2014 EDITION

# LONDON CYCLING DESIGN STANDARDS

MAYOR OF LONDON

TRANSPORT FOR LONDON
EVERY JOURNEY MATTERS

# Contents

The London Cycling Design Standards (LCDS) sets out requirements and guidance for the design of cycle-friendly streets and spaces. It should be used by those who shape the environment through planning and street design as well as engineers designing cycle-specific infrastructure.

LCDS forms one part of TfL's Streetscape Toolkit, and should be read in conjunction with the other constituent documents:

- Streetscape Guidance
- London Pedestrian Design Guidance
- Accessible Bus Stop Design Guidance
- Kerbside Loading Guidance
- Station Public Realm Urban Design Guidance

**Published by Transport for London, 2014**

# 1. Design requirements

This chapter provides an introduction to the design standards and a summary of key requirements.




**Version control**

Version 1 (Dec 2014) – Published

Version 2 (Sept 2016) – Minor amendments following publication of TSRGD (2016)

## 1.1 Raising standards

### 1.1.1 Introduction

The Mayor has set out his vision for cycling and his aim to make London a 'cyclised' city. Building high quality infrastructure to transform the experience of cycling in our city and to get more people cycling is one of several components in making this happen. This means delivering to consistently higher standards across London, learning from the design of successful, well used cycling infrastructure and improving substantially on what has been done before. It means planning for growth in cycling and making better, safer streets and places for all.

Last published in 2005, the revised London Cycling Design Standards (LCDS) sets out the approach needed in London to deliver this step-change in quality and to inform and reinforce borough plans and strategies for promoting cycling.

Now comprehensively updated to reflect established and emerging best practice, LCDS is a document that should shape design options and promote an integrated and ambitious approach to delivering high quality infrastructure for cycling in all parts of London.

### 1.1.2 Summary of requirements

LCDS identifies the design outcomes desired to deliver the ambitions of the The Mayor's Vision for Cycling (2013), reflecting the Mayor's Roads Task Force report, 'The vision and direction for London's streets and roads' (2013). It requires that all infrastructure delivered through TfL-funded programmes applies the following:

- **Guiding principles**, which help clarify how the Mayor's Vision for Cycling should be delivered
- **Levels of service**, which are ways of measuring the quality of design outcomes, both in terms of what they offer for cycling and what they contribute to places

**The requirements for cycling infrastructure proposals delivered through the Mayor's Vision for Cycling, are that they should:**

1. Demonstrate how the guiding principles have been reflected in design decisions

**2a.** Deliver the appropriate strategic level of service based on place characteristics as outlined in the Roads Task Force street types approach

**2b.** Meet the minimum standard expressed in the Cycling Level of Service (CLoS) assessment, and any further programme- or project-specific requirements

## 1.1.3 Using LCDS

London aspires to be a great cycling city. The application of the guiding principles set out in this document and rigorous attention to achieving higher service levels as a result of new infrastructure are central to this. Street types and the CLoS assessment give the ability to set standards flexibly but consistently.

Those planning and delivering cycling infrastructure are encouraged through this guidance to be bolder, to commit to making better, more attractive streets and spaces for cycling and walking and to experiment with temporary measures where necessary to prove that change is achievable.

The overall aim is to plan and deliver a London-wide network for cycling that meets with aspirations for infrastructure that is safe, comfortable, direct, coherent, attractive and adaptable.

LCDS consists of comprehensive guidance to support meeting those aspirations, and should be read and understood by all those involved in the design of infrastructure for cycling, including not only highway planners and engineers but all those who help shape the street environment. While it carries no legal obligation, any decision to depart from its advice should be accompanied by a reasoned justification for doing so and should be discussed and agreed with the relevant highway authority.

Figure 1.1 Structure of London Cycling Design Standards

**1 Design requirements**
- Good design outcomes for cycling
- Guiding principles
- Levels of service by street type

**2 Tools and techniques**
- Cycling Level of Service assessment
- Network planning
- Scheme delivery

**3 Cycle-friendly streets and spaces**
- Better places for everyone
- Understanding user needs
- Civilising streets

**4 Cycle lanes and tracks**

**5 Junctions and crossings**

**6 Signs and markings**

**7 Construction, including surfacing**

**8 Cycle parking**

## 1.1.4 Document structure

The first two chapters of LCDS cover general design requirements and techniques for planning and delivering high quality infrastructure. The procedures set out here should be applied in a way that is consistent and proportionate with the scale of intervention proposed. They are intended to help deliver the desired outcomes efficiently and to a high standard, rather than place unnecessary burdens on designers.

Chapter three covers user requirements for any place, and how those needs may be balanced to create civilised streets and better places for everyone. The remaining five chapters of LCDS consist of detailed design guidance to support the requirements and principles set out in chapter one.

## 1.1.5 Design outcomes

The six core design outcomes, which together describe what good design for cycling should achieve, are: Safety, Directness, Comfort, Coherence, Attractiveness and Adaptability.

These are based on international best practice and on an emerging consensus in London about aspects of that practice that we should adopt in the UK. They are important not just for cyclists but for all users of streets, public spaces, parks and watersides, where investment in cycling has the potential to improve the quality of place.

These design outcomes, illustrated in figure 1.2, contribute to broader concepts of placemaking, in particular the principles of good design set out in National Planning Practice Guidance (2013) and local design guidance such as TfL's Streetscape Guidance.

The future must not be like the past.
Even infrastructure designed with good intentions in mind can fail to provide a good level of service to cyclists, as the examples in figure 1.2 show.

Success will be measured by the quality of design outcomes. Improvement therefore needs to be focused on the cycling experience: how safe and comfortable it feels, how direct and attractive a journey is to cycle, and whether cycle routes are coherent and easy-to-follow.

Figure 1.2a Good design outcomes 1-3

### 1 - Safety

Good infrastructure should help to make cycling safer and address negative perceptions about safety, particularly when it comes to moving through junctions.

Space for cycling is important but a narrow advisory cycle lane next to a narrow general traffic lane and guard-rail at a busy junction is not an acceptable offer for cyclists.

### 2 - Directness

Routes must be logical and continuous, without unnecessary obstacles, delays and diversions, and planned holistically as part of a network.

This track works well on links but requires cyclists to give way at each side road. Cyclists often choose to stay on carriageway rather than take fragmented routes with built-in delay.

### 3 - Comfort

Riding surfaces for cycling, and transitions from one area to another, should be fit for purpose, smooth, well constructed and well maintained.

Uncomfortable transitions between on-and off-carriageway facilities are best avoided, particularly at locations where conflict with other road users is more likely.

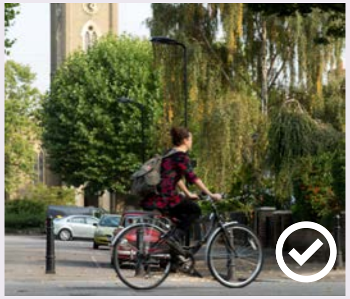
Figure 1.2b Good design outcomes 4-6

### 4 - Coherence

Infrastructure should be legible, intuitive, consistent, joined-up and inclusive. It should be usable and understandable by all users.

Neither cyclists nor pedestrians benefit from unintuitive arrangements that put cyclists in unexpected places away from the carriageway.

### 5 - Attractiveness



Infrastructure should not be ugly or add unnecessarily to street clutter. Well designed cycling infrastructure should enhance the urban realm.

Sometimes well-intentioned signs and markings for cycling are not only difficult and uncomfortable to use, but are also unattractive additions to the streetscape.

### 6 - Adaptability

Cycling infrastructure should be designed to accommodate users of all types of cycle, and an increasing numbers of users over time.

Where streets have been engineered primarily for use by motor vehicles, it is difficult to make infra-structure for cycling that is legible and adaptable.

## 1.1.6 Guiding principles

It will take consistent commitment to the quality and ambition of cycling infrastructure design to realise The Mayor's Vision for Cycling. The 20 guiding principles set out below are fundamental to that approach. Working through them can help practitioners to understand what it will take to deliver the Mayor's Vision. They are geared towards learning from what has been done well in the past and tackling the reasons why many previous attempts to deliver good cycling infrastructure have fallen short.

**REQUIREMENT 1:**

Consideration of the guiding principles should shape the design of any infrastructure delivered as part of the Mayor's Vision for Cycling. How they are applied will depend on site-specific conditions and on detailed design, but schemes should demonstrate that these issues have been taken seriously and have informed design decisions.

### 1. Cycling is now mass transport and must be treated as such

Most current cycle provision is squeezed into spare space or on the margins of roads. It reflects a belief, conscious or otherwise, that hardly anyone cycles, that cycling is unimportant and that cycles must take no meaningful space from more important road users, such as motor vehicles and pedestrians.

This no longer applies, especially in the centre. TfL's April 2013 cycling census found that 24 per cent of all rush-hour traffic in central London is cycles, and 16 per cent across the entire day, with shares of up to 64 per cent on some main roads. Similar shares apply in inner London.

New cycle facilities must be designed to cope not just with these existing levels of use, but with the future we are planning: of further increases in cycling in zones 1 and 2, and of existing inner-city cycling levels starting to spread to the suburbs.

### 2. Facilities must be designed for larger numbers of users

In an era of mass cycling, facilities designed for minimal cycling will not work.

Hundreds of cyclists an hour will be using many of the busier main road cycle tracks – sometimes already are. Tracks should ideally be 2 metres wide in each direction (4 metres for bidirectional tracks) to allow room to overtake. If this is not possible, faster cyclists will ignore them. This should be the rule, though there will have to be some exceptions.

People will cycle in growing numbers, whether other road users want them to or not. The only issue is whether we cater for them effectively – reducing the potential for conflict with others – or ineffectively.

### 3. Cycles must be treated as vehicles, not as pedestrians

Cyclists and pedestrians should not be forced together where there is space to keep them apart, creating unnecessary conflict which can only increase as the number of cyclists rises.

We have a strong preference against schemes requiring cyclists and pedestrians to share the same highway space, wherever they can be avoided. It will be necessary to use some shared areas in our cycle routes, particularly where the space is wide, but we will prefer to create delineated cycle tracks across it, perhaps with sloping, pedestrian-friendly kerbs or different surfacing.

Cyclists and pedestrians should not share the same space at crossings and junctions. Clearly-delineated separate and/or parallel routes should be provided for cyclists and pedestrians. Typical bad cycle design deals with junctions by making cyclists pretend to be pedestrians, bringing them on to the pavement and having them cross the road, often in several stages, on toucan crossings.

### 4. Cyclists need space separated from volume motor traffic

There are three ways of achieving this: full kerb segregation, semi-segregation and lower-traffic streets. Full kerb segregation is important and a major part of our plans. Most main roads in London are, however, also bus routes with frequent stops. The cycle lane would have to go between the bus and the pavement. Everybody getting off or on a bus would have to step straight into the lane, which would raise safety concerns both for bus passengers and cyclists. On bus routes where there is room, we will install segregated lanes with 'floating' bus stops on 'islands' in the carriageway to avoid bus passengers having to step straight off into the cycle lane. Where there is not room, we will use alternative forms of separation.

### 5. Where full segregation is not possible, semi-segregation may be the answer

Semi-segregation can take a number of forms, described in this document: wider shared bus and bike lanes, better separated from the traffic with means such as traffic wands in the roads, or mandatory cycle lanes, separated with traffic wands. We want to follow the example of US cities in using simpler, more flexible and cheaper forms of separation.

### 6. Separation can also be achieved by using lower-traffic streets.

Routes should make more use of secondary roads, where they are sufficiently direct, to separate cyclists from volume traffic. A cross-London network of high-quality guided 'Quietways' will be created on lower-traffic back streets. Nor is there any rule that Superhighways need be on the busiest main roads; one of the most successful current routes, CS3 in inner east London, is not. We will also mix the two, with stretches on back streets joined to segregated stretches on the main road and across junctions where there is no sufficiently direct side street.

### 7. Where integration with other road users is necessary, differences of speed, volume and vehicle type should be minimised

In the Dutch principles of sustainable safety, this idea is expressed as the 'homogeneity' of mass, speed and direction.

### 8. Cyclist interventions need not be attempted on every road

We have no intention of preventing cyclists from using any road, save motorways. But some busy, narrow main roads can never be made truly safe for cyclists, and there is little point trying if better alternative roads exist. In locations where a number of roads run parallel, consider designating different roads for different users.

### 9. Routes must flow

Routes must feel direct and logical. Users should not feel as if they are having to double back on themselves, or go the long way round. Unnecessary small obstacles and diversions should be removed. Chicanes and 'cyclist dismount' signs must be avoided. Currently, many routes appear deliberately designed to break the flow.

### 10. Routes must be intuitively understandable by all users

Cyclists – and other road users – must be in no doubt where the cycle route runs and where each different kind of user is supposed to be. This is partly about waymarking, which must be frequent, clear and reassuring, guiding users at every decision point and at some points in-between.

It is more, however, about design. Ambiguous or confusing designs, such as shared use footways, schemes where the cycle route disappears, or schemes which funnel cyclists unexpectedly into the path of other traffic, should be avoided.

### 11. Provision must be consistent and routes must be planned as a network

The worst routes tend to be the result of small, piecemeal interventions made in an unconnected way. Ideally, schemes should be designed on a whole-route basis, integrated with what you want to do for all users on the street. Even without this, strenuous efforts should be made to avoid inconsistent provision, such as a track going from the road to the pavement and then back on to the road, or a track which suddenly vanishes.

Cycle facilities must join together, or join other things together. Routes should be planned holistically as part of a network. Isolated stretches of route are of little value.

### 12. Routes and schemes must take account of how users actually behave. If they do not, they will be ignored

They should respect people's wishes to take the most direct route. There is little point, for instance, in designing a cycle route through a road junction that requires cyclists to perform convoluted movements or wait at multiple sets of crossings. If you do, they will simply carry on using the motor traffic route. There is little point in a route which takes cyclists too far out of the way to be useful.

The 'Cyclists dismount' sign is the infallible mark of a faulty cycle route. No-one wants to get off and walk. Either the sign will be disobeyed, or the route will simply not be used. If a route cannot be done without these signs, it should not be done at all.

