Cycling by Design

TRANSPORT SCOTLAND
CÒMHDHAIL ALBA

sustrans
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Comments

Cycling by Design will be updated regularly to take account of project experience and changes to the legal or design environment.

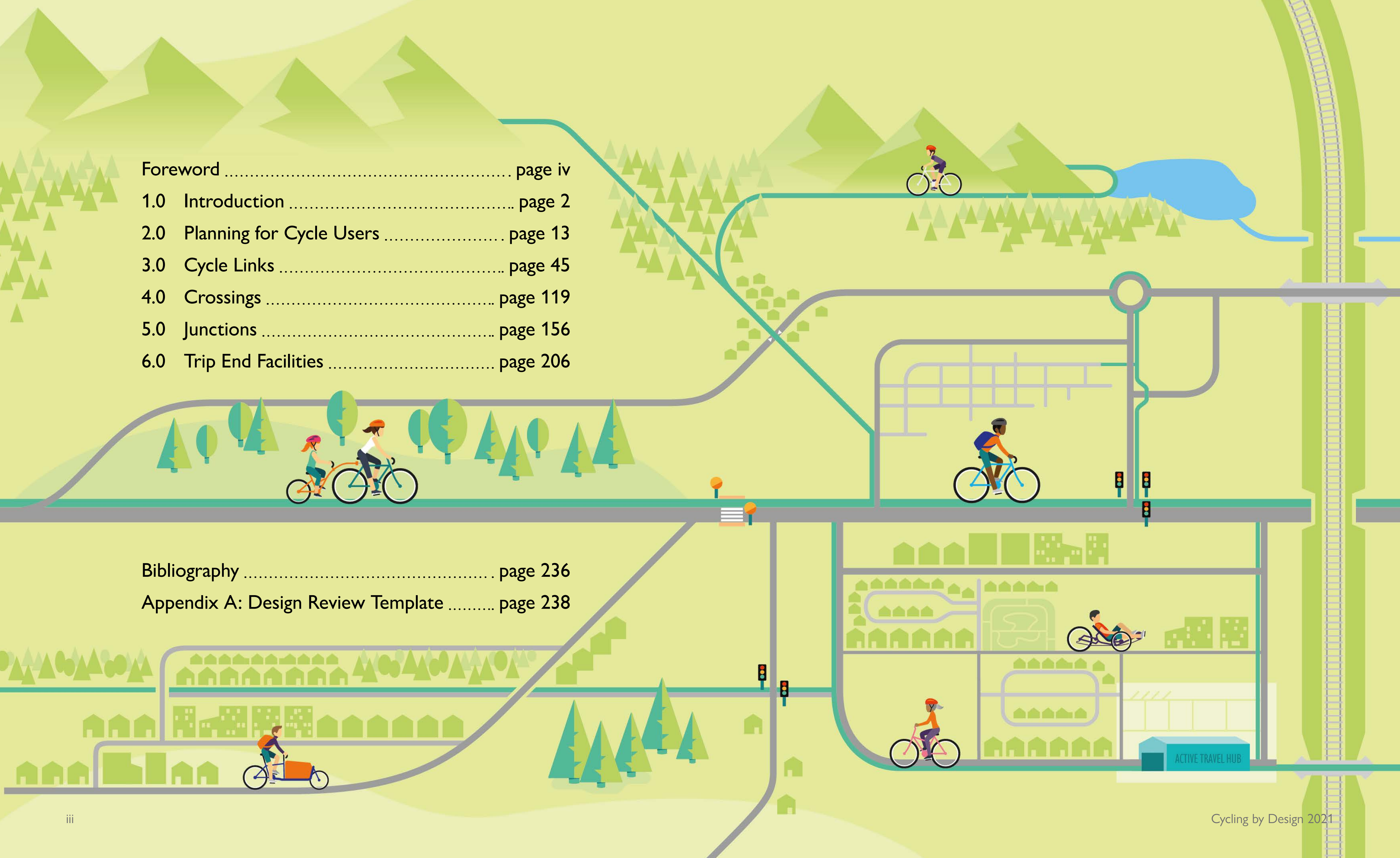
These updates will be overseen by a Steering Group comprising Transport Scotland, Sustrans and SCOTS.

Any feedback on the content of the document should be directed to us via e-mail.

Document History

Revision	Date	Description
Rev 0	September 2021	First publication of expanded Cycling by Design endorsed by Steering Group

Contents



Foreword

In the last 18 months, many people have chosen active travel more often, whether for leisure or everyday journeys. They will have seen for themselves how much progress is needed to make cycling safe and attractive everywhere. As road traffic levels have increased again, this has been all the more apparent. I am therefore pleased to welcome this new guidance document for the design of permanent cycling infrastructure in Scotland. It will continue to develop, and I would like to thank the members of the steering group whose continued involvement will help to achieve further improvement.

This is an exciting time for active travel in Scotland, with record levels of investment and as we work towards our 2030 vision for walking, wheeling and cycling to be the most popular choices for shorter everyday journeys. Key recommendations of the Active Travel Task Force in 2018 highlighted the need for consistent, high quality infrastructure to drive behavioural change and remove barriers to cycling, and this design guidance provides everyone with the tools needed to achieve these aims.

For Scotland to realise its active travel potential, we need much more investment in active travel infrastructure, as well as consistency when delivering it. That is what this document aims to provide.

This publication will support Scotland's green recovery from the impacts of the Covid-19 pandemic, as we focus on delivering a transport system that supports the vision of the National Transport Strategy – one which reduces inequality, takes climate action, helps deliver a sustainable economy, and improves our health and wellbeing. More people choosing to walk, wheel and cycle will reduce pollution and emissions, will improve the quality of our local environments as well as reducing our contribution to climate change.

I am pleased to present Cycling by Design to you, in conjunction with our delivery partners, whose contributions to the development of this guidance have been invaluable.

Patrick Harvie MSP

Minister for Zero Carbon Buildings, Active Travel and Tenants' Rights

I commend this revised and updated Cycling by Design guidance to all local authorities, regional transport partnerships and supporting agencies. This revised guidance is now directly applicable to all roads and locations, including urban, suburban and rural locations as well as trunk roads.

This high quality, user-focussed design guidance will support local authorities and developers to provide cycling infrastructure to support the growth in cycling, and active travel more widely, and sustain the continued growth of our local communities and economies. This guidance provides clear direction to enable designers to provide cycle infrastructure which is fit for purpose for all users.

It is intended that this guidance will remain a living document and I encourage all local authorities and SCOTS members to provide feedback on the guidance to enable further refinement to benefit all of our communities across Scotland.

Ewan Wallace

Chair, Society of Chief Officers of Transportation in Scotland (SCOTS)

Sustrans' aspiration is for Scotland to have a family of holistic design guidance that helps deliver healthy and sustainable built environments fit for the 21st Century. More cycling is a key element of success and we are delighted to have worked alongside Transport Scotland and SCOTS to produce this document.

We hope that Cycling by Design enables designers to deliver roads, streets, paths and places that encourage people to cycle, regardless of their age or ability. We hope that it is sufficiently strategic to communicate the Sustainable Travel Hierarchy vision, while detailed enough to provide the practical tools to deliver it. We hope that it enables holistic and context-driven thinking and innovation.

This is not the last word. Guidance must evolve to remain relevant. As part of the Steering Group we commit to further develop the culture of innovation, learning, and sharing necessary to move beyond outdated approaches that were developed in an era of planning for motor vehicle dominance.

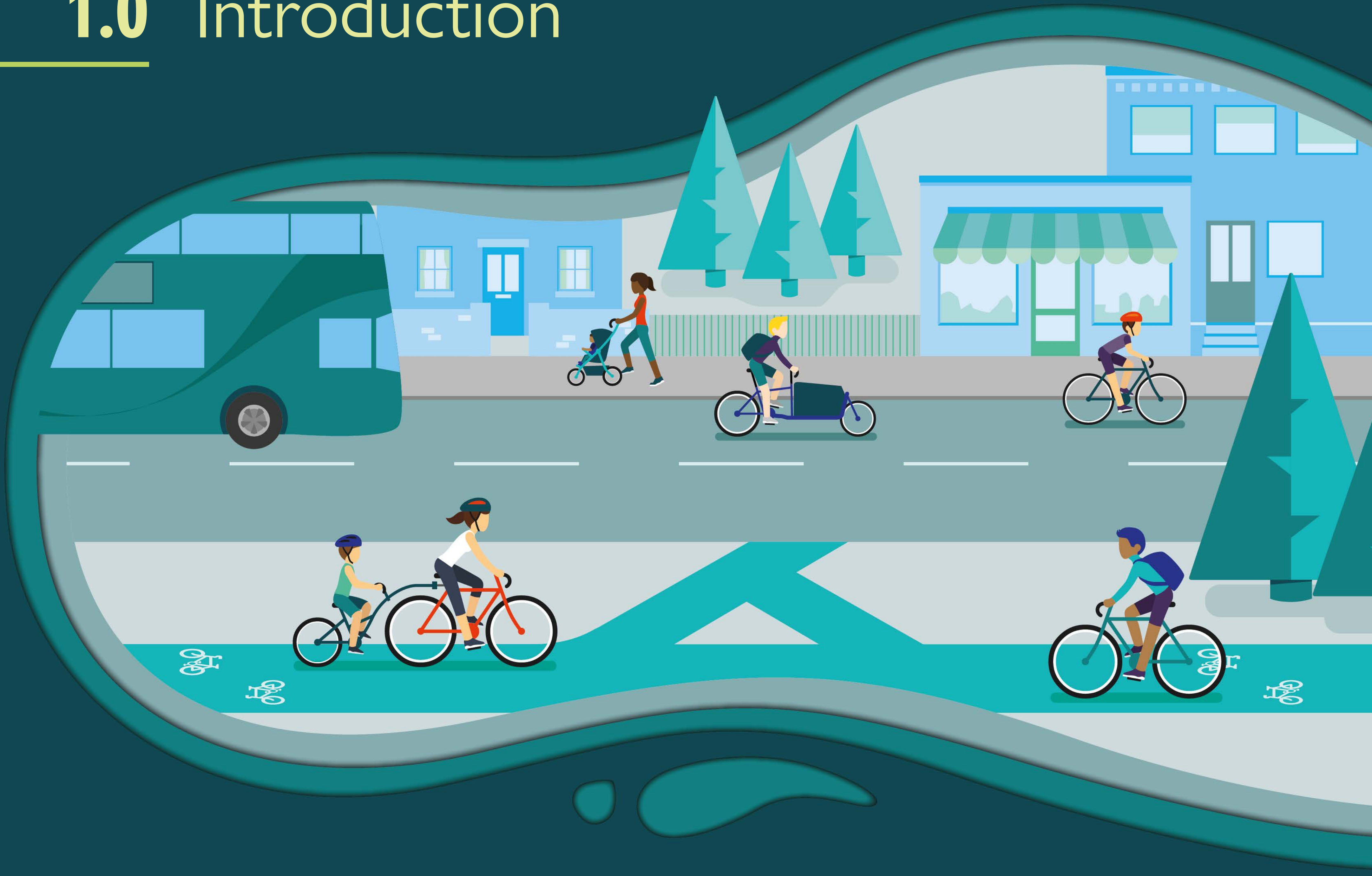
Everyone reading this has a role to play. Your feedback will help us to keep Cycling by Design relevant, to plug gaps and learn from your experiences.

I look forward to working with you as we deliver on this commitment.

John Lauder

Deputy CEO, Sustrans

1.0 Introduction



1.0 Introduction

Figure Numbers

1.1 Context

Cycling by Design provides guidance for cycling infrastructure design on all roads, streets and paths in Scotland. It aims to ensure that cycling is a practical and attractive choice for the everyday and occasional journeys of all people, particularly new, returning or less confident users.

Encouraging people to travel more actively and sustainably is at the heart of the Scottish Government's ***National Transport Strategy (NTS2)*** vision and priorities and will contribute to the equality, health and carbon reduction targets that the strategy supports. High-quality cycling infrastructure can attract a wider range of people to take up cycling to meet these wider policy aims.

The guidance has been developed to respond to a key recommendation by the ***Active Travel Taskforce***. The taskforce reported its findings in 2018 and sought to "improve delivery of the ambitious and inclusive walking and cycling projects in Scotland that will help to create high-quality places and communities that support health and wellbeing". Cycling by Design supports this objective and the key infrastructure recommendations made by the taskforce.

The guidance supports the integration of cycling with people walking and wheeling in a holistic and attractive environment that serves the needs of all users, so that designs can facilitate the implementation of the Scottish Government's Sustainable Travel Hierarchy, shown in Figure 1.1.

The guidance provides designers with the information they need to make good design decisions and to prepare solutions which are appropriate in the overall context of each specific situation.

Feedback will be critical to the evolution and success of the document. It will remain under continual review and will be updated to reflect emerging best practice and comments from designers across Scotland.

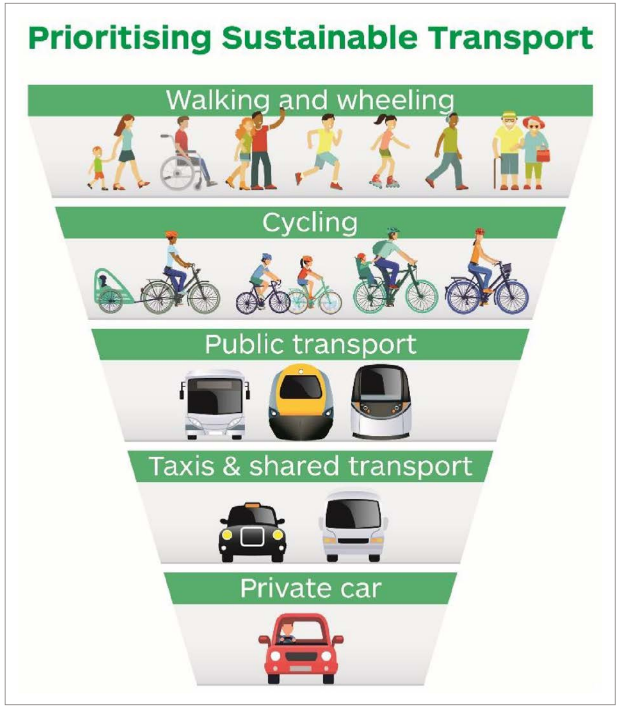


Figure 1.1: Sustainable Travel Hierarchy (National Transport Strategy 2)

1.2 Relationship with policy and strategy

Appropriate application of the guidance will allow designers to contribute towards national and local policy objectives to reduce emissions, tackle congestion, increase tourism and improve physical and mental health. It directly supports the Vision, Priorities and Outcomes of the NTS2 as detailed below.

NTS2 Vision: We will have a sustainable, inclusive, safe and accessible transport system, helping deliver a healthier, fairer and more prosperous Scotland for communities, business and visitors.

Role of Cycling by Design: To guide the delivery of high-quality infrastructure to help meet this vision.

NTS2 Priority: Reduce Inequality

- Will provide fair access to services we need
- Will be easy to use for all
- Will be affordable for all

Role of Cycling by Design: Ensure cycling infrastructure is designed to attract all potential cycle users, regardless of age, gender, ethnicity or disability, and is fully integrated with other modes.

NTS2 Priority: Take Climate Action

- Will help deliver net-zero target
- Will adapt to the effects of climate change
- Will promote greener, cleaner choices

Role of Cycling by Design: Promote consistent and cohesive cycling infrastructure that encourages users to choose more sustainable ways of travelling. Allow opportunities for planting, sustainable drainage and other forms of blue-green infrastructure to enhance cycling facilities.

NTS2 Priority: Help Deliver Inclusive Economic Growth

- Will get people and goods where they need to get to
- Will be reliable, efficient and high quality
- Will use beneficial innovation

Role of Cycling by Design: Guide designers on providing high-quality infrastructure that reduces cycle user journey times and provides space for sustainable modes of transport.

NTS2 Priority: Improve our Health and Wellbeing

- Will be safe and secure for all
- Will enable us to make healthy travel choices
- Will help make our communities great places to live

Role of Cycling by Design: Put the safety of all users at the forefront of design, regardless of their ability or experience. Contribute to healthy travel choices by ensuring the delivery of high-quality cycling infrastructure. Provide guidance on integrating cycling infrastructure with placemaking opportunities.

Appropriate application of the guidance will also contribute positively to the development and application of the following key policies, strategies and initiatives:

- **National Planning Policy** – by establishing national guidance on how to plan cycle networks, implement attractive cycling infrastructure, and support the enhanced integration of land use planning and sustainable transport planning as presented in ***Scottish Planning Policy*** and the ***National Planning Framework (NPF3)***. Preparation of Scotland's fourth ***National Planning Framework (NPF4)*** is underway, with new policy positions on low carbon developments and 20-minute neighbourhoods proposed, which Cycling by Design guidance will also support.
- **Active Travel Framework outcomes** – by improving the quality, safety and accessibility of cycling infrastructure and contributing to more people choosing to cycle.
- **Active Travel Taskforce recommendations** – by providing best practice design guidance that will allow a more cohesive cycle network to be developed.
- **Cycling Action Plan for Scotland (CAPS)** – by ensuring that future cycling infrastructure is attractive to new users who may not be confident or experienced enough to use the current network, thereby increasing the numbers of people choosing to cycle.
- **National Cycle Network (NCN)** – by creating enhanced design requirements to improve the quality and attractiveness of the existing network.
- **National Walking and Cycling Network (NWCN)** – by improving the quality of paths designed for cycling as part of the growing network.
- **Trunk Roads Cycling Initiative** – by providing clear guidance to designers on the quality of the cycling infrastructure that should be incorporated in trunk road schemes.
- **Local and Regional Transport Strategies** – by ensuring that the cycling actions emerging from these strategies are delivered to the highest standard.
- **Local and Regional Active Travel Action Plans** – by ensuring the design requirements for future networks are well-defined.
- **The Highway Code consultation proposals** – by providing consistent guidance on infrastructure that will afford greater priority to those walking, wheeling and cycling, that aligns to the proposed changes to ***The Highway Code***.
- **National Walking Strategy** – by ensuring that the built environment is developed in a way that also allows for high-quality walking and cycling facilities.

1.3 Relationship with other design guidance

Cycling by Design is the primary reference for the design of cycling infrastructure in Scotland. It has been developed to be used in association with the following policy and design guidance documents. Designers should refer to these documents to enable a full understanding of the requirements for the design of streets, roads and places, so that the infrastructure serves the needs of all users.

- **Designing Streets**

  This provides Scottish Government policy and guidance on holistic street design. It should be used to supplement Cycling by Design when integrating cycling facilities into wider street design.

- **National Roads Development Guide**

  This provides guidance on the application of Designing Streets to different local road contexts. It should be used to supplement Cycling by Design when integrating cycling facilities into wider street design.

- **Roads for All: Good Practice Guide for Roads**

  This provides Transport Scotland's requirements for the inclusive design of road infrastructure. It should be used to improve designers' understanding of these requirements alongside Cycling by Design.

- **Sustrans Traffic-Free and Greenways Design Guide**

  This provides guidance on the design of traffic-free cycle routes (remote cycle tracks). It can be used to supplement Cycling by Design when designing remote cycle tracks.

- **Local Authority design guidance (where available)**

  This provides local requirements for street design. It should be used alongside Cycling by Design where available. Unless stated by the local roads or planning authority, Cycling by Design requirements should be used as the primary reference for cycling facilities.

- **Green Infrastructure Design and Placemaking**

  This provides guidance on incorporating green (and blue) infrastructure into the design of streets and places. It should be used to identify opportunities for integrating blue-green infrastructure into cycle route design.

- **Design Manual for Roads and Bridges (DMRB)**

  This provides design standards for trunk roads. It should be used to identify additional geometric standards when designing cycling infrastructure alongside the trunk road network.

- **Traffic Signs Manual**

  This provides guidance on the use of traffic signs, road markings and traffic control devices. It is the primary reference for the application of traffic signs and the requirements of the ***Traffic Signs Regulations and General Directions 2016 (TSRGD)***.

- **Inclusive Mobility and Guidance on the Use of Tactile Paving Surfaces**

  These provide guidance on accessibility requirements and the application of tactile paving surfaces to support these requirements. Both documents are under review by the Department for Transport, with updated guidance to be published. These documents and future updates should be used as the primary reference for the application of tactile paving surfaces.

1.4 Application of the guidance

Cycling by Design is intended to enable experienced designers to integrate cycling into a holistic and attractive built environment, and should be applied on all schemes delivering:

- Cycling infrastructure
- New and improved roads
- New developments
- Any other built environment feature where cycling should be considered

The aspiration is to achieve a high level of service for all cycle users across Scotland. Designers are expected to meet or exceed the design requirements set out in Cycling by Design in order to meet this aspiration.

Design requirements presented throughout this document are referenced by numbered clauses and highlighted to denote their status. These are presented in the format of the example below:

x.x.x (Example) This element of the design should achieve the requirements set out in this numbered clause.

Where design requirements are defined as **'Desirable Minimum'**, this should be considered as the minimum requirement to provide a high-quality facility in accordance with the recommendations of this document.

Reductions below this level may only be applied where specific constraints are identified, such that the desirable minimum requirement cannot be reasonably achieved. In such cases limited reductions are permissible, but the highest achievable standard should be maintained.

'Absolute Minimum', where defined, represents the scope of permissible reduction to the requirement.

Where elements of the design are subject to statutory obligations these must be adhered to.

The Design Review process outlined in Chapter 2 enables designers and Overseeing Organisations to ensure that the cycling infrastructure being provided satisfies the objectives of the scheme and provides a high level of service for all users. Indicators of levels of service are described in Chapter 2. The process ensures that where reductions below the desirable minimum requirement are deemed justifiable, the reasons are identified and recorded, and appropriate mitigation considered.

The design of cycle facilities should be undertaken holistically to ensure that cycle infrastructure is integrated with facilities for non-cycle users, including those with disabilities, and to ensure that the movement of people walking and wheeling is a primary consideration.

Holistic design will enable the correct balance of 'place' and 'movement' functions, which is aligned to ***Designing Streets*** policy guidance and expanded further in Chapter 3. It will ensure that communities and facilities are provided with the infrastructure they require to operate and thrive.

1.5 Key messages for designers

The following 12 key messages summarise how designers should approach the application of Cycling by Design's requirements in this new context:

1 We must plan and design for **mass cycling** by all kinds of people on different types of bike. Cycling infrastructure should no longer be something that we provide on the road network to only be used by the same people who are currently cycling. Instead it needs to be something that can be used by everyone.

2 Cycle users must be **protected from motor traffic** by physical separation or by significantly reducing the volume and speed of motor traffic on local neighbourhood streets. Additional space for protected facilities should be taken from the road carriageway and not from the footway.

3 Cycling infrastructure must be **fully accessible** by anyone who wants to use it, regardless of age, ability or experience. This means that gates or other access barriers which restrict the movement of many people, including those with disabilities, should not be included in design.

4 Cycle routes must form part of **fully connected networks** and be of a consistent quality throughout. We would not design a road network that 'abandoned' drivers or required them to get out and push their vehicle between routes. Cycling must be no different.

5 Cycles must be **treated as vehicles**. People cycling travel at different speeds from those walking and wheeling. In most circumstances these two user categories should be separated from each other.

6 Cycling takes **physical effort**. By minimising the number of times that cycle users have to stop, slow down and regain momentum, designers can provide more attractive facilities that encourage increased uptake of cycling.

7 Cycling infrastructure should be **intuitive for all who use it** or interact with it. It should be clear which space is allocated to different users, including pedestrians and motor vehicles, and how interactions are managed.

8 Cycling infrastructure should contribute positively to a **sense of place**. Along with other aspects of street design, it should attract people to use the infrastructure and spend time in the places that it is part of.

9 **Design with maintenance in mind**. Well-designed and constructed cycling infrastructure can be easily undermined if it becomes too difficult to maintain. This must be planned for at the earliest stage.

10 Creating safe cycling infrastructure can often be done quickly and economically by removing through-traffic from networks of local streets and safely connecting these networks. **Trialling these and other measures** on a temporary basis can help to test, monitor and improve the infrastructure and to gain public support.

11 **Designers should cycle** and experience each route they design to fully appreciate how the users of their infrastructure experience the network.

12 For these reasons, the design requirements of Cycling by Design 2021 are **higher than they were previously**. Exceptions may be needed where it would otherwise prevent the completion of a full cycle network, but these can only be applied when absolutely necessary and with due consideration of the level of service and Design Review processes set out in this document.

1.6 Definition of terms

For the purpose of this document, the following definitions are used:

- Cycle (and cycle vehicle) – any form of pedal-powered vehicle, including those that also include an electric-assist function, and all modes legally permitted to use facilities designated for cycles.
- Cycle lane – a lane within the cross section of the road carriageway for use by cycle users and separated from motor traffic by road markings. A cycle lane may be either:
  - Advisory – Permissible for motor traffic to overrun the road markings where this cannot be avoided.
  - Mandatory – Not permissible for motor traffic to cross the road marking, other than the exceptions noted in ***TSRGD***.
- Cycle track – a track for cycle users that is separate from the road carriageway. A cycle track may be:
  - Cycle track at carriageway level – at the same level as motor traffic but separated by physical means.
  - Stepped cycle track – adjacent to the road carriageway and separated vertically from both the road carriageway and the footway.
  - Cycle track at footway level – adjacent to the road carriageway and separated vertically from the road carriageway. Pedestrians and cycle users may use the same space or may be separated from each other within it (where space is shared, this is commonly known as a shared footway).
  - Remote or detached cycle track (commonly known as a cycle path or shared path) – a route that is not adjacent to the road carriageway as set out in Chapter 3. Pedestrians and cycle users may use the same space or may be separated from each other within it.
- Cycle traffic – cycle vehicles moving along cycle lanes, cycle tracks or the road carriageway.
- Cycle user – any person using a cycle to travel.
- Designer – individual or party responsible for implementing the guidance for infrastructure design. May be roads authority officers, developers, consultants or others working on their behalf.
- Motor traffic – motorised vehicular traffic.
- Overseeing Organisation – the roads authority responsible for overseeing the implementation of design and maintaining cycling infrastructure.
- Pedestrian – any person walking or wheeling.
- Wheeling – travelling by wheelchair.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2.0 Planning for Cycle Users

2.0 Planning for Cycle Users

Figure Numbers

Table Numbers

2.1 Introduction

Attracting more people to choose cycling requires a high level of service to be considered at all levels of policy, planning and delivery. A network-wide, end-to-end journey approach must be taken to ensure that high-quality infrastructure is implemented, maximising the potential to unlock suppressed demand.

Providing high-quality facilities which access all destinations, enabling more people to make their journeys by cycle, will positively contribute to the priorities of the ***National Transport Strategy (NTS2)***.

Cycle user requirements are unique. Cycles need to be planned for as vehicles within the road network, but their detailed requirements at the beginning and end of journeys are more closely aligned with pedestrian movements. An integrated approach is therefore necessary to ensure the freedom of movement of different users, and to manage the interactions between these users on different parts of the network.

This chapter sets out:

- The needs of different cycle users and how they interact with other users
- The underlying principles of design
- How designers should provide a high level of service for all users
- The design process to develop infrastructure in accordance with these principles
- How to plan for cycling at a network level and within new developments
- The requirements of the design review to be undertaken for all schemes.

2.2 Cycle users' needs

The three key elements that influence the infrastructure needs of cycle users are:

- the type of user
- their journey purpose
- the type of cycle vehicle they use for the trip.

The requirements of each of these elements inform the core design principles and levels of service that follow.

Type of user and journey purpose

Table 2.1 provides a summary of different types of cycle user, the typical purpose of their cycle journeys and the resulting design requirements. To provide a cycle network that will serve the needs of everyone, Cycling by Design requires designers to deliver infrastructure that will provide a high level of service.

Type of User	Level of User	Typical Journey Purposes	Requirements
New and Less Confident Users	Will include 'novice' users – younger children, accompanied cycle users and those new to cycling.	Learning to ride Travelling to school Neighbourhood trips for recreation or to visit family and friends	Safety is the primary requirement. Quiet routes, quiet streets and off-carriageway facilities are essential.
	Will also include 'intermediate' users – older children, some accompanied and disabled cycle users, those who may cycle less frequently and those who may be returning to cycling after an absence.	Travelling to school or work Neighbourhood trips for recreation or to visit family and friends Local everyday trips, such as commuting, caring, shopping and leisure	Safety remains the primary requirement, but convenience and ease of cycling will be significant motivating factors. Direct routes with protection from traffic are likely to be most effective.
Confident, Existing Users	Will include those who cycle frequently and with confidence to mix with motor traffic.	Regular commuting Longer distance leisure trips and cycle tourism	Safety and convenience but may choose the most direct route with least delay, including when this is on the road carriageway.

Table 2.1: Cycle user requirements

Designers have to understand user needs, and design infrastructure with all cycle users in mind. Designs that meet the needs of only confident cycle users should be the exception (see Level of Service in section 2.4).

It is also critical that, regardless of user type, cycling is recognised as a distinct mode of travel, operating at a significantly higher speed than walking and wheeling, and therefore with different requirements.

Cycle vehicle

There are a range of cycle vehicles that users choose and examples of these are provided in Table 2.2. Designers should provide for the anticipated vehicles.

To account for the various dimensions and additional turning requirements of some of these cycle vehicles, design guidance in this document is based on a design vehicle that is 2.8 m long with a dynamic width envelope of 1.0 m. The dynamic width envelope represents the physical width of the cycle, its user and the width within which lateral movement occurs when riding on a link.

Swept path analysis has been undertaken using this design vehicle. A wider dynamic envelope of 1.2 m has been used at bends.

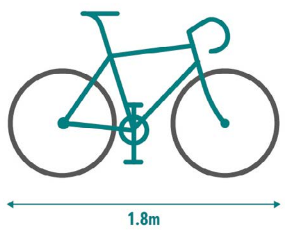
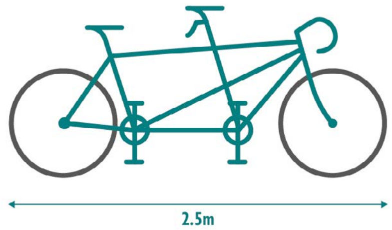
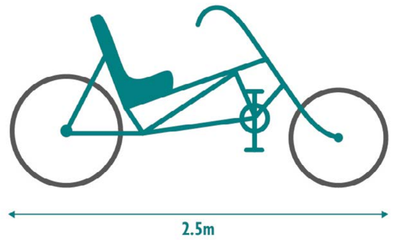
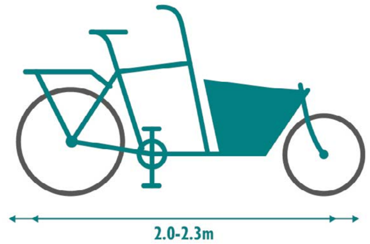
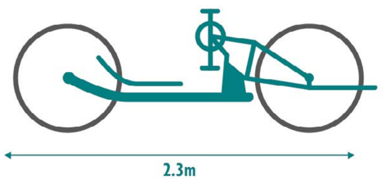
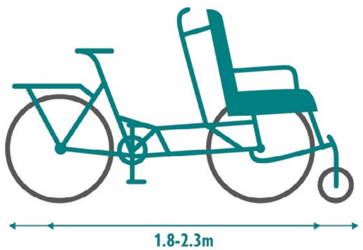
Standard	Tandem	Recumbent	Cargo Bike
 • 1.8 m length • 0.65 m width • 1.65 m turning circle	 • Additional turning circle requirements up to 3.2 m	 • Additional turning circle requirements up to 3.2 m • Lower eye height for visibility envelope	 • Up to 0.85 m width • Additional turning circle requirements up to 2.65 m
Handcycle	**Wheelchair User Tricycle**	**Additional Child Trailer**	**Additional Trailer Bike**
 • Additional turning circle requirements up to 2.65 m • Lower eye height for visibility • Lower clearance to kerbs and other objects	 • Additional turning circle requirements up to 3.2 m	 • Additional turning circle requirements up to 2.65 m	 • Additional turning circle requirements up to 3.2 m

Table 2.2: Cycle vehicle requirements

The effort required to cycle

Cycling requires physical effort to build up and maintain momentum and to retain balance. Minimising the effort required is key to making the journey attractive and convenient, regardless of age and ability. This can be done by:

- Minimising the number of times that a cycle user is required to slow down, stop and regain momentum
- Where possible, avoiding routes with steep gradients, even if this makes the route slightly less direct
- Providing smooth and well-maintained cycle route surfaces to minimise resistance
- Minimising crossfall on the route (see Chapter 3)
- Including landscaping and other features to help break headwinds and reduce air resistance.

2.3 Core design principles

Cycle user needs are represented by the six core design principles. These are summarised below alongside the intended key outcomes for cycling infrastructure:

Safety: Designs should minimise the potential for actual and perceived accident risk. Perceived risk is a key barrier to cycle use. Users should feel safe as well as be safe at all stages of their journey, including parking at their origin and destination. It is important to provide consistency of design and avoid ambiguity.

Coherence: Cycling infrastructure should form a coherent network which links origins and destinations. This allows the cycle network to link communities, facilities and integrate with other modes of travel. Routes should be continuous from an origin to a destination, easy to navigate, well signed, intuitive and of a consistently high quality.

Directness: Cycle users should be offered the most direct route based on existing and latent trip desire lines, minimising detours and delays. Directness has both geographical and time elements, with delays at junctions and crossings, as well as physical detours, affecting it.

Comfort: Cycle user comfort is critical to journey experience and making cycling an everyday choice for users. Routes should minimise mental and physical stress and effort, be convenient and avoid complex manoeuvres. Smooth, uninterrupted surfaces with gentle gradients and secure, sheltered cycle parking will enhance comfort. Cycling infrastructure should be well-maintained to ensure its continued comfort and appeal.

Attractiveness: Infrastructure should be designed in harmony with its surroundings in such a way that the whole experience makes cycling an attractive option. A route should complement and enhance the area through which it passes. Lighting, personal security, aesthetics, environmental quality and noise are important considerations.

Adaptability: Cycling infrastructure should be able to evolve and improve as cycle demands change. Meeting the preceding design principles in a way that allows infrastructure to adapt to changing user needs will form a critical component of cycle networks. Trialling of potential measures using more flexible infrastructure will assist in meeting this aim.

By applying the guidance contained within this document and adhering to these core design principles, designers can provide holistic solutions that cater for the broadest range of people, including new and less confident cycle users. Embedding these core design principles within the guidance allows designers to apply this guidance with all users in mind.

2.3.1 Designers should always aim to provide infrastructure that meets these principles and the Sustainable Travel Hierarchy set out in Chapter 1.

2.3.2 Designers should use the core design principles when setting design objectives.

Ultimately, cycling infrastructure should form part of an integrated transport system and built environment where users will, at different times, need to walk, wheel, cycle, and travel by public transport and private motor vehicle.

2.4 Level of service

It is a critical requirement of Cycling by Design that all new or improved cycling infrastructure, road improvements, new developments and public realm improvements are designed to meet the needs of all cycle users. The level of service (LOS) indicators will help designers to identify the strengths and weaknesses of their design and identify aspects to be improved to achieve a high LOS.

2.4.1 Designers should aim to provide a high LOS for any cycling infrastructure or road improvement project in Scotland.

2.4.2 A robust Design Review process (see Section 2.8) should be undertaken on all designs.

Note: The Design Review process is used to document and explain all design decisions, including those where a high LOS cannot be achieved.

Table 2.3 provides a summary of the key LOS indicators against each core design principle. These indicators are expanded for specific elements of design guidance in the chapters that follow, to remind designers of their importance when making key decisions.

A high level of service will be suitable for most users, including new and less confident users.

A medium level of service may not be suitable for some users, particularly novice users.

A low level of service will not be suitable for a range of users, including novice and intermediate users.

Principle	High level of service	Medium level of service	Low level of service
 Safety	Cycle users are always protected from motor traffic when required by the conditions set in Table 3.2 in Chapter 3.	In some cases, cycle users are expected to mix with motor traffic in higher speed or volume conditions that are set out in Table 3.2 in Chapter 3.	In some cases, cycle users are expected to mix with motor traffic in significantly higher speed or volume conditions that are set out in Table 3.2 in Chapter 3.
 Coherence	Cycle routes are continuous and fully joined-up. They allow cycle users to maintain consistent speed, are well-signed and intuitive.	Cycle routes contribute to a network, but users experience some disruption when connecting between routes, and navigation may be difficult.	Cycle users must dismount or are 'abandoned' at the end of a route.
 Directness	Cycle route is at least as direct as the equivalent motor traffic journey, with minimal need to stop or give-way. Delay for cycle users at junctions is less than for motor traffic.	Cycle route is up to 20% less direct than the equivalent motor traffic journey, with some need to stop or give-way. Delay for cycle users at junctions is equal to motor traffic delay.	Cycle route is more than 20% less direct than the equivalent motor traffic journey, with frequent need to stop or give-way. Delay for cycle users at junctions is greater than for motor traffic.
 Comfort	Cycle route surfaces are machine laid, smooth and well-maintained (at least as regularly as the road network). Desirable minimum widths and gradients are fully achieved.	Sections of route are hand-laid with frequent joints. Route is maintained less frequently than the road network. Desirable minimum widths or gradients are not achieved for some of the route.	Sections of the route are unbound, bumpy, not regularly maintained or otherwise hazardous. Desirable minimum widths or gradients are not achieved for the majority of the route.
 Attractiveness	Cycle route and parking areas are well lit, overlooked and do not create any personal security issues for users. The cycle route adds to the sense of place in the area, encouraging people to spend time there.	Some sections of the route are infrequently lit or not overlooked. Parking areas are secure but not overlooked or are insufficient in number.	The majority of the route is infrequently lit or not overlooked. Parking areas are not secure or are insufficient in number.
 Adaptability	Cycle route and parking areas have the flexibility to expand, evolve or adapt to changing demands.	Only some of the cycle route or parking areas has the flexibility to expand, evolve or adapt to changing demands.	No scope to amend cycling infrastructure once installed.

Table 2.3: Summary of Level of Service indicators


NO WAY OUT

2.5 Planning and delivery process

Multi-modal / strategic appraisal

Cycling by Design sets out network planning and design guidance to be implemented within the wider context of planning, delivering and maintaining cycle schemes, cycle networks or other cycle facilities developed in the built environment.

The decision to develop a cycle route or cycle network should be the product of a multi-modal or strategic appraisal process that has identified and appraised potential transport interventions to address evidenced-based transport problems or opportunities. An Equality Impact Assessment should be available to ensure that the needs of all potential users have been considered from the start. This should be regularly reviewed and updated throughout all subsequent stages including the design stage and at key decision points.

Whenever Scottish Government funding, support or approval is needed to change the transport system, an appraisal using Scottish Transport Appraisal Guidance (STAG) is required, and its use is also encouraged in other circumstances. STAG represents best practice guidance for transport appraisals and follows a structure and methodology that is consistent with the *UK Government's Green Book (Central Government Guidance on Appraisal and Evaluation)*.

Whatever appraisal process is followed, it should provide decision-makers with the information they need in a clear, structured format. Emerging proposals that require cycle-specific transport design guidance should follow the guidance outlined in this document, and information derived during the appraisal process can be used in the development of a cycle scheme.

Ultimately, a robust case for change is required to have been clearly demonstrated in appraisal / assessment work alongside the development of options. This is done prior to the design stage.

Additionally, depending on the type of scheme and / or its potential effects, other assessments may be required, e.g., a Strategic Environmental Assessment (SEA) or a Child Rights and Wellbeing Impact Assessment (CRWIA). Relevant authorities can provide further advice and guidance where relevant.

Cycle scheme planning and delivery

Building on these outputs, designers and those planning cycle networks should fully embed the core design principles set out in this document at all stages of the planning and delivery process, as identified in Figure 2.1 and further set out in this section.

Cycling by Design sets out network planning and design guidance to be implemented within the wider context of planning, delivering and maintaining cycle schemes, cycle networks or other cycle facilities developed in the built environment.

Stakeholder and community engagement will form a key part of each stage. Engaging with all relevant stakeholders throughout the planning and delivery process will be an important step towards meeting the Overseeing Organisation's Public Sector Equality Duty.

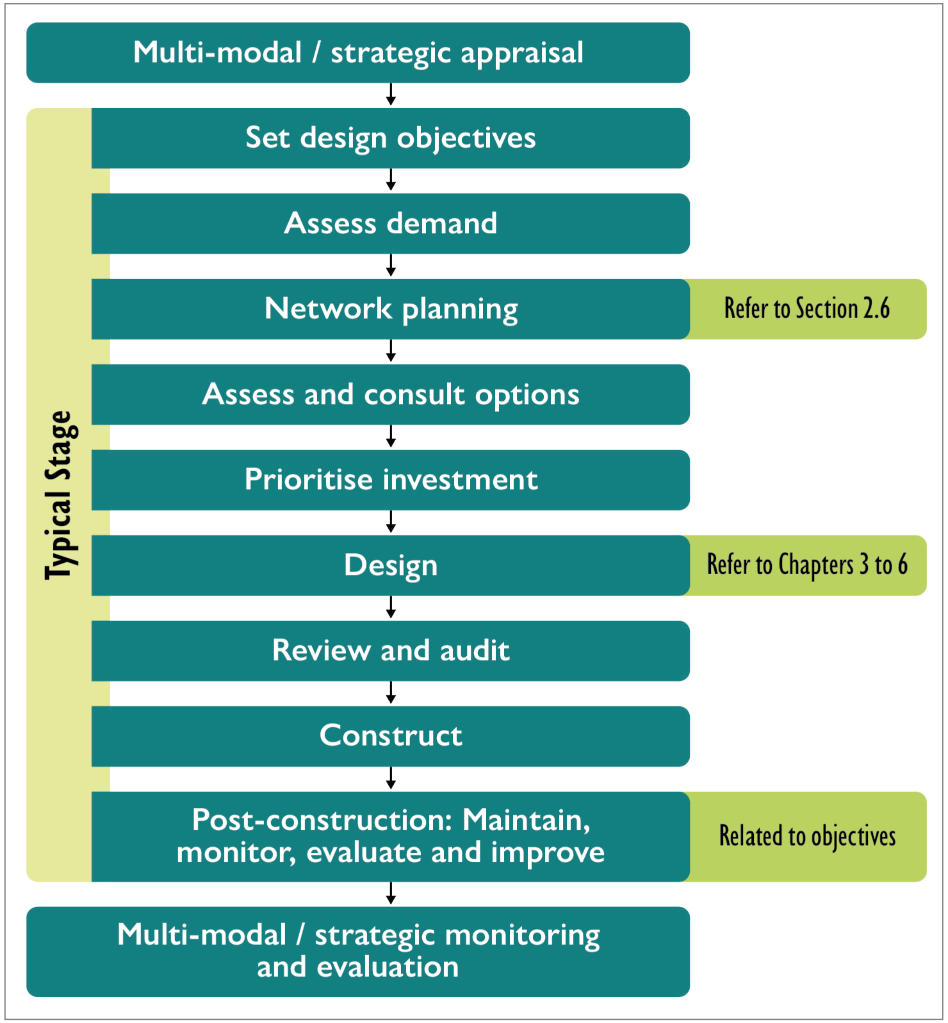


Figure 2.1: Planning and delivery process

Set design objectives

Appropriate design objectives should be set and aligned to the wider transport objectives for the area as follows:

- When setting design objectives for the development of a cycle network, these should relate to how that network can contribute to the wider policy aims of the area. Design objectives could be based on the coverage or density of the network, the connections it will make, the number of people who will use it and how these factors align to the desired social, health, environmental, safety and economic policy outcomes for the area. This will be informed by the Local Transport Strategy and Local Development Plan for the area.
- When setting design objectives for a cycle route or road improvement project, these should relate to how that project will help to meet the design objectives of the network that it forms part of (and in turn provide the same linkages to wider policy).

In both cases, the design objectives should be set to enable safe, high-quality cycling infrastructure to be designed and delivered to maximise the participation of cycling in that area. The design objectives should aim to provide a high level of service against each core design principle. Also, it will be important to review the established multi-modal / strategic objectives which will have sought to address the problems or opportunities identified during that appraisal process.

In all circumstances, the design objectives should form the basis of the design options. Design objectives could be refined as the design process progresses, and more information becomes available, but identifying clear and measurable objectives will allow the performance of the infrastructure to be effectively monitored and evaluated upon implementation. Therefore, design objectives should be set with SMART principles from the start. A SMART objective will be:

- **Specific:** will say in precise terms what is sought and where
- **Measurable:** will set out the metrics that will be used as an indicator of success
- **Achievable:** there is general agreement that the objective set can be reached
- **Realistic:** the objective is a sensible indicator or proxy for the change which is sought
- **Time bound:** the objective will be associated with an agreed timeframe.

Sources of information for setting design objectives include:

- Multi-modal / Strategic Appraisal
- Local and Regional Transport Strategies
- Sustrans' ***Places for Everyone*** guidance (for projects funded through that programme)
- Sustrans' ***Cycling for Everyone*** guidance
- ***Scottish Transport Appraisal Guidance***
- ***DMRB GG 142 Walking, Cycling and Horse Riding Assessment and Review*** (for trunk road projects but can assist in identifying objectives more widely)
- ***Assessing impact and the Public Sector Equality Duty: a guide for public authorities (Scotland)***, from the Equality and Human Rights Commission.

Assess demand

A detailed understanding of existing local travel patterns can be informed by surveys of walking, cycling, wheeling, public transport and motor traffic journeys, and by census data on journeys to work and education. From this data, planners can establish the patterns of trips currently being made by cycling, as well as those short-to-medium length journeys that are being made by other modes but which could be encouraged towards cycling with improved infrastructure. Where available, the data should be disaggregated by parameters such as age, gender, income, disability.

It is important to remember that these data sources may not reflect the full potential for cycle user trips where prevailing conditions or barriers that prevent people from making these trips exist. Such barriers may include disjointed cycle networks, personal security fears or routes that do not cater for different types of cycle vehicle.

It is equally important to estimate future travel patterns, which can be informed by analysis of future spatial planning contained within Local Development Plans and, where available, from transport models of the local area. This can be supplemented by behavioural surveys that can reveal the potential for modal shift or additional uptake in cycling under different future scenarios.

This will allow planners to set out the expected demand for cycling at a route and network level, now and in the future. This can be useful for the planning of the network and also to demonstrate to the public and decision makers the need for an improved network. The level of demand will also influence the geometric requirements of the scheme.

Sources of information for assessing demand include:

- Local development plans and transport strategies
- Local active travel strategies
- Cycling Scotland, Sustrans and Local Authority cycle counters
- Propensity to Cycle Tool, https://www.pct.bike/
- Regional Transport Models

Assess and consult on options

It is important that scheme options, at a network or route level, are fully assessed and consulted upon to arrive at the preferred scheme. Assessment of options should be undertaken against the design objectives set for the project and the core design principles.

While level of service indicators are primarily used to focus designers on how their designs will affect end-user experience, these may also be useful when assessing network or route options against each other.

Stakeholder consultation is vital to ensure that the assessment process takes full account of all relevant views of the options being developed and assessed. Consultation and engagement with communities, user groups, other interest groups, planning officers, transport officers, network maintenance teams and others should be undertaken from the earliest stages of network and route delivery.

Sources of information for assessment and consultation include:

- Scottish Transport Appraisal Guidance (as part of wider transport projects)
- Health Economic Assessment Tool (HEAT)
- National Standards for Community Engagement, www.voicescotland.org.uk
- Place Standard tool, www.placestandard.scot

Prioritise investment

The planning and assessment steps of the process will help to guide priorities in cycle network and route delivery. This will allow decisions to link back to the design objectives set for the network as a whole and to guide investment priorities to those parts of the network where it will have the greatest overall benefit.

Priorities should be aligned to the wider policy outcomes of the area and to the ways in which the cycle route or network can contribute to the desired outcomes for health, environment, safety and place-making.

These priorities could relate to the removal of immediate barriers or the improved maintenance of existing routes. However, to have the greatest impact the focus should be on the expansion of the cycle network to provide fully connected, safe and accessible new routes for all, including those who are new and less confident cycle users.

Design, review and audit

Chapters 3 to 6 provide the detailed guidance on the design of cycling infrastructure. Additional requirements and guidance for the design of infrastructure can be found in:

- ***Designing Streets*** – providing Scottish Government policy on street design
- ***Roads for All: Good Practice Guide for Roads*** – providing Transport Scotland requirements for inclusive design for road infrastructure
- ***Sustrans Traffic-Free and Greenways Design Guide*** – for the design of detached and remote cycle tracks
- ***Local Street Design Guidance*** – for specific local requirements on holistic street design
- ***National Roads Development Guide*** - produced by the Society for Chief Officers of Transport in Scotland, supported by Transport Scotland and Scottish Government Planning and Architecture Division. This document supports Designing Streets and expands on its principles to clarify the circumstances in which it can be used
- ***Traffic Signs Regulations and General Directions 2016 (TSGRD)*** – for the prescription of traffic signs and road markings
- ***Traffic Signs Manual*** – for the application of traffic signs and road markings
- ***Inclusive Mobility and Guidance on the Use of Tactile Paving Surfaces*** – for Department for Transport requirements in their design and application.

To ensure that these designs fully meet safety, quality and accessibility requirements, the following reviews and audits are required:

- **Design Review** – when developing designs for cycling infrastructure or road improvements, the Design Review process set out in Section 2.8 of this document should be used to confirm how the requirements of Cycling by Design have, or have not, been met. This will form one part of the Quality Audit required by ***Designing Streets*** for holistic street design projects
- **Equality Impact Assessment** – upon completion of the design, the Equality Impact Assessment that commenced at the objective setting stage and was updated during design, should be reviewed and updated to ensure that the design does not discriminate and improves accessibility where possible
- **Road Safety Audit** – should be undertaken at preliminary and detailed design stages in line with ***DMRB GG 119***
- For trunk road schemes, the review stage of ***DMRB GG 142 Walking, Cycling and Horse Riding Assessment and Review*** should be completed to ensure that the opportunities identified for cycling have been fully provided for in the design.

Post construction: maintain, monitor, evaluate and improve

Guidance on the maintenance of cycling infrastructure is provided in Chapter 3.

Targets for the monitoring of cycling infrastructure should be set at a network or route-specific level and linked to project design objectives. This will allow those planning cycling infrastructure to monitor the performance of the infrastructure against its original aims, and to set targets that are based on outcomes (such as the number of new cycle journeys on the network) rather than outputs (such as the total length of new cycle route).

Indicators should be established that will allow these targets to be measured regularly over a period of time in order to monitor the success of the infrastructure against its design objectives. The data that is available or will need to be collected to provide these indicators should be considered at the earliest stage, ideally when setting design objectives. Data sources may include cycle counters, user surveys and condition surveys of the infrastructure.

The performance of the network or cycle route can then be regularly evaluated against these indicators to identify trends and to establish any aspects of the infrastructure that can be improved.

Sustrans' ***Places for Everyone*** guidance provides further information on the monitoring and evaluation of projects that are funded through that programme, and can be applied to cycling infrastructure schemes more generally.

2.6 Network planning

Scottish Planning Policy and the National Planning Framework set the context for the development of sustainable, green, low carbon and integrated places across our cities, towns, villages, rural and island areas. Planning a network to ensure that every street is safe and comfortable to cycle on will play a key role in realising this ambition, and requires adherence to the planning and delivery process set out in Figure 2.1.

Network planning is informed by the setting of appropriate design objectives and the anticipated future demand for cycling at a local and regional level. It should identify the key origins and destinations that will generate the demand for cycling, the constraints and opportunities that exist to connect these places, and how best to link them through a fully connected network of routes.

Engagement with the local community and stakeholders is key. Local residents, businesses and other stakeholders have unique insight into the barriers and opportunities for cycling that will inform an understanding of demand, the gaps that need to be filled and the opportunities that exist to form a cohesive cycling network.

Local and regional transport authorities could consider cycle network planning independently, but there may be advantages to the delivery of a cycle network and its integration with other modes by developing this network plan when preparing Local Development Plans and Local and Regional Transport Strategies.

Network components

Cycle networks will generally comprise:

- Primary routes, which will link to key trip attractors, attract the highest demand for cycling and will often be used for commuting trips. Primary cycle routes will often be used to form active freeways in urban areas
- Secondary routes, which will link to local centres
- Local access routes, which will connect from primary and secondary routes into local neighbourhoods and streets at the beginning and end of journeys
- Long distance routes, which will often be used for recreation and touring purposes.

The network can be supported by core paths, which facilitate, promote and manage the exercise of access rights under the Land Reform (Scotland) Act 2003, and are identified as such in a local authority or National Park authority core paths plan. Note, there are no set physical standards for core paths.

The location, density and integration of these routes will vary depending on local network requirements. Guidance on how to approach this is set out in the following pages.

The routes themselves will be formed by a combination of cycle tracks that are remote from the road carriageway, cycle tracks adjacent to the carriageway and mixed traffic streets. The selection of these facilities will depend on a range of factors for each route and street, including motor traffic volume, speed, and local context. Guidance on the selection and design of these facilities is given in Chapter 3.

Each route is also likely to accommodate cycle crossings of the road carriageway, junctions and accesses. Guidance on the design of these is given in Chapter 4 and 5.

A successful cycle network will include secure cycle parking and other facilities at the beginning and end of each journey. Guidance on these facilities is given in Chapter 6.

Network planning techniques

Different techniques are available to undertake a robust network planning exercise for cycling. Guidance on these is provided here. Regardless of the technique applied, a detailed understanding of local travel patterns and stakeholder participation will form critical early parts of the process.

With a strong understanding of potential demand, the following techniques may be used to identify potential routes on a new or expanded cycle network:

- **Gap analysis** – by plotting the expected demand for cycling against the current provision, planners will, in most cases, be able to identify the key gaps to be filled in the network. This will be obvious for the routes with the highest potential demand for cycling but care should also be taken to ensure that gaps for local access routes are identified. This approach may be all that is needed for most locations but can be supplemented by more sophisticated techniques for larger towns and cities.
- **Mesh density** – examining the overall coverage of the cycle network can help identify gaps for larger networks, such as those in larger towns and cities. This is achieved by plotting the existing or proposed cycle network and then calculating the density of that network within defined sub-areas. These sub-areas may be bound by the existing road network or land uses, or by more arbitrary means such as 1 km square cells. The density of the cycle network within each sub-area can then be compared to see where key gaps lie.

The aim should be for the cycle network to be at least as dense and to provide as much coverage as the road network for the same area. This essentially means that every street should provide a high level of service for cycling, either through low-traffic conditions or protected cycle facilities. This will ensure full equality of modal choice and that cycling is seen to be at least as convenient as other modes for short-to-medium length journeys.

Level of Service Indicators – Network Planning

In relation to Design Principle – Coherence

●●● **High Level of Service:**
Cycle network density is less than 200 m between key primary and secondary routes.

Cycle routes are continuous and fully joined-up. They allow cycle users to maintain consistent speed, are well-signed and intuitive.

●● **Medium Level of Service:**
Cycle network density is 200-800 m between key primary and secondary routes.

Cycle routes contribute to a network but users experience some disruption when connecting between routes, and navigation may be difficult.

● **Low Level of Service:**
Cycle network density is greater than 800 m between key primary and secondary routes.

Cycle users must dismount or are ‘abandoned’ at the end of a route.

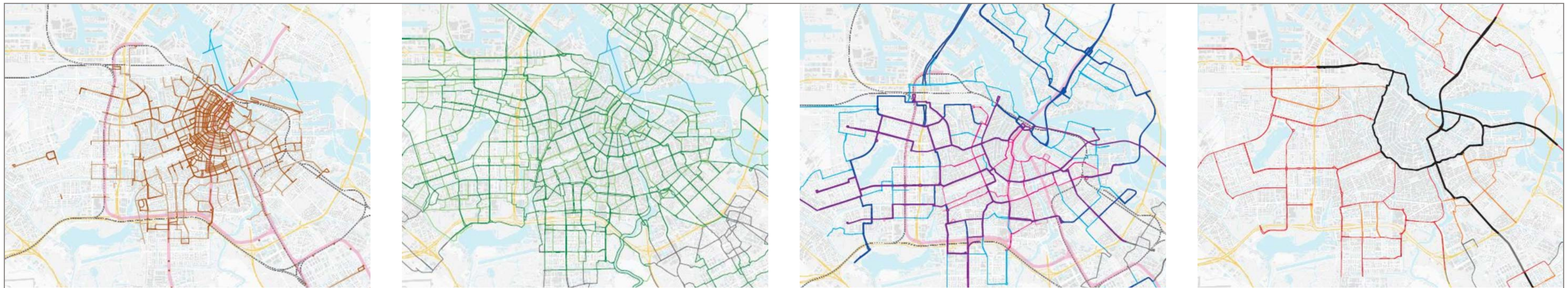
Integration with other modal networks

The planning and delivery of a cycle network will need to be fully integrated with the wider transport network in each city, town, village or rural area. There is often competition for space between walking, wheeling, cycling, public transport and motor traffic modes on an individual street or link. Reallocation of space in favour of sustainable modes will help to resolve these issues at the street level, but this may also be supported by taking a strategic network approach to the planning of each mode's network.

One way to do this is to establish the desired outcome for each component of the network. For example:

- Primary cycle routes – able to carry high volumes of cycle users on the most direct routes between key destinations, maintaining an average speed of 15 kph. Typical mesh density of 400 to 800 metres
- Secondary cycle routes – providing direct connections to all residential centres. Typical mesh density of 200 to 400 metres
- Local access routes – all other streets.

A similar approach can be taken for the desired outcomes for the walking, wheeling, public transport and road networks in line with the desired policy outcomes for the area as a whole. These indicative networks can then be overlaid to identify where competition for space will be most prevalent when trying to meet the desired level of service on each network.



Dense primary and secondary walking network | **Dense primary and secondary cycling network** | **Less dense primary and secondary public transport network** | **Significantly less dense primary and secondary road network**

Figure 2.2: Modal network integration

Strategic decisions can then be made by planners on how to make these 'trade-offs' at a network level to inform the allocation of space at a local street level. For example:

- The primary network for each mode should be prioritised (assuming that the primary network for walking, wheeling and cycling is more dense than the primary network for public transport, which in turn is more dense than the primary road network)
- Where the primary network for different modes compete for space, most priority should always be given to sustainable modes as set out in the Sustainable Travel Hierarchy.

This approach has been developed in Amsterdam as the 'Plusnet' method of network planning, as set out in Figure 2.2. The approach will be best suited to larger towns and cities but can be scaled to apply to smaller networks when planning cycle networks.

When defining networks for each mode, the aim should be for walking, wheeling and cycling to be at least as convenient, and ideally more convenient, than making the same journey by car. Figure 2.3 sets this out conceptually, with further details on how to apply this to urban and rural networks on the following pages.

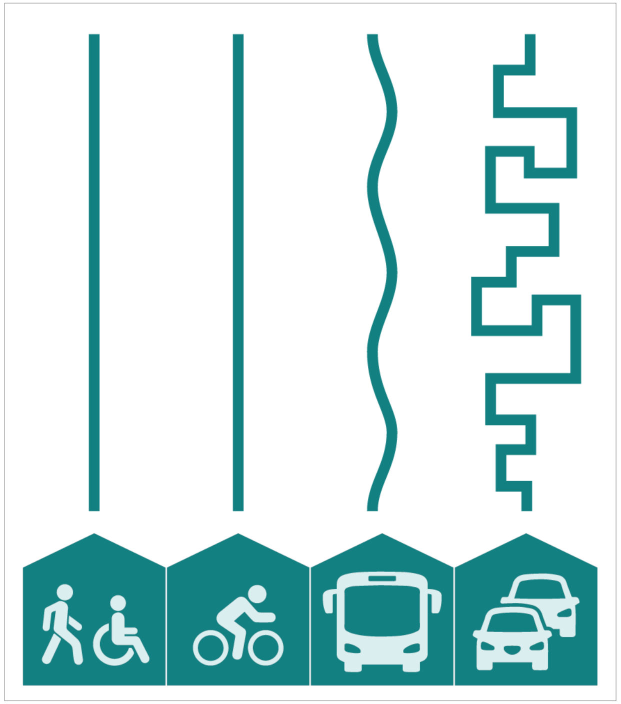


Figure 2.3: Establishing more convenient walking, wheeling and cycling routes

Urban settings – Low Traffic Neighbourhoods

Low traffic neighbourhoods (LTNs) create safe cycle networks by:

- allowing through-movement for walking, wheeling, cycling and in some cases bus movements
- restricting the through-movement of motor traffic within defined neighbourhood areas
- allowing local access and egress by motor traffic for all homes and businesses (including deliveries and servicing).

This is achieved by the tactical placement of modal filters and other traffic management measures that restrict motor traffic movements and make travelling through the neighbourhood by sustainable modes more convenient.

