards to be undertaken as part of the evaluation.
Boundary Offset	5 m from boundary	Absolute Minimum 3 m Possible exemption to rule where adjacent to park or reserve, where no street vehicle access and open view along frontage but his needs justification and mitigation measures for safety of users. Footpaths should be maintained and retained as a separate facility unless the whole area is to be shared.
Width between edge line of driving vehicle/parking and cyclist	1 metre	Absolute Minimum 0.6 m where no parking 0.85 metres adjacent to on-street parking
Separated cycle path at bus stops	Bypass path around bus stop retaining priority	Bypass path around bus stop with raised treatment to slow cyclists. Consider in-line bus boarder stop option if an infrequent route (bus in traffic lane).
Side roads and access treatments	Retain priority over side-roads	Raised Crossings
Road crossings on Collector and Arterials	Traffic Signals	Median island & kerb extensions (retain suitable width on crossing link for on-road cyclists)
Cycle path: Design Speed for Alignment	25km/h (30km/hr for sight distances)	20km/h
Visibility at driveways	No parking within 3 metres of a driveway if provided on the same side as the cycleway. Additional space is required when the number of parks preceding the driveway increases in number.	
Visibility at intersections	No parking within 30 metres of an intersection (under NZTA review)	

**and be ratified by the MCR Steering Group.*

8 Separated Cycle Paths Single directional on-street (1-way on each side of the carriageway)

This chapter looks at the best practice design process for separated cycle paths single directional on-street (1-way on each side of the carriageway). Description of path type and desirable cross-sections are explained to help the designer meet the design objectives outlined in this chapter.

8.1 Relevant Reference Documents:

Austroads guides (2014) – Part 6A – Pedestrian and Cyclist Paths

Traffic Control Devices Manual - NZTA

Crime Prevention through Environmental Design (CPTED)

MOTSAM standards - NZTA

8.2 Description

This section of the Design Principles Best Practice Guide provides recommended guidance for separated cycle paths on-road (1-way) as shown in some examples below.

Photo 2: Ilam Road (Christchurch)

8.3 Desirable Design Cross-sections

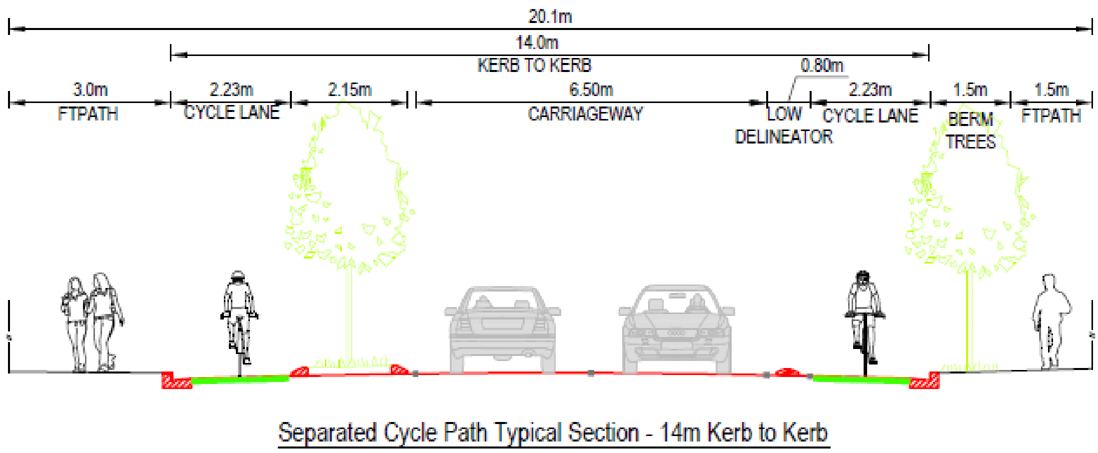


Figure 8-1: No parking option (the cross-section does not add up to 14m consideration needed for road marking widths etc)

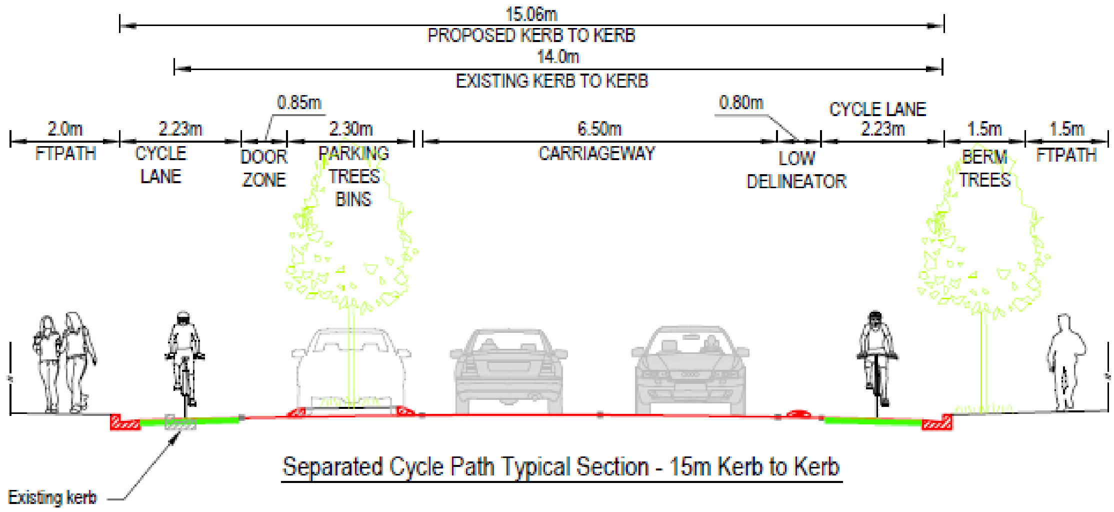


Figure 8-2: Parking option (the cross-section does not add up to 14m consideration needed for road marking widths etc)

Figure 8-3: Copenhagen Facility Cross Section

(Copenhagen/Dutch Style cycleways will have similar cross-sections but there will be vertical height delineation)

8.4 Design Approach

Table 8-1 below sets out the design approach for the key design requirements for separated cycle paths single directional on-street (1-way on each side of carriageway):

Table 8-1: 5 Key Separated Cycle Paths Single directional on-street (1-way on each side of carriageway) Design Requirements

Main Requirement	Important Aspect	Design Applicable to separated cycle paths single directional on-street (1-way on each side of carriageway)
Safety	Crash risk	Minimise interaction with traffic. The facility can connect people and places in the road corridor by providing dedicated space for cyclists. Can be road level, intermediate level or footpath level).
		Requirements for sight and visibility (including vertical level differences) are met.
		Cycle paths designed on anticipated cycle volumes ensure sufficient width is provided.
		Where parking is provided on the side of the street with the cycle facility ensure there is sufficient protection for cyclists from dooring (0.8m minimum).
		Cyclists should have right of way over minor roads at T-intersections or appropriate signage and marking is provided to ensure path users are clear on priority.
		Intersection treatments should be consistent and legible (easy to read and a user knows how to use them.
		Service trenching and lids need to be finished to a high standard.
	Legible & Predictable	Ensure the design is self-explanatory to all path users.
	Visibility	Cycle path users have full visibility of driveways, and be set at least 3 metres from the property boundary to increase intervisibility (cars exiting driveways and cyclists approaching).
		The path is visible both during the day and at night in terms of passive surveillance and lighting. There should be consistency in lighting (preferred white light)
Directness	Distance	Average detour time is minimised.
	Time	Cycle design speed on links and at corners. Blind corners should be avoided.
		Minimising stops/starts
Comfort	Width	Paths and lanes are wide enough for anticipated and future volumes. A sufficient delineation width is provided between driving traffic and the cyclist closest to the road.
	Construction	Path should be wide and strong (construction depth) enough to allow service vehicles access for maintenance.
		Consideration of vertical cross-section to determine shoulder gradients.
		No seal joints should be provided within the cycle lane.
	Clear of obstacles	Street furniture should be set back from the cycle path. Street trees should be limbed.
		Placement of signage and lighting columns needs careful consideration.

Main Requirement	Important Aspect	Design Applicable to separated cycle paths single directional on-street (1-way on each side of carriageway)
	Smoothness	Surface types need to be smooth while retaining traction. Smooth sealed paths are preferred.
Coherent		Signs and markings compliant with Traffic Control Devices Manual.
		Cycle symbols are to be provided in the cycle lane at the start and end, and provided intermittently in accordance with MOTSAM standards.
		Use directional signage for cycle network users.
		Use directional arrows where necessary.
Attractiveness		Good lighting, where appropriate as per CPTED guidelines, consider blue and white light.
		Materials should reflect the land-use and place.
		Separation can be achieved by a landscaped area or contrasting surface texture separating the cycle and pedestrian paths.
		Enhance by adding plantings, artwork and points of interest.
		Passing through interesting and beautiful places.
		Add rest areas with seats and bike stands and maybe an information board.

8.5 Best Practice Design Guide

The Best Practice Design Guidance assessment process provides informed desirable design practice. This process starts at the best practice or desirable design working towards the less than minimum desirable design solution documenting every decision through the entire process. The minimum desirable design is approved by the TAG Group and less than minimum desirable design is approved by the Major Cycleway Steering Group. This process guides personal in making safety viable design options (Refer Figure 5-2).

Taking account of the design approach in Table 8-1above the optimal for this facility type are set out in Table 8-2. Where necessary, the re-alignment of the kerb may be required to achieve desirable design objectives.

Table 8-2: Separated Cycle Paths Single directional on-street (1-way on each side of the carriageway) Desirable Design Objectives

Design Attribute	**Desirable Design**	**Desirable Minimum** **(to be agreed by exception by the TAG Group)***
Path width for cycle lane	2.1 - 2.3 metres	1.8m min desirable, 1.6m absolute minimum, but only for short isolated sections where clear visibility is maintained throughout. Will require additional treatments such as vertical profile change. These sections will be identified as requiring review and design change as cycle volumes increase.
Width between cycle facility and driving lane	0.6 metres (above 50km/hr this needs to be increased)	0.5 metres

Design Attribute	**Desirable Design**	**Desirable Minimum** **(to be agreed by exception by the TAG Group)***
Width between edge line of parking space and cyclist	1 metre (not necessary to provide this width of solid buffer, as space could be used by a cyclist).	Absolute Minimum 0.6 m where no parking 0.85 metres adjacent to on-street parking
Delineator	Solid kerbs/separators/vertical height difference (consider place function also)	Paint buffer 0.6 metres where no parking and 0.85m where there is parking and vertical posts. Physical measures are always preferred.
Visibility at driveways	No parking within 3 metres of a driveway if provided on the same side as the cycleway. Additional space is required when the number of parks preceding the driveway increases in number.	
Visibility at intersections	No parking within 30 metres of an intersection (Under NZTA review)	
Separated cycle path at bus stops	Bypass path around bus stop	Consider bus stop build outs for low frequency bus services. Bypass around bus stop with raised treatment to slow cyclists.
Side roads and access treatments	Reduce number of side road accesses, raised crossings, Signage and markings	Signage and markings
Road crossings	Traffic Signals	Traffic signals on arterials, kerb build outs, medians and raised platforms
Cycle path: Design Speed for Alignment	25km/h (30km/hr for sight distances)	20km/h

**and be ratified by the MCR steering Board*

9 Neighbourhood Greenways (Slow Streets)

This chapter looks at the best practice design process for neighbourhood greenways. Description of neighbourhood greenways and cross-sections are explained to help the designer meet the design objectives outlined in this chapter.

There is evolving research that may result in changes to this section.

9.1 Relevant Reference Documents:

Austroads guides (2014) – Part 6A – Pedestrian and Cyclist Paths

Traffic Control Devices Manual - NZTA

Crime Prevention through Environmental Design (CPTED)

MOTSAM standards - NZTA

9.2 Description

Major Cycleways passing through residential areas will be referred to as Neighbourhood Greenways. The information in this section refers to Neighbourhood Greenways. Slow streets in commercial areas will require site specific design taking into consideration volumes, mass differentials (buses, service vehicles etc).