### 13. Many of the standard tools currently used to manage cyclists' interactions with others do not work

Chicanes and the like restrict the usefulness and capacity of a route, block the passage of some types of bicycle, especially those used by disabled cyclists, and create unnecessary conflict with other users funnelled into the same small space. We certainly do not say that schemes should not tackle anti-social behaviour by cyclists, which annoys and frightens many people. But they must do so in ways more likely to succeed and to work for all parties.

### 14. Changes in road space can influence modal choice

Supply influences demand. Changing road space allocation can impact on modal choice, as is clear from the experience of bus lanes in London. Within the framework provided by the Roads Task Force street types, the network and route planning process should identify where the most benefit is to be gained from reallocating road space. This will help encourage more journeys by cycle and support planning for growing numbers of cycle users.

### 15. Trials can help achieve change

If there is dispute about the impact of a road change, we recommend trialling it with temporary materials. If it works, you can build it more permanently. If it does not, you can easily and quickly remove or change it. However, it is important that the scheme is got right at the beginning, to maximise the chances that it works.

### 16. Avoid over-complication and the 'materials trap'

Many UK road and public realm schemes, not just in cycling, waste large sums on over-specified but essentially cosmetic alterations. Cycling interventions need not be heavily engineered and costly. A lot of the best are simple and cheap – such as, for instance, using a small number of bollards to create an entire cycle-only space.

The amount of work on a route should be proportionate to the level of intervention proposed. There is no need to treat a light-touch backstreet route with the same level of design, consultation and intervention as a Superhighway on a busy main road.

### 17. But do not be afraid of capital infrastructure

Sometimes, investing in more substantial infrastructure is the only way to overcome a major barrier. This can make or break a route, so it is well worth exploring the value that a bridge or a tunnel, for example, might add to a route.

### 18. All designers of cycle schemes must experience the roads on a cycle

Ideally, all schemes would be designed by people who cycle regularly. But at a minimum, anyone who designs a scheme must travel through the area on a cycle to see how it feels. We strongly recommend that designers and engineers also try cycling on some existing facilities, to understand why they do or do not work.

### 19. As important as building a route itself is maintaining it properly afterwards

Road markings get dug up by utility contractors, ignored in repaints or just worn away; tarmac is allowed to crack and part; tracks and lanes are seldom or never swept, leaving them scattered with debris and broken glass. In winter, cycle lanes are usually the last place on the road or pavement to be cleared of snow and ice, if they are cleared at all. All lanes must be properly maintained and swept frequently for debris and broken glass. Route proposals must include a maintenance plan.

### 20. Know when to break these principles

Ideally, routes will be uninterruptedly excellent. In practice, where it is absolutely unavoidable, we will accept a short stretch of less good provision rather than jettison an entire route which is otherwise good. But we expect that this will be rare.

## 1.2 Levels of service for cycling

### 1.2.1 Responding to context

The design outcomes articulated in this document do not come in the form of 'cut-and-paste' layouts.

> The focus in delivering the Mayor's Vision for Cycling should be on the quality of the infrastructure delivered. This needs to be informed primarily by the context and by sensitivity to end users' needs.

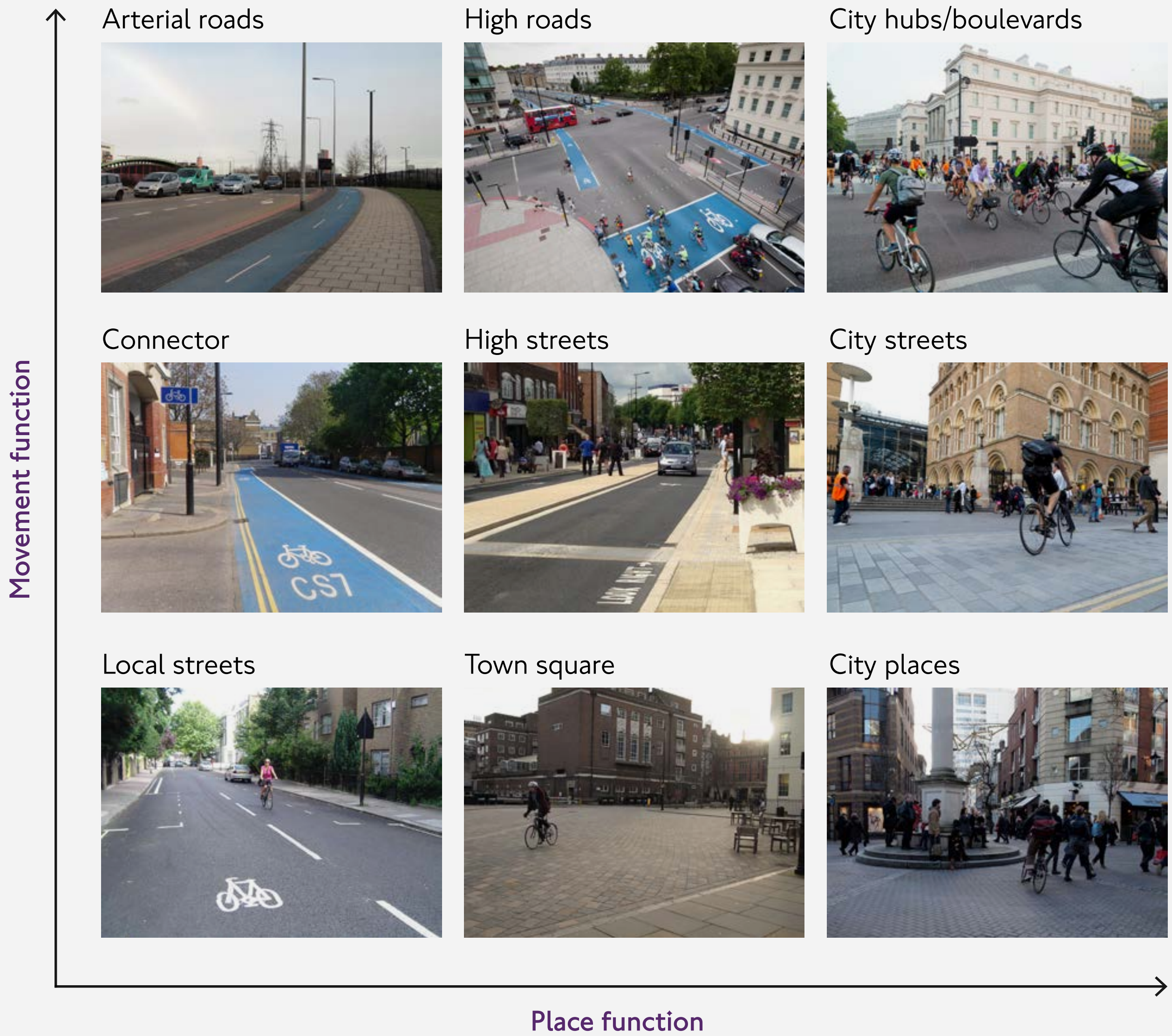
Two measures have been developed to define what a good level of service for cyclists means in practice. These articulate both a strategic and a local level of service.

### 1.2.2 Street types

The first measure focuses on place characteristics and arises from the Roads Task Force. This has established a framework of nine street types (see figure 1.3) designated according to the relative significance of movement and place within an area. 'Movement' is defined in terms of people (and goods), not vehicles, whereas 'place' captures activities on the highway and the relationship with frontages adjacent to the street.

The adoption of street types across neighbouring highway authorities will play an important role in providing a unified view on where best to apply different measures.

Figure 1.3 Cycling infrastructure that may typically feature in each street type



At a strategic level, street types serve in this guidance as a way of highlighting the place function of a street alongside its movement function. As outlined in section 4.1.4, place and users are the primary consideration – cycle-friendly interventions should not be dictated by the speed and volume of traffic alone.

Street types can therefore be used to frame improvements to support cycling and help determine the strategic level of service required, alongside other detailed place and user considerations.

**REQUIREMENT 2a:**

Proposals for interventions to support cycling should refer to the RTF street types. They should demonstrate that the provision made for cycling is appropriate for the place and its users, referring where necessary to the indicative ranges set out in figure 1.4.

## Development of the street type methodology

Street types classify the function of a location on the highway. A street's performance can be improved by implementing measures to better meet its functional requirement.

In locations with a higher place function, such as a town square, scheme design might focus on how cycling can help to bring people into a space to dwell and how general traffic might be calmed to make the place more inviting still. This might be more important for local high streets and squares than for city streets and city places, where levels of pedestrian activity are likely to be high.

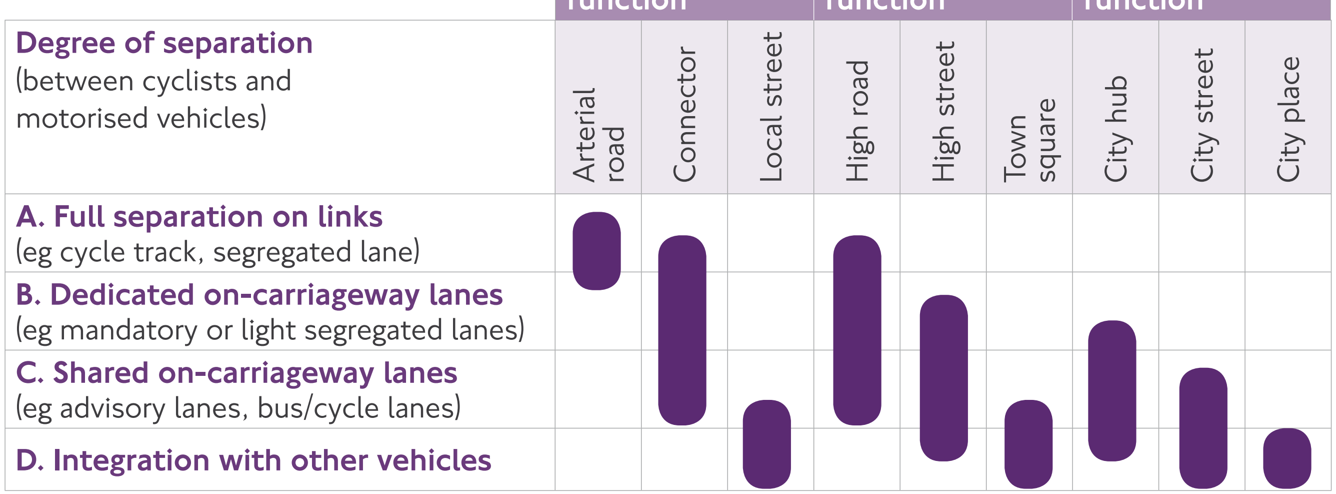
Where through-movement is dominant, design for cycling should address capacity and safety issues such as cycle priority, avoidance of delay and managing conflict with motorised vehicles.

TfL is developing a process that encourages agreement on street types with all relevant stakeholders. This process will be repeatable, consistent and transparent and involve officers from highway, planning and development control departments. A single view of the network will be approved by appropriate representatives for the highway authority and relevant London Council Committee members. Once approved, street types will be mapped and available for reference.

## Interventions for cycling

In figure 1.4, types of cycling intervention are categorised according to the 'degree of separation' they offer between cyclists and motor vehicles. Where the street has a higher movement function, improved level of service for cyclists can be achieved by greater user separation and by traffic calming measures. Further detail and guidance on degree of separation and different types of appropriate cycling provision are provided in chapter 4.

Figure 1.4 Indicative range of cycling interventions by RTF street type



While it is important to ensure that cycle intervention is appropriate for the street type, it is also important to provide continuity for cyclists along a route. A strategic overview of a route is required to ensure cycling provision is seamless across street type boundaries.

Mandatory cycle lane on a 'connector'

### 1.2.3 Cycling Level of Service assessment

The second level of service measure for cycling operates at a more detailed level. A Cycling Level of Service (CLoS) assessment has been developed in order to set a standard for the performance of cycling infrastructure for routes and schemes, and for individual junctions. The assessment is described in full in section 2.2.3. Its pupose is to frame discussion about design options so that schemes are appealing for existing cyclists and can entice new cyclists onto the network. It may be used on any scheme that has an impact on the street environment.

The assessment also provides an argument for how improvements for cycling could be made in stages, trialling new layouts or different forms of traffic management when it may be difficult to make the case for a permanent change. A closure to motorised vehicles, allowing filtered permeability for cyclists, may be a first stage of longer-term area improvements, making streets better, safer places for all. The first stage represents one intermediate level of service, the second a higher level.

**REQUIREMENT 2b:**

The CLoS assessment describes a level of service that all schemes should meet. This is based on existing policies and good design practice. Falling below the minimum standard on the critical factors triggers the need for reassessment of the scheme.

Staged improvements for cycling at Palatine Road, Hackney

## 1.3 Applying LCDS

### 1.3.1 Delivering high quality infrastucture

The test of success will be whether the infrastructure that is delivered is high quality and fit-for-purpose when built. It should achieve the six design outcomes – safe, direct, comfortable, coherent, attractive and adaptable – and be shown to attain the levels of service outlined in the previous section. This high standard will apply to the delivery programmes set in motion by the Mayor's Vision for Cycling and described in this section.

### Barclays Cycle Superhighways

Superhighways are cycle routes running from outer London into central London. They enable safer, faster and more direct cycle journeys into the city. Four have launched, including an extension of CS2 in November 2013, and a number of new routes are planned for opening by 2016.

The aim of Superhighways is to improve cycling conditions for people who already commute by cycle, and to encourage new cyclists, thereby contributing to the growth set out in the Mayor's Vision for Cycling.

Full segregation on CS2 extension

The Superhighways will be delivered to high standards. With the proviso that nothing must reduce cyclists' right to use any road, segregation will be favoured. Where it is not possible to separate with kerbs and where justified by traffic conditions, light segregation and wide, mandatory cycle lanes will be considered. Tackling junctions to provide safer and more comfortable conditions for cyclists is a priority, separating cyclists from other traffic in time and space.

Visualisation of the North-South route

### Mini-Hollands

The three outer London Mini-Hollands will see cycling interventions that will transform Enfield, Kingston-upon-Thames and Waltham Forest, and benefit other town centres as areas with exemplar facilities for cyclists. This will result in an uplift in safe cycling associated with excellent cycle facilities and public realm provision. The emphasis is on transformational infrastructure measures, and the programme is specifically targeted at capturing the potential for journeys by cycle to replace many journeys currently undertaken by private car.