The benefits of LTNs in delivering cycle networks include:

- safer, calmer conditions for cycling
- more space for placemaking
- less through traffic on residential streets
- sustainable modes become more time efficient than private motor vehicles, thereby increasing the demand for the former and reducing demand for the latter
- cost effective solutions that are simpler to implement than providing protected cycling facilities on all streets.

Figure 2.4 illustrates a characteristic approach to the development of LTNs.

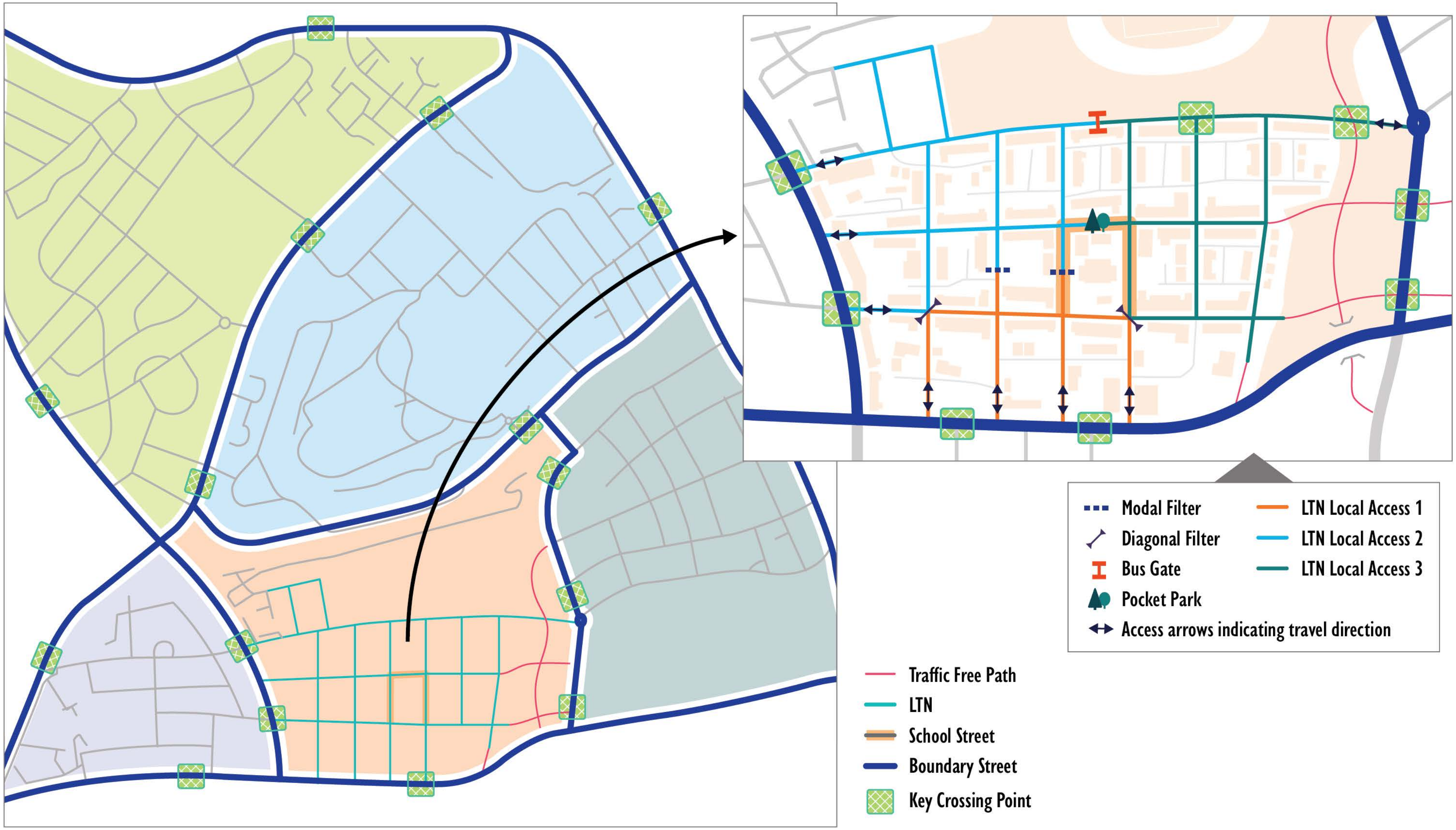


Figure 2.4: Low Traffic Neighbourhood approach

The steps involved in developing a successful LTN are:

Step 1 – Classify local streets

Identify the streets that are of most importance to strategic transport movements and those that require vehicle access for local residents and businesses only (including deliveries and servicing). This will be best facilitated through community workshops and wider stakeholder engagement to ensure that the function (and potential future function) of each street is informed by local knowledge.

Step 2 – Define size and structure of LTN

Based on this classification, the size and structure of the LTN should be defined as follows:

- The streets on the boundary of the LTN will cater for all transport movements, including primary cycle routes, public transport and through-traffic
- The 'cells' contained within these boundaries will be for local motor traffic access only, and will act as through routes for walking, wheeling, cycling and in some cases local bus movements
- The cells should be structured to ensure that key local trip attractors such as schools, community centres and parks are easily accessed by walking, wheeling and cycling
- The size of each cell will vary and will depend on the local context of these trip attractors. It should be large enough to make car journeys less convenient for short local trips, encouraging modal change for these trips, but not so large that local journeys within the cell become too long and encourage car use. Typically, 1.0 to 1.5 square kilometres will be a suitable size for a LTN.

Step 3 – Identify locations for filtering measures

These should be placed where they have the greatest impact in terms of restricting through motor traffic movements, whilst allowing motor traffic access to homes and permitting through movements by walking, wheeling and cycling (and in some cases by bus). This will be achieved by a combination of the measures set out in Table 2.4.

Measure	Purpose	Location	Example
Modal filter	To restrict vehicle movements whilst permitting walking, wheeling and cycling. (further guidance in Chapter 3)	On streets or at junctions where this will help to remove through-traffic. Care is needed to minimise the lengths of any reverse movements needed by local motor traffic.	
Pocket park	To create a green space between modal filters used for walking, wheeling, cycling and play.	On parts of streets where no local vehicle access is required.	
Diagonal filters	To enforce turning restrictions at crossroad junctions, whilst permitting walking, wheeling and cycling in all movements.	Crossroad junctions	
Turning restrictions	To restrict vehicle turning movements.	Junctions	
One-way streets	To limit vehicle access or egress from a street as part of a wider network plan. (further guidance in Chapter 3)	Only on streets which can be designed to avoid any potential for increased motor traffic speed resulting from one-way operation.	
Bus gates	To permit through-movements by local bus and cycling, whilst restricting through-traffic.	On key local bus routes that permeate low traffic neighbourhoods.	

For all measures, keeping sign clutter to a minimum is a key objective. Using planters and other measures sympathetic to the local environment will enhance the placemaking aspect of the neighbourhood.

Table 2.4: Low Traffic Neighbourhood measures

Step 4 - Design individual streets

To ensure that traffic speeds remain low and that conditions are created for comfortable cycling (further guidance is provided in Chapter 3). Identifying the function of individual streets within a local network will have a direct impact on how it is used by traffic. This could be by allocating certain streets as secondary cycle routes on a quiet route network, or providing opportunities for play-focussed activities around schools, parks or other local facilities.

Step 5 - Create connections between LTNs

With the right conditions established within each 'cell' of the network, it will be possible for planners to identify the key connections that need to be made between each cell and from the cells to the primary and secondary cycle network. By improving these connections, the accessibility of each neighbourhood by cycle can be significantly enhanced. Figure 2.5 provides an example of this at a network level in Bolton, as part of Greater Manchester's proposed Bee Network.

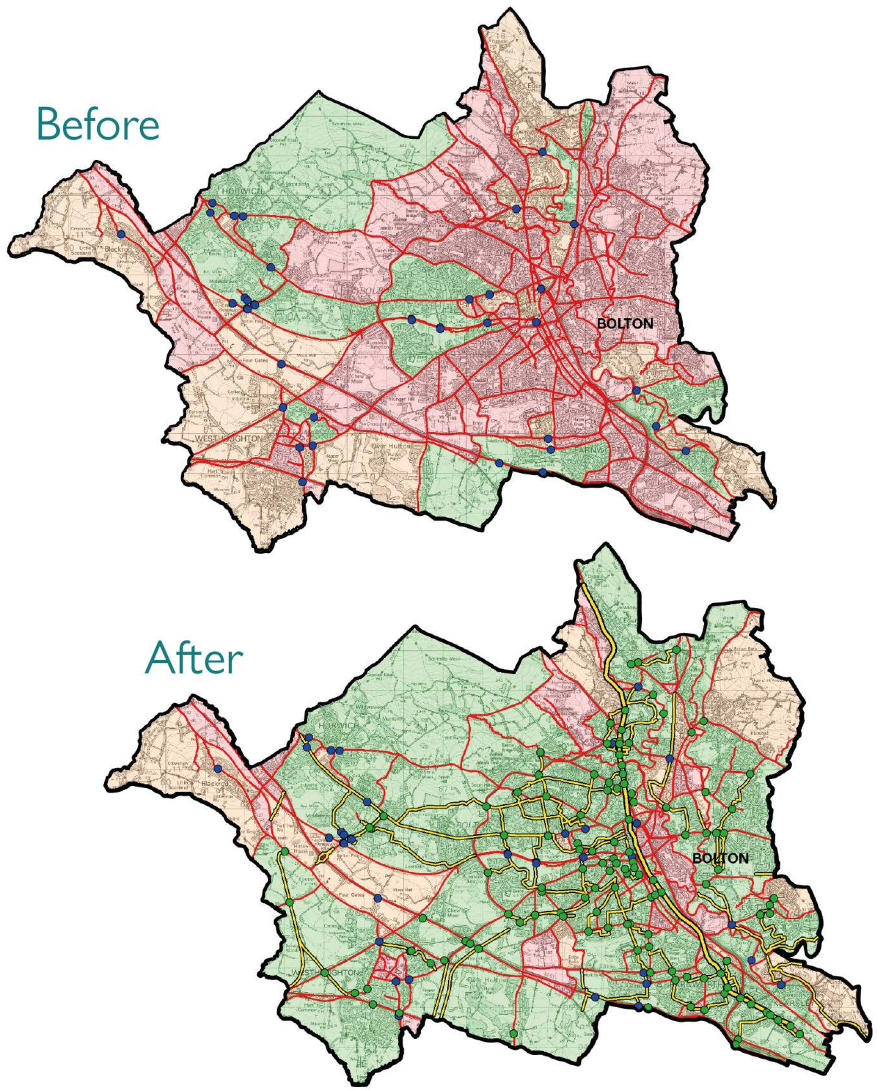


Figure 2.5: Example of proposed accessibility improvements in Bolton (Transport for Greater Manchester)

Rural settings

For the purpose of Cycling by Design, rural settings comprise both rural roads (as defined by DMRB) and the villages and settlements that these roads pass through.

Although route choice is likely to be more limited in rural settings, opportunities exist to improve the connectivity and permeability of the cycle network and contribute to enhanced rural place-making, as illustrated in Figure 2.6.

The high movement function of most rural roads will make mixed use of the carriageway suitable for only a limited number of cycle users. Cycle tracks that are detached or remote from the carriageway are therefore preferable in most rural situations, with control of motor traffic speed and volume within villages and settlements a key objective to providing a connected and usable cycle network. Measures to reduce the speed of traffic on individual streets is provided in Chapter 3.

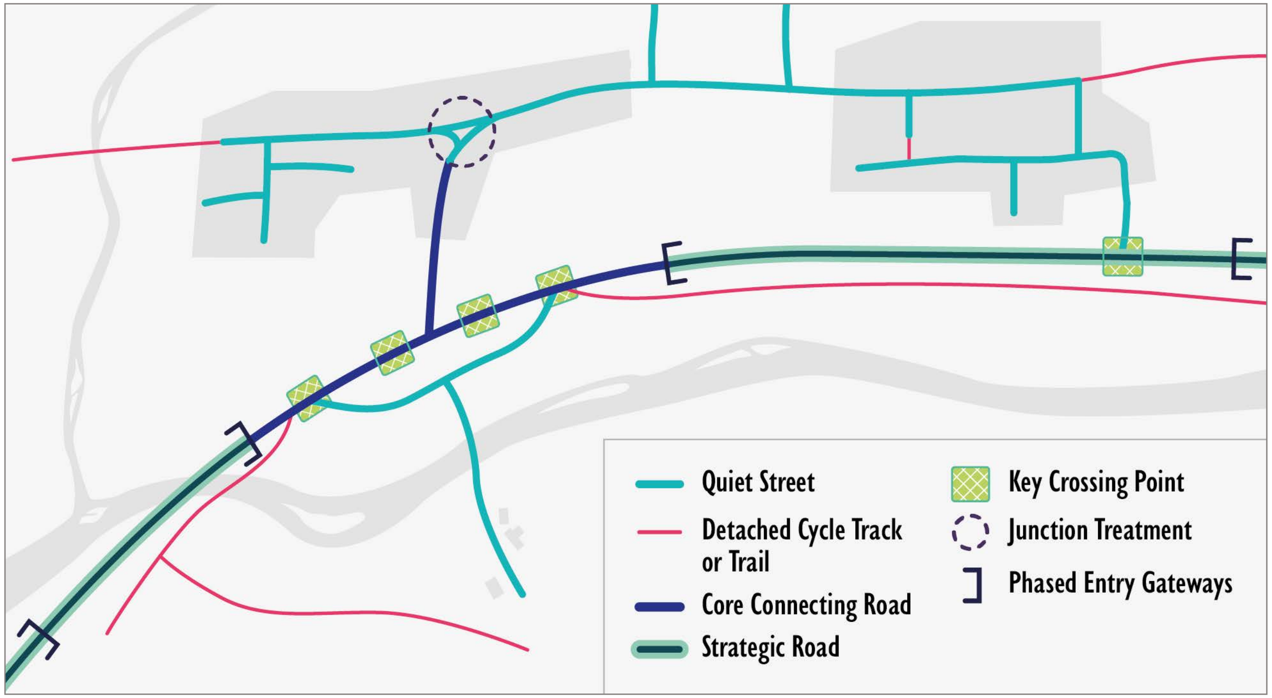


Figure 2.6: Rural cycle networks

Network planning measures can support cycle use in rural settings. A hierarchy of streets and routes that are suitable for different types of cycle journey could be set as follows:

- **Long-distance routes** – the national cycle network and other long-distance routes that pass through rural settings are increasingly being delivered as detached cycle tracks that run alongside the main road network or as remote cycle tracks.
- **Rural connecting routes** – between settlements, the opportunities for cycling on lightly-trafficked roads and to restrict access to some of these roads by motor traffic will provide more attractive routes for local journeys and for connecting long distance routes to local centres.
- **Quiet streets and lanes** – where traffic speeds can be significantly reduced and the presence of those walking and cycling can be made clear.

The network should provide direct routes for cycle users to ensure that a high level of service is maintained.

2.7 Planning for new developments

When planning new development sites and new road schemes, there is a unique opportunity to build in cycle friendly conditions from the outset. The guidance provided in Cycling by Design should be applied to achieve a high level of service for cycling within all new developments and new roads.

In new developments there should be no existing physical constraints that cannot be overcome by good design to achieve this.

2.7.1 Designs in new developments and for new road schemes should meet or exceed the highest level of service.

It is recognised that there may be existing constraints when linking the development to nearby facilities. The Overseeing Organisation will account for this when considering the Design Review that is submitted along with the design to support the planning application.

In meeting or exceeding the requirements, designers will help to create the conditions necessary within new developments to enable cycling within the development and to link the development with existing facilities, thereby contributing to national, regional and local policy targets and ambitions.

Designing Streets provides Scottish Government policy for street design, including new developments. This requires the layout of streets within new development sites to connect to their surroundings through permeable networks that encourage walking, wheeling and cycling.

The network planning approach that is set out in Section 2.6 supports this policy aim from a cycling perspective, enabling low traffic neighbourhoods with filtered access for motor traffic while delivering permeable access for cycling.

The opportunity exists to apply this approach to new development sites from the outset, rather than 'retrofitting' it to existing neighbourhoods. Therefore, new development sites have a vital role to play in creating cycle-friendly conditions within the development site and beyond by contributing to the expansion of the wider cycle network.

The cycle network plan will provide a framework for developers to understand:

- What cycling infrastructure is in place or will be in place to connect to the development
- The potential demand for that cycle network from those living, working in and visiting the development
- The planning authority's expectations for the connections that need to be made from the cycle network to and through the development.

The components of the cycle network within and surrounding a new development site should comprise the same elements set out in Section 2.6:

- Primary routes, which will usually connect the development site to key trip attractors. For larger developments with key trip attractors themselves (such as schools, employment, or retail centres), it may be necessary to extend these primary routes into the development and to design these accordingly (see Chapter 3)
- Secondary routes, which will connect to local centres within the development
- Local access routes, comprising all other streets.

The layout of the cycle network within a new development site should:

- be at least as dense and ideally more dense than the road network. There should be no physical reason why this cannot be achieved within new development sites
- be more permeable than the road network
- provide internal streets that are designed to restrict traffic volumes and speeds such that they are low enough for mixed use (see Table 3.2 in Chapter 3). This can be achieved by the filtering of traffic during the planning of the street network (see Section 2.6) and through individual street design (see Chapter 3).

The planning of an internal network should be informed by the Local Development Plan and / or the regional and local transport strategies and the potential connections to the wider transport network. The design of the network will usually be informed by the Design and Access Statement and the Transport Assessment for the new development. The Transport Assessment is used to forecast the travel demands of the site and assess their impact on the surrounding network. Travel demand forecasts within the Transport Assessment should consider the potential for the increased levels of cycling that will be enabled by the measures described above. This will ensure that the potential cycling movements are not underestimated or the motor traffic movements over-estimated.

The Transport Assessment will form one part of the planning application being submitted for the site and should take account of the requirements of Cycling by Design, including the network planning and travel demands described above.

There are opportunities for planning authorities to specify and enforce these requirements to developers and contractors through the planning process via Local Development Plans and planning guidance. These can provide information on:

- the key points of connection to the wider cycle network
- any requirements for off-site cycle route improvements
- requirements for the on-site cycle network in line with Cycling by Design requirements
- requirements for other cycling infrastructure such as cycle parking.

Planning conditions can then be attached to successful planning applications relating to specific requirements of Cycling by Design, if these are linked back to local planning policy and the requirements of the Scottish Government's ***Planning Circulars 4/1998*** and ***3/2012***. If local planning policy, and any cycle network plan defined therein, establishes the need for cycle routes within or adjacent to the new development, then it may also be appropriate to seek developer contributions.

Smaller developments which fall below the normal thresholds to provide Transport Assessments should still be required to provide and/or contribute towards new and improved cycling infrastructure in line with local and national planning policy.

It is recommended that designers of new developments use the Design Review process that is set out in Section 2.8 to inform and support the planning and Road Construction Consent (RCC) applications for the development. This will allow the planning and RCC applications to be informed by key decisions from this Design Review.

Any failure to meet the requirements set by Cycling by Design will be identified in the Design Review for the development, and should be taken into account by the planning authority when determining planning permission. Such failures may also affect any funding being sought that relies on Cycling by Design compliance.

2.8 Design review

Meeting or exceeding the requirements set by this guidance is critical to ensure that future cycling infrastructure provides a high level of service and is attractive to all potential cycle users, particularly new or less confident cycle users.

The Design Review process applies to all schemes incorporating:

- Cycling infrastructure
- New and improved roads
- New developments
- Any other built environment feature where cycling should be considered.

The Design Review should be submitted to the Overseeing Organisation for consideration and approval. Where designers are unable to meet the requirements set by Cycling by Design, the Design Review will set out:

- The requirement(s) not able to be met
- The reasons why the requirement(s) are not able to be met and the attempts that have been made to do so, recognising the need to provide a high level of service and apply the Sustainable Travel Hierarchy
- The impact that falling below the design requirement will have on the project's objectives
- The type of users, e.g. novice, intermediate etc., who are likely to be excluded from the infrastructure as a result of falling below the requirement, and how this can be mitigated
- Any safety issues created for cycle users or other users and how this can be mitigated
- Any accessibility issues created for cycle users or other users and how this can be mitigated, in line with the ongoing Equality Impact Assessment for the project
- Recommendations for alternative actions that could be undertaken to enable these requirements to be met (such as land acquisition or the closure of the motor traffic lane) and who has the authority to implement these, as part of a holistic approach to delivering high-quality cycling infrastructure.

The Overseeing Organisation should consider the Design Review and either agree with its findings or request a change to the design to meet Cycling by Design requirements. Local road and trunk road authorities should involve each other in the design review process where cycling infrastructure may be designed on behalf of one but adopted and maintained by another.

The Design Review will form part of the Audit and Review process. When cycling infrastructure is being delivered as part of holistic street improvements, the Design Review process will form one element of the Quality Audit process that is required by ***Designing Streets*** (along with inputs from other disciplines and specialists as part of that holistic design).

Guidance is provided on the review and assessment of cycling infrastructure in ***DMRB GG 142 Walking, Cycling and Horse-Riding Assessment and Review***. This is a requirement for trunk road schemes, and the principles of ***DMRB GG 142*** can be applied to the Design Review of local projects.

The ***Place Standard*** tool (https://www.placestandard.scot) provides a framework to allow designers to assess the impact of their design on the place quality of the surrounding environment. Although not a requirement of Cycling by Design, it is recommended that designers utilise the ***Place Standard*** tool to help inform the development of designs and during the Design Review process to help identify any impacts or improvements that can be made.

Road Safety Audits will continue to be undertaken independently of this Design Review process, as set out in ***DMRB GG 119***.

3.0 Cycle Links

3.0 Cycle Links

Figure Numbers

Table Figures

3.1 Principles

This chapter sets out the requirements for the design of cycle links, which may comprise:

- Mixed traffic streets
- Cycle tracks
- Cycle lanes.

Mixed traffic streets allow cycle users to occupy the same space as motor traffic. They offer well-connected routes for cycle users and freedom of movement within a network, but only provide safe conditions and an acceptable level of service for users when motor traffic volumes and speeds are low. The criteria for this are set out in Section 3.3.

Cycle tracks separate cycle users from motor traffic, providing a degree of protection and enhancing the attractiveness of cycling within that corridor. These may be adjacent to the road carriageway, or detached facilities that are not associated with an adjacent road carriageway.

Cycle lanes within the road carriageway offer less protection to users and provide a low level of service. For this reason, cycle lanes are not a preferred facility but may be considered in the limited situations described in Section 3.7.

Routes incorporating cycle links may require a combination of these facilities. A consistent provision is likely to result in a more attractive route but cycle routes should respond to the local context of the street to ensure they add to the character and place of the area. Regardless of the facilities used, cycle links should be as convenient and direct as possible to attract new users. Cycle links should form part of a cohesive cycle network plan (as set out in Chapter 2) and not be planned and designed in isolation.

It is vital that cycle links do not compromise safe and attractive facilities for pedestrians. Where width is required to form a cycle link within an existing corridor, the reallocation of space from the road carriageway is always preferable.

Likewise, it is vital that motor traffic links do not compromise safe and attractive facilities for cycling. Where existing space is allocated to motor traffic, there should not be a presumption that all this space must be retained for motor traffic.

This chapter sets out the design requirements for different cycle link types, and how they interact with motor traffic lanes, pedestrians, and on-street features including bus stops, parking and loading.

3.2 Types of cycle link

The types of cycle link available vary in terms of the level of separation they provide, both between cycle users and motor traffic and between cycle users and pedestrians.

These are described in the relevant sections of this chapter. Initial consideration of the factors that influence their suitability is outlined in Table 3.1.

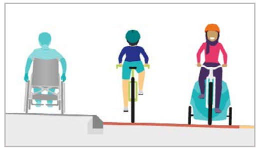
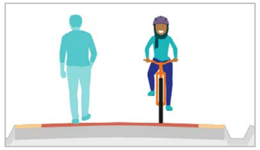
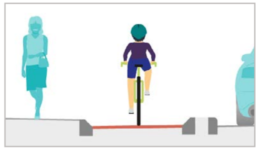
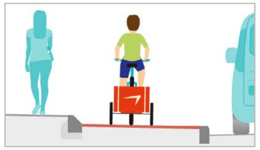
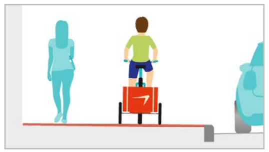
Link Type	Considerations
Mixed Traffic Streets	• Mixing with motor traffic within suitable conditions • Greatest freedom of movement for cycle users 
Detached or Remote Cycle Tracks	• Not adjacent to motor traffic, thus provide greatest protection • May provide separation from pedestrians • May not link to as many trip attractors as other options  
Cycle track at carriageway level (adjacent to carriageway)	• Provides physical protection from motor traffic (which may include light segregation) • Provides separation from pedestrians  
Stepped cycle track (adjacent to carriageway)	• Provides physical protection from motor traffic • Provides separation from pedestrians 
Cycle track at footway level (adjacent to carriageway)	• Provides physical protection from motor traffic • May provide separation from pedestrians  
Cycle lanes (on carriageway)	• No physical protection from motor traffic • Provides separation from pedestrians

Table 3.1: Types of cycle link

3.3 Provision of appropriate facilities

Motor traffic is the main deterrent to cycling for many people. A reduction in motor traffic volumes and speeds will therefore improve the attractiveness of the route for cycle users. Greater physical protection from motor traffic will also improve user safety where suitable conditions cannot be created for mixed use streets. The suitability and most appropriate degree of protection will be influenced by local conditions.

When identifying the type of cycle link to provide on a corridor, the following require consideration:

- The desired level of protection and interaction between cycle users and motor traffic
- The desired level of separation and interaction between cycle users and pedestrians
- The opportunity that the cycle link will offer to enhance the surrounding environment and 'place' context of the link.

Protection from motor traffic

Key issues relating to the protection of cycle users from motor traffic are:

- **Traffic volume and speed** – The degree of protection required from motor traffic is largely influenced by the volume and speed of motor traffic. Higher speeds and higher traffic volumes necessitate a greater degree of protection. See Table 3.2 for guidance (pcu relates to passenger car units).
- **Junctions and accesses** – The number, location and type of junctions and local accesses on the corridor are also key considerations when identifying the type of link to provide. Regular breaks and disruptions to the cycle link are not desirable. An appropriate facility will seek to provide a continuous route to cycle users.
- **Cycle user connections** – Although a cycle link will provide a direct and attractive end-to-end facility, the positions at which cycle users are expected to join and leave that facility to link their journey require consideration. Where cycle links do not accommodate desirable movements, alternative design options that facilitate these movements may be more appropriate.

3.3.1 Facilities to protect cycle users from motor traffic should provide a high level of service, as set out in Table 3.2.

3.3.2 Where cycle users are separated from motor traffic, this should be provided by physical means.

Note: Physical separation offers greater protection to cycle users and provides a more attractive facility, regardless of adjacent vehicular speed and traffic flow.

3.3.3 Cycle lanes should only be considered where cycle tracks cannot reasonably be provided, and where the on-carriageway conditions meet the criteria set out in Table 3.2.

Motor Traffic Speed (85th percentile)	**Two-way traffic flow** (pcu per day)	**Two-way traffic flow** (pcu per hour)	**Mixed Traffic Street**	**Detached or Remote Cycle Track**	**Cycle Track at Carriageway Level**	**Stepped or Footway Level Cycle Track**	**Light Segregation**	**Cycle Lane**
0 to 30 kph	0 to 2000	0 to 200	●●●	●●●	●●●	●●●	●●●	●●●
	2000 to 4000	200 to 400	●●	●●●	●●●	●●●	●●●	●●●
	4000+	400+	●	●●●	●●●	●●●	●●●	●●
30 kph to 50 kph	0 to 1000	0 to 100	●●●	●●●	●●●	●●●	●●●	●●●
	1000 to 2000	100 to 200	●●	●●●	●●●	●●●	●●●	●●
	2000 to 4000	200 to 400	●	●●●	●●●	●●●	●●●	●●
	4000+	400+	●	●●●	●●●	●●	●●	●
50 kph to 65 kph	0 to 1000	0 to 100	●●	●●●	●●	●●	●●	●●
	1000 to 2000	100 to 200	●	●●●	●●	●●	●●	●
	2000+	200+	X	●●●	●●	●●	●	●
65 kph to 80 kph	0 to 1000	0 to 100	●	●●●	●●	●●	●●	●
	1000+	100+	X	●●●	●	●	●	●
80 kph to 95 kph	0 to 1000	0 to 100	●	●●●	●	●	●	●
	1000+	100+	X	●●●	●	●	X	X
95 kph to 110 kph	All	All	X	●●●	●	●	X	X

In relation to Design Principle – Safety

●●● **High Level of Service:** Suitable for most users.

●● **Medium Level of Service:** May not be suitable for some users, particularly novice users. Designer should consider the lack of attractiveness of the facility to these users and how this can be overcome or mitigated.

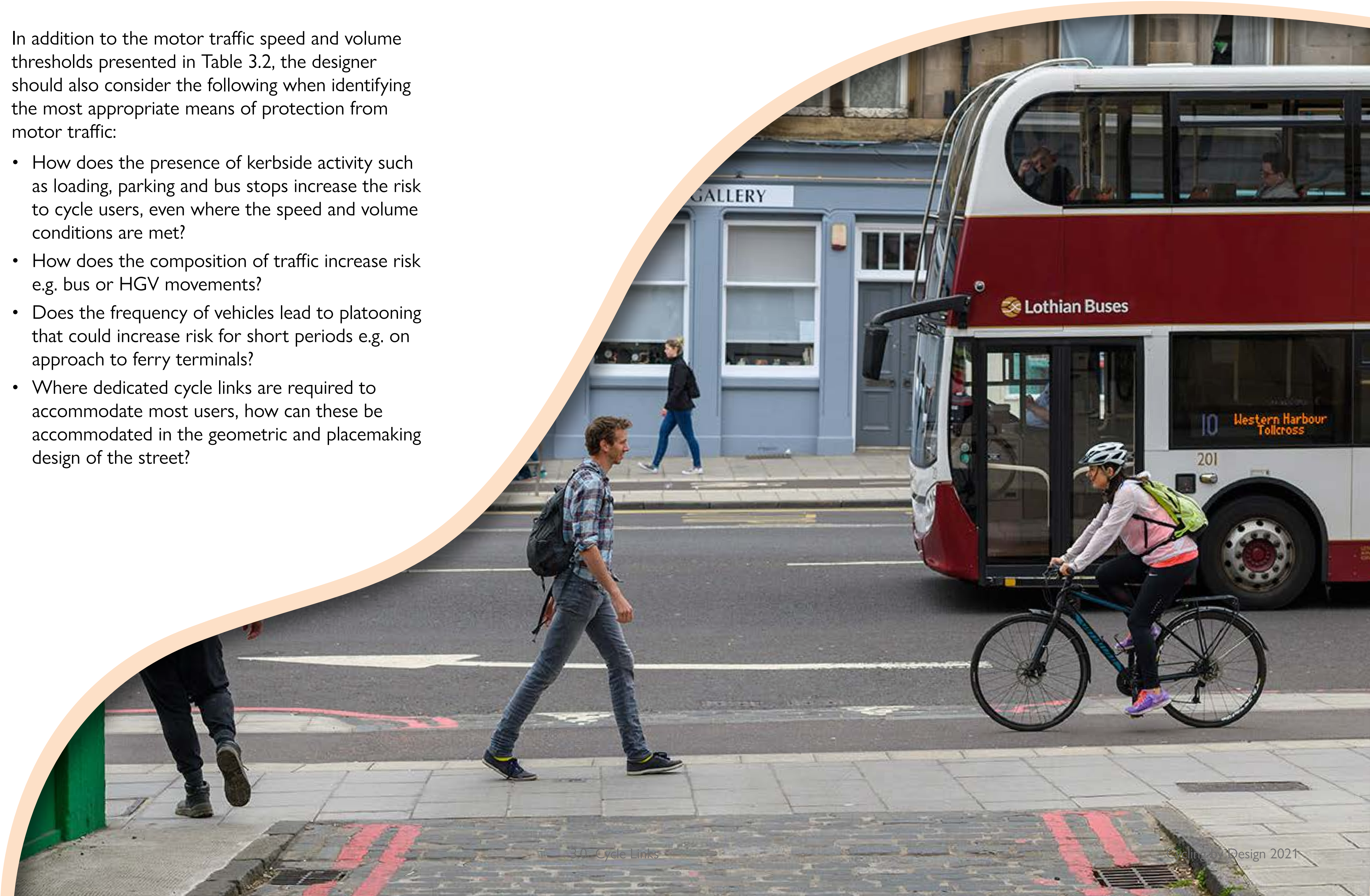
● **Low Level of Service:** Not suitable for a range of users, including novice and intermediate users. Should be avoided unless the risk to these users is conveyed to the Overseeing Organisation by the designer and accepted by the Overseeing Organisation. See Section 2.4.

X **Should not be used**

Table 3.2: When to separate cycle users from motor traffic

In addition to the motor traffic speed and volume thresholds presented in Table 3.2, the designer should also consider the following when identifying the most appropriate means of protection from motor traffic:

- How does the presence of kerbside activity such as loading, parking and bus stops increase the risk to cycle users, even where the speed and volume conditions are met?
- How does the composition of traffic increase risk e.g. bus or HGV movements?
- Does the frequency of vehicles lead to platooning that could increase risk for short periods e.g. on approach to ferry terminals?
- Where dedicated cycle links are required to accommodate most users, how can these be accommodated in the geometric and placemaking design of the street?



Interaction between cycle users and pedestrians

If the decision is made that cycle users should be separated from motor traffic, the next significant aspect of selecting the most appropriate cycling infrastructure is the degree of interaction with pedestrians. The needs of all users should be considered fully in the design of any part of the built environment. All points and areas of potential cycle and pedestrian interaction should be identified by the designer in advance of developing infrastructure intended for cycle users. In keeping with the Sustainable Travel Hierarchy, appropriate space for people walking, cycling and wheeling should be given precedence over space for motorised modes, particularly private vehicles.

Available width can be a constraint to the provision of cycling facilities but does not justify the introduction of an inappropriate facility. Shared pedestrian and cycle facilities in inappropriate situations compromise the safety and attractiveness of the route to all users. Where the provision of a separated facility is deemed necessary but is constrained by available space, means to achieve the required space should be identified, or alternative means of separation explored. This can be achieved by the reallocation of space from the road carriageway in favour of those walking, wheeling and cycling. At a network planning level, it can also be achieved by providing a higher level of service for cycle users on alternative routes, helping to distribute users and reduce levels of interaction between them.

For new developments there should be a specific presumption in favour of separating pedestrian and cycling movements in the built environment. As set out in Chapter 2, there is a unique opportunity to develop high quality facilities for all users at the outset, and there should be no physical constraint preventing the separation of users that cannot be overcome by good design.

Within built up areas where a cycling facility is to be located adjacent to a road, there should be a strong presumption in favour of separating pedestrian and cycle movements. In these circumstances, shared use facilities should only be used as a means of delivering route continuity where all other options have been examined and documented in the Design Review. At crossings and other points of interaction, there will sometimes be a need for users to mix and this is set out in Chapter 4.

In other circumstances, designers should consider the likely frequency and nature of interactions between users, as well as the number and relative proportions of people walking, wheeling and cycling. Factors which may make shared use facilities appropriate in these circumstances include:

- Low user density and therefore low potential conflict. Table 3.3 and 3.4 indicate the level of interaction relative to user volumes. The wider the route, the less conflict will be felt for a given number of user interactions
- A very low number of active frontages alongside a route, making it less likely that users will cross over each other to access amenities
- Low speed differential between users, often established by a high degree of non-linear movement, a high place function or high degree of leisure or other slow speed movement which influences the behaviour of users
- Where separation might encourage a high speed differential between users or lead to excessively complex layouts that are confusing for users and are likely to result in users straying into each other's space.

Table 3.3 indicates how frequently a pedestrian can expect to encounter cycle users for various cycle flows. Table 3.4 similarly indicates how frequently a cycle user can expect to encounter pedestrians for a range of pedestrian flows. The levels of interaction indicated are based on walking speeds of 5 kph and cycling speeds of 15 kph, and would increase with higher speeds.

Cycle user access to pedestrianised areas or streets with restricted motor vehicle access can improve the permeability of the cycle network and allow cycle users direct and safe access to end destinations. Prohibition of cycling in these areas is unlikely to be desirable or effective, as it would restrict this direct and safe access, and may be ignored where better route options are not available to cycle users.

In many pedestrianised settings or at particular times of day, higher speed through-movements by cycle users may be inappropriate. The most effective approach to minimise through movements in pedestrianised areas is to ensure that the surrounding network offers better level of service route options. Designers should take a network-wide approach to attract cycle users away from pedestrianised settings rather than introducing ineffective prohibitions.

Experience of Pedestrian	Cycle Flow (2-way) 30 per hour	Cycle Flow (2-way) 50 per hour	Cycle Flow (2-way) 100 per hour	Cycle Flow (2-way) 150 per hour	Cycle Flow (2-way) 300 per hour	Formula
Meeting a cycle user in opposite direction	3 mins	1 min 48 s	54 s	36 s	18 s	$\frac{3600}{\text{(1-way flow of cycles)} \times [1 + \text{(speed of peds / speed of cycles)}]}$
Being overtaken by a cycle user	6 mins	3 mins 36 s	1 min 48 s	1 min 12 s	36 s	$\frac{3600}{\text{(1-way flow of cycles)} \times [1 - \text{(speed of peds / speed of cycles)}]}$

Table 3.3: Average time between interactions for a pedestrian

Experience of Cycle User	Pedestrian Flow (2-way) 30 per hour	Pedestrian Flow (2-way) 50 per hour	Pedestrian Flow (2-way) 100 per hour	Pedestrian Flow (2-way) 150 per hour	Pedestrian Flow (2-way) 300 per hour	Formula
Meeting a pedestrian in opposite direction	1 min	36 s	18 s	12 s	6 s	$\frac{3600}{\text{(1-way flow of cycles)} \times [1 + \text{(speed of cycles / speed of peds)}]}$
Overtaking a pedestrian	2 mins	1 min 12 s	36 s	24 s	12 s	$\frac{3600}{[\text{(1-way flow of cycles)} \times \frac{\text{(speed of cycles} - \text{speed of peds)}}{\text{speed of peds}}]}$

Table 3.4: Average time between interactions for a cycle user

Surrounding environment of the link

In many cases, the decision on the type of link will also be guided by the surrounding environment or placemaking context of the route.

Alongside the considerations of separating cycle traffic from motor traffic and pedestrians, the contribution of the cycle link to its surroundings and how this influences the selection of the link will be important.

For example, the conditions suitable for mixed traffic streets are most likely to be met where the street has a greater 'place' function than 'movement' function, as advocated in the Scottish Government's ***Designing Streets*** policy statement. These are streets where there is (or there is potential for) a greater balance of people wishing to dwell and spend time on the street over those wishing to simply pass through, as illustrated in Figure 3.1.

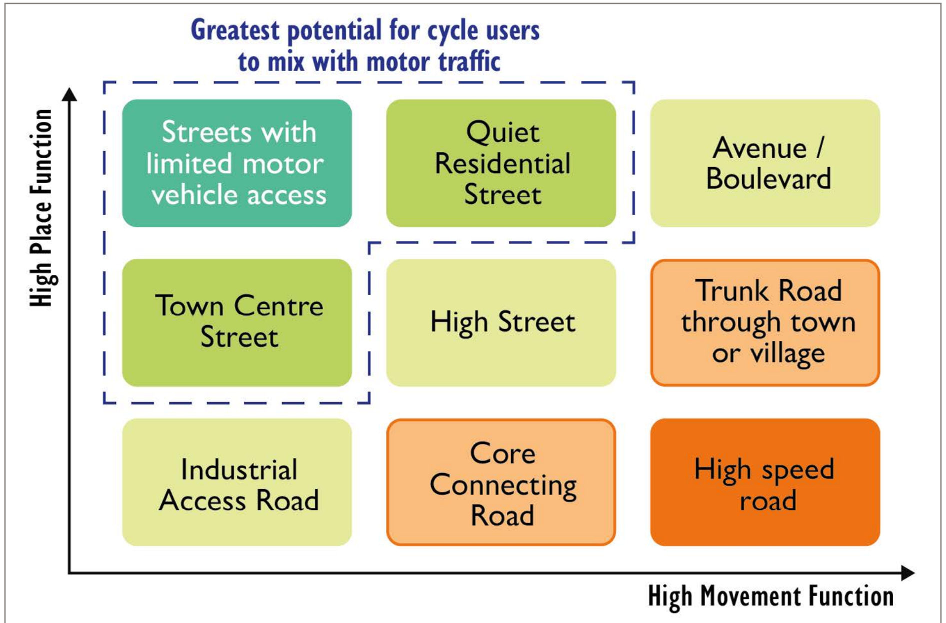


Figure 3.1: Typical street and place types by movement and place function

The choice to separate cycle users from pedestrians and motor traffic can influence the overall function and place quality of the street. The following requires careful consideration at the outset of cycle link choice, particularly if the place function of the area is high:

- How the choice of separation for the cycle link will impact or restrict the use of the surrounding space, both for movement and dwelling purposes. This will require a review of how people currently use the space and identification of potential impacts
- How physical separation and the choice of materials used will impact the visual amenity of the surrounding space. This will require discussion with local planning officers in advance of planning applications
- How to maximise opportunities for improvements to blue/green infrastructure or urban design within the link and alongside it.

Cycling infrastructure can have a positive impact on the surrounding environment of the link if it is considered within the holistic design of the street or place.

Designers of cycling infrastructure are expected to work collaboratively with landscape and urban designers to identify and build in these opportunities from the outset of design. This document deals primarily with the design requirements for cycling infrastructure itself, and designers are encouraged to seek guidance from the Scottish Government's ***Place Standard Tool*** and ***Green Infrastructure Design and Placemaking guidance***.

3.4 Geometric design requirements

It is essential that facilities are provided that meet appropriate geometric standards. This will ensure that they are comfortable, safe, attractive and suitable for users and their cycle vehicles.

The geometric criteria established in this section are based on the design vehicle defined in Chapter 2. The needs of other cycle vehicles also have to be considered by designers, particularly at critical locations such as crossings and junctions, where the standard criteria may not be sufficient for all individual user requirements. Guidance on these additional considerations is provided when describing relevant facilities for crossings and junctions in Chapter 4 and Chapter 5 respectively.

Requirements for link geometry and cross sectional width are provided here.

Link geometry (alignment)

Requirements for link geometry, relating to horizontal and vertical alignment and sight distance, are defined in this section for three categories of cycle link:

- Local access links, which will tend to serve shorter journeys, often in more constrained environments and with higher potential for interaction with pedestrians. These are likely to be on secondary routes on the cycle network. Their requirements are defined on the basis of a design speed of 20 kph.
- Commuter links, which will tend to serve longer journeys and interchange points in less constrained environments on primary or secondary routes. Their requirements are defined on the basis of a design speed of 30 kph.
- Higher speed links, which will tend to be fully separated, primary routes where cycle users are expected to build up greater speed. Their requirements are defined on the basis of a design speed of 40 kph.

Cycle link geometry is determined by these categories, but is not determined by the type of cycle link provided. For example, the minimum link geometry requirements for a cycle lane forming part of a commuter link will be the same as the minimum link geometry requirements for a detached cycle track forming part of a commuter link.

Where cycle links are adjacent to roads, the geometry of the road will largely influence the geometry of the cycle link. Notwithstanding this, the geometry values defined in this section apply to all cycle links, and any reductions below the desirable minimum values will be subject to assessment through the Design Review process set out in Chapter 2.

The category of cycle link should be established based on route purpose and local characteristics, prior to development of the geometric design.

In some circumstances the category of link may vary along a corridor to reflect local conditions and how the link is used within specific sections of the corridor.

3.4.1 Link geometry should be in accordance with Table 3.5.

3.4.2 Dynamic sight distance should be measured from an eye height range of 0.8 m to 2.2 m, to a target height range of 0.8 m to 2.2 m, as illustrated in Figure 3.2.

Note: Dynamic sight distance is the advance distance a cycle user requires to see ahead, to make the task of riding feel safe and comfortable and to pass slower cycle users and pedestrians. It is defined by the distance that a cycle user will travel in eight seconds at design speed.

3.4.3 Stopping sight distance should be measured from an eye height range of 0.8 m to 2.2 m to a target height range of 0 to 2.2 m, as illustrated in Figure 3.2.

Note: Stopping sight distance represents the ability of a cycle user to see an obstruction on the route ahead, and stop where necessary.

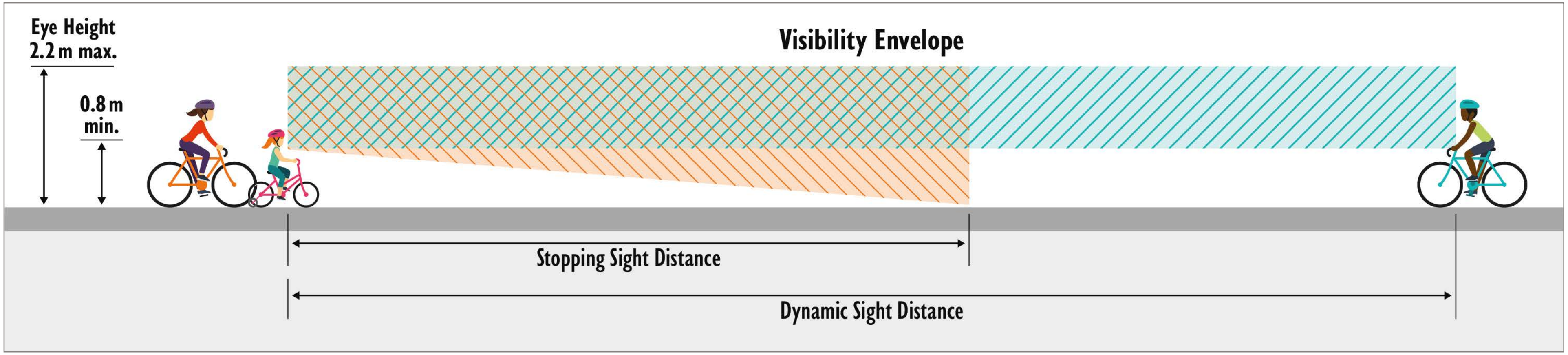


Figure 3.2: Visibility requirements

Criteria	**Local Access Link** (20 kph design speed)	**Commuter Link** (30 kph design speed)	**High Speed Link** (40 kph design speed)
Sight distance – Dynamic desirable minimum	44 m	67 m	89 m
Sight distance – Stopping desirable minimum	17 m	31 m	47 m
Horizontal radius – Desirable minimum	14 m	32 m	57 m
Vertical crest curvature – Desirable minimum (K)	6	6	14
Vertical sag curvature – Desirable minimum (K)	5	5	5
Gradient – Desirable maximum	3%	3%	3%

Table 3.5: Cycle link geometry requirements

New cycle links will often be constrained by existing topography. Although this may be unavoidable in some locations, providing cycle links on steep gradients will not provide the highest level of service for all users, and alternative routes should be considered where practical.

Level of Service Indicators – Gradient

In relation to Design Principle – Comfort

●●● High Level of Service:
There are no sections of route steeper than 3% gradient

●● Medium Level of Service:
Some sections of route exceed 3% gradient due to local topography, but the route is designed to minimise the length of these sections

● Low Level of Service:
Much of the route exceeds 3% gradient

Additional width is required for cycle links on gradients greater than 3% to allow for additional lateral movement (for uphill cycling) and speed (for downhill cycling), as set out in Table 3.7. One-way cycle links will generally be preferable in these situations to reduce cycle user conflict. Where designers have space to provide a wider facility in one direction over another, more width should be given to the downhill direction to accommodate additional speed.

Vertical curvature is defined by minimum K values, where a crest curve represents a negative change in gradient (e.g. over the top of a hill) and a sag curve represents a positive change in gradient (e.g. through the low point of a valley). The K value is the distance required to alter the gradient by +/-1%. Crest curves affect forward visibility and their values are therefore determined on that basis. Sag values generally do not affect visibility and are therefore based on comfort.

3.4.4 Where ramps are provided on cycle links to access bridges or underpasses or to overcome local constraints, the desirable maximum gradient is 5%.

3.4.5 Higher gradients may be applied to ramps intended to be used by cycle users but it is recommended that the length and rise of these ramps is limited as shown in Table 3.6, which is aligned to the recommendation of ***Roads for All: Good Practice Guide for Roads***.

Consideration may be given to dual provision ramps. These can provide landings between the rise of ramps on one side for those users who will benefit from these, and the separate provision of ramps without landings on the other side for those who may find this more comfortable.

Ramp Gradient	Recommended Maximum Length	Recommended Maximum Rise
5%	10 m	500 mm
7%	5 m	350 mm

Table 3.6: Ramp requirements

Cross-sectional geometry

Cross sectional requirements will vary depending on the type of facility and the number of users expected. Figure 3.3 shows the widths needed to cycle comfortably alongside other users, illustrating the basis for the desirable width dimensions that are defined in this section.

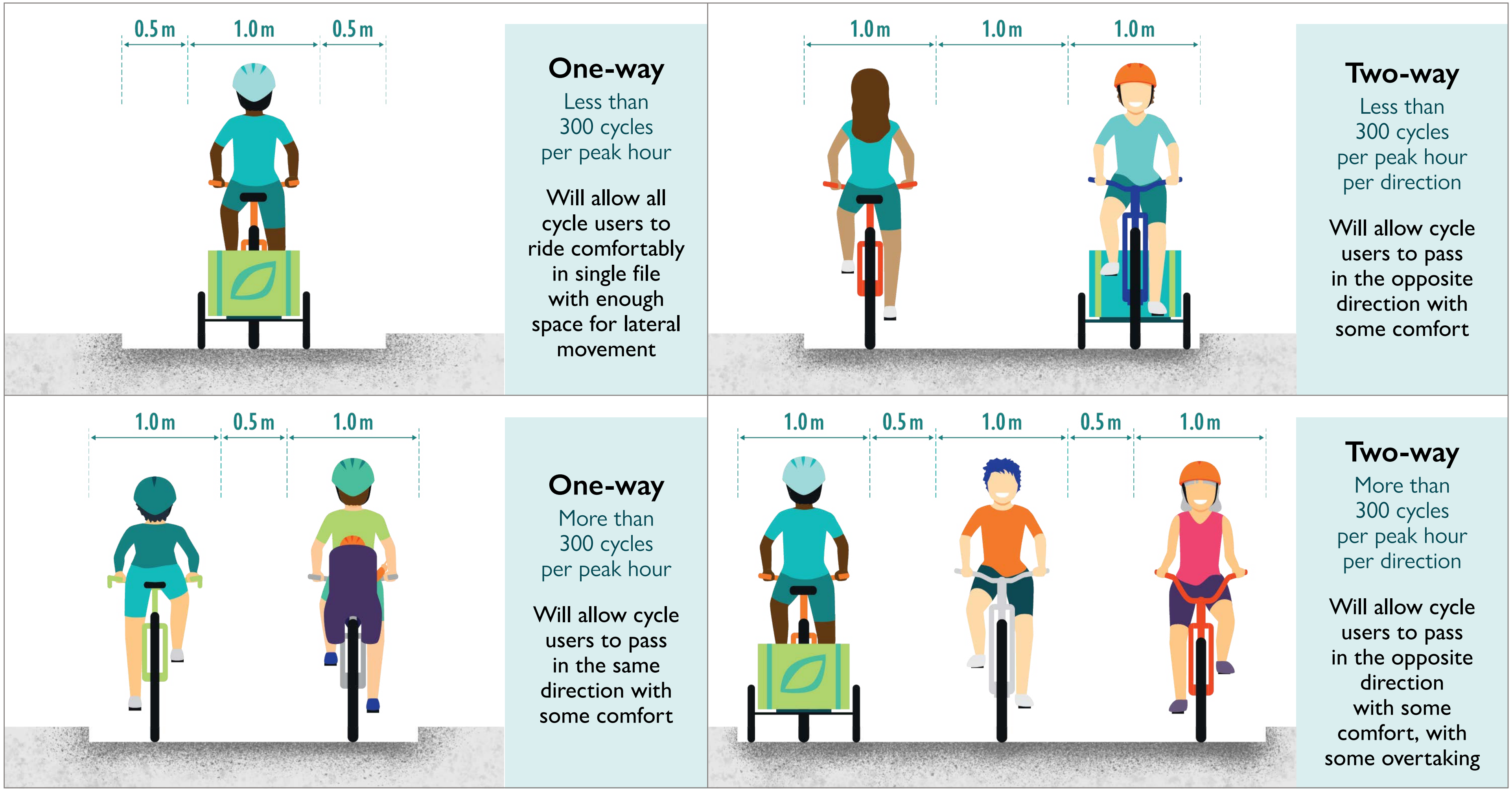


Figure 3.3: Basic space for cycle users (desirable)

A 1.0 m dynamic width envelope will accommodate different types of cycle vehicle and allow sufficient space for the lateral movement needed for users to retain balance and momentum. A separation of 0.5 m will allow for comfortable overtaking and social cycling in the same direction, while a separation of 1.0 m will provide comfortable and safe passing in opposite directions.

Tables 3.7 and 3.8 show the dimensions that are required of the cycle track types described in the following sections. Facilities should be designed in accordance with the desirable minimum dimensions. Where desirable values cannot be achieved due to particular constraints, reductions towards absolute minimum may be considered, subject to the Design Review process.

It is vital that new cycle links and improvements to existing cycle links account for anticipated future volumes of cycle users and not just existing users. Links to guidance on assessing future demand are provided in Chapter 2.

Cycle Track Types		Footway Width	Separation	Cycle track width* – One-way, less than 300 cycles per hour peak	Cycle track width* – One-way, more than 300 cycles per hour peak	Cycle track width* – Two-way, less than 300 cycles per hour peak (per direction)	Cycle track width* – Two-way, more than 300 cycles per hour peak (per direction)	Buffer Width
Remote Cycle Tracks Separated from Pedestrians	Desirable minimum	2.0 m	Varies with Facility	2.0 m	2.5 m	3.0 m	4.0 m	N.A.
	Absolute minimum	1.5 m	Varies with Facility	1.5 m	2.0 m	2.0 m	3.0 m	N.A.
Remote Cycle Tracks Shared with Pedestrians	Desirable minimum	N.A.	N.A.	Not Recommended	Not Recommended	4.0 m	Not Recommended	N.A.
	Absolute minimum	N.A.	N.A.	Not Recommended	Not Recommended	2.5 m	Not Recommended	N.A.
Cycle Tracks adjacent to Carriageway Separated from Pedestrians	Desirable minimum	2.0 m	Varies with Facility	2.0 m	2.5 m	3.0 m	4.0 m	Refer to Table 3.8
	Absolute minimum	1.5 m	Varies with Facility	1.5 m	2.0 m	2.0 m	3.0 m	Refer to Table 3.8
Cycle Tracks adjacent to Carriageway Shared with Pedestrians	Desirable minimum	N.A.	N.A.	Not Recommended	Not Recommended	4.0 m	Not Recommended	Refer to Table 3.8
	Absolute minimum	N.A.	N.A.	Not Recommended	Not Recommended	2.5 m	Not Recommended	Refer to Table 3.8

- On gradients greater than 3%, cycle track width should be increased by 0.25 m to allow for greater lateral movement.
- Where gullies are present on a cycle track that do not allow cycles to easily overrun, the cycle track width should be increased by the widths of the gully.

Table 3.7: Dimensions for cycle tracks

Speed Limit	Minimum Buffer Width
30 mph	0.50 m
40 mph	1.00 m
50 mph	2.00 m (including any hard strip)
60 mph	2.50 m (including any hard strip)
70 mph	3.50 m (including any hard strip)

Table 3.8: Buffer widths

Sufficient clearance is required to fixed objects and other features, such as street furniture, light segregation features and adjacent buildings and infrastructure. Greater proximity to fixed objects and features will reduce the effective width of the basic cross-sectional space for cycle users as they will position themselves to avoid these objects.

3.4.6 The clearance provided between the cycle track (or cycle lane) and fixed objects and features should be in accordance with Table 3.9.

Features	Minimum Clearance
Vertical feature between 60 mm and 150 mm	0.20 m
Vertical feature between 150 mm and 600 mm	0.25 m
Vertical feature higher than 600 mm	0.50 m
Ditch or slope	0.50 m
Canal or other watercourse	1.20 m
Equestrian route	1.00 m

Table 3.9: Clearance to objects and other features

Level of Service Indicators – Cross Section

In relation to Design Principle – Comfort

●●● **High Level of Service:**
Desirable minimum widths are fully achieved

●● **Medium Level of Service:**
Some sections of the route fall below desirable minimum widths, or

Most of the route falls below desirable minimum widths, but cycle user numbers are less than 50 per hour with limited scope for growth

● **Low Level of Service:**
Most of the route falls below desirable minimum widths

In relation to Design Principle – Adaptability

●●● **High Level of Service:**
Cross section of the route has the flexibility to expand, evolve or adapt to changing demands

●● **Medium Level of Service:**
Only some of the route has the flexibility to expand, evolve or adapt to changing demands

● **Low Level of Service:**
No scope to amend cycling infrastructure once installed

3.4.7	The maximum crossfall on a cycle link should be 2.5%.
Note:	The crossfall on all cycle links should be no more than is necessary for adequate drainage, to ensure that cycle users (and pedestrians where the link is shared) do not experience any discomfort when travelling at low speeds.
Note:	Camber rather than crossfall will be more comfortable for wheelchair users if the link is shared with these users.

3.4.8	Where existing on-carriageway crossfall exceeds 2.5%, the designer should assess the impact of this, modify the design accordingly and use the Design Review process to justify. Where necessary, alternative off-carriageway links should be developed.

3.4.9	Superelevation should not be specifically applied for cycle links.

3.4.10	Edge protection should be provided where there is less than 4.5 m clearance from the edge of the cycle link to steep drops, water hazards or other hazards that would otherwise lie in the path of an out-of-control cycle user. This would include cycle links on ramps to overbridges and underbridges.

3.5 Detached or remote cycle tracks

Cycle tracks which are detached or entirely remote from any associated road carriageway offer the greatest level of protection from motor traffic and therefore have the potential to be very attractive to cycle users.

They are appropriate for use on long distance cycle links in rural areas, promoting recreational trips to various locations of interest, or equally to provide safer commuting between these areas. Detached or remote cycle tracks will usually be two-way, though associated one-way sections in each direction may be appropriate at constrained locations (such as through structures).

They also have the potential to provide attractive facilities in more urban situations where they can be used to connect facilities between neighbourhoods, through parks and alongside canals. These cycle tracks often provide the best recreational and family-friendly routes in urban areas and can potentially act as wildlife corridors linking other greenspaces.

Detached or remote cycle tracks may be shared with pedestrians or may include separated pedestrian facilities. Where they are separated this may be by level (using a kerb) or at the same level by a paved or grass strip, or by kerb demarcation or delineation where space is limited. Grass or other planting in the separation strip can add ecological value to the cycle link and improve opportunities for sustainable drainage systems.

The interaction with pedestrians needs to be carefully considered, and the priority of pedestrian movement within the Sustainable Travel Hierarchy maintained.

Figures 3.4 to 3.6 illustrate a range of detached or remote cycle track layouts. Refer to Section 3.12 for cycle track construction options.