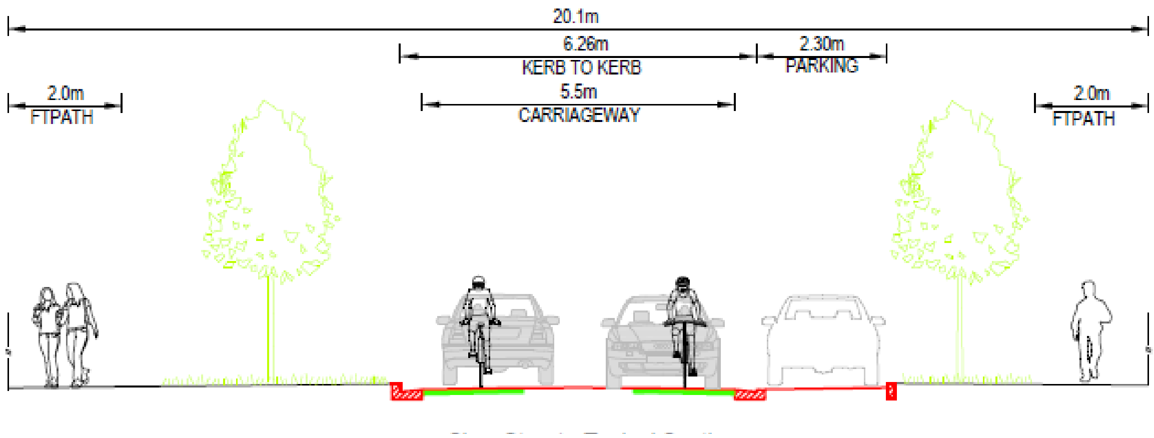


Figure 9-1: Proposed cross-section with parking (staggered along the street)

9.3 Design Approach

The MCA process is undertaken using the 5 key design requirements for a variety of path types. (Refer Section 3.13) Cycleways should be safe and perceived to be safe and this factor is the most important factor in the MCA process and is required to pass the 'safe' test. Once the greenways path type is chosen through the MCA process the best practice design guidance is applied. (Refer Section 0)

Table 9-1 below sets out the design approach for the 5 key design requirements for neighbourhood greenways:

Table 9-1: 5 Key Neighbourhood Greenways Design Requirements

Main Requirement	Important Aspect	Design Applicable to neighbourhood greenways
Safety	Crash risk	Minimise speed differential between traffic and cyclist.
		Neighbourhood Greenways have low traffic speeds and volumes. They may often be two-way streets where cyclists can easily and safely mix with slower traffic and slower speeds provide a safer environment for pedestrians.
		Discourage unnecessary through-traffic to improve the safety and comfort of walking and cycling. Neighbourhood Greenways can feature a range of different street treatments including, but not limited to: street entrance or exit restrictions; median islands at intersections with cycle gaps to prevent vehicles from continuing along the neighbourhood greenway; mid-block or street-end closures for vehicles with by-passes for cycling; diagonal diverters at intersections to prevent through traffic; contra-flow cycle lanes; lower speed limits; and other traffic calming measures (eg: raised platforms, narrow lanes, or chicanes with cycling bypasses etc).
		Cyclists and pedestrians will be given a higher priority in designs than other traffic, so that cyclists can comfortably share the full carriageway of the street.
		The design and appearance of the street is designed to encourage low traffic speeds (less than 30km/h) and low volumes, maximising safety for cyclists and pedestrians. Vertical elements (trees or street furniture) can provide visual enclosure to the street reducing sight lines and therefore speed.
		Requirements for sight and visibility (including vertical level differences) are met.
		Parking provision on neighbourhood greenways needs consideration, if there is a fear by a new cyclist that car doors will open in front of them then a cyclist is unlikely to feel as comfortable in using the neighbourhood greenways. Parking could be provided in opposing locations, the parking bays could be staggered along the street to reduce stress of dooring for cyclists and having to make evasive manoeuvres. Parking should be provided in bays of fewer than 6 vehicles to provide a break for cyclists passing parked cars.
	Legible & Predictable	Ensure the design is self-explanatory to all users.
	Visibility	Ensure the street is well lit with consistent lighting.
Directness	Distance	Average detour time is optimised.
	Time	Cycle design speed on links and at corners to be considered. Blind corners to be avoided.
		Minimising stops/starts.
Comfort	Width	Vehicle lane widths (not marked lanes so no centre line) do not compromise cycle safety.
	Clear of obstacles	Street furniture should be set placed accordingly.
		Street trees should be limbed up.
	Smoothness	Surface types need to be smooth while retaining traction.
Coherent		Signs and markings compliant with Traffic Control Devices Manual.
		Legibility through Major Cycleway route signage.
Attractiveness		Good lighting that is consistent.

Main Requirement	Important Aspect	Design Applicable to neighbourhood greenways
		Visible to path users and for passive surveillance.
		Landscaped areas, trees and or contrasting surface texture to re-enforce the 30kmh zone.
		Designs suitable to reflect the local character of the street.
		A high standard of design and features including landscaping, surfacing, furniture and lighting.

9.4 Best Practice Design Guide

The Best Practice Design Guidance assessment process provides informed desirable design practice. This process starts at the best practice or desirable design working towards the less than minimum desirable design solution documenting every decision through the entire process. The minimum desirable design is approved by the TAG Group and less than minimum desirable design is approved by the Major Cycleway Steering Group. This process guides personal in making safety viable design options (Refer Figure 5-2).

Taking account of the design approach in Table 9-1 above the optimal for this facility type are set out in Table 9-2.

Table 9-2: Neighbourhood Greenways Desirable Design Objectives

Design Attribute	Desirable Design	Desirable Minimum (to be agreed by exception by the Best Practice Guide Team)*
Neighbourhood Greenways – Traffic Volumes	1000vpd desirable – 1500vpd max (consider peak hour flows close to major generators)	1000vpd desirable – 1500vpd max NZTA to supply new data on volumes based upon work underway
Neighbourhood Greenways – Traffic Speeds	30km/hr Max Posted (preferred design speed is 20km/hr for people on cycles)	30km/hr posted
Neighbourhood Greenways – length of straight sections	300 metres	400 metres[7]
Road width excluding parking but including channel	6.26 metres	6.5 metres (An existing 9 metres wide street can be reduced to 6.5m by providing 2.5m indented parking bays).

[7] *The length over which a car has to follow a cyclist be limited to 400m. A longer Cycle Street could be achieved by designing the street in sections between which cars have to turn off.*

Design Attribute	Desirable Design	Desirable Minimum (to be agreed by exception by the Best Practice Guide Team)*
Traffic Management Approach	Some examples (not limited too): • street entrance or exit restrictions; • median islands at intersections with cycle gaps; • mid-block or street-end closures for vehicles with by-passes for cycling; • diagonal diverters at intersections to prevent through traffic; • Raised tables	Bypass via shared path
Side roads and access treatments	Neighbourhood Greenways for Major Cycleway should take priority	Signage and markings
On-street parking provision	No more than 40% of length of street is used for parking	No more than 50% of the length of the street is used for parking
Main road crossings	Traffic Signals on arterials and collectors	Kerb extensions, raised platforms and central islands

and be ratified by the MCR Steering Board

10 Mid-block Crossings

This chapter looks at the best practice design process for mid-block crossings. Description of mid-block crossing are provided to help the designer meet the design objectives outlined in this chapter.

10.1 Relevant Reference Documents:

Infrastructure Design Specification, 2010 (IDS)

Construction Standard Specification, 2013 (CSS)

Austroads Part 4 (2014)

Austroads guides (2014) – Part 6A – Pedestrian and Cyclist Paths

Traffic Control Devices Manual - NZTA

MOTSAM - NZTA

Pedestrian Planning Design Guide

Crime Prevention through Environmental Design (CPTED)

NZTA Urban Design Guidelines (October 2013)

NZTA Bridge Manual

NZS4121:2001 Design for Access and Mobility – Buildings and Associated Facilities

CROW Design manual for bicycle traffic (2007)

10.2 Description

Crossing busy roads are challenging for cyclists. Major Cycleways that cross these roads need to be designed to protect the cyclist and provide a greater level of comfort.

Improvements for cyclists can be achieved by:

- Minimising the number of conflicts with vehicular traffic
- Minimising mass and speed differentials
- Maximising visibility between motorists and cyclists
- Ensuring lighting is sufficient to retain visibility at night
- Minimising delays and waiting times (use of central islands and changes to traffic signals etc)

The following mid-block crossings (not in order of preference):

- Mid-block Crossings – Un-signalised
- Mid-block Crossings – Signal controlled crossings
- Mid-block Crossing - Bridges
- Mid-block crossing - Underpasses

10.3 Treatment Selection Guide

Selection of intersection treatment is undertaken using the 5 key design requirements for a variety of mid-block treatment types. (Refer Section 3.13) With the MCA process and mid-block treatment chosen dependent on traffic volume the best practice design guide is applied. (Refer Section 10.4.2) The traffic volume for type of mid-block treatment is shown below.

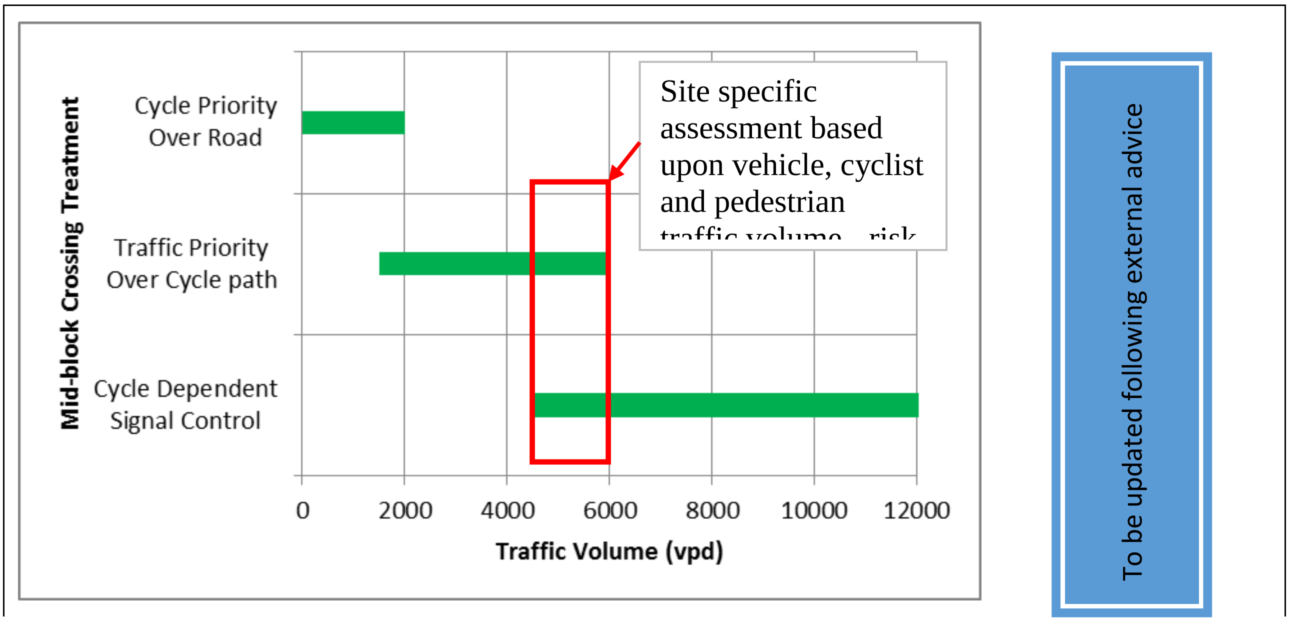


Figure 10-1: Mid-block Crossing Treatment Selection Graph

10.4 Mid-block Crossings – Un-signalised

10.4.1 Benefits / Applications

Un-signalised mid-block crossings provide assistance to cyclists to cross lower traffic volume (less than 5000vpd) roads. Road crossings for cyclists should be simple and clear.

The pedestrian planning design guide provides specific use of zebra crossings. They should not be used in locations with fewer than 50 pedestrians per hour. At present, cyclists have to dismount at zebra crossings. Any proposals to allow cyclists to travel across zebra crossings without dismounting will need to go through a formal NZTA trial.

10.4.2 Best Practice Design Guide

The information below is current best practice, but will updated based upon subsequent research.

10.4.2.1 Local roads and low volume collector roads (5000vpd max).

- Kerb build outs can reduce the crossing distance (to 6 metres) and inclusion of a raised table (subject to road classification) would contribute to slower vehicle speeds. Sufficient visibility should be provided, which may require longer build outs to keep parking away from the crossing point. The pedestrian planning design guide suggests kerb extensions have particular safety benefits and also result in less delay for pedestrians. They will be most beneficial on roads with traffic flows less than 500 vehicles per hour.
- Central islands allow a cyclist to cross in two stages. It may be more comfortable to widen the gap in the middle of the island to 3 metres to allow room for two passing cyclists. (Modified CSS Pedestrian Island for cycle crossing). Austroads Part 4 suggests that pedestrian refuges in the centre of the road are recommended to enable a staged crossing where traffic volumes are greater than 3000 vpd. The main effect of pedestrian islands is a significant reduction in pedestrian delay; they are most useful where traffic flows exceed 500 vehicles per hour (over 5000 vehicles per day).
- Central islands can also improve the visibility of the crossing and also assist as a traffic calming feature. Traffic calming may also be considered on the approaches, but not at the crossing to

ensure priority is clear. Ensure sufficient lane widths for cyclist's on-road passing by the island (5m lanes if cycle lane not provided).

- In order to accommodate a bicycle which is typically 1.75m long, the refuge island should be 2 metres wide minimum. If the island is located close to schools where there are concentrated demands at certain times of the day a wider and longer storage may be required. Holdrails[8] should be provided in line with the Construction Standard Specifications. If the crossing is in an area of high pedestrian demand (schools etc) then an alternative form of crossing may be justified.
- Visibility from the path should be maximised and build outs should be used where visibility requires to be improved. (Use Pedestrian Planning Design Guide calculations for crossing sight distance).
- Signage and markings should be provided to assist with identifying priority and the direction of the cycleway (WayFinding). (Refer Part C – Wayfinding and Signage).
- If on over-dimension route (probably unlikely) then the over-dimension envelope must be retained (usually 10.5 metres clear width).