## Quietways

Quietways will complement Superhighways by providing a network of cycling routes through less heavily trafficked streets in every London borough, joining up with off-carriageway routes where possible. Quietways will be direct, easy to follow and will be delivered end-to-end, not piecemeal. They are not principally aimed at existing fast, confident cyclists. They are aimed at new cyclists who want a safe, unthreatening experience.

Quietways will mostly be radial, from central London to the suburbs, with some orbital routes. They will be continuous, following cyclists desire lines. The vast majority will be on more lightly trafficked back streets, with some on canal towpaths or paths across parks and open spaces. At some points, for the sake of directness, Quietways may need to join main roads, but this should be kept as brief as possible. Where they have to join busier roads, or pass through busy, complicated junctions, segregation should be provided.

Quietways are low-intervention routes on links, with largely unsegregated cycling provision because they are on quieter streets. The main interventions on the vast majority of the network will be direction signing, surfacing improvements, removing barriers such as chicanes and improving the flow of the route. There may need to be some removal of parking, but this should be kept to a minimum.

The Greenway and Quietway programmes have been merged. Many Greenways, both existing and those now being delivered, will be used as part of the Quietway network. But not all Quietways will be Greenways – the majority of Quietways will be normal streets, not parks or canal towpaths.

Key principles for Quietways are as follows:

- Routes should be on the quietest available roads consistent with directness
- Routes should be as straight and direct as possible
- Routes should try to avoid unnecessary turns
- At some points, for the sake of directness, Quietways may need to join main roads, but this should be as brief as possible; where they have to join busier roads, or pass through busy, complicated junctions, segregation must be provided
- Routes should use the same road in both directions unless it is absolutely unavoidable; one-way streets should be made two-way for cyclists where this is possible
- Right turns in traffic, which require cyclists to filter into the middle of other vehicles, should be avoided wherever possible; right turns on quiet roads are acceptable
- Right turns which require cyclists to filter in busy traffic should always be avoided; if it is unavoidable, a short stretch of segregation or other road rearrangement should be provided
- Wayfinding will largely be on-carriageway, though signs will be necessary at some junctions
- Routes need to operate full-time; where routes are through parks that are closed at night, then an acceptable and sufficiently direct alternative night route, on similarly quiet roads, will need to be well signposted
- Partners should consider 'social safety' as a central and integral part of Quietway design and delivery; lighting and CCTV should be improved where necessary

## Better Junctions

The Mayor's Vision for Cycling includes a revised Better Junctions programme. Reflecting the commitment to make London's busiest junctions safer and more attractive for cyclists and other vulnerable road users, this will involve substantial improvements to 33 junctions across London. This includes locations on existing and proposed Cycle Superhighways.

## Other programmes

Improvements to infrastructure that can help support cycling are also made through the existing TLRN Regional Improvement Programme schemes undertaken by TfL and through Local Implementation Plan (LIP) schemes led by the boroughs and cities.

## 1.3.2 Trialling and innovation

This document also considers innovations currently being trialled, or planned for trial. These practices are not yet established but have great potential to broaden significantly the options we have for designing high quality infrastructure for cycling in the future. They include:

- Dedicated traffic signal infrastructure for cyclists; potential applications of low-level signals are described in section 5.4.3
- Continuous and intermittent forms of separation of cyclists from motor vehicles on links; content on kerb segregated and light segregated cycling facilities is provided in section 4.2




- Different ways of managing kerbside activity, including 'floating' parking, loading and bus stops on the offside of cycle lanes/tracks; sections 3.2, 4.2.6 and 4.3.10 cover these areas
- Ways of helping cyclists turn right from the nearside, without having to turn across lanes of moving motor traffic; two-stage right turns are described in section 5.4.7

## 1.3.3 Legal and policy context

Current policy on cycling in London is driven by the The Mayor's Vision for Cycling (2013) and by the Mayor's Transport Strategy (2010). The latter sets a target for increasing the mode share for cycling to 5 per cent of all journeys by 2026. This will represent a 400 per cent increase since 2001.

Figure 1.5 sets out other important documents that form the policy and strategy context for cycling infrastructure, as well as key legal and regulatory considerations. These should be applied in conjunction not only with LCDS but also local plans and relevant guidance, standards and strategies produced by the London boroughs and the Cities of London and Westminster.

In August 2013, the Prime Minister announced his ambition to increase cycling in England from 2-3 per cent of trips in England towards the levels achieved in certain other European countries. To achieve this, he challenged local authorities to raise the bar in designing and delivering cycle-friendly infrastructure to encourage many more people to try cycling.

As part of the same announcement, it was indicated that the Department for Transport may endorse the LCDS as good practice guidance for use by highway engineers across England.

The Network Management Duty requires local traffic authorities to manage their networks with a view to securing the expeditious movement of traffic on the authority's road network and facilitating the same for road networks for which the other authority is the traffic authority (so far as may be reasonably practicable having regard to their other obligations, policies and objectives). In this instance, 'traffic' is explicitly defined as including pedestrians, cyclists and motorised vehicles.

Figure 1.5 Selected legal and policy context for cycling in London

| Relevant policy context | Key aspects of legal and regulatory context |
|---|---|
| **London-wide**<br>• Mayor's Vision for Cycling (2013)<br>• The London Plan (2011) and draft Further Alterations (2014)<br>• Transport action plan: improving the health of Londoners (2014)<br>• Accessible London: achieving an inclusive environment SPG (2014)<br>• Cycle Safety Action Plan (2014)<br>• Roads Task Force report, 'The vision and direction for London's streets and roads' (2013)<br>• Mayor's Transport Strategy (2010)<br>• Cycle Security Plan (2010)<br>• Clearing London's Air (2010), the Mayor's strategy for improving air quality<br>• Tree and Woodland Framework for London (2005)<br><br>**National**<br>• National Planning Practice Guidance (2013)<br>• All Party Parliamentary Cycling Group (APPCG), Get Britain Cycling (2013)<br>• Local Transport Note LTN 2/08: Cycle Infrastructure Design (2008)<br>• Manual for Streets (2007) and Manual for Streets 2 (2010) | **TSRGD**<br>The Traffic Signs Regulations and General Directions (2016) set regulatory requirements for signs and road markings.<br>**Highways Act (1980)**<br>This Act places a statutory obligation on highway authorities to provide for the safe movement of people and goods.<br>**Traffic Management Act (2004)**<br>This gives additional responsibilities to local traffic authorities, particularly in relation to planning and co-ordination of works. It also places the Network Management Duty on local authorities.<br>**Health and Social Care Act (2012)**<br>This shifts more responsibilities onto local authorities and enables more direct links between health outcomes and local policies in areas such as transport.<br>**Crime and Disorder Act (2006)**<br>Section 17 places a general responsibility on local authorities to design out crime and to take account of community safety plans.<br>**Equality Act (2010)**<br>**Construction Design and Management regulations (2007)**<br>CDM sets out the need for practitioners to be adequately trained for the work they are doing. |

## Inclusive design and the Equality Act

The Equality Act (2010) requires authorities to make reasonable adjustments to remove barriers for disabled people. This applies to the street environment and to public transport services and covers disabled cyclists as well as pedestrians.

Cycles are often used as mobility aids or are used in combination with other mobility aids. Some disabled cyclists use non-standard cycles; some do not, but are not able to walk or carry their cycle, balance without support when static or dismount in a small space. Inclusive cycling design needs to be built into all schemes catering for all, from novices to long-distance cyclists.

Public bodies also have a legal obligation under the Equality Act (2010) to have due regard to the need to advance equality of opportunity between persons who share a relevant protected characteristic and persons who do not share it. In terms of this guidance, this means pursuing inclusive design for all streets and spaces, ensuring that everyone using these environments should be able to participate independently in everyday activities with confidence.

Where proposed interventions raise concerns about the impact on equality of opportunity, early engagement with relevant user groups and preparation of an Equality Impact Assessment (EqIA) are recommended.

Recumbent cycle user

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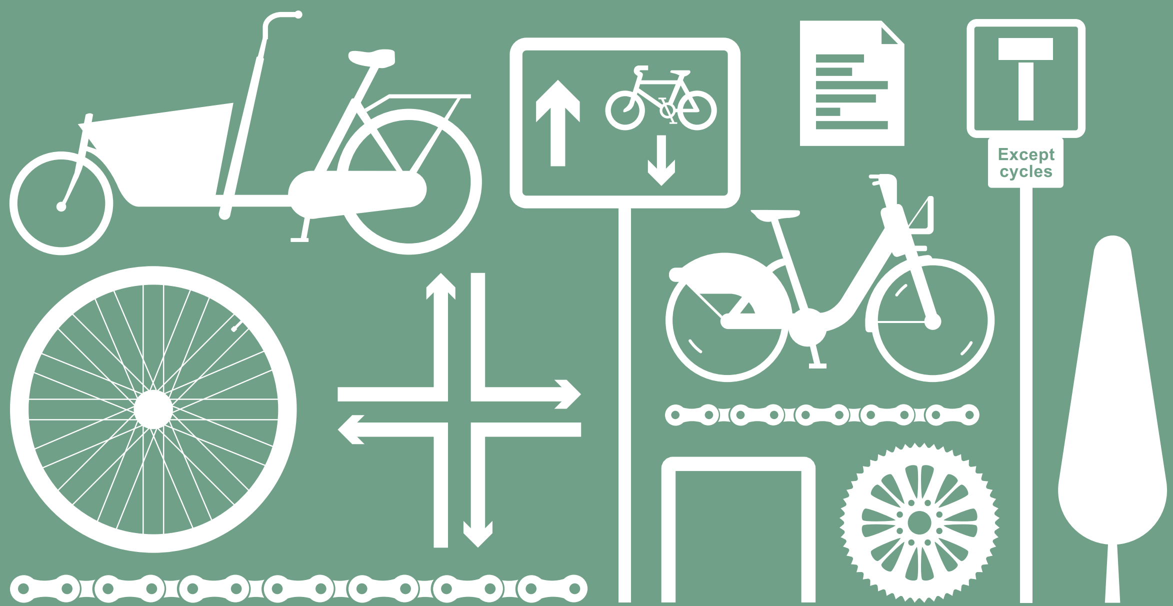
# 2. Tools and techniques

This chapter sets out network planning, route planning and implementation tools and techniques, showing how planning, design and delivery are related. All the tools described here are intended to serve the objective of efficiently delivering safer, more comfortable, direct, coherent, attractive and adaptable cycling infrastructure.




**Version control**

Version 1 (Dec 2014) – Published

Version 2 (Sept 2016) – Minor amendments following publication of TSRGD (2016)

# 2. Tools and techniques

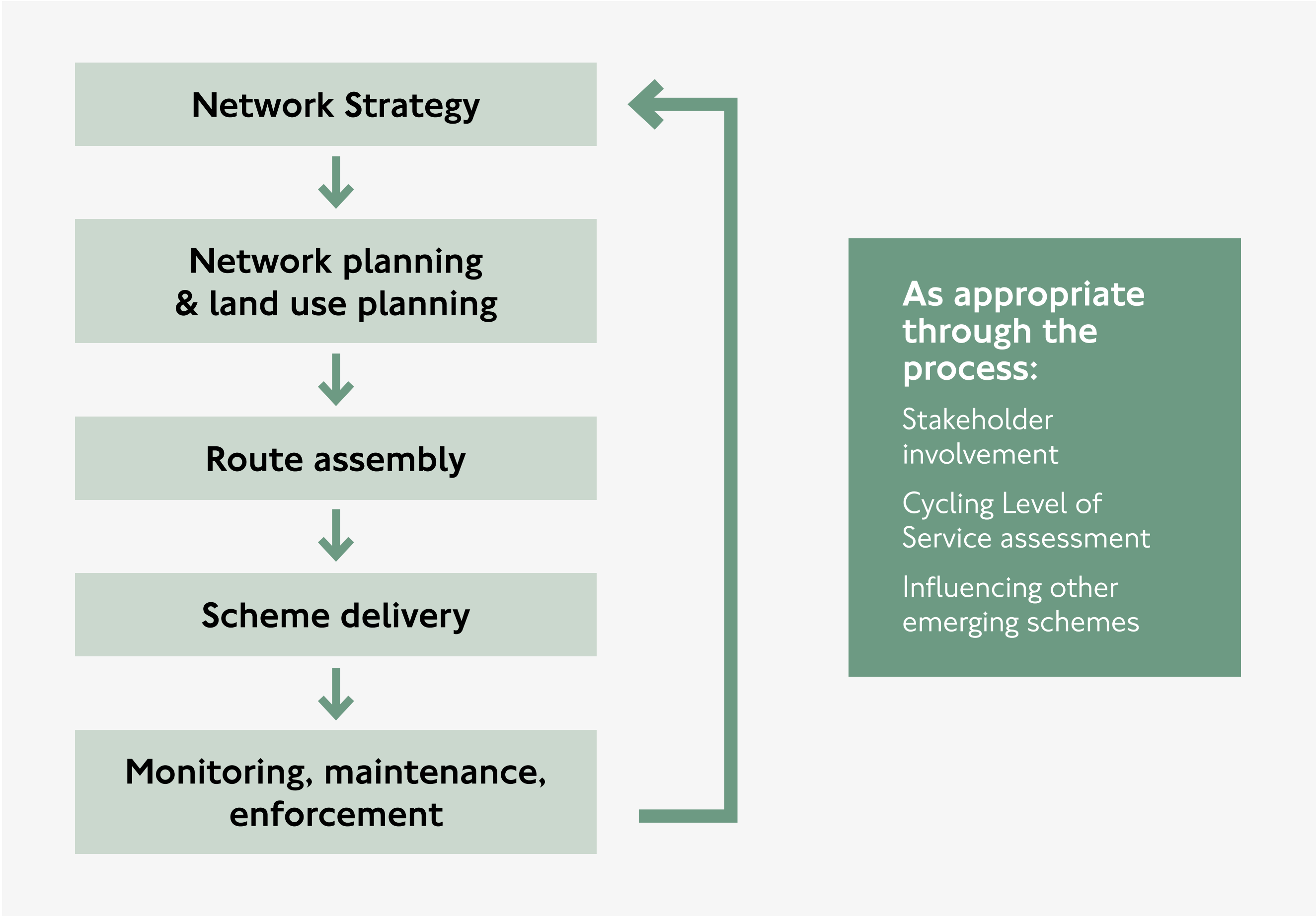
# 2.1 The Tube Network for the Bike

## 2.1.1 Overview of procedures

The level of route delivery planning, design and stakeholder involvement needs to be appropriate for the level of intervention proposed. Where there are limited changes to be made, as is likely for large stretches of Quietway routes, then a minimal approach should be taken and procedural demands should not be allowed to impede delivery.