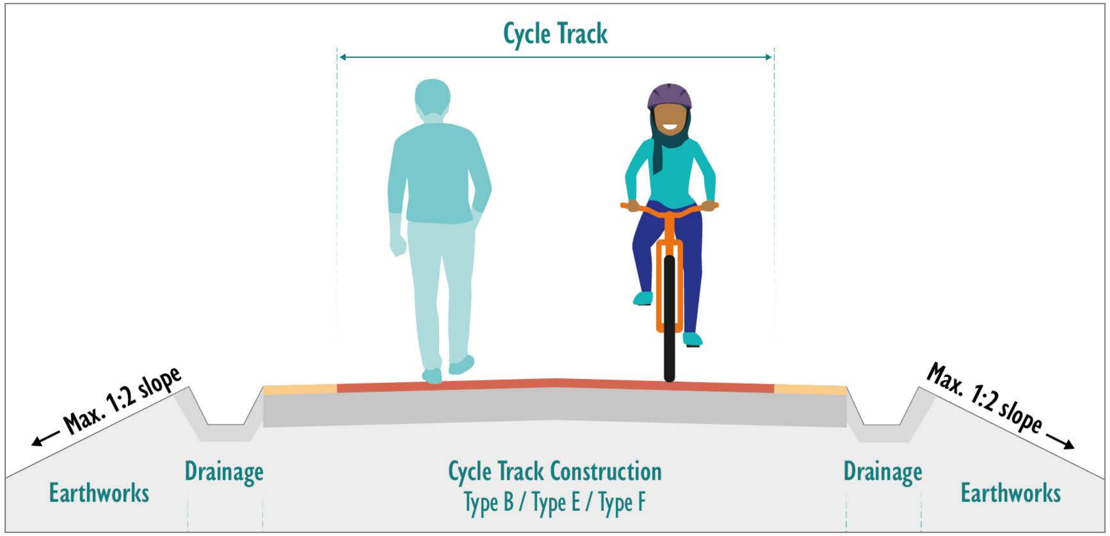


Figure 3.4: Detached or remote cycle track (shared with pedestrians)

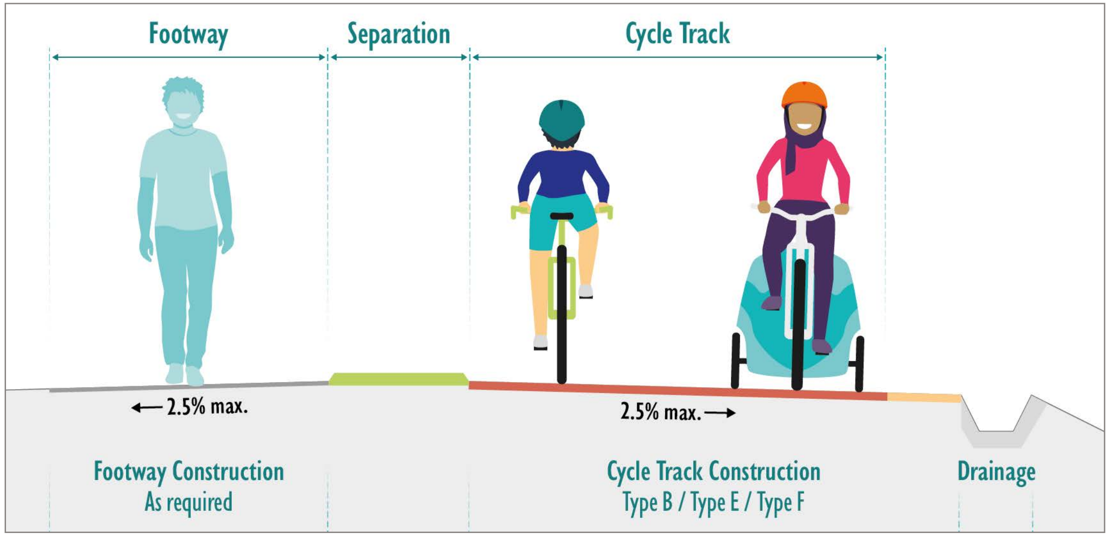


Figure 3.5: Detached or remote cycle track (separated from pedestrians on same level)

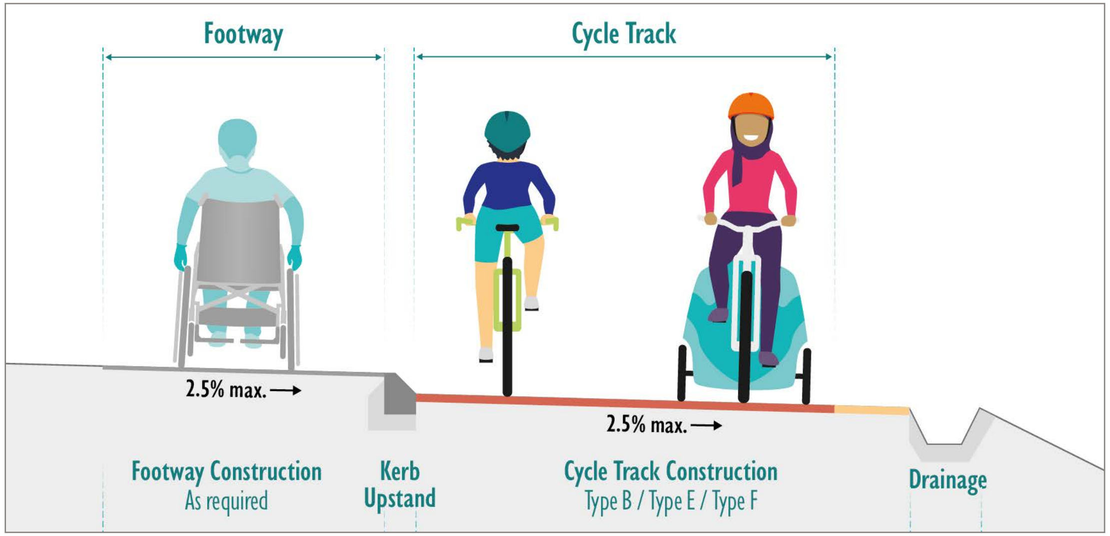


Figure 3.6: Detached or remote cycle track (separated from pedestrians by level)

3.5.1 The desirable and absolute minimum widths for the cycle track and pedestrian facilities should be in accordance with Tables 3.7 and 3.8.

3.5.2 Where the cycle track is separated from pedestrians on the same level, this should be by means of a minimum 1.0 m strip that may be paved or grass. Where space is limited the width of separation may be reduced or be made by delineation.

Note: Care should be taken to ensure that raised demarcation kerbs or delineation strips do not create ponding e.g. by providing regular gaps in the line. A 20 mm profile is more detectable than a 12 mm profile.

3.5.3 Where grass (or other planting) is proposed within the separation area, the maintaining authority should be consulted.

3.5.4 For detached or remote cycle tracks separated by level, the separation width between the cycle track and footway is defined by the width of the kerb.

3.5.5 For detached or remote cycle tracks separated by level, the kerb between the cycle track and footway should be splayed and be of 60 mm minimum height.

3.5.6 Sections of one-way cycle track should not be shared with pedestrians.

Steeper downhill gradients result in higher cycle speeds. On steeply graded separated tracks, cycle users should be routed to the outside of the sharpest bends where practical.

On steep, shared tracks, localised separation can be employed at bends in the same way. This avoids the need for separation along the full length but also offers protection for pedestrians.

Separation by verge has benefits on a steeply graded path, as it minimises the risk of cycle user encroachment onto the pedestrian space.

Remote cycle tracks may create actual or perceived personal security issues if not well designed. Care should be taken that sufficient width is provided, any vegetation is suitably offset from the cycle track and full visibility requirements are achieved to mitigate these risks. Lighting of remote cycle tracks is recommended to ensure a high level of service for users at night.

Level of Service Indicators – Personal Security

In relation to Design Principle – Attractiveness

●●● **High Level of Service:**
The cycle link is well lit and overlooked. Full forward visibility is achieved and vegetation is regularly maintained

●● **Medium Level of Service:**
Some sections of the link are infrequently lit or overlooked. Vegetation or other obstacles create localised breaks in visibility

● **Low Level of Service:**
Most of the link is infrequently lit or overlooked. Vegetation or other obstacles create regular breaks in visibility

Converting existing facilities to cycle tracks

Opportunities to provide remote cycle tracks may arise on existing or disused facilities.

Examples include:

- Conversion of a dismantled railway to a cycle track facility
- Conversion or provision of a cycle track facility on an existing canal tow path
- Conversion or provision of a cycle track facility on an existing bridlepath
- Conversion of an old single-track road that has been replaced by a new road.

In all cases, an assessment is required to ensure the suitability of the existing infrastructure for use, and to determine what construction works are required to develop the facility. The scope of this assessment will be influenced by the specific site, but issues to consider include:

- Interaction with pedestrian facilities and requirements
- Review of any actual or perceived safety risk resulting from remote routes
- Future infrastructure maintenance responsibility, including cycle track pavement, structures, signage, fencing and lighting
- Existing physical constraints to providing a compliant facility, such as existing overbridges or width restrictions
- Planning and consultation requirements with those authorities responsible for the existing infrastructure.

3.5.7 Geometric requirements for converted facilities should be in accordance with those generally defined for detached and remote cycle tracks.

3.5.8 Clearance to watercourses and equestrian routes should be in accordance with Table 3.9.

Note: Planning consents and agreements with landowners and operators are required when converting existing facilities to cycle tracks. Consultation with user groups may also be needed, including with the British Horse Society Scotland when developing a joint scheme involving an equestrian route.

Access control

Barriers, gates and other forms of access control are often used on remote cycle tracks to prevent access by motor traffic or, in some cases, to control the speed of cycle users on approach to crossings or other points of interaction.

However, these access control measures may exclude some disabled people and others riding non-standard cycle vehicles from the cycle track. They may also require cycle users to dismount to negotiate the barrier, making the route less attractive and comfortable to cycle.

For these reasons, there should be a presumption against the use of access control measures unless there is a persistent and significant safety or personal security concern raised by unwanted access, including motor traffic or motorcycle access.

For the control of cycle user speed, it is preferable to adjust the horizontal alignment on approach to crossings or other points of interaction, and ensure that good forward visibility is provided to these points. This will allow cycle users to be fully aware of the interaction points and the need to adjust speed accordingly to give way to pedestrians or motor traffic if required.

Where access controls are provided (either through bollards on a cycle track or a gated access to restrict the movement of livestock), suitable spacing of 1.5 m should be provided to allow all types of cycle vehicle to pass unrestricted. These bypasses should be fully open to cycle users but may be controlled via self-closing gates if required by landowners.

Cattle grids can be difficult for cycle users to cross and should be avoided where cycle access is being designed.

3.6 Cycle tracks adjacent to carriageway

Cycle tracks are protected from the adjacent road carriageway by physical means. This distinguishes them from cycle lanes and provides a greater degree of comfort to cycle users, increasing their perceived and actual safety and the attractiveness of the route. They give cycle users greater confidence to use the road network.

On this basis, a physically protected cycle track is the preferred facility wherever a route is associated with an adjacent carriageway.

Cycle tracks of this type are most likely to lie between the road carriageway and pedestrian facilities. The following three sub-categories of cycle track adjacent to the carriageway are distinguished by their level, relative to the adjacent carriageway and pedestrian facility:

- Cycle track at carriageway level
- Stepped cycle track
- Cycle track at footway level

All of these can improve the attractiveness and quality of the street when designed as part of holistic street improvements, incorporating opportunities for planting, seating and use of the spaces alongside the cycle track.

Cycle tracks at carriageway level and stepped cycle tracks maintain a level difference between cycle users and pedestrians. This layout is preferred, particularly in urban locations where pedestrian numbers are high, as it offers a greater degree of separation and therefore fewer potential interactions between pedestrians and cycle traffic.

A level difference is particularly significant in enabling blind and partially sighted users to be able to identify the cycle track and steer the pedestrian along its edge. Where no level difference is provided, it will be important to keep any building lines clear of street furniture to provide long cane users with an unobstructed route that can be easily navigated.

One-way cycle tracks are preferred to two-way cycle tracks when adjacent to the road carriageway, as they provide greater certainty to all road users of expected cycle movements and the interactions to be managed. Two-way cycle tracks can cause difficulties where kerbside activity is high, such as at bus stops, parking and loading areas. They are not suitable where only light segregation provides the protection from motor traffic. However two-way cycle tracks can be considered where they provide improved connections to the wider cycle network.

Where kerbs are employed, care is needed to ensure that surface water can run off from the cycle track and outfall at a suitable location, and avoid any ponding on the cycle track.

On roads that are one-way to general traffic, contra-flow or two-way cycle tracks can be installed to allow cycle users to travel in the opposite direction to the general traffic flow.

Cycle tracks can also be used to support speed reduction, by reducing the width available to general traffic. Where cycle tracks are formed within an existing road corridor, space should generally be reallocated from the road carriageway and not from pedestrian facilities.

Cycle track at carriageway level

A cycle track at carriageway level allows cycle users to cycle at the same level and often on the same surface as motor traffic, whilst providing physical protection between the two.

The level of protection from motor traffic, and therefore the degree of safety and attractiveness that is achieved, is influenced by the degree of physical protection provided. It is recommended that physical protection of a cycle track at carriageway level be provided by a kerbed reserve as shown in Figure 3.7, as this provides the greatest degree of protection.

Alternatively, protection may be provided by light segregation as shown in Figure 3.8. Light segregation can be achieved by features such as rubber kerbing, bollards and intermediate planters. These are quicker and cheaper to install than fully kerbed protection and thereby allow for trialling of measures in advance of permanent construction works.

Designers are required to consider the traffic conditions and level of use to determine whether light segregation offers sufficient protection to cycle users. It offers greater protection than painted cycle lanes and should be considered where a kerbed reserve cannot be reasonably provided.

Guidance on light segregation options is given in Table 3.10. Care should be taken that any form of light segregation is passively safe (i.e. minimises the severity of injury of anyone who may collide with it). All light segregation options are likely to result in a build-up of debris and detritus. This will have a maintenance implication and require enhanced or more frequent street cleaning which should be considered at the outset.

Where the cycle track is set at carriageway level, the adjacent pedestrian facility is separated from the cycle track by a level difference.

Refer to Section 3.12 for cycle track construction options.

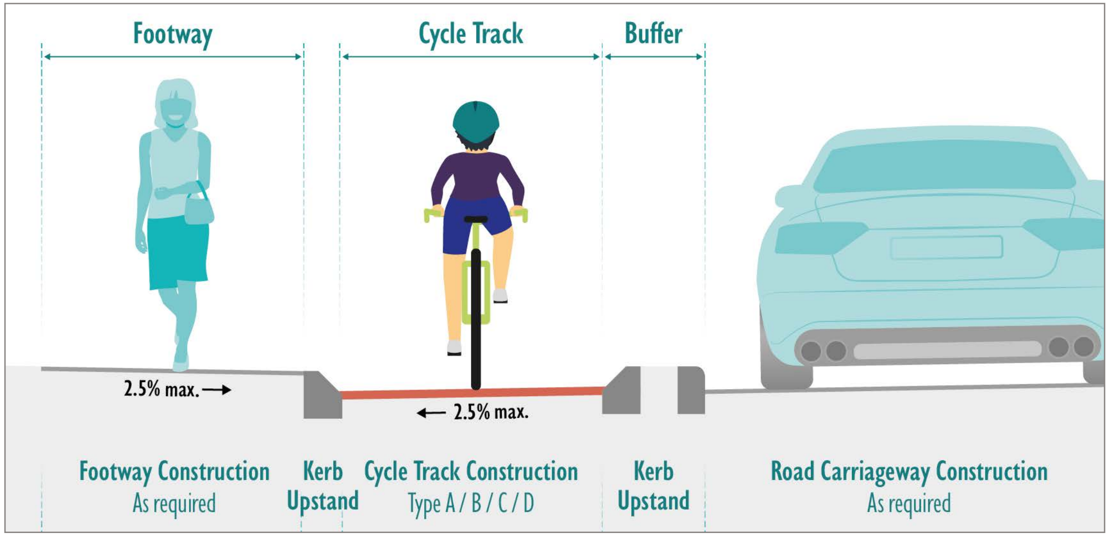


Figure 3.7: Cycle track at carriageway level (kerbed)

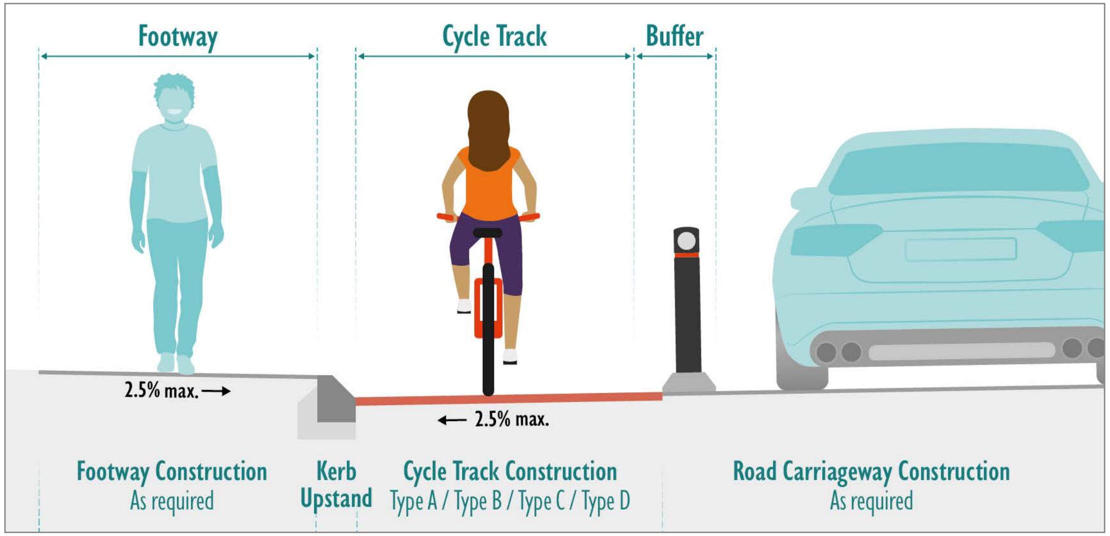


Figure 3.8: Cycle track at carriageway level (light segregation)

Cycle tracks at carriageway level will often be preferred where a new cycle track is to be formed from space previously given to the road carriageway, and where it is not practical or desirable to form a stepped cycle track. They enable the existing carriageway crossfall to be maintained, which can be beneficial for drainage purposes. Where this is the case, regular gaps in the kerbed reserve are required to ensure continuity of surface water flow.

Cycle tracks at carriageway level are particularly appropriate where there are multiple side roads or minor accesses along the route, simplifying crossings without requiring level changes for the cycle user. The crossing of side roads and accesses is of importance to ensure the continuity of the cycle route in all scenarios. Design requirements for these are set out in Chapter 5.

3.6.1 The desirable and absolute minimum widths for the cycle track, pedestrian facilities and buffer should be in accordance with Tables 3.7 and 3.8.

3.6.2 The separation width between the cycle track and footway is defined by the width of the kerb.

3.6.3 The kerb between the cycle track and footway should be splayed and of 60 mm minimum height.

Batons or Wands

Best suited to start/end of protected sections.

Advantages: Height makes them highly visible to all users. Well recognised and understood.

Cons: Can be visually intrusive.

Armadillos or Zebras

Best suited to intermediate sections.

Advantages: Robust low-level protection for cycle users. Minimal visual impact on streetscape.

Cons: Can be a trip hazard for pedestrians crossing informally. Low level makes them less visible to drivers and not favoured by motorcycle users.

Wand Orcas

Best suited to start/end of protected sections.

Advantages: Height makes them highly visible to all users. Island element provides robust low-level barrier.

Cons: Can be visually intrusive.

Orcas

Best suited to intermediate sections.

Advantages: Robust low-level protection for cycle users. Shallow gradient on cycle user side is more forgiving. Minimal visual impact on streetscape.

Cons: Can be a trip hazard for pedestrians crossing informally. Low level makes them less visible to drivers and not favoured by motorcycle users.

Rubber Kerbs

Best suited to intermediate sections.

Advantages: Low visual impact. Quick and easy to install.

Cons: Low level makes them less visible to drivers and pedestrians, creating a potential trip hazard.

Landscaping Objects

Best suited to intermediate sections.

Advantages: Robust low-level protection for cycle users. Visually appealing.

Cons: Potentially higher maintenance burden than other options. Easier to displace or damage.

Table 3.10: Light segregation options

Stepped cycle tracks

Stepped cycle tracks provide protection between motor traffic, cycle traffic and pedestrians on three levels. This provides an additional degree of separation for cycle users from motor traffic, but also maintains the level difference between the cycle track and the footway, which is preferred by blind and partially sighted pedestrians.

Stepped cycle tracks are more space efficient than cycle tracks at carriageway level as they provide physical separation from the road carriageway without an additional kerbed reserve. However, they can be more complex to construct, and the absence of a kerbed reserve may entice motor traffic to use the stepped track for parking or loading activities.

For this reason, the inclusion of a raised kerb or light segregation may be provided within the buffer between the cycle track and the carriageway. This provides additional protection for cycle users and an additional deterrent to motor traffic, while ensuring that the necessary clearance width is provided. Figures 3.9 and 3.10 illustrate a stepped cycle track without and with light segregation (a raised kerb may be provided as an alternative to light segregation). Guidance on light segregation options is given in Table 3.10.

Refer to Section 3.12 for cycle track construction options.

Consistent cycle link design is vital to ensure the safety and attractiveness of a route. If it is not possible to provide a consistent stepped cycle track for suitable lengths of the route due to drainage, access or other requirements, then alternative link types will be more appropriate.

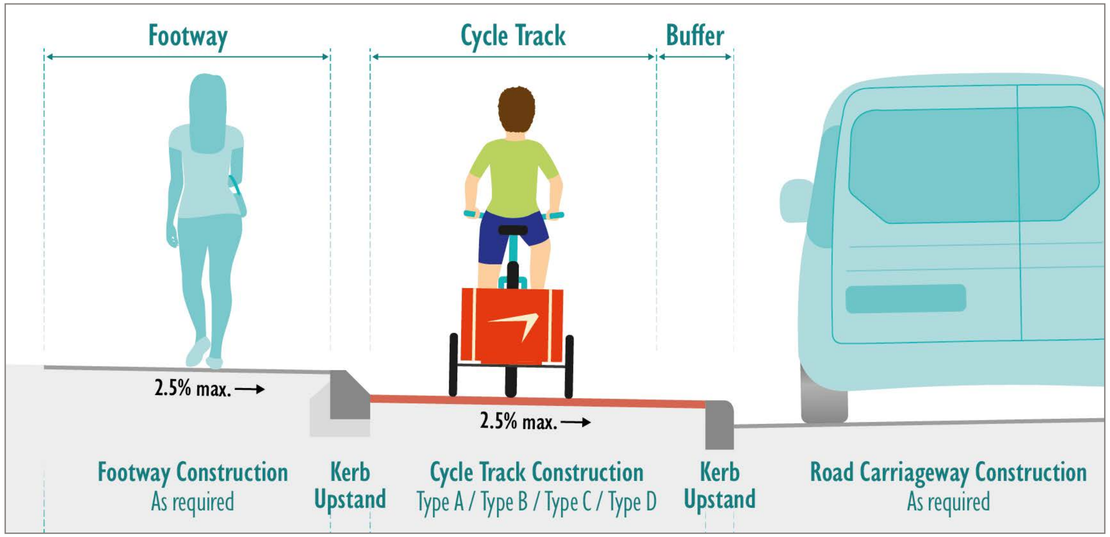


Figure 3.9: Stepped cycle track

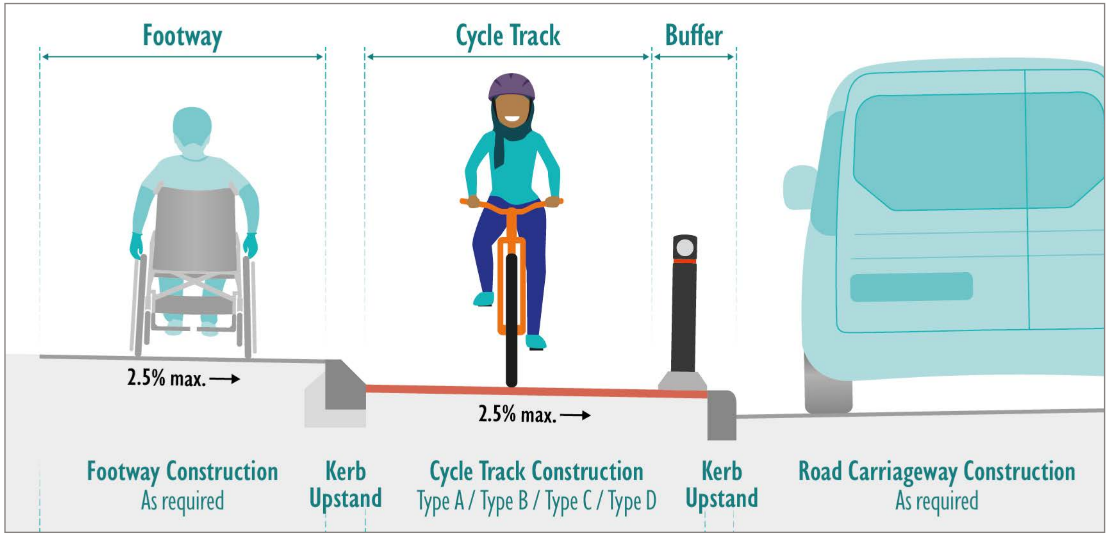


Figure 3.10: Stepped cycle track with light segregation

Stepped cycle tracks on existing road corridors should generally be formed through the reallocation of road space rather than taking space from the adjacent footway.

Where there is a demand for pedestrian crossing of the cycle track and adjacent road, the stepped cycle track should transition to a cycle track at carriageway level (or footway level if required) to provide a suitable crossing point for pedestrians.

Stepped cycle tracks often require additional drainage infrastructure, can be more complex to construct to achieve desired levels and may not be practical when retrofitting cycle tracks within constrained corridors. Drainage requirements will dictate the direction of crossfall, either to the roadside kerb or footway kerb.

Careful consideration of future cycle user volumes is needed to ensure adequate width is provided for overtaking, which can be less comfortable for users on stepped cycle tracks.

3.6.4 The desirable and absolute minimum widths for the cycle track, pedestrian facilities and buffer should be in accordance with Tables 3.7 and 3.8.

3.6.5 The separation width between the cycle track and footway is defined by the width of the kerb.

3.6.6 The kerb between the cycle track and footway should be splayed and of 60 mm minimum height.

3.6.7 Two-way stepped cycle tracks should not be provided.

Note: Two-way stepped cycle tracks are likely to place cycle users adjacent to motor traffic moving in the opposite direction. Greater physical protection between cycle users and motor traffic is preferred in this case.

Cycle track at footway level

It is desirable to separate pedestrians and cycle users by level, but this will not always be practical or achievable. Cycle tracks at footway level are usually less desirable but may be considered where:

- The available space allows for sufficient separation between pedestrians, cycle users and motor traffic as shown in Figure 3.11 and can be integrated into a holistically designed street
- The cycle track joins a detached cycle track at the same level
- There is a need for regular crossing of the cycle track by people with prams or in wheelchairs.

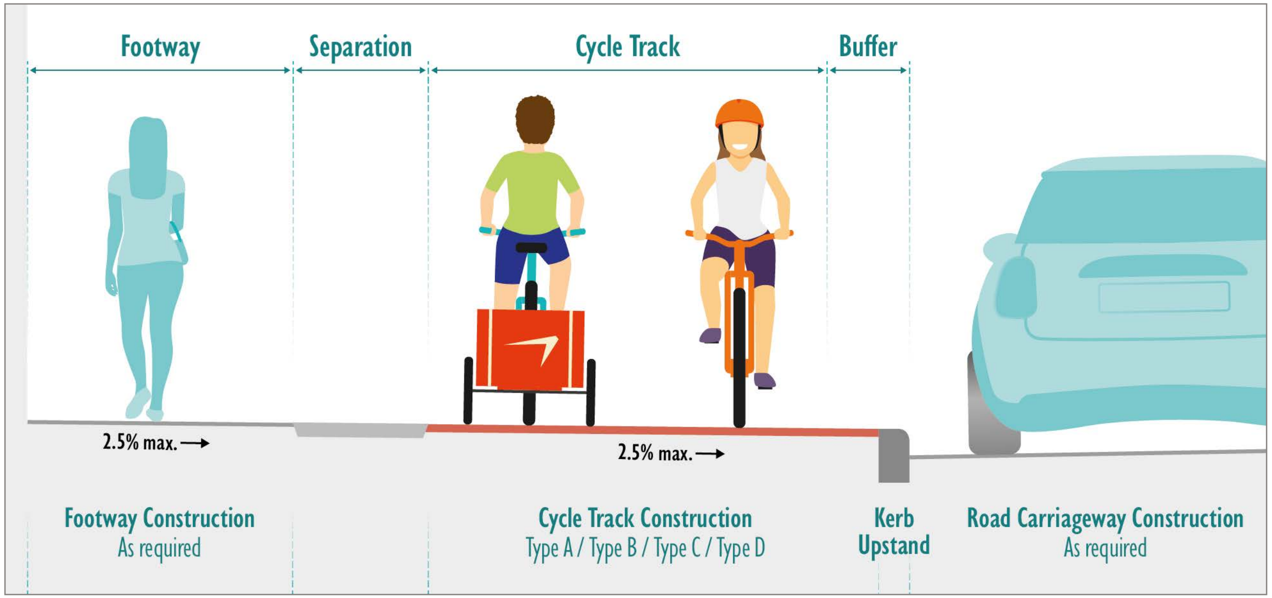


Figure 3.11: Cycle track at footway level (separated from pedestrians)

Separation between the cycle track and the pedestrian space minimises the potential for pedestrian and cycle interaction. Where space allows, this may be achieved by a paved or grass strip, or by kerb demarcation or delineation where space is limited. Grass or other planting in the separation strip can add ecological and placemaking value to the cycle link and improve opportunities for sustainable drainage systems.

In circumstances where there is less pedestrian activity, and therefore less likelihood of potential interactions between pedestrians and cycle users, it may be suitable not to separate users, as shown in Figure 3.12. Refer to Section 3.3 for guidance on when low levels of interactions between pedestrians and cycle users may allow mixed use as an alternative to separated facilities.

This arrangement will often be suitable in rural situations where pedestrian and cycle user levels are low. In rural areas the kerb between the edge of the road carriageway and the cycle track is not a requirement. In such cases the road speed will often be relatively high, and therefore a wider buffer is required in accordance with Table 3.8.

There should be a presumption against shared footways and cycle tracks alongside urban streets.

Refer to Section 3.12 for cycle track construction options.

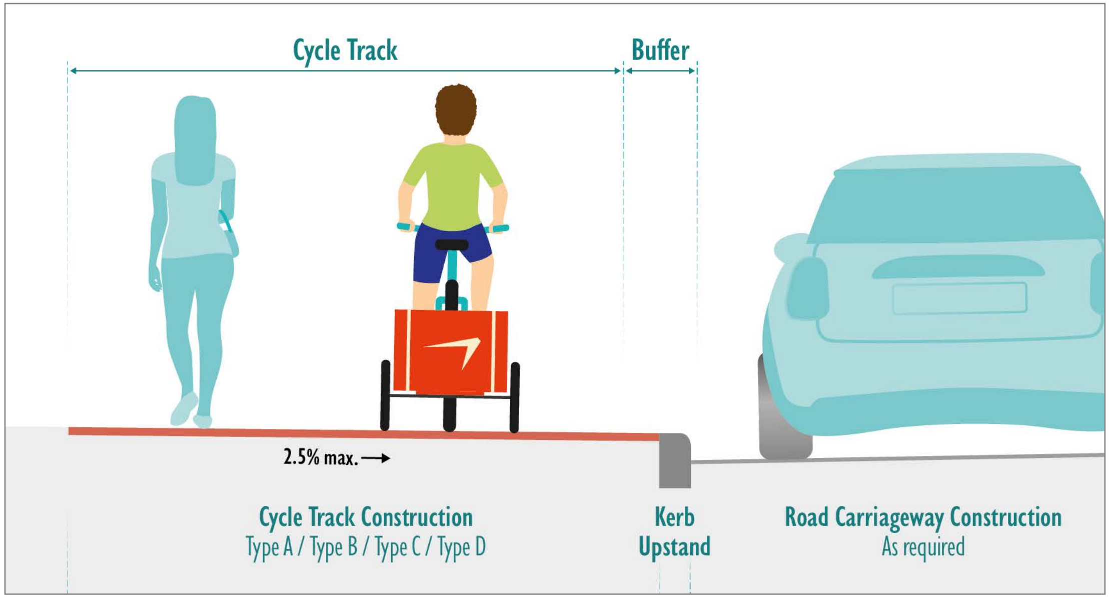


Figure 3.12: Cycle track at footway level (shared with pedestrians)

3.6.8 The desirable and absolute minimum widths for the cycle track, pedestrian facilities and buffer should be in accordance with Tables 3.7 and 3.8.

Note: On very quiet rural routes a reasonable level of service may be achieved with an absolute minimum width on this type of facility.

3.6.9 Where the cycle track is separated from pedestrians on the same level, this should be by means of a minimum 1.0 m strip that may be paved or grass. Where space is limited the width of separation may be reduced or be made by demarcation kerb or delineation.

Note: Care should be taken to ensure that raised demarcation kerbs or delineation strips do not create ponding e.g. by providing regular gaps in the line. A 20 mm profile is more detectable than a 12 mm profile.

3.6.10 Where grass (or other planting) is proposed within the separation area, the maintaining authority should be consulted.

3.6.11 Cycle tracks shared with pedestrians should be two-way.


PEOPLE
MAKE
GLASGOW

3.7 Cycle lanes

Cycle lanes allocate and define the available space for cycle users within a carriageway. They are delineated within the carriageway only by road markings.

Physically protected cycle tracks will provide a higher level of service than cycle lanes, due to the greater level of protection and the resulting level of safety and attractiveness of the facility for its users. Therefore, cycle lanes should only be considered where cycle tracks cannot reasonably be provided, and where the conditions on the adjacent carriageway are deemed to apply a low level of risk to cycle users (see Section 3.3).

Within these limited circumstances, cycle lanes provide benefits to some users when compared to the absence of any facility. For those users, cycle lanes can reduce delay by providing a passing opportunity where traffic is queued and offer greater freedom of movement for those comfortable cycling on the road carriageway.

Cycle lanes can increase drivers' awareness of cycle users but they also encourage cycle users to take up a secondary position in the road carriageway where, in most circumstances, it will be far better to provide a protected cycle track (refer to Figure 3.14 for secondary position).

Where used, careful consideration of cycle lanes within the overall network is needed to ensure that less confident cycle users are not suddenly 'exposed' to sections of cycle lane, having been more comfortable in protected cycle tracks earlier in their journey.

3.7.1 The desirable minimum width of a cycle lane should be 2.0 m.

3.7.2 The absolute minimum width of a cycle lane should be 1.5 m.

Note: A narrow cycle lane can encourage close overtaking by motor traffic.

3.7.3 Where gullies are present on the cycle lane, they should be provided with a tighter mesh covering that is suitable for cycle wheels to cross, or the width of the cycle lane should be increased by the width of the gully.

3.7.4 Parking should be tightly controlled and enforced to ensure no motor vehicles stop or wait within the cycle lane.

With-flow cycle lanes

Cycle lanes can be provided on two-way roads, in which case they run immediately adjacent to the carriageway lane running in the same direction.

Mandatory cycle lanes define an area of the carriageway that is reserved for cycle users and which other vehicles must not encroach upon within its hours of operation. Regulations relating to mandatory cycle lanes are defined in ***Schedule 9 of TSRGD***.

Advisory cycle lanes are primarily used to warn motor vehicle drivers of the presence of cycle users and to encourage them to provide suitable space. However, it is permissible for motor traffic to drive within an advisory cycle lane, or to stop within the lane subject to parking and loading restrictions on the street. Advisory lanes therefore offer less benefit to cycle users.

3.7.5 Cycle lanes on two-way roads should be with-flow i.e. the direction of the cycle flow should be the same as that of the adjacent traffic lane.

3.7.6 With-flow cycle lanes should be mandatory, entirely reserved for cycle use and legally enforceable, subject to permitted exceptions.

Note: Light segregation or kerbed protected cycle tracks will provide a higher level of service for most situations where a cycle lane is being considered.

3.7.7 In the following permitted exceptions, with-flow cycle lanes may be advisory:

- Where the remaining width of an adjacent motor traffic lane is less than 3.25 metres
- Where the cycle lane is adjacent to areas of parking and loading where motor vehicles may need to cross the lane (see Section 3.11).

Note: In these circumstances, the measures described in Section 3.8 for mixed traffic streets should be considered to support low traffic speeds.

3.7.8 Sections of mandatory with-flow cycle lanes may transition to advisory cycle lane over limited lengths as they cross junctions and accesses.

Contra-flow cycle lanes

To improve the permeability of the cycle network, cycle users may be exempt from road closures, one-way streets and banned turns where new traffic management proposals are being considered.

In general, there should be a presumption when planning cycle networks that all streets will be two-way for cycle users. On streets with one-way restrictions for motor traffic, a contra-flow (or two-way) protected cycle track will offer the most safe and attractive facility to cycle users. Alternatively, where traffic conditions permit, a contra-flow cycle lane may be considered as set out in Figure 3.13.

Where traffic conditions allow for mixed traffic streets, consideration can be given to two-way cycling with only minimal delineation of the cycle lane by using advisory lanes.

This can only be pursued where both cycle user visibility requirements and vehicle driver awareness of cycle movements in the opposite direction can be achieved. Narrow streets, parked cars, street furniture and other objects will limit this visibility and awareness, particularly of recumbent and hand cycle users.

3.7.9 Contra-flow cycle lanes should usually be mandatory, entirely reserved for cycle use, and must exempt cycle users from the street's one-way regulation.

3.7.10 The exemption to the one-way restriction should be indicated by signs advising of the exemption.

3.7.11 Sections of mandatory contra-flow cycle lane may transition to advisory cycle lane over limited lengths as they approach junctions and accesses.

3.7.12 The width of the opposing traffic lane should be between 3.0 m and 3.2 m to allow comfortable cycling in the same direction whilst not requiring encroachment to the contra-flow lane.

3.7.13 Light segregation or kerb protection may be added to contra-flow cycle lanes where there is a risk of vehicle encroachment.

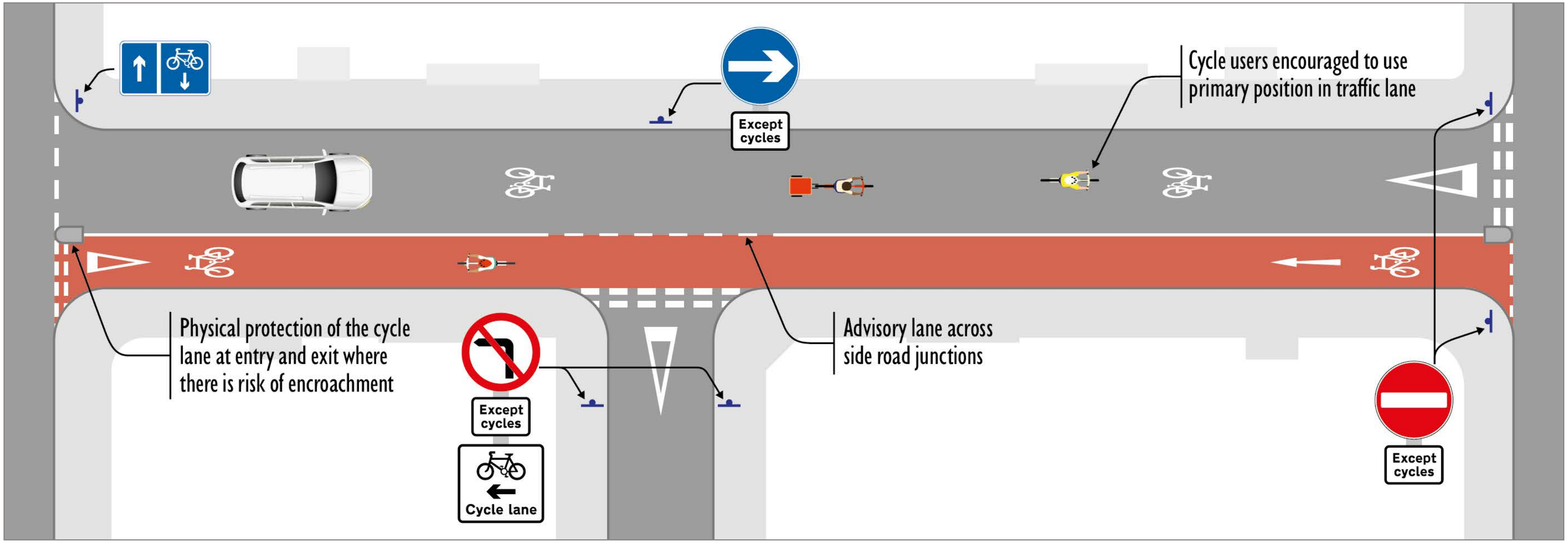


Figure 3.13: Contra-flow cycle lane

Shared bus and cycle lanes

Cycle users can use shared bus and cycle lanes unless restricted from doing so by a traffic regulation order. Allowing cycle users to share bus lanes will provide the benefits of improved route choice on the cycle network, though these benefits are limited to experienced and confident cycle users only.

For these reasons, cycle networks should offer an alternative cycle route to a shared bus and cycle lane and new cycle facilities should not be planned to share space with buses.

3.7.14 Shared bus and cycle lanes should be a minimum of 4.0 m wide. A width of 4.6 m is more desirable and provides a higher level of comfort for cycle user. A cycle lane may be marked within this space.

Note: Lane widths of 4.6 m will allow buses to comfortably overtake cycle users within the lane.

3.7.15 Where this cannot be achieved, shared bus and cycle lanes may be 3.2 m wide.

3.7.16 Lane widths between 3.2 m and 4.0 m should be avoided.

Note: Lane widths between 3.2 m and 4.0 m have potential to encourage unsafe overtaking of cycle users within the lane.

3.7.17 Cycle users should not be encouraged to use offside bus lanes (lanes not immediately adjacent to the kerbside) due to the presence of traffic on both sides.

These requirements apply equally to contra-flow bus lanes. Care should be taken when amending existing shared contra-flow bus and cycle lanes to ensure that narrow lanes do not encourage buses to leave the bus lane to pass cycle users, thus increasing the risk of collision with oncoming traffic.

3.8 Mixed traffic streets

Mixed traffic streets allow cycle traffic to mix with motor traffic and bring the following potential benefits:

- Freedom of movement for cycle users for access and egress
- Space efficiency and flexibility of the street's function and use
- Increased driver awareness of cycle users, particularly where the design enables more cycle users to use the street, supporting the control of traffic speed
- Easier and less expensive to provide and maintain.

These conditions and benefits are likely to be easier to establish where the street has a greater 'place' function than 'movement' function, such as on quieter residential streets.

Designing for cycle traffic to occupy the same space as motor traffic requires traffic volumes and speeds to be low, as set out in Section 3.3.

When considering the suitability of a mixed traffic street, and developing proposals, designers can:

- Identify streets that meet the traffic volume and speed thresholds required for mixed traffic, and include these streets when promoting joined-up cycle networks
- Identify the conditions that need to be achieved on streets where mixed traffic would be beneficial for cycle networks, and put measures in place to achieve these conditions (i.e. reduce traffic volume and/or speed).

Creating the right conditions will allow the expansion of the cycle network through 'quiet routes' or 'cycle streets', and complement protected cycle links.

Limiting the speed differential between cycle users and motor traffic is critical to cycle users' safety and comfort and to drivers' appreciation of cycle users' space. As cycle users will usually travel between 10 and 15 mph, maintaining traffic speed at or below 20 mph through design is an important aspect of road safety.

Low speed conditions should be self-enforcing through design that does not encourage higher motor vehicle speed. Low speed conditions can be supplemented by mandatory 20 mph speed limits.

Whilst cycle traffic may also mix with motor traffic where there is a greater movement function than place function of the road or street (such as on low-trafficked rural roads), this is likely to introduce a greater risk to cycle user comfort and safety, making mixed use attractive for only a limited number of cycle users. Cycle tracks that are detached or remote from the carriageway are therefore preferable in most rural situations.

3.8.1 Streets should only be designed for cycle users to mix with motor traffic where a high level of service as set out in Table 3.2 can be achieved.

3.8.2 Where the street conditions for cycle users to mix with motor traffic cannot be met, a protected cycle link should be provided.

Cycle riding positions with mixed traffic

When mixing with motor traffic, cycle users will be more visible to drivers when adopting the primary riding position (the same position as a vehicle will adopt in a lane, to avoid being overtaken).

Maintaining a consistent riding position between junctions is a key requirement for comfortable cycling. Cycle users are only likely to adopt the secondary riding position (positioned closer to the kerb than other vehicles) if they can maintain this position consistently and are not required to weave between positions. A clearance of approximately 1.5 m is required between cycle users and motor traffic to allow safe and comfortable overtaking.

The width of traffic lanes on mixed traffic streets is therefore of critical importance. Many streets in Scotland have been developed to provide a 7.3 m road carriageway, in line with ***DMRB*** geometric requirements. This creates typical lane widths of around 3.65 m that are too wide for a cycle user to safely take up a primary position, but not wide enough to allow motor traffic to safely overtake cycle users without straddling lanes.

3.8.3	Where streets are designed for cycle users to mix with motor traffic, traffic lane widths should be designed to be between 2.8 m and 3.2 m to allow cycle users to safely adopt the primary riding position.

3.8.4	Where cycle users are expected to adopt the secondary riding position on a continual basis, the street design should formalise this arrangement by provision of a protected cycle link.

Allowing cycle users to safely adopt the primary position requires careful street design to maintain the necessary traffic speed thresholds. This is particularly important if buses or heavy goods vehicles are expected to use the street.

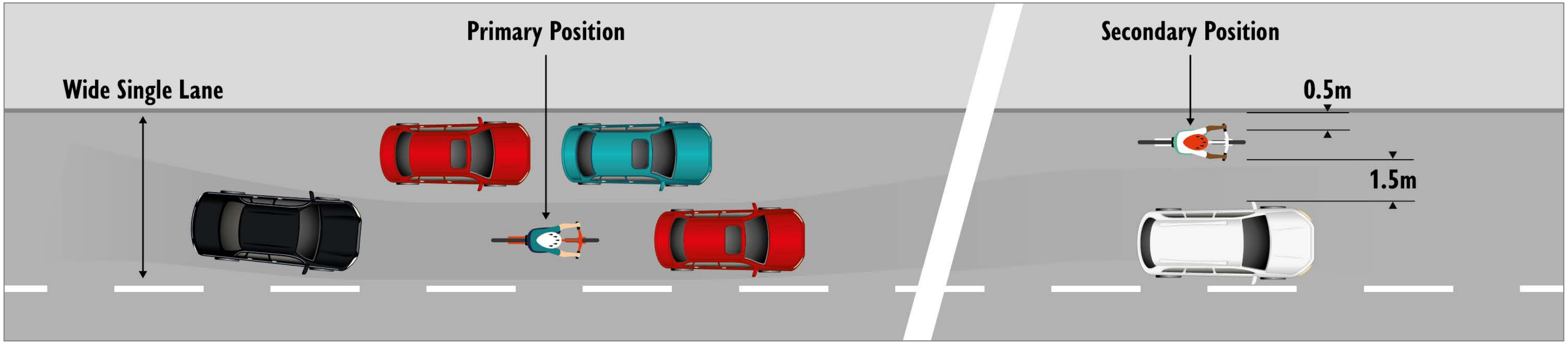


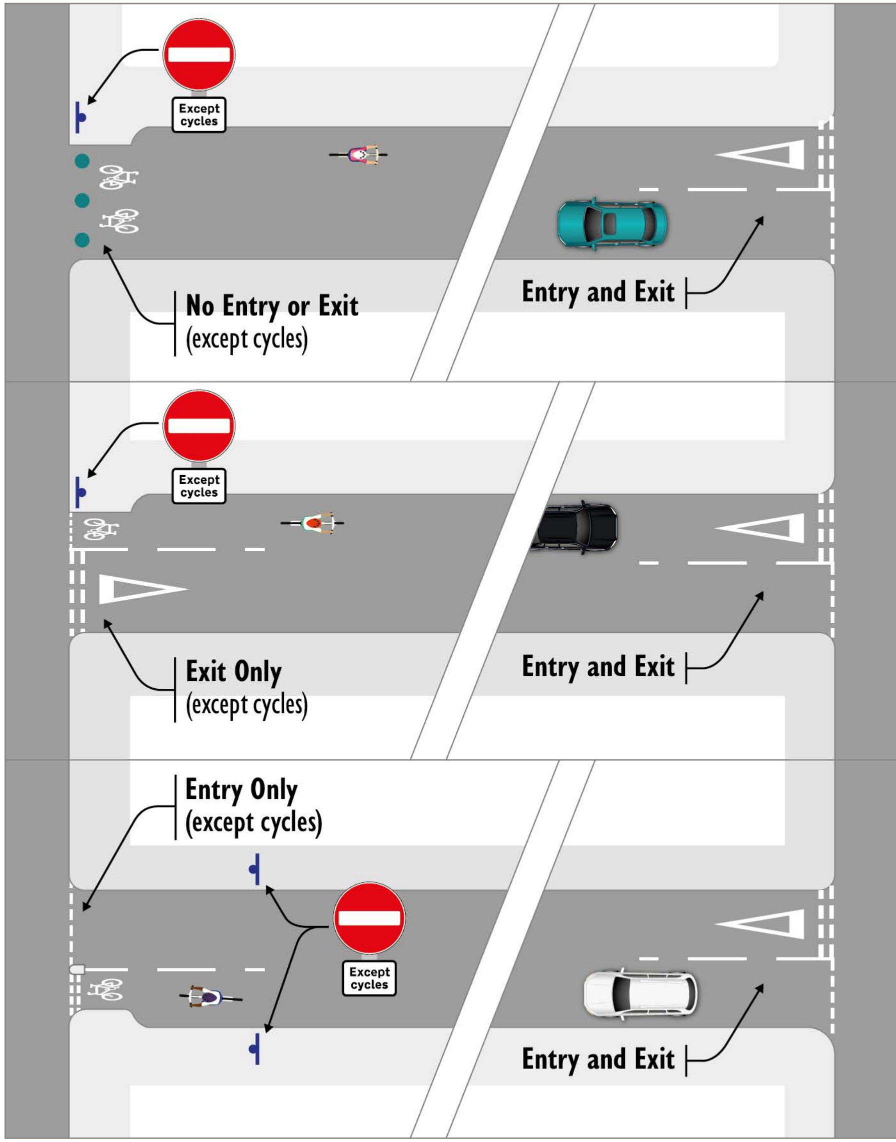
Figure 3.14: Primary and secondary riding positions

Measures to reduce traffic volume

Controlling traffic volumes on mixed traffic streets should be planned at network level, as set out in Chapter 2.

These include options for filtered permeability, which restricts the route choices available to motor traffic within a local network, whilst retaining route choice and direct access for walking, wheeling and cycling. This can be achieved by modal filters (preventing vehicle access by bollards but allowing cycle movements) or one-way plugs (allowing vehicle movements in one direction only). Figure 3.15 provides guidance.

3.8.5	One-way plug options should not restrict cycling movements.
3.8.6	Designers should identify which permeability option is most likely to reduce through-traffic in local areas.
3.8.7	Additional design features such as deflection islands may be applied to supplement the permeability option.



Modal filter: Prevents motor vehicles from entering or exiting one side of the street. Can only be used if there is sufficient turning opportunity for vehicles.

One-way in for motor traffic: Allows motor vehicles to exit in both directions, which may be preferable for larger vehicles unable to turn within the street.

One-way out for motor traffic: Allows motor vehicles to enter in both directions but only exit in one, which may be preferable if there would be difficulty for traffic joining the main road. Physical protection of the cycle exit will discourage motor vehicle encroachment.

Figure 3.15: Filtered permeability options

Measures to reduce traffic speed

Once the traffic conditions across the network have been established, the design of individual streets will support the desired outcome of sustained, low traffic speeds to maintain cycle friendly conditions on streets intended for on-carriageway cycling.

It is important that the low speed environment of the street is self-explanatory and self-enforcing. This will ensure that these conditions are maintained as the use of the street varies throughout the day.

Designing Streets sets out Scottish Government policy for street design, including guidance on how the speed of traffic should be controlled:

> *"Designers should aim to create streets that control vehicle speeds naturally by well-crafted design from the outset rather than through unsympathetic traffic-calming measures added at the end of the design process"*
>
> *"Evidence from traffic calming schemes suggests that speed controlling features are needed at intervals of around 60-80 m in order to achieve speeds of 20 mph or less. Straight and uninterrupted links should therefore be limited to this range to help ensure that the arrangement has a natural traffic-calming effect".*
>
> ***Designing Streets, 2010***

Creating more comfortable conditions for on-carriageway cycling can be achieved through holistic street design, by providing visual and psychological calming techniques which will contribute to the wider placemaking and wellbeing outcomes of good street design.

This is preferable to the retro-fitting of isolated measures that will slow the speed of traffic on existing streets, but isolated measures may still have the desired effect of slowing traffic that will make on-carriageway cycling more comfortable. In such cases, isolated measures should always be integrated to the surrounding environment and place context of the street.

Many streets that create suitable conditions for cycling will also be used by refuse vehicles, delivery vehicles and other large vehicles and the needs of these vehicles must be included in street design, whilst controlling their speed. With small corner radii, large vehicles may need to use the full carriageway width to turn.

The measures presented in ***Cycling by Design*** to create these conditions can be supplemented by planting and other forms of blue / green infrastructure to provide additional ecological value and resilience to local flooding, in line with Scottish Government policy on climate change.

Application of measures to mixed use streets

Guidance is given on the following pages on the application of measures to control motor traffic speeds on the following types of mixed use street:

- Quiet residential streets
- Cycle streets
- Mixed use streets with wider existing carriageway

Quiet Residential Streets

On most quiet residential streets, it will be possible to control traffic volumes (through the use of low traffic neighbourhoods set out in Chapter 2) and traffic speeds (through the use of the measures set out below) to provide suitable conditions for mixed traffic.

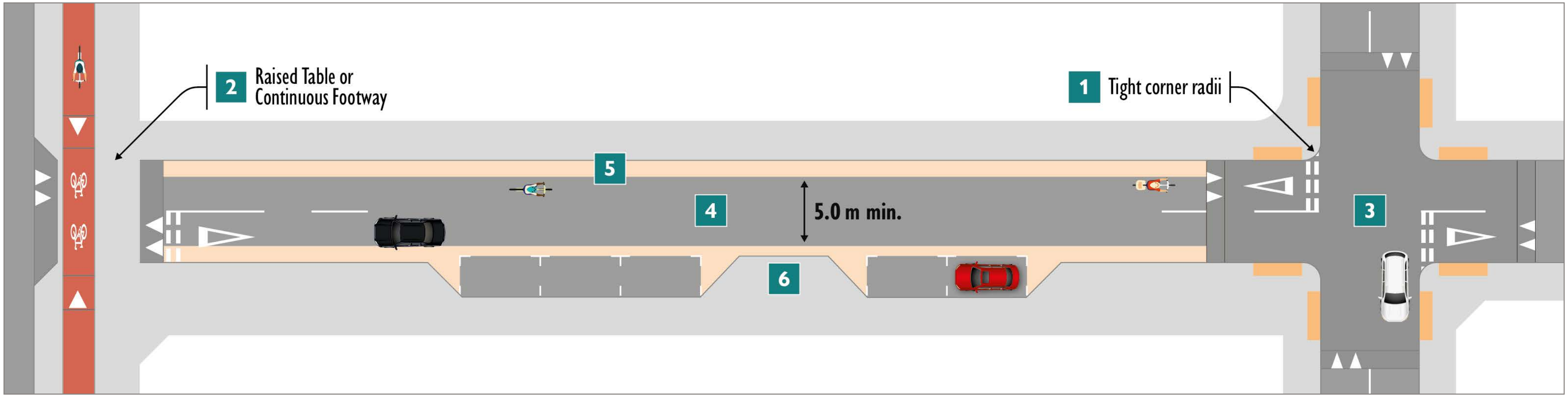


Figure 3.16: Typical street design measures on quiet residential street

The following typical street design measures will assist in reducing traffic speeds (refer to Figure 3.16):

1 Tight corner radii at junctions. These are recommended to be 4.0 m or less to reduce motor traffic turning speed when entering the street. Large vehicles may need to use the full carriageway width to turn.

2 Continuous footways or raised tables at side street entries. Continuous footways provide additional benefit to pedestrians and cycle users on the through route, and guidance is given on their application in Chapter 5. Where they are not desirable, raised tables should be considered with ramps at a maximum gradient of 1:10. On bus routes, the maximum gradient of ramps will be 1:15, subject to consultation with local bus operators.

3 Raised tables at junctions. Ramps on approach to raised tables should commence a minimum of 3.0 m in advance of the junction corner to provide step-free crossings for pedestrians.

In addition, the following street design measures can assist in creating a visual narrowing of the space dedicated to motor traffic, making vehicle drivers more aware of the potential interaction with other users and more likely to control their speed:

4 Centre line removal. The absence of centre line markings will make drivers more aware of potential conflict, reduce speed and encourage drivers to overtake a cycle user with greater clearance, and will be preferable in most cases to edge or median strips. Centre line markings are required where they convey a warning about a hazard, such as the presence of an island or approaching junction.

5 Visual narrowing via edge strips. Edge strips should be a minimum of 0.5 m wide, of contrasting colour or material to the carriageway to emphasise its visual narrowing effect. Edge strips should be flush with the carriageway to allow overrun where necessary. Contrasting colour or material for edge strips will have a greater impact on driver behaviour but maintenance implications may be a restricting factor.

6 Footway build-outs. Build-outs support the visual narrowing of the carriageway and improve crossing opportunities for pedestrians.

Cycle streets

Where cycle volumes are expected to be high on mixed use streets, consideration should be given to the creation of a 'cycle street'. The purpose of a cycle street is to convey a sense of cycle user priority within a mixed street environment and for motor traffic to be treated as 'guests' within this environment.

Cycle streets will be suitable where the following conditions can be met:

- Cycle traffic volumes are expected to be higher than motor traffic volumes
- The street forms a key part of the wider cycle network and is expected to maintain high cycle volumes over time
- The street does not form a through-route for motor traffic and is expected to maintain low motor traffic volumes and speeds over time

These streets will apply many of the same measures aimed at controlling motor traffic speeds on quiet residential streets but will be visually distinctive from other streets to convey their intended purpose. Typically, this will involve a coloured surface across the length of the cycle street (see Section 3.12) and priority given to the cycle street at junctions.

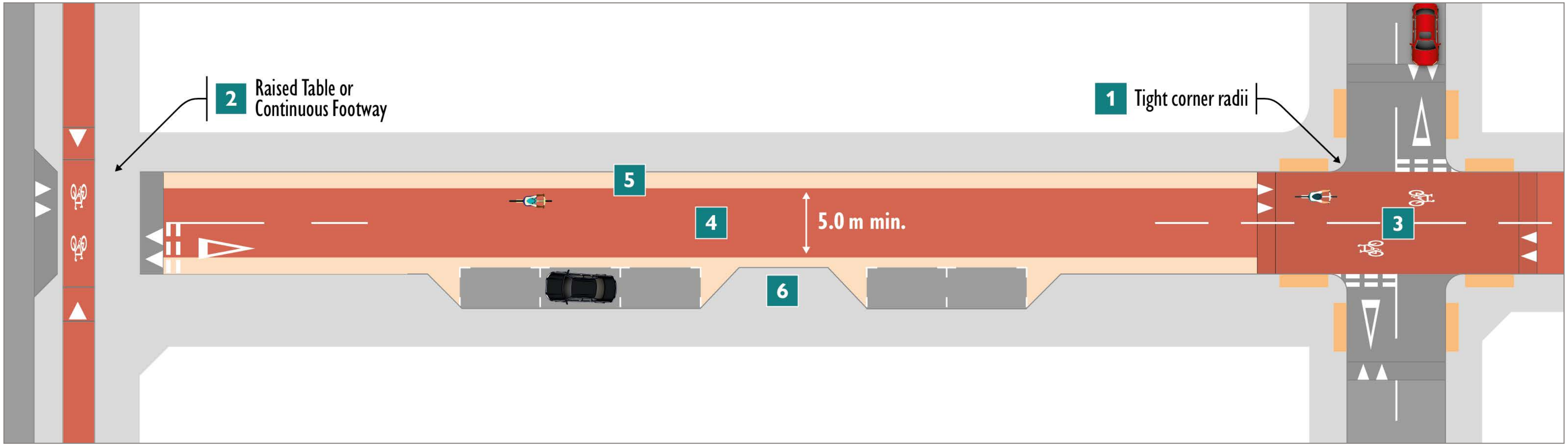


Figure 3.17: Typical street design measures on cycle street

Mixed traffic streets with wider existing carriageway

On mixed traffic streets with a wider existing road carriageway, the following design measures should be considered in addition to those described above to support the visual narrowing of the carriageway and improve opportunities for safe cycling and pedestrian movements (refer to Figure 3.18).

7 Visual narrowing via median strips. Median strips should be a minimum of 1.0 m wide and of contrasting colour or material to the carriageway to emphasise its visual narrowing effect. Median strips should be flush with the carriageway to allow overrun where necessary. The remaining carriageway lane width should be between 2.8 m and 3.2 m.

8 Informal crossing refuges using low level street furniture can define less formal crossing locations or to trial new crossing locations. Street furniture should include reflective strips to ensure suitable visibility at all times of day and night.

Finally, the following isolated horizontal deflection measures can support vehicle speed reduction on local roads but are less sympathetic to holistic street design and the placemaking outcomes desired by Scottish Government policy.