Photo 3: Mid-block Crossing (Rail Crossing)- Fendalton Road, Christchurch

Photo 4: Mid-block Crossing (crossing island)- Greers Road, Christchurch

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[8] *Holdrails – Handrail for cyclists to use for balance while waiting to cross road.*

10.4.3 Local roads only, carrying less than 2000vpd - Priority Crossing Treatments

Path priority crossing treatments allow off-road paths to continue across a road. Austroads Part 4 (Intersections and Crossings) suggests that this treatment is generally appropriate where:

- the speed environment is below the general urban speed limit, or where a local area traffic management scheme is proposed that would achieve suitable crossing conditions
- it is located in urban areas
- good visibility at the crossing point exists for both road and path users
- it is located away from intersections of roads
- the priority that would be assigned to the road is consistent with that elsewhere along the road, in the vicinity of the crossing
- not more than two lanes of traffic exist (both directions)
- the proportion of commercial traffic volume is low

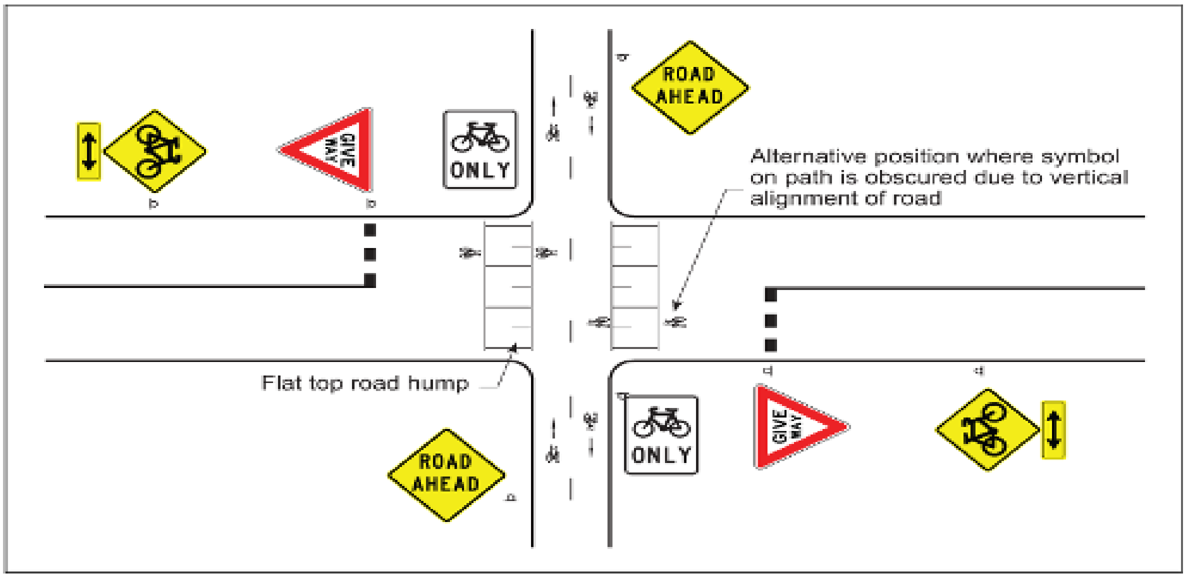


Figure 9.4: Cyclist priority treatment for use at low-volume street crossings

Figure 10-2: Source: Austroads Part 4 (Intersections and Crossings) - the markings etc should be consistent with NZ markings.

This facility type has been introduced on Matai Street (east) and similar facilities has been used in Nelson on the rail trail on low traffic volume (less than 2000vpd) streets (Jellicoe Avenue, Newall Avenue, and Andrew Street). Where the rail trail crosses higher traffic volume (greater than 3500vpd) street a pedestrian island has been used and traffic retains priority.

Photo 5: **Rail Trail Crossing - Stoke, Nelson (courtesy of Jeanette Ward)**

Photo 6: Rail Trail Crossing - Stoke, Nelson (courtesy of Jeanette Ward)

10.4.3.1 Local roads only, carrying less than 2000vpd

The following is therefore suggested for use of priority (For cyclist) crossings on Major Cycleways:

- simple road layouts so as not to overload driver
- Sufficient platform length so a driver is aware of change in grade and has time to react to a cyclist on the crossing
- Slow cyclists down prior to entering crossing. Use of rumble strips in cycle lane to slow cyclists approaching the give-way
- Consider use of rumble paint on approach to crossing (give-way line)
- Lighting is sufficient to see cyclists at dark.

10.5 Mid-block Crossings – Signal controlled

Dedicated signals provide cyclists with a safe way to cross when traffic volumes are high (greater than 3500vpd). The following design guidance is provided:

- Signalised crossings with separate facilities (but adjacent) for pedestrians and cyclists will provide a safe crossing facility for pedestrians and cyclists (Option 1).
- The separation of cyclists allows for the shorter cycle phase to run separately from the pedestrian signal phase, which can which can reduce the impact on traffic capacity (Option 2).
- Bicycle lanterns are required at the crossings as legally a cyclist would need to dismount at a crossing without them.
- All signalised crossings need to consider the capacity and network implications (and how it relates to the Network Management Plan) of the crossings on the arterial road. Where traffic efficiency is required to be maintained on a four-lane road an alternative crossing design should be considered where the pedestrian crossing is staged but cyclists continue to cross in one stage.
- The design should minimise waiting time for cyclists at crossings. Induction loops detect cyclists and trigger the signals and can be used on the approach to the crossing.

- The pedestrian crosswalk should be a minimum of 2 metres wide and the cycle crossing a minimum of 3 metres wide. In areas of high pedestrian demand, the crosswalks should be widened.
- All designs for signal controlled crossings should be approved by Road Corridor Operations and the Christchurch Transport Operations Centre (CTOC).
- Designers should refer to the standard details for elements required for signal design.

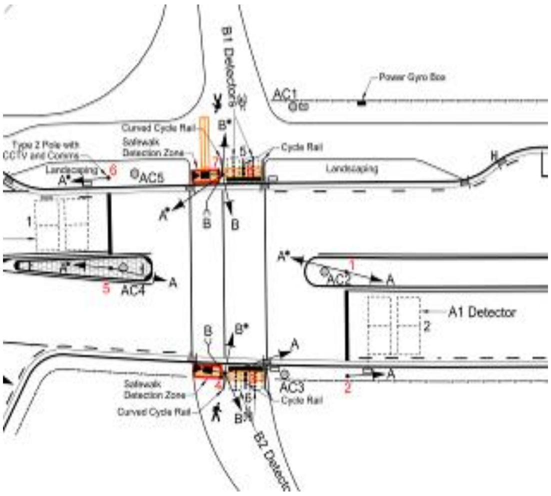


Figure 10-3: Option 1 – Example of a Combined Cycle and Pedestrian Crossing (consider lane widths on- road for cycle users)

Figure 10-4: Option 2 – Retaining operational efficiency on 4-lane roads

10.6 Mid-block – Bridges (Predominantly crossing waterways)

Bridging the Gap – NZTA Urban Design Guidelines (October 2013) provides information on Pedestrian Cycle Bridges and Underpasses.

The document recognises that bridges offer the opportunity to maintain the visual connections with adjacent land uses and road, and can offer attractive views for pedestrians and cyclists and for these reasons bridges can offer a safer and more pleasant experience than underpasses.

It is recommended that pedestrian and cycle bridges should be located and designed to make them safe and easy for people to use, to reduce travel time, and to create inviting connections along routes that people want to use. Bridges allow a high level of separation (level of service) and comfort when crossing busy roads especially State Highways and Motorways.

Below is a summary of the points made in the document when considering pedestrian and cycle bridge design:

- Location: bridges should be located to serve identified desire lines. If indirect, users may to choose to cross elsewhere
- Form: Pedestrian bridges carry lighter loads than road bridges which, allows more flexibility to the form. Consider materials, texture, colour, landscaping and lighting of the bridge.
- Integration: Integrated into their context (consider character and scale of bridge and surrounding landscape).
- Accessibility: Bridges should be accessible to all pedestrians and cyclists, including the mobility impaired.

- Landmark structures: Bridges are prominent structures, and therefore there are opportunities to create new landmarks.
- Experience: Seek to create an interesting experience for users. Look to maximise or frame views.
- Approaches: Approach ramps should be designed as part of the bridge composition and integrated in the landform and landscape. Wherever possible take advantage of topography and minimise approach lengths.
- Safety: should be wide enough to accommodate pedestrians and cyclists. Allow for additional shy space to barriers, and also future proof for demand increases.
- Lighting: Lighting should be provided to ensure the safety of users. Bespoke lighting can be used as a design feature but care must be taken to avoid light spilling into surrounding environment.
- Detailed design: Should have good quality detailing and finishes.

The bridge design should meet appropriate design standards including IDS, CSS, City Plan and NZTA Bridge Manual, and NZS4121:2001 Design for Access and Mobility – Buildings and Associated Facilities. Building consents, and potentially Resource Consents are required for bridges.

The handrail height is an important aspect of the bridge design. The consequences of falling from a bridge are serious, and could potentially result in fatal outcomes. However, a solid fence too high will create an unpleasant environment for users; particularly walkers who are travelling at a slower speed. The suggested handrail height is 1.4m as this is the desirable height specified in Austroads Part 7 and other international guidelines. The figure below shows the difference between a 1.4m high fence and a normal pedestrian fence height (1.1m). It is clear that relative to a cyclists centre of gravity the 1.4m height is suitable for a bridge as it is safe and retains a good outcome for walkers.

Figure 10-5: Extract from (National Cooperative Highway Research Program (NCHRP) report – Determination of appropriate railing heights for bicyclists (use vertical railings instead of horizontal railings)

Vertical bars on a handrail create a potential for 'snagging' of bicycle pedals and handle bars, where the pedals or handle bars can get caught on something), when a cyclist travels too close to the fence (for example where passing an oncoming user). To overcome the snagging risks a number of options could be considered. These are:

- cover the inside of the bars with a panel so there is a smooth fence surface,
- adding a handrail to the top of the fence to create a buffer zone (although reduces the clear width of the deck).

Splaying a fence outwards at the top can help create a wider clear width on the bridge.

10.7 Mid-block – Underpasses

There may be situations where an at-grade crossing is unachievable and an underpass provides the most suitable choice for a pedestrian and Major Cycleway link (preferably limited to State Highways). If there is no alternative link, without a significant detour and an underpass is completely necessary then they have to be designed well for personal safety reasons. Crime Prevention through Environmental Design (CPTED) principles should guide the design and location of the underpass.

Any underpass will be required to be approved by the Major Cycleways Steering Board.

Photo 7: 2 –way cycle with pedestrian path underpass

The NZTA document provides that following guidance for underpasses (refer to document for additional guidance):

- Safety: The walls of the underpass should not feature recesses where litter might accumulate or someone might hide.
- Alignment: The underpass should offer a straight route so that one end of the underpass is visible from the other. Bends and angles in the underpass should be avoided as they create hidden places which encourage vandalism, crime and anti-social behaviour.
- Surveillance: The design of the underpass should allow people to see activity within the underpass from the outside. Where possible the entrance of the underpass should be overlooked by adjacent buildings.
- Integration: Underpasses must be integrated with the wider pedestrian and cycle network, and with the adjacent land uses. The design of the underpass must be integrated with the earthworks, structures, stormwater, landscape and public art proposals of the project.
- Location: The underpass must be located to serve an identified desire line and it must be designed in a way that encourages people to use it; secluded locations should be avoided. Adjacent land-use must be considered, and underpasses next to certain land-uses such as schools may not be desirable.
- Dimensions: Underpasses should be as wide and high as possible to maximise light penetration, visibility and amenity. Any tunnel effect should be minimised.
- Approach: The paths leading to the underpass must be direct and straight so that the underpass is clearly visible on the approach. The underpass should be at grade with the surrounding land

where possible. If necessary, the road above should be elevated to minimise change of level in the underpass. The approach ramps must be gradual enough to accommodate wheelchair users.

- Drainage: A good drainage system must be provided to allow for satisfactory disposal of runoff and prevent flooding and pooling.
- Lighting: Good lighting must be provided both inside and at the entrances of the underpass. Median skylights should be considered to provide day lighting midway through the underpass.
- Maintenance: Robust, long-life, vandal proof materials and lighting should be used in the underpass to minimise maintenance.
- Interior: Murals, art, backlit advertisement, feature paving, lighting and surface treatments should be considered to create a pleasant environment in the underpass.
- Headroom through underpasses should be at least 2.4 metres. Width should be a minimum of 5 metres (3 metre cycleway and 2m pedestrian path).
- Delineation to tie to approaches.

11 Intersections

This chapter looks at the best practice design process for intersections. A description of intersections is provided to help the designer meet the design objectives outlined in this chapter.

11.1 Relevant Reference Documents:

CCC - Infrastructure Design Standard, 2010 (IDS)

CCC - Construction Standard Specification, 2013 (CSS)

CCC - Intersection & Pedestrian Crossing Design for People with Disabilities 2016

Austroads Part 4 (2014)

Austroads guides (2014) – Part 6A – Pedestrian and Cyclist Paths

Traffic Control Devices Manual - NZTA

MOTSAM - NZTA

Pedestrian Planning Design Guide

Crime Prevention through Environmental Design (CPTED)

NZTA Urban Design Guidelines (October 2013)

Infrastructure Design Specification, 2010 (IDS)

Construction Standard Specification, 2013 (CSS) (Currently under review for MCR elements)

NZTA Bridge Manual

CROW Design manual for bicycle traffic (2007)

11.2 Description

Moving through controlled intersections and t-intersections are challenging for cyclists. Major Cycleways that cross these intersections need to be designed to protect the cyclist and provide a greater level of comfort.

Improvements for cyclists can be achieved by:

- Minimising the number of conflicts with vehicular traffic
- Minimising mass and speed differentials
- Maximising visibility between motorists and cyclists
- Ensuring lighting is sufficient to retain visibility at night
- Looking for consistency and uniformity of intersection design along a route
- Considering corner radii at the intersection for appropriate design speeds
- Minimising delays and waiting times (use of central islands and changes to traffic signals etc)
- Minimising diversions around the intersection that may create a situation where cyclists choose to take a more direct and potentially less safe option

The following intersections are considered (not in order of preference):

- Priority intersections
- Signal controlled T-intersection
- Signal controlled crossroads

11.3 Treatment Selection Guide

Selection of intersection treatment is undertaken using the 5 key design requirements for a variety of intersection treatment types. (Refer Section 3.13) The traffic volume for type of intersection treatment is shown in the Infrastructure Design Standard.