The relationship between different techniques and procedures for a cycle route is shown in figure 2.1 below. The process for other, location-specific interventions will not involve route assembly but should still relate to network strategy and land use planning and should be tested through similar engagement and assessment procedures.

Figure 2.1 Overview of techniques and procedures for delivery of cycle infrastructure



## 2.1.2 London's cycling network strategy

The network strategy for London is the development of the 'Tube Network for the Bike' approach described in the Mayor's Vision for Cycling. Its application in London is geared to enabling more people to cycle more safely, mindful of the expected growth in numbers of cyclists. Routes and schemes that contribute to the network in outer London are aimed at transforming cycling in areas where numbers of cyclists may be low or stable but where there is great potential for further growth.

The elements that will add significantly to the network through the Mayor's Vision for Cycling are:

- **Cycle Superhighways**
  New Superhighways
  Upgrade of the four existing Superhighways
- **Quietways**
  Central London Grid
  New Quietways in inner and outer London
- **Mini-Hollands**
  Transformation of town centres and associated areas in three outer London boroughs: Enfield, Kingston-upon-Thames and Waltham Forest

New and improved infrastructure delivered beyond these programmes, whether or not it is conceived specifically to support cycling, can add further to borough networks and to the creation of a high quality network for cycling in London.

Different approaches have been planned for areas of different cycling potential. Area-wide infrastructure is appropriate for central London or specific outer London town centres, where there is a high density of potential and existing cycle journeys. Outside these urban centres, the cycling potential is less concentrated, so planned infrastructure will be adapted accordingly.

### Cycle Superhighways

The first four Superhighways brought about an average 77 per cent increase in cycling on the routes concerned – 30 per cent of those cycling trips are new or switched from another mode (TfL, Barclays Cycle Superhighways Evaluation Report, 2012). The contribution of the Cycle Superhighway programme to the overall network has been revised in light of the aspirations set out in the Mayor's Vision for Cycling. Cycle Superhighways in the new network will include upgraded versions of the existing routes and new routes.

The Cycle Superhighways programme has a large interface with the responsibilities of London boroughs and others. In some cases, the route is on borough-owned roads and there needs to be close working between TfL and the boroughs to obtain approvals and buy-in to any proposals. Even where TfL is the highway authority, boroughs should still be closely involved in the design process as the measures implemented are likely to have an impact beyond the TfL Road Network (TLRN) highway.

### Quietways

Assessment criteria for prioritising potential Quietways routes, including those that form part of the Central London Grid, are set out in figure 2.2. Routes should be assessed against these measures as far as possible before final route selection and detailed design.

Figure 2.2 Quietways route prioritisation criteria

### Network Prioritisation

- Contribution to a network – a geographical spread of routes that capture trip attractors and connect key points across London
- Deliverable along the entire length of a route over an agreed period
- Awareness of other schemes being delivered in the area that may influence phasing or impact the selected route

### Attractiveness

- Avoiding or treating significant collision hotspots
- Secure and offering a feeling of safety
- Accessible at all times, or with a suitable 'after-hours' alternative
- Having priority at junctions/intersections/crossings (ideally)
- Making use of streets with limited traffic access (ideally)

### Buildability

- Known significant outstanding land ownership, access issues or ecological issues
- With significant sections already to a good standard
- Limited requirement for signals work
- Practicality and cost effectiveness of any modification to junctions

### Directness and Cohesion

- Following cycle desire lines, public transport routes or routes used for short trips by car
- Connecting places of interest
- Minimising delays and avoiding unnecessary diversions (preferably using the same roads in each direction)
- Overcoming specific barriers to cycling, particularly at junctions
- Easy to navigate and homogeneous

### Traffic composition and impact to other users

- Minimising use of heavily trafficked roads
- With limited use by freight vehicles and other HGVs
- Having limited points of conflict with oncoming and crossing traffic, parked vehicles and loading bays
- Improving pedestrian facilities, if possible, and with the ability to manage movement through areas of heavy pedestrian use

### Political support

- With support in principle for the entire route from the managing authority, senior officer and/or relevant local authority Member
- With agreement on alignments and improvements secured between all boroughs involved

### 2.1.3 Stakeholder involvement

Stakeholder support and consultation throughout the process is important for schemes to be successful. To be meaningful, it needs to be conducted at times when it can positively influence outcomes without causing delay and can be done in a proportionate manner. Engagement of stakeholders at the start of a project can help avoid errors that would be harder and more costly to rectify at a later stage. Stakeholders can provide valuable information and local knowledge during route planning and scheme development.

Two distinct functions need to be considered: incorporating and responding to stakeholder interests, and keeping stakeholders informed of issues that affect their interests.

It is recommended that the following people and organisations are involved at a meaningful time in the design process:

- Ward councillors and highway authority
- Local cycle user groups and cycling organisations
- TfL, including modal specific representatives such as buses and taxis and private hire
- Local employers and other generators (or potential generators) of significant cyclist movement, such as higher education establishments and hospitals
- Freight industry representatives
- Local disability groups
- Groups with an interest in pedestrian accessibility
- Groups with an interest in inclusive cycling
- Metropolitan Police Service – specifically, traffic management officers
- Developers or landowners whose land may be affected or who may be asked to contribute to funding
- Residents, local amenity groups, conservation groups and English Heritage
- Schools and colleges

Conduct of an Equality Impact Assessment (EqIA) or Accessibility Audit can be a useful tool for engaging some of the above groups on issues around accessibility and improving the environment for people with protected characteristics under the Equality Act (2010). This includes cyclists and public and private transport users as well as pedestrians. Where schemes propose significant close interaction of pedestrians and cyclists – any proposal involving shared use, for example – an EqIA is recommended.

## 2.2 Cycling Level of Service assessment

### 2.2.1 Background

A Cycling Level of Service (CLoS) assessment has been developed in order to set a common standard for the performance of cycling infrastructure for routes and schemes, and for individual junctions. The purpose of the CLoS assessment is to frame discussion about design options so that schemes are appealing for existing cyclists and can entice new cyclists onto the network. It should be used on any scheme that has an impact on the street environment.

As it is focused on 'rideability' (the experience of cycling) and the performance of links and junctions CLoS does not differentiate between street types. Infrastructure appropriate to the street type is a prior consideration, although acceptable scoring ranges may need adjustment by street type according to how programme-specific requirements are defined.

CLoS builds on the knowledge of existing systems such as the CIHT Cycle Audit and Cycle Review, the London Cycling Campaign's User Quality Audit and 'Love London, Go Dutch' matrix and the Dutch 'Bicycle Balance' system. It does not replace any existing audit system such as the Road Safety Audit, Non Motorised User Audit or Cycle Audit. It is designed to raise issues already covered by regulatory and statutory documents rather than introducing new requirements and can be used in conjunction with toolkits such as PERS and FERS, the pedestrian and freight environment review systems.

The CLoS assessment provides an argument for how improvements for cycling could be made in stages. A closure to motor vehicles, allowing filtered permeability for cyclists, may be a first stage of meeting longer-term objectives for area improvements, making streets better, safer places for all. The first stage represents one intermediate level of service, the second a higher level.

## 2.2.2 When to assess

Anybody can undertake the CLoS assessment but highway authorities or consultants working within the industry are capable of giving extra quality assurance in using the tool. The assessment is designed to promote discussion, and should be balanced with the judgement of the engineer or planner involved.

The CLoS should fit into several stages of the lifecycle of a scheme:

- At planning stage, it could help to identify issues, frame objectives and quantify benefits arising from potential improvements to inform a business case (by using existing economic evaluation procedures) – this particularly refers to route assessment and route prioritisation
- At design brief stage, it could be used to give a baseline score for the existing conditions
- At a preliminary design stage, several feasibility options could be measured against each other and the differences used to inform discussion with stakeholders
- Post-completion, it could help ensure that maintenance of the route remains a priority

## 2.2.3 Scoring

CLoS is based on the six design outcomes of safety, directness, coherence, comfort, attractiveness and adaptability. It then breaks down each into specific factors.

At the next level of detail are indicators that can be used to measure performance against each factor. For example, the 'safety' element contains three factors: collision risk, feeling of safety and social safety.

CLoS focuses on environments that would entice new cyclists to switch journeys from other modes and maintain this modal shift for the long term.

As figure 2.3 shows, each indicator has a set of descriptions and score values – either 0, 1 or 2. The 'basic' level of service, or zero score, may trigger the need for improvement, but this depends on the overall context of the route and of the project.

Users are encouraged to set expectations that are ambitious while also being achievable.

> Zero scores should be considered as not meeting the required standard for programmes and projects funded under the Mayor's Vision for Cycling but there may be some latitude in exceptional circumstances.

Zero scores should generally be a prompt for examining whether the factor in question will have a negative impact on the propensity to cycle.

Certain factors also have 'critical' scores, which describe circumstances that should be a cause for particular concern. Clients and designers must address these as a priority, even if only to 'lift' them to a zero score as an interim measure – a scheme that registers as 'critical' on any one indicator has not met the required standard. To be given greater weighting in the scoring system, it is suggested that the 0, 1 or 2 scores should, for critical factors, be multiplied by three.

At the route planning stage, it is not likely that all factors can be measured. In this case, factors that are of greatest importance and relevance at the network level should be prioritised.

Figure 2.3 Cycling Level of Service assessment matrix (part 1)

| Factor | Indicator | Critical* | Basic CLoS *(score=0)* | Good CLoS *(score=1)* | Highest CLoS *(score=2)* | Score |
|---|---|---|---|---|---|---|
| **Safety** | | | | | | (48) |
| **Collision risk** | Left/right hook at junctions | Heavy streams of turning traffic cut across main cycling stream | Side road junctions frequent and/or untreated. Conflicting movements at major junctions not separated | Fewer side road junctions. Use of entry treatments. Conflicting movements on cycle routes are separated at major junctions | Side roads closed or footway is continuous. All conflicting streams separated at major junctions | |
| | Collision alongside or from behind | Nearside lane in range 3.2m to 4.0m | Cyclists in wide (4m+) nearside traffic lanes or cycle lanes less than 2m wide | Cyclists in dedicated cycle lanes at least 2m wide | Cyclists separated from motorised traffic | |
| | Kerbside activity or risk of collision with door | Cycle lanes <1.5m alongside parking / loading with no buffer | Frequent kerbside activity / effective width for cyclists of 1.5m | Less frequent kerbside activity / effective width for cyclists of 2m | No kerbside activity / No interaction with vehicles parking or loading | |
| | Other vehicle fails to give way or disobeys signals | | Poor visibility, no route continuity across junctions and unclear priority | Clear route continuity through junctions, good visibility, priority clear for all users, visual priority for cyclists across side roads | Cycle priority at signalised junctions; visual priority for cyclists across side roads | |
| **Feeling of safety** | Separation from heavy traffic | | Cyclists in general traffic lanes or cycle lanes less than 2m | Cycle lanes at least 2m wide | Cyclists physically separated from other traffic at junctions and on links, or no heavy freight | |
| | Speed of traffic (where cyclists are not separated) | 85th percentile greater than 30mph | 85th percentile greater than 25mph | 85th percentile 20-25mph | 85th percentile less than 20mph | |
| | Total volume of traffic (where cyclists are not separated) | >1,000 vehicles/ hour at peak | 500 - 1,000 vehicles / hour at peak (but becomes 'critical' if 5 per cent or more are HGVs) | 200 - 500 vehicles / hour at peak (but becomes 'basic' if 2 per cent or more are HGVs) | <200 vehicles / hour at peak | |
| | Interaction with HGVs | Frequent, close interaction | Frequent interaction | Occasional interaction | No interaction | |

Figure 2.3 Cycling Level of Service assessment matrix (part 2)

| Factor | Indicator | Critical* | Basic CLoS *(score=0)* | Good CLoS *(score=1)* | Highest CLoS *(score=2)* | Score |
|---|---|---|---|---|---|---|
| **Social safety** | Risk/fear of crime | | High risk: 'ambush spots', loitering, poor maintenance | Low risk: area is open, well designed and maintained | No fear of crime: high quality streetscene and pleasant interaction | |
| | Lighting | | Long stretches of darkness | Short stretches of darkness | Route lit thoroughly | |
| | Isolation | | Route passes far from other activity, for most of the day | Route close to activity, for all of the day | Route always overlooked | |
| | Impact of highway design on behaviour | | Layout encourages aggressive behaviour | Layout controls behaviour throughout | Layout encourages civilised behaviour: negotiation and forgiveness | |
| **Directness** | | | | | | (8) |
| **Journey time** | Ability to maintain own speed on links | | Cyclists travel at speed of slowest vehicle ahead (including other cyclists) | Cyclists can usually pass other vehicles (including cyclists) | Cyclists can always pass other vehicles | |
| | Delay to cyclists at junctions | | Journey time longer than motor vehicles | Journey time around the same as motor vehicles | Journey time less than motor vehicles | |
| **Value of time** | For cyclists compared to private car use (normal weather conditions) | | VOT greater than private car use value due to some site-specific factors | VOT equivalent to private car use value: similar delay-inducing factors and convenience | VOT less than private car use value due to attractive nature of route | |
| **Direct-ness** | Deviation of route (against straight line or nearest main road alternative) | | Deviation factor greater than 40 per cent | Deviation factor 20-40 per cent | Deviation factor less than 20 per cent | |