9 Cycle bypass at pinch-points. Cycle users may be given priority by narrowing the width given to motor traffic and allowing cycle users to bypass.

10 Where other measures are not considered sufficient to reduce vehicle speed on streets with significant forward visibility, lane deflection chicanes may be used in conjunction with give way markings.

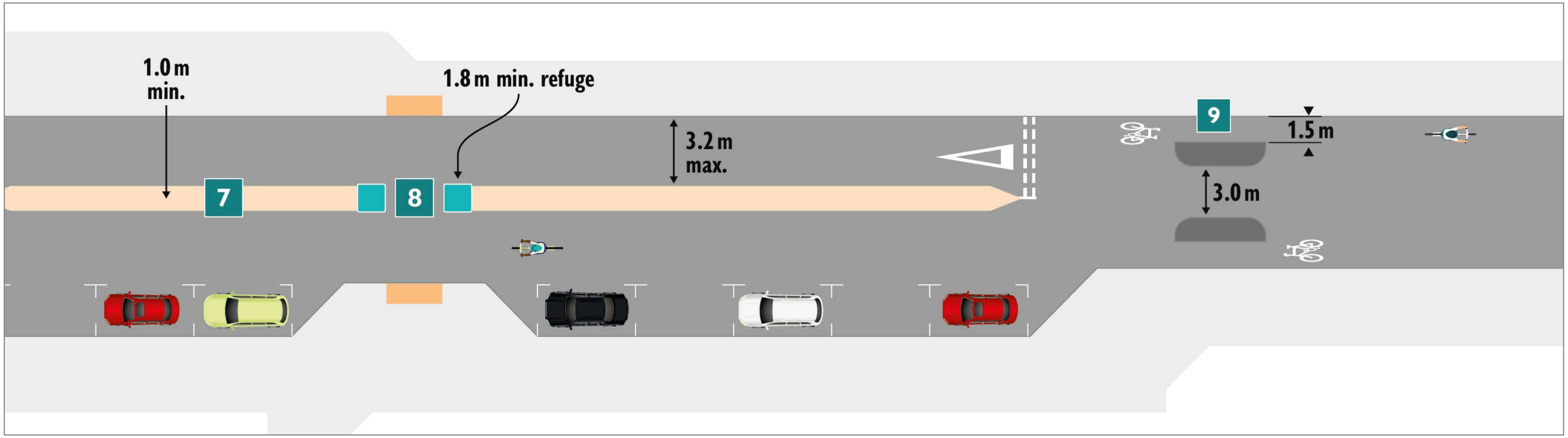


Figure 3.18: Typical street design measures on wider mixed traffic street

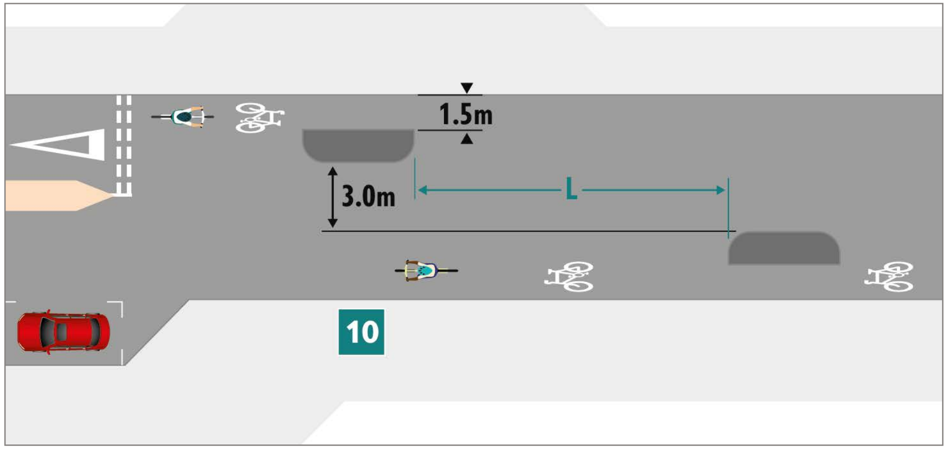


Figure 3.19: Lane deflection

3.8.8	At pinch-points and lane deflections, motor traffic should have an available width of at least 3.0 m and the cycle bypass lanes at least 1.5 m.
3.8.9	At pinch-points and lane deflections, island widths should allow 0.5 m clearance to bollards or other street furniture.
3.8.10	At lane deflection chicanes, stagger length L (as illustrated in Figure 3.19) should be between 9.0 m and 13.0 m to maintain vehicle speeds below 20 mph, but should be confirmed by swept path analysis for longer vehicles.
3.8.11	Lane deflection at pinch-points should only be applied where the 85th percentile approach speed of traffic is 50 kph or lower and there are no obstacles to visibility of the gateway by oncoming vehicle drivers.
3.8.12	Parking should be restricted at pinch-points.

Each of these design measures may be used in isolation or combination to meet the specific requirements of the street. Designers should consider the full length of the street when applying measures to control traffic volume and apply these measures as part of a holistic design approach. This should include public realm and landscaping improvements that can add to the overall sense of place on the street and contribute to low motor traffic speeds.

Where streets cannot be designed holistically but traffic speed needs to be controlled, the designer may apply isolated speed control measures to make on-carriageway cycling more comfortable but should seek to integrate these measures within the wider street design approach.

Combined with other measures, a change in surface material may be used to reinforce the expected change in driving behaviour approaching key entries, junctions or facilities such as schools.

Vertical traffic calming measures are often unsuitable within the street context due to their limited effect in reducing motor vehicle speed and the problems they pose to non-standard cycles and trailers. Where speed humps are to be incorporated into a wider street design, these should be sinusoidal in profile rather than flat-topped to reduce the impact on cycle user comfort. Where speed cushions are to be incorporated into a wider street design, they should be carefully positioned to allow cycle users to continue on a line that maintains the primary riding position and avoids the cushions.

Constrained sections of road

In many settlements, the limited width between building lines will make it impractical to provide a protected cycle link alongside a single road carriageway. This makes it even more important to control traffic conditions to allow cycle users to safely share the carriageway within these settlements, with suitable gateway features to indicate this change.

Lane deflections at pinch-points can be effective in slowing the speed of traffic entering the constrained section of road, with entering traffic giving way to oncoming traffic. Entrance gateways to rural settlements may be used in combination with lane deflections to further control the speed of traffic.

Contrasting surface materials, removal of the centre line and provision of cycle symbol road markings can also be considered through the constrained section to highlight the mixed traffic nature of that section, as shown in Figure 3.20.

3.8.13 Cycle users should only be mixed with motor traffic in constrained sections of road where a high level of service can be achieved, as set out in Table 3.2.

Note: Protected cycle tracks will otherwise be preferable if roadspace can be reallocated to provide these.

Passing places

On low-trafficked single-track roads experiencing an increasing number of cycle users, additional passing places and cycle warning signs to ***TSRGD Diagram 950*** can be used to increase drivers' awareness of cycle users.

Where cycle users are required to share single-track roads with motor traffic, additional passing places on inclines and where forward visibility is most limited will allow cycle users to slow down and allow vehicles to pass without coming to a complete stop. The length of passing places will depend on actual traffic speeds and forward visibility at each location.

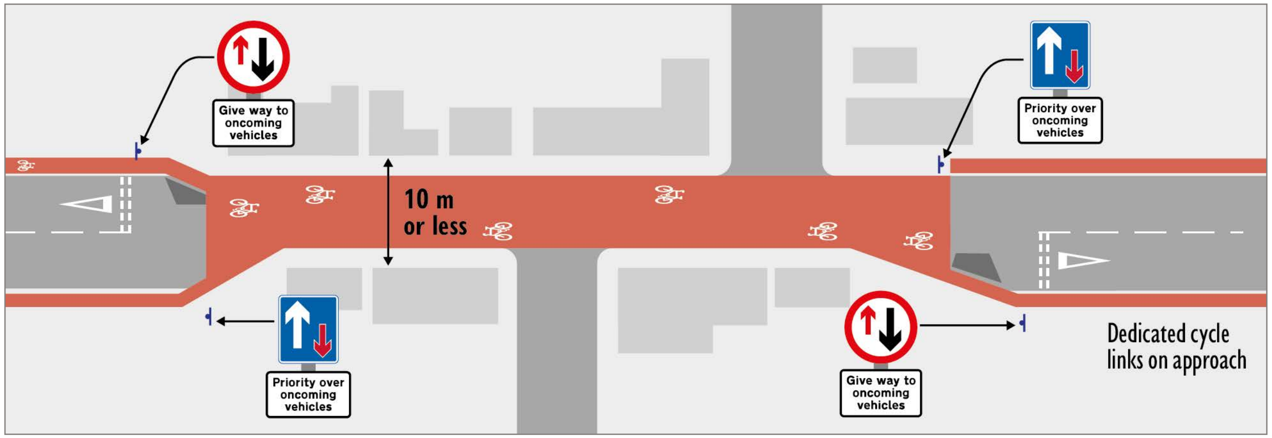


Figure 3.20: Mixed traffic within tightly constrained sections

3.9 Transitions between cycle link types

Maintaining as consistent a cycle link design as possible will maximise the coherence and attractiveness of the route. However, there will be circumstances in which a cycle track requires to transition to or from a cycle lane, or the road carriageway.

When doing so, careful consideration of the cycle link that users are transitioning to is required. New and less confident cycle users will be less comfortable transitioning to cycle lanes or mixed traffic conditions unless the conditions set out in Section 3.3 are met.

3.9.1 Transitions between a cycle lane and cycle track should be one-way only.

3.9.2 Transitions between a cycle lane and cycle track should occur over a minimum 5 m length as shown in Figure 3.21.

3.9.3 Where the cycle track is at stepped or footway level, it should transition to and from the cycle lane via a ramp at a maximum of 5% gradient.

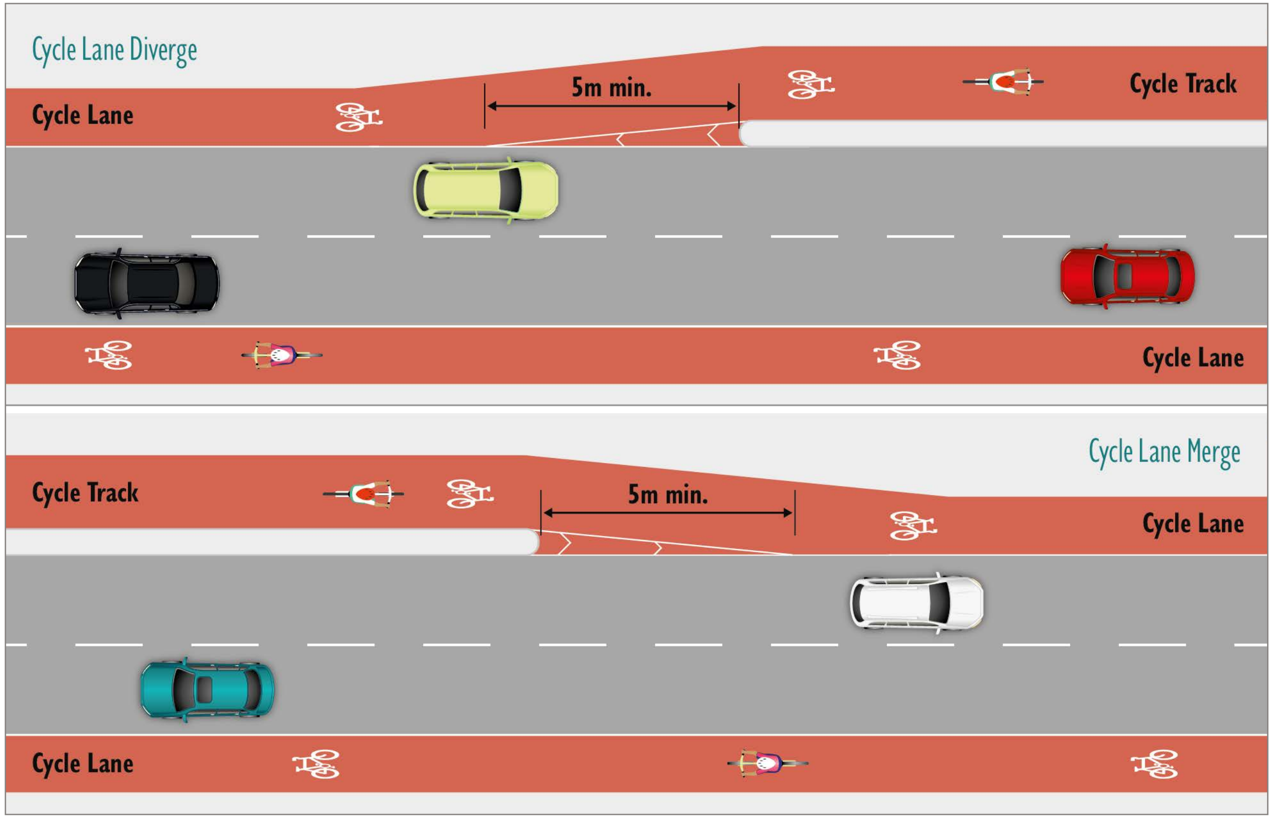


Figure 3.21: Cycle lane transitions

Transitions between a cycle track and mixed traffic street should only be used where the designer has assessed the risk and confirmed the suitability of returning cycle users to road carriageway, as set out in Section 3.3. A visibility splay is required between the cycle track and the mixed traffic street.

Within these circumstances, these transitions can occur for one-way or two-way cycle tracks.

3.10 Bus stops

Bus stops present a particular challenge for cycle users, and often require them to overtake or to wait behind stationary buses. Both situations present a safety risk to cycle users by placing them close to or between large motor vehicles.

The following design options are presented, which offer differing levels of separation for cycle users from buses:

- Bus stop bypass (with island or continuous island)
- Cycle track at bus boarder
- Cycle lane across inset bus box
- Cycle lane across in-line bus box.

In reducing the conflict between cycle users and buses, each of these design options also provides a differing level of interaction between cycle users and pedestrians, which must be carefully managed. Early engagement with walking, cycling and disabled user groups will help to understand and plan for these interactions.

Bus stop bypasses generally offer greater benefits to cycle users, but the alternative bus stop layouts can be considered where:

- the space requirements set out below for bus stop bypasses cannot be met
- bus frequency at the stop is low
- a very high number of bus passengers are expected to alight, combined with low cycle user numbers (though this is not suitable for a cycle track at bus boarder layout).

It is important for designers to consult with local bus operators to understand current and future bus vehicle requirements when planning and designing bus stops.

As set out in Chapter 2, it is also important to understand the interaction of bus and cycle routes at the network planning stage to reduce potential interactions where possible.

Bus stop bypass

Allowing cycle users to bypass potential conflicts with buses is the most desirable arrangement, if the interaction between cycle users and pedestrians can be suitably managed.

Bus stop bypasses provide an island between the cycle track and the road. Where the approaching cycle track is protected, the island is formed by a widening of the buffer. In locations where a cycle lane runs immediately adjacent to the road, the island has to be formed using a suitable transition.

This layout will require additional space to accommodate the bus stop island, cycle track and footway. It is desirable to reallocate space from the road carriageway rather than the footway when providing bus stop bypasses.

The design principles of bus stop bypasses are:

- Pedestrians should have priority over cycle users
- Pedestrian crossings of the cycle track should be on clear desire lines
- The layout should encourage cycle users to slow on approach to these crossings
- Visibility between users should be achieved
- Sufficient circulation space on the island should be provided for all bus users.

Bus stop bypasses may be isolated, to pass a single bus stop, as illustrated in Figure 3.22.

Where space permits and where bus passengers will benefit from linking the bus stop to a crossing location or other amenity on the same island, the continuation of the bus stop island over a greater length can provide a greater degree of protection for cycle users from motor traffic. This is shown in Figure 3.23.

Bus stop bypasses may accommodate one-way or two-way cycle links, and this will be defined by the cycle facility on approach. Two-way cycle tracks at a bus stop bypass will introduce additional conflict for bus stop users and potential disorientation for some users. Therefore, it is essential that good visibility at the crossing points is provided (in accordance with Chapter 4). Extended continuous islands are particularly beneficial where the cycle track is two-way, as it typically provides straighter geometry on the approach to crossing points.

Forward visibility is essential as the cycle user approaches and passes through the bus stop bypass, allowing the cycle user to identify any potential interaction with pedestrians. Figure 3.22 illustrates the visibility splays for cycle users approaching each crossing of the cycle track. Care is needed to ensure that street furniture, bus stop advertising panels or other objects do not obstruct this visibility.

Pedestrian crossings of the cycle track should be provided at locations that meet pedestrian desire lines. They should allow pedestrians to move freely between the crossing and the bus shelter on the island and be well positioned for the expected location of the bus door.

Pedestrian crossings may be provided by dropped kerb crossing to highlight the crossing to approaching cycle users and to give positive confirmation to blind or partially sighted pedestrians of the crossing location. Alternatively, a raised table will allow the crossing to be maintained at the same level as the footway and can be considered to help slow cycle users on approach. Early engagement with user groups will inform decisions on the suitable type of crossing arrangement.

Bus stops in the immediate vicinity of schools, hospitals, sheltered housing and other community facilities are likely to generate a high number of bus users. Bus stop bypasses may not be appropriate in these circumstances. Designers should consider suitable mitigation (see Table 3.11) or an alternative arrangement that can reduce interactions with cycle users at a network planning level (see Chapter 2).

Bus stop bypasses on steep downhill gradients should be avoided, as cycle users are likely to approach these at higher speeds, creating interactions that are more difficult to manage.

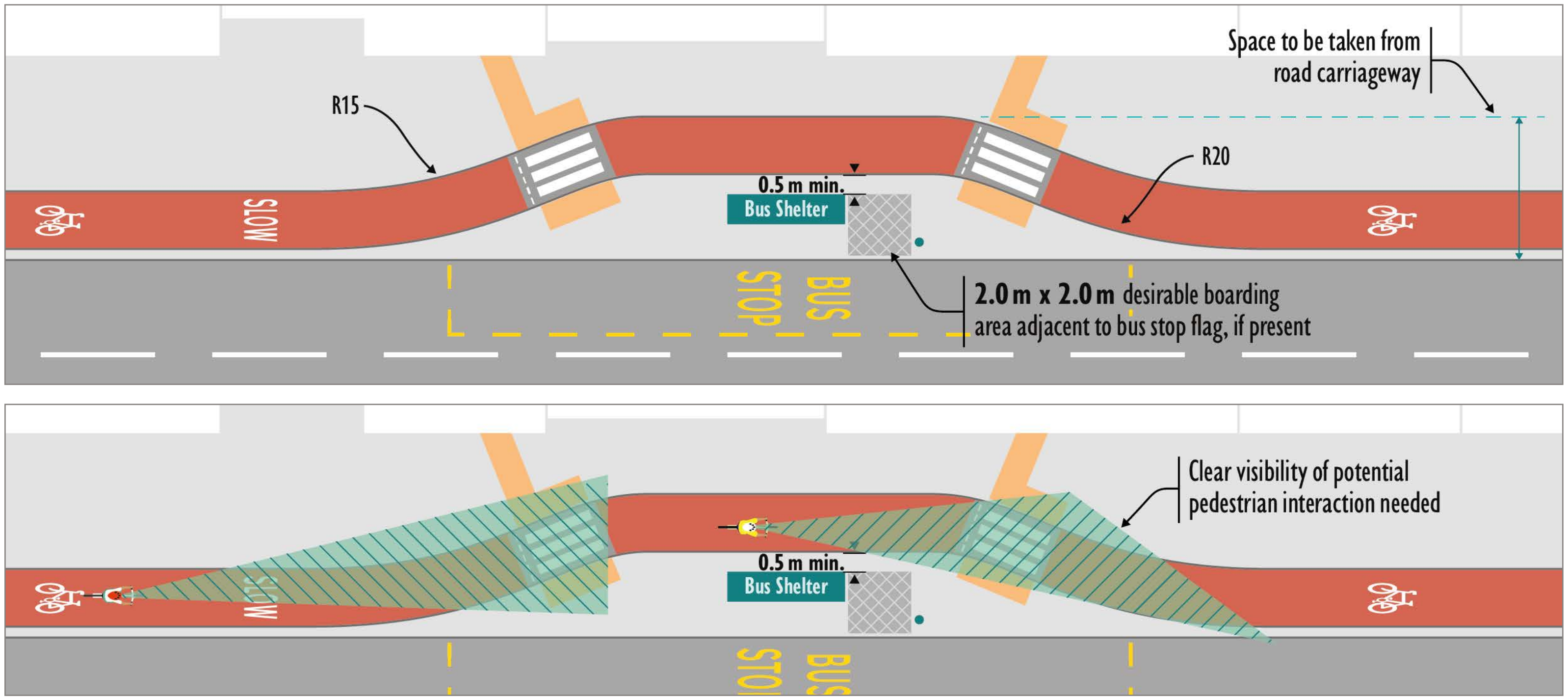
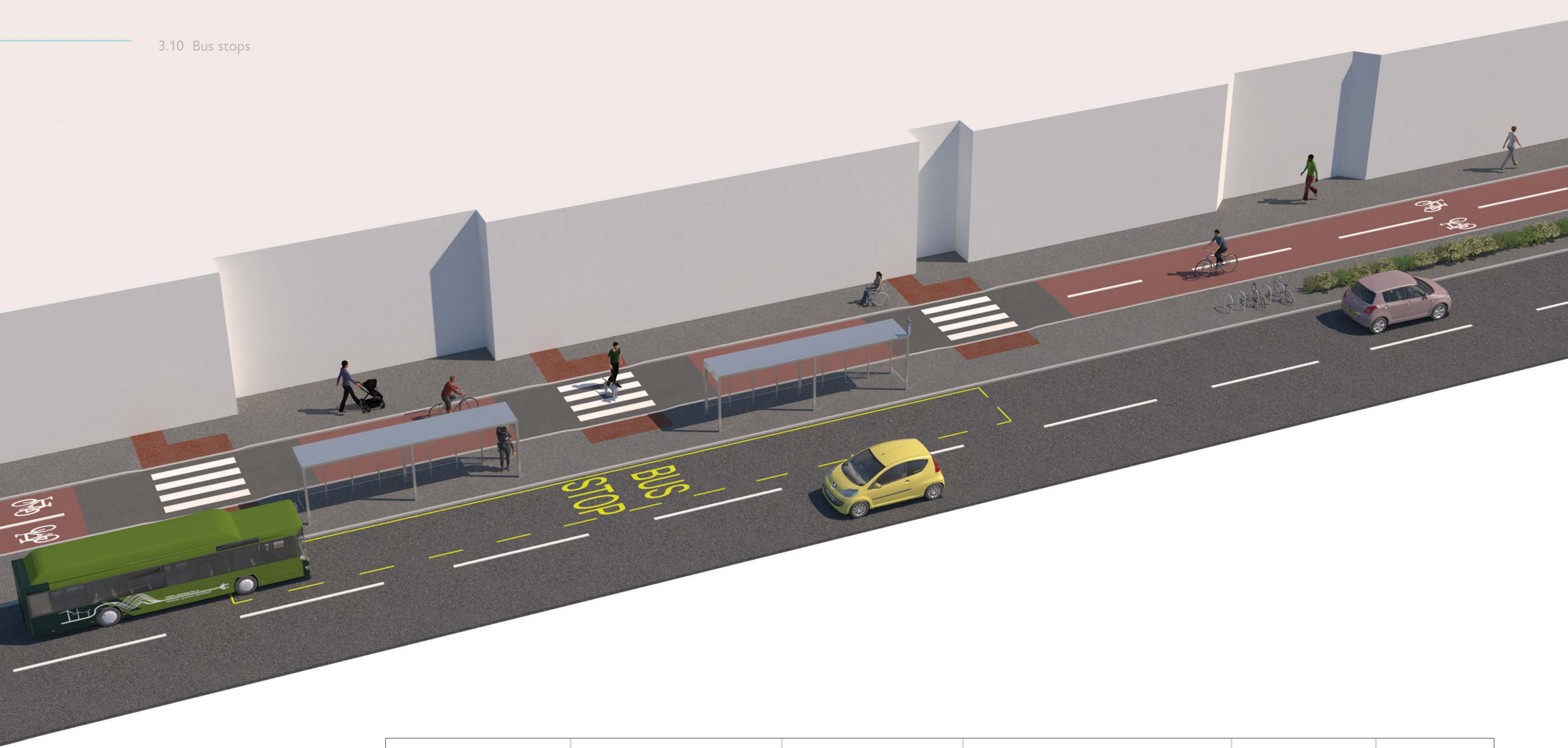


Figure 3.22: Bus stop bypass (with island)



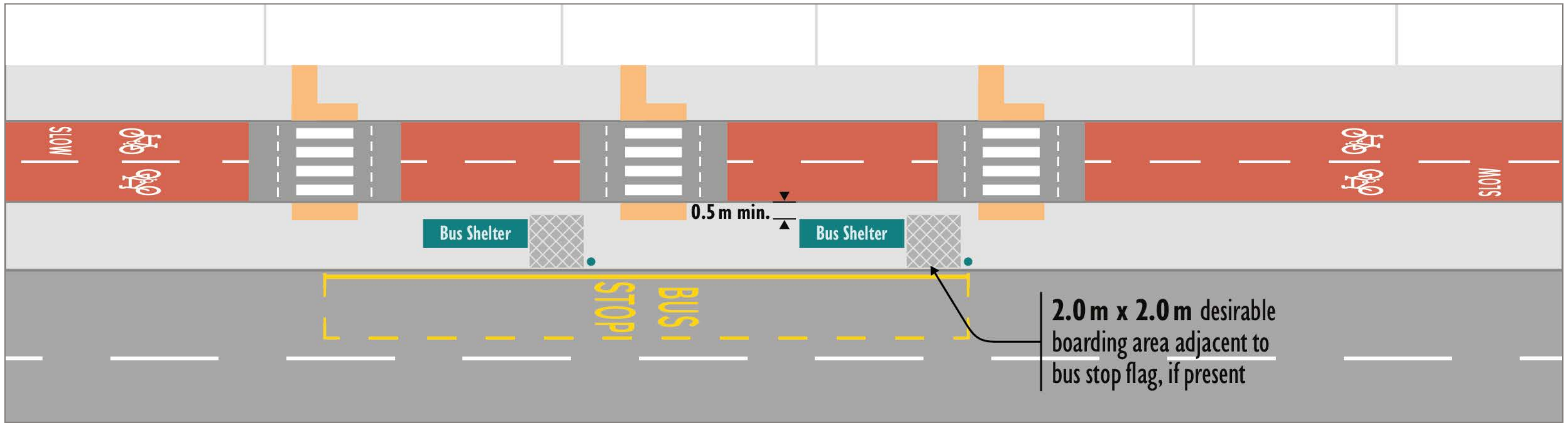


Figure 3.23: Bus stop bypass (continuous island)

3.10.1 The width of the bus stop island should allow for the width of the shelter, plus at least 0.5 m between the back of the shelter and the cycle track and a suitable distance from the front of the shelter to the road carriageway.

Note: ***Roads for All: Good Practice Guide for Roads*** recommends the distance from the front of the shelter to the road carriageway to be 1.3 m to allow comfortable circulation space for bus passengers.

3.10.2 An overall length and width of 2.0 m should be provided at the bus boarding area to allow wheelchair users to make a 90 degree turn when boarding or alighting the bus.

3.10.3 The footway width should be maintained for pedestrians passing the bus stop bypass in accordance with Section 3.4.

3.10.4 The cycle track should be at a lower level than the footway and the bus stop island, with a level difference of at least 60 mm.

3.10.5 The cycle track width should desirably be maintained at the same width as the approaching cycle track or lane, but may be reduced locally to absolute minimum widths throughout the bus stop bypass if the approaching width is greater.

3.10.6 If a cycle lane approaches a bus stop bypass, it should transition to a cycle track a minimum of 10 m in advance of the bus stop road markings and transition back to a cycle lane a minimum of 20 m after the bus stop road markings.

3.10.7 The desirable maximum crossfall of the bus stop island should be 2.5%.

Note: The requirements for a pedestrian crossing of a cycle track are set out in Chapter 4.

In situations where a bus boarder kerb is required, this may result in the local raising of the footway and cycle track to ensure that a maximum crossfall can be achieved with dropped kerb crossings in place.

Positioning the pedestrian crossings at the outer edges of the bus stop island, as illustrated in Figure 3.22, rather than the middle of the bus stop island will allow this level difference to be achieved over the longitudinal fall of the island as well as the crossfall. This will reduce the need to locally raise the footway and cycle track. Note that not all bus operators require a raised bus boarder kerb.

Table 3.11 identifies considerations for the design of bus stop bypasses where additional means to control the interaction of users are required.

Additional Considerations	Circumstances
Actual or visual narrowing	Where cycle speed needs to be further controlled, this can be achieved by actual narrowing of the cycle track across the bypass, or visual narrowing using hatch markings to narrow the visual space but maintain the physical space for manoeuvre.
Rumble strips	Where cycle speed needs to be controlled further, the inclusion of rumble strips on approach may be considered. As this will detract from cycle user comfort, visual narrowing should be considered first.
Signal controlled crossing	Where bus passenger and cycle user numbers are exceptionally high, a signal-controlled crossing of the cycle track may be considered in place of a zebra crossing.
Crossing position and shelter type	Crossings should be placed where they meet pedestrian desire lines and provide enough space for circulation on the bus stop island. With a standard forward-facing bus shelter, this is likely to be on the outer edges of the island, as illustrated in Figure 3.22, to allow access into the shelter. With an alternative bus shelter arrangement that allows access from the rear (cycle track side), an alternative or additional central crossing location may be provided if visibility between bus passenger using the crossing and cycle users giving way to them can be achieved.
Bollards to guide pedestrians to crossing	Street furniture alongside the cycle track may be used to guide pedestrians to the crossing location to discourage informal crossing at other locations. However, this has the potential to reduce the effective width of the cycle track, and clearance should be considered. This should only be considered where pedestrian crossing discipline creates a specific problem. Tactile maps may be added to bollards or other street furniture to assist blind or partially sighted pedestrians navigate from crossing to bus waiting area.
On-board bus information	In all circumstances, designers should liaise with bus operators to encourage operators to alert passengers that they are approaching an island bus stop, and to be alert for cycle movements.

Table 3.11: Additional considerations to improve pedestrian and cycle interactions at bus stop islands

Cycle track at bus boarder

Where space cannot be formed to meet the requirements of a bus stop bypass, a cycle track at the bus boarder layout may be considered. This introduces a greater degree of interaction between cycle users and bus passengers, and should only be considered where bus frequency is low.

In this arrangement the cycle track gives way to the pedestrian footway accessing the bus boarder across the full length of the bus stop as shown in Figure 3.24. This will allow for alternative bus stop door arrangements and for the uncertainty of actual bus stopping positions.

A cycle track at a bus stop boarder layout is only appropriate where the cycle track is one- way. Two-way cycle tracks at a bus stop will introduce additional interactions for bus stop users and potential disorientation for some users.

Contrasting surfacing may be considered to make the mixed use of the space clearer to bus passengers.

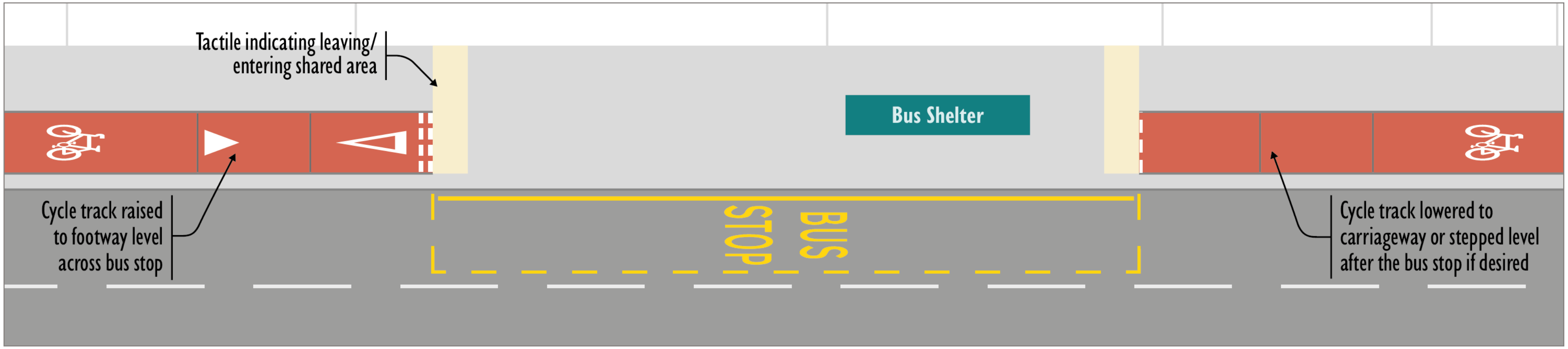


Figure 3.24: Cycle track at bus boarder

3.10.8 Cycle tracks at a bus stop boarder should be one-way.

3.10.9 Cycle tracks should not be provided at a bus stop boarder where peak bus frequency is greater than 12 buses per hour.

3.10.10 Where the cycle track is at stepped or carriageway level, it should transition to and from the pedestrian area via a ramp at a maximum of 5% gradient.

3.10.11 If a cycle lane approaches a bus boarder, it should transition to a cycle track a minimum of 5 m in advance of the bus stop road markings and transition back to a cycle lane a minimum of 5 m after the bus stop road markings.

Cycle lane across inset bus box

Where an inset bus stop is to be maintained, the continuation of a cycle lane across the bus box may be considered. However, this will provide a much lower level of service for cycle users than previous options and consideration should be given to a bus stop bypass within the same space.

This arrangement is less comfortable for cycle users as it places them in conflict with buses entering and exiting the bus stop and between stationary buses and passing motor traffic. This is not the preferred arrangement where space exists for the alternatives introduced previously.

Where used, the cycle lane should be advisory across the length of the bus box to allow bus access and egress, and should transition from a mandatory lane 10 m in advance of the bus stop and back to a mandatory lane 10 m after the bus stop.

Cycle lane across an in-line bus box

An on-road cycle lane may be stopped as it passes through an in-line bus box, but only in the most constrained circumstances.

This arrangement is less comfortable for cycle users as it places them in the traffic lane with other motor traffic, alongside a stationary bus, and forces cycle users to transition into a running lane when buses are stopped. It will also expose cycle users to conflict with buses entering and exiting the bus stop. Benefits are limited to experienced and confident cycle users only.

Where used, the cycle lane should stop at the back of the bus box and recommence immediately after the bus box. Road markings to ***TSRGD Diagram 1057*** (cycle symbol) can be placed in the traffic lane immediately adjacent to the bus box to alert motor vehicle drivers of the potential for cycle users to be in this lane.

3.11 On-street parking and loading

A cycle link should not be halted where there is a requirement for on-street parking and kerbside loading.

Removal or relocation of parking can be considered as part of a wider parking review of the area, enabling provision of a more direct and safe cycle link. Careful consideration must be given to disabled parking provision before doing so to ensure that disabled bays are suitably located. Similarly, where alternative arrangements can be made available, the relocation or removal of service bays can be considered through consultation with local businesses.

Where the continuation of a cycle link is required to pass on-street parking and loading areas, this can be achieved by a:

- Cycle track on the footway side of on-street parking or loading areas
- Cycle lane being routed along the traffic-side of on-street parking areas.

Alternative cycle links on other routes can be considered where the available width or other local conditions do not make the above options desirable.

Where kerbside loading is to be accommodated alongside cycle tracks, careful consideration should be given to restricting loading times to be outwith periods with the greatest movement of cycle users.

Suitable layouts are described in more detail below. Cycle lanes on the traffic-side of loading areas should be avoided where possible.

Cycle track on footway side of on-street parking

This arrangement provides a cycle track on the footway side of the parking area, which is separated from the parking area by a strip of appropriate width. The strip is formed of a kerbed upstand where the track is at stepped level, or formed by light segregation or coloured surfacing for tracks at carriageway level.

This is the preferred arrangement for cycle users passing a parking area as it avoids placing them between parked vehicles and moving motor traffic, and will usually be more direct. A typical layout is shown in Figure 3.25. In locations where a cycle lane runs immediately adjacent to the road, consideration should be given to transitioning this to a cycle track in advance of the parking to facilitate this layout.

The following issues need particular consideration:

- **User awareness** – cycle users and motor vehicle users need to be fully aware of each other's presence. A suitable buffer between the parking area and coloured surfacing of the cycle track will assist with this, as shown in Figure 3.25. Parking areas should stop in advance of the approach to junctions, to provide motor vehicle drivers with good visibility of cycle users before any turning movements at the junction.
- **Opening doors** – user awareness is paramount where motor vehicle users open their doors. Good visibility of approaching cycle users will assist with this, as will measures to encourage cycle users to slow down. If cycle users are approaching the area downhill and at high speed, it will be more difficult to take corrective action to avoid conflict, and alternative measures should be considered.
- **Access to footway** – where designated disabled parking spaces are provided, or where people with mobility challenges need direct access to the footway (such as at doctors' surgeries), an alternative arrangement that allows disabled vehicle users to exit directly onto the footway may be preferable. This is set out in the following 'cycle lane on traffic side of on-street parking' layout.
- **Level differences** – care is needed when providing carriageway level tracks to ensure that the separation between the parking area and the cycle track does not create a trip hazard. Where kerbed upstands are provided, dropped kerbs should be provided at each end of the parking row to allow footway access.
- **Street furniture** – no street furniture should be placed between the cycle track and the parking area.

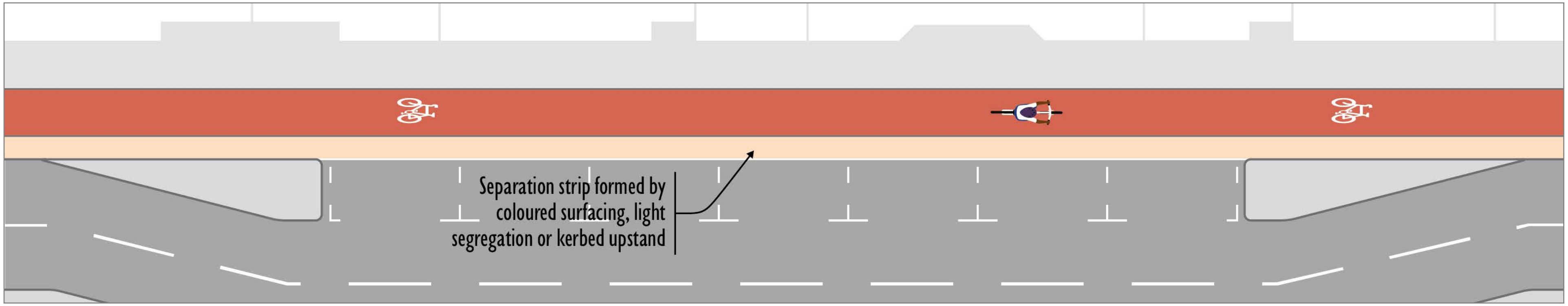


Figure 3.25: Cycle track on footway side of on-street parking

3.11.1 Cycle tracks on the footway side of on-street parking should be one-way.

Note: Two-way cycle tracks at parking areas will introduce additional interactions for those exiting vehicles and potential disorientation for some users.

3.11.2 The width of the cycle track and the footway across the length of parking should be in accordance with Section 3.4.

3.11.3 The cycle track should be separated from the parking area by a strip of desirable minimum width 1.0 m, which should be increased to 2.0 m alongside disabled parking bays. In constrained situations this may be reduced to an absolute minimum width of 0.5 m.

Note: Where designated electric vehicle spaces are provided, the kerbed island between the cycle track and parking should be sufficiently wide to accommodate electric vehicle charging units without any intrusion onto the cycle track.

Cycle lane on traffic side of on-street parking

In locations where a cycle lane runs immediately adjacent to the road, the cycle lane may be continued on the traffic side of the parking area. This arrangement is less favourable to cycle users as it places them between parked vehicles and moving motor traffic, and will usually be less direct. Options to remove parking that obstructs a more direct cycle route can be considered.

This may be considered as an alternative if the interaction between cycle users and motor vehicle users exiting their vehicle onto a cycle track cannot be resolved, particularly for the needs of disabled vehicle users. In limited situations, consideration may be given to transitioning a cycle track to pass the parking area for this purpose. However, alternative methods should be explored.

3.11.4 The cycle lane should be advisory across the length of parking.

3.11.5 The transition to a mandatory cycle lane (if required) should occur at the limits of the parking bays.

3.11.6 The cycle lane should be separated from the parking area by a strip of desirable minimum width 1.0 m. In constrained situations this may be reduced to an absolute minimum width of 0.5 m.

3.11.7 SLOW markings may be used to alert drivers to the potential hazard of the cycle lane bend out.

3.11.8 Where gaps of less than 30 m exist between zones of parking or loading bays, the cycle lane should not be deflected to return to the kerbside.

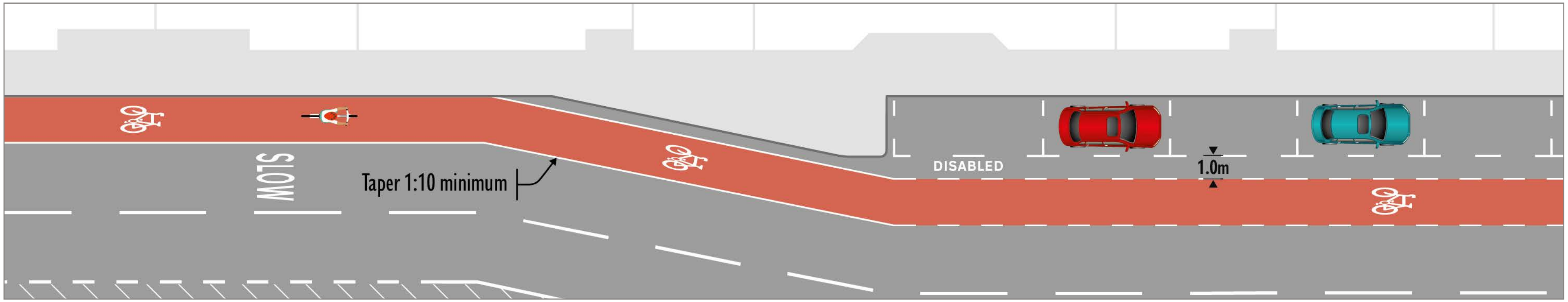


Figure 3.26: Cycle lane on traffic side of on-street parking

Cycle track bypass of a loading island

Where kerbside loading is required, it is essential that the design of cycle facilities allows for these operations, and that any interactions are managed appropriately.

This is the preferred layout for cycle users passing a loading area as it reduces interaction with loading activities. The layout is similar to the bus stop bypass, as it diverts the cycle track around the back of the loading area.

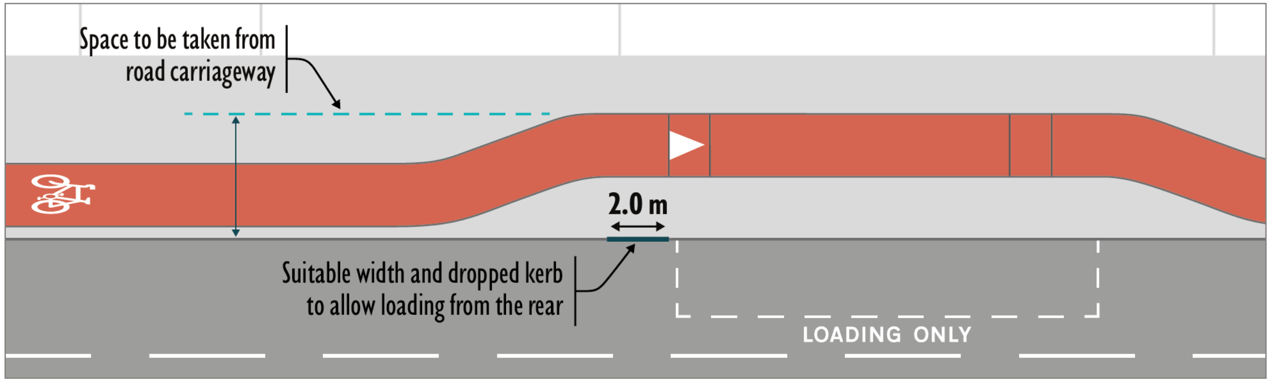


Figure 3.27: Cycle track bypass of loading island

3.11.9 Cycle tracks on the kerbside of loading areas should be one-way.

Note: Two-way cycle tracks at loading areas will introduce additional conflict.

3.11.10 The loading island should be a desirable minimum width of 2.0 m. In constrained situations it may be reduced to an absolute minimum width of 1.5 m, subject to the buffer requirements set out in Section 3.4.

3.11.11 The loading island should extend 2.0 m beyond the rear of the marked loading bay to allow loading activity from the rear of the vehicle, with dropped kerbs onto the island provided to facilitate this loading activity.

3.11.12 If a cycle lane approaches a loading area, it should transition to a cycle track at carriageway level a minimum of 10 m in advance of the loading bay and back to a cycle lane a minimum of 20 m after the loading bay.

3.11.13 The width of the cycle track and footway along the length of the loading bay should be in accordance with Section 3.4.

3.11.14 The cycle track should be raised to the same level as the footway and loading island for a length of 5 m to allow loading activities. A raised delineator should be used to denote the change to cycle track at footway level.

3.11.15 The cycle track surface should be maintained across the loading bay, with loading activities giving way.

Cycle track at carriageway level with dropped kerbs at loading bay

This arrangement is less attractive for cycle users but may be considered where width is constrained and loading activities are less regular. The narrower width provided between the loading area and the cycle track increases the potential for interaction between cycle users and loading activities. Loading activities are expected to give way to cycle users.

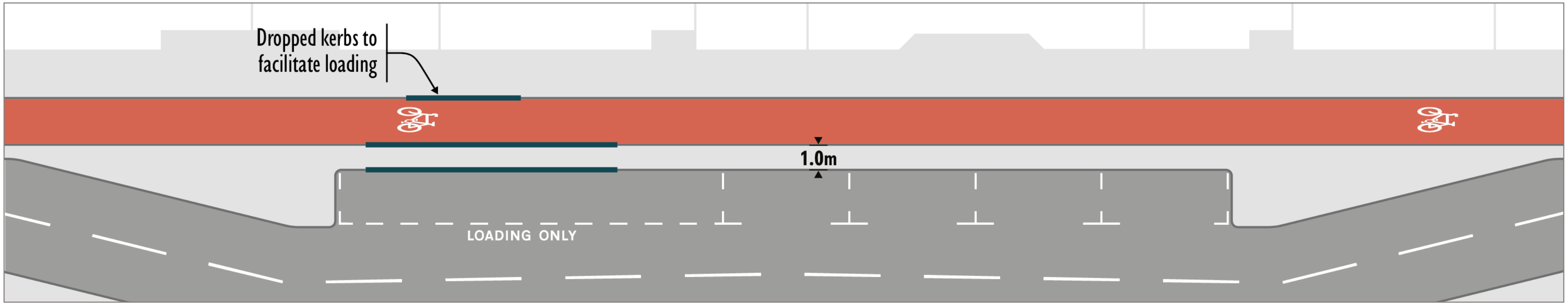


Figure 3.28: Cycle track at carriageway level with dropped kerbs at loading bay

3.11.16 Cycle tracks on the kerbside of loading areas should be one-way.

Note: Two-way cycle tracks at loading areas will introduce additional conflict.

3.11.17 The width of the cycle track across the length of the loading bay should be in accordance with Section 3.4.

3.11.18 The loading island should be a desirable minimum width of 1.0 m. In constrained situations it may be reduced to an absolute minimum width of 0.5 m

3.11.19 Dropped kerbs within the kerbed island should be provided at lengths of 4.0 m minimum (loading side) and 2.4 m minimum (footway side) to facilitate loading activities.

3.11.20 The cycle track surface should be maintained as it passes the loading bay.

3.12 Construction of cycle links

Pavement construction

The construction of cycle links is important as cycle users are more vulnerable to changes in surface quality and minor defects than other road users.

Figure 3.29 sets out typical pavement construction details for cycle tracks. Designers should engage early with the Overseeing Organisation to understand specific local requirements.

For mixed traffic streets, cycle lanes, and where cycle tracks are formed from the existing road carriageway, the pavement construction is likely to exceed these pavement construction requirements.

Designers should also engage with Overseeing Organisations to understand what local and sustainable materials are available that can be specified in design, with options for permeable paving investigated in high flood risk areas.

Maintenance requirements are set out in Section 3.13. Ensuring that these requirements are planned for at the design stage will be critical in constructing a robust and durable cycle link.

Cycle friendly gullies are available with tighter mesh grates that allow cycles to cross without the risk of wheels catching in the grate gap. These should be provided wherever possible to improve the comfort and attractiveness of the route and avoid the need for additional width where traditional gullies are provided.

Traditional manholes, gullies and other ironwork should not be placed on the running line of cycle wheels, and cycle tracks should be widened where necessary to remove these from the cycling line. Where this cannot be achieved all ironwork should be reset so that it is flush with the carriageway surface and gratings should be orientated to be at right angles to the direction of cycle flow.

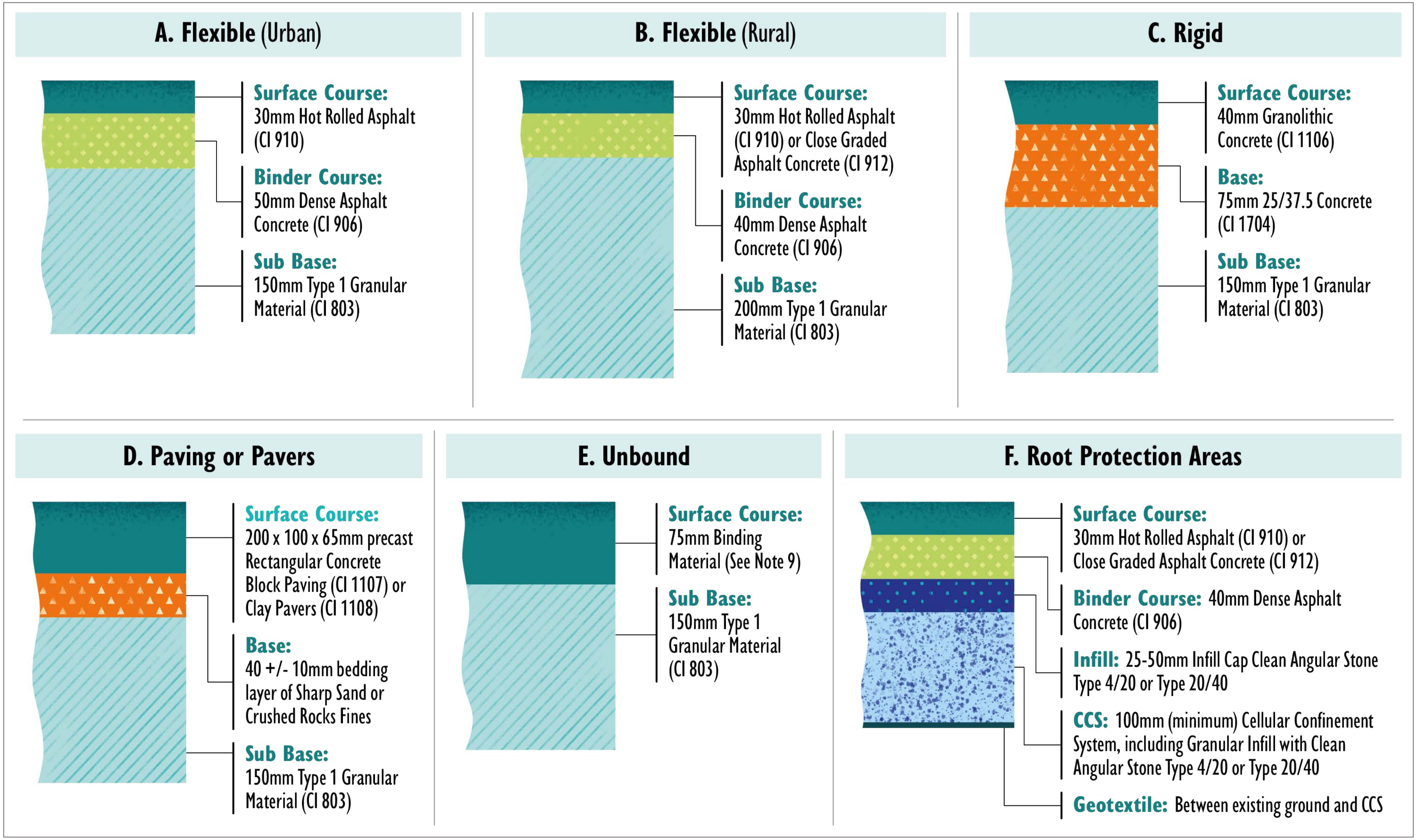


Figure 3.29: Pavement construction options

Notes for consideration when choosing pavement construction options:

1. *DMRB CD 239* can be applied for surfaced routes with asphalt, concrete block or clay pavers, natural stone slabs or setts, pre-cast concrete flags or in-situ concrete, which are subject to pedestrian and/or cycle traffic and some overrun by vehicular traffic.
2. Additional depth is required to accommodate any vehicular traffic loading (e.g. maintenance vehicles, private resident vehicles, farm vehicles, leisure vehicles).
3. A geotechnical assessment of existing ground conditions should be undertaken to specify the appropriate pavement type. If the formation level (subgrade) test performance is below 2.5% (CBR value), the assessment should include measures for ground enhancements (e.g. additional Class 1A material to mitigate soft ground conditions). For trunk road schemes *DMRB CD 239* guidance should be followed.
4. The sub-base depth to achieve exclusion depth for frost susceptible material is typically 390 mm (including Type 1 granular material as per Cl 803) and as per *DMRB CD 239*.
5. A vehicle loading assessment is required to provide enhanced pavement specification. For trunk road schemes, *DMRB CD 239* guidance should be followed.
6. A geotexile layer should be considered beneath the sub-base and laid over the approved formation if the ground conditions are poor. This is strongly recommended under unbound paths, regardless of ground conditions.
7. Kerbs should be considered for stability on the edges, as well as enhancing drainage and tie-in sections (particularly if vehicle traffic is present) and be provided in accordance with *DMRB CD 239*.
8. For rural areas and root protection areas the pavement can be altered by providing a combined surface/binder course of 60 mm (including Close Graded Asphalt Concrete as per Cl 912).
9. Unbound surfaces rely on friction between small aggregate particles (typically graded down from 6mm in size) to help them ‘bind’ together.
10. For root protection areas the depth of Cellular Confinement System (or number of layers) should be assessed considering the load bearing capacity and any vehicular shared use of route. Occasionally, an additional sub-base course should be considered.
11. Clauses referenced within this Figure and associated notes relate to the *Manual of Contract Documents for Highway Works*.

Level of Service Indicators – Cycle Link Surface Construction

In relation to Design Principle – Comfort

●●● **High Level of Service:**
Cycle route surface is machine laid and smooth, with no defects

●● **Medium Level of Service:**
Cycle route surface is hand-laid with frequent joints, or contains some defects

● **Low Level of Service:**
Cycle route surface is unbound or deterioration has led to frequent defects

Kerb upstands

Research commissioned by ***The Guide Dogs for the Blind Association*** suggests that kerb upstands between cycle tracks and footways should provide a level difference of at least 60 mm to be fully detectable by blind and partially sighted users.

Kerbs on either side of a cycle track should be splayed at an angle of 45 degrees to reduce the risk of cycle users striking the kerb with their pedal. Where the width of the cycle track is greater than the desirable minimums set out in Section 3.4, existing vertical upstand kerbs can be considered as an alternative.

Transitions between kerb types should be minimised as these can be complex to construct.

Kerb upstands between the road carriageway and the cycle track (or between the road carriageway and the buffer between it and the cycle track) have less influence on cycle user experience and should be specified based on roads authority requirements.

Buffers may be formed of blocked paving, grass verges or asphalt infill between kerbs.

The demarcation between a cycle track and footway at the same level can be formed using a demarcation kerb. This can be formed using a trapezoidal kerb up to 20 mm in height, which will be more effective than a painted delineation strip at separating cycle and pedestrian space.

Coloured surfacing

Consistent use of coloured surfacing within the surface layer on all cycle links will enhance driver awareness of the potential presence of cycle users and the attractiveness of the route for less confident cycle users.

It will also increase pedestrian awareness of the cycle link, which will be important at all points of pedestrian interaction, including junctions, crossings, bus stops and parking areas. Tonal contrast between areas allocated to pedestrians and cycle users will assist partially sighted pedestrians in navigating these spaces.

3.12.1	Coloured surfacing of cycle lanes and cycle tracks adjacent to the road carriageway is recommended.
3.12.2	It is recommended that a red coloured surface is applied to cycle links across Scotland to improve the consistency of application and understanding by all users.

When deciding how to apply this recommendation, roads authorities should carefully consider the following factors:

- **Legibility** – the more that a consistent surface colour is applied, the greater the level of understanding and appreciation will be for its purposes from all user groups
- **Comfort and attractiveness** – clear and visually distinguishable cycle facilities will provide greater confidence to new and less confident cycle users that the network is fully joined-up and encourage them to use these facilities more
- **Safety priorities** – where cost is a constraint, authorities may choose to focus the application of coloured surfacing to locations where the greatest safety risks lie, such as at junctions and on approach to crossings and areas of kerbside activity (parking, loading and bus stops)
- **Maintenance** – like-for-like repairs to cycle link surfaces will be important for user comfort for the reasons set out above. The ability to repair and maintain coloured surfacing without creating gaps in the coloured surface will be important
- **Economies of scale** – whilst the unit cost of applying and maintaining coloured surfacing may be higher than an asphalt road surface, there is potential for these unit costs to decrease with increased application and economies of scale across the country.

Options for the provision of coloured surfacing are set out in Table 3.12.

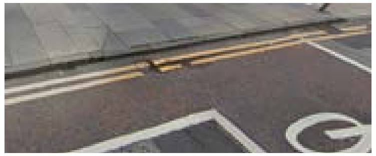
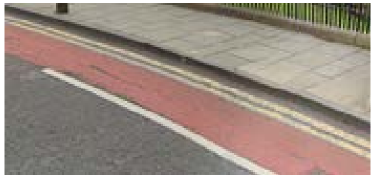
Option	Details		Advantages	Disadvantages
Red asphalt surface	Coloured asphalt with pigmented binder layer		• Visually distinctive over significant lengths, without being overly intrusive • Can be as durable as the equivalent road carriageway surface	• Unit cost will be more expensive than other options (but may decrease with increased application) • Replacement of small areas of deterioration can be problematic if like-for-like surface material is not available
Red chips within surface	Coloured chips added to surface layer mix		• Less visually intrusive in heritage areas • Can be as durable as the equivalent road carriageway surface • Less expensive to install during routine maintenance and to maintain afterwards	• Less visually distinctive than other options
Red screed or overlay surface	Coloured thermoplastic screed or other overlay surface applied directly over existing asphalt surface		• Most visually distinctive. Effective at emphasising particular features of a cycle link, including junction approaches	• Likely to be less durable than other options • Can be more visually intrusive than other options, which could lessen its impact at key locations if used excessively

Table 3.12: Options for cycle link coloured surfacing

3.13 Maintenance

Maintenance of cycle links is critical to ensure user safety, to maintain the attractiveness of the network and to improve the value of the network over the longer term.

Poorly maintained cycle links will deter users from making cycle journeys, particularly new and less confident users, who are critical to meeting government policy targets of increased cycling mode share.

Regular inspections of the network are required to identify immediate hazards, potential future hazards and areas with risk of rapid deterioration.

The inspection frequency of the cycle network should be set in the context of the overall maintenance strategy of the maintaining authority. Inspections should be carried out on foot or by cycle.

Inspections should record and prioritise the correction of the following:

- Debris, including broken glass, litter, spillages, stones, gravel, branches and leaves
- Potholes and other deterioration of the path surface (including gaps of 10 mm or greater, depressions of 20 mm or greater or any 'steps' that have been created in the surface)
- Loose or rocking slabs
- Loose, broken or misaligned ironwork, including manholes and drainage covers
- Path edge deterioration
- Local ponding or water build-up of 10 mm depth or greater
- Missing or worn road markings
- Deterioration of screed or coloured surface
- Vegetation overgrowth that impacts the path surface, effective width or visibility
- Vandalism or damage to signs, walls, fences, gates, and cycle parking.

Priority for correction of the issues identified during inspection should be based on firstly rectifying immediate hazards, and secondly planning the rectification of issues that could lead to future hazards. The timescales for rectification should be aligned to the maintenance strategy of the maintaining authority and should be no more than the timescales for rectifying the equivalent hazards on the authority's road network.

Reporting of maintenance needs by cycle users and other members of the public should be encouraged by the maintaining authority.