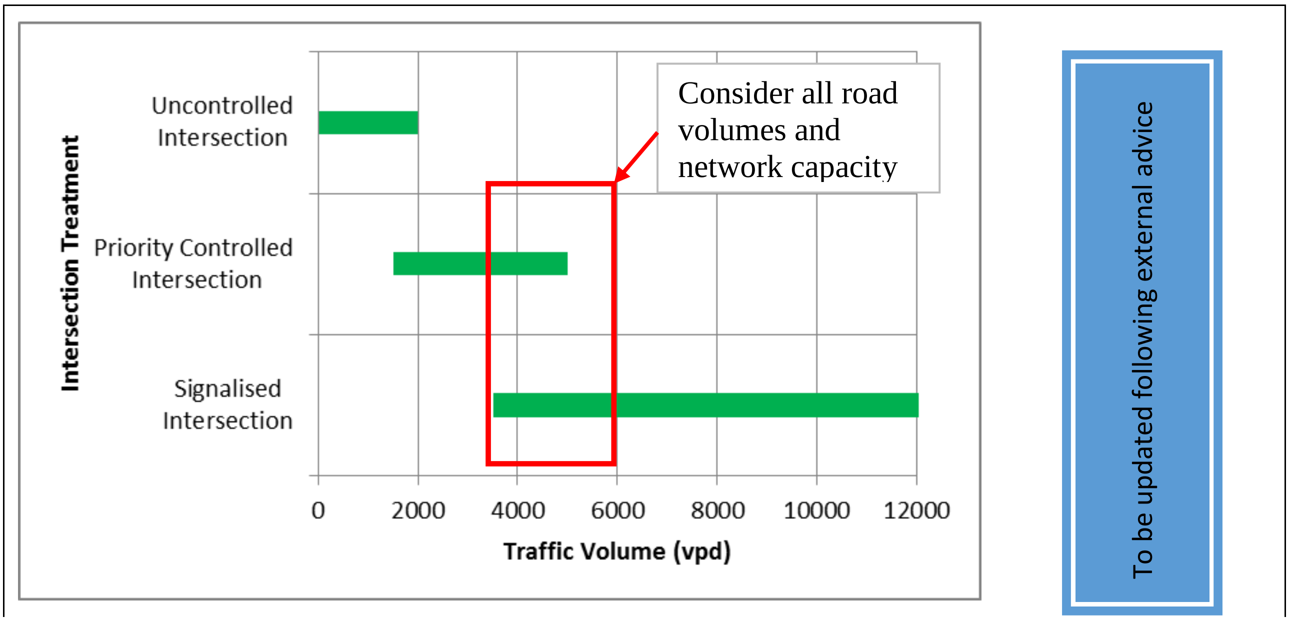


Figure 11-1: Intersection Treatment Selection Guide

11.4 Priority Controlled Intersections

Major cycleways that encounter priority controlled T-intersections or priority controlled crossroads ideally will give continued priority, inter-visibility and protection for cyclists. Onerous is on driver exiting the stop and give way control to ensure way is clear. Note special care taken for one-way street with cycleway, especially were on-road cycleway is two-way.

The following design guidance is provided:

- If on the major arm of the intersection, the cycle facility should retain priority over the minor leg. This clarifies the right of way situation.
- All minor legs shall be marked and signed as give-way or stop control (subject to visibility).
- Where turn boxes are provided, visibility should be increased for the right turning cyclist to have clear visibility of the intersection.
- Parking around the intersection should be restricted, at least for 30 metres.
  [NZTA to advise on work being undertaken]
- A small kerb radius (3m minimum – 5 metres maximum) could also be used to slow turning vehicles. Vehicle tracking should be undertaken for a refuse vehicle and designers should check to see if the intersection sits on a bus route where a bus needs to turn left.
- Turning manoeuvres need to be tracked to ensure a car turning left can do so safely from the traffic lane and any cycle lane delineator is set back to ensure it is not damaged consistently/or made more permanent.

- Raising the intersection should also be considered to slow traffic on slow streets and on minor legs on the approach to Major Cycleways (on priority leg).
- Speed reduction treatments are essential at local road crossroads.
- Off-road facilities could be considered at crossroads to allow cyclists to make a two-stage turn.
- A green coloured surface across the intersection will improve visibility and awareness of the main cycleway (consider material choice to increase longevity).
- The design needs to consider the potential conflict with driveways or entrances across the T-intersection.
- To minimise conflicts, access restrictions should also be considered for vehicular traffic.
- Ensure vehicle tracking is undertaken for refuse vehicles, public transport (mountable aprons).
- Acceleration and deceleration lanes are not permitted along Major Cycleways where the cycle way has priority (not bent-in where an auxiliary lane may assist with left turn vehicles that are turning into a side road with a bent-out facility).

There are three options for maintaining priority at these intersections types, straight through, bent in and bent out.

Straight through (standard treatment at present) will always be the recommended option on one-way cycle facilities. Green surfacing and continuity lines must be provided to maintain priority over the minor leg. Where a separated cycle facility has parking adjacent to it, then parking needs to be restricted for at least 30 metres (Dutch Manual for Bicycle Design) prior to the intersection to allow drivers to see cyclists transitioning from a separated facility behind parking.

Two-way cycle facilities have to be managed very carefully as drivers exiting, particularly turning left, may only look to the right and exit, and fail to see a cyclist travelling towards the turning vehicle resulting in a collision. Where a two-way facility exists and requires passing through an intersection additional measures such as traffic calming, turning restrictions, signage and markings will be required.

Photo 8: Separated cycle facility at a priority controlled intersection (Christchurch)

Photo 9: Facilities to assist turning at a priority controlled intersection (Christchurch)

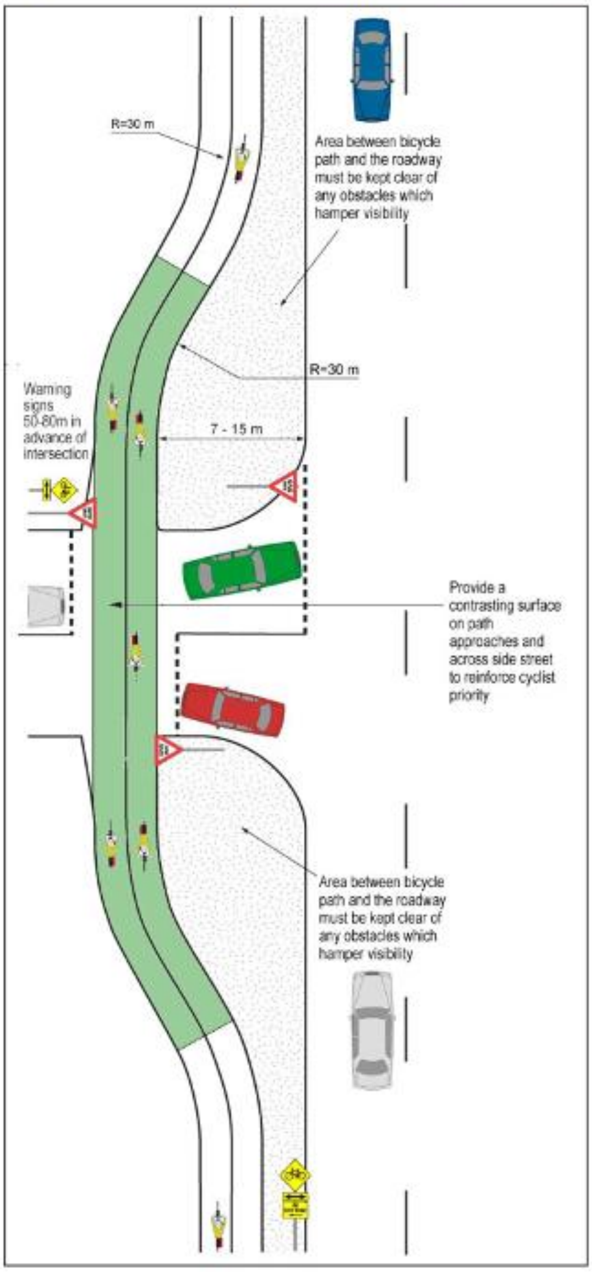
To assist cyclists on a Major Cycleway to turn right from the priority leg to a side road, a hook turn can be used to allow a cyclist to face the direction of the side road and choose a suitable gap in the traffic to cross. This reduces the need for a cyclist to enter the traffic lanes to turn right. Suitable visibility is required for the cyclist waiting at the hook turn.

If there is sufficient space in the road reserve separated paths can be bent away from the main road, which allows storage for a vehicle turning into the side road. Austroads recommends a distance of 7metres minimum to allow for a car length and clearance (refer to the Cycling Aspects of Austroads, 2014), and recommends that the treatment is suitable where there are few heavy vehicles using the side road, volumes on the side road are low and speed on the major road and side road is less than 60km/hr. Signage is required on the main road for turning traffic to remind them to give-way at the cycleway.

On the Major Cycleway Network the straight through cycleway is preferred, but where there is a two-way cycle facility this tool could assist at priority intersections.

Alternative treatments (such as bend –out / bend – in) could be considered.

Figure 7.10: Bicycle path crossing bent-out at side road



[placeholder for additional diagram]

Figure 11-2: Source: Austroads 2009

11.5 Signalised intersections

Detailed design guidance for this section is still being developed and when completed will be submitted for approval and inclusion into this guide.

12 Design and Construction

This chapter deals with the design and construction of any cycle route or cycle facility. This does not replace the CSS but provides further information relating to the cycle facilities.

12.1 Relevant Reference Documents:

Christchurch City Council Construction Standard Specification, 2013 (CSS)

CCC - IDS

Christchurch City Council Cycle design guide

Austroads guides (2014) – Part 6A – Pedestrian and Cyclist Paths

Traffic Control Devices Manual

Crime Prevention through Environmental Design (CPTED)

http://www.fietsersbond.nl/de-feiten/fietsparkeren/fietsparkeur/fietsrekken-met-fietsparkeur

12.2 Off-Carriageway Routes – Shared Paths

12.2.1 Surfacing and drainage

Shared paths will have a similar construction to residential driveways as the default.

However, in reserves if motor vehicles (maintenance) are expected to use the path (always assume use by motor vehicle) pavement design should be appropriate for the vehicle loadings and the site ground conditions (consider use of fabric and appropriate edge treatment).

In reserves & river banks, construct as for residential drives and use 150mm battens on edges and if adjacent to planting as in CSS. Surpave/turf cells edge treatment may be used adjacent to paths in reserves and along river corridors for vehicle use (consider joggers/runners running parallel to the path).

If there is a considerable side slope say 20%+ construct a second 150mm batten (1m offset at 5-10%) to absorb any movement in the bank and prevent the path edge from slumping. Consider use of pre-bending timber battens to achieve smooth radii (5m minimum on the inside of a bend).

Surfacing must be to a high standard to make the ride smooth and comfortable (consider evenness, skid resistance, drainage and rolling resistance). The preferred surface for shared paths is Asphaltic Concrete. Concrete may be used if approved. If a path is user specific and the cyclists are separate from the pedestrians, the footpath element may have a different surface such as grit or crusher dust. Consideration should be given to wheelchair users when considering surface treatments.

Asphaltic concrete surfacing is to be laid by paving machine to achieve the required CSS standard (CSS part. (Part 6 item Clause 6.8))

Where additional width is being provided to an existing path, a seal overlay should be provided to ensure there are no join lines in the path and there is less chance of the new addition separating from the existing formed path (joint failure).

The finished surface should not hold water. The path should have one crossfall (2%) and not a crown. If necessary, the path should be built up above adjacent ground to avoid ponding over the path.

Austroads Part 6a Pedestrian and Cycle Paths provide information on gradients for downhill travel and suggest gradients steeper than 5% (1:20) should not be provided unless it is unavoidable. If travelling uphill, 3% is the desirable maximum gradient for use on paths. In cases where 3% cannot be achieved consideration should be given to limiting gradient to a maximum of 5% and provide shorter flatter sections. It is considered that 5% for uphill is suitable.

12.2.2 Landscaping and Trees

Consideration should be given to the types of trees being planted adjacent to the shared path. To minimise damage to the path due to tree roots, tree root barriers will be necessary. Trees must be located so their ultimate canopies will not impinge on the cyclist 'envelop', if not the tree will need to be limbed to approximately 2.5 metres to ensure the branches are not within the cyclists' path of travel.

If there are existing tree roots along the path alignment care will be required during construction to minimise any damage. If cutting tree roots and installing a tree root barrier is not possible, it is considered acceptable for slight gradient changes should the path need to rise to go over the roots.

Low level landscaping is suitable adjacent to shared paths, however plant species should be carefully considered and dense landscaping is not suitable should a cyclist need to swerve off the path. Species (eg Flax and grasses) that could encroach into the path must be placed a suitable distance from the path. Sightlines for personal and traffic safety must be retained. An alternative to landscaping could be the use of permeable surfaces such as turf cells.

Refer to the CSS for recommendations on weed control for the path. This is essential and should be supervised on site.

If service trenches exist within the cycle facility, then service covers must be flush with finished carriageway level. If work is required in the service trenches, contractors will need to provide an alternative route for cyclists during the works, but also finish the work to the cycleway standard (flush with the adjacent surface level).

12.2.3 Wayfinding Signage

This should be implemented in line with Part C.

12.2.4 Regulatory Signs and Markings for Shared Paths

Refer to Part C – Wayfinding and signage

The following details are provided for guidance until the completed document is released

Signs and markings compliant with Traffic Control Devices Manual for Shared Paths (Section 2.6 11.4 (1)) should be installed (typical use signs are shown below)

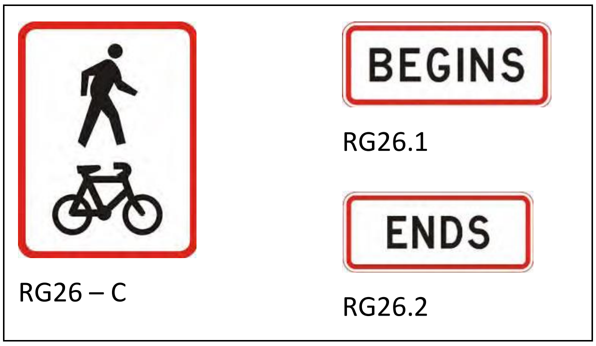


Figure 12-1: Shared Path Signs

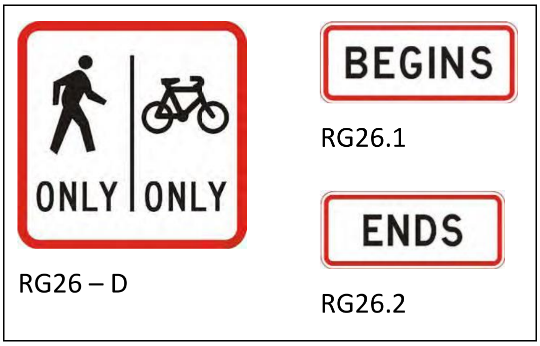
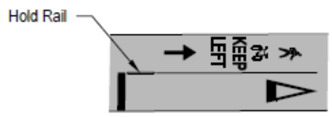


Figure 12-2: Separated Path Signs

If pedestrians, cycles, wheeled recreational devices or mobility devices are restricted to a specific side or part of a path, or where the path is separated for users travelling in different directions, a road controlling authority can use the above signs.