Figure 2.3 Cycling Level of Service assessment matrix (part 3)

| Factor | Indicator | Critical* | Basic CLoS *(score=0)* | Good CLoS *(score=1)* | Highest CLoS *(score=2)* | Score |
|---|---|---|---|---|---|---|
| **Coherence** | | | | | | (6) |
| **Connections** | Ability to join/leave route safely and easily | | Cyclists cannot connect to other routes without dismounting | Cyclists share connections with motor traffic | Cyclists have dedicated connections to other routes | |
| | Density of other routes | | Network density mesh width >400m | Network density mesh width 250-400m | Network density mesh width <250m | |
| **Wayfinding** | Signing | | Basic direction signing (cyclists follow road signs and markings) | Some cycle-specific direction signing | Consistent signing of range of routes and destinations at decision points | |
| **Comfort** | | | | | | (20) |
| **Surface quality** | Defects: non cycle friendly ironworks, raised/ sunken covers/gullies | Major defects | Many minor defects | Few minor defects | Smooth, high-grip surface | |
| **Surface material** | Construction | | Hand-laid asphalt or unstable blocks/sets | Machine laid asphalt concrete or HRA; smooth blocks | Machine laid asphalt concrete; smooth and firm blocks undisturbed by turning vehicles | |
| **Effective width without conflict** | Clear nearside space in secondary position or motor vehicle speed/ volume in primary position | Secondary: <1.5m<br>Primary: high motor vehicle flow | Secondary: 1.5m<br>Primary: medium motor vehicle flow | Secondary: 1.5-2.0m<br>Primary: low motor vehicle flow | Secondary: >2.0m<br>Primary: no overtaking by motor vehicles | |
| **Gradient** | Uphill gradient over 100m | | >5 per cent | 3-5 per cent | <3 per cent | |
| **Deflections** | Pinch points caused by horizontal deflections | | (Remaining) lane width <3.2m | (Remaining) lane width >4.0m or <3.0m (low motor vehicle flow) | Traffic is calmed so no need for horizontal deflections | |
| **Undulations** | Vertical deflections | | Round top humps | Sinusoidal humps | No vertical deflections | |

Figure 2.3 Cycling Level of Service assessment matrix (part 4)

| Factor | Indicator | Critical* | Basic CLoS *(score=0)* | Good CLoS *(score=1)* | Highest CLoS *(score=2)* | Score |
|---|---|---|---|---|---|---|
| **Attractiveness** | | | | | | (12) |
| **Impact on walking** | Pedestrian Comfort Level (PCL) | | Reduction in PCL to C, D or E | No impact on pedestrian provision or PCL never lower than B | Pedestrian provision enhanced by cycling provision or PCL A | |
| **Greening** | Green infrastructure or sustainable materials incorporated into design | | No greening element | Some greening elements | Full integration of greening elements | |
| **Air quality** | PM10 & NOX values referenced from concentration maps | | Medium to High | Low to Medium | Low | |
| **Noise pollution** | Noise level from recommended riding range | | >78DB | 65-78DB | <65DB | |
| **Minimise street clutter** | Signing required to support scheme layout | | Large amounts of regulatory signing to conform with complex layout | Moderate amount of signing, particularly around junctions | Minimal signing, eg for wayfinding purposes only | |
| **Secure cycle parking** | Ease of access to secure cycle parking on- and off-street | | No additional secure cycle parking | Minimum levels of cycle parking provided (ie to London Plan standards) | Cycle parking is provided to meet future demand and is of good quality and securely located | |

Figure 2.3 Cycling Level of Service assessment matrix (part 5)

| Factor | Indicator | Critical* | Basic CLoS *(score=0)* | Good CLoS *(score=1)* | Highest CLoS *(score=2)* | Score |
|---|---|---|---|---|---|---|
| **Adaptability** | | | | | | (6) |
| **Public transport inte-gration** | Smooth transition between modes or route continuity maintained through interchanges | | No consideration for cyclists within interchange area | Cycle route continuity maintained through interchange and some cycle parking available | Cycle route continuity maintained and secure cycle parking provided. Transport of cycles available. | |
| **Flexibility** | Facility can be expanded or layouts adopted within area constraints | | No adjustments are possible within constraints. Road works may require some closure | Links can be adjusted to meet demand but junctions are constrained by vehicle capacity limitations. Road works will not require closure; cycling will be maintained although route quality may be compromised to some extent | Layout can be adapted freely without constrain to meet demand or collision risk. Adjustments can be made to maintain full route quality when roadworks are present | |
| **Growth enabled** | Route matches predicted usage and has exceedence built into the design | | Provision does not match current levels of demand | Provision is matched to predicted demand flows | Provision has spare capacity for large increases in predicted cycle use | |
| **TOTAL (max 100)** | | | | | | (100) |

**For highlighted critical indicators, score is multiplied by 3 (basic = 0, good = 3, highest = 6)*



Changes to traffic management that deliver high levels of service for cyclists may be trialled, so that all users can assess the potential benefits – removal of through motor traffic in Narroway, Hackney and in Walthamstow Village

## 2.2.4 Involving users in assessment

User satisfaction surveys can be particularly useful for capturing some of the more subjective judgements in the assessment. It is important to make a clear connection between the needs of the local users and the reasons for making certain design decisions. As figure 2.3 shows, subjective safety – therefore the perception of risk – is a key factor in measuring the fitness-for-purpose of a cycling facility, even where the collision history of a location, for example, might indicate that the objectively measured risk is low.

The impact on walking is an important element in the assessment, even though it may not be directly linked to level of service for cyclists. A Pedestrian Comfort Assessment, as described in TfL's Pedestrian Comfort Guidance, should complement use of CLoS and provide a balanced analysis of impact on walking and cycling.

## 2.2.5 Junction assessment tool

As the Cycle Safety Action Plan (2014) describes, the most common cycle collision types tend to involve movements at or around junctions. A supplementary process for assessing junctions has therefore been developed to give a broader assessment of a given location, or in order to inform scoring of the collision risk criteria in the CLoS assessment.

Rather than going through the entire CLoS assessment for each possible movement of a cyclist through a junction, an estimation of potential conflict can be done through briefly assessing each of the potential movements in turn and marking them on a plan of the junction, as shown in figure 2.5. Each movement can be rated and marked on the plan according to how safely and comfortably it can be made by cyclists:

- Red – where conditions exist that are most likely to give rise to the most common collision types
- Amber – where the risk of those collisions has been reduced by design layout or traffic management interventions
- Green – where the potential for collisions has been removed entirely

'Green' should be taken to mean suitable for all cyclists; 'red' means suitable only for a minority of cyclists (and, even for them, it may be uncomfortable to make).

Any banned movements for cyclists should be shown in black with a cross at the end. Movements that can be made but would involve a particularly high level of risk to the cyclist should be noted with a red cross at the end. These are movements that most cycle trainers would advise against making.

## 2.2.6 Scoring junction assessments

To help in comparing options, a score can be given based on each movement: 0 for red, 1 for amber and 2 for green. In this way, a total can be generated for the junction, or even for individual routes through the junction (if it is the case that one route or movement for cyclists is a significantly higher priority than another).

The highest possible score for a crossroad junction would be 24 and for a T-junction 12.

In order to help assess junction movements, figure 2.4 suggests typical scenarios that might lead to a 'red', 'amber' or 'green' rating.


Dedicated cycle signals make this cross-movement 'green' for cyclists

Figure 2.4 Indicative criteria for scoring junction assessments

| Factors needing removal or mitigation | Possible improvements | Further improvements |
|---|---|---|
| **RED** | **AMBER** | **GREEN** |
| Heavy left turn movement with high HGV mix<br>Opposed right turns with general traffic accelerating quickly into opportunistic gaps<br>Left slip lane<br>Guard-railing<br>Large junction radii<br>High speed motor traffic through junction<br>Uphill gradients<br>Wide junction crossings<br>No clear nearside access<br>Multiple lanes | Entry treatment at side road junction<br>Continuation of lane across junction<br>Right-turn protected island<br>Tight corner radii; pinch points removed (avoiding nearside lane of 3.2-4.0m)<br>Bus lane of 3.0-3.2m or of 4.5m or more<br>2m wide central feeder lane<br>ASLs (preferably 5m+ deep)<br>Signal adjustments to cycle movements | Left turn ban for general traffic<br>Opposing right turn banned for general traffic<br>Physically protected turn<br>Left bypass of signals<br>Segregation of cycle movements using dedicated cycle signals<br>Raised tables<br>Area-wide speed limit/ reduction |

## 2.2.7 Example junction assessment

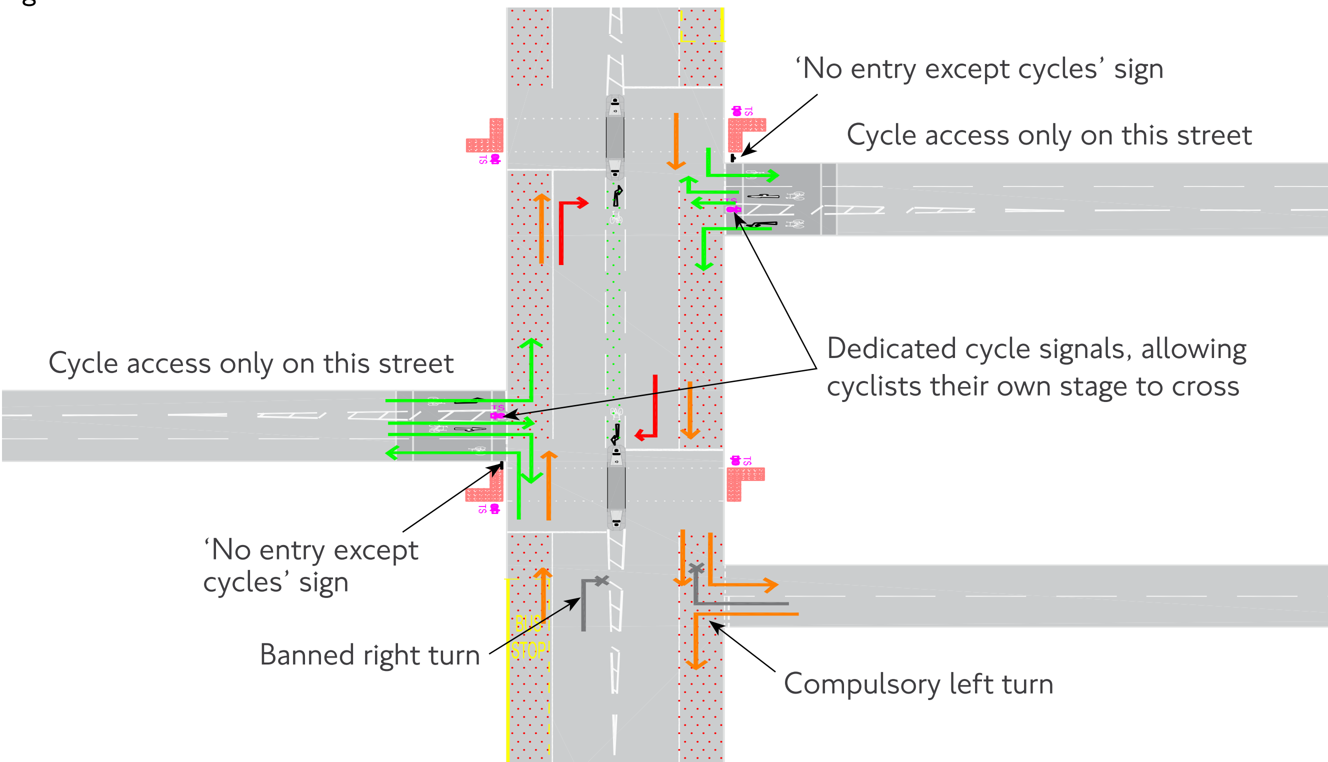
Figure 2.5 shows a busy high street crossed by a cycle route on offset side streets that are closed to motor vehicles.

Traffic signals hold general traffic on the high street in both directions to allow a separate stage for cycle movements only. Cycle movements out of the side streets are all shown with green arrows as they can take place unopposed during that stage.

- Cyclists on the high street turning right into either side street have to cross two lanes of general traffic and then look for a gap in a further two lanes of oncoming traffic. The presence of the right turn-pocket is helpful but without separation in time and space this movement is still difficult and should be marked as red
- Cyclists moving along the high street can do so within a bus lane and so this movement is shown as amber as they do not have to mix with the main traffic flow
- The other side street to the south has banned movements for all vehicles including cyclists and so this is shown as black with an x at the end
- The overall junction score is 24/40

For 'red' movements, one solution might be to enable the movement at a location away from the main point of potential conflict, but there may be many different ways of reconfiguring the junction to provide better and safer provision for cyclists (see chapter 5 for more details on junction design).

Figure 2.5 Junction assessment



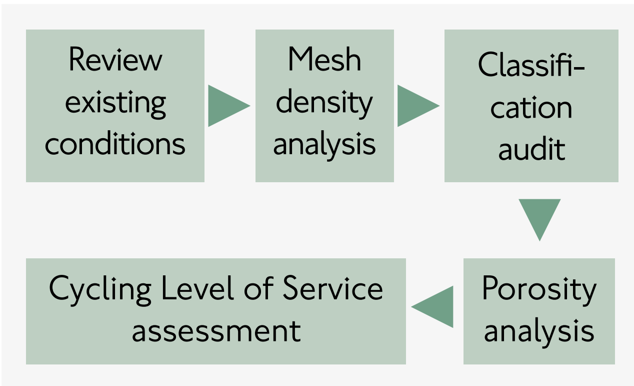
## 2.3 Developing a coherent cycle network

### 2.3.1 Five-step analysis

This section covers examples of techniques that can be used to help network planning. It is organised as a five-step analysis, summarised in figure 2.6, covering the full process for planning a network for cycling from the beginning. It takes into account urban form and land use as well as street types and route characteristics.

In reality, some of the network is likely to be in place (but may be in need of upgrading) and some of the analysis may already exist. The five steps are presented here as helpful techniques that can support the development of a coherent network, and can also be used in communicating the various attributes that a good network for cycling should contain.

Figure 2.6 Five-step analysis: planning a cycle network from the beginning




### 2.3.2 Review of existing conditions

Figure 2.7 shows a typical London street layout with a railway line, a canal, a park and different road classifications such as connectors, high roads, high streets, city streets, city places and local roads. These are suggested by the road thickness and frontages. Character buildings and major trip generators have also been highlighted. Proposals for cycling should reflect the character of an area and the movement and place functions of its streets. Cycling infrastructure should improve the quality of streets and so coherent network planning needs to be sensitive to its surroundings.

Overlaid on the street plan is a 400m by 400m grid: this is also the standard mesh density sought for cycle networks in central London, as referenced in the CLoS. The coloured lines show the existing cycle networks:

- The red route forms part of the national cycle network which spans the UK and, in some cases, joins up with the international EuroVelo network. It should be recognised that this network has a strategic importance and any changes to it could affect many users.