The maintenance of the cycle link and its surrounding infrastructure should be fully considered at the design stage. This is particularly important for grass verges and landscaping, to ensure that such facilities can be included in the maintaining authority's inspection and maintenance strategy to avoid compromising user experience.

The requirements for maintenance vehicle access should also be considered at the design stage, with the width and loading requirements of the link designed to accommodate these vehicles.

Access to all cycle tracks by mechanical road brushers is essential. The geometric requirements provided in Section 3.4 will allow for this, but designers should ensure access for these vehicles by avoiding pinch-points that may restrict their access. Where possible, exceeding the desirable minimum widths set out in this chapter will improve opportunities for maintenance.

Key maintenance considerations at the design stage include:

- Sealed surfaces are more costly to install but provide a more comfortable user experience and require less maintenance overall, thereby reducing the whole-life cost of the link
- Suitable cycle track alignment and drainage design will reduce the potential for ponding, associated deterioration and maintenance of the surface
- Planting and vegetation should be offset from the cycle track to allow for regular maintenance and to avoid overgrowth that will impact on the effective width of the cycle link, forward visibility and the visual inspection of the cycle link and associated structures.

Cycle tracks should be prioritised to at least the same level of gritting and winter maintenance as the road network within the local authority maintenance strategy. Opportunities to regularly improve cycling infrastructure should also be identified and incorporated into the road network maintenance programme.

The extent of maintenance responsibilities for a cycle link should be agreed at the design stage. It may be that different sections of the link fall within the maintenance responsibility of the trunk roads authority, local roads authority or others such as Sustrans, Scottish Canals or private landowners. Where this is the case, the designer should identify the extent of these responsibilities to ensure the link can be consistently and effectively maintained upon completion.

Further guidance on maintenance is available in the ***UK Road Liaison Group's Well-Managed Highway Infrastructure: a Code of Practice (2016)*** and ***Asset Management Guidance for Footways and Cycleways (2018)***.

4.0 Crossings

4.0 Crossings

Figure Numbers

Table Numbers

4.1 Principles

Safe and effective crossings are essential where facilities for cycle users and pedestrians and roads interact.

This chapter sets out guidance to be applied at crossing points where different user groups interact and provides examples of how this guidance can be applied at typical layouts.

The Scottish Government's Sustainable Travel Hierarchy sets out guiding principles which should be recognised when designing crossings. Consideration of those most at risk is vital. Cycle users are potentially vulnerable when interacting with motor traffic. Similarly, where cycle users and pedestrians interact, the pedestrian requires careful consideration to facilitate crossing. Understanding potential and latent demand, and how this may impact on future volume of all users, is key to developing appropriate crossing facilities.

The core principles outlined in Chapter 2, of safety, directness, comfort, attractiveness, coherence and adaptability, should be used to guide design decisions where crossings are required. Understanding the success criteria that will achieve these objectives, and applying these to designs, is critical.

Success criteria include the following:

- Maximising motor vehicle driver concentration
- Minimising the interaction between cycle users and motor traffic and pedestrians
- Providing suitable visibility at crossings, facilitated by suitable angles of approach
- Minimising the speed differential between cycle users and motor traffic, and cycle users and pedestrians, by the design of the approaching layout
- Maximising cycle users' concentration by removing/minimising extraneous obstacles such as chicanes, bollards and signs
- Reducing probability of cycle users having to stop, wait and regain momentum, particularly by crossings being blocked
- Enabling cycle users to follow the most direct and logical route
- Maximising natural surveillance and user visibility
- Providing a coherent approach to crossings and junctions along a cycle route.

4.2 Providing appropriate facilities

Crossings should provide safe passage for all users and this is achieved by managing the interactions between user groups. Solutions should be appropriate to the circumstances of the site and the behaviour and demands of the users. This is essential to conform to the core design principles.

Crossing types

Where a crossing is required, either between pedestrians and cycle users, or cycle users and motor traffic (or a combination of both), there are four broadly defined methods of managing the interactions:

- Controlled crossings (without signals) – such as Parallel and Zebra crossings
- Uncontrolled crossings – either completely uncontrolled, or arranged in a layout where users on one facility are required to give way to those on another facility
- Signal controlled crossings and junctions incorporating phases for cycle users
- Grade separation – where facilities are completely separated by overbridges or underbridges.

This chapter sets out key individual components of the design at crossing locations and outlines a variety of layouts which can be applied.

Developing appropriate solutions

Selecting the most appropriate form of crossing requires careful assessment. For cycle users and pedestrians, safety, directness and comfort are paramount. Managing the interactions at crossings is key to enabling those most at risk to navigate independently.

The design process depends on the resolution of site-specific factors. It is not necessarily the case that the greatest level of control will be the best solution. Overprovision in the wrong situations can be problematic. For example, signal control where it is not justified by demand can lead to excessive and unnecessary delays and frustration for all users. Therefore, balance and local factors strongly influence decisions.

4.2.1 An initial site assessment should be carried out by an experienced practitioner to ensure factors relating to the site are incorporated in the design process.

A site-specific assessment will consider factors that may include:

- Pedestrian and cycle user volume and composition
- Motor traffic volume and composition
- The context of the interaction within a junction or multi-modal crossing
- Speed of motor traffic
- Injury accident record
- Street geometry and other geometric controls
- Adjacent physical constraints
- Coherence with other crossings on the route
- Feedback from public consultation, including groups representing disabled users.

Cycle user and pedestrian interactions – key considerations

In general terms, a higher volume of pedestrians and cycle users will require a greater degree of control, subject to other site-specific factors. Formal control measures such as Zebra crossings become more appropriate with higher user numbers, enabling pedestrians to cross the cycle facility safely.

Signal-control is unlikely to be necessary to address simple interactions between cycle users and pedestrians, unless volume is particularly high. However, signal control might be incorporated into more complex arrangements, such as where cycle users and pedestrians interact in the context of a road junction.

Consistent management of cycle user and pedestrian interactions along a route or within a local area allows those most at risk to become familiar with the layout and with the behaviours of other users.

Where cycle routes intersect they are unlikely to justify signal control. As the mode is the same on both routes there is also no requirement for other control measures such as a Zebra crossing. Therefore, these interactions will generally be uncontrolled. This may provide priority to one dominant route through a give-way arrangement, or alternatively give no formal priority to either route.

Road crossings – key considerations

The most appropriate way to manage a road crossing will depend on various site-specific factors, and a key consideration is the speed of motor traffic.

Table 4.1 provides a preliminary guide to suitable road crossing types based on motor traffic speeds. It illustrates that as the speed of motor traffic increases, and the degree of control applied to motor traffic reduces, the safety of users crossing the road is less certain and the crossing generally becomes less attractive to cycle users, particularly to those who are less experienced or less confident.

There are defined maximum speeds at which controlled Parallel and Zebra and signal-controlled crossings may be provided. However, while there are no defined thresholds regarding the provision of uncontrolled crossings, the level of service can reduce significantly where motor traffic speeds are higher.

Grade separation provides the greatest protection to cycle users crossing roads, particularly on higher speed roads. It is unlikely to be justified environmentally or economically at low traffic speeds, or low traffic volumes. Where grade separation is provided, the directness of the route for cycle users and pedestrians should be maintained as far as possible.

4.2.2 Parallel and Zebra crossings should not be installed on roads with an 85th percentile speed of 35 mph (56 kph) or above without speed reducing measures to slow traffic, in accordance with ***Traffic Signs Manual Chapter 6***.

4.2.3 Stand-alone signal-controlled crossings should not be provided where the 85th percentile speed of motor traffic is greater than 80 kph.

Motor Traffic Speed (85th percentile)	**Uncontrolled**	**Controlled Zebra or Parallel**	**Signal-Controlled**	**Grade Separated**
0 to 30 kph	●●	●●●	●●●	●●●
30 kph to 55 kph	●	●●	●●●	●●●
55 kph to 80 kph	●	x	●●●	●●●
More than 80 kph	●	x	x	●●●

●●● **High Level of Service:** Suitable for most users.

●● **Medium Level of Service:** May not be suitable for some users, particularly novice users. Designer shall consider the lack of attractiveness of the facility to these users and how this can be overcome or mitigated.

● **Low Level of Service:** Not suitable for a range of users, including novice and intermediate users. Shall be avoided unless the risk to these users is conveyed to the Overseeing Organisation by the designer and accepted by the Overseeing Organisation. See Section 2.4.

x **Should not be used.**

Table 4.1: Selection matrix for road crossings

4.3 Design components

There are various components which are common to several crossing layouts. These include visibility requirements and the treatment of waiting areas adjacent to crossings. These are discussed in this section.

Visibility envelope

Visibility is an essential factor in ensuring safety where facilities intersect.

At Zebra and Parallel crossings, and at uncontrolled crossings where priority is assigned to a 'through route' over an 'adjoining route', the principle of a visibility envelope is applied. Adequate visibility is ensured by the provision of such an envelope. This is illustrated in Figure 4.1.

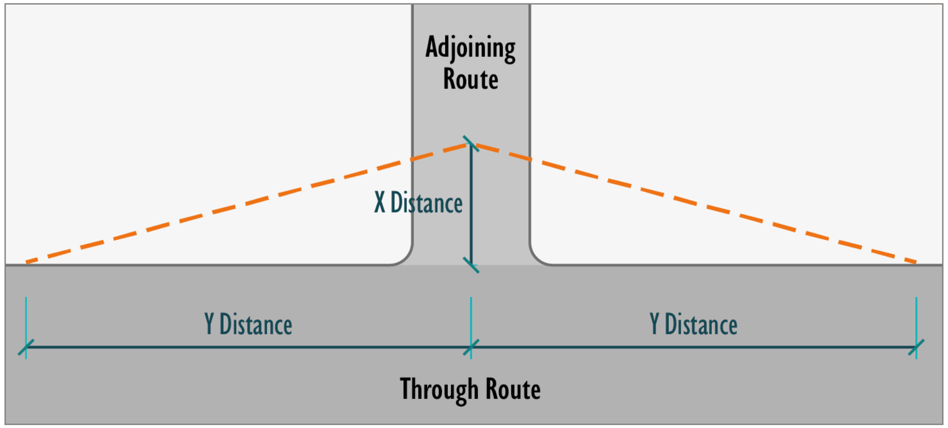


Figure 4.1: Visibility envelope

The visibility envelope defines an eye point on the adjoining route or facility, which is set a perpendicular distance (X) from the through route. From this point, users have to be able to see the full width of the through route, for an appropriate distance (Y). Where the through route is two-way this has to be provided in both directions. Otherwise it is only required in the direction of approaching traffic.

The required distances and heights are dependent on the type of facility. The eye height and X distances for pedestrian and cycle facilities and roads are detailed in Table 4.2. Pedestrian X distances are based on the requirements of wheelchair users (and their assistants), mobility scooters and pram users.

The associated target height and Y distances are detailed in Table 4.3. The speed used to define the Y distance is:

- The design speed, where the through route is a cycle track or a new road
- The 85th percentile motor vehicle speed, where the through route is an existing road.

The visibility envelope as described does not apply to signal-controlled junctions, or to uncontrolled conflict points which assign no priority. Requirements at these locations are discussed in the relevant sections.

Location	Eye Height Range (m)	Desirable Minimum X (m)	Absolute Minimum X (m)
Pedestrian Facility	0.9 to 2.0	1.5	1.5
Cycle or Shared Facility	0.8 to 2.2	4.0	2.0
Road	1.05 to 2.0	4.5	2.4

Table 4.2: Eye height and X distances (based on adjoining route)

Location	Target Height Range (m)	Design (85th Percentile) Speed (kph)								
		120	100	85	70	60	50	40	30	20
Cycle Facility	0.26 to 2.0	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	47*	31*	17*
Road	0.26 to 2.0	295*	215*	160*	120*	56**	43**	31**	20**	N.A.

* Values in blue are based on parameters in ***Design Manual for Roads and Bridges***
** Values in green are based on parameters in ***Designing Streets***

Table 4.3: Target height and Y distances (m) for cycle facilities and roads (based on through route)

4.3.1 A visibility envelope should be provided at Zebra and Parallel crossings, and at uncontrolled interactions where an adjoining route meets a through route, in accordance with the values defined in Tables 4.2 and 4.3.

Note: In retro-fit situations adjacent to visibility constraints, designers are encouraged to refer to the Design Review process outlined in Chapter 2.

4.3.2 Where the adjoining route is a cycle track, low level obstructions which would obscure the visibility from a recumbent cycle or hand cycle should be avoided in the immediate vicinity of the crossing or interaction point.

4.3.3 Where the adjoining route features give way markings, the X distance should be measured from the marking. Otherwise it should be measured from the nearside edge of the through route.

4.3.4 Where a cycle track or road forms the through route, the Y distance should be measured from the centre of the adjoining facility, as illustrated in Figure 4.1.

4.3.5 Where a pedestrian facility forms the through route, the Y distance should be measured from the edges of the adjoining facility, and should be a minimum of 2.0 metres.

4.3.6 Where the through route terminates within the Y distance (e.g. at a priority junction), the visibility should be provided to the end of the through route.

Where an adjoining route is required to cross two adjacent facilities, the visibility splay may have to be measured at both interaction points. In such situations, visibility has to be provided from the edge of the first facility encountered, using appropriate X and Y dimensions. Subsequently, appropriate visibility also has to be provided where the second facility is encountered. This is illustrated in Figure 4.2. This situation is likely to arise on entry to shared use waiting areas, and at continuous cycle tracks and footways (detailed in Chapter 5).

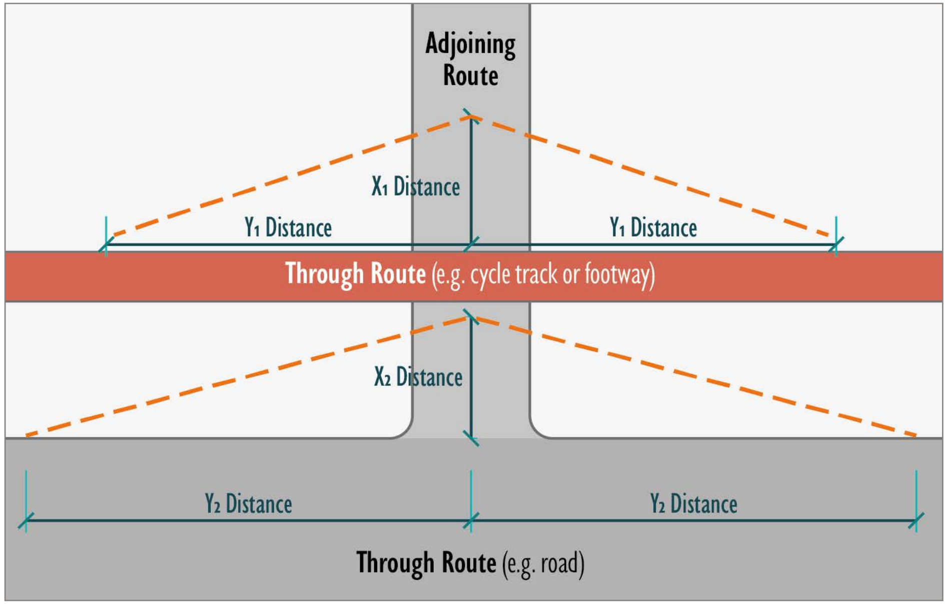


Figure 4.2: Visibility envelope at adjacent facilities

Shared use waiting areas at crossings

Where pedestrians and cycle users are required to cross a road in close proximity, shared use waiting areas allow the situation to be managed safely while not compromising the Sustainable Travel Hierarchy. A significant principle of shared use waiting areas is that all users are made aware of the changed status of the area that they are entering, so that they understand the situation and can alter their behaviour accordingly.

Where the status of a route is changing, either between a pedestrian route and a shared use waiting area, or between a designated cycle route and a shared use waiting area, tactile paving is used to indicate the change.

Cycle users require adequate visibility of the pedestrian route with which they are interacting, so that they can ensure that it is clear before entering. Where necessary, cycle speed control measures may be applied on approach to the shared use waiting area, through the horizontal alignment of the approaching cycle route and/or road markings.

At the point where pedestrians are required to cross, appropriate tactile paving is required, defined by whether the road crossing is controlled or uncontrolled. Dropped kerbs are also required at the crossing point, and appropriate visibility of the road provided. In the case of uncontrolled and Parallel crossings, the X-distance from a shared use waiting area is defined by the requirements of the cycle user.

Guidance on tactile paving and dropped kerbs is contained in ***Guidance on the use of Tactile Paving Surfaces*** and in ***Roads for All: Good Practice Guide for Roads*** respectively.

A typical shared use waiting area at a crossing point is illustrated in Figure 4.3.

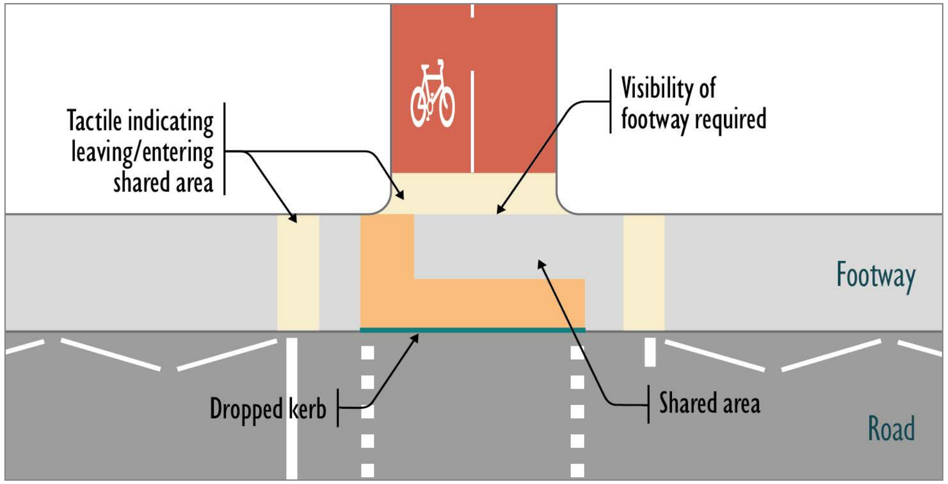


Figure 4.3: Shared use waiting area at a crossing

4.3.7 Dropped kerbs at crossings and transitions should be 'flush' with the adjacent road or cycle route surface, with the permissible tolerance being up to 6 mm.

Separated landing areas at crossings

While shared use waiting areas can be an effective means of managing the interaction between cycle users and pedestrians on the road edge, the provision of separate waiting areas has potential to reduce the degree of interaction and delay. A way of achieving this is by providing a "landing" area on the road edge, which is clear of any adjacent footway or cycle track. An example is illustrated in Figure 4.4.

The landing area enables cycle users and pedestrians to be positioned separately as they wait to cross the road. This is beneficial where the road crossings are also separate, such as at Parallel crossings. Interactions between the footpath and cycle track have to be managed appropriately, and the most effective method will be dependent on layout and user volume on the intersecting facilities. In the example illustrated a Zebra crossing is provided to enable pedestrians to cross the cycle track and access the landing area.

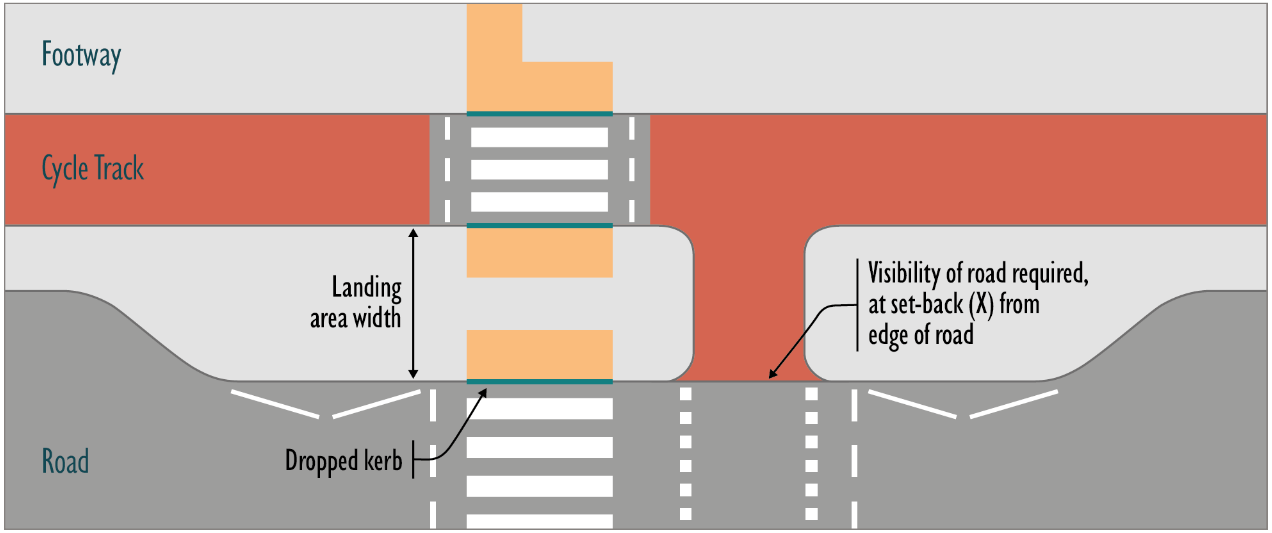


Figure 4.4: Landing area for waiting at a crossing

The provision of a landing area requires additional width on the roadside. In the example illustrated the combined width of the footway, the cycle track and the landing area is required. The landing area width has to accommodate any tactile paving, and to enable the design cycle vehicle to be positioned clear of the cycle track through route. Where appropriate, build-outs can help to provide the required width.

Guidance on tactile paving and dropped kerbs is contained in ***Guidance on the use of Tactile Paving Surfaces*** and in ***Roads for All: Good Practice Guide for Roads*** respectively.

It is preferable to provide consistent crossing facilities on both sides of the road. This improves clarity for users and simplifies wayfinding. However this will often be influenced by the layout of interacting facilities, and the space available. The provision of separated facilities on one side of the road may be beneficial, even where similar facilities cannot be provided on the other side.

Perpendicular approaches to crossings and junctions

Where a cycle facility approach is perpendicular to the road it needs to cross, the horizontal alignment in advance of the crossing should discourage high speeds. SLOW markings on the cycle route (to ***TSRGD Diagram 1058.1***) may be used to warn cycle users of the interaction ahead but excessive signage and visual clutter should be avoided. Speed and access control measures such as physical barriers and bollards should only be considered as a last resort and will need to consider access for all cycle types if used.

4.4 Parallel and Zebra crossings

Parallel and zebra crossings assign a degree of control to a route, enhancing the priority of those crossing. They enable those most at risk to cross the route of larger and potentially faster vehicles, for example:

- Enabling pedestrians to cross cycle tracks
- Enabling cycle users and pedestrians to cross a road.

Parallel and Zebra crossings are easily aligned with the Sustainable Travel Hierarchy. In situations where the vehicle type on one route is larger and potentially faster, and may otherwise assume priority, the balance of priority can be redressed in favour of the users who sit higher in the Sustainable Travel Hierarchy.

These controlled crossings require care and consideration by all users. Those crossing are required to wait until it is safe to proceed. Those on the through routes should give way to those waiting and must give way to those who have proceeded to cross.

Features of a controlled crossing are likely to include:

- Zebra markings
- A parallel route for cycle users
- Physical infrastructure to accommodate crossing, such as dropped kerbs and tactile paving.

Guidance on tactile paving and dropped kerbs is contained in ***Guidance on the use of Tactile Paving Surfaces*** and in ***Roads for All: Good Practice Guide for Roads*** respectively.

Controlled crossings are relatively inexpensive to install and maintain, and likely to have a relatively low visual and environmental impact on the surrounding area. They are most likely to be suitable where traffic volumes and speed are low on the through route and where there is a demand for those most at risk to be given priority over larger vehicles.

Care is required to ensure that enough space and information is provided to all users of the crossing and that visibility for users is maximised. It may be necessary to introduce additional features to slow users approaching the crossing.

Zebra crossing of cycle track

Where cycle users and pedestrians meet, the provision of a Zebra crossing increases pedestrian priority and aligns with the Sustainable Travel Hierarchy. They are used where a pedestrian route is required to cross the cycle network. They may be standalone, included within facilities such as bus stop bypasses, or be incorporated as part of a wider junction, potentially in combination with features such as:

- A controlled crossing of the road, e.g. Zebra crossing
- A signal-controlled crossing of the road, e.g. Puffin crossing.

Suitable crossing facilities including dropped kerbs and tactile paving are required. Adequate visibility along the cycle track is required from a position within the pedestrian route where it meets the cycle route. Features to emphasise the crossing and to slow cycle users, such as speed tables, may also be incorporated.

The crossing is identified by alternate black and white Zebra crossing markings aligned in the direction of the cycle route. The coloured surface of the cycle track is suspended across the crossing to emphasise it more clearly to all users. SLOW markings on the cycle track may be used to warn cycle users of the crossing ahead.

Figure 4.5 illustrates an example of a Zebra crossing for pedestrians across a two-way cycle track.

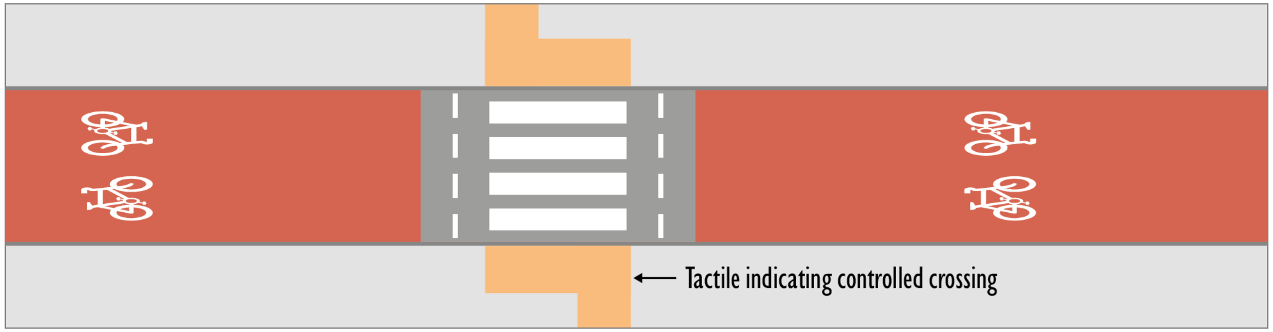


Figure 4.5: Zebra crossing of cycle track

4.4.1 A visibility envelope is required in accordance with Section 4.3.

4.4.2 Signs and markings should be in accordance with ***Traffic Signs Manual Chapter 6***.

Note: Where a Zebra crossing only crosses a cycle track, a yellow globe and zig-zag markings on approach are not required.

4.4.3 The route through the crossing, i.e. the Zebra markings, should be a minimum width of 2.4 m, and may be wider determined by the pedestrian crossing demand.

4.4.4 Dropped kerbs should be ‘flush’ with the cycle track, with the permissible tolerance being up to 6 mm.

Parallel crossing

Where a cycle track meets a road, motor vehicles often dominate due to their greater speed and size, and measures may therefore be necessary to redress the balance. A Parallel crossing of the road increases pedestrian and cycle priority and aligns with the Sustainable Travel Hierarchy.

Suitable crossing facilities, including dropped kerbs and tactile paving are required. A suitable visibility envelope is required along the road for those waiting to enter the road.

Motor traffic speed on approach to the crossing should be controlled and it may be appropriate to incorporate traffic management measures such as a road hump/speed table, with a maximum ramp gradient of 1:10.

Figure 4.6 illustrates an example layout of a Parallel crossing for cycle users and pedestrians to cross a single carriageway road.

The example illustrates a protected parallel cycle track on the 'north' side of the road, and a remote cycle track meeting a footway on the 'south' side. Pedestrians and cycle users are provided with separate waiting areas on the 'north' side, with a shared waiting area shown on the 'south' side where space is more limited.

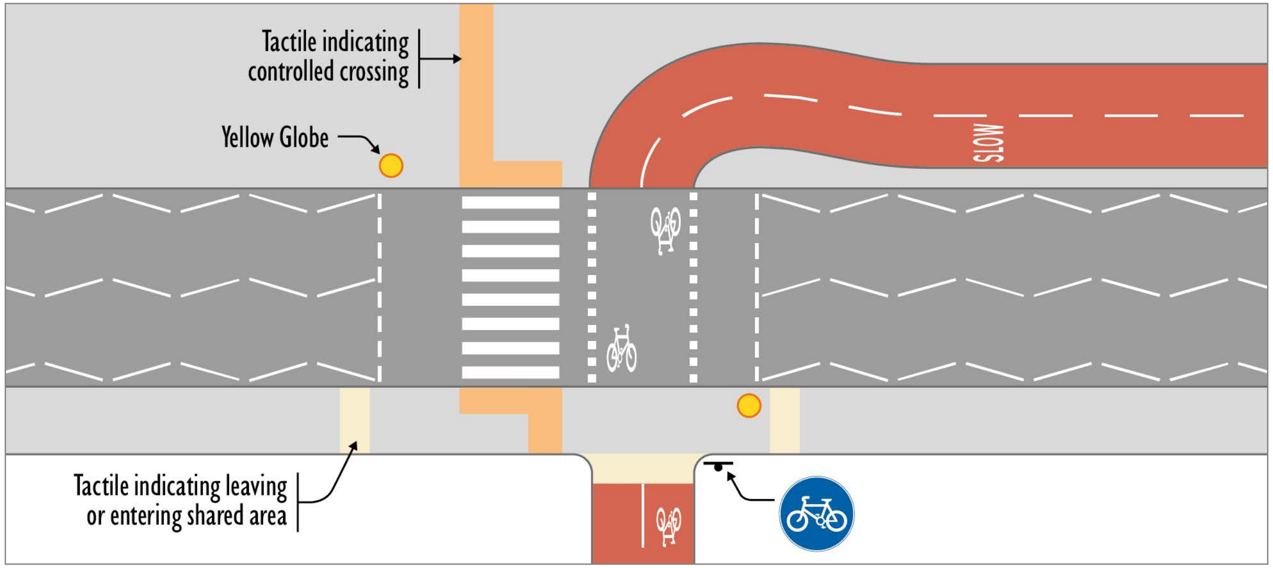


Figure 4.6: Parallel Crossing

4.4.5 Parallel crossings should not be installed on roads with an 85th percentile speed of 35 mph (56 kph) or above without speed reducing measures to slow traffic, in accordance with ***Traffic Signs Manual Chapter 6***.

4.4.6 A visibility envelope is required in accordance with Section 4.3.

4.4.7 Signs and markings should be in accordance with ***Traffic Signs Manual Chapter 6***.

4.4.8 The facility should be designed for crossing the road in a single stage.

4.4.9 The route through the pedestrian element of the crossing should be a minimum of 2.4 m, and may be wider determined by the pedestrian crossing demand.

4.4.10 The route through the cycle users' element of the crossing should be at least the same width as the adjoining cycle route and a minimum of 3.0 m for two-way and 1.5 m for one-way operation.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4.5 Uncontrolled crossings and interactions

Uncontrolled crossings provide users of one facility the opportunity to cross another facility with the lowest level of control of users. The Sustainable Travel Hierarchy requires pedestrians to be given precedence and places greater importance on cycle users than motor traffic. However, the speed, nature and volume of motor traffic can make it more naturally dominant at points of interaction, and uncontrolled crossings do little to redress this. These crossings will therefore provide a lower level of service for cycle users than alternative crossing types in most situations.

Uncontrolled solutions are relatively inexpensive to install and maintain, and likely to have relatively low visual and environmental impact on the surrounding area. They are most likely to be suitable in conditions of low use and low motor traffic speed. Where motor traffic speed or volume is high other options should be considered.

In many circumstances where roads and cycle routes interact at an uncontrolled crossing, the cycle user will be required to give way. Where this is not appropriate and a greater level of cycle user priority is desired, a greater level of control is necessary.

Features of an uncontrolled crossing may include:

- Traffic signs and road markings to advise and regulate the movement of users
- Physical infrastructure to accommodate users crossing, e.g. dropped kerbs and tactile paving.

Guidance on tactile paving and dropped kerbs is contained in ***Guidance on the use of Tactile Paving Surfaces*** and in ***Roads for All: Good Practice Guide for Roads*** respectively.

Due to the high degree of interaction and low level of control, appropriate visibility at such crossings is essential.

At most uncontrolled crossings and interaction points, priority will be assigned to one route over another. This is essential at roads where motor traffic is involved. It is also usually appropriate where cycle user and pedestrian facilities interact. Assigning priority is potentially less necessary where:

- The mode of user on both facilities is the same
- The mode of user is at low speed and volume is not excessive
- Any conflict between users results in minimum risk.

In such scenarios users may be able to moderate their behaviour without the use of signage, road markings or infrastructure. Such situations are most likely to occur in low flow areas and require good visibility between users to ensure they are aware of the situation and can identify and react to any potential conflict as they approach.

Cycle user and pedestrian interactions

Where cycle user routes and pedestrian routes meet, three potential situations may arise:

- Cycle users give way to pedestrians (e.g. entering a shared use waiting area)
- Pedestrians give way to cycle users
- No formal priority is assigned, and all users are required to interact.

Situations where pedestrians give way to cycle users are most likely to occur at crossings where cycle routes are continuous, and the pedestrian volume is low. They may occur where a cycle track passes kerbside activity areas such as on-street parking and loading bays. If the provision of such a facility does not offer an adequate and safe opportunity for pedestrians, then an alternative arrangement will be necessary.

Suitable crossing facilities, including dropped kerbs and tactile paving are required.

Adequate visibility along the cycle track (dependent on speed) is required from a position within the pedestrian facility where it meets the cycle track.

A typical uncontrolled crossing layout where pedestrians give way to cycle users is illustrated in Figure 4.7.

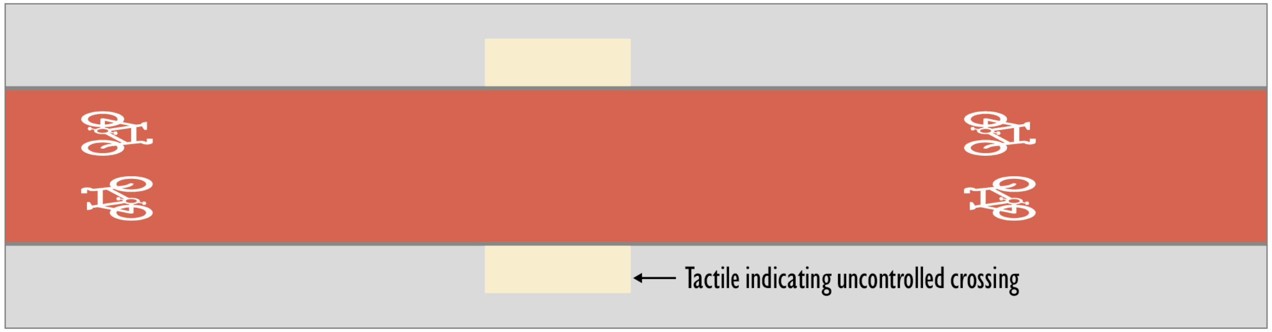


Figure 4.7: Uncontrolled crossing layout – pedestrians give way to cycle users

4.5.1 A visibility envelope should be provided in accordance with Section 4.3.

4.5.2 The minimum width of dropped kerb at the crossing should be 1.2 m as advised in ***Roads for All: Good Practice Guide for Roads***, and may be wider to accommodate the pedestrian crossing demand.

Note: A 2.0 m width will allow two wheelchair users to pass on the crossing.

4.5.3 Dropped kerbs should be 'flush' with the cycle track, with the permissible tolerance being up to 6 mm.

4.5.4 SLOW markings on the cycle track may be used to warn cycle users of the interaction ahead.

Cycle user and road interactions

Cycle user routes may meet roads at crossings or at junctions where cycle users are required to join the carriageway. Priority is always assigned at the interaction point between motor traffic and cycle users. The speeds and potential consequences of a collision where motor traffic is involved are greater than at other interaction points.

Where the road is assigned priority, cycle users are required to give way, and adequate visibility of the road is required from a position within the cycle route. Features will vary depending on the situation. In situations where a cycle-only route intersects directly with the road, markings are required, as illustrated in Figure 4.8.

However, in many cases the cycle user will have entered a shared use waiting area with pedestrians. In such cases tactile paving and dropped kerbs will define the interface with the road.

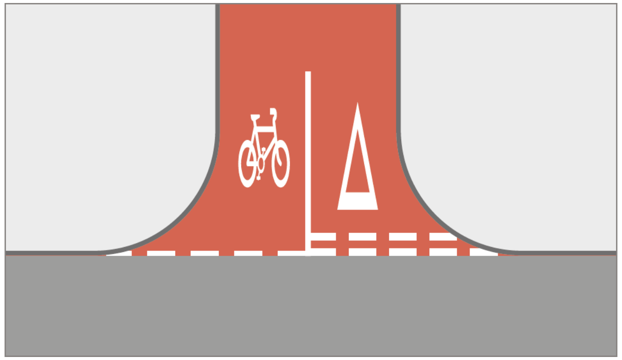


Figure 4.8: Uncontrolled direct interaction between cycle route and road

4.5.5 A visibility envelope is required in accordance with Section 4.3 at all uncontrolled interactions between a cycle route and a road.

4.5.6 Where an off-line cycle track interfaces directly with a road, a minimum corner radius of 4 m should be provided.

4.5.7 Signs and markings should be in accordance with ***Traffic Signs Manual***. Where the cycle facility interacts directly with the road, road markings (including ***TSRGD Diagram 1003B***) should be used on the cycle facility to define the need for users to give way.

Uncontrolled single carriageway crossing – urban situation

Figure 4.9 illustrates an example of an uncontrolled crossing layout for a cycle user route and associated pedestrian route, crossing a single carriageway road in an urban setting. A shared use waiting area is illustrated.

Parking and street furniture can affect visibility at crossing locations and may have to be limited to meet visibility requirements. Where the road is subject to on-street parking, the provision of build-outs can reduce the crossing length, assist in achieving the required visibility envelope, and enable users to wait at the crossing without impeding pedestrians proceeding along the footway. The location of build-outs should not create pronounced 'pinch-points' on the road carriageway, as this can compromise the safety of road users.

In low speed environments it may also be desirable to provide a raised table at the crossing to control the speed of motor traffic and reduce the change in level for crossing users, though this is more commonly applied at controlled crossing facilities.

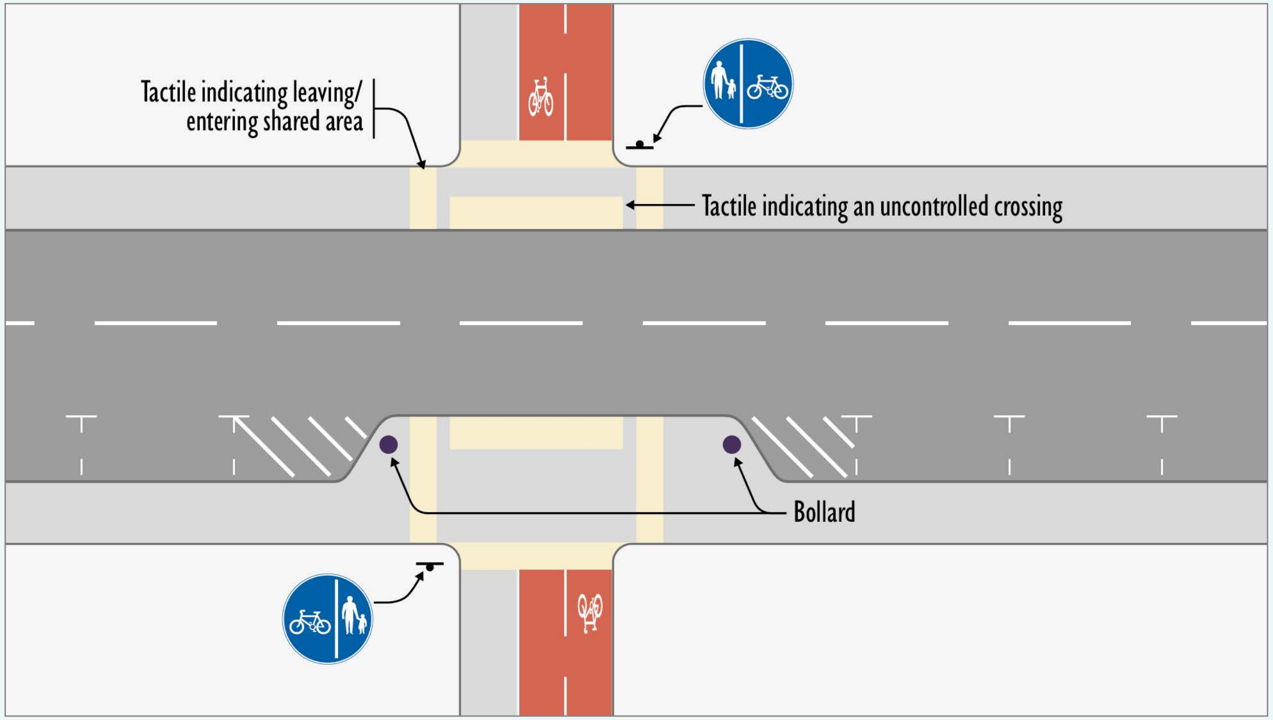


Figure 4.9: Uncontrolled crossing of urban single carriageway


Cyclists
give way to
pedestrians

Uncontrolled single carriageway crossing – rural situation

Figure 4.10 illustrates an example of an uncontrolled layout for a cycle route crossing a single carriageway and interacting with a footway running parallel to one side of the road. A shared use waiting area is illustrated.

This scenario may be more typical of a rural situation with fewer roadside features but potentially higher motor traffic speed. Where uncontrolled crossings of the carriageway are provided, it is important that traffic speed is not excessive to enable safe crossing. Mitigating measures such as warning signage can be used to reduce motor traffic speed and reduce the risk associated with the crossing. The risk increases with traffic speed, and grade separation is preferable where motor traffic speeds are high.

Central refuges are not provided for crossings on single carriageways where the speed limit exceeds 40 mph, unless the refuge island is incorporated into a single lane dualling design.

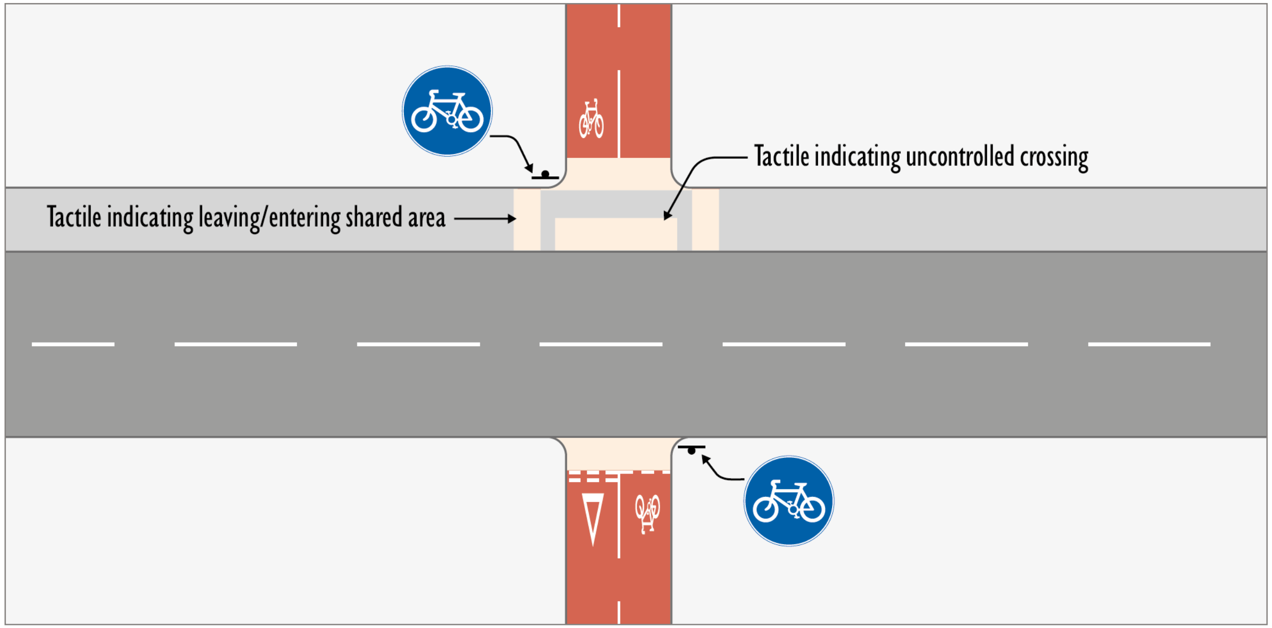


Figure 4.10: Uncontrolled crossing of rural single carriageway

Uncontrolled dual carriageway crossing

Another potential scenario is where cycle user facilities cross a dual carriageway. At-grade crossings will often be undesirable in this scenario if traffic speeds are high, and grade separation would potentially provide a more attractive option. Mitigating measures such as warning signage can be used to reduce motor traffic speed and reduce the risk associated with the crossing.

Figure 4.11 illustrates an uncontrolled crossing of a dual carriageway. Shared use waiting areas are illustrated. A shared use waiting area is provided on the central reserve at dual carriageway crossings so that the crossing can be carried out in two stages.

A straight across crossing is generally preferred as staggered crossings can be difficult to negotiate, particularly by those using larger cycles. They can also cause delay and give rise to potential conflict between cycle users and pedestrians within the central reserve.

If staggered crossings are provided it is essential that the central reserve can accommodate the design parameters for the design cycle and a two-way cycle track (including pedestrian facilities where appropriate). A short stagger offset between the two crossings will allow a smoother and more comfortable path through the central reserve for cycle users than the provision of tight, right-angled turns.

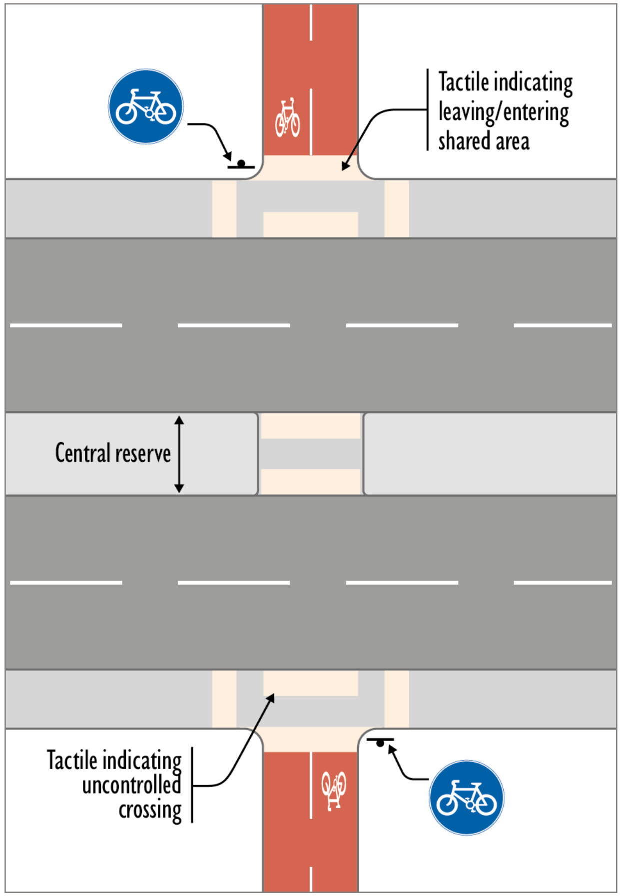


Figure 4.11: Uncontrolled dual carriageway crossing

4.5.8 The central reserve should be a minimum width of 3.0 m measured perpendicular to the road. This width is exclusive of hard strips.

Note: Where this cannot be achieved, the Design Review process will be used to provide justification to allow acceptance or consideration of alternatives by the Overseeing Organisation (refer to Chapter 2).

4.5.9 Additional width may be necessary to provide clearance to any fixed objects (refer to Chapter 3).

4.5.10 The width of the crossing through the central reserve should not be less than that of the adjoining facility and should be an absolute minimum width of 2.5 m.

4.6 Cycle priority crossings

Cycle routes may be given priority over lightly-trafficked roads in situations where motor traffic speeds are low. This arrangement incorporates standard give-way markings on the road (to ***TSRGD Diagram 1003A***), requiring motor traffic to give-way to cycle users. A layout is illustrated in Figure 4.12.

Opportunities to provide cycle user priority are most likely to arise in new developments and in situations where a cycle track has been taken off-line at a junction to cross a side road.

In situations where cycle users are assigned priority, it is vital that drivers are clearly aware of the facility, and that motor traffic speeds approaching the crossing are not excessive. The visibility of the cycle track from the road is defined by a conventional visibility splay using X and Y dimensions.

Where pedestrians are to be accommodated, the Sustainable Travel Hierarchy should be considered. Parallel crossings may provide a more suitable alternative where pedestrians and cycle users are required to cross together.

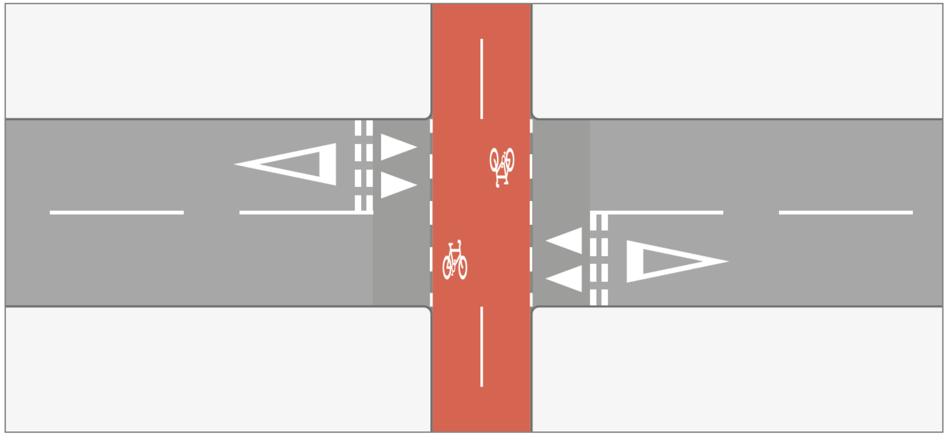


Figure 4.12: Cycle priority crossing of road

4.6.1 Cycle priority crossings should not be provided where the speed limit on the road is greater than 30 mph.

4.6.2 A visibility envelope is required in accordance with Section 4.3, with the cycle track defined as the through route, and therefore ensuring visibility of the cycle track from the road.

4.6.3 A speed table with ramps not exceeding 1:10 may be applied, to control the speed of motor traffic and reduce the change in level for cycle users as they cross the road.

4.6.4 The cycle track surface material and colour should continue across the crossing to visually emphasise priority.

4.6.5 SLOW markings on the cycle track may be used to warn cycle users of the interaction ahead.

4.7 Signal-controlled crossings

Signal-controlled crossings are generally suitable in urban areas where user volume is relatively high.

Signal-controlled crossings are generally only used to address the crossing of a road. They have a relatively higher installation and maintenance cost than uncontrolled or other controlled crossings. Where interactions arise between cycle users and pedestrians without adjacent motor traffic, these can be adequately controlled without traffic signals.

Signal-controlled crossings incorporating cycle facilities may include:

- Where pedestrians cross a road and an adjacent cycle facility (Puffin crossing)
- Where cycle users (often with pedestrians) cross a road.

Several features of a signal-controlled crossing will apply regardless of the specific layout. Suitable crossing facilities, including dropped kerbs and tactile paving are required. Facilities to emphasise the crossing and to slow drivers, such as speed tables, may also be incorporated.

Guidance on tactile paving and dropped kerbs is contained in ***Guidance on the use of Tactile Paving Surfaces*** and in ***Roads for All: Good Practice Guide for Roads*** respectively.

Audible and/or tactile signals should be provided where crossings serve pedestrians, for the benefit of blind and partially sighted people.

Signal control means that visibility of the opposing route for those waiting to cross a facility is less important than at other crossing types. However, crossing locations should not be obscured, and visibility to the appropriate signal head on the approach (for motor traffic and cycle users) and from the kerb line (for pedestrians and cycle users) is essential.

Puffin crossing incorporating a cycle track

A signal-controlled pedestrian crossing can be used where a road has adjacent cycle routes.

Figure 4.13 illustrates an example layout of a signal-controlled crossing for pedestrians (Puffin) to cross a cycle track and road. The cycle user facility in the illustrated example is a protected two-way cycle track on one side of the road only.

Where signal-controlled pedestrian crossings cross a cycle track and road, the crossing should be continuous across both, i.e. the cycle route is included within the controlled area of the crossing. This applies whether the cycle route is protected or not.

Pedestrian crossing times are calculated based on the combined width of the road and the cycle route. The length of the cycle user phase will correspond to that of the road.

Kerbside detectors may be incorporated to enhance the crossing facility. These can sense when a pedestrian has crossed or moved away after pushing the demand button, in which case the demand is cancelled. Detectors can also sense pedestrians on the crossing and hold all vehicles at a red signal until they have crossed. Where appropriate, pedestrians can be given the default green signal, especially at times of the day when traffic flows are low.

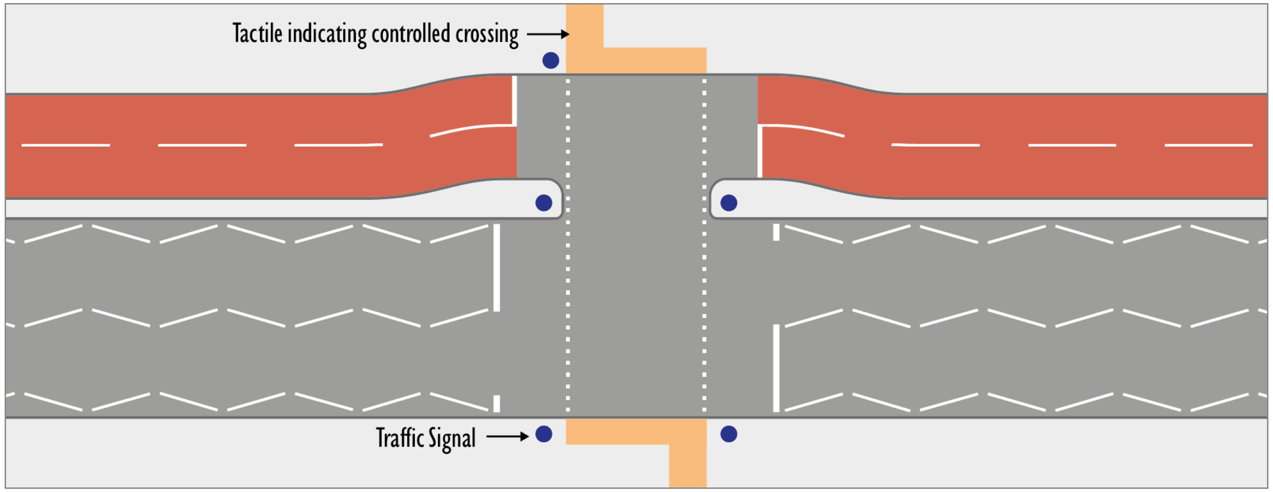


Figure 4.13: Signal-controlled pedestrian crossing of cycle route and road (Puffin)

4.7.1 Signal controlled crossings should not be provided where the 85th percentile speed of motor traffic is greater than 80 kph.

4.7.2 The minimum width (between the two rows of studs) for pedestrians should be 2.4 m, and may be wider determined by the pedestrian crossing demand.

4.7.3 Where a speed table is provided, the length (relative to the direction of motor trafffic) should be defined by the width of the crossing.

4.7.4 Signal timings to allow pedestrians to cross should be in accordance with ***Traffic Signs Manual Chapter 6***.

Signal timings to accommodate cycle users

The regularity and time given to each user at a signal-controlled crossing is dependent on flow balances and demand, and the length of the crossing. Often, green time is allocated by default to one route (motor traffic) with time given to other routes (pedestrian and cycle) by request only. To better align with the Sustainable Travel Hierarchy, it may be desirable in some locations for a higher proportion of green time to be given to the pedestrian and cycle routes by default.

Signal timings are required to consider cycle movements in two aspects:

- The green time given to cycle users crossing
- The intergreen time given to cycle users to clear the crossing after the green time expires.

Guidance for calculating signal timings for cycle users is provided in ***Traffic Signs Manual Chapter 6***. The minimum green time provided to cycle users is 7 seconds, but this may be increased to allow for higher proportions of cycle traffic. The use of on-crossing detection can also help by automatically extending crossing times when needed.

The design parameters for cycle users at traffic signals are shown in Table 4.4. These have been used to calculate the intergreen times in Table 4.5. Where the crossing has an uphill gradient of greater than 3% the parameters are adjusted to reflect slower cycle acceleration and speed on the crossing. At a crossing, the path difference represents the length of the crossing.

Parameter	Value	Notes
Acceleration	0.5 m/s^2	Less than 3% uphill gradient
	0.4 m/s^2	Equal to or more than 3% uphill gradient
Design Speed	20 kph	Less than 3% uphill gradient
	15 kph	Equal to or more than 3% uphill gradient

Table 4.4: Parameters to determine intergreen times for cycle users

Path Difference	Flat, Downhill or Uphill Gradient of less than 3%	Uphill Gradient of 3% or more
1 to 3 metres	5 seconds	5 seconds
4 metres	5 seconds	6 seconds
5 to 9 metres	6 seconds	6 seconds
10 to 14 metres	7 seconds	8 seconds
15 metres	8 seconds	8 seconds
16 to 18 metres	8 seconds	9 seconds
19 to 21 metres	9 seconds	10 seconds
22 to 23 metres	9 seconds	11 seconds
24 to 27 metres	10 seconds	11 seconds
28 to 33 metres	11 seconds	13 seconds
34 to 36 metres	12 seconds	14 seconds

Table 4.5: Intergreen timings to accommodate cycle users

Detectors on the approaches to signal-controlled crossings can enable the cycle green phase to be called in advance of a cycle user arriving at the shared use waiting area or stop line at junctions. Where a cycle track passes through a series of signal-controlled junctions, consideration can be given to coordinating the signals to provide a green wave for cycle users, based on the cycle user design speed.

4.7.5 The minimum green time for cycle users on a crossing should be 7 seconds, in accordance with ***Traffic Signs Manual Chapter 6***.

4.7.6 The intergreen time to allow cycle users to clear the crossing should be in accordance with the values provided in Table 4.5, where the path difference represents the length of the crossing.

Note The path differences identified can also be used in the design of signal-controlled junctions, see ***Traffic Signs Manual Chapter 6***.

4.7.7 Where a crossing is shared with pedestrians, the intergreen times may have to be extended to accommodate pedestrian crossing requirements.

Note A walking speed of 1.2 m/s is conventionally used to calculate timings for pedestrian crossings.

Note A lower walking speed of 1.0 m/s to suit slower moving pedestrians may be used, either on a site-by-site basis or as an area-wide policy.

Signal-controlled cycle crossings

Signal controlled crossings can be provided to enable cycle users to cross a road. In many cases pedestrian crossing facilities will also be incorporated.

Where cycle users and pedestrians both have to cross a road, the crossing may be arranged as follows:

- In a shared crossing, where the cycle users and pedestrians cross together (as in a Toucan arrangement)
- In separate facilities.

Separate facilities can provide a better level of service by reducing conflict between different users, but potentially require a larger area and greater crossing width.

Crossings are designed as a single stage without the need for users to wait on refuge islands. Push button or demand units have to be positioned where waiting pedestrians and cycle users can reach them easily, including by cycle users who are low to the ground (recumbent cycle users) or seated well back from the front wheel.

If a nearside signal aspect for pedestrians and cycle users is used, it should be positioned so that users look towards approaching traffic when looking at the signal. Nearside signal aspects at crossings can often be obscured by waiting pedestrians, and to address this (particularly at busy locations) a second, higher level signal on the near side may be provided.

Additional detectors may also be required on wider crossings to detect users on the crossing and hold road traffic at a red signal until they crossed.

Figure 4.14 illustrates an example Toucan crossing layout where a shared cycle track crosses a road and its associated parallel footways. A shared use waiting area is illustrated to enable cycle users and pedestrians to interact safely before crossing.