Standard details are provided for marking of shared paths to encourage users to travel on the left side of the path to allow room for overtaking.



Shared Pathway Symbols

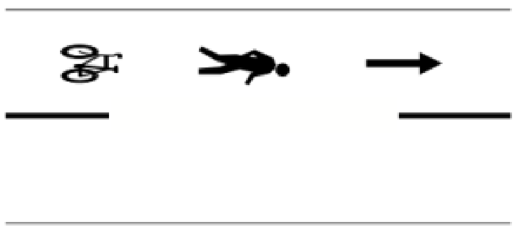


Figure 5-6: Centreline with pavement symbols advises path users to keep left.

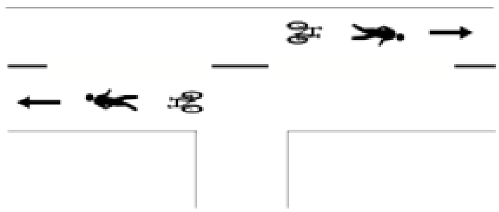


Figure 5-7: Pavement symbols and centreline should be located adjacent to path access points

12.3 On-Carriageway Routes – 1-way and 2-way Paths

12.3.1 Surfacing

Surfacing should be as specified by CSS, (usually paver laid) to make the ride smooth and comfortable. The preferred surface for the cycle facility is Asphaltic Concrete. Loose chip should not exist within the cycle facility.

Where paths cross through Central City and Suburban Centres alternative surfaces may be preferred to recognise the places function of the location. Interlocking concrete blocks or cobblestone paving can be used but care should be taken with foundations and laying to ensure the smoothest possible ride.

All surfacing must meet skid resistance requirements. Where necessary, grooving may be required in the surface. Investigations into NAASRA[9] testing should also be considered.

Potholes, rutting and other surface defects should be rectified. Patching and re-surfacing, are to be carried out as necessary in the cycle facility. Suitable pavement design will be required to minimise potential for ongoing potholes and pavement failure in the cycle facility. Particular consideration needs to be given where the Refuse Collection Vehicle may run on the Cycle Path. (Refer Section 15)

The finished seal level adjacent to the flat channel is to be flush, excess depth of seal causing a lip shall be removed through milling and smoothing of the surface to a tolerance of +5mm.

[9] *NAASRA – Surface roughness compliance test*

The seal joins can exist outside the cycle lane or within the edge line road marking but preferably within the traffic lane.

12.3.2 Drainage

The 380mm width of existing flat channels is generally excluded from the overall width of the cycle facility. Where dish channel exists, this will need to be replaced with kerb and flat channel (or covered dish channel or widen the cycle lane by 0.5m at pinch points/short lengths due to the driveway ramps).

Areas of ponding on a cycle route will have an effect on cyclists. Additional sumps and appropriate falls should be considered to facilitate run-off. Maximum encroachment of ponding should not exceed 700mm.

Sump grates should be replaced with cycle friendly grates and laid flush to the carriageway with minimal height tolerances. Designers will need to specify the angle of the sump. The drainage engineer will assist with inlet capacity checks.

Investigations could be undertaken on side entry pits, rain gardens and other forms of stormwater management/drainage systems.

The Best Practice Design Guidance assessment process provides informed desirable design practice. This process starts at the best practice or desirable design working towards the less than minimum desirable design solution documenting every decision through the entire process. The minimum desirable design is approved by the Best Practice Guide Team and less than minimum desirable design is approved by the Major Cycleway Steering Board. This process guides personal in making safety viable design options (Refer Figure 5-2).

The following table provides the desirable design objectives to be met for drainage cross-falls.

Table 12-1: Desirable Design Crossfalls

Design Attribute	Desirable Design Update currently being assessed	Desirable Minimum (to be agreed by exception by the TAG Group) *
Crossfall	2% paths 3-5% carriageways	1.5 - 3% Paths 2.5 – 7% Carriageways Minimum 1.5%, Maximum 5% at edge of Std Cwy Camber
Longitudinally	maximum 3% This is the % over longer lengths and does not include transitions	3% - 7% maximum

*and be ratified by the MCR Steering Board

12.3.3 Services

Whilst it would be preferable to not have services located within the cycle facility, the cost of relocation is high and therefore are unlikely to be relocated.

Therefore, if service trenches exist within the cycle facility, then service box lids / covers must be flush with finished carriageway level. Ideally service box lids / covers will be located outside the extent of the cycle facility. If work is required in the service trenches, contractors will need to provide an alternative route for cyclists during the works, but also finish the work to the cycleway standard (flush with the adjacent surface level).

Where there are service trenches that are not levelled and or sunken these are to be repaired and resurfaced to meet the standards for a cycleway for the full width of the cycle facility.

12.3.4 Transitions

Where an on-road path transitions to an off-road facility the kerb cut-down detail as shown on CSS SD613 is to be used. The transition detail is to be discussed with the contractor at the contract start up meeting. Designers should be invited to help supervisory staff on site in ensuring design details are being constructed correctly and the use of templates to check shape should be considered.

Kerb cut-downs are also to be provided where cycle parking is provided on the footpath. They need to be long enough for a cyclist travelling at speed to exit the carriageway without having to change the alignment of the ride. They should also be smooth.

12.4 Delineators and Cycleway Separator Designs

12.4.1 Selection Criteria

The type of cycleway delineator or separator will be chosen based on the MCA process. (Refer Section 3.9) Factors that will influence the type of delineator or separator chosen is drainage and details specified below. There are four three options presented as examples (in order of preference):

- Kerb profile delineator (continuous and segmented)
- Copenhagen treatment
- Clear zone treatment (pavement marking) preferable to have solid delineation where possible

Standard details have been produced for the solid delineators for use on the Major Cycleways.

If using a kerb profile the delineator should be no more than 100mm high (50mm absolute minimum) if using a kerb profile separator. This allows for kerb top markers to be placed on top of the kerb and allows appropriate access for Operational vehicles (esp. refuse trucks). It must be noted that the kerb profile delineator can be a trip hazard for elderly when crossing the road.

If considering a median island separated cycle track the same considerations for the height should be applied with 100mm high being the maximum height to avoid the cyclist striking the kerb. It is preferable to use a slanting slope on the cycle side such as those used on Tuam Street. On the traffic lane side the kerb is to be non-mountable to deter normal traffic parking on it.

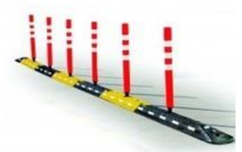
Where islands can be achieved between the cycle facility and the traffic lane, landscaping and trees should be encouraged to enhance the streetscape. The width of the separator will vary to suit different streets, however the edge profile should be consistent, such that users will know what to expect when moving around the network. Where islands are 1.5 metres (kerb face to kerb face) trees can be accommodated in trenches rather than individual tree pits.

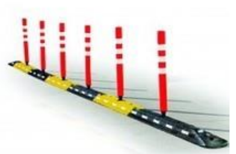
The third option for a separated cycleway is to raise the cycleway to footpath level. It is essential to provide a separating strip between the pedestrians and cyclists to seek to ensure that pedestrians do not start to use the facility as a footpath. It is also recommended that a paved strip be provided adjacent to parked cars to allow passengers to alight without having to use the cycle space (examples from Sydney are shown below).



Photo 10:Raised Separated Cycleway Sydney

Cycle Track Barrier Selection Matrix

	Striped Buffer	Delineator Posts	Armadillo Low	Flexible Traffic Separator	Linear Barrier	Cast in Place Barrier Curb	Parked Cars	Cast in Place Barrier Curb	Precast Barrier Curb	Copenhagen Cycle Path
										
Cost/Benefit										
Cost	★★★★	★★★	★★★	★★★	★★★	★★★	★★	★★	★	★
Cyclist Perceived Safety	★	★★★	★★	★★★	★★★	★★★	★★★★	★★★★	★★★★	★★★★
Other Considerations										
Durability / Maintenance	★★	★	★★★		★★★	★★★	★★★★	★★★★	★★★	★★★★
Sweeping	★★★★	Depends on Width	Depends on Width	Depends on Width	Depends on Width	Depends on Width	★★★	Depends on Width	Depends on Width	Depends on Width
Rubbish Collection	★★★★	★	★★★★	★	★★★★	★★★★	Depends on Time of Day	★★★★	★★★★	★★★★
Storm Water	★★★★	★★★	★★★	★★	★★★	★★★	★★★★	★★	★★	★
Traffic Compatibility (Motor vehicle / barrier interactions)	★★★★	★★★★	★★★	★★★★	★★★	★★★★	★★★	★★★★	★★★	★★★★
Aesthetics (Accounts for Full Life Cycle)	★★	★	★★	★★	★★	★★	★★★	★★★	★★★	★★★
Construction Impacts	★★★★	★★★	★★★	★★★	★★★	★★	★★★★	★★	★★★	★
Width Required										

Striped Buffer	Delineator Posts	Armadillo Low Bumps	Flexible Traffic Separator	Linear Barrier	Cast in Place Barrier Curb	Parked Cars	Cast in Place Barrier Curb	Precast Barrier Curb	Copenhagen Cycle Path
									

Notes										
General							Requires on-street parking			
Cost	Least expensive option	Good cost per meter	Very good cost per meter		Good cost per meter	Good cost per meter	ADA parking changes, pedestrian refuge islands, and ADA ramp changes can affect cost	Cast in place curbs are much less expensive due to reduced handling time	Custom precast curbs significantly increases cost over cast in place barriers	Reconstruction including storm water improvements is likely
Cyclist Perceived Safety	No physical element	Good vertical element	Decent deterrent for motorists. Low contrast.	Good vertical element	Good deterrent for motorist	Good deterrent for motorist	Strong deterrent for motorist. Good vertical element.	Strong deterrent for motorist. Horizontal separation.	Strong deterrent for motorist. Horizontal separation.	Strong deterrent for motorist.
Durability / Maintenance	Thermo / paint needs to be maintained	Flexible bollards may require frequent replacement	Good durability	Flexible bollards may require frequent replacement	Good durability	Good durability	No element to maintain	Very durable barriers	Good durability	Very durable design
Sweeping	No obstruction	If barrier is less than 8.5' from curb special sweeping equipment will be necessary	If barrier is less than 8.5' from curb special sweeping equipment will be necessary	If barrier is less than 8.5' from curb special sweeping equipment will be necessary	If barrier is less than 8.5' from curb special sweeping equipment will be necessary	If barrier is less than 8.5' from curb special sweeping equipment will be necessary	Sweeping could be done in off-peak or no parking hours if cycle track narrow	If barrier is less than 8.5' from curb special sweeping equipment will be necessary	If barrier is less than 8.5' from curb special sweeping equipment will be necessary	If barrier is less than 8.5' from curb special sweeping equipment will be necessary
Rubbish Collection	No obstruction	Height of barrer obstructs collection vehicles. Barrier could be driven over but not optimal.	Collection vehicles can drive over barrier	Height of barrier obstructs collection vehicles. Barrier could be driven over but not optimal.	Collection vehicles can drive over barrier	Collection vehicles can drive over barrier	Collection could be done in off-peak or no parking hours if cycle track narrow	Collection vehicles can drive over barrier	Collection vehicles can drive over barrier	Collection vehicles can drive over barrier
Storm Water	No obstruction	No / minimal obstruction	No / minimal obstruction	Barriers could be spaced to allow storm water to curb	No / minimal obstruction	No / minimal obstruction	No obstruction	Barriers could be spaced to allow storm water to curb	Barriers could be spaced to allow storm water to curb	Requires reconstruction of street to redesign stormwater system
Traffic Compatibility (Motor vehicle / barrier interactions)	No high speed motor vehicle traffic concerns	No high speed motor vehicle traffic concerns	May have concerns adjacent to higher speed traffic	No high speed motor vehicle traffic concerns	May have concerns adjacent to higher speed traffic	No high speed motor vehicle traffic concerns	May have concerns adjacent to higher speed traffic	Curb profile can be varied based on context	Appropriate for moderate traffic speeds	No high speed motor vehicle traffic concerns
Aesthetics	Neutral aesthetics	Damaged barriers quickly become ragged looking	Neutral aesthetics	Damaged barriers quickly become ragged looking	Neutral aesthetics	Good aesthetics over barrier life	Good aesthetics over barrier life	Good aesthetics over barrier life	Good aesthetics over barrier life	Good aesthetics over barrier life
Construction Impacts	Striping changes only	Barrier installation is quick and non-invasive. Bolt/glue solution.	Barrier installation is quick and non-invasive. Bolt/glue solution.	Barrier installation is quick and non-invasive. Bolt/glue solution.	Barrier installation is quick and non-invasive. Bolt/glue solution.	Curbs have to be poured in place and doweled into street	Hard construction may not be required	Curbs have to be poured in place and doweled into street	Barrier installation is quick and non-invasive. Bolt/glue solution.	Complete reconstruction is likely required
Width Required	Fairly compact barrier solution	Fairly compact barrier solution	Fairly compact barrier solution	Fairly compact barrier solution	Low-profile barrier solution	Low-profile barrier solution	Good if on-street parking is existing	Fairly compact barrier solution	Fairly compact barrier solution	Low-profile barrier solution

Modified from Source: http://www.peopleforbikes.org/blog/entry/wonktastic-chart-rates-15-different-ways-to-protect-bike-lanes

12.5 Bollards

The following details are provided for guidance until the completed document is released

Bollards can be hazardous to cyclists and pedestrians when place incorrectly in the pathway. The use of bollards within the cycle path on the Major Cycleway Network should be minimised to reduce conflict.