Figure 2.7 Existing context showing base network

- The blue routes shown are local routes that may well have been developed as part of the London Cycle Network programme and so may serve a strategic function as part of long-held desire lines for cyclists. Routes of this type can date back many years, may be best considered for future network adoption and often already feature cycle-friendly interventions.
- The green route shows a route along a canal towpath that may form part of the greenway network. This route is not suitable for cycling at a high speed, as it requires the courteous behaviour essential to sharing space with pedestrians. Still, canal towpaths can be part of the area cycle network, due to its attractive, traffic-free condition.

In any area the remnants of previously planned strategic cycle networks should be evident and these should be referenced on the base plan so that gaps or other failures can be assessed. It is important to view routes in context and incorporate cycling within the unique layout of the area without compromising strategic network considerations such as coherence and directness. At all stages of this process, it is also important to source up-to-date and accurate information.

### Method

- Briefly assess place characteristics: natural features, key constraints (eg waterways or railways, including bridging points), local centres, land uses, trip generators (see figure 2.17 for a fuller list)
- Identify key trip generators, active frontages, character buildings
- Classify roads based on RTF street types (or refer to street type maps where this work has already been done)
- Overlay existing cycle networks, including strategic and local routes

### Analysis

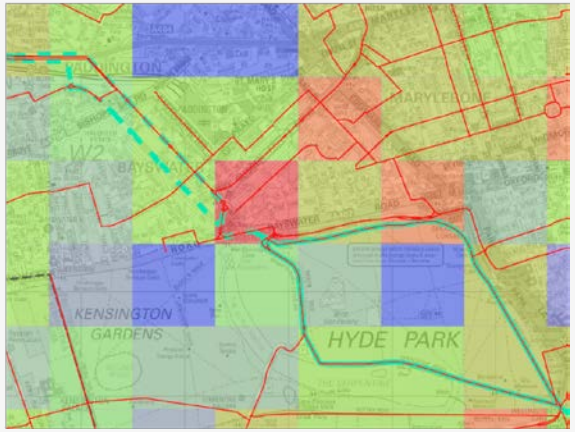
- Look for gaps in the existing cycle networks
- Look to see if cycling provision is appropriate for the RTF street type
- Look for desire lines between trip generators
- Identify character areas and heritage areas

## 2.3.3 Mesh density analysis

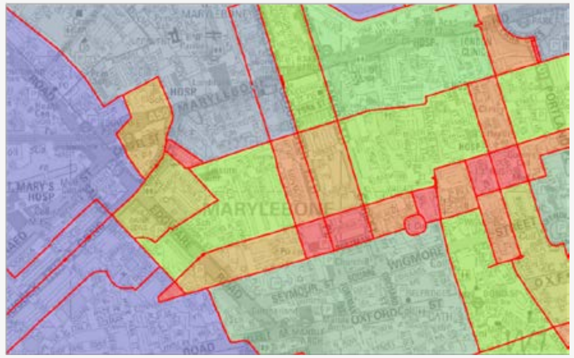
In a properly joined-up cycle network, cyclists should not have to travel more than 400 metres to get to a parallel route of similar quality. As referenced in CLoS, this attribute of a cycle network is known as 'mesh density': it describes whether the grid of cycle routes is tighter (with more route choice) or looser (less extensive).

Analysis of mesh density is best undertaken with GIS software and there are two main methods to follow (see figure 2.8). The first involves dividing the area into cells and measuring the length of

Figure 2.8 Heat map representation of the density




Cell example



Area bound example

cycle network in each cell. A 1km by 1km cell should have 4km of cycle network. The second method involves starting with the cycle network and its routes and measuring the size of the areas bounded by the routes.

An area of 160,000 square metres would be present inside a 400-metre by 400-metre mesh and so this can be used as the standard to measure against. Smaller areas should show as hotter on the heat map (reds and oranges) as there is more coverage than required and higher areas should show as cooler (blues) as there is not enough coverage.

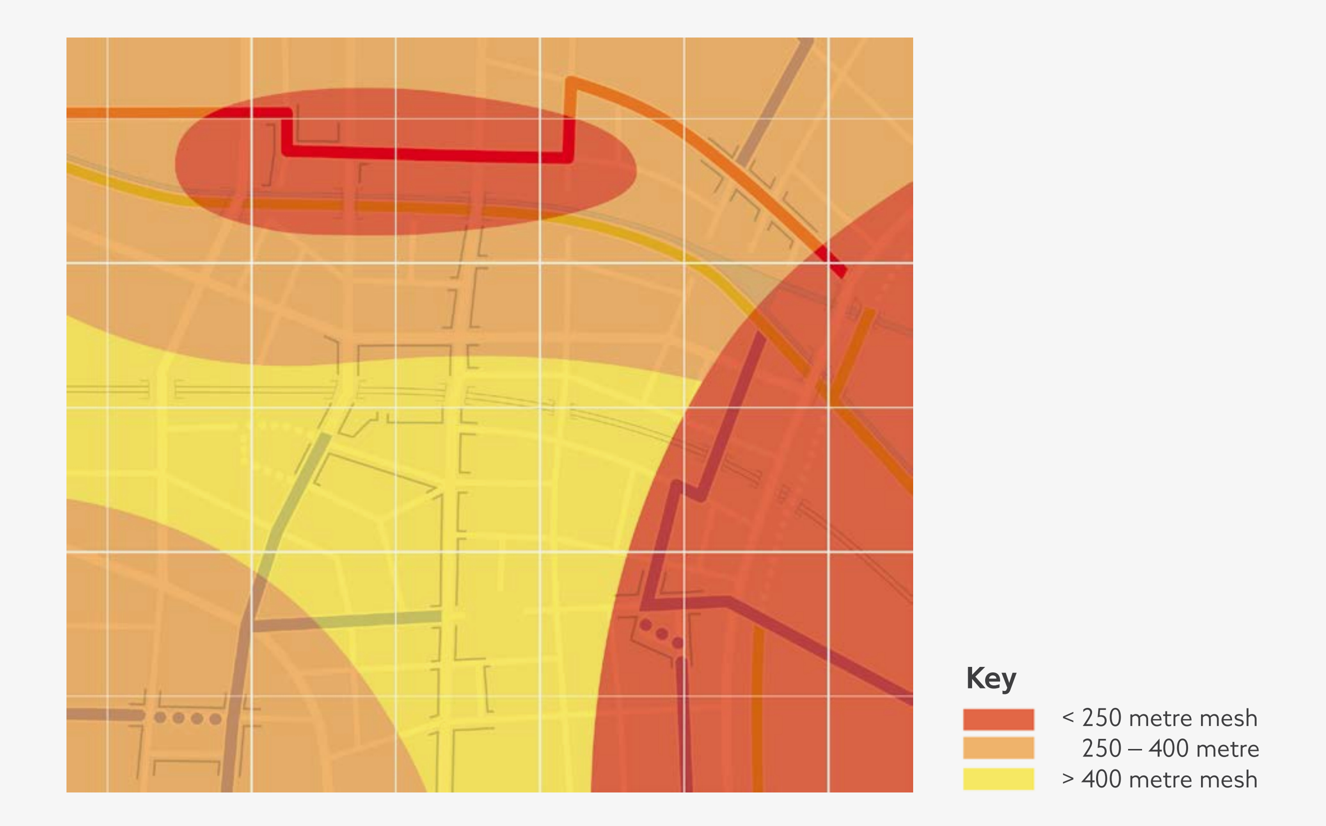
Sections of network that run across major barriers to cycling, such as major untreated junctions and gyratory systems, should not be counted in either method. Local authorities should use up-to-date information about the condition and extent of local networks.

Figure 2.9 shows a heat map representation of the density of routes in the study area. The analysis highlights in yellow the 'cooler' areas, with poorer cycle network coverage. The 'hotter' red areas have a higher mesh density: less distance between parallel routes. This type of analysis can be used to test the impact of planned interventions and can be run after networks have been extended to test even coverage.

## Method

- Assess cycle networks for major barriers
- Load existing cycle network data
- Overlay existing cycle networks, strategically planned and local routes
- Highlight bridges, natural features and constraints

Figure 2.9 Mesh density heat map




## Analysis

- Look for areas of low network coverage and identify potential route options
- Look for areas of high network coverage and identify most strategic alignments

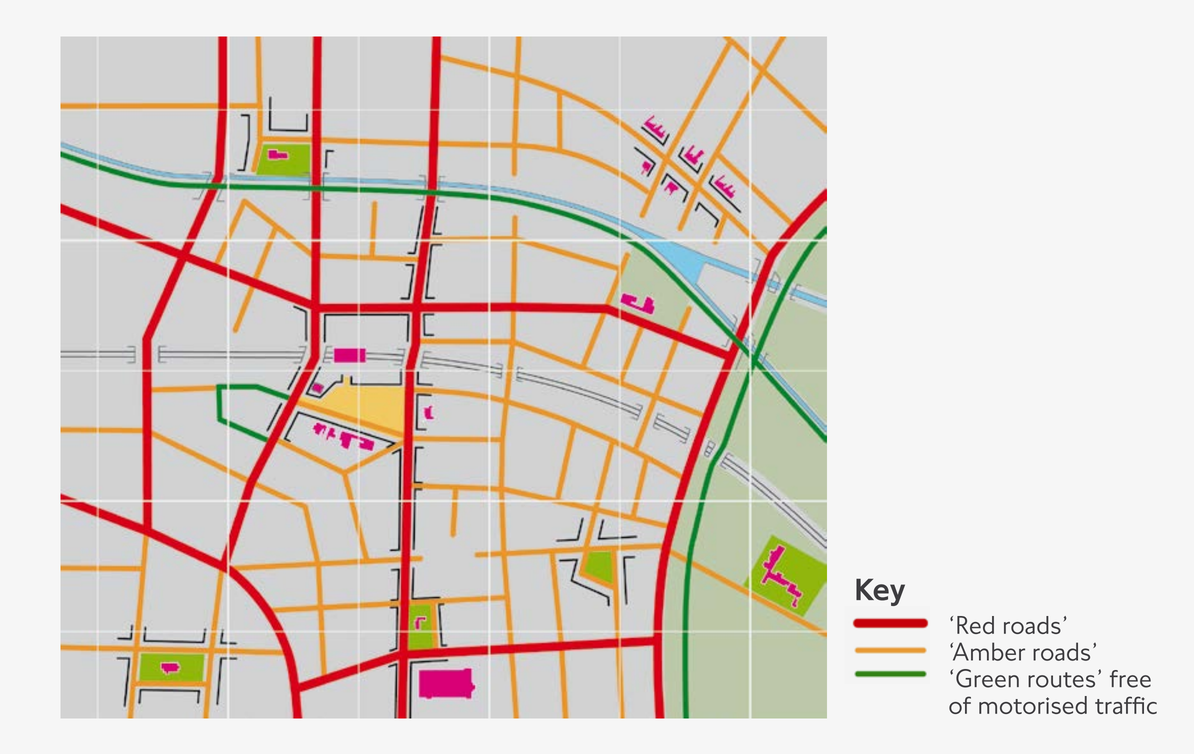
## 2.3.4 Accessibility classification

Figure 2.10 shows a reclassification of every road in the area based on the level of experience needed to ride it comfortably. Roads coloured red suggest a high level of confidence, 'amber roads' are cyclable in comfort by most cyclists and 'green routes' free of motorised traffic are suitable for cyclists of any age and experience.

The majority of London's roads are amber and so are rideable but certain 'red roads' can be intimidating for new cyclists and so it is important to identify these. Local knowledge and the input of cycle trainers within the authority should help identify the correct classifications. The main determinants are street types, speed and volume of traffic, mix of vehicle types and the extent to which cyclists are required to integrate with general traffic and perform manoeuvres whilst in traffic.

This red, amber and green approach can also be taken to assessing crossings in the area. The difference between red and amber crossings of 'red roads' is particularly important in network terms as cyclists tend to migrate towards the more comfortable crossing conditions. Local cycling stakeholders should be able to provide information about where these more comfortable crossings are located if resources are not available to do a full network audit. Ordnance Survey GIS systems also provide this data.

Figure 2.10 Accessibility classification of road network




### Method

- Assess all links on the network to determine level of experience needed to cycle in comfort
- Highlight comfortable 'amber' crossings of 'red roads'

### Analysis

- Look for potential new crossing sites, bearing in mind the benefits that can be secured for other users as well as cyclists (ensuring a balanced approach)
- Look for areas dominated by 'red roads' and consider interventions

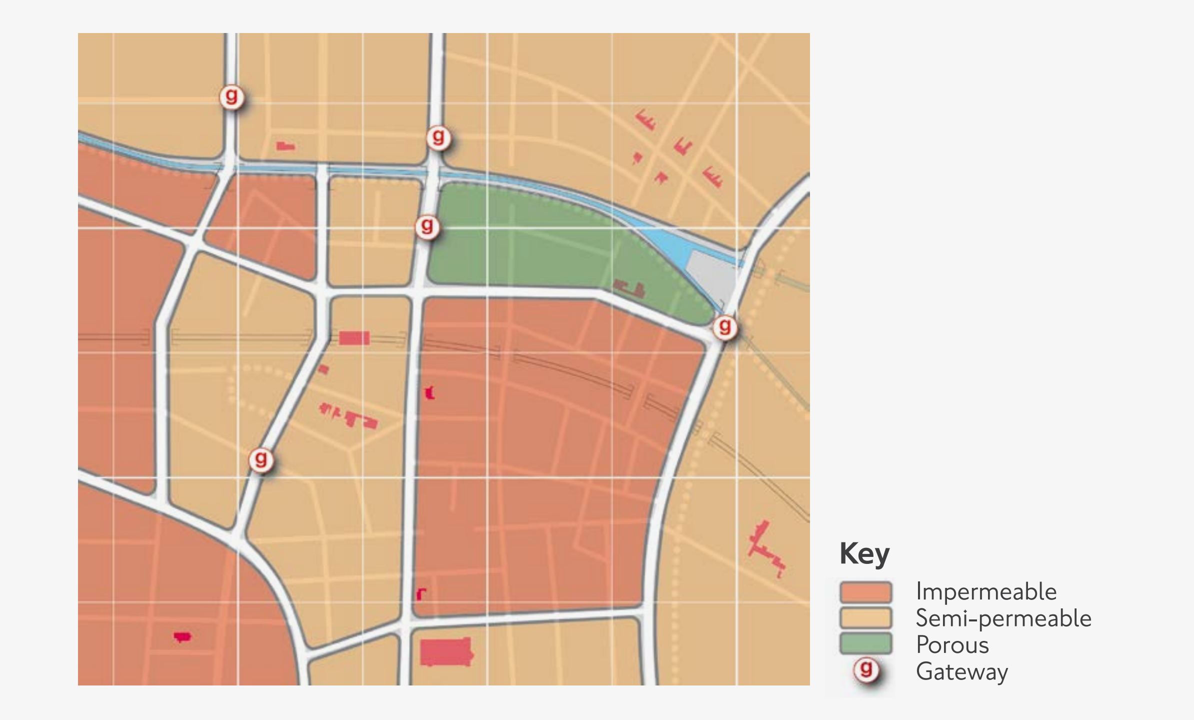
## 2.3.5 Area porosity analysis

Area porosity is a measure of how many places there are for cyclists to enter, pass through and leave an area comfortably. A location that is 'porous' is a space that cyclists can pass through with ease and comfort – usually a junction. If the porosity of an area is high, then overall it is very permeable for cyclists (but often less so for other vehicles).