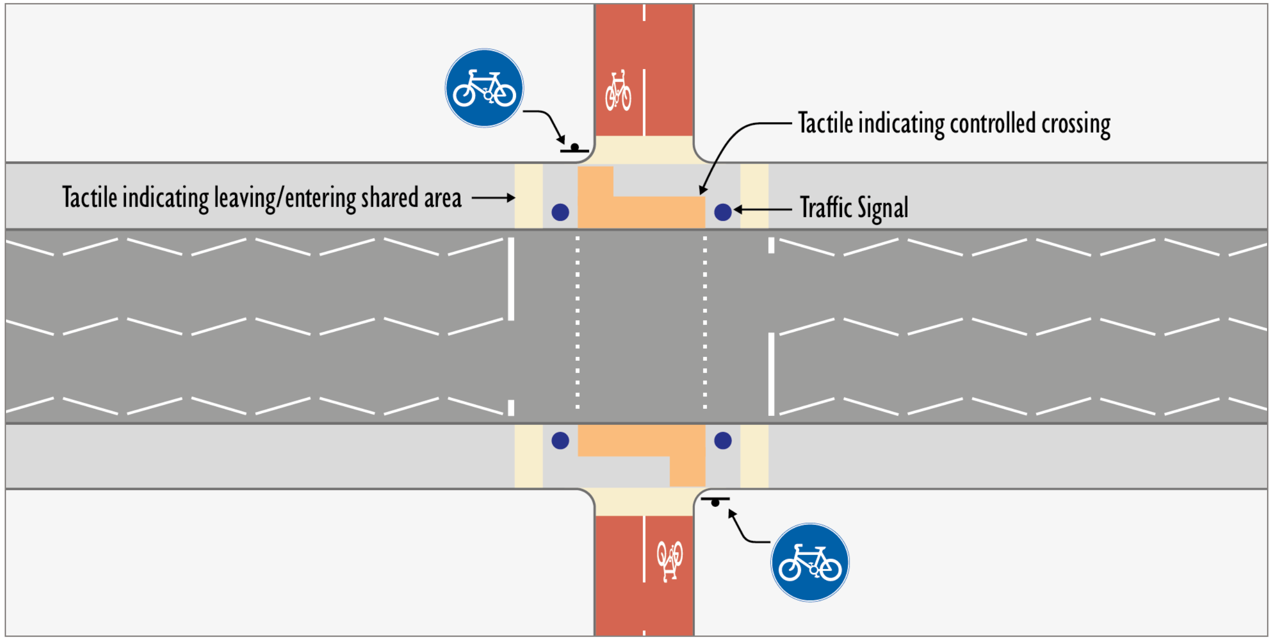


Figure 4.14: Signal-controlled cycle and pedestrian crossing (Toucan)

Figure 4.15 illustrates an example signal-controlled crossing where a cycle track crosses a road and its associated parallel footways, independent of a pedestrian crossing. The cycle track is extended through the footway to form a junction with the road. The cycle track stop line is located at the back of the footway to minimise conflict and enable pedestrians to cross the cycle track when the cycle signal is red.

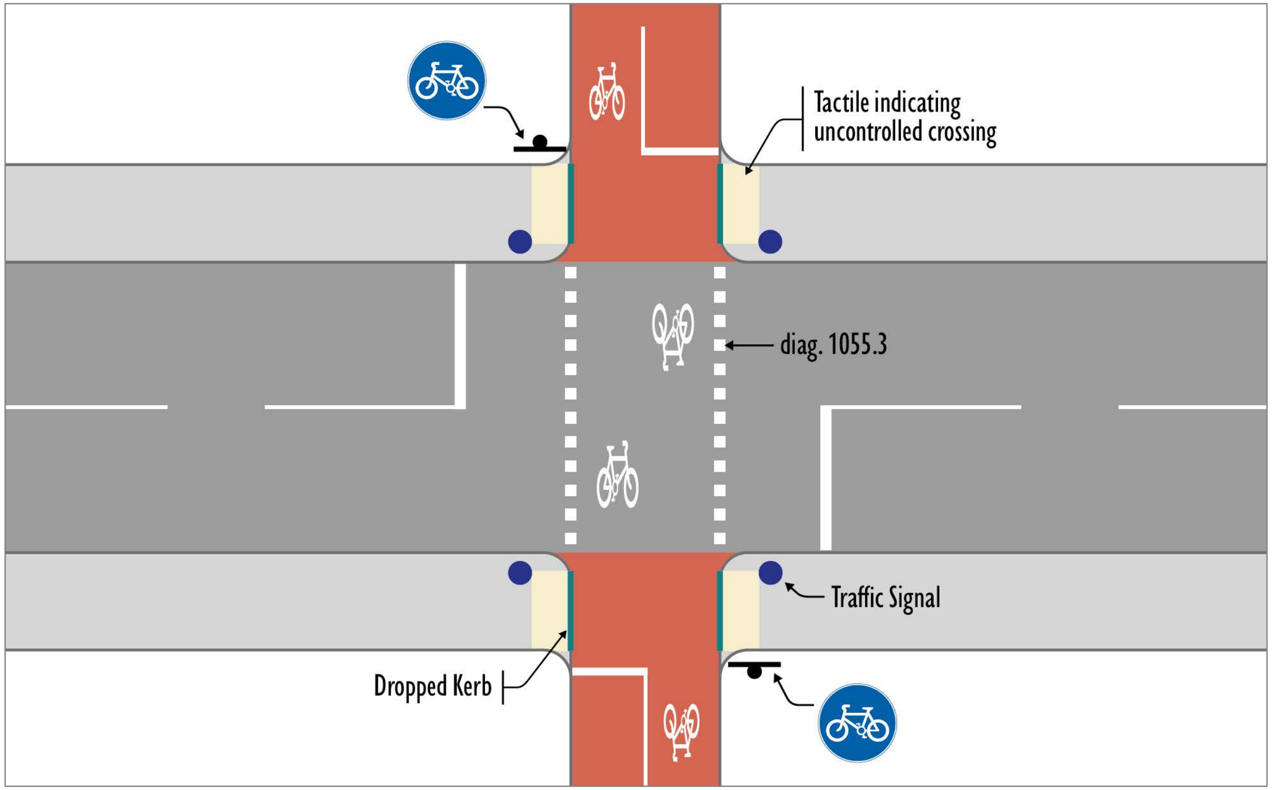


Figure 4.15: Signal-controlled cycle crossing

4.7.8 Signal controlled crossings should not be provided where the 85th percentile speed of motor traffic is greater than 80 kph.

4.7.9 Where cycle users and pedestrians cross together at a Toucan crossing, the minimum width of the crossing should be 4.0 m.

4.7.10 Where the cycle crossing does not accommodate pedestrians, the crossing should be at least the same width as the adjoining cycle facility and a minimum of 3.0 m for two-way and 1.5 m for one-way operation.

4.7.11 Where a separate pedestrian crossing is provided near a signal-controlled cycle crossing this should be in accordance with ***Traffic Signs Manual Chapter 6***.

4.8 Grade separated crossings

Grade separation can overcome potential interaction by separating routes completely, either by overbridges or underbridges.

By separating cycle users and pedestrians from motor traffic the risk of collisions can be avoided. It is also possible to reduce delay by eliminating waiting times, though increased journey distance to access the overbridge or underbridge may add to journey time.

Grade separated crossings tend to be more expensive and have a higher visual and environmental impact on the surrounding area due to the additional infrastructure and space requirements. They may not always be affordable or desirable, and are unlikely to be an appropriate or desirable solution in low speed, low volume 'street' environments. Each individual case has to be assessed on its own merits.

Grade separation is likely to be considered as the most suitable solution where:

- Collision risk and/or severance is considered high
- Motor traffic speeds are high (typically 85th percentile speeds in excess of 85 kph)
- Peak period cycle flows are high
- A crossing site assessment identifies that traffic conditions are not suitable for an at-grade crossing
- Existing infrastructure can be adapted to accommodate users
- Cycle desire lines can be accommodated
- The topography is suitable.

The decision whether to provide an overbridge across the road or an underbridge crossing beneath the road will be influenced largely by the topography and layout of the surrounding area. A direct route through the crossing is preferred to those that require substantial deviation from the desired line of travel.

The composition of users is also relevant in defining which grade separated facility is most suitable, due to the different needs of users. An underbridge can provide benefits to cycle users in terms of gaining and maintaining momentum through the structure, whereas this is not an advantage for pedestrians.

Other aspects which influence the choice of an overbridge or underbridge include:

- The height difference to be overcome for an underbridge is less than an overbridge because the clearance requirement for cycle users is less than for motor vehicles. This has the potential to result in lower and shorter approach gradients, subject to site topography and layout
- Cycle users and pedestrians are less open to the elements in an underbridge
- Underbridges tend to have a lesser visual impact, thereby preserving landscape, visual amenity and any architectural heritage benefits.

Underbridges can result in perceived (and potentially actual) personal security issues, due to the lack of visibility of the location and potential for anti-social behaviour. While this can be somewhat mitigated through appropriate design, this type of infrastructure can still deter a number of people from using the route, particularly at night. This will need to be considered at the options appraisal stage to support the Overseeing Organisation's Public Sector Equality Duty.

Ramps to access grade separated facilities

Access ramps on approach to both overbridges and underbridges have to be designed with emphasis on accessibility. ***Roads for All: Good Practice Guide for Roads*** provides requirements relating to accessibility, including advice on ramps, landings, tactile paving and handrail requirements.

Access ramps and stairways should be at least the same width as the overbridge or underbridge, and ramp gradients should comply with the guidance provided in Chapter 3. An access ramp should incorporate appropriate horizontal landings. Guidance on the total rise between landings is provided in ***Roads for All: Good Practice Guide for Roads***.

Wheeling ramps may be provided on stairways (on both sides), but cognisance must be taken of handrail requirements.

Straight ramps are generally preferable for cycle users. A helical ramp may be provided where suitable and should be of adequate width to allow two cycles to pass comfortably while turning.

Where steps are provided tactile paving should be included on the approach, to warn blind or partially sighted people. Guidance on tactile paving is contained in ***Guidance on the use of Tactile Paving Surfaces***.

Underbridges

Cycle users can be accommodated in new-build underbridges or existing pedestrian underbridges converted to include cycle users.

A significant aspect in the success of an underbridge facility is ensuring that it is safe, secure and attractive to users. It is essential to mitigate any concerns over personal safety. This can be achieved through:

- Optimising through-visibility and natural light
- Maximising headroom within the facility
- Minimising the perception of enclosed space
- Minimising the length of the underbridge.

Through-visibility is a function of width, height and tapering, and good lighting (including natural light). Natural light can be increased by angling wing walls to maximise penetration of daylight. Headroom requirements should be maintained throughout the full length of the structure and should not be compromised by access ramps running into the covered area.

Where the underbridge incorporates a separated pedestrian facility, the pedestrian facility headroom can be 100 mm less than the adjacent cycle track headroom, to allow for the provision of a kerb.

Whilst a rectangular cross-section is illustrated in Figure 4.16, circular or other shaped sections may be used where they circumscribe a rectangular section with the required dimensions.

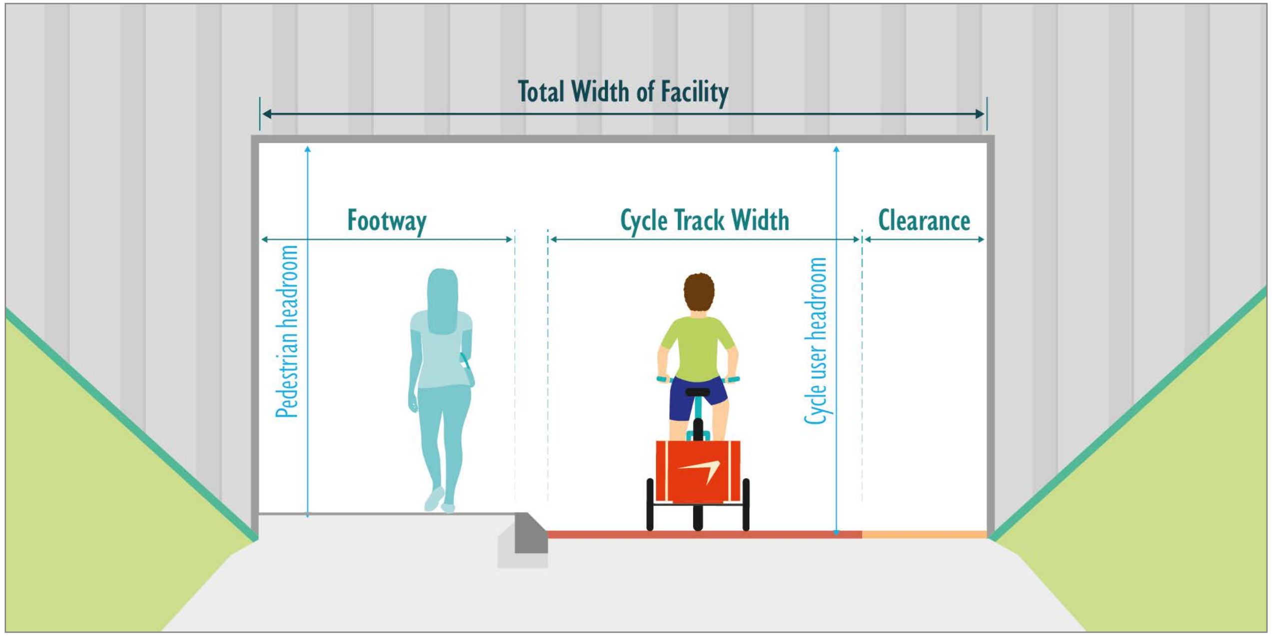


Figure 4.16: Underbridge dimensions

Underbridge facilities will typically accommodate both pedestrians and cycle users. It is preferable to separate these users within the space rather than providing a shared route. Kerb separation is preferred. For a shared route to be successful, the existing and predicted desire lines should be assessed for both pedestrians and cycle users.

Surface drainage needs to be appropriately considered, with adequate combinations of crossfall and longitudinal gradient provided to avoid ponding of surface water.

4.8.1 Stopping sight distance for the appropriate design speed should be provided through an underbridge (see Chapter 3).

4.8.2 The minimum cross sectional width and clearances for both shared use and separated cycle track facilities through a new underbridge should conform to the general width requirements for that type of cycle link, as outlined in Chapter 3.

4.8.3 Where an existing underbridge is converted to accommodate cycle users, the absolute minimum total width of the facility may be reduced to 3.0 m. This may be divided to provide absolute minimum cycle track and footway widths of 1.5 m each.

4.8.4 Headroom requirements for underbridges should be as defined in Table 4.6. Relaxations to absolute minimum values may only be applied where existing structures are converted for cycle facilities.

Facility	Underbridge length less than or equal to 23 m	Underbridge length more than 23 m
Cycle Track or Shared Facility – Desirable minimum headroom	2.4 m	2.7 m
Cycle Track or Shared Facility – Absolute minimum headroom	2.2 m	2.2 m
Separated Pedestrian Facility – Desirable minimum headroom	2.3 m	2.6 m
Separated Pedestrian Facility – Absolute minimum headroom	2.2 m	2.2 m

Table 4.6: Headroom requirements for underbridges

Overbridges

Cycle users can be accommodated on new-build overbridges or existing overbridges converted for, or developed to include, cycle users.

An overbridge is often regarded as a less desirable option than an underbridge, but may be more appropriate in some situations, including:

- Where the local topography is not appropriate to accommodate an underbridge
- Where an underbridge would result in significant environmental impact including visual impact
- Where an underbridge would require long diversions via ramps
- Where an existing overbridge provides an opportunity to provide a suitable cycle facility.

Overbridge facilities will typically accommodate both pedestrians and cycle users. It is preferable to separate these users within the space rather than providing a shared route. Any separation has to be compatible with that provided on the overbridge approaches. For a shared route to be successful, the existing and predicted desire lines should be assessed for both pedestrians and cycle users.

A proposal to convert an existing footbridge or road overbridge should be assessed on its own merits in consultation with all parties potentially affected. The layout and details of the existing overbridge and its current usage should be reviewed alongside the quality of other possible routes.

Parapet heights should be considered, and specific risk assessment is required where an existing parapet height of less than 1.4 m is proposed for use. Suitable mitigation measures where a parapet height of less than 1.4 m is proposed to be retained can include (but are not limited to):

- Separation of pedestrians and cycle users by means of a delineator strip
- Tonal contrast or surface texture with pedestrians placed next to the parapet
- An advisory line keeping cycle users away from the parapet
- Monitoring of use for a suitable period.

4.8.5 Stopping sight distance for the appropriate design speed should be provided across an overbridge (see Chapter 3).

4.8.6 The minimum cross sectional width and clearances for both shared use and separated cycle track facilities across an overbridge should conform to the general width requirements for that type of cycle link, as outlined in Chapter 3.

4.8.7 The minimum parapet height on new overbridges serving both cycle users and equestrians should be 1.8 m.

4.8.8 The minimum parapet height on new overbridges serving cycle users but not serving equestrians should be 1.5 m.

4.8.9 On existing overbridges a reduction in the parapet height to an absolute minimum of 1.2 m may be considered, but will require an additional 0.5 m to the clearance distance defined in Chapter 3.

Note: A risk assessment is required where an existing parapet height of less than 1.5 m is considered for use.

4.9 Lighting at crossings

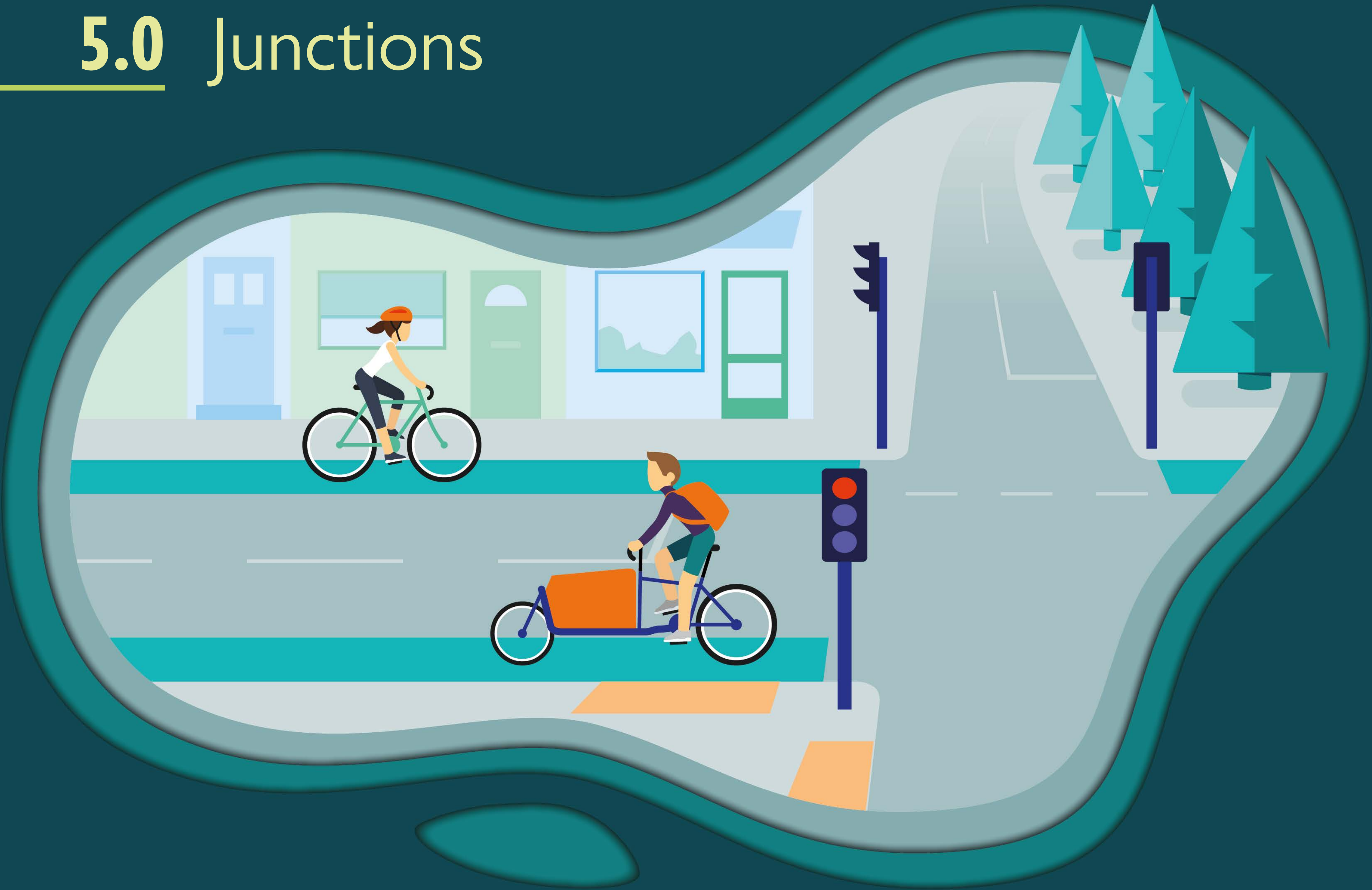
Crossings are often used during hours of darkness and it will be necessary to ensure that the crossing can be seen against the background of other lights and signs. Good road lighting will reduce most of the problems related to extraneous light sources, and an experienced lighting engineer should ensure that the level recommended in the appropriate guidance is used at all crossing sites.

If there is still doubt about the visibility of cycle users, then supplementary lighting can be provided to illuminate the crossing but should avoid glare to drivers which could hide or 'veil' cycle users, thus defeating the objective of its installation.

The cycle approach and waiting area (at least the area covered by the tactile paving surface) and the carriageway crossing area should be illuminated to a uniform level.

Guidance on the lighting of cycling infrastructure is provided in the ***Institution of Lighting Professionals, Professional Lighting Guide 23: Lighting for Cycling Infrastructure***.

5.0 Junctions



5.0 Junctions

Figure Numbers

5.1 Principles

Junctions on the road network are the locations where the greatest degree of interaction between cycle users, motor traffic and pedestrians is likely to occur. Therefore, determining the appropriate layout, and the correct method of managing the various interactions at a junction are fundamental to their success.

Junctions on the road network where cycle users and others are likely to meet include:

- Priority junctions
- Signal-controlled junctions
- Roundabouts (which can also incorporate signal-control).

The sections within this chapter are structured on this basis. The chapter provides guidance and defines requirements for full junction layouts, and measures which may be adopted within a junction layout to best facilitate cycle user and pedestrian movement.

Identifying the most appropriate location, form of junction and crossing types requires a careful assessment. Appropriate junction selection and design is based on a comprehensive understanding of the place and movement functions of the individual location, and considers the following:

- The relationship between the junction and the connecting cycle, pedestrian and public transport facilities, i.e. the surrounding network function
- Speed of motor traffic
- Traffic volume and turning movements (including cycle users and pedestrians)
- Desire lines, trip generators and attractors
- Injury accident record (at existing locations).

This information will allow the designer to fully consider the needs of all users. A full, on the ground, physical audit of the site is required to enable the designer to gain an appropriate understanding of the context and of existing facilities for cycle users and other users in the local area. Only then can the development of a final design be made using the appropriate design standards and guidance.

Additional guidance and standards relating to junction design can be found in relevant road authority guidance, including ***Designing Streets***, ***The National Roads Development Guide***, ***Roads for All: Good Practice Guide for Roads*** and the ***Design Manual for Roads and Bridges***.

Interactions

Within a single junction there may be numerous individual interactions between intersecting routes and different users. An effective junction layout will successfully manage the various interactions which arise within it. These could include interactions between:

- Cycle users and pedestrians
- Cycle users and other cycle users
- Cycle users and motor traffic.

To improve the understanding of the management of interactions within the broader context of a junction, several scenarios have been considered. Example layouts are provided that apply the good practice from the preceding chapters of the guidance.

Limited guidance on the likely use of traffic signs and road markings is provided on the associated figures and in the supporting text. In practice, suitable junction arrangements will often require bespoke arrangements to resolve the various interactions arising in the most appropriate way. Designers should refer to ***Traffic Signs Manual*** and ***TSRGD*** for guidance on traffic signs and road markings.

5.2 Priority junctions

Priority junctions occur where motor traffic is controlled by traffic signs and road markings only (without traffic signals). They operate on the simple basis of one route (the adjoining route) ceding priority to another (the through route). The adjoining route traffic only enters the through route where gaps in traffic allow this to happen. Priority junctions are typically arranged in a T-junction or crossroads layout and do not include roundabouts which represent a separate category of junction.

An important principle of a priority junction is that the through route is given the opportunity to flow freely through the location. This applies to all traffic on the through route, including cycle users. This is reflected in the example layouts presented in this section, which comprise:

- Continuous cycle track and footway at side road layouts
- Cycle track at side road layouts (bend-out layouts)
- Cycle lane over side road layouts.

Level of Service Indicators – Priority Junctions

In relation to Design Principle – Directness

●●● **High Level of Service:**
Motor traffic will need to give way to cycle users more often than cycle users will need to give way to motor traffic along a route

●● **Medium Level of Service:**
Cycle users will need to give way to motor traffic on a similar number of occasions as motor traffic will need to give way to cycle users along a route

● **Low Level of Service:**
Cycle users will need to give way to motor traffic more often than motor traffic will need to give way to cycle users along a route

Standalone signal-controlled cycle user and pedestrian crossing facilities should not be incorporated within road junctions which otherwise operate on a priority basis, unless located sufficiently far from the through route to avoid queuing back. Otherwise the whole junction should be signal-controlled.

Junction between cycle tracks

Where two cycle tracks meet at an uncontrolled junction, two potential layouts may be provided:

- One route is assigned priority over the other
- No formal priority is assigned.

Priority may be determined by factors such as cycle flow, layout, coherence and consistency, i.e. priority would favour the straighter route, and any interactions with pedestrians and other vehicles at the location.

Assigned priority is most likely to be required where:

- Cycle volumes are high and there is greatest potential for interaction
- Intervisibility between cycle links is limited
- There is a clear case for providing priority to one route over the other.

An example layout where cycle users give way to other cycle users is illustrated in Figure 5.1.

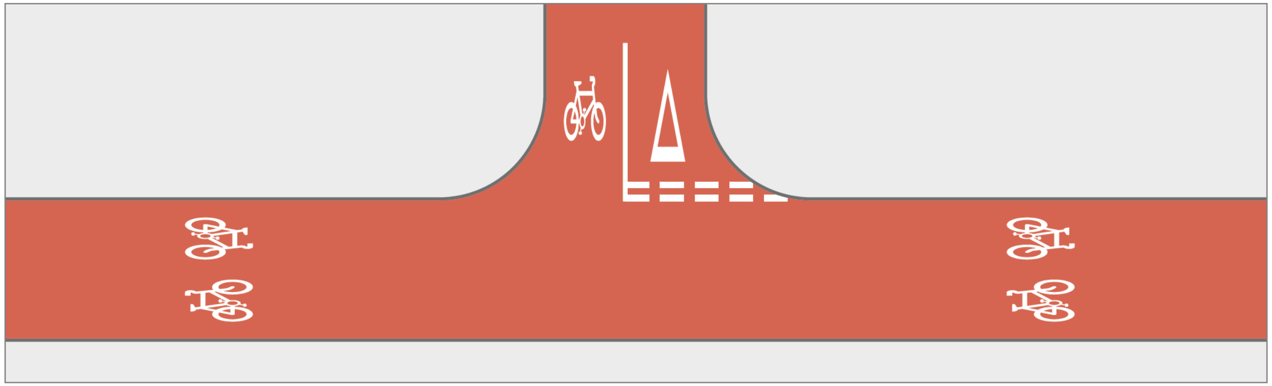


Figure 5.1: Junction between cycle tracks

5.2.1 Where priority is assigned, a visibility envelope should be provided in accordance with Chapter 4.

5.2.2 A minimum corner radius of 4.0 m should be provided.

5.2.3 Signs and markings to denote the need for users to give way should be in accordance with ***Traffic Signs Manual Chapter 3***.

Alternatively, the scenario being considered may lend itself to users being able to moderate their behaviour without the use of priority signage, road markings or infrastructure. Such situations are most likely to occur in low flow, often rural areas. This will require good intervisibility between facilities in advance of the junction, to ensure that users are aware of the situation and can identify and react to any potential conflicts as they approach.

Continuous cycle track and footway at side road layouts

Continuous cycle track and footway layouts across side roads provide a route for cycle users and pedestrians that conveys a strong visual indication of priority over approaching and turning motor traffic. These are likely to be suitable on side roads with low motor traffic volume and speed and where the main road speed is low, including where these conditions can be created, or in areas where those walking, wheeling and cycling outnumber motor traffic volumes.

Continuous cycle track and footway layouts are commonly and successfully used in several countries but are a relatively new concept in Scotland. Their increased introduction will improve the continuity of cycling infrastructure and enable best practice examples to be developed and monitored, ensuring the needs of all users are correctly supported. Recognising this, and in addition to the recommendations outlined in this document, designers are encouraged to use the Design Review process outlined in Chapter 2 and seek approval from the relevant Overseeing Organisation when developing continuous footway layouts.

The example layout presented in both Figures 5.2 and 5.3 incorporates:

- A main road with a parallel cycle track and adjacent footway
- A side road with adjacent footways.

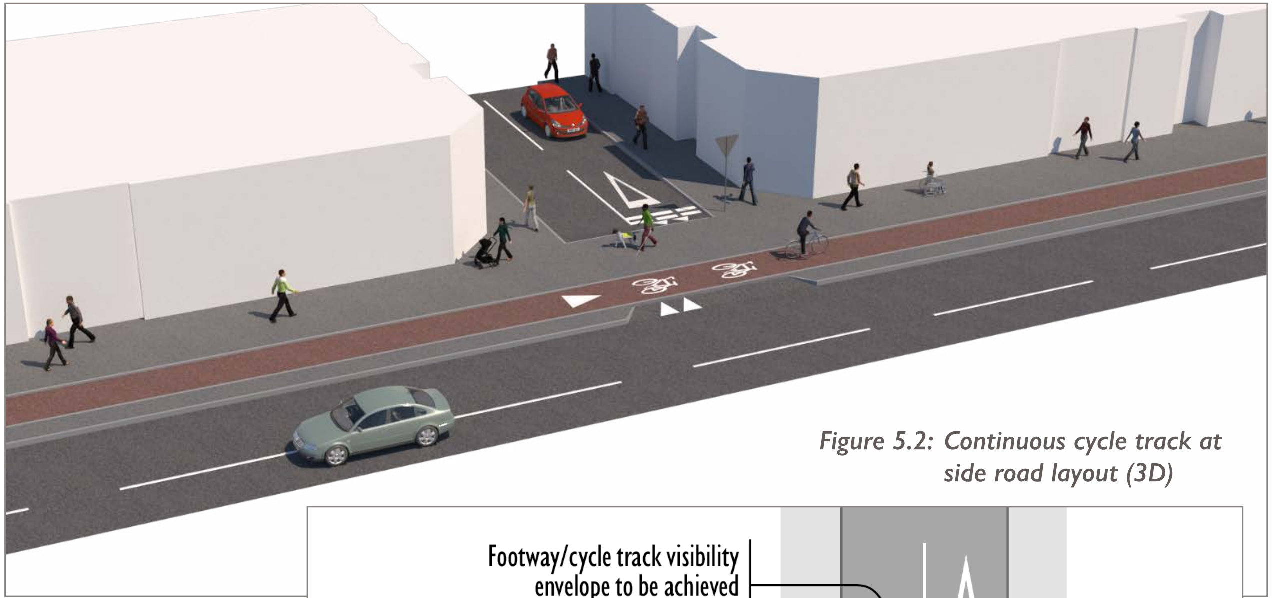


Figure 5.2: Continuous cycle track at side road layout (3D)

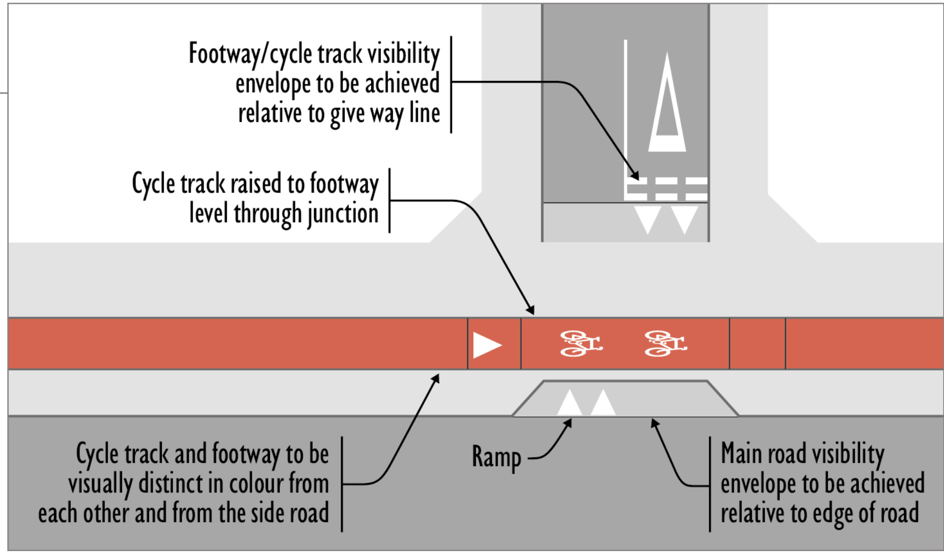


Figure 5.3: Continuous cycle track at side road layout

Junction operation

The example layout features a two-way side road where traffic on this adjoining route yields to cycle traffic on the cycle track and traffic on the main road. The give way markings are also offset to infer priority to pedestrians in combination with the visual continuity of the cycle track and footway. The visual continuity, ramp and the tight corner radii are intended to encourage lower speeds of approaching and turning motor traffic.

The number of interactions reduce where the side road is one-way, while also minimising the crossing length for pedestrians and cycle users, with one-way exiting traffic having the lowest potential for interaction.

This type of junction treatment will most likely be successful where drivers are familiar with the layout (such as a residential court development), and where total traffic flows on the side road are low. Based on research of cycle track crossings at minor roads and of driver behaviour at continuous footways, these layouts have been observed to operate well at up to 100 vehicles per peak hour on the side road. Motor traffic flows that exceed this threshold will likely mean that interactions with cycle users and pedestrians will be too high to safely provide cycle user and pedestrian priority. As set out in Chapter 2, the application of this junction treatment can form part of wider network measures that will reduce the prevalence of through-traffic, meaning that it can be considered where a reduction in side road traffic to this level is expected.

The provision of a continuous cycle track and footway layout at several side roads will significantly improve coherence and therefore the level of service offered to users. Familiarity of the arrangement by all road users will also make the case stronger for the consistent application of the arrangement.

Design features

Certain design features are required to ensure that drivers are aware of entering a space where they give way to pedestrians and cycle users. It is essential that drivers turning into the side road have enough clear visibility of the cycle track and footway to allow enough time to react and wait before commencing their turn. Roadside parking and loading can restrict this inter-visibility and should be carefully considered.

To be most effective, the cycle track and footway material on approach to the junction should be maintained across the side road and should visually contrast with the nearby carriageway. The layout will then provide the continuous appearance required to help convey to drivers that they are crossing a facility where they do not have priority.

Designers should consider the need for tactile or other information to convey a warning to blind or partially sighted pedestrians that, in the absence of an upstand, they are entering a space also used by motor vehicles. This should be managed through early engagement with relevant interested parties and is an important step towards meeting the Overseeing Organisation's Public Sector Equality Duty. Alongside this, thought should be given to the intended visual message of continuity of the pedestrian and cycle facilities, indicating priority over approaching and turning motor traffic.

Visibility of the main road from behind the give-way line will often be inadequate to allow a driver to exit the side road in a single manoeuvre. Drivers may be required to check each individual facility as they approach, therefore encouraging slow speeds as vehicles cross the footway and the cycle track. This may necessitate vehicles giving way to road traffic from the road edge and temporarily obstructing the cycle track and footway.

On very low-trafficked two-way side roads, e.g. a residential court development, the width of the side road may be narrowed in advance of the junction to allow only one vehicle to pass. This can reduce approach speed and minimise the opportunity for obstructive parking or loading.

The layout presented in Figure 5.4 provides a degree of storage for motor traffic entering and exiting the main road carriageway and the opportunity to incorporate additional give-way markings at the edge of the main road. This reduces the potential for vehicles waiting to enter the main road to block the cycle track.

The layout requires additional space and can only be considered where an acceptable footway width is maintained. This arrangement will be less desirable for pedestrians in most cases as it may require the local narrowing of the existing footway and deviation from the pedestrian desire line.

The storage space should be limited to ensure that vehicles still undertake their turning manoeuvre at a slow speed when they encounter the cycle track. It is also imperative that visibility and awareness of the cycle track from the main road prior to turning is maintained. Where greater storage length is deemed necessary other layouts should be considered (see 'Priority cycle track at side road layouts').

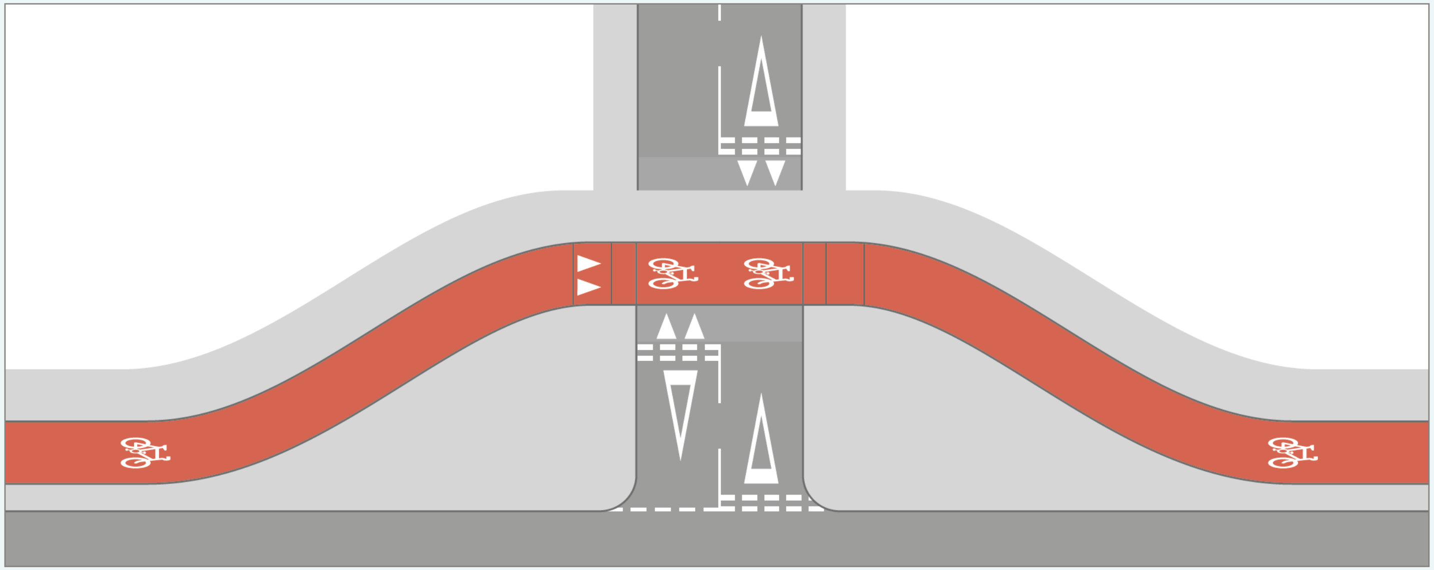


Figure 5.4: Continuous cycle track at side road layout (with offset)

5.2.4 The continuous cycle track at side road layout should only be used in locations where the main road and side road have a speed limit of 30 mph or less.

5.2.5 Adequate visibility of the cycle track and footway from the side road should be provided relative to the give-way marking using the appropriate set-back (X-distance – see Chapter 4).

Note: In retrofit situations adjacent to visibility constraints, designers are encouraged to refer to the Design Review process outlined in Chapter 2 to consider whether a continuous cycle track and footway layout could operate acceptably with lower visibility.

5.2.6 Adequate visibility of the main road from the side road should be provided relative to the edge of the main road using the appropriate set-back (X-distance – see Chapter 4).

5.2.7 The maximum width of a one-way side road at the junction should be 3.0 m, maintained for a minimum length of 5.0 m beyond the back of the footway.

5.2.8 The maximum width of a two-way side road at the junction should be 6.0 m, maintained for a minimum length of 5.0 m beyond the back of the footway.

5.2.9 If the approaching cycle track is not at the same level as the footway, it should be raised to footway level in advance of the side road building line (or other edge of footway demarcation) with a maximum longitudinal gradient of 1:20 relative to the footway.

5.2.10 The visually distinctive colour and/or surface of the cycle track and footway, distinct from each other and from the adjacent roads, should be maintained for a minimum of 10 m on each approach to the side road.

5.2.11 No kerbing should be provided across (perpendicular to) the continuous cycle track or footway.

5.2.12 Ramps for motor traffic to cross the cycle track should be a minimum of 1:10 and a maximum of 1:6 (most effective).

5.2.13 No kerbed radius should be provided.

5.2.14 Where storage space is provided between the main road and the cycle facility, this should be limited to a maximum of 5.0 m, but should avoid excessive detours for cycle users and pedestrians.

Construction considerations for continuous cycle tracks and footways

Where asphalt for the cycle track is used, reference should be made to Chapter 3 for guidance on materials.

Block paving can offer a reasonable surface for cycle users, although it will require greater effort to cycle on than an asphalt surface. However, the availability of different coloured blocks can help delineate the cycle track from the carriageway and footway. Cobbles and setts are uncomfortable for cycle users and pedestrians and are generally a road surface material, although in heritage areas these could be sliced or planed to create a smoother surface for pedestrians.

Paving flags for cycle users are less suitable due to lower skid resistance and the potential for rocking and cracking, although they are likely to form the surface of many adjacent footways. Therefore, paving flags can offer a useful solution to provide the visual contrast between a footway and the carriageway and cycle track. This provides a continuous surface for pedestrians through the junction that avoids a clear footway/carriageway edge.

It is also recognised that ramps are susceptible to compaction. Therefore, ramps may be constructed of setts or asphalt especially when the junction is anticipated to be used by a relatively significant proportion of large vehicles. The ramp should, where possible, employ either identical materials to the footway or materials of a similar tone to help ensure visual continuity.

In all circumstances, the base of the continuous cycle track and footway should be designed to reflect anticipated loadings, traffic volumes and ground conditions. Smaller paving units, potentially reinforced, with a rigid sub-base are recommended for the footway.

Priority cycle track at side road layouts

This scenario, sometimes referred to as a 'bend-out' crossing, is also used at priority road junctions to maintain a reasonably direct route for cycle users, but where a continuous cycle track and footway at side road layout is not suitable due to traffic volumes and/or speeds.

The layout has some similarities to the continuous cycle track at side road layout but requires the cycle facility, and any associated pedestrian facility, to be diverted further from the road junction and is therefore less direct and potentially less desirable. This allows the pedestrian and cycle crossing of the side road to be offset from the road junction enabling a vehicle to stop if users are crossing. It also means that any vehicles waiting to enter the main road will not obstruct the cycle user and pedestrian route.

An important consideration is the separation between the road junction and the crossing location. A greater distance provides more storage space and may be necessary where large vehicles or greater traffic volumes are expected. However, this diverts cycle users and pedestrians further and requires more space, which is often not available in urban environments.

The example layout presented in Figure 5.5 incorporates:

- A main road with a parallel cycle track and adjacent footway
- A side road with adjacent footways.

As the crossing point is offset from the junction, a range of options, including a controlled Parallel crossing and a signal-controlled crossing, can be considered. Where a standalone Parallel crossing is used, there must be enough space to accommodate the minimum requirements for zig-zag markings, as outlined in ***Traffic Signs Manual Chapter 6***. Where a standalone signal-controlled crossing is used, the crossing should either be located sufficiently far from the through route that vehicles do not queue back into the main carriageway, or the whole junction should be signal-controlled, as also defined in ***Traffic Signs Manual Chapter 6***.

Figure 5.5 illustrates a controlled Parallel crossing of the side road that would benefit both pedestrians and cycle users.

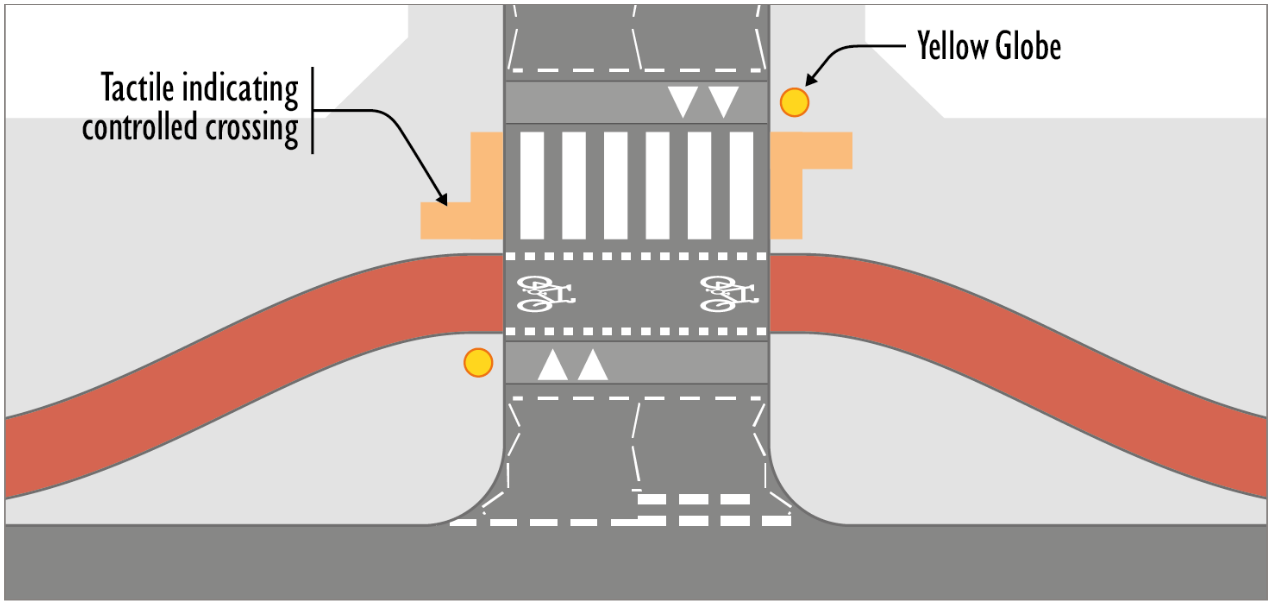


Figure 5.5: Priority at side road bend-out layout (Parallel crossing)

5.2.15	Priority cycle track at side road layouts should only be considered where main road and side road traffic speeds are 40 mph or less, and should not incorporate a Parallel crossing at locations where the 85th percentile speed of motor traffic is greater than 35 mph (56 kph), in accordance with ***Traffic Signs Manual***.
5.2.16	The minimum length between the road junction and the crossing location should be 5.0 m but should avoid excessive detours for cycle users and pedestrians.
5.2.17	The horizontal alignment of the cycle track should meet the requirements of Chapter 3.
5.2.18	The horizontal alignment of the cycle track may be reduced to provide an absolute minimum horizontal radius of 4.0 m on the immediate approach to the crossing, which may discourage high cycle user speeds.
5.2.19	The cycle track through the crossing may be highlighted by providing a contrasting colour treatment.

Cycle track and footway give way at side road layout

This scenario is also used at priority road junctions to maintain a reasonably direct route for cycle users, but where a continuous cycle track and footway or priority at side road layouts are not feasible due to traffic speeds exceeding 40 mph.

This layout is less direct for cycle users and pedestrians who will have to give way and will therefore be less desirable. However, it offers a degree of protection from turning traffic.

As with priority at side road layouts, an important consideration is the offset between the road junction and the crossing location. Where cycle users and pedestrians need to give way, the offset should be far enough to allow users to determine when motor traffic is about to turn into the junction.

The example layout presented in Figure 5.6 incorporates:

- A main road with a parallel cycle track and adjacent footway
- A side road with adjacent footways.

In terms of cycle user interaction, the side road represents the through route (with priority) and the cycle track (and the adjacent footway) represents the adjoining route. The main road does not interact with the cycle route.

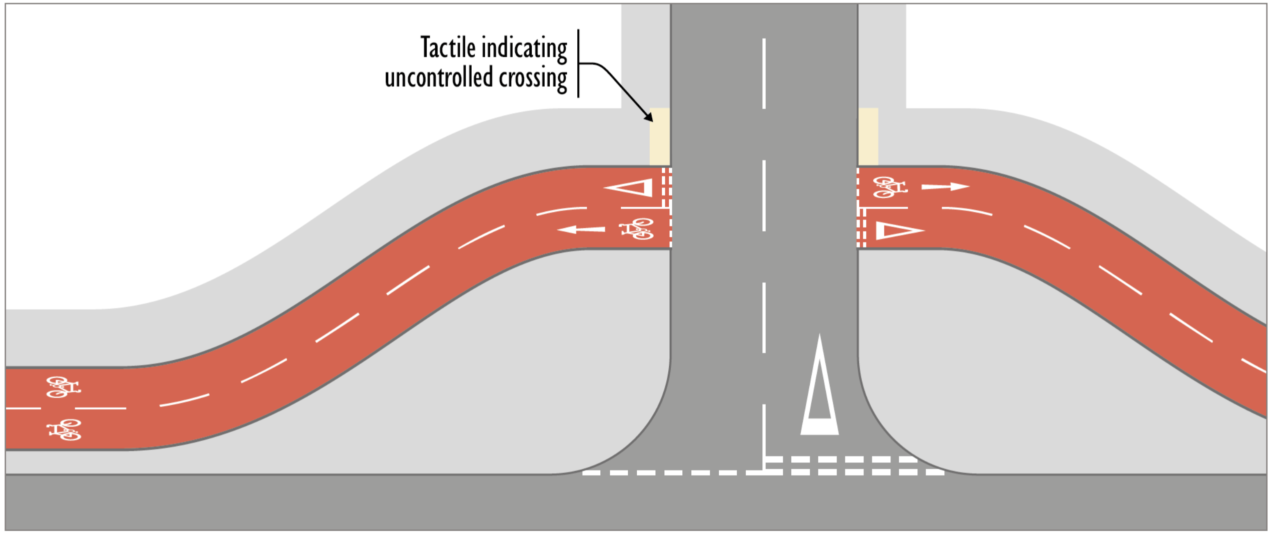


Figure 5.6: Give way to side road bend-out layout

Figure 5.6 illustrates an uncontrolled cycle/pedestrian crossing of the side road. Further advice on details at crossings, including visibility and infrastructure requirements, is included in Chapter 4.

5.2.20 The desirable minimum length between the road junction and the crossing location should be 10.0 m. Excessive detours for cycle users and pedestrians should be avoided.

5.2.21 The desirable minimum length between the road junction and the crossing location at minor private accesses should be 5.0 m.

5.2.22 The horizontal alignment of the cycle track should meet the requirements of Chapter 3.

5.2.23 The horizontal alignment of the cycle track may be reduced to provide an absolute minimum horizontal radius of 4.0 m on the immediate approach to the crossing, and may discourage high cycle user speeds.

Cycle lane over side road layout

If the approaching cycle facility is a protected cycle track and an alternative layout cannot be provided, e.g. a continuous cycle track layout, it will be necessary to transition to a cycle lane as the route passes through the junction. This will enable main road vehicles to turn. The example layout presented in Figure 5.7 illustrates:

- A main road with a parallel cycle track and adjacent footway
- A side road with adjacent footways.

In terms of cycle user interaction, the cycle lane across the junction and the adjacent road represent the through route (with priority) and the side road represents the adjoining route.

Interaction between the cycle lane and traffic turning across it from the main road is controlled by drivers' awareness of the rules of the Highway Code and the road markings of the cycle lane. As such, there is potential for cycle user priority to be undermined if the cycle lane and its users are not fully visible to turning vehicles.

Where this layout is provided it is important that the vehicle emerging from the adjoining route has adequate visibility of the through route (both the cycle track and the road) from behind the give way marking. This ensures that the emerging vehicle is not required to stop again within the cycle lane. It is also essential that motor traffic turning into the side road has clear visibility of the cycle lane and the approaching cycle track.

For the layout to operate safely and effectively for cycle users it requires low vehicle turning speeds. This can be achieved by minimising corner radii, which will also maintain pedestrian desire lines and minimise pedestrian crossing distances. Motor vehicle speeds can be reduced further by incorporating a ramp or raised table for pedestrians. Entry and exit tapers for turning vehicles should not be used as these can encourage higher speeds.

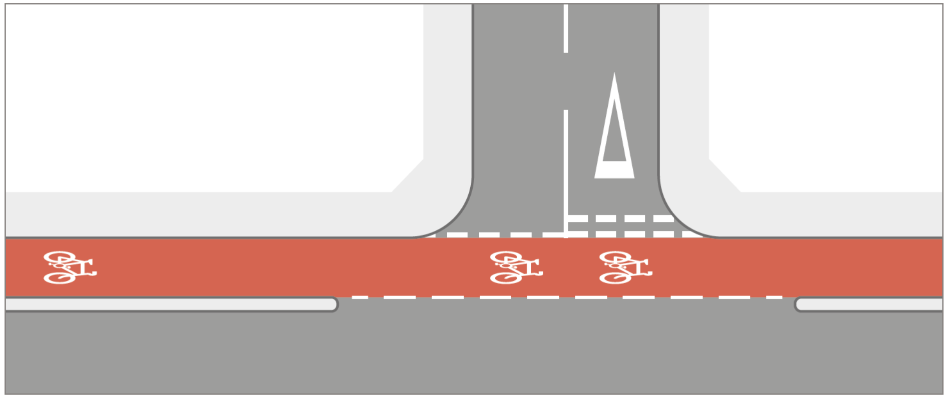


Figure 5.7: Cycle lane over side road layout

5.2.24	This layout should only be used in locations where the main road speed limits do not exceed 30 mph.
5.2.25	Adequate visibility of both the cycle facility and the main road from the side road should be provided relative to the give-way line, using the appropriate set-back (X-distance – see Chapter 4). The vehicle emerging from the side road should not be required to stop within the cycle lane.
5.2.26	Junction corner radii should be limited to a maximum radius of 6.0 m to limit vehicle turning speeds. As advised in Designing Streets, large vehicles may need to use the full carriageway width to turn.
5.2.27	Any physical protection of the cycle track on the approach to the priority junction should be terminated a maximum of 5.0 m from the commencement of the side road corner radius.
5.2.28	Cycle lane provision should be continued through the junction using a longitudinal road marking to ***TSRGD Diagram 1004*** (for the continuation of an advisory cycle lane) or ***TSRGD Diagram 1010*** (for a cycle lane through a junction, which is more prominent where a cycle track transitions to a cycle lane through the junction).
5.2.29	The cycle lane should be coloured across the junction.
5.2.30	Cycle lanes over the side road should be at least as wide as the connecting cycle track or cycle lane.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5.3 Signal-controlled junctions

Traffic signals can be used at junctions to control the flow of traffic between interacting routes and provide safe crossing locations for pedestrians and cycle users. They operate by separating movements in time, so that each movement can make safe and efficient use of the space available.

The aim is to reduce the risk of collision between different movements, whilst maximising capacity and reducing delay for all users. Several factors can influence how this is achieved, including the available space, the different movements and traffic volumes to be accommodated, and the control strategy for the sequencing of traffic signal phases.

This section presents examples of full junction layouts incorporating cycle facilities. It also identifies treatments which can be incorporated within junctions to enable safe cycle movement. Guidance is provided on the allocation of space and management of signal timings to support cycle user movements. Layouts presented comprise:

- Protected signal-controlled junction layouts
- Two-stage right-turn layout
- Hold the left turn layout
- Cycle bypass layout
- Cycle gate layout
- Advanced stop lines (ASL) layout.

While the layouts provided apply the good practice presented in earlier chapters, suitable junction arrangements will often require more bespoke arrangements to resolve the various interactions in the most appropriate way, and to consider the competing demands.

The guidance provided for these example layouts is based on improving the attractiveness of cycle facilities at junctions for all users, particularly less experienced users. Where guidance is likely to provide benefit to experienced cycle users only, this is highlighted.

Additional facilities for cycle users at signal-controlled junctions can be particularly valuable to less experienced users. An example is a balancing aid at traffic signals, to be used by cycle users who require a physical prompt/ assistance when pushing off from a stationary position at a red light.

Refer to the ***Traffic Signs Manual Chapter 6*** for the calculation of traffic signal timings for cycle users.

Level of Service Indicators – Signal-controlled Junctions

In relation to Design Principle – Directness

●●● High Level of Service:
The overall delay for cycle users at the junction is less than the overall delay for motor traffic

●● Medium Level of Service:
The overall delay for cycle users at the junction is equal to the overall delay for motor traffic

● Low Level of Service:
The overall delay for cycle users at the junction is greater than the overall delay for motor traffic

In relation to Design Principle – Safety

●●● High Level of Service:
Cycle users are separated from conflicting motor traffic in both time and space when moving through the junction

●● Medium Level of Service:
Cycle users are provided with separate time to move through junction from conflicting motor traffic, but may share the same space

● Low Level of Service:
Cycle users share the same space as motor traffic and move through the junction at the same time

Protected signal-controlled junction layouts

Protected signal-controlled junction layouts provide separate space, in an orbital cycle track, and time for cycle users, allowing them to proceed safely at a separate time to motor traffic and to maintain a reasonably direct route.

These layouts offer the best combination of safety and directness for inexperienced cycle users to negotiate a signal-controlled junction and should be considered as the preferred signal-controlled layouts where the space is available to accommodate them.

Protected signal-controlled junctions are a relatively new concept for road and street networks in Scotland. Where they are proposed, designers are encouraged to use the Design Review process outlined in Chapter 2 and seek approval from the relevant Overseeing Organisation.

A protected signal-controlled junction layout enables cycle track users to make all desired movements around the junction separate to motor traffic. Also, subject to signal staging and timing, right turns may be achievable in a single movement and with little delay. To encourage use by cycle users, it is beneficial to minimise the additional distance required to negotiate the junction and timings can be managed to ensure predominant cycle movements are not disadvantaged relative to general traffic, especially during peak periods. Any significant delay or detour could encourage cycle users to use the road to travel through the junction, thus diminishing the value of the protected facilities.

The layouts provided illustrate two variations on the protected signal-controlled junction:

- Full signal control – Figures 5.8 to 5.10
- Zebra crossings of the cycle track – Figures 5.11 to 5.14.

These example layouts provide guidance for 4-arm junctions with cycle tracks on all arms. The principles of the guidance can equally be applied to 3-arm junctions or to situations where cycle tracks are only present on some of the approach arms.

In all scenarios presented, the cycle track crossing of the road is separated from the pedestrian crossing of the road, and all cycle and motor traffic movements are signal-controlled. It is important that a consistent approach is applied across all arms of the junction to ensure familiarity and understanding by all users.

The key design principles are:

- Pedestrian crossings of the cycle track and road carriageway should be on clear desire lines and should be as consistent as possible to ensure familiarity by all users
- The layout should avoid cycle track users stopping any more than is necessary to manage the interaction with motor traffic
- Visibility at interaction points should meet the necessary requirements
- Space should be taken from the road carriageway rather than from the pedestrian footway.

5.3.1 Dimension R(a) (Figure 5.8, Figure 5.10 and Figure 5.11) should be designed to facilitate all expected left-turning vehicle movements, but should be a maximum of 6.0 m to limit vehicle turning speeds.

5.3.2 Dimension R(b) and R(c) (Figure 5.8, Figure 5.10 and Figure 5.11) should be a minimum of 4.0 m.

5.3.3 Cycle crossings of the road carriageway and pedestrian crossings of the cycle track/road carriageway should occur at the same level.

5.3.4 If the approaching cycle track is not at the same level as the carriageway, it should be lowered to carriageway level in advance of the stop line with a maximum longitudinal gradient of 1:20.

5.3.5 The cycle track through the junction may be highlighted by providing a contrasting colour treatment.

5.3.6 SLOW markings on the cycle track to ***TSRGD Diagram 1058.1*** may be used to warn cycle users they are approaching the junction.

Protected junctions – full signal-controlled layouts

Full signal-controlled layouts require pedestrians to cross the road and the associated cycle track in a single movement. Therefore, crossing timings are to be set to enable crossing of the full width of both facilities.

The advantages of full signal-controlled layouts include:

- Less space is required than for layouts with a zebra crossing of the cycle track
- Pedestrians have more controlled priority (and potentially greater perception of safety) over the cycle track than for layouts with a zebra crossing of the cycle track. This may be desirable where cycle volumes are high and pedestrian crossing opportunities would otherwise be limited.

The disadvantages of full signal-controlled layouts include:

- A longer signal-controlled pedestrian crossing is required, therefore increasing the time required for the pedestrian crossing phase and contributing to overall delay at the junction.

Figures 5.8 and 5.9 illustrate an example layout of a protected signal-controlled junction with full signal control. This layout has no internal cycle stop lines, requiring separate cycle user and pedestrian stages in the signal cycle.