If a bollard is used, then the appropriate and correct pavement marking (elongated diamond) should be provided around the bollard to lead path/cycleway users away from the bollard.

If bollards are to be used, the bollard needs to be of a contrasting colour and reflectorised. A standard bollard will be developed and included in a later addition to this guide.

A standard detail for use of bollards and associated marking has been provided below.

These markings are required where a central bollard is installed within a cycleway to highlight the shift in the lane to avoid the structure.

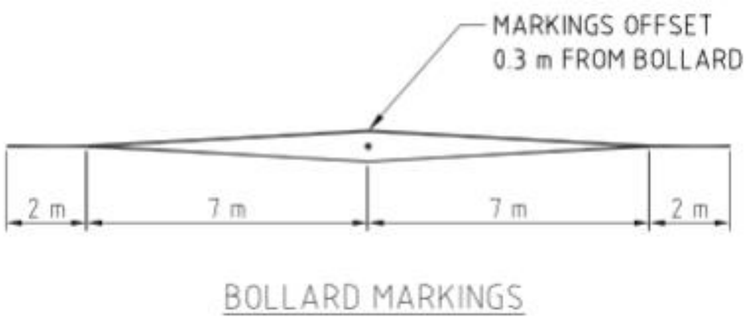


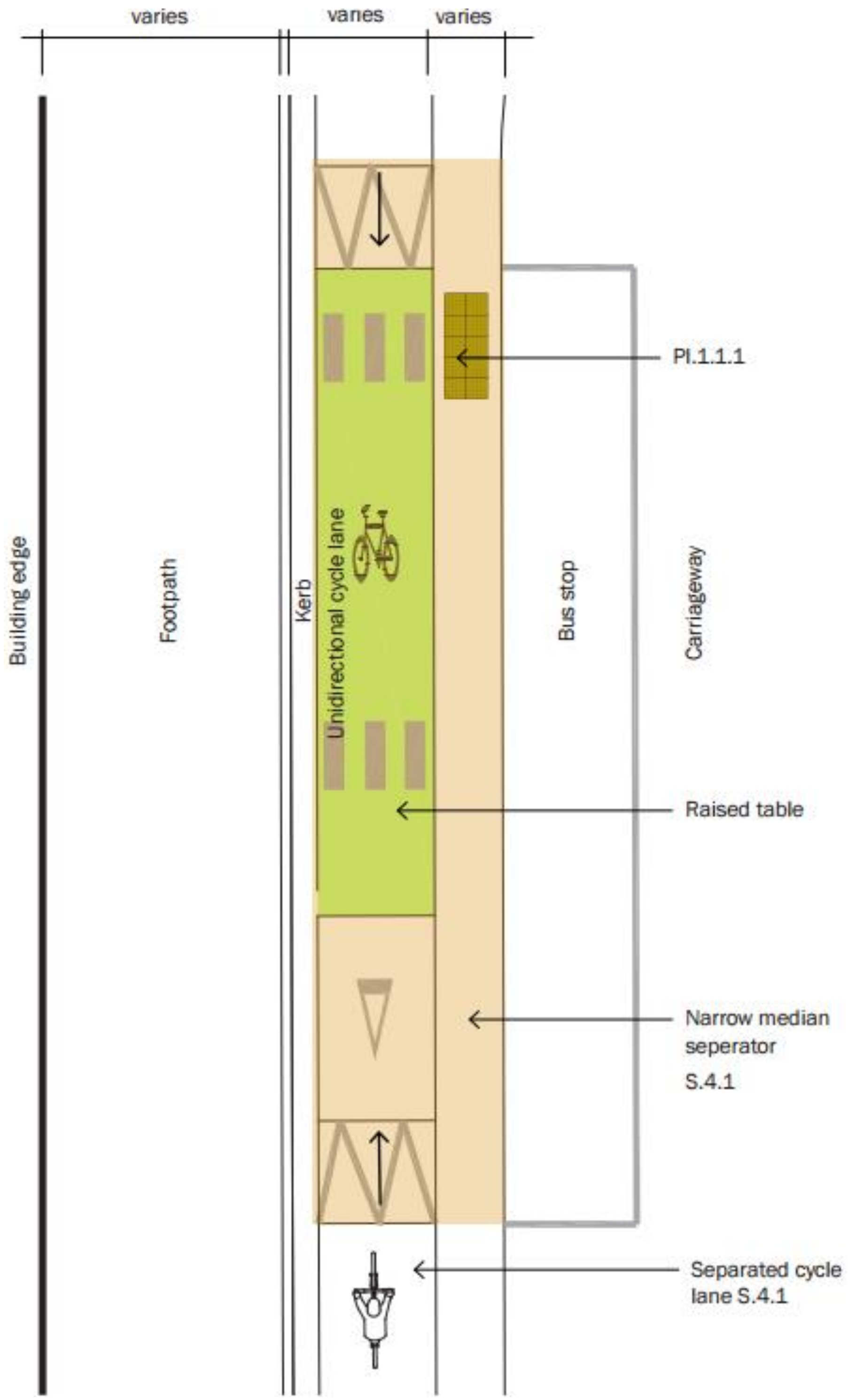
Figure 5-5: Example of Bollard Pavement Markings

12.6 Bus Stops

The following details are provided for guidance until the completed document is released

The objective is not to have MCR on Bus routes, however if unavoidable specific design needs to be undertaken in a case by case basis. This is to be incorporated into route prioritisation in Section 3.12.

Where a bus route also uses the same routes a major cycleway, the design of the bus stops need careful consideration. A standard detail has been produced for this.



Note: Designers to consider placement of handrails based upon volumes of predicted cycleway use

Where seats are provided at bus stops, the area around the seat needs to be sealed for ease of maintenance. This area can be made more attractive through the use of paving or of a paved appearance.

12.7 Hook Turns

To assist cyclists on a Major Cycleway to turn right from the priority leg to a side road, a hook turn can be used to allow a cyclist to face the direction of the side road and then choose a suitable gap in the traffic to cross. This reduces the need for a cyclist to enter the traffic lanes to turn right. Ensure suitable visibility for the cyclist waiting at the hook turn.

Symbol to be applied on the road as per MOTSAM.

New signage approved for use on the approach to hook turns.

12.8 Road Marking and Coloured Surfacing

When available this section will refer to the WayFinding guide which will become part of the guide. Refer to Part C – to be developed

The following details are provided for guidance until the completed document is released

A consistent standard of road markings is required. At a minimum level, cycle logos and appropriate lane marking should be provided.

The placement of cycle logos should be highly visible. The cycle symbol to the right of a vehicle entrance should be located approximately 750mm from the vehicle entrance and up to 1 metre as long as it is not obstructed by parked vehicles.

Cycle logo to appear upright to the oncoming road user to whom it relates too. E.G. at driveways to the car user, at hook turn boxes to the cyclist doing the hook turn.

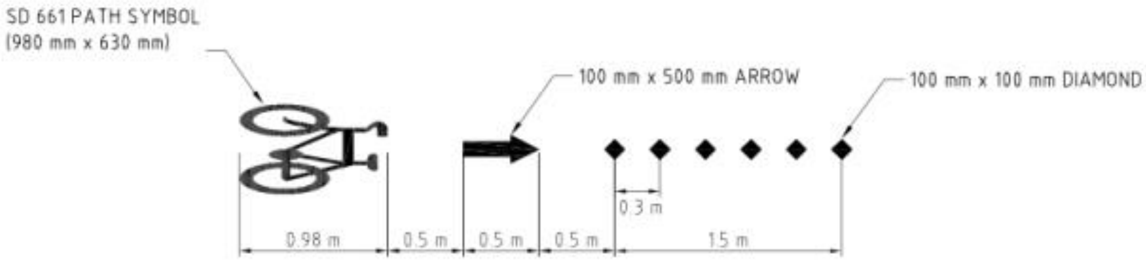
A symbol placed to the left of a vehicular entrance will need to be placed at 1 metre due to the position of the motorist on the right of the vehicle and the angle from the drivers’ eye through the passengers’ window to the pavement.

Mid-block crossings will not be marked with coloured surface across carriageway. However, green continuity lines can be included within the crosswalk.

Signal detector markings are utilised to highlight to the cyclist the location of the detector coils to ensure detection of the bicycle.

Cyclists sometimes cite that the traffic signals are unresponsive, and therefore use that to justify their running of a red light. Observation indicates that few cyclists know where to position the bicycle so that it actuates the detector loop. Given the low amount of metal in bicycles (especially now with carbon fibre construction) it is essential that the cyclist positions themselves directly over the detection coils.

AUSTROADS Part 14 (2009), Section 7.1.7 details the use of white diamond pavement markings and cycle symbol to indicate the correct position for actuation of the loop.



PROPOSED CCC STANDARD SIGNALS DETECTOR PAVEMENT MARKING

Coloured surfacing (apple green) is recommended at a minimum for the following:

- across priority intersections;
- at approaches and departures at intersections (including hook turn boxes/advanced stop boxes);
- high traffic generating driveways;
- areas of potential conflict;
- when cycleways are on the inside of a bend
- entry and exit points
- under symbols;
- To show clearly the linkages between sections of MCRs that may be of different cross section type. i.e. accessway to on street.

The design process should incorporate a specific pavement marking layout plan to ensure that the contractors have a clear source of information. Any changes during construction should be done in consultation with the design lead for the project.

Kerb Top Markers and Raised Pavement Markers should be used to highlight the cycle facility in poor light and darkness.

Where removal of old markings is required the operator should feather out the edges of the old markings so that sharp edge lines are not created, minimising the risk of confusion.

Mid-block Markings – Shared paths

Primary marking

- Shared path symbol (pedestrian over cyclist as per RG26C signage). Place at start, end and use repeaters. In parks and reserves, repeater markings do not need to be as frequent.
- No other markings are required (except at bus stops, crossings etc).

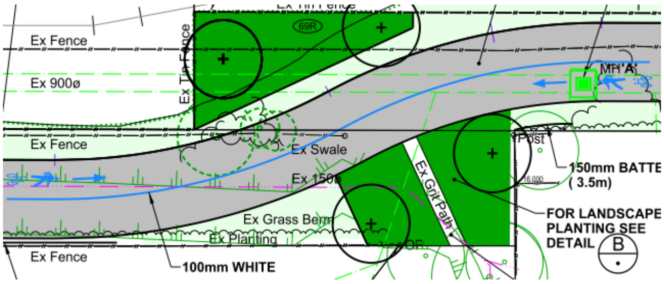
(marking to reflect signage)

Secondary marking

- Use messaging to inform users how to behave on the path. This should be a retrospective implementation if a problem arises.

Secondary marking

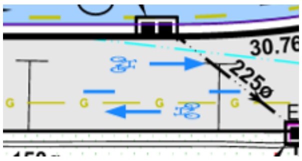
- Through bends provide a continuous centre line to encourage users to keep left (significant bends, not minor).



Mid-block Markings – 2-way cycleway

Primary marking

- Cycle symbols
- Use directional arrows with cycle symbols where required

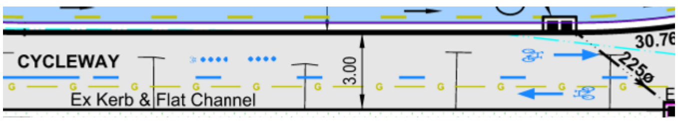


Primary marking

- No stopping lines are not required in the cycleway. Should be on the roadway side of a separator.

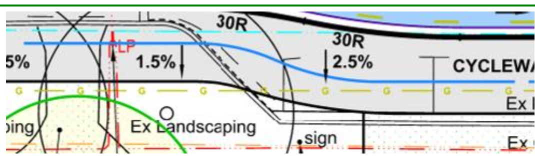
Secondary marking

- A white dashed centre line can be provided using a 1 metre long white line then a 3 metre gap. This is for where special circumstances exist. As volumes increase and user issues arise a centre line could be added at a later date.

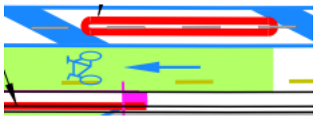
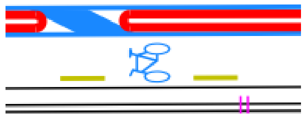


Secondary marking

- Through bends provide a continuous white centre line.



Mid-block Markings – 1-way cycleway

Primary marking	• Cycle symbols • Use directional arrows with cycle symbols • No other markings are required (except at bus stops, crossings etc).	 
Primary marking	• No stopping lines are not required in the cycle way they should be on the roadway side of a separator.	

Mid-block Markings – Greenways

Primary marking	• Sharrows • No other markings are required (except at bus stops, crossings etc.).	Awaiting guidance on use of Sharrows

Use of green surfacing

Provide coloured surfacing (apple green) for the following:

- high traffic generating driveways;
- areas of potential conflict;
- when cycleways are on the inside of a bend;
- entry and exit points;
- To show clearly the linkages between sections of MCRs that may be of different cross section type. i.e. greenway to separated cycleways.

The cycle lane symbol shall be marked at the start of a cycle lane and immediately beyond each intersection or other break in the lane. Spacing symbols between 50m and 100 m within an urban area is desirable.

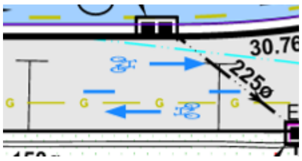
Driveways at shared paths

At every driveway on a shared path the following is proposed:

This is to be placed approximately 1 metre to the driver's side.

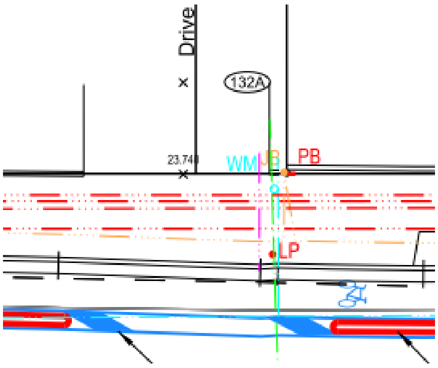
Driveways on bi-directional paths

At every driveway on a bi-directional path the following is proposed. Green surfacing is to be used at high traffic generators.