Figure 2.11 shows areas bound by 'red roads'. Comfortable 'amber' crossings are shown as gateways as these effectively open up areas to less confident cyclists. The provision of a gateway crossing can enable many square kilometres of route options to be opened up and also serve as key navigational points across areas.

Where areas are bound by 'red roads' and have no gateways, then they are coloured red. Where they have one gateway they are coloured amber and where then have two they are coloured green. Rather than focussing on routes, this method shows the porosity of an area by highlighting different crossing options on different streets. This approach is particularly useful when planning routes to schools as it allows children and their parents to be clear about the standard of roads they will encounter and where key crossings are.

Figure 2.11 Area porosity analysis showing areas bound by primary roads and number of gateways




### Method

- Create areas bound by primary roads
- Gather information as to where the current comfortable 'amber' crossings and access points are
- Colour in bounded area based on the number of access points

### Analysis

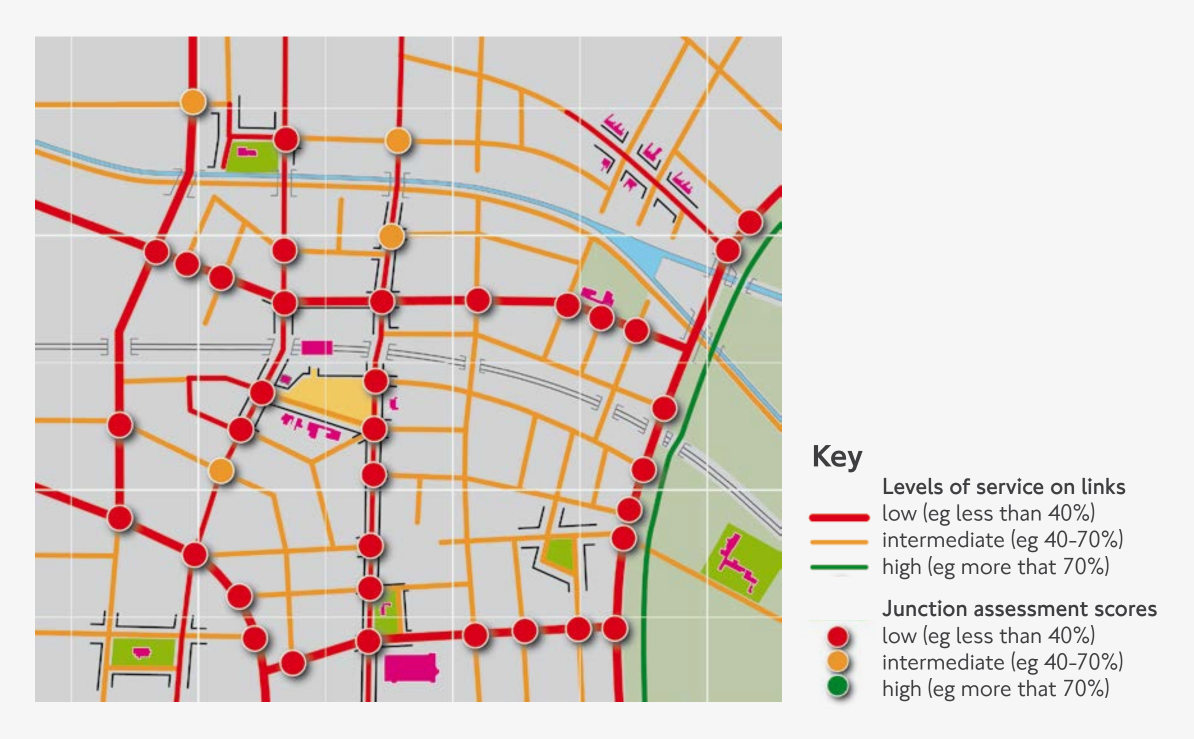
- Look for areas that are effectively cut off as they are bound by busy 'red roads'
- Assess where the likeliest new crossing can be provided into an area
- Identify where access is needed for maintenance (for vehicles carrying out maintenance works)
- Plan adjustments to networks to incorporate gateways, mindful of the directness design outcome

## 2.3.6 Cycling Level of Service audit

Figure 2.12 shows road classification based on the Cycling Level of Service, converting scores into red, amber and green categories. This takes time to complete in full but gives a comprehensive baseline of the rideability of the streets in an area. Routes that fall below the standards stipulated in the CLoS should be considered for upgrading or, if constraints are too great, then this approach can highlight alternative alignments. The colouring is likely to look similar to the accessibility classification system: this approach, based on the key design outcomes, adds a greater level of sophistication, should it be required.

Potential strategic routes in the chosen area may require substantial investment, which may need detailed justification. The junction assessment tool should be applied to all junctions along planned strategic network routes and where cycle routes pass across busier roads. If multiple roads are assessed, then the effect of area traffic management improvements can be measured against the established baseline. This method is the most time-consuming but helps collect vital information to underpin scheme prioritisation and area traffic network strategies.

Figure 2.12 Cycling Level of Service indicative ratings for network links and key nodes




### Method

- Use the CLoS and junction assessment tool to assess the area network or focus on particular established or planned strategic routes

### Analysis

- Look where best conditions are and assess whether these can be connected to form routes
- Assess potential for upgrading junctions to higher CLoS standards
- Assess the standard of existing network routes and look for potential improved alignments

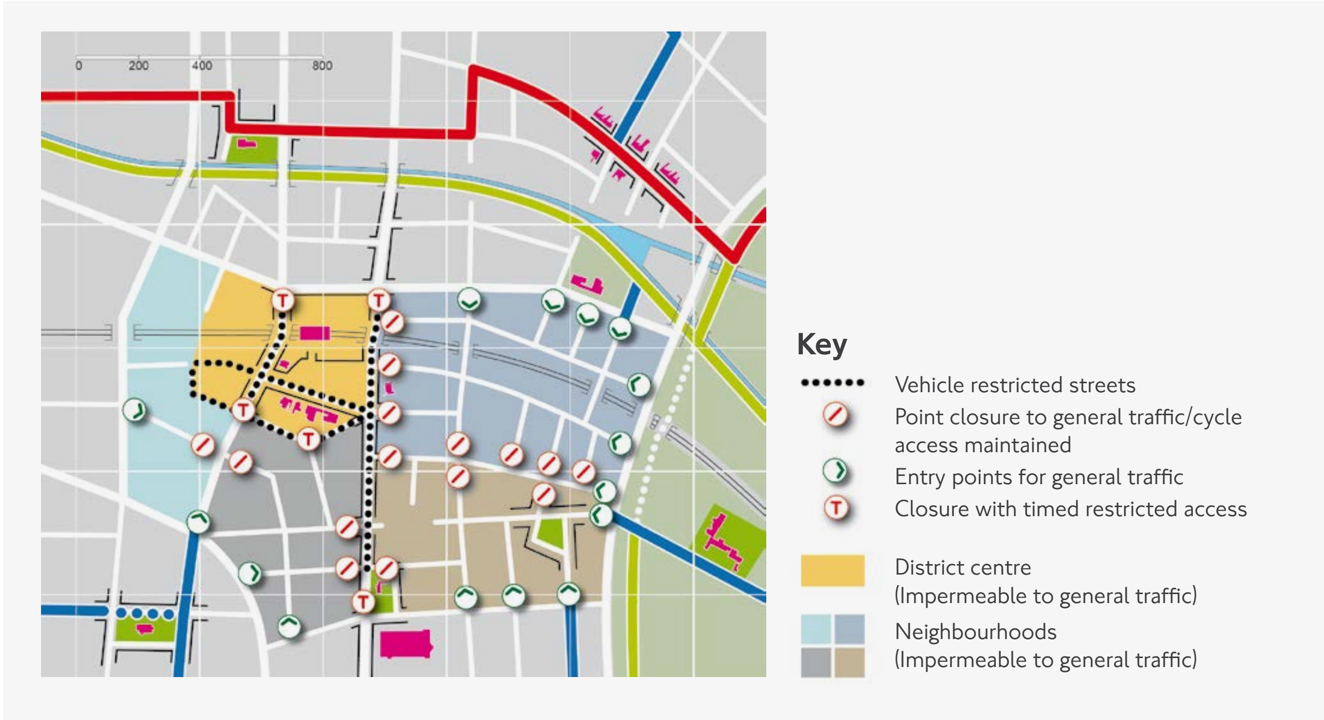
## 2.3.7 Example approaches to developing the network

These tools can help identify where interventions would make the whole area accessible to all cyclists. To develop this into a strategy, there are two main approaches: area-based and route-based. The examples below describe how the application of these strategic approaches may work in practice. In both cases, working through the detail involves engaging with the impact on all modes and considering existing on-street infrastructure and the potential for improving it for a broader range of users.

### Area approach – filtered permeability

Figure 2.13 shows a potential intervention that takes an area-based approach to improving conditions for cycling by removing through motor traffic in zoned areas around a traffic-free centre. Motorised traffic can enter and leave the zones but cannot pass between them without using the primary routes or alternative roads outside the zones. Cyclists can pass freely through motorised traffic restrictions between zones and so are favoured in terms of journey time and convenience. Residents benefit from removal of through-traffic and their homes can still be served by deliveries and parking. Most motorised vehicle movements will be made by residents themselves. The general level of traffic is reduced to such an extent that the CLoS scores are improved on all roads

Figure 2.13 Filtered permeability area treatment example




dramatically without the need for cycle-specific infrastructure. This is a bold approach but delivers a high level of service for cycling in a cost-effective manner.

The London Borough of Hackney has implemented this approach in certain areas and has the highest modal share for cycling in London. Other cities and towns have used features such as rivers and railway lines to divide areas into zones. If quick and easy access for pedestrians and cyclists is implemented across these barriers then these modes will flourish, while motorised traffic has to take longer, more circuitous routes.

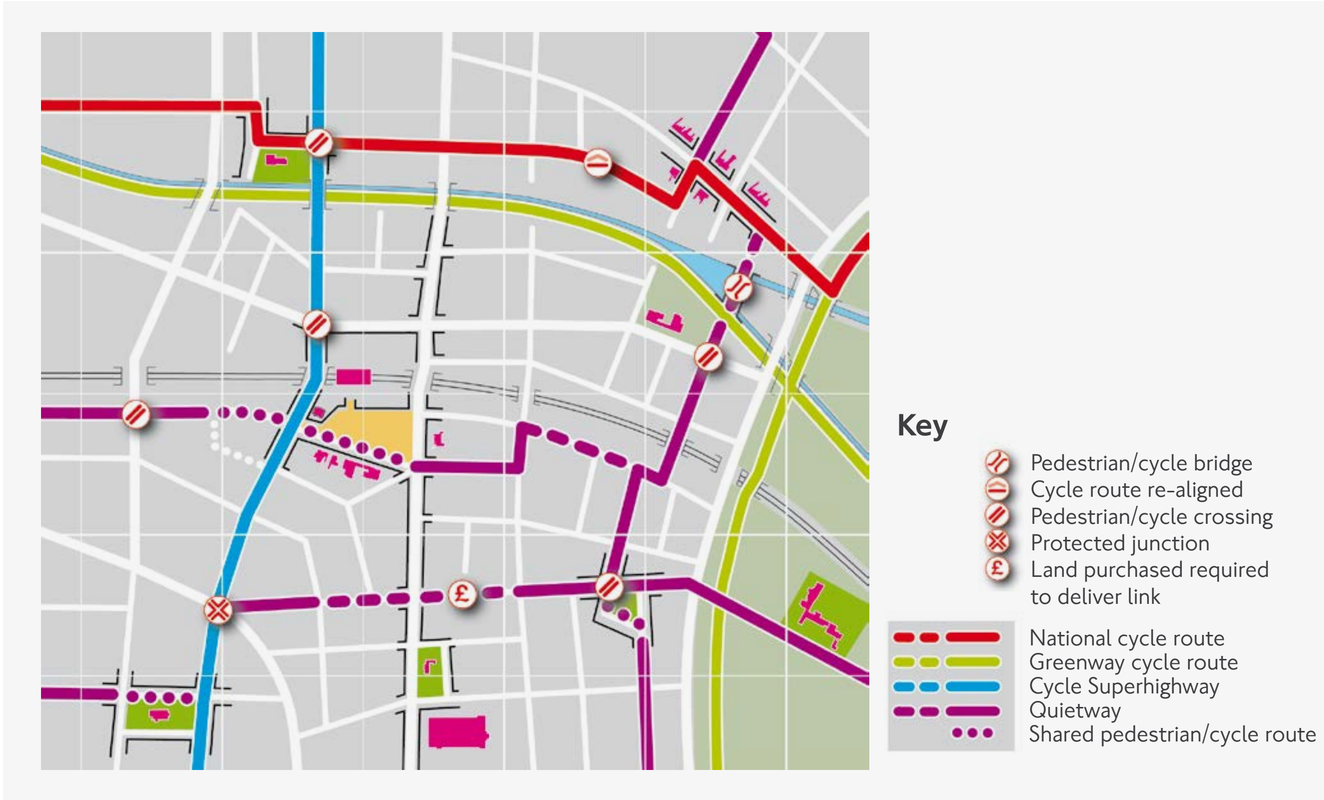
### Route option – network delivery

Figure 2.14 shows a route-based approach, where networks have been expanded, connected and revised based on the five-step analysis (summarised in figure 2.6). In the example below, major interventions such as a full junction redesign on a connector road where a Superhighway meets a Quietway have been proposed as well as a new bridge link allowing a Quietway to continue within the stipulated mesh density range. Acquisition of some private land has been suggested to the south-east of the town centre, enabling two Quietways to connect. New parallel 'amber' crossings have also been proposed to increase area porosity.