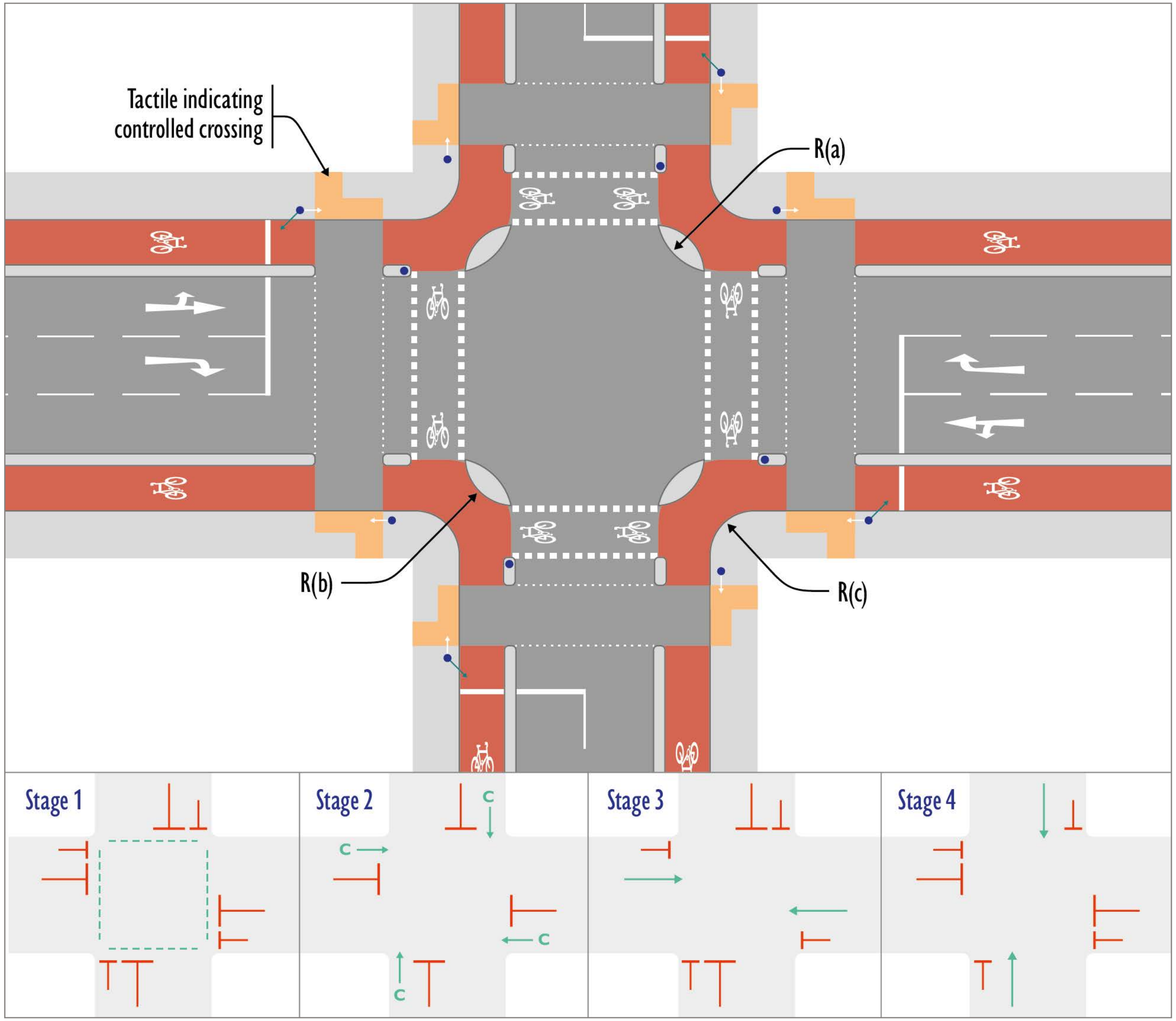

Figure 5.8: Protected signal-controlled junction layout (no internal stop lines) and typical staging arrangements

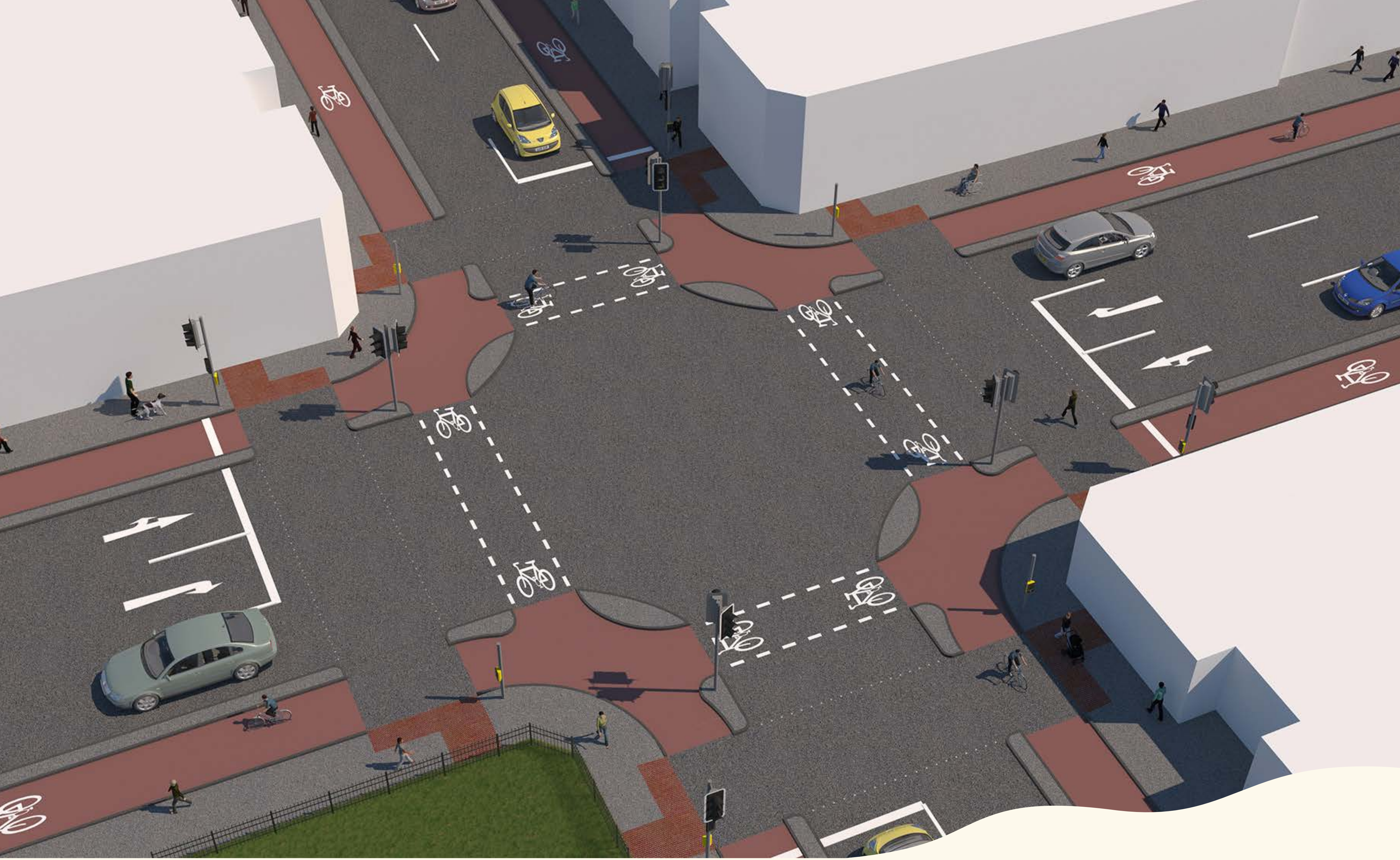

Figure 5.9: Protected signal-controlled junction layout (no internal stop lines) (3D)

Where more space is available, internal stop lines can be incorporated which potentially offer cycle users more green time within the signal cycle by allowing left-turning cycle users to proceed when pedestrians are held.

This is particularly beneficial for left-turning cycle users who will be able to proceed without any delay during most stages of the signal cycle. However, to ensure that cycle users recognise the additional stop lines and traffic signals that are introduced within the junction, additional space is required to provide a greater distance and deflection between the cycle stop lines. More delay may be introduced for some cycle users, who may have to stop and regain momentum at more than one signal stop line. Careful consideration is needed on the level of delay this introduces and the possibility of non-compliance by cycle users, especially those who are only intending to turn left across the pedestrian crossing. Changes in surface material to emphasise this change can be considered. This layout is illustrated in Figure 5.10.

It is important for designers to consider the space available for cycle users to wait in this arrangement. If insufficient space is made available for the expected number of cycle users, they will potentially block back across the pedestrian crossing area.

Care is also needed to ensure that the additional infrastructure can be designed to be sympathetic to the overall place context of the area.

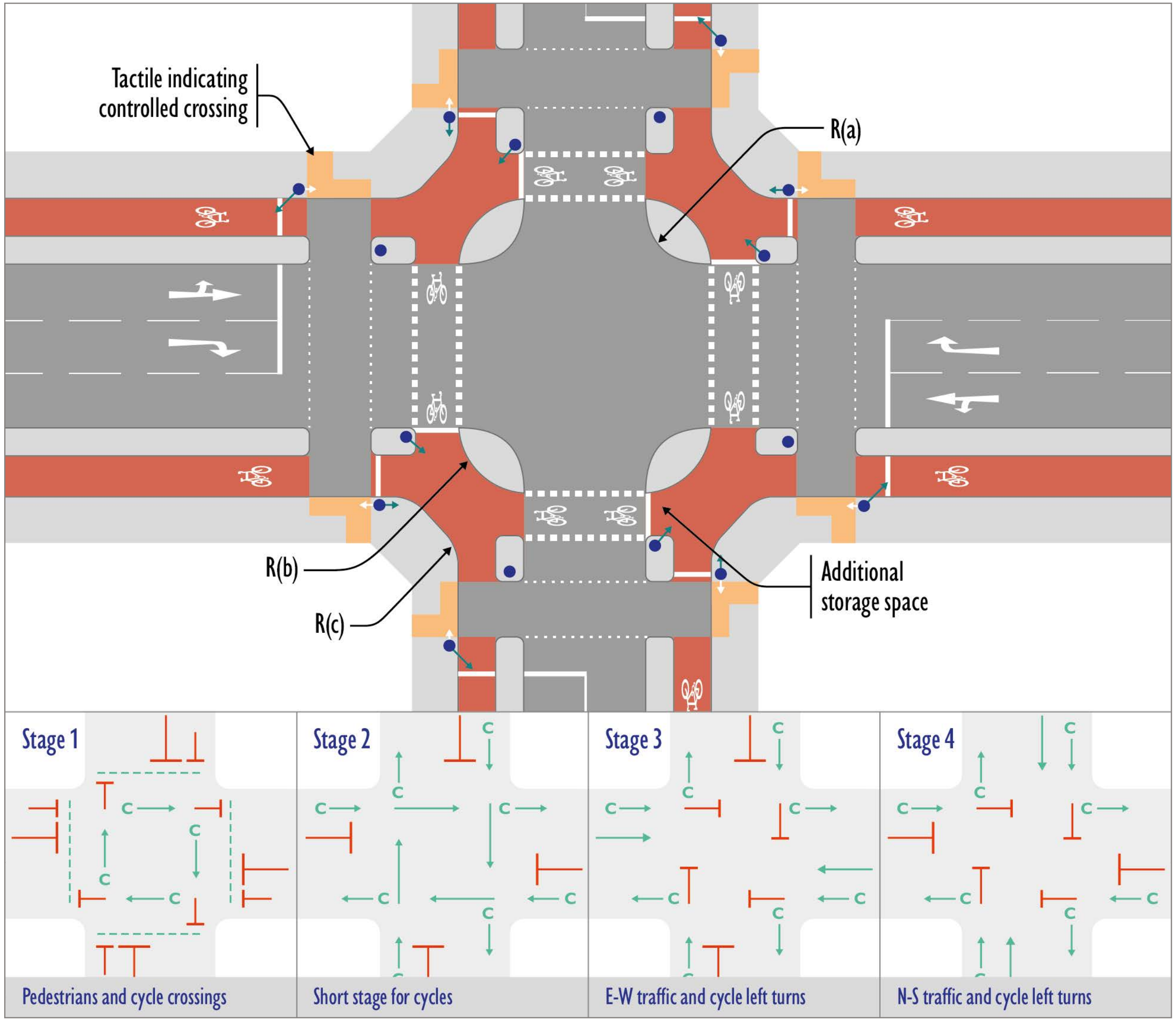

Figure 5.10: Protected signal-controlled junction layout (including internal stop lines) and typical staging arrangements

Protected junctions with Zebra crossings of the cycle track

Protected junctions with a Zebra crossing of the cycle track offer less delay and more convenience to cycle users but require more space to accommodate the layout. The pedestrian crossing of the cycle track is not signal-controlled and is enabled by a Zebra crossing. The pedestrian crossing of the road is signal-controlled. Therefore, the pedestrian crosses the cycle track and the road in separate stages and requires a landing area between the cycle track and the road. This maintains the concept of providing safer junction layouts for cycle users while also allowing signal-controlled pedestrian and cycle user phases to run simultaneously across the road in a single signal-controlled stage.

It is important that pedestrian crossings of the cycle track are located on the pedestrian desire line. In most cases the crossing of the cycle track should be in line with the pedestrian crossing of the road carriageway, though it may be offset if there is a need for pedestrians to access other facilities on the separation island, such as a bus stop.

The advantages of layouts with Zebra crossings of the cycle track include:

- Cycle users can filter left onto and off the orbital route without signal control
- Cycle users can proceed without stopping where there are no pedestrians waiting to cross
- Signal-controlled pedestrian crossings of the road will be shorter than a full signal-controlled layout, introducing less overall delay to the junction.

The disadvantages of layouts with Zebra crossings of the cycle track include:

- More space is required than for fully signal-controlled layouts, to accommodate the pedestrian landing area. Build-outs can provide an opportunity to create the required separation
- Blind and partially sighted users may be less comfortable with this layout and feel more isolated on the pedestrian landing area. It is therefore critical to provide clear information (through road markings, correctly positioned poles and tactile paving) and enough space for all users to make the layouts comfortable. It is also vital to provide consistency in how these crossings are applied within each junction and on closely spaced junctions on a route to ensure familiarity by all users
- Visibility requirements of the cycle track at crossing points is greater than for signal-controlled crossings (refer to Chapter 4).

Figures 5.11 and 5.12 illustrate an example layout of this type of protected junction with Zebra crossings of the cycle track.

5.3.7 The width of the pedestrian landing area, between the crossing of the cycle track and the signal-controlled crossing of the road, should be a minimum of 2.7 m between kerbs to allow for tactile paving at each crossing point and a space between these.

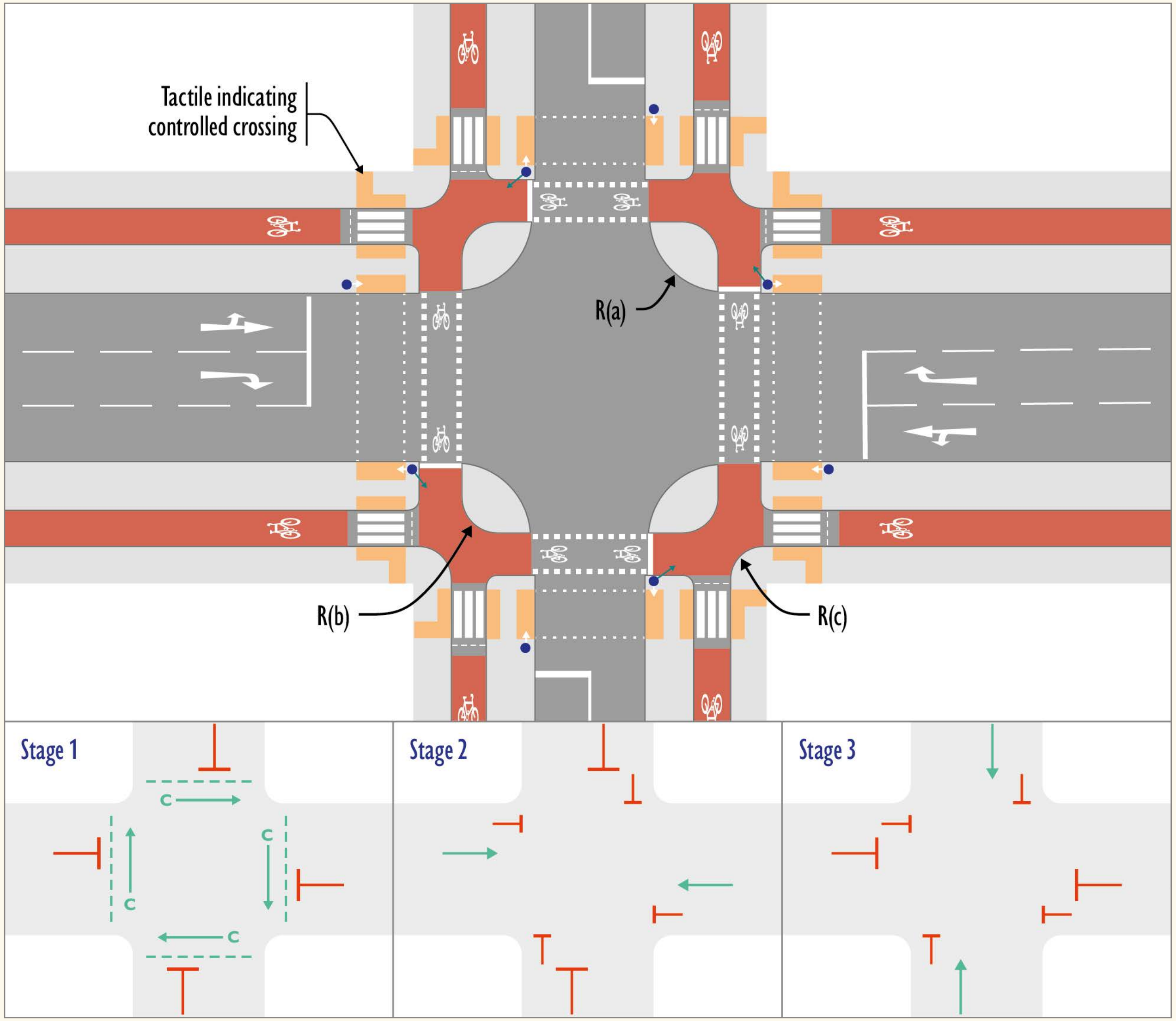

Figure 5.11: Protected signal-controlled junction layout with Zebra crossing of cycle track and typical staging arrangements

Figure 5.12: Protected signal-controlled junction layout with Zebra crossing of cycle track (3D)


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Protected junctions with Zebra crossings of the cycle track – CYCLOPS layout

Another alternative incorporating Zebra crossings of the cycle track is the CYCLOPS (cycle optimised protected signal) layout. This is a variation of the layout illustrated in Figure 5.11 with the principle feature of an external orbital cycle track rather than the internal orbital cycle track provided in the examples above. This maintains the concept of providing safer junction layouts for cycle users while also allowing signal-controlled pedestrian and cycle user phases to run simultaneously in a single signal-controlled stage.

The pedestrian crossing of the cycle track is not signal-controlled and is enabled by a Zebra crossing. The pedestrian crossing of the road is signal-controlled. Therefore, pedestrians require a landing area between the cycle track and the road. Pedestrian crossings of the cycle track should be on the pedestrian desire line.

The layout reduces the number of pedestrian crossings on the cycle track network by consolidating all pedestrian movements into a single crossing point on each corner. Fewer Zebra crossings of the cycle track are required when crossing more than one arm of the junction, compared with the example illustrated in Figure 5.11.

An example layout of a CYCLOPS protected junction is illustrated in Figure 5.13 and 5.14.

The CYCLOPS layout shares similar advantages and disadvantages with other layouts incorporating Zebra crossings, when compared to fully signal-controlled junctions.

Further advantages of the CYCLOPS layout compared to other signal-controlled layouts include:

- The external orbital cycle track potentially provides an improved angle of approach for cycle users and additional space for queuing at cycle user stop lines
- Potentially more direct routes for pedestrians on desire lines, including an opportunity to incorporate diagonal pedestrian crossings of the junction (not illustrated).

The disadvantages of the CYCLOPS layout include:

- Potentially increases the route length for cycle users
- Pedestrians may feel less comfortable with this layout compared to other protected signal-controlled layouts, and potentially more isolated on landing areas
- Blind and partially sighted users may find landing areas more difficult to negotiate than the landing areas illustrated in Figure 5.11
- More space may be required for large enough landing areas to accommodate the appropriate tactile paving and a space between these, as well as providing enough space to accommodate the competing pedestrian movements between two signal-controlled crossings of the road and the Zebra crossing of the cycle track.

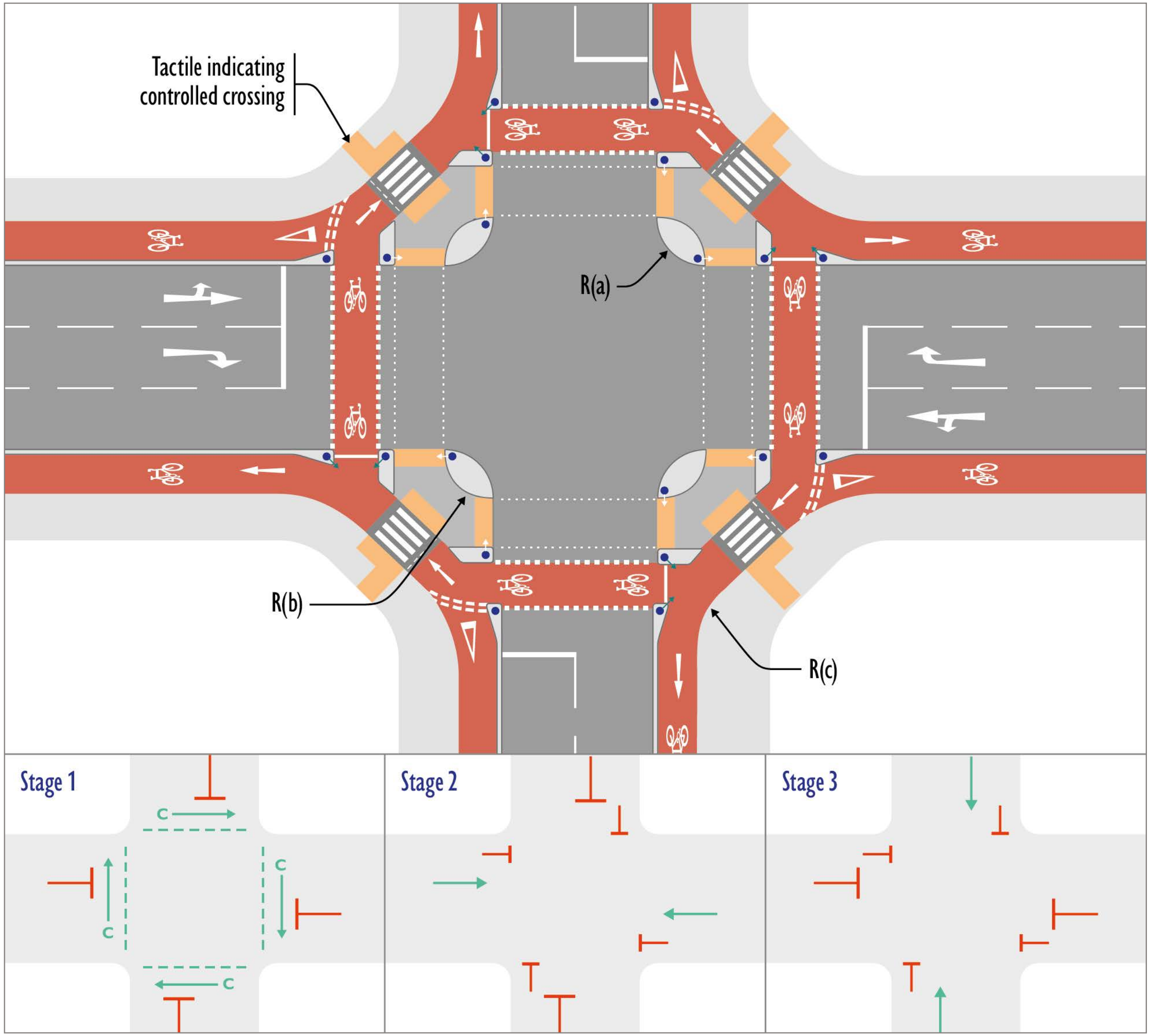

Figure 5.13: CYCLOPS protected signal-controlled junction layout with Zebra crossing of cycle track and typical staging arrangements

Figure 5.14: CYCLOPS protected signal-controlled junction layout with Zebra crossing of cycle track (3D)

Two-stage right-turn layout

A two-stage right-turn layout allows cycle users to turn right without having to move to the centre of the carriageway. This can be beneficial on multi-lane approaches where motor traffic speed and volume make right turning from the road carriageway unattractive for cycle users. Signs located on the junction approaches and based on the map-type sign to ***TSRGD Diagram 2601.2*** should be considered. As noted in ***Traffic Signs Manual Chapter 6***, two traffic signs to support a two-stage turn layout have been designed, although these will require authorisation.

The layout incorporates a waiting area for cycle users that is offset from vehicle movements on the main road arm and ahead of any stop lines or crossings on the side road arm. This is illustrated in Figure 5.15.

The right-turning arrangement for a cycle user is as follows:

- Cycle user enters the junction when their approach arm is given a green signal
- Cycle user pulls into the nearside waiting area, located within the side road arm, and waits
- When the side road arm is given a green signal, the cycle user is permitted to complete their turn across the junction
- Where early release phasing is incorporated, the cycle user can complete the right turn before motor traffic from the side road arm receives its green signal.

The right-turning cycle user in the waiting area is reliant on a secondary signal, located across the junction at the arm into which they are turning. It is essential that this signal is at a high level and clearly visible to the cycle user. An early release signal can be beneficial in ensuring that the right-turning cycle user can complete their turn before motor traffic enters the junction. Where this is incorporated, the secondary signal requires a separate cycle aspect.

Two-stage right turns are often provided in conjunction with ‘hold the left turn’ layouts.

Two-stage right turn layouts involve a greater degree of cycle user and motor traffic interaction than protected signal-controlled junctions. It is therefore less preferable and may not be attractive to less-experienced cycle users. It may be considered where constraints mean that the higher provision of a protected junction cannot be reasonably accommodated.

5.3.8 The layout should provide sufficient space to allow cycle users to enter the waiting area and then position themselves correctly for their second stage.

5.3.9 The cycle waiting area should be completely offset from the traffic and cycle lane running parallel to it.

5.3.10 The cycle waiting area should be capable of accommodating a design vehicle 2.8 m long by 1.2 m wide and the total number of cycle users that are expected to make the turn within each signal cycle at peak times.

5.3.11 The waiting area should be highlighted by providing a contrasting colour treatment.

5.3.12 Where early release is incorporated, the far-sided secondary signal should turn to green at the same time as the low-level cycle signal for users waiting behind the stop line within the same arm.

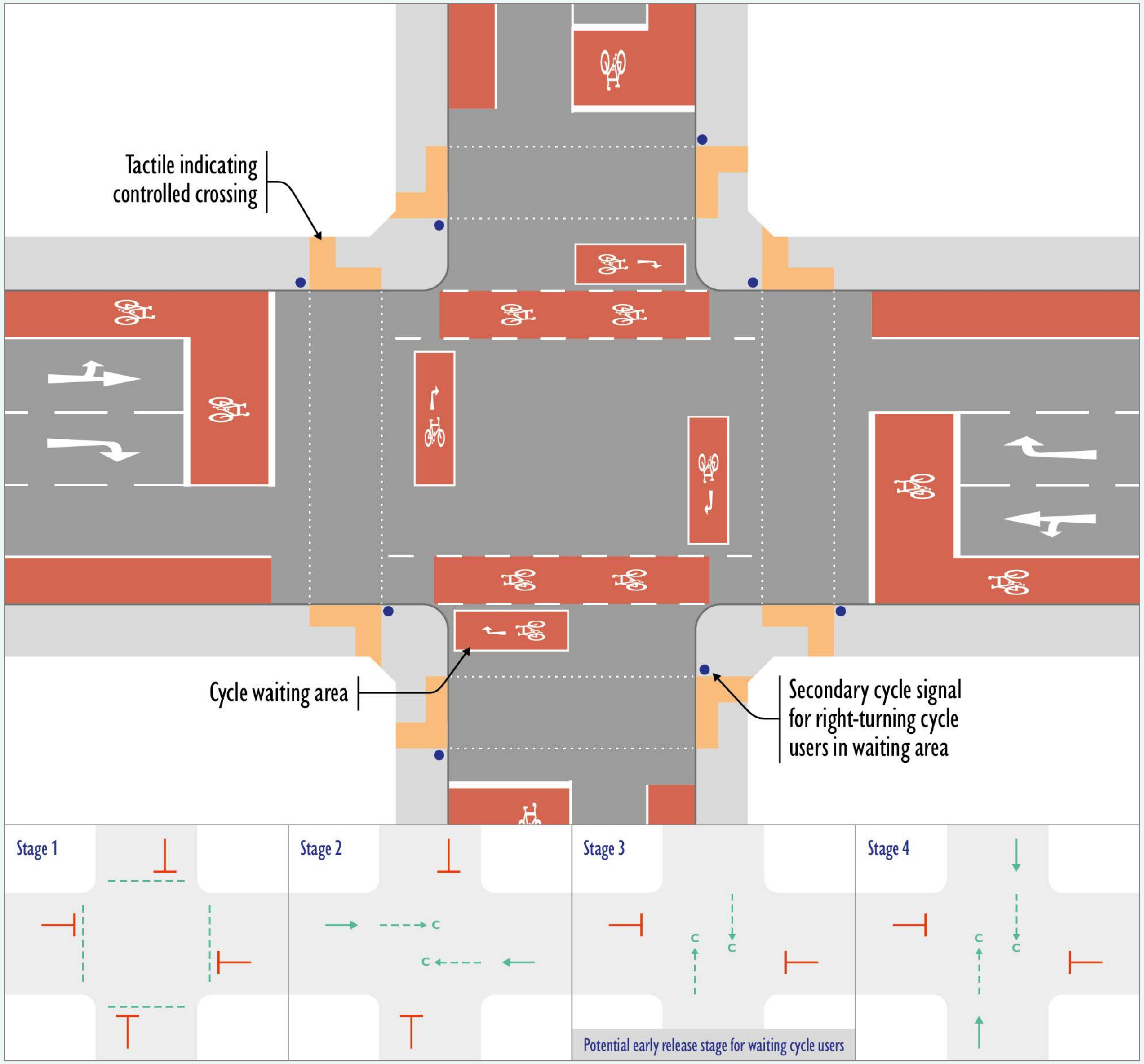

Figure 5.15: Two-stage right-turn layout and typical staging arrangements

Hold the left turn layout

A 'hold the left turn' is a junction treatment used at signal-controlled junctions to enable cycle track users to gain the right of way before the associated motor traffic signal.

A nearside cycle track is given a dedicated green signal while motor traffic turning across the cycle track (typically the left turn but also any opposing right turn) is held on red. The turning motor traffic only receives a green signal when cycle users are held on red.

A hold the left turn facility is most appropriate where there is a moderate volume of left-turning traffic and a large cycle flow proceeding ahead and/or left. By allowing cycle track users to proceed at the same time as motor traffic proceeding straight ahead on the main road, it can often have the benefit of providing cycle users with a large proportion of the junction green time, thereby reducing delay.

An example layout is illustrated in Figure 5.16.

It may also incorporate provision for right-turning cycle users. Where this is the case an associated two-stage right-turn facility should normally be provided.

5.3.13	The cycle track should be physically protected from the left turn lane.
5.3.14	The left turn lane may be physically protected from the remaining traffic lanes.

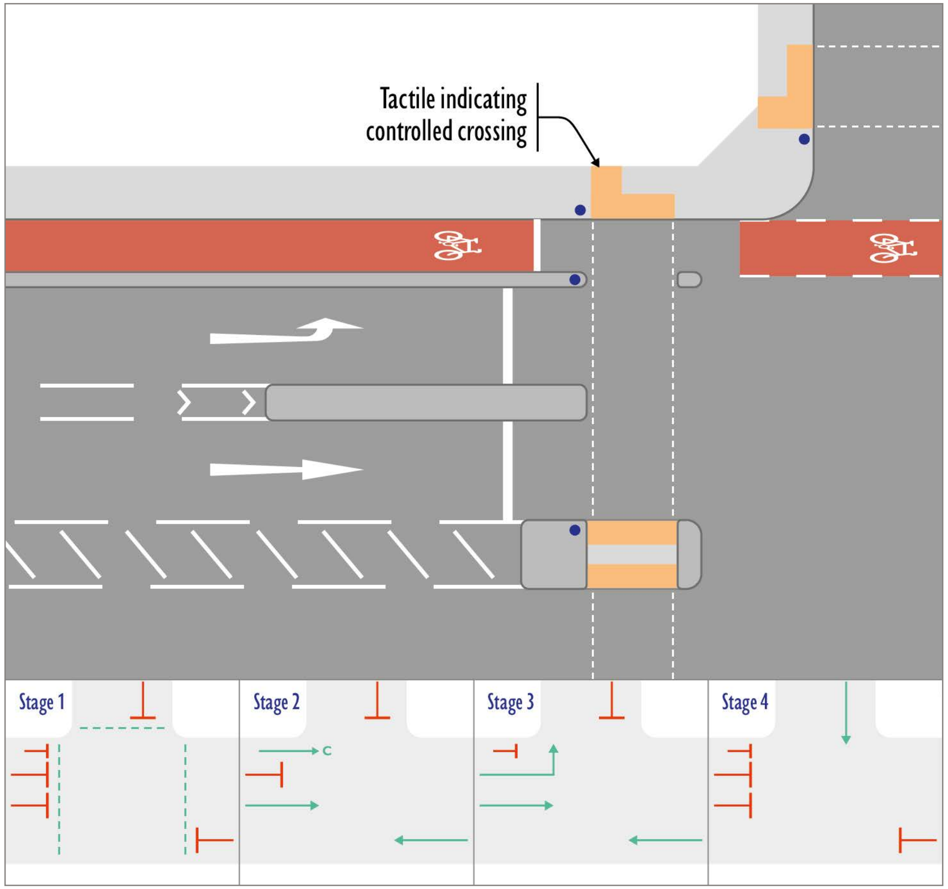

Figure 5.16: Hold the left turn layout and typical staging arrangements

Cycle gate layout

A cycle gate facility is a treatment which can be applied at signal-controlled junctions that provides a reservoir area with separately controlled entry points for cycle track users and motor traffic.

It will have the greatest benefit where there is a high volume of cycle users proceeding straight ahead or turning right at signal-controlled junctions, or where there are many left-turning vehicles or 'scissor movements'. This is most likely to be the case on key commuting routes with a high volume of peak period cycle track users and motor traffic.

A cycle gate relies on there being two sets of signals and two stop lines for cycle users on the entry arm. The first stop line acts as a 'gate' to allow cycle users to enter a 'cycle reservoir' ahead of motor traffic to await a green signal at the second stop line. This allows cycle users time and space to move away from a junction ahead of motor traffic.

The cycle gate operates on a sequence such that:

- The reservoir is clear when the cycle user signals turn green, so that cycle users can move to the front of the area
- The signals controlling the exit from the reservoir turn green in advance of those on the road traffic entry, to give cycle users in the reservoir the desired advantage.

The layout has some similarities to an advanced stop line (ASL) layout but provides a higher level of provision for cycle users. The layout removes the interaction that can occur when cycle users reach an ASL as the signals turn to green. It enables the provision of low-level cycle signals at the second stop line, to give an additional release to cycle users.

It is important that the cycle gate reservoir is not marked in such a way as to make it appear like an ASL. For example, it should not have coloured surfacing or be marked with cycle symbols. The cycle track on the approach may have coloured surfacing but this should terminate at the first cycle stop line.

A typical layout is illustrated in Figure 5.17.

5.3.15 The first motor traffic stop line should be positioned behind the first cycle user stop line.

5.3.16 The distance from the first motor traffic stop line to the second stop line, and therefore the reservoir length, should be a minimum of 18.0 m.

5.3.17 The distance from the first cycle user stop line to the second stop line should be a minimum of 7.0 m.

Note: Adequate distance between the stop lines will disassociate them from each other and reduce any see-through issue between the two sets of traffic signals.

5.3.18 The signal operation should give cycle users enough time to enter the junction before motor traffic enters the reservoir. Refer to ***Traffic Signs Manual Chapter 6*** for guidance on signal timings.

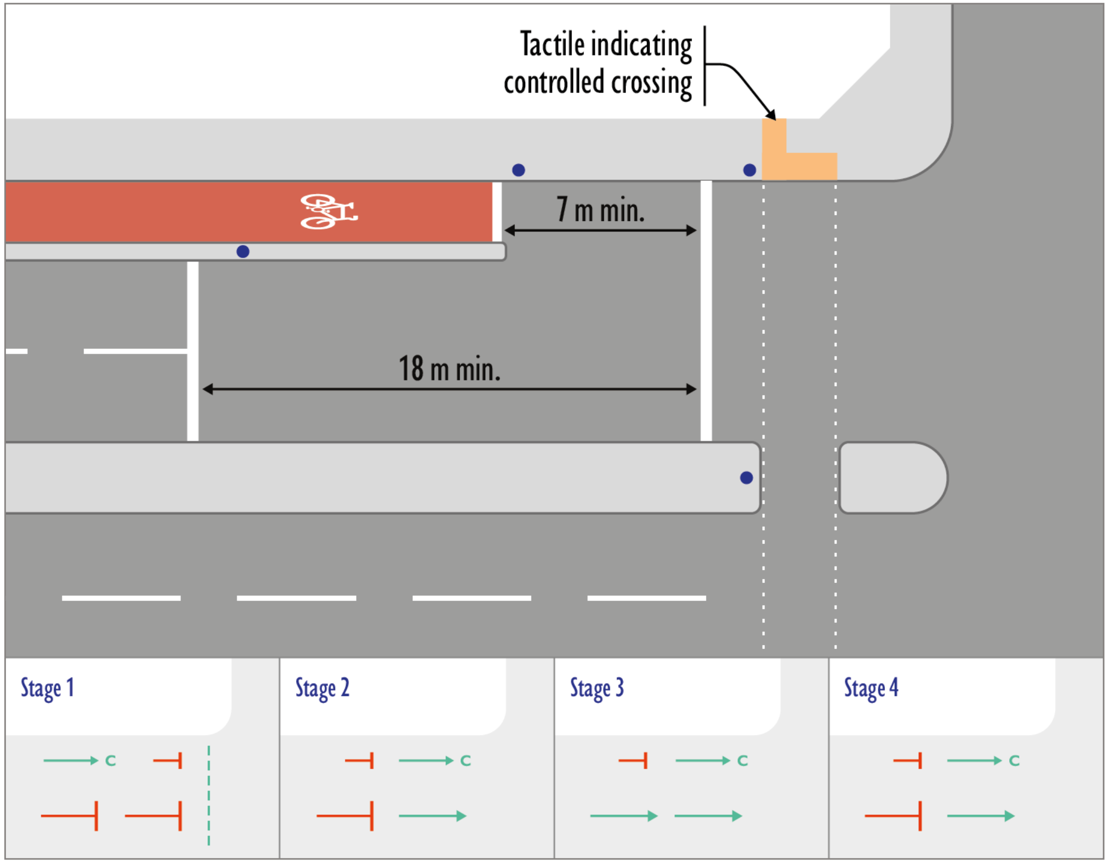

Figure 5.17: Cycle gate layout and typical staging arrangements

Advanced stop lines layout

Advanced stop lines (ASLs) provide a reservoir area at a signal-controlled stop line for cycle users to position themselves ahead of other traffic, as illustrated in Figure 5.18, but only when motor traffic is held at a red light. They are a low-cost intervention that have little impact on junction capacity if road traffic lanes are unaltered. In most cases, their installation at existing junctions will not require signal timing changes, with the potential exception of intergreen timings.

They should be used with caution as they give less protection than other examples presented in this guidance and are not suitable for all cycle users. Where space allows, the alternative layouts provided in previous pages should be considered first. ASLs may be best employed as part of a two-stage right-turn layout and/or incorporating an early release signal.

ASLs can be effective for experienced cycle users on approaches where traffic flows do not exceed 5,000 vehicles per day, the road has a maximum of two traffic approach lanes, and where the approach receives no more than 30% of the cycle green time.

ASLs are intended to allow cycle users to adopt the appropriate position at the junction for their intended manoeuvre. The layout places cycle users in a more visible location ahead of traffic, rather than at a potential blind spot to the left of traffic, which is a hazard in the presence of HGVs. An ASL also allows cycle users to wait in an area relatively free from exhaust fumes and can make it easier for right-turning cycle users to position themselves in the best location.

For users who find it difficult to accelerate quickly, the ASL can be an uncomfortable position, located in front of traffic which has been given a green signal to proceed. This may affect recumbent cycle users and inexperienced users in particular.

ASLs can be preceded by approach cycle lanes ***TSRGD Diagram 1001.2***, by a diagonal 'gate' marking ***TSRGD Diagram 1001.2A*** to indicate a point of entry to cycle users, or neither an approach lane or 'gate' ***TSRGD Diagram 1001.2B***. Cycle lanes feeding into the ASL are either near side approach lanes or central approach lanes between traffic lanes. Central approach lanes can place cycle users in a vulnerable position and are not generally recommended for less confident cycle users and alternative layouts, described previously, are likely to offer a much better solution. Central approach lanes should only be considered where at least 2.0 m can be provided for these lanes and are usually only provided where there are high numbers of left-turning vehicles mixing with cycle users going ahead or right.

ASLs require judgement by the cycle user, as the timing of their approach to the junction relative to the signal phasing is important. This could mean it is difficult for cycle users to establish an appropriate position, or they could find themselves in the 'blind spot' of a left-turning vehicle. Cycle users who are lower to the ground may also be less likely to be seen from vehicles waiting behind and to the side.

ASLs should normally extend across all the traffic lanes, though in limited circumstances part-width ASLs may be appropriate. Situations where part-width lanes can be considered include:

- Where right-turn manoeuvres are not permitted (for cycle users or all vehicles)
- There are multiple right-turning lanes
- Vehicle movements into the arm of the junction would encroach into a full-width ASL reservoir
- A nearside lane is controlled by a left-turn filter signal.

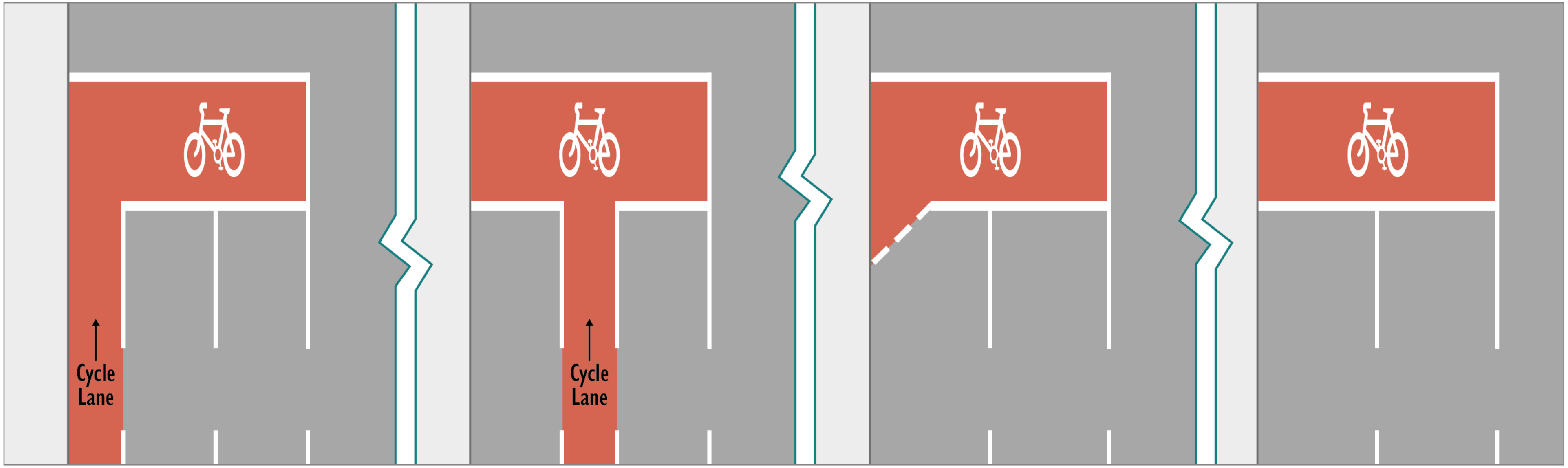

Figure 5.18: Advanced stop line layouts

5.3.19 Nearside approach lanes should be mandatory unless there is a strong reason to permit vehicle encroachment.

5.3.20 A central approach lane should have an absolute minimum width of 2.0 m and be advisory.

5.3.21 Where there are filter arrows for left or right-turning traffic, waiting cycle users should not be put in a position where they obstruct vehicular traffic moving when the filter lane is active.

5.3.22 The cycle reservoir should be between 4.0 m and 7.5 m deep.

Note: If the reservoir is shallow, cycle users can feel intimidated by the proximity of motor vehicles, and cycle users who are lower to the ground may be less visible by following motor vehicles.

5.3.23 The ASL reservoir should be coloured to discourage motor vehicle encroachment.


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Signal heads for cycle users

TSRGD prescribes two types of signal head to control cycle user traffic.

TSRGD Diagram 3000.2 is sometimes referred to as high level cycle signals (HLCS) and is used to control cycle user only movements on a protected cycle track or approach to a junction.

TSRGD Diagram 3000.2A is sometimes referred to as low level cycle signals (LLCS) and is generally used:

- As a primary signal for protected cycle only movements
- As repeater signals mounted at cycle users' eye-level on the same pole as traffic signals
- As repeater signals mounted at cycle users' eye-level on the same pole as full-size cycle signals
- For early release where the cycle user signal gains right of way before an associated signal for motor traffic, mounted on the same pole as full-size signals. In this scenario, low-level cycle signals are generally used with an ASL, allowing cycle users to position themselves in front of the motor traffic queue.

An example of HLCS and LLCS are illustrated in Figure 5.19.

5.3.24 A minimum horizontal clearance of 450 mm should be provided between the edge of the road and a HLCS or LLCS.

5.3.25 A minimum horizontal clearance of 250 mm should be provided between the edge of the cycle track and a HLCS or LLCS but should be determined on a site-specific basis.

5.3.26 Any island that accommodates a HLCS alone should be a minimum of 1.05 m or 1.15 m wide depending on the signal head width.

5.3.27 Any island that accommodates a LLCS alone should be a minimum of 810 mm or 860 mm wide depending on the signal head width.

5.3.28 Any island that accommodates a LLCS mounted on a signal pole with a high-level general traffic signal should be a minimum of 1.05 m or 1.15 m wide depending on the signal head width.

5.3.29 A primary LLCS should be 1.2 m from the stop line. It is usually aligned at 45 degrees to the stop line, though a shallower angle may be considered for protected lanes/tracks in order to avoid see-through problems and account for other site-specific conditions.

5.3.30 A secondary LLCS should be aligned to a point in the middle of the carriageway or cycle lane/track and 2.0 m upstream of the stop line. It should be within a 30-degree offset of the middle of the lane.

5.3.31 Secondary HLCS should be considered where there is a risk to cycle users of poor visibility of low-level signals due to layout constraints or high levels of demand.

5.3.32 Visibility to the signals should be achievable from an eye height of 0.4 m to accommodate handcycles.

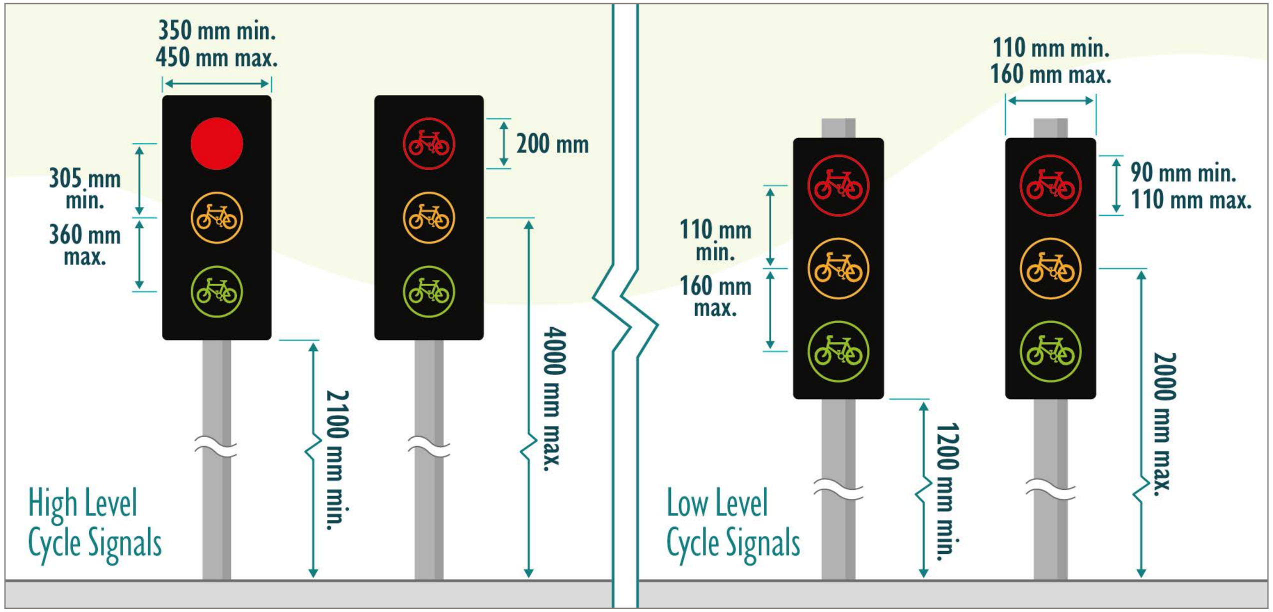

Figure 5.19: High level cycle signals and low level cycle signals

5.4 Roundabouts

The way cycle users are accommodated at roundabouts will depend on several factors relating to layout, volume and composition of traffic. Roundabouts vary in scale – from mini roundabouts to large roundabouts catering for complex traffic patterns.

As with other junction types, protection of cycle users by physical means is generally preferred as it provides a safer and more attractive facility for users. Designers need to take all safety and comfort implications into consideration and provide off-carriageway cycle user facilities where appropriate and feasible. Cycle lanes on the outside of the circulatory carriageway should not be used, even on compact and mini roundabouts. Cycle lanes offer no physical protection and cycle users are vulnerable to 'left hook' collisions when motor vehicles are exiting the junction.

Some situations may occur at smaller, compact or mini roundabouts in very low trafficked and low speed environments, where cycle users are able to comfortably use the carriageway. This will only be the case where the conditions for cycle users mixing with motor traffic are met (see Chapter 3).

Where this is the case and cycle users are not protected from circulating traffic, designers should seek to ensure that:

- Approach arm traffic speeds are low
- Circulatory carriageway speeds are low
- Cycle users are positioned prominently and are highly visible on the approach arms and the circulatory carriageway.

These factors are a function of the geometric design parameters and of the nature of the traffic environment. However, designers need to take all safety and comfort implications into consideration and provide protected cycle facilities at roundabouts as the first choice in most cases. While this section provides guidance for different types of roundabout, each solution will be site specific.

Reference should also be made to the relevant roads authority's design guidance for roundabouts.

Protected cycle track roundabout layout

The first consideration for most roundabouts will be to separate cycle users from circulating traffic to offer an alternative and safer route through the junction. It is imperative to minimise any additional delay or distance for cycle users and pedestrians.

Separation is achieved by providing a one-way circulatory cycle track around the roundabout and suitably designed crossings of each arm.

The example layout presented in Figure 5.20 incorporates:

- A roundabout with a circulating cycle track and adjacent footway
- A controlled Parallel crossing for cycle users and pedestrians
- A two-way road forming the 'western' arm of the roundabout, with one-way cycle tracks on each side and adjacent footway.

Intervisibility between the circulatory road carriageway and the circulating cycle track is necessary to ensure that drivers and cycle users are aware of each other's presence as they approach the crossing points. The crossing should be visible to the driver. Continuous coloured surfacing across a Parallel crossing may be considered where appropriate, but it is essential that cycle users understand that they do not have priority over other traffic until they are on the crossing.

The form of crossing may vary. The volume of users may justify cycle priority crossings or signal-controlled crossing points, although signal-controlled crossings will potentially result in longer circulatory routes for cycle users and pedestrians and cycle priority crossings will likely require pedestrian crossings to deviate from the pedestrian desire line.

It is essential that motor traffic speeds exiting the roundabout are not excessive and that drivers are able to react to the crossing. Therefore, exit radii from the roundabout should be limited.

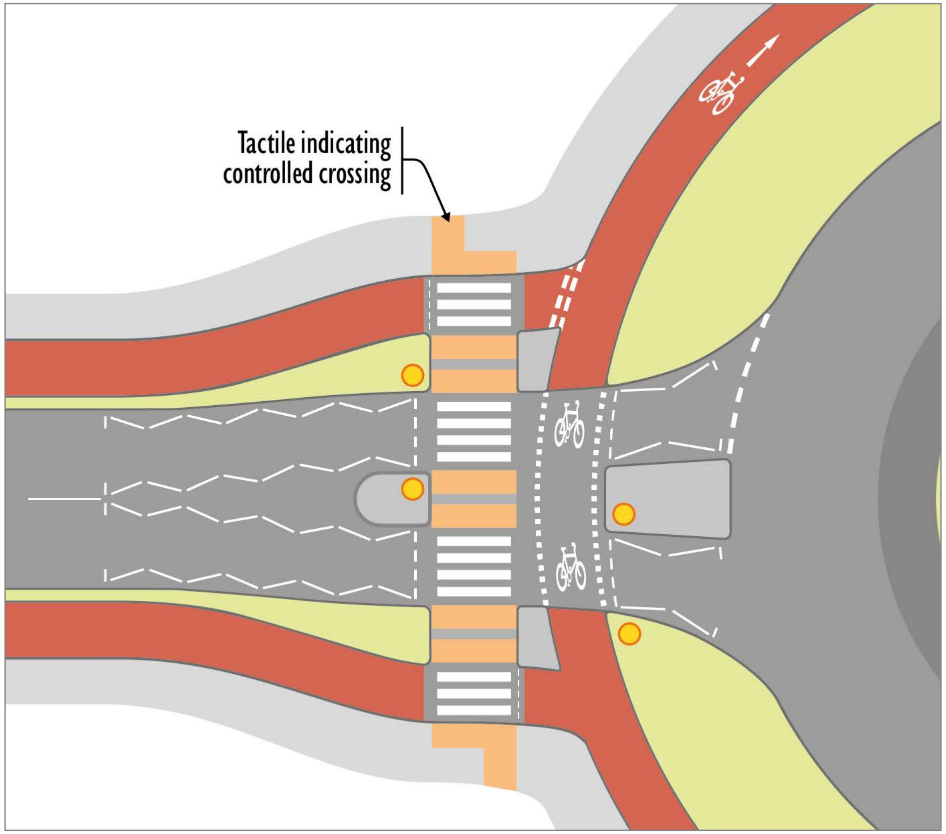

Figure 5.20: Protected cycle track roundabout layout

5.4.1 The minimum length between the edge of the roundabout and the location of a parallel crossing should be 5.0 m but should avoid excessive detours for cycle users and pedestrians.

5.4.2 Drivers approaching a roundabout with a Parallel crossing should be able to see the full width of the crossing from a distance at least equal to the desirable minimum stopping sight distance (SSD) for the design speed of the roundabout approach.

5.4.3 Drivers exiting the circulatory carriageway of the roundabout should have full visibility of the Parallel crossing.

5.4.4 Where signal-controlled crossings are provided, these should be located 20.0 m from the edge of the roundabout circulatory carriageway. This helps to ensure drivers are travelling slowly as they approach the crossing and to ensure that cycle users and pedestrians are not forced too far from their desire line.

5.4.5 Crossings should be at a right angle between cycle users / pedestrians and motor traffic to ensure visibility for all users.

5.4.6 Landing areas for pedestrians should be included on the roundabout arms between the cycle track and the road carriageway, and on the traffic island.

5.4.7 The width of the pedestrian landing areas should be a minimum of 2.7 m between kerbs to allow for tactile paving at each crossing point and a space between these.

5.4.8 At the roundabout give-way line, drivers should be able to see the full width of any pedestrian crossing across the next exit if it is within 20.0 m of the roundabout exit on that arm.

5.4.9 A minimum 4.0 m radius should be provided where the approaching cycle track joins the circulating cycle track.

Photo by Durman Stearn Civil Engineering Limited

Compact roundabouts

A compact roundabout, defined in DMRB as a roundabout with a central island of at least 4 m in diameter and an inscribed circle diameter (ICD) of between 28 and 36 m, has single lane entries and exits on each arm, which are arranged in a radial pattern, rather than tangential to the central island. The width of the circulatory carriageway is such that it is not possible for two cars to pass one another and drivers are unlikely to attempt to pass a cycle user.

Therefore, where conditions for cycle users mixing with motor traffic are met (Chapter 3), compact roundabouts can be suitable for on-carriageway cycle users without protected facilities. This is dependent on traffic flow, traffic composition and traffic speed and where mixed traffic is also appropriate on the junction approaches.

Mini roundabouts

Mini roundabouts, defined in DMRB as a roundabout where the central island is not kerbed and with an ICD not exceeding 28 m, feature a one-lane circulatory carriageway around a small flush or domed circular island represented by a solid white road marking. They do not feature a physical kerbed island. All road approaches to a mini roundabout are single lane.

Well-designed mini roundabouts that have high levels of driver compliance and entry arm give-way markings can reduce traffic approach speeds as part of traffic calming schemes. Therefore, where conditions for cycle users mixing with motor traffic on approach to the junction are met (Chapter 3), mini roundabouts can be suitable for on-carriageway cycle users without protected facilities. Mini roundabouts can make right turns easier for cycle users than a standard priority junction layout.

Signal-controlled roundabouts

While signalisation of a roundabout can improve traffic operation generally, it is likely that motor traffic on entering and exiting the circulatory carriageway will continue to pose a safety problem for cycle users. Designers should investigate the feasibility of offering cycle users an alternative route away from the general traffic circulatory carriageway, including grade separated provision.

However, a signal-controlled roundabout can benefit cycle users when additional cycle user measures are included, e.g. separate staging, cycle gates or other means to facilitate cycle movement through the roundabout. It can also provide an opportunity to provide pedestrian crossing facilities.

When providing for cycle users at-grade, one of the following approaches may be used at signal-controlled roundabouts:

- Provide facilities on-carriageway at the signalised nodes, so that cycle users are protected from motor traffic, e.g. using a hold the left turn arrangement. An example is illustrated in Figure 5.21. ASLs will not create the conditions to enable most users to navigate a signal-controlled roundabout
- Provide a cycle track around the junction with signal-controlled crossings of the roundabout entries and exits as part of the overall junction control. An example is illustrated in Figure 5.22
- A cycle track across or around the roundabout central island with appropriate signal-controlled crossings of the circulatory carriageway and the roundabout entries and exists, particularly on larger roundabouts where a more direct route is required or potentially beneficial to connect a single cycle route.

Where needed, designers are encouraged to use the Design Review process outlined in Chapter 2 and seek approval from the relevant Overseeing Organisation when developing complex roundabout layouts.