Driveways on uni-directional paths

At driveways on a uni-directional path it is proposed to place a cycle symbol adjacent to the driveway (approximately 1 metre to the driver's side). Green surfacing is to be used at high traffic generators.



13 Urban Design and Streetscape

This section is currently under development.

14 Major Cycleways Lighting

This chapter looks at major cycleways lighting design. Description and design objectives are provided to help the designer meet the design objectives outlined in this chapter.

14.1 Relevant Reference Documents:

Lighting for roads and public spaces Part 3.1: Pedestrian area (category P) lighting – Performance and design requirements AS/NZS 1158.3.1:2005

14.2 Description

Lighting can improve traffic safety, traffic flow, and social safety and increase the comfort of all road users including pedestrians and cyclists and simply making an area visible.

Unlike motorised vehicles most cycle lighting is limited in strength so its primary purpose is to alert other road users to the presence of the cyclist. Hence most cyclists are largely dependent on ambient or public lighting to see where they are going in safety and comfort.

The major cycleways are being planned to encourage more people to cycle and are expected to experience high levels of cycle usage as they connect popular origins and destinations with routes that offer high levels of service to the users.

Public lighting provided at the appropriate levels will help support the major cycleway routes in meeting their objectives and maintaining these through good auditing and maintenance programmes.

14.3 Design Objectives

The major cycleway routes will be used intensively as they form the main connections between main origins and popular destinations. They are being designed to introduce a higher than normal level of service for their users to encourage more to cycle. Part of this high LOS[10] is achieved through the level of public lighting provided.

Generally all major cycleway routes will be lit, as most are designed to attract commuter usage being on useful and needed links. However, some Major Cycleway Routes have sections that are primarily for recreational use and or some pass through sensitive areas, where it may be undesirable to encourage use in dark hours. So whilst generally the public lighting on Major Cycleway Routes will be provided to match the high Level of Service some may have no lighting at times appropriate to each section of the routes and their operational characteristics.

Variations to the standard lighting levels derived from the reference standards below will need signoff per the escalation of the standards process for Major Cycleway Routes

14.4 Reference Australian/New Zealand Standards

Generally, the lighting requirements applicable to the Major Cycleway Routes can be assessed using the contemporary standards that are used for Christchurch *Lighting for roads and public spaces Part 3.1: Pedestrian area (category P) lighting – Performance and design requirements AS/NZS 1158.3.1:2005*

[10] LOS – Level of Service

The tables presented in Appendix E below indicate lighting categories for pathways (including cycleways), refer to AS/NZS 1158.3.1:2005 for full details.

The example table presented in Appendix E below provides values of light technical parameters and permissible luminaire types for roads in local areas and for pathways, refer to AS/NZS 1158.3.1:2005 for full details.

This standard covers the operating characteristics of the route, the levels of usage, the risk of crime and the need to enhance the prestige to determine an applicable lighting level.

The above standard covers all geographical situations for routes - from road environments including where cycleways / paths are within the road corridor, parks and reserves, access ways etc. The proposed updating of the above standards to recognise and meet the Major Cycleway Routes objectives can be achieved through considered interpretation of the selection criteria and the corresponding population of the relevant tables which will result in identifying the lighting levels for differing sections of the routes.

In Table 2.2 of the lighting design requirements, the pedestrian / cycle activity is determined as high / medium / low.

The band of volumes within each of these is suggested to be high = over 500 pathway users (in total from pedestrians and cyclists) per peak dark hour, Med = 50 to 500 and low = less than 50. These may need some adaptation or refinement due to operating characteristics such as types of users, directional flows etc.

In some circumstances, such as where Major Cycleway Routes are on residential roads, supplementary/higher levels of lighting are likely to be needed over and above the current levels, however where they track on or closely alongside arterial roads the existing lighting levels are likely to suffice. It should be noted that LEDs are the preferred choice for lighting and that some upgrades may be achieved through simple replacement of the existing older style lamps.

In general terms the large majority of the MCR are predicted to fall within the lighting standards sub category of P3 or a variation of it.

This equates to between:

- 1.75 to 1.3 lux = horizontal luminance
- 0.3 to 0.26 lux = point horizontal luminance
- 0.3 to 0.22 lux = point vertical luminance (pathways)
- With luminance uniformity on the horizontal levels of 10

Variations (covered by the Standards) will include ramps, bridges and subways.

15 Refuse Collection

The following details are provided for guidance until the completed document is released

This chapter looks at refuse collection operation and impacts on major cycleway routes. Desirable design cross-sections are provided to help a designer meet the design objectives outlined in this chapter.

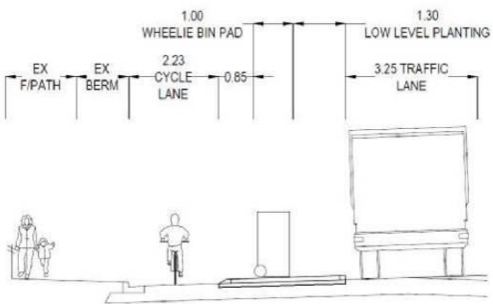
Within the design process, consultation shall be undertaken with the refuse collection companies. All decisions shall be formally documented with designs undertaken on a case by case basis. If the best practice desirable design cannot be met the process shown in Figure 5-2 is to be completed.

15.1 Desirable Refuse Collection Cross-sections

The cross sections options developed through the design guide have been tested to allow for refuse collection.

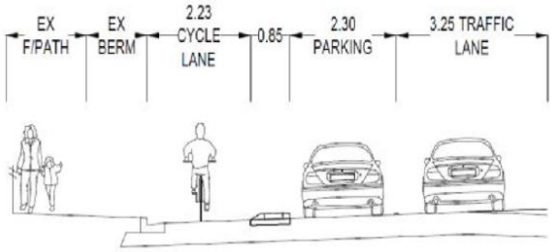
Bins need to be spaced 0.5m apart and from obstructions when put out on the street for residents. The largest bin is just under 1m square.

Cross Section 1 – Cycleway with Separator at build outs (between street parking)



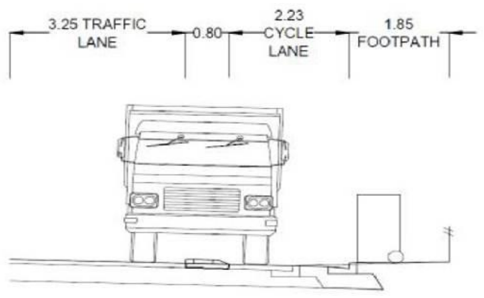
- 2.23m cycleway
- 0.85m kerbed island
- 1.0m wheelie bin pad + 1.3m wide planter
- 3.25m traffic lane

Cross Section 2 – Cycleway with Separator and street parking



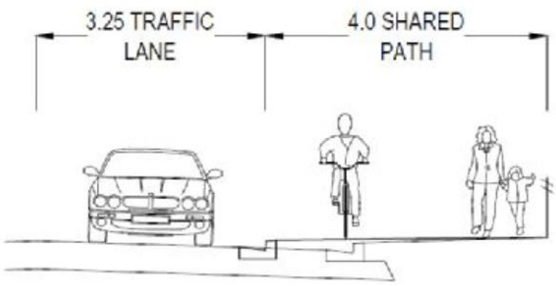
- 2.23m cycleway
- 0.85m kerbed separator island
- 2.3m parking bays
- 3.25m traffic lane

Cross Section 3 – Cycleway with Separator and no street parking



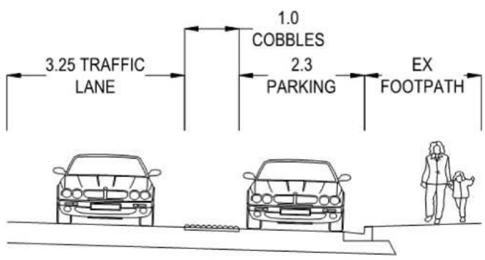
- 2.23m cycleway
- 0.80m kerbed separator island
- 3.25m traffic lane

Cross Section 4 – Raised Shared Path adjacent to traffic lane



- 4m shared footpath / cycleway
- kerb and channel
- 3.25m traffic lane

Cross Section 5 – Street Parking (opposite Shared Path or On street cycleway)



- 0.80m kerbed island adjacent to footpath
- 2.3m parking bay
- 3.25m traffic lane

Appendix A - Assessment matters for design context

The assessment matters are prompts only. Stages 1 and 2 of the assessment (volumes, %HGV's, adjacent land uses, speeds, barriers etc) will influence many of the chosen matters.

Design Outcome	Description	Indicators	-2 - 0 (option ruled out if couldn't be addressed)	0 - +2
Safety				
Collision Risk	Risk of cycle v motor vehicle crash mid-block	Alongside/behind	Higher level of interaction with vehicles	Minimise interaction with traffic especially in higher speed higher traffic volume environments
		Kerbside activity/door opening collisions	High level of interaction with parking and servicing if separation cannot be achieved.	Provide separation between the two uses. Can be road level, intermediate level or footpath level.
	Risk of cycle v motor vehicle crash at intersections and or driveways (vehicles turning over main cycle route, vehicles failing to give-way)	Vehicles turning over main cycle route	Frequent uncontrolled side roads	Fewer side road intersections and crossroads Fewer numbers of high generating driveways/commercial driveways that are not treated
		Other vehicles failing to give-way or not complying at traffic signals	Conflicting movements at signalised intersections not controlled	Provide separated phases/movements at intersections. Provide good visibility between driveways and intersections and people on bikes.
	Risk of cycle v pedestrian crashes	Recognise the place function and setting when passing through Suburban Centres, parks, coastal areas or alongside rivers. There are likely to be higher pedestrian demands in these locations also. Understand pedestrian needs including visually impaired pedestrians.	Providing narrow shared footpaths in high pedestrian demand areas or coastal environments	Minimise shared use paths along retail frontages and/or significant pedestrian attractors
			Pathways and facilities designed for anticipated volumes and speeds	Pathways and facilities designed for anticipated volumes and speeds
			Shared paths provided with no separation to frontage activities, roadways, rivers etc	Provide clearance from retail/education front doors, windows or driveways
			No measures to indicate to people on bicycles to slow down in shared environments	Reducing the speed differential through cycle calming

Design Outcome	Description	Indicators	-2 - 0 (option ruled out if couldn't be addressed)	0 - +2
			Blind corners	Good visibility between users
Feeling of Safety	Separation from Traffic on higher volume and higher speed roads		No separation on higher volume and high speed roads	High degree of separation on higher volume and higher speed roads
	Interaction with large vehicles		No separation from large vehicles at driveways and intersections	High degree of separation provided at driveways and intersections

Design Outcome	Description	Indicators	0-2	0 - +2
Directness				
Journey Time and value of time (compared to private car use)	Speed	Ability to maintain a good speed on the link for people on bikes with consideration of impact for journeys on foot.	Provision of narrow cycleways and pathways. No opportunity to overtake.	Width and geometry of cycle facility. Ability to overtake.
			Route is not accessible for all types of people riding bicycles.	Route can accommodate for different abilities and other types of cycles (cargo bikes, recumbent cycles, tandems, tricycles etc)
	Delays to cyclists at intersections	Ability to be able to provide priority at priority and controlled intersections	People on bicycles have to stop and give-way	Provide priority at intersections
			People on bicycles having to wait for long cycle times at signals	Minimise stops/starts
Directness/Route length	Deviation	Deviation from route (against straight line/nearest main road)/shortest route **when looking at sections bear in mind the overall route length.	More than 20%s	Less than 20%

Design Outcome	**Description & Indicators**	**Indicators**	**0-2**	**0 - +2**
Coherence				
Connections	Links origins and destination	Enhances linkages between places	Cycleway follows a series of winding pathways and detours	Creates safe, attractive and secure pathways. Avoids unnecessary winding of the pathway and address desire lines.
			Cycle route and facilities does not encourage people to use the streets and facilities	Creates positive streets and thoroughfares
	Easy to follow route	Natural cues to route and self-explaining routes	Users have to make a series of turns at intersections with over reliance on signage	Changing priorities to allow the cycleway to flow
Wayfinding	Easy to use	Consistent approach to information provided along the route	Inconsistent approach to legibility/natural wayfinding.	Ensure signs and markings are compliant with the wayfinding manual and the Traffic Control Devices Manual.

c	**Description & indicator**	**0--2**	**0 - +2**
Attractiveness/ Urban Design and Landscape Values			
Pleasant experience	Opportunities to enhance the journey	Route has functional use but low level of service in terms of journey experience	Route travels through interesting and beautiful places and provides opportunities to interact with activities.
		Route and facility provides no relief for users	Rest areas with seats and bike stands, bike repair stands and maybe an information board are provided along the route.
		Users of the route are continually exposed to the elements and traffic noise and fumes.	Regular shelter (either trees or manmade if necessary) for protection during rain events is provided.
		Users have no ability to pause and refresh.	Public conveniences such as toilets and water fountains are located along the route or are close by.
Greening	Opportunities to green the cycleways	No opportunities available for enhancing the route and also the Garden City image.	Trees and plantings, artwork and points of interest are provided along the route.

c	**Description & indicator**	**0--2**	**0 - +2**
Context	Incorporating and acknowledging the wider context of the route	Route and facility design stands out but not in a positive way.	Recognises and adds value to the landscape context
		Route is stark and unattractive when poor compromises are made	Cycleways and street designs adapt to local conditions and the setting in which it traverses
		Route and facility design contradicts the context of the area	Reflects social, cultural and economic context as well as physical elements and relationships
		Route unlikely to be supported by Heritage Team and public if unresponsive	Celebrates cultural identity and recognises heritage values of a place
	Collaboration	Lessons learnt from projects are ignored	Communication and sharing of knowledge. Engages with the community on designs
Character	Protecting or enhancing local distinctiveness and identity	Cycleway detracts from the area it is passing through	Reflects neighbourhood identity, provides positive characteristics and is appropriate to the locality.
Choice	Ensuring flexibility of choice for the community	Limited scope to adapt cycleways as demands and requirements change	Ensures designs are flexible and adaptable
		Pathways and routes are not designed for all users including adapted bicycles	Ensures design is accessible for all
Creativity	Creating strong identities	Designs and route choice are weak and doesn't support the local identity	Uses innovative solution to enhance the experience and journey
Amenity Values	Inviting and interesting	Cycle route is merely a route from A to B. Low level of service for journey experience	Contribute to people's appreciation of its pleasantness, aesthetic coherence, and cultural and recreational attributes

Design Outcome	**Description & indicator**	**0--2**	**0 - +2**
Comfort			
Width of Pathways	Consideration of volume, speeds and demands on cycle facilities/paths and be clear of obstacles	Pathways and facilities are not designed for volumes and speeds, which results in users feeling uncomfortable	Facilities are designed for anticipated volumes and locations so users feel comfortable on the cycleway of pathway
Custodianship	Environmentally sustainable, safe and	Creates and intrusion into protected areas	Protects landscapes, systems and heritage areas

	healthy solutions	Large amounts of landscaping and individual features create a lot of maintenance work along the route, which if not undertaken will have knock on effects.	Low cost maintenance and on-going costs for the route
Offers consistent level of protection	People travelling along the route are provided with consistent levels of protection	Route is inconsistent and people on bicycles don't know what to expect.	Consistent level of protection is achieved.
Gradient	Ease of uphill travel & safety of downhill travel	Users find it difficult to climb steep gradients. Therefore, not accessible for all users	Additional measures provided such as places to pause out of the way of the path/other people travelling on bicycles.
Surface material and quality	Materials should reflect the land-use and place and enhance the streetscape	Inappropriate materials chosen for the route and areas of special interest. Results in an unattractive route for cycleway users.	A robust materials palette has been established for the corridor with spots for points of interest. Achieve separation between the cycle and pedestrian paths with landscaping/ contrasting surface texture. Minimise shading that cause frost/ice

Design Outcome	Description & indicator	0--2	0 - +2
C P T E D			
CPTED (refer to National Guidelines for Crime Prevention through Environmental Design in New Zealand) Part 1: Seven Qualities of Safer Places	Access: Safe movement and connections	Perception of unsafe areas could deter users from using the route.	Routes are well defined with safe access between destinations and no entrapment spots.
	Surveillance and sightlines: See and be seen Activity Mix: Eyes on the Street	Routes pass through secluded areas with little frontage activity	Routes have good passive surveillance, are overlooked and are well lit to maximise visibility
	Layout: Clear and logical orientation	Users are unsure of route and feel uncomfortable in uncertain circumstances	Design supports safe movement and enhance personal safety. Entrances and exits to parks etc are well signed.
	Sense of ownership: Showing a space is cared for	Route is not well maintained and uses choose to find alternative routes.	Route is clearly identified and it is clear of ownership (if crossing through private land etc).
	Quality environments: Well designed, managed and maintained environments	Route is poorly constructed and users choose alternative routes. If uncared for is less likely to be attractive.	The cycle facility is well designed and constructed to a high standard. Materials and fixtures should be vandal resistant.

Appendix B Assessment matters for community effects

Design Outcome	Description	0--2	0 - +2	Supporting programmes/mitigation
Residents				
Changes to access to residential property	Access to property is altered through network changes	Additional journey times through cul-de-sacs	Could address existing rat running issues and remove unnecessary traffic.	Local Area Traffic Management Schemes to slow vehicles
		Additional traffic on local routes through the use of traffic signals. **The provision of traffic signals should align with the hierarchy in the Infrastructure Design Standard.	Improved access to amenity/local shops/education, reserves through alternative modes of travel.	Local Area Traffic Management Schemes Biodiversity Action Plan
	Network effect of changes	Changes move traffic on to a lower order road in the hierarchy such as local residential streets	Displaced traffic is moved to higher order roads.	Christchurch Transport Strategic Plan Network Management Plan
Changes to parking provisions on-street	Removal of on-street parking	Number of car parks lost is unacceptable/cannot be balanced on neighbouring streets. The existing parking demands should be assessed, this should also identify if long-term parking is an issue from surrounding businesses on residents.	The removal of parking increases safety for road users, people on foot, bicycle, public transport and vehicles. Increase in available space for pedestrian crossings, landscaping.	Parking plan and strategy to support cycleway Draft Suburban Parking Policy Central City Parking Plan Parking Strategy for the Garden City
Changes to the streetscape	Removal of trees and landscaping	Reducing the attractiveness of the street through tree removals and loss of landscaping. Changing the local environment that could induce traffic volumes and speeds.	Improved amenity through landscaping and tree planting can have additional benefits on reducing traffic speeds. Add to the character of the local built environment	Local Area Traffic Management Schemes Biodiversity Strategy Special Amenity Areas

Design Outcome	Description	0--2	0 - +2	Supporting programmes/mitigation
Business/School				
Changes to access	Access to property is amended through network changes	Additional journey times	Could address existing rat running issues for local shopping centres.	Travel Plans for Business and Schools Walkable centres in CTSP
		Additional traffic on local routes through the use of traffic signals	Improved access to amenity through alternative modes of travel	Improved access for people on foot, by bike or public transport. CTSP.
Changes to parking provisions on-street and loading	Removal of on-street parking	Number of car parks removed cannot be balanced on neighbouring streets or time restricted to improve turnover. The existing parking demands should be assessed; this should also identify if long-term parking is an issue for businesses.	Parking is provided for local use to support business functions such as loading, and short-term parking.	Parking plan and strategy to support cycleway Draft Suburban Parking Policy/Central City Parking Plan Parking Strategy for the Garden City Provide additional on-street cycle parking Walkable centres in CTSP Undertake shopper surveys on-street to determine travel demands to suburban centres and local businesses.
Changes to the streetscape	Removal of trees and landscaping	Reducing the attractiveness of the street through tree removals and loss of landscaping.	Improved amenity through landscaping and tree planting can have additional benefits on reducing traffic speeds. Makes the environment more pleasant and support suburban centres. Create more public space for people to enjoy the centres.	Local Area Traffic Management Schemes Biodiversity Suburban master plans

Design Outcome	Description	0--2	0 - +2	Supporting programmes/mitigation
Network effects				
Changes to the transport network	Alignment of transport network	Route option and design doesn't align with the One Network and CTSP	Route option and design aligns with the One Network and CTSP	CTSP Cycle Design Guide Network Management Plan
		Inappropriate use of traffic signals (for example use of traffic signals on local roads) **any new signals being promoted for the MCR route should have early discussions with CTOC.	Improved access to amenity through alternative modes of travel/cohesion	CTSP Cycle Design Guide Network Management Plan Infrastructure Design Standard.
Changes to operations	Rubbish collection	Design compromises the ability for rubbish collection	Design has considered rubbish collections	Early discussion with Waste Team at CCC
	Street cleaning	Design compromises the ability for street cleaning, and has knock on effect under heavy rainfall.	Design allows for street cleaning	Early discussion with Waste Team at CCC
Changes to maintenance			Improved amenity through landscaping and tree planting can have additional benefits on reducing traffic speeds	Local Area Traffic Management Schemes Biodiversity

Appendix C - Assessment Matters for Risk

Design Outcome	Description	0--2
Approvals	Resource Consents /Regional Consents	Identify early any consenting requirements particularly around Heritage, Waterways etc.
Construction	Constructability	All routes will carry construction risk. Identify as many issues as possible through the route selection MCA.
External factors	Land purchase/easements/agreements	Identify property requirements early. Consideration be given to increase programme timing and costs.

Appendix D – Road Safety Audit

The Road Safety Audit process (as a component of the SANF review) is intended to deliver a safe road system. The Road Safety Audit Guidelines process suggests a ranking system is used that assesses the likely frequency of a crash occurring, and the likely outcome. With the adoption of the Safe System, the emphasis is on avoiding the more severe casualty outcomes. The guideline promotes the use of a matrix that rates the frequency and severity of a crash for each issue. The qualitative assessment requires professional judgement and a wide range of experience in projects of all sizes and locations.

If a feature or element of the proposed infrastructure is considered to present a safety risk to users, the guidelines suggest the following categories:

The frequency and severity ratings are used together to develop a combined qualitative risk ranking for each safety issue using the Risk Assessment Matrix in Table 15-1 below. The qualitative assessment requires professional judgement and a wide range of experience in projects of all sizes and locations.

Table 15-1: Concern assessment rating matrix

Severity (likelihood of death or serious injury)	**Frequency** (probability of a crash)			
	Frequent	Common	Occasional	Infrequent
Very likely	Serious	Serious	Significant	Moderate
Likely	Serious	Significant	Moderate	Moderate
Unlikely	Significant	Moderate	Minor	Minor
Very unlikely	Moderate	Minor	Minor	Minor

While all safety concerns should be considered for action, the Major Cycleway Steering Group will make the decision as to what course of action will be adopted based on the guidance given in this ranking process with consideration to factors other than safety alone. As a guide a suggested action for each risk category is given in Table 15-2 below.

Table 15-2: Concern categories

Concern	Suggested action
Serious	Major safety concern that must be addressed and requires changes to avoid serious safety consequences.
Significant	Significant safety concern that should be addressed and requires changes to avoid serious safety consequences.
Moderate	Moderate safety concern that should be addressed to improve safety.
Minor	Minor safety concern that should be addressed where practical to improve safety.

In addition to the ranked safety issues it is appropriate for the safety audit team to provide additional comments with respect to items that may have a safety implication but lie outside the scope of the safety audit. A comment may include items where the safety implications are not yet clear due to insufficient detail for the stage of project, items outside the scope of the audit such as existing issues not impacted by the project or an opportunity for improved safety but not necessarily linked to the project itself. While typically comments do not require a specific recommendation, in some instances suggestions may be given by the auditors.

Appendix E – Lighting Standards

TABLE 2.2

LIGHTING CATEGORIES FOR PATHWAYS (INCLUDING CYCLEWAYS)

1	2	3	4	5	6
Type of pathway		**Selection criteria[a,b]**			**Applicable lighting subcategory**
General description	**Basic operating characteristics**	**Pedestrian/ cycle activity**	**Risk of crime[f]**	**Need to enhance prestige**	
Pedestrian or cycle orientated pathway, e.g. footpaths, including those along local roads[d] and arterial roads[e], walkways, lanes, park paths, cycleways	Pedestrian/cycle traffic only	N/A	High	N/A	P1[c]
		High	Medium	High	P2[c]
		Medium	Low	Medium	P3
		Low	Low	N/A	P4

[a] The selection criteria of Columns 3 to 5 should be separately evaluated. The highest level of any of the selection criteria that is deemed appropriate for the pathway will determine the applicable lighting subcategory.

[b] Refer to Appendix C for guidance on choosing the applicable level of each selection criteria for the environment and purpose of a lighting scheme.

[c] Where there are vertical surfaces of high reflectance (e.g. light coloured walls bordering on an alleyway) alongside the pathway, the next lower lighting subcategory may be selected.

[d] Where the footpath is along a local road and subcategory P1 or P2 is selected, the light technical parameters for that subcategory only apply to the formed footpath. Where subcategory P3 or P4 is selected, the light technical parameters apply to the whole road reserve width, including the footpath.

[e] Footpaths associated with arterial roads are deemed not to require separate lighting provided that—

(i) the road is lit to at least the applicable level of Category V lighting complying with AS/NZS 1158.1.1; and

(ii) the footpath is unshaded, e.g. there are no substantially continuous building awnings, and the footpath is contiguous with the roadway.

If the footpath is shaded, or is separated from the roadway by an extensive nature strip or a service road, it shall be provided with lighting to at least subcategory P4.

[f] The risk levels 'High', 'Medium' and 'Low' correspond to the classifications of the same names in HB 436.

TABLE 2.6

VALUES OF LIGHT TECHNICAL PARAMETERS AND PERMISSIBLE LUMINAIRE TYPES FOR ROADS IN LOCAL AREAS AND FOR PATHWAYS

1	2	3	4	5	6
Lighting subcategory	Light technical parameters				Permissible luminaire type (see Table 2.10)
	Average horizontal illuminance[a,b] ($\overline{E}_h$) lux	Point horizontal illuminance[a,b] (E_{Ph}) lux	Illuminance (horizontal) uniformity[c] Cat. P (U_{E2})	Point vertical illuminance[a,b] (E_{Pv}) lux	
P1	7	2	10	2	Type 4 where part of a road reserve or Types 2, 3, 4 or 6 elsewhere
P2	3.5	0.7	10	0.7	
P3[e]	1.75	0.3	10	0.3[d]	
P4[e]	0.85	0.14	10	N/A	
P5[e]	0.5	0.07	10	N/A	

[a] These values are maintained.

[b] Compliance is achieved by being greater than or equal to the applicable table value.

[c] Compliance is achieved by being less than or equal to the applicable table value.

[d] The vertical illuminance requirement only applies when subcategory P3 is selected for application to pathways, i.e. it does not apply for local roads.

[e] The values for New Zealand for subcategories P3 and P3R are also subject to the lamp source lumen derating values as per Clause 2.6. The New Zealand values are as per the table below. In New Zealand, when the luminaires are to be supported on existing reticulation poles, the subcategories P3R and P4R may be designated and the following reduced levels applied:

Subcategory	$\overline{E}_h$	E_{ph}	E_{pv}
P3 (NZ)	1.3	0.22	0.22
P3R	0.9	0.11	N/A
P4R	0.7	0.07	N/A

Subcategory P5 lighting shall not be chosen for this situation.

NOTES:

1 Validation of the values in Columns 2 to 5 is by calculation, not field measurement. This is particularly relevant to small values in Columns 2, 3 and 5, which will typically be difficult to validate by field measurements.

2 See Section 3 for the design methods and requirements for use in assessing compliance with the specified light technical parameters.

Appendix F – Best Practice Design Guide Process