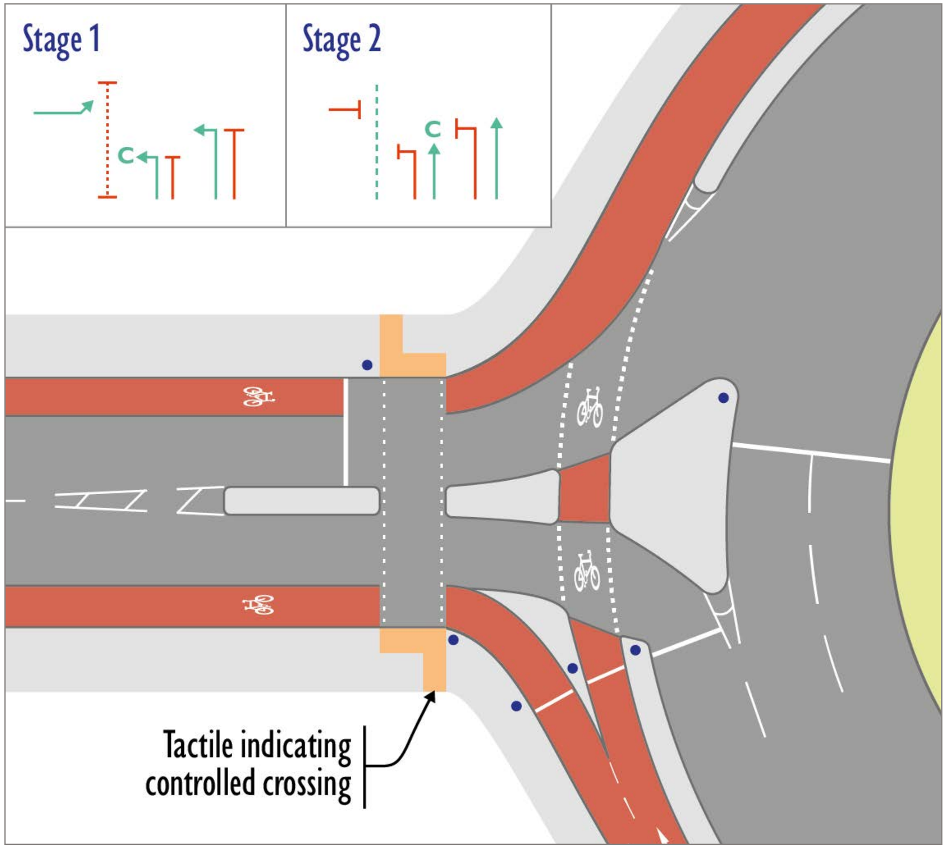

Figure 5.21: Signal-controlled roundabout layout using a hold the left turn arrangement

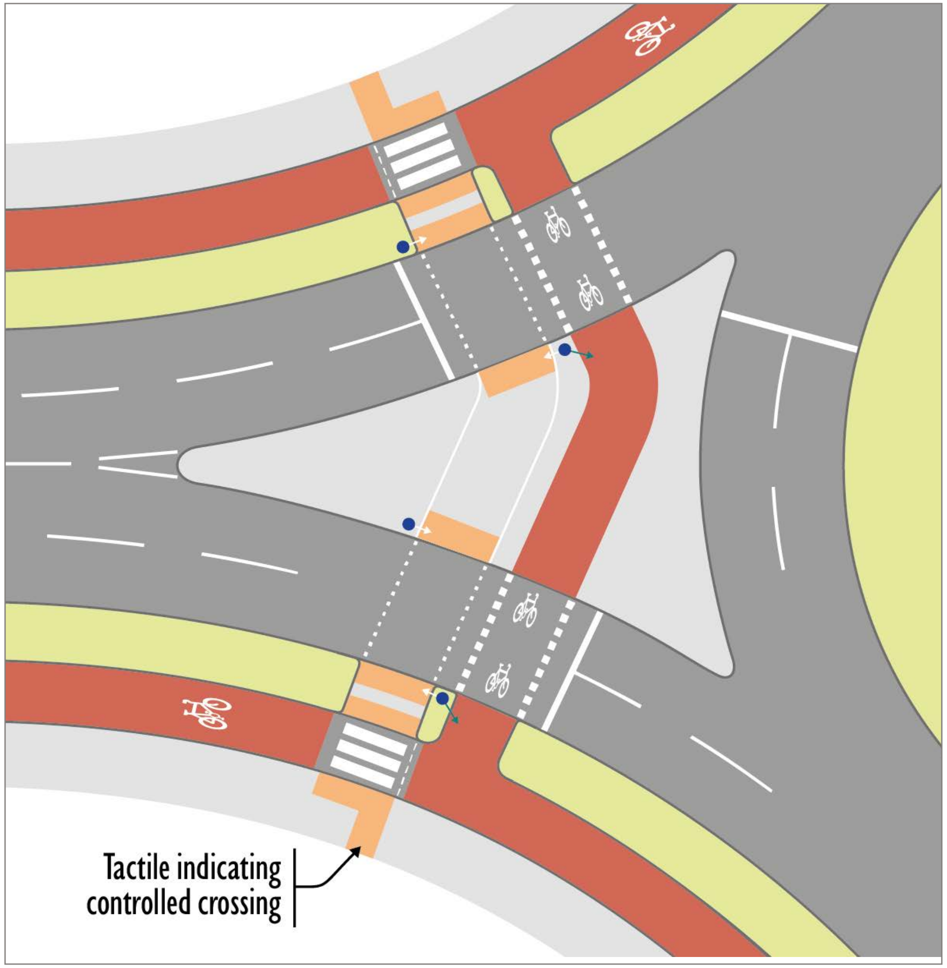

Figure 5.22: Signal-controlled roundabout layout with signal-controlled crossings of the roundabout entries and exits

5.5 Other junction features

A variety of other features can be provided at junctions to facilitate their use by cycle users. Such measures can be considered where a new junction is being developed, or for incorporation at an existing junction to improve cycling facilities.

Cycle user transition / jug handle layout

This scenario can be used where cycle users travelling on a cycle track parallel to a road, an on-carriageway cycle lane or on the carriageway, wish to turn to cross the carriageway. The facility provides a transition for cycle users, removing the need to make an acute right turn from the cycle track or cycle lane, or to wait in the centre of the carriageway. The jug handle allows users to remain in a dedicated facility in advance of making the crossing manoeuvre, potentially improving comfort and safety for users.

A jug handle layout can be used in conjunction with various crossing types, although is likely to be most applicable at crossings within a junction. The example layout presented in Figure 5.23 represents a jug handle layout incorporating:

- A main road with a parallel cycle track and adjacent footway
- A jug handle facility
- A signal-controlled cycle user crossing.

Footway width requirements in accordance with Chapter 3 should be maintained adjacent to the jug handle

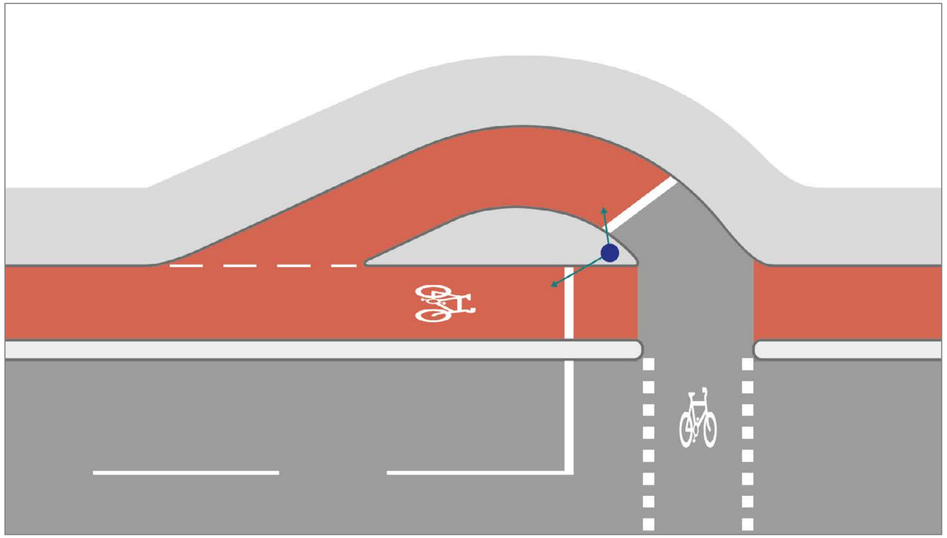

Figure 5.23: Crossing of road network with transition/jug handle

5.5.1	A desirable minimum radius of 6.0 m should be provided on the inside edge of the jug handle element.
5.5.2	The inside edge of the jug handle element may be reduced to an absolute minimum radius of 4.0 m where space is limited.

Cycle bypass layout

A cycle bypass facility is a junction treatment to improve cycle user comfort and enable cycle users to maintain momentum while other vehicles are held. It is commonly appropriate where traffic is subject to a give way or stop line, or to increase permeability for cycle track users at a junction where a left turn or all movements are prohibited for motor traffic.

The layout can often be challenging to integrate with pedestrian crossing facilities, and it is essential that the provision of a cycle bypass does not reduce pedestrian comfort levels. Any pedestrian crossing of a cycle bypass should be placed on the pedestrian desire line for the approach to and from the crossing points of the road carriageway.

Visibility requirements at the crossing point and at the end of the bypass should be in accordance with Chapter 4. A cycle bypass should discharge into a cycle lane or track. A typical layout is illustrated in Figure 5.24.

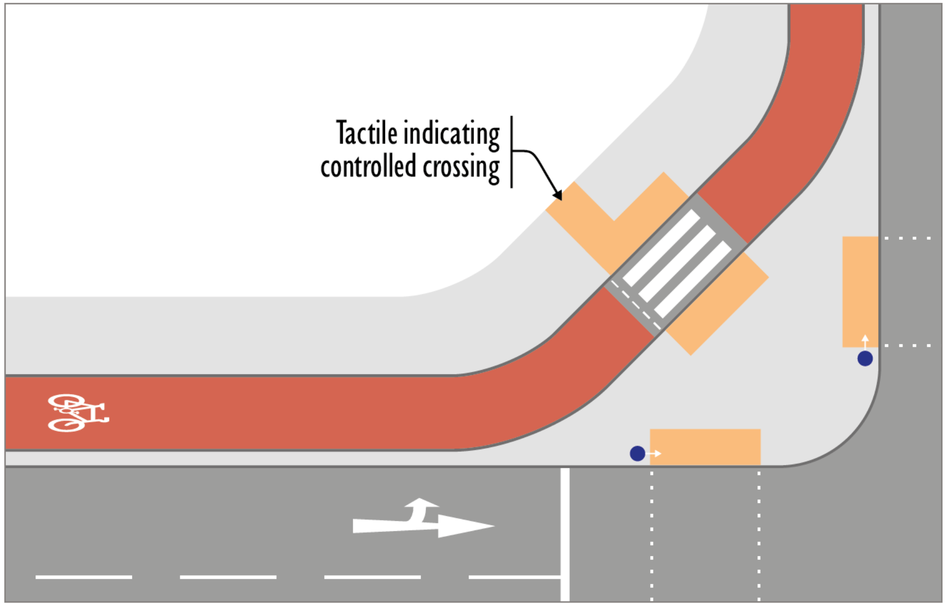

Figure 5.24: Cycle bypass layout

Footrests

Footrests at signal-controlled junctions and crossings, or other locations where cycle users need to stop and wait, can assist cycle users in proceeding with their journey. These can be integrated with a handrail for cycle users to hold rather than putting their foot down, which is particularly useful for those using toe clips or clipless pedals.

Figure 5.25: Footrest with integrated hand rail

6.0 Trip End Facilities

6.0 Trip End Facilities

Figure Numbers

Table Numbers

6.1 Principles

The core design principles of safety, coherence, directness, comfort, attractiveness and adaptability apply equally to the facilities that a cycle user experiences at the beginning and end of their cycle journey, as they do to the infrastructure that they experience on the journey itself.

The attractiveness of a well planned and maintained cycle network could be undermined if adequate facilities are not available for the parking, storage and maintenance of users' cycles at their journey origins and destinations.

This chapter provides guidance for the design of cycle parking facilities and sets out the success factors for other end-of-trip facilities.

6.2 Cycle parking

As well as serving a functional purpose, the provision of carefully planned, well located, frequent and secure cycle parking facilities can help promote cycle use by making them a prominent part of the street or road environment. Well-designed parking with enough capacity and appropriate circulatory space reduces the clutter of cycles chained to other forms of street furniture, which can affect accessibility for all users of the street.

User requirements

When planning cycle parking, careful consideration should be given to the requirements of those who are using the facility and how their needs can be met. The basic user requirements are set out below, which apply to all types of cycle parking, regardless of duration.

Easy to use: Adequate space in the parking area to facilitate easy manoeuvring without catching other cycles as well as adequate provision of locking points to accommodate different types of cycle.

Accessible: Convenient, visible and prominently located near entrances, at other trip end destinations and throughout the network to encourage the maximum number of users. Provision for 'non-standard' cycle vehicles should also be made.

Safe: Located in areas that are naturally overlooked by the occupants of buildings or pedestrians, lit (essential for personal security when parking at night), secure and vandal proof, ideally with suitable CCTV or other security arrangement.

Suitable: Fit for purpose, i.e., appropriate type of facility and number of spaces that serve the needs of the users and the local land use.

Attractive: Sympathetic to the wider environment to enhance its appearance, appropriate to the surrounding area and complementary to surrounding street furniture.

Coherent: Sits within the context of a cycle route network connecting main origins and destinations, including public transport nodes. Cycle parking with no or poor connecting routes may suppress demand.

Well managed and maintained: Efficient to use, clean and free from damaged or abandoned cycles.

Durable: A robust design, constructed with appropriate materials and fixings, that will minimise the whole life cost of cycle parking provision and deter thieves.

In addition to these basic requirements, it is important to consider the specific needs of users for the area where parking is being implemented. These include the journey origins / destinations served by the parking facility, how long cycle users are likely to use the facility and what type of parking facility will best suit these needs.

Short stay parking will be needed close to buildings and other facilities that attract visitors for 2 hours or less. They are likely to attract a high turnover of spaces. These facilities should be located close to building entrances or other facilities such as bus stops. This has benefits including:

- minimising delay to cycle users
- encouraging new users
- enhanced security through visibility and passing footfall.

Medium stay parking will be needed at facilities that attract visitors for up to 12 hours, for example at health and recreational facilities, places of work, education and transport interchanges. Parking should be conveniently located close to the entrance to these facilities but may also need additional security or shelter to be attractive to these users.

Longer stay parking will be needed at places of work, in residential areas and at public transport interchanges and stops. Well-located, covered and secure parking facilities will meet the needs of these users.

Origin or Destination and User	Short Stay (less than 2 hours) with Stands or Wall Loops	Medium Stay (2 to 12 hours) with Stands, Store or Locker	Long Stay (more than 12 hours) with Store, Locker or Hangar
Place of Work – Employee	X	✓	✓
Place of Work – Visitor	✓	X	X
Shopping – Employee	X	✓	✓
Shopping – Visitor	✓	X	X
Education – Student or Teacher	X	✓	✓
Education – Visitor	✓	X	X
Residential – Resident	X	X	✓
Residential – Visitor	✓	X	X
Recreational or Leisure – All Users	X	✓	✓
Health – Employee	X	X	✓
Health – Visitor	X	✓	X
Transport Interchanges and Stops – All Users	✓	✓	✓

✓ Appropriate X Not Appropriate

Table 6.1: Appropriate parking facility by user type and parking duration

Demand and capacity requirements

Successful cycle parking requires to be considered as part of the transportation aspects of development management and built into the early stages of designing new land use developments.

There is also a need to understand the destination of existing cycle demand and to provide suitable cycle parking close to these existing facilities, to fill gaps in the supply of parking on our streets, towns and cities. In assessing the parking demand, this will generally be a function of the land use type and its size, or the proximity of trip generators and attractors, for example:

- Residential properties
- Commercial properties: staff and customers
- Retail facilities and pedestrianised areas: staff and customers
- Educational locations: staff and students
- Train stations: staff and customers
- Bus stations: staff and customers
- Subway stations: staff and customers
- Car club bays: customers
- Cafés: staff and customers
- Religious centres: staff and visitors.

Designers should provide at least the minimum number of cycle parking spaces as required by Local Planning policy for all new developments, and when retrofitting parking to existing streets.

When determining the demand for the number of parking spaces above the minimum requirements set by Local Planning policy, consideration can be given to the following information sources:

- **Counts and surveys** – cycle surveys that have assessed the provision of and the demand for cycle parking at different times of the day and year to understand variations of use
- **Modal split data** – provides a guide of cycling levels within an area and can be used in combination with a broad assessment of likely demand for cycling, based on key attractors and their catchment areas
- **Demographic data** – consideration of the catchment population of an area, again used in combination with an understanding of the key destinations that will attract cycle trips
- **Latent demand** – as a minimum, cycle parking provision may reflect targets for growth in cycling. These targets may be part of a Local Transport Strategy, Travel Plan or on-site assessment
- **Temporary trials** – data can be gathered using temporary cycle parking associated with events or where authorities believe there may be a greater demand for cycling, without the cost of full implementation until trials are complete.

Photo by Cyclehoop

Level of Service Indicators – Cycle Parking

In relation to Design Principle – Safety

●●● **High Level of Service:**
Secure, overlooked, well-lit and exceeds the desirable minimum level of provision

●● **Medium Level of Service:**
Secure but not overlooked and/or only providing the desirable minimum level of provision

● **Low Level of Service:**
Not secure and below the desirable minimum level of provision

In relation to Design Principle – Adaptability

●●● **High Level of Service:**
Has the flexibility to expand, evolve or adapt to changing demands

●● **Medium Level of Service:**
Has only limited flexibility to expand, evolve or adapt to changing demands

● **Low Level of Service:**
Has no scope to expand, evolve or adapt to changing demands once installed

Design

General considerations

The layout of cycle parking is important to ensure that all users, including those with mobility impairments, can access the facilities. A clear route to cycle stands, not blocked by parked vehicles or street furniture, will help to achieve this. Specific layout requirements are described for each type of parking facility on the following pages.

The following types of cycle parking are considered:

- Sheffield Stands and M-profile Stands
- Two-tier Stands
- Cycle Hangars
- Wall Loops
- Cycle Stores
- Horizontal Cycle Lockers.

6.2.1 Cycle stands which only grip the cycle by a wheel (including butterfly racks and concrete slots) should not be installed as they offer only limited security, can cause a trip hazard to pedestrians and can damage wheel rims.

6.2.2 Any cycle parking facility should allow for the frame and both wheels to be locked to the fixture. A minimum of two points of contact is recommended and some flexibility in the design of cycle parking stands to suit local conditions may be considered, but all facilities should fulfil the main function of allowing for two-point frame and wheel locking.

6.2.3 As with any street furniture, sharp corners and other hazards should be designed out.

6.2.4 Cycle parking should be designed and located to ensure that it does not represent a barrier to access for other users of the street. This will require enough space for all users to pass and circulate around the cycle parking facility with cycles in place.

6.2.5 Where necessary, dropped kerbs should be provided for users to access cycle parking facilities from the cycle track or road carriageway.

6.2.6 Provision for 'non-standard' cycle vehicles should be provided at each parking facility, usually by allowing these cycles to be parked at the end of a row of cycle stands. Clear signage directing users to these areas should be provided and a different coloured surfacing may be useful to differentiate these spaces from other general cycle parking.

6.2.7 For personal security and practical purposes, cycle parking should be appropriately illuminated and may be done so independently or may be achieved by adjacent street lighting. Cycle parking placed in dark recesses will not be attractive or secure.

6.2.8 Resident cycle parking should be located internally. Communal provision should be accessed via a secure entrance that is well lit and overlooked.

6.2.9 Where long stay cycle parking cannot be provided internally, the Planning Authority should consider a financial contribution to assist the developer or building owner in providing more long stay cycle parking, for example, Cycle Hangars conveniently located on the street.

6.2.10 Cycle parking should be appropriately coloured/tonally contrasted to the surrounding area to assist blind and partially sighted users and pedestrians navigating the adjacent space. Reference should be made to ***Roads for All: Good Practice Guide for Roads*** for additional information relating to the colour and conspicuousness of street furniture.

Sheffield stand and M-profile stand

Sheffield stands are the most used facility for short stay cycle parking, although they can be used on-street or in combination with shelters and other facilities for longer stay parking. M-profile stands provide an alternative profile to Sheffield stands, and both have been designed specifically to allow cycles to be locked at multiple points.

A typical Sheffield stand and a typical M-profile stand, intended for full size cycles, are illustrated in Figure 6.1.

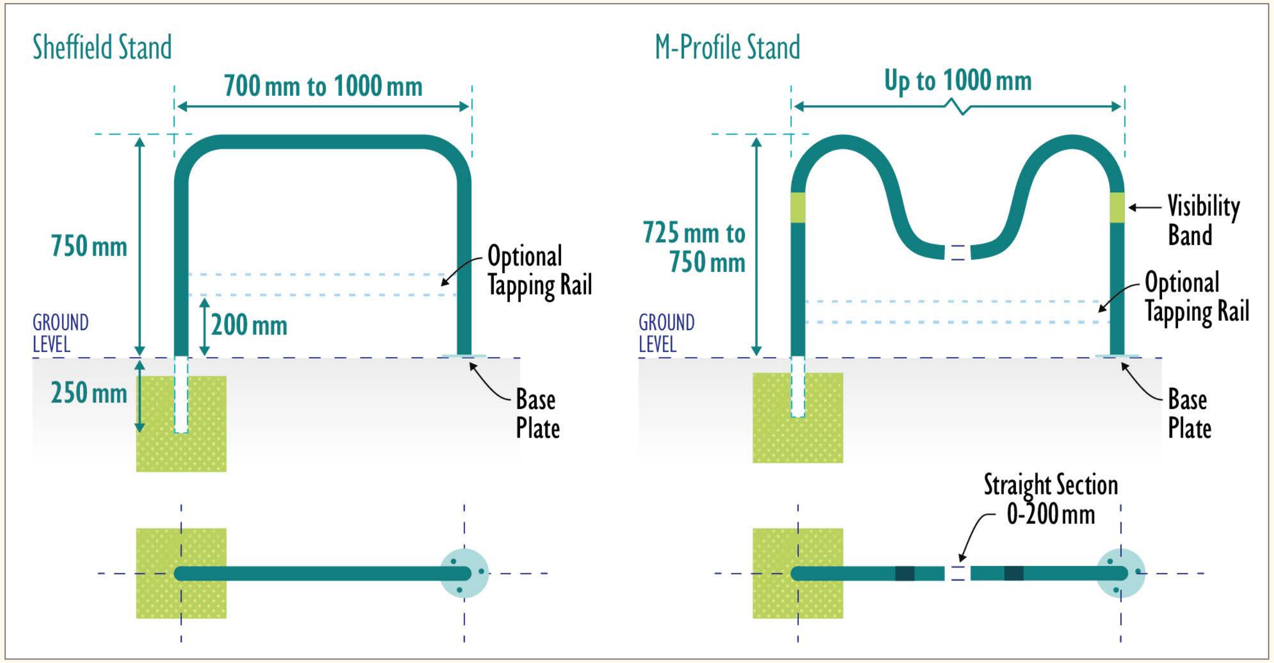

Figure 6.1: Sheffield stand and M-profile stand

When used on-street, it is preferable for Sheffield stands and M-profile stands to be located on space that is reallocated from the road carriageway, before consideration is given to locating stands on the footway.

In all situations, local restrictions and considerations will influence the location of parking. These include ensuring that pedestrian desire lines are not blocked, that access is maintained for kerbside delivery to adjacent properties where this is needed, and that access is maintained for underground utility maintenance. In situations where the erection of a cycle stand could create a potential injury risk to other users, such as to children in a school playground, a physical barrier (such as a shelter) to separate the cycle stand from those at risk may be installed.

Designers should provide a more favourable location for cycle parking over the parking of private cars, and in frequent, small groups where gaps will allow 'non-standard' cycle vehicles to be secured to outside stands. Conveniently located parking can be achieved by replacing on-street car parking spaces with cycle parking stands and ensuring stands are located in prominent locations near entrances to major trip attractors and generators, as close to user destinations as possible.

However, where Sheffield stands or M-profile stands are located on the footway, these should be located where it is unlikely to cause obstruction to pedestrians and where a minimum clear footway width of 2.0 m can be maintained (although this may have to be wider in a busy area). Additionally, cycle stands could be installed on a paving material with a different surface texture or colour to the surrounding footway to differentiate it from the footway. Potential on-street Sheffield stand layouts are illustrated in Figure 6.2.

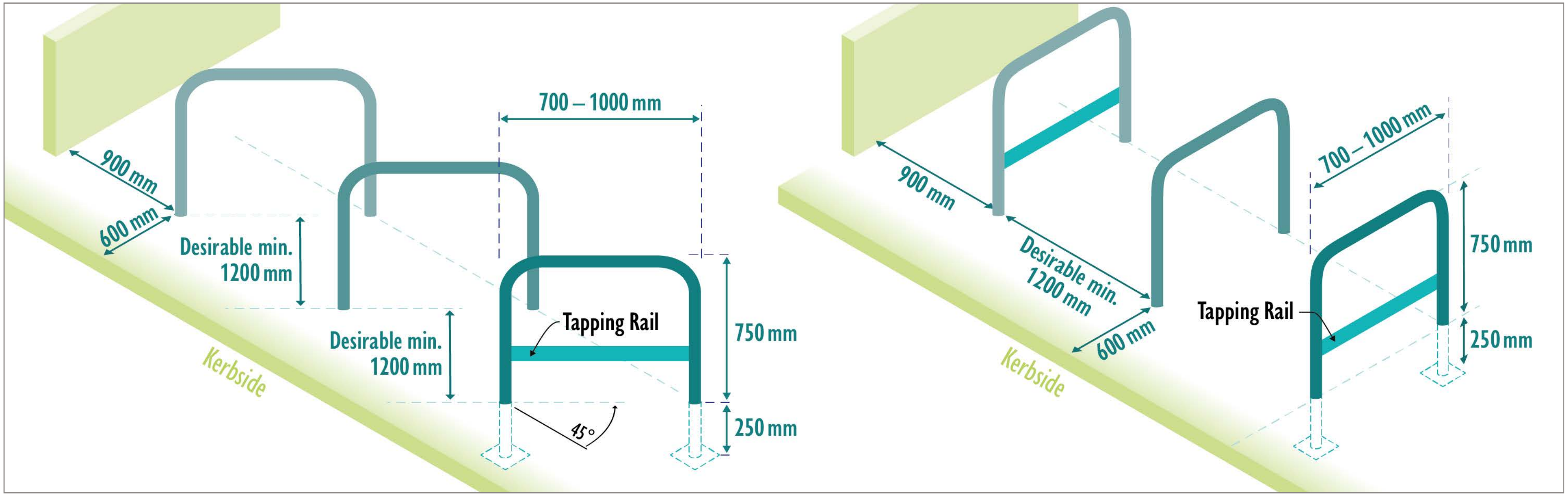

Figure 6.2: Sheffield stand layouts

Covered Sheffield or M-profile stands with open access may be appropriate at relatively small transport interchanges to protect cycles from the weather where users require flexibility in travel choice, which suit both the occasional and regular user. Ideally these would have clear transparent sides. Note, Horizontal Cycle Lockers may also supplement this type of provision at transport interchanges.

The advantages of Sheffield or M-profile stands include that they:

- Are cost effective, extremely adaptable and easy to use and understand by cycle users
- Can be designed and positioned to fit into the surrounding environment
- Can be designed and positioned to accommodate non-standard cycles
- Are accessible from both ends and allow two cycles to be locked to the stand if installed correctly
- Can lock both wheels.

The disadvantages of Sheffield or M-profile stands include that they:

- Are prone to vandalism
- Depending on shelter, can be open to weather
- While each stand is designed to accommodate two standard cycles, this can lead to a clashing of pedals and/or handlebars, and extra difficulty in locking the bike.

Design requirements for Sheffield and M-profile stands are set out below.

6.2.11	The spacing between Sheffield stands or M-profile stands that are in line should be a minimum of 2,500 mm between centres and a minimum clearance of 900 mm from the nearest facility, for example, cycle track or carriageway, or any vertical obstruction.
6.2.12	The spacing between Sheffield stands or M-profile stands that are parallel to each other should be a minimum of 1,200 mm. The minimum clearance from the nearest parallel facility should be 900 mm and the minimum clearance from the nearest perpendicular facility should be 600 mm.
6.2.13	The angled installation of Sheffield stands or M-profile stands should be angled at 45 degrees.
6.2.14	Sheffield stands or M-profile stands should be well signed, with signs conforming to ***TSRGD*** and ***Traffic Signs Manual***, likely to comprise the combination of ***TSGRD Diagram 968*** and ***TSGRD Diagram 968.1*** to denote a 'parking place for pedal cycles'.
6.2.15	Signage may be put in place that clearly identifies any cycle parking allocated for non-standard cycles, for example, "Reserved for cargo and non-standard cycles. Priority to disabled cyclists".
6.2.16	A Sheffield stand should be 700-1,000 mm wide.
6.2.17	An M-profile stand should be up to 1,000 mm wide.
6.2.18	The height of a Sheffield stand should be 750 mm above ground level.
6.2.19	At schools, leisure facilities or other similar locations where children may attend, an extra horizontal bar should be provided on Sheffield stands 500 mm above ground level to provide support for children's cycles.
6.2.20	The height of an M-profile stand should be 725-750 mm above ground level.
6.2.21	The central straight section of an M-profile stand should be 300-400 mm above ground level.

6.2.22	A lone Sheffield or M-profile stand or the end Sheffield or M-profile stands of a group should incorporate a tapping rail 150 mm above ground level, to help prevent people with visual impairments inadvertently colliding with the stands. Its placement is important to its functionality as a visual aid.
Note:	The tapping rail also serves to provide a closed loop for tethering a cycle that will still hold the cycle even if a leg becomes detached from the ground.

6.2.23	The tube diameter of Sheffield stands or M-profile stands should be 50-70 mm.

6.2.24	Sheffield stand or M-profile stand ends may be embedded in concrete (a minimum of 250 mm) or bolted to the surface, individually or collectively welded to parallel bars at ground level to form a 'toast rack' system.

Two-tier stand

Two-tier stands offer an effective solution for high-capacity medium and long stay cycle parking in areas where space may be constrained. Two-tier stands use a staggered trough system on both upper and lower tiers or can incorporate Sheffield or M-profile stands on the lower tier.

A typical Two-tier stand layout, intended for full size cycles, with Sheffield stands on the lower tier is illustrated in Figure 6.3.

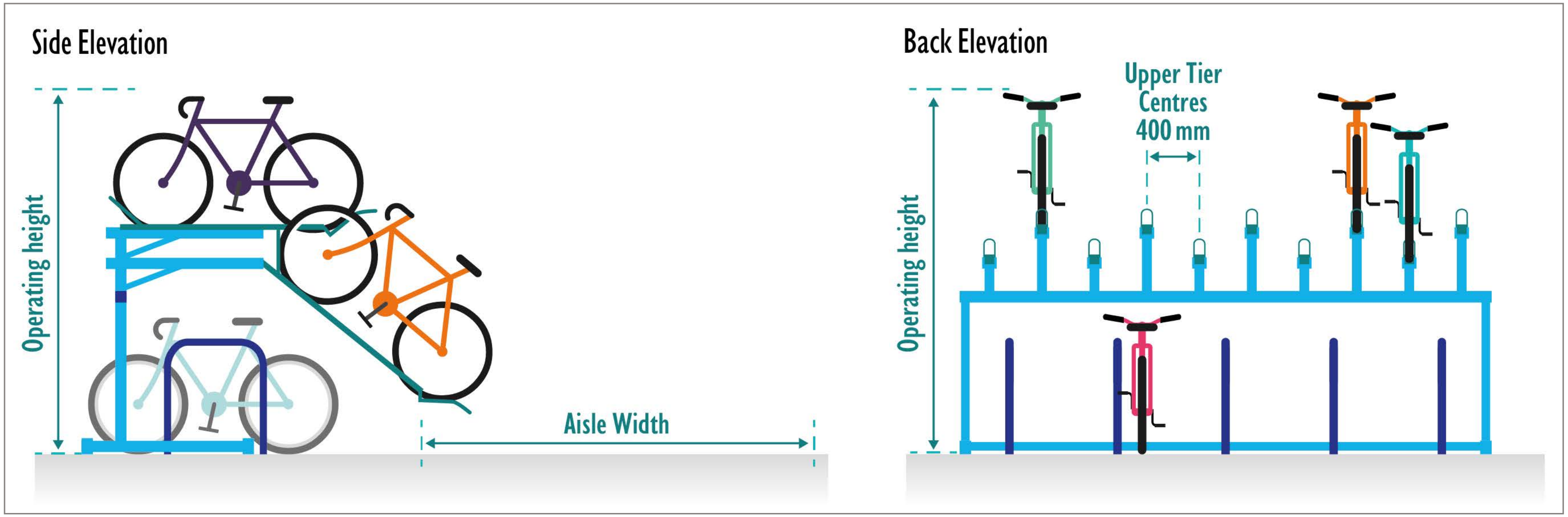

Figure 6.3: Two-tier stand

It is important that Two-tier stands are situated in prominent locations near entrances to major attractions and as close to the destination point as possible. They should be located only where they do not cause a hazard to other users and only where a minimum clear footway width of 2.0 m can be maintained, or where the appropriate operating space can be provided when located off-street.

The upper tier troughs employ an easy to use 'pull down-push up' top loading mechanism that is either spring loaded or gas-assisted. The upper tier troughs should also feature a safety catch securing the upper trough in position once loaded and hi-visibility handles.

The advantages of Two-tier stands include:

- Staggered troughs allow for handlebars to avoid clashing and enable easy operation
- If used, two cycles can be locked to Sheffield or M-profile stands on the bottom tier and these provide the advantage of familiarity and easier maintenance.

The disadvantages of Two-tier stands include:

- The top tier can be less easy to operate for some users
- Generally, not suitable for heavy cycles or those with child seat, baskets or panniers
- Not suitable for non-standard cycles such as tricycles or cargo bikes
- Additional maintenance burden due to requirement for moving parts
- May not fit in buildings or basement parking areas with limited ceiling heights.

Design requirements for Two-tier stands are set out below.

6.2.25	The spacing of troughs on Two-tier stands should be a minimum of 400 mm.
6.2.26	A minimum aisle width of 2,500 mm should be provided beyond the lowered frame of Two-tier stands to allow cycles to be turned and loaded, although further guidance should be sought from the manufacturer/supplier.
6.2.27	The minimum aisle width beyond the lowered frames of Two-tier stands should be increased to 3,500 mm where there are racks on either side of the aisle.
6.2.28	Two-tier stands should be well signed, with signs provided conforming to ***TSRGD*** and ***Traffic Signs Manual***, likely to comprise the combination of ***TSGRD Diagram 968*** and ***TSGRD Diagram 968.1*** to denote a 'parking place for pedal cycles'.
6.2.29	A Two-tier stand will require a height of at least 2,700 mm.
6.2.30	Two-tier stand ends should be bolted to the surface.

Cycle Hangars

While best practice would be to provide dedicated long stay cycle parking in a secure, covered and lockable enclosure, preferably within the footprint of the building within new developments, the lack of internal cycle storage in existing residences and commercial buildings can lead to the scenario where internal circulatory spaces and stairwells can be blocked.

In areas where existing buildings are accessed by steps or have no space for outside storage, on-street cycle parking may be more practical. The provision of standard on-street parking, for example, Sheffield stands, may present problems of security and exposure to the elements, deterring the uptake of cycling by residents or staff and customers.

Therefore, to encourage more cycle use, Cycle Hangars, generally accommodating six cycles, can be installed to provide a dedicated place to park securely outside the curtilage of an existing building. These may be located by either reclaiming existing road space used for car parking or in a nearby location with suitable hard standing. Cycle Hangars are normally only available to registered key-holders.

The advantages of Cycle Hangars include that they:

- Are weatherproof and reduce the anxiety of potential theft
- Can securely accommodate several cycles within less space than a standard on-street parallel parking space, when reclaiming existing road space used for car parking
- Provide space for optional branding which can support or fund their installation
- Can be customised to suit demand.

The disadvantages of Cycle Hangars include that they:

- May not be accessible to non-standard cycles and users of cycles as mobility aids unless designed with adequate space
- May require residents to rent a space or spaces from the Local Authority.

Cycle Hangar dimensions can vary depending on the manufacturer. However, approximate dimensions to provide safe and dry storage space for up to six standard cycle vehicles are a width of 2,500 mm, a length of 2,000 mm, and a height of 1,400 mm.


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59
57

Wall Loop

A Wall Loop offers one point of contact for cycle locking and is therefore less preferable to the other short stay parking facilities. However, they can provide a parking solution where space is very constrained and may be more appropriate in areas where footway widths are restricted. Wall Loops may be a useful additional facility to supplement Sheffield or M-profile Stands in areas heavily used by cycle users for short stay parking.

A typical Wall Loop layout, intended for standard cycles, is illustrated in Figure 6.4.

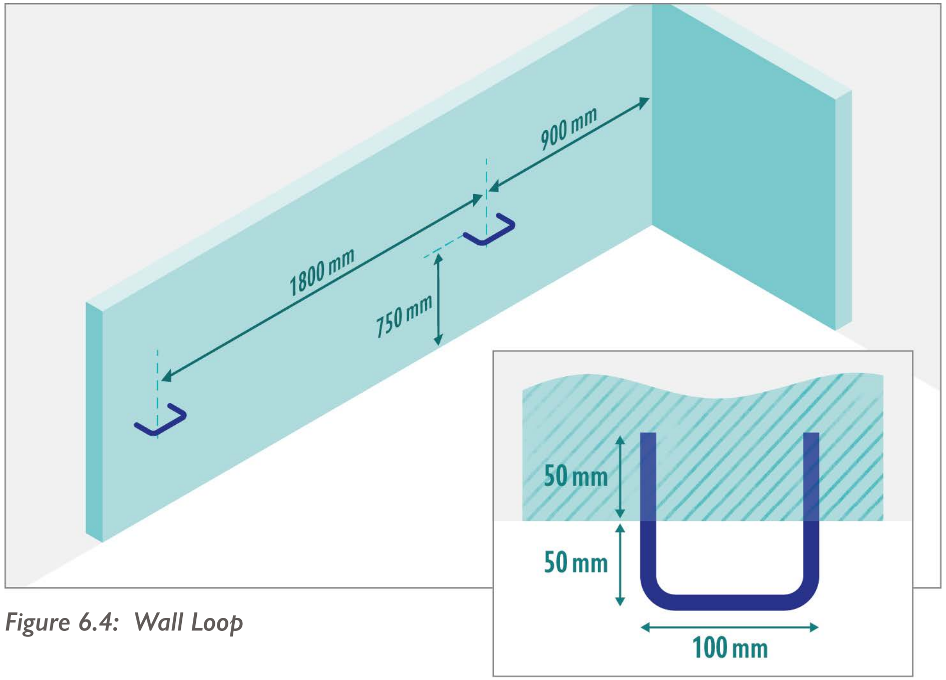

Figure 6.4: Wall Loop

Wall Loops may generally be provided for short to medium stay parking scenarios as a solution where there is limited space. As with other forms of cycle parking, Wall Loops should be situated in prominent locations near entrances to major attractions and as close to destinations as possible. Likewise, locating Wall Loops adjacent to the footway should only be considered where they are unlikely to cause obstruction to pedestrians.

The advantages of Wall Loops include that they:

- Are simple, relatively inexpensive and useful where footway widths are restricted
- Can be used to supplement Sheffield stands or M-profile stands in heavily used areas for short stay parking
- Will avoid clashing of pedals and/or handlebars.

The disadvantages of Wall Loops include that they can be:

- Less secure – standard locking chain will not fit around both cycle wheels and frame, and the loop
- May not be suitable for some non-standard cycles.

Design requirements for Wall Loops are set out below.

6.2.31	The spacing between Wall Loops should be 1,800 mm between centres and a minimum of 900 mm from the nearest wall or other vertical obstruction.
6.2.32	Wall Loops should be well signed, with signs provided conforming to ***TSRGD*** and ***Traffic Signs Manual***, likely to comprise the combination of ***TSRGD Diagram 968*** and ***TSRGD Diagram 968.1*** to denote a 'parking place for pedal cycles'.
6.2.33	Wall Loops should be 100 mm wide.
6.2.34	Wall Loops should be 750 mm above ground level.
6.2.35	Wall Loops should protrude no more than 50 mm from the wall.
6.2.36	Wall Loops should be embedded a minimum of 50 mm into the wall.

Cycle Store

A Cycle Store provides a sheltered and secure location with multiple cycle stands. These provide an additional level of shelter and security for users wishing to park their cycles for more than short stay visits.

A typical Cycle Store layout, intended for full size cycles, is illustrated in Figure 6.5.

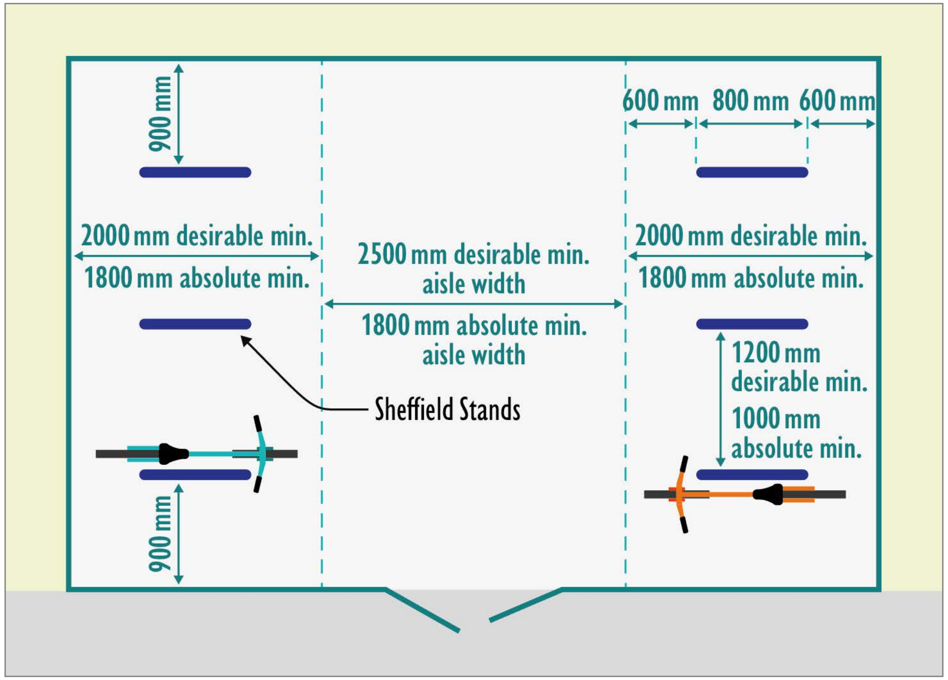

Figure 6.5: Cycle Store layout

A Cycle Store may be under continuous supervision or have a shared key arrangement where each cycle user has a key to the outer door or gate. They may include Sheffield or M-profile Stands internally to individually secure cycles or include the use of two-tier stands. As with other parking types, a Cycle Store should be well lit for personal security and practical purposes.

The advantages of Cycle Stores include that they:

- Are weatherproof and reduce the anxiety of potential theft
- Allow cycle users to keep supplementary equipment, such as lights, attached to the cycle.

The disadvantages of Cycle Stores include that they:

- Are more expensive, require more space and maintenance
- Require adequate management arrangements to be in place to maximise their use, provide maintenance and reduce misuse
- May not be accessible to non-standard cycles and users of cycles as mobility aids unless designed with adequate space.

Design requirements for Cycle Stores to accommodate standard cycle vehicles are set out below. Extra space should be provided when accommodating non-standard cycles.

6.2.37	The perpendicular spacing of Sheffield of M-profile Stands should be a minimum of 1,200 mm, including when part of a two-tier stand layout, and a minimum of 900 mm from the boundary wall or fence of the Cycle Store.
6.2.38	The ends of Sheffield or M-profile Stands should be a minimum of 600 mm from the boundary wall or fence of the Cycle Store and from the access aisle separating groups of stands.
6.2.39	The access aisle width separating groups of stands should be 2,500 mm, but may be a minimum of 1,800 mm for Sheffield or M-profile Stands. The minimum aisle width for Two-tier Stands should follow the guidance provided previously.
6.2.40	Cycle Stores should be well signed, with signs provided conforming to ***TSRGD*** and ***Traffic Signs Manual***, likely to comprise the combination of ***TSRGD Diagram 968*** and ***TSRGD Diagram 968.1*** to denote a 'parking place for pedal cycles'.
6.2.41	Signage may be put in place that clearly denotes cycle parking allocated for non-standard cycles, for example, "Reserved for cargo and non-standard cycles. Priority to disabled cyclists".
6.2.42	If access for cycle users is located behind a door or gate, a minimum width of 1,000 mm for moving the cycle through the space should be provided. Any door or gate should be easy to use and have a delayed automatic closer to allow cycle users to pass through in good time.

More innovative solutions also exist that incorporate green-roofed cycle shelters, which can provide habitats for birds and insects, as well acting as a climate change adaptation technique by absorbing rainfall and mitigating against flooding.

Horizontal Cycle Locker

Horizontal Cycle Lockers offer alternative secure cycle storage in areas where Cycle Stores cannot be accommodated.

A typical Horizontal Cycle Locker layout, intended for full size cycles, is illustrated in Figure 6.6.

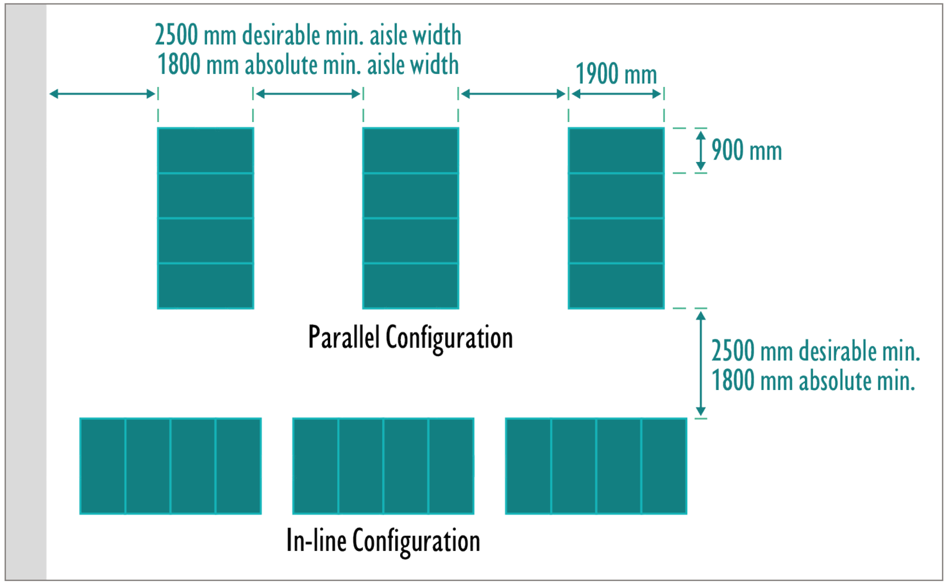

Figure 6.6: Horizontal Cycle Locker layout

Horizontal Cycle Lockers occupy more space than short stay cycle stands but can provide additional security and protection for cycles at key locations, such as railway stations, where enough space is not available for Cycle Stores. They may be most appropriate in situations where regular users can take ownership of 'their' locker to ensure the locker is always kept neat and tidy and locked to prevent key copying and misuse. Alternatively, Horizontal Cycle Lockers may be operated by coin, token, credit card or secured by a cycle lock.

The advantages of Horizontal Cycle Lockers include that they:

- Offer a secure parking facility, allowing accessories to be stored and reducing the anxiety of potential theft, if well managed
- Provide weather protection
- Provide space for optional branding which can support or fund their installation and may also ensure they are in visible locations.

The disadvantages of Horizontal Cycle Lockers include that they:

- Are significantly more expensive than Sheffield or M-profile stands
- Take up space and may be visually intrusive
- Are unsuitable for occasional or short stay use
- Require adequate management arrangements to maximise their use, provide maintenance and reduce misuse
- May not be accessible to non-standard cycles and users of cycles as mobility aids unless designed with adequate space.

Design requirements for Cycle Lockers are set out below.

6.2.43	Horizontal Cycle Lockers should be a desirable minimum of 900 mm wide.
6.2.44	Horizontal Cycle Lockers should be a desirable minimum of 1,900 mm in length.
6.2.45	Horizontal Cycle Lockers should be a desirable minimum of 1,200 mm in height.
6.2.46	The access aisle width between opposite lockers should be 2,500 mm, but may be a minimum of 1,800 mm.
6.2.47	A circulatory aisle width of 1,500 mm should be maintained around the locker/locker units, including from any vertical obstruction, to manoeuvre cycles.
6.2.48	Horizontal Cycle Lockers should be well signed, with signs provided conforming to ***TSRGD*** and ***Traffic Signs Manual***, likely to comprise the combination of ***TSRGD Diagram 968*** and ***TSRGD Diagram 968.1*** to denote a 'parking place for pedal cycles'.
6.2.49	Signage may be put in place that clearly denotes cycle parking allocated for non-standard cycles, for example, "Reserved for cargo and non-standard cycles. Priority to disabled cyclists".
6.2.50	If access for cycle users is located behind a door or gate, these should be easy to use and a minimum width of 1000 mm for moving the cycle through the space. Any door or gate should have a delayed automatic closer to allow cycle users to pass through in good time.

Cycle parking in car parks

Car parks are often enclosed, sometimes sheltered, spaces with existing security arrangements. Allowing cycle parking within these areas can provide additional comfort, shelter and security for medium to long stay parking.

Cycle parking in car parks should have step free access and be clearly visible and located in a supervised area or with CCTV coverage.

It is also imperative that cycle parking in car parks has safe, direct, attractive and comfortable cycle routes leading straight to the cycle parking area, placed conveniently at the entrance to the building or office with direct access to these cycle routes. This should be integral to the design of new car park layouts.

The advantages of cycle parking in car parks include that it:

- Offers increased security but without the additional cost of installing Horizontal Cycle Lockers or Cycle Stores
- Can make efficient use of areas within the car park not otherwise used.

The disadvantages of cycle parking in car parks include that they:

- May not be sufficiently lit or covered, particularly an issue for medium or long stay parking
- May not be accessible to non-standard cycles and users of cycles as mobility aids unless designed with adequate space.

Design requirements for cycle parking in car parks are set out below.

6.2.51 Cycle parking in car parks should be well signed, with signs provided conforming to ***TSRGD*** and ***Traffic Signs Manual***, likely to comprise the combination of ***TSRGD Diagram 968*** and ***TSRGD Diagram 968.1*** to denote a 'parking place for pedal cycles'.

6.2.52 Signage may be put in place that clearly denotes cycle parking allocated for non-standard cycles, for example, "Reserved for cargo and non-standard cycles. Priority to disabled cyclists".

See above guidance for dimensions and installation of Sheffield, M-profile and Two-tier stands.

6.3 Public transport integration

Importance of integration

The integration of cycling and other forms of transport provides a highly competitive (efficiency, time and cost saving) door to door alternative to the private car for medium to long distance trips. This adds flexibility to commuting journeys and significantly increases the catchment area for public transport relative to that for pedestrians.

People are more likely to cycle if the journey to and from the public transport facility is convenient and there is good, reliable provision of cycle parking or cycle carriage to allow them to continue their journey using public transport. The main types of interchange include:

- **Cycle and Ride** – Cycling to or from public transport where secure cycle parking is provided. The cycle is left at this location and public transport is used for the remainder of the journey
- **Cycle Carriage** – Cycling to an interchange point and travelling with the cycle on the public transport service and using it at the other end to continue the journey
- **Public Cycle Hire** – Utilising cycle hire facilities at the public transport nodes to link journeys.

It is essential that the correct type of cycle parking is based on user needs and duration of stay and supplemented with routes to and from transport interchanges that are highly visible and prioritised. As outlined in Section 6.2, cycle parking at transport interchanges should be fit for purpose, suitably located and visible to promote cycle use ahead of private car use.

As well as public transport, cycling can also be integrated with car club provision.

Cycle and ride

Cycle and Ride facilities should be highly visible formalised parking areas at or near to public transport interchanges. To provide a facility that will be successful, the location of the Cycle and Ride site and the type of facilities to be provided need to be carefully planned to help promote cycle integration.

In order to maximise the use of Cycle and Ride facilities they should be located at sites where:

- The public transport interchange is within convenient cycling distance of travellers' trip origins, and intercepts known commuting routes
- An integrated journey is more attractive than completing the full trip by cycling. Integrating public transport and cycling should therefore be aimed at medium/ long distance trips
- The journey from trip origin to the Cycle and Ride facility should be safe, convenient and attractive to use.

Cycle carriage

Not all cycle users wish to leave their cycle at the public transport interchange. Some users may require their cycle at the other end of the public transport link for their onward journey, for example, those who use their cycle as a mobility aid.

An understanding of existing and potential cycle carriage capacity on the public transport network is therefore important when planning an integrated cycle network, and engagement with rail and bus operators should be sought.

A variety of systems are used to carry cycles on trains. These include dedicated storage space in carriages with modified seating arrangements, or dedicated carriages such as those operating on the West Highland Line.

Where specific carriages or doors should be used for accessing cycle storage, these should be clearly signed, and signs placed consistently at the front and rear of train carriages.

Likewise, a variety of systems are used to carry cycles on buses and include rear mounted racks, in storage areas on longer haul routes, or by providing dedicated storage onboard such as that recently incorporated on a variety of bus services operated by Borders Buses (see Figure 6.7).

Providing information to passengers on how to use cycle carriage facilities will assist with the efficiency of public transport services.

Where cycle storage is provided it should not be at the cost of disabled access or seating. Both facilities should be provided separately where possible, and cycle storage should be designed to enable disabled users access.

Figure 6.7: Example of buses with cycle storage operating on Borders Buses services in Scottish Borders (photo by Borders Buses)

6.4 Public cycle hire

A public cycle hire scheme offers rental or free cycles in urban areas catering for a variety of short trips that can be used for daily mobility, including one-way-use or as part of the public transport system.

Cycle hire schemes are now well established in Scotland and there is clear demand for these schemes within the planning of urban cycle networks, providing access to functional cycles for those looking to make relatively short journeys while 'dressed for the destination' rather than the journey itself.

The common successful elements of cycle hire schemes are:

- A dense network of docking stations or virtual docking opportunities
- Stations located close to large trip attractors and connected by a safe, cohesive cycle network
- Flexibility in the offering of manual or electric cycles
- Enough urban space for expansion of cycle stations
- Pricing structure to maximise turnover of use and encourage short trips
- Smartcard and/or credit card payment system
- Strong management of distribution and maintenance.

Implementation and management responsibility for cycle hire schemes has often been through third party contracts and tied to advertising.

The flexibility offered by virtual docking opportunities (where cycles are locked internally by the user when their trip is finished, rather than locking to a fixed docking station) needs to be carefully balanced with the security of both the cycles and the safety of other users of the street.

To determine the appropriate level of provision and the likely infrastructure requirements, designers should consult with the relevant planning authority to consider the estimated demands, location and layout to fit the local circumstances.


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6.5 Active travel hubs

An Active Travel Hub provides a focal point for cycling and walking routes. The specifics of each Hub are tailored to the location and based upon need but will typically include cycle library initiatives/ cycle hire, safe and secure facilities for personal cycles, cycle repair/maintenance facilities, improved links to public transport, local path networks, travel information and associated outreach activity.

Funding is available to support the development of an Active Travel Hub via Transport Scotland's Low Carbon Travel and Transport Challenge Fund which is administered by the Energy Saving Trust.

An Active Travel Hub should be targeted at increasing the opportunities for walking, cycling and wheeling for functional journeys and connectivity with public transport as well as supporting the uptake of low carbon vehicles.

Furthermore, it is essential they complement any existing infrastructure and are located at convenient, safe and accessible sites in order to maximise use, impact and outcomes. Hubs may be located:

- At park and ride facilities
- At major employment and education centres – schools, colleges, universities
- Close to public transport facilities – ferry terminals, bus stations etc
- Within town centres
- At health and leisure centres
- Close to tenement buildings/flats where on-street charging may be problematic
- In socio-economic disadvantaged areas
- In areas intended to address local air quality problems
- In areas which address geographical travel and transport challenges
- At public sector organisation facilities (i.e. local authority fleets) amenable for general public use.

It is important that hubs address the wide and varied needs of potential users, including catering for mixed mobility needs.

An Active Travel Hub may also be integrated with a Low Carbon Transport Hub, which provide refuelling facilities for a range of alternative fuels and transport modes, for example, electric vehicle charging points, hydrogen refuelling stations and gas refuelling facilities or alternatively a single fuel type.

6.6 Other trip-end facilities

People who cycle to workplaces and other popular destinations should be provided with other high-quality end-of-trip facilities, that may include showers, lockers, drying rooms, ironing facilities, bicycle service/repair toolkits, active travel repair stations and e-bike charging facilities. These can be just as important as cycle parking, making it a more attractive option for those amenable to travel by cycle.

Appropriate end-of-trip facilities can be determined as part of the development management process, i.e. assessed by the planning authority prior to a proposed development receiving planning approval, or when planning permission may be required when installing facilities retrospectively to an existing development. For new developments, these elements would likely form part of the supporting Transport Assessment and Travel Plan documents and would consider the potential contribution a development can make to sustainable travel, tailored to the circumstances of the development.

For existing facilities, the Scottish Government and Cycling Scotland offer advice and grants to employers and workplaces so they can develop similar facilities for their locations to encourage staff and visitors to cycle.

A package of co-ordinated measures will be more effective in changing travel patterns than individual initiatives. Also, support and funding for capital projects that encourage staff and visitors to travel by cycle exist that could support the provision of facilities at existing sites.

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Appendix A: Design Review Template

Cycling by Design
Design Review Template

Meeting or exceeding the requirements set out in Cycling by Design is critical to ensure that future cycling infrastructure provides a high level of service and is attractive to all potential users.

To ensure this, each design should be subject to a Design Review, detailing how the design is able to provide a high level of service, or where certain Cycling by Design requirements cannot be met.

The Design Organisation should submit the Design Review to the Overseeing Organisation in this format or in a similar format that covers the key review questions raised for each chapter of Cycling by Design.

Project Title:	
Location:	
Date:	
Overseeing Organisation:	
Designer:	
Additional Details (optional):	

2.0 Planning for cycle users

Brief description of how the design contributes to the wider cycle network of the area.

Explain how the design contributes to a high level of service for cycle users. Where a high level of service cannot be met, please set out the reasons for this.

3.0 Cycle links

Explain how the design contributes to a high level of service for cycle users. Where a high level of service cannot be met, please set out the reasons for this and provide associated evidence.

The requirement(s) of Cycling by Design that were not able to be met in this chapter.

Clause (e.g. 4.2.2)	Clause Description

Why these requirement(s) were not met

Attempts made to meet these requirements

The resulting impacts on the project objectives

Users that have been excluded due to requirement(s) not being met, (e.g. novice, intermediate etc.)

How this can be mitigated

Safety issues that have been created due to requirement(s) not being met

How these can be mitigated

Accessibility issues created for cycle user or other users due to requirement(s) not being met

How these can be mitigated

Alternative actions that could be undertaken to enable these requirements to be met, (e.g. land acquisition or the closure of road traffic lane)

Who has the authority to implement these?

4.0 Crossings

Explain how the design contributes to a high level of service for cycle users. Where a high level of service cannot be met, please set out the reasons for this and provide associated evidence.

The requirement(s) of Cycling by Design that were not able to be met in this chapter.

Clause (e.g. 4.2.2)	Clause Description

Why these requirement(s) were not met

Attempts made to meet these requirements

The resulting impacts on the project objectives

Users that have been excluded due to requirement(s) not being met, (e.g. novice, intermediate etc.)

How this can be mitigated

Safety issues that have been created due to requirement(s) not being met

How these can be mitigated

Accessibility issues created for cycle user or other users due to requirement(s) not being met

How these can be mitigated

Alternative actions that could be undertaken to enable these requirements to be met, (e.g. land acquisition or the closure of road traffic lane)

Who has the authority to implement these?

5.0 Junctions

Explain how the design contributes to a high level of service for cycle users. Where a high level of service cannot be met, please set out the reasons for this and provide associated evidence.

The requirement(s) of Cycling by Design that were not able to be met in this chapter.

Clause (e.g. 4.2.2)	Clause Description

Why these requirement(s) were not met

Attempts made to meet these requirements

The resulting impacts on the project objectives

Users that have been excluded due to requirement(s) not being met, (e.g. novice, intermediate etc.)

How this can be mitigated

Safety issues that have been created due to requirement(s) not being met

How these can be mitigated

Accessibility issues created for cycle user or other users due to requirement(s) not being met

How these can be mitigated

Alternative actions that could be undertaken to enable these requirements to be met, (e.g. land acquisition or the closure of road traffic lane)

Who has the authority to implement these?

6.0 Trip end facilities

Explain how the design contributes to a high level of service for cycle users. Where a high level of service cannot be met, please set out the reasons for this and provide associated evidence.

The requirement(s) of Cycling by Design that were not able to be met in this chapter.

Clause (e.g. 4.2.2)	Clause Description

Why these requirement(s) were not met

Attempts made to meet these requirements

The resulting impacts on the project objectives

Users that have been excluded due to requirement(s) not being met, (e.g. novice, intermediate etc.)

How this can be mitigated

Safety issues that have been created due to requirement(s) not being met

How these can be mitigated

Accessibility issues created for cycle user or other users due to requirement(s) not being met

How these can be mitigated

Alternative actions that could be undertaken to enable these requirements to be met, (e.g. land acquisition or the closure of road traffic lane)

Who has the authority to implement these?

Signatories

Signature:	
Designer Name:	
Date:	

Signature:	
Overseeing Organisation:	
Date:	