Some of the interventions are likely to be costly but justification can be made with reference to the five-step process. This presents a logical, best practice assessment of an area's cycling potential and clearly points out network deficiencies and potential improvements.

This process shows how city-wide cycle networks can be adjusted locally to reflect the character, constraints and opportunities of the surrounding area. Each local authority should incorporate these approaches into their area planning strategies and this should lead to the mainstream establishment of cycling as a viable mainstream transport option in line with the Mayor's Vision.

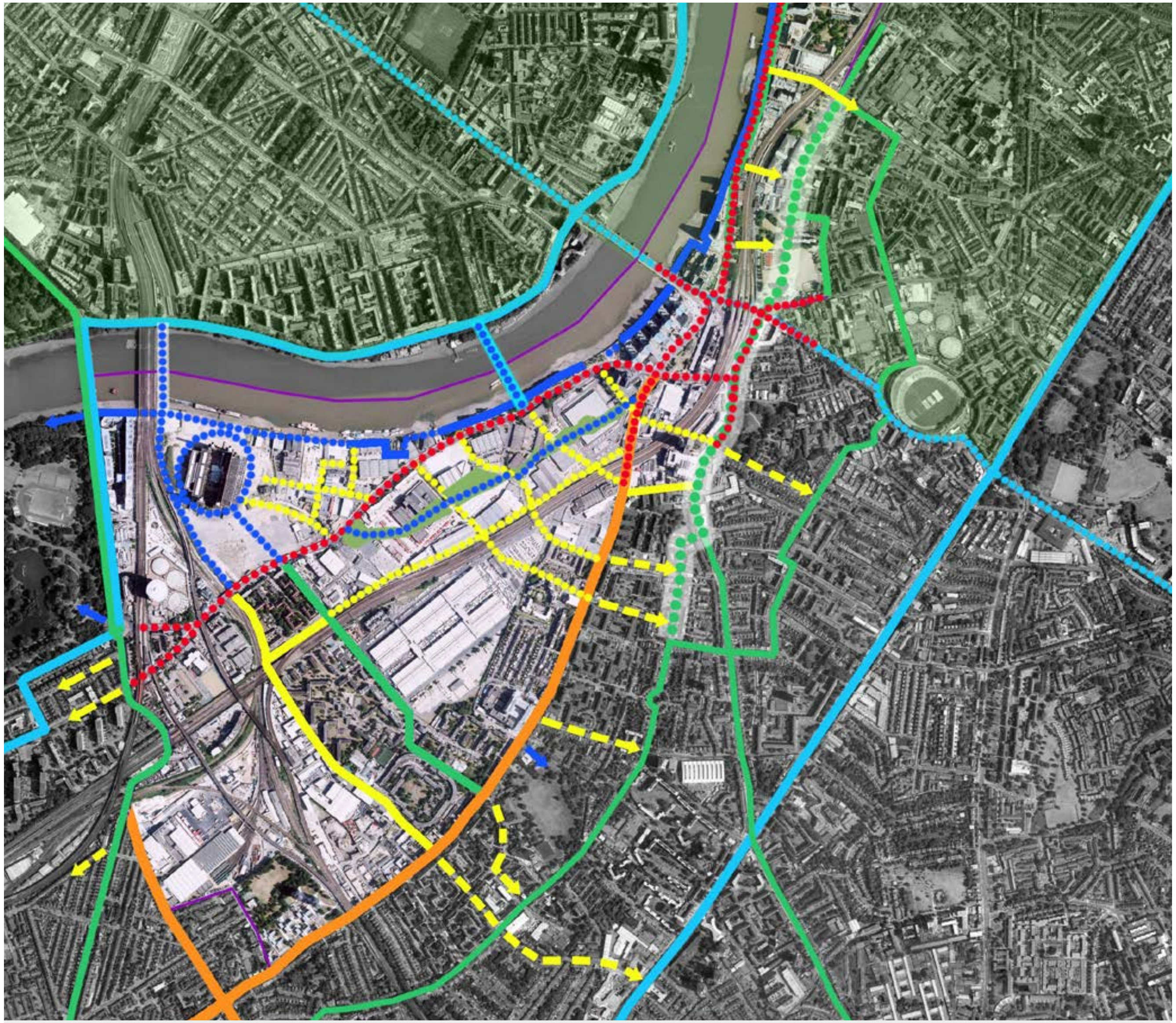
Figure 2.14 Network delivery route treatment example



## 2.3.8 Planning cycling into new development

The cycle network strategy should be an important influence on the planning of larger development areas and should be integrated into authority- and area-wide spatial planning frameworks as well being reflected in site-specific proposals. Figure 2.15 summarises how the cycling design outcomes might be addressed in these plans and strategies.

High quality cycling provision must be designed into all new development from the beginning. Typical problems in new developments include: the quality and quantity of cycle parking, a tendency to resort to shared infrastructure between pedestrians and cyclists, lack of coherence and connectivity of cycle lanes and tracks, and junctions that are not designed with all users in mind (with advanced stop lines as the sole provision for cyclists). It is recommended that high levels of cycling service are aimed for as key objectives for any development, and the advice in this guidance should generally be followed to achieve it.



Proposed cycle network for Nine Elms on the South Bank, showing a dense grid of cycle-friendly streets and spaces

Figure 2.15 Support for cycling in planning policies, strategies and site-specific proposals

| Strategic: planning and policy-making | Area-wide planning | Site specific (planning applications) |
|---|---|---|
| **Safety**<br>Commitments to reducing death and injury on London's streets, and to creating low speed environments. | Analysis of existing conditions for cyclists and pedestrians. Commitment to meeting design standards in improving provision. | Road Safety Audit, Non-Motorised User Audit or Quality Audit as part of Transport Assessment |
| **Directness**<br>Policy that prioritises sustainable forms of transport and supports accessible, legible, permeable urban form. | Analysis of the relationship between origins and destinations (schools, local centres, parks, homes, places of work), how cycling links will be provided between them and how all road user needs should be balanced. | Detail on proposed route(s), showing analysis of directness and likely delay for cyclists. Identification of barriers to be overcome by improving cycling provision. |
| **Comfort**<br>Linking air quality and environmental improvements to shifts from motorised forms of transport. | Requirements on level of service to be provided on identified routes. Evidence of responding to identified future demand for cycling. | Sufficient detail to allow analysis of effective width, gradient, deflections and capacity and surface quality. Should describe impacts on pedestrian comfort (using TfL's Pedestrian Comfort Guidance). |
| **Coherence**<br>Commitment to sustainable forms of development and good integration between transport modes. | A hierarchy of streets and routes that clearly shows a joined-up, legible network for cycling. | Details of how proposals contribute to the development of a coherent network in the wider area. |
| **Attractiveness**<br>Recognition of the benefits of more people walking and cycling and interventions that promote better places for all. Provision of good quality, well located, secure cycle parking to help support growth in cycling. | Design guidance or code that deals with public realm quality – for example, setting out indicative street types that clearly how show good provision for cyclists will be provided. This should include indicative locations and quantity of cycle parking. | Detailed proposals for materials, cycle parking, other street furniture, signage, landscaping, management arrangements and maintenance costs. |
| **Adaptability**<br>Provision for measuring and monitoring strategic outcomes on cycling (eg route use, vehicle volumes and speeds) to help adapt to changing contexts. | Implementation plan that allows (re)assessment of cycling provision during and beyond the various development phases. Consideration of how improvements to cycling and walking are to be funded, for example through CIL or S106. | Proposals that set out how cycling facilities operate with other uses and kerbside activity and how provision can respond to change in demand over time. |

## 2.3.9 Area-based proposals

The way cyclists move through the development and to likely destinations needs to be considered in masterplanning or in planning movement generally. Links should be made to networks in the wider area to ensure the neighbourhood is well-connected and people do not have to rely on a limited number of transport choices. Cycling and walking need to be attractive options for people as soon as they move in.

The right balance needs to be struck between prescription and flexibility when planning cycling infrastructure. When negotiating Section 106 contributions and Community Infrastructure Levy (CIL) from developments to help fund improvements to cycling in an area, it is better to describe the desired outcomes rather than specifying in the legal agreement exactly what must be built. Where Section 106 requirements and CILs are overly restrictive, they can be difficult to enact, or enacting them may have adverse consequences for cycling.

In an outline planning consent, there should be a commitment to providing dedicated cycling facilities, but some flexibility should remain about the type and exact location of cycling provision. Over-prescription at this stage could undermine attempts to design the most appropriate treatments once detail of street and building design becomes clearer. Setting out the strategy for cycling in an outline application is more important than the detail: ideally this should draw on an existing network strategy (see section 2.1).

New bridge at Rainham: making large areas more joined-up for cycling may well involve investing in new infrastructure

## 2.3.10 Planning applications

TfL's online Transport Assessment Guidance tool describes the purpose and content of transport assessments as part of the planning application process. This deals with areas such as pedestrian and cycle linkages, trip generation, modelling and impact.

It is important to establish at the transport assessment stage that access for cyclists to and through a development will be provided to a defined quality. This is likely not only to require the input of cycling officers to the development control process but also some local knowledge about the existing cycling network, which local stakeholders and cycling officers can help to provide. Applicants should use this to assess and map existing local provision and explore ways in which improvements could be made, to add value to their schemes.

Reference to the cycling level of service of existing streets in the vicinity of a new development, based on objective analysis, is recommended; applicants must not rely alone on route information provided by TfL cycle guide maps.

Through pre-application discussions, the application stage and enforcement, the planning process should ensure that proposals meet policy requirements, that they are fit for purpose for the proposed site and development, and that they are implemented as planned.

## 2.4 Scheme delivery

### 2.4.1 Scheme stages

The network planning stage provides a framework for assessing and prioritising routes in more detail. Once a route has been selected, the progress of a scheme involving substantial intervention will normally follow the stages shown in figure 2.16 right. Individual boroughs are likely to have their own delivery processes that reflect the outline provided below – the relevant borough guidance should be followed.

The full process set out here should include all necessary consultation, approvals, checks and audits. The six design outcomes – safety, comfort, directness, coherence, attractiveness and adaptability – should be used to frame scheme objectives, together with recognising the intended outcomes for other modes besides cycling.

### 2.4.2 Brief and feasibility

Figure 2.17 shows the type of information that could be assessed in order to inform design options in the feasibility stage. An assessment may have already been undertaken during network planning or to inform area-wide proposals, but there may be a need to revisit this in more detail once routes have been prioritised. Data collection needs to be done in a proportionate manner, appropriate to the level of intervention proposed.

Figure 2.16 Scheme stages

| | |
|---|---|
| 1. Scheme brief | Includes objectives related to design outcomes, programme-specific requirements, network strategy and route assessment (using CLoS assessment and non-motorised user audit). |
| 2. Feasibility | Includes consideration of: stats and utilities, other schemes or maintenance programmes, other modes, community issues, local character, any signal modelling requirements. Stage 1 Road Safety Audit. |
| 3. Notifications | Traffic Management Act (TMA) notification: works location, scope, timescale. New Roads & Street Works Act Section 58 notices: coordination of works. Permits from neighbouring authorities for works on the boundary. |
| 4. Consultation | Internal consultation and review processes Stakeholder engagement (see section 2.2 above). On-street notification. |
| 5. Detailed design | In line with legal responsibilities, eg Highways Act 1980, CDM Regulations 2007, Road Traffic Regulation Act 1984, Traffic Management Act 2004, Equality Act 2010. |
| 6. Pre-construction | Stage 2 Road Safety Audit. Includes F10 Notification of Construction Project, Construction Phase Plan and any Traffic Management Orders required. |
| 7. Site supervision | TMA works approval required from TfL. |
| 8. Maintenance | Stage 3 Road Safety Audit once works are completed Stage 4 Road Safety Audit one year after completion and when 3 years of collision data are available. |

Figure 2.17 Current route characteristics

| | | |
|---|---|---|
| **Place characteristics** | • Land uses and mix of activities<br>• Trees and other planting<br>• Materials | • Lighting<br>• Height, scale and massing of buildings |
| **New developments and other schemes** | • Changes to physical layout<br>• New or removed generators of cycle movement | |
| **Major barriers/severance** | • Waterways, railways and main roads<br>• Large, contiguous landholdings | |
| **Legal aspects** | • Traffic Orders<br>• Land ownership | • Conservation areas and Listed buildings<br>• Tree Preservation Orders |
| **Pedestrian amenity and activity** | • Conflicting movements at junctions and crossings<br>• Volumes of pedestrians<br>• Levels of pedestrian comfort | • Nearby uses that attract pedestrians, particularly people with temporary or permanent disabilities<br>• Shared use and shared space<br>• Intersection with (off-highway) walking routes including Strategic Walk Network |
| **Traffic operations** | • Volume, speed and mix of traffic<br>• Capacity of links and junctions | • Heavy turning movements<br>• Main conflicting movements at junctions |
| **Kerbside activity** | • Loading/unloading provision, including loading bays<br>• Parking provision, including parking bays<br>• Bus stops and stands | • Activities of taxis and private hire vehicles<br>• Frontage access and islands |
| **Cycle movements and cyclists' needs** | • Routes, flows and main movements<br>• Collision statistics | • Complaints and comments |
| **Available widths** | • Highway, carriageway and footway | • Specific pinch-points and narrowing |
| **24-hour access** | • Time-limited bus lanes and mandatory cycle lanes<br>• Limits on access through parks and green spaces (formal and risk-based) | |

## 2.4.3 Signal works

If signal works are necessary then these should be programmed with TfL during the feasibility stage. If modelling capability is not present in-house then a consultant should be commissioned to run through the Model Auditing Process (MAP) with TfL.

MAP is a requirement for schemes that have an impact on the TLRN or Strategic Road Network, and represents good practice for any other scheme. It has been developed to ensure that models submitted to TfL for audit are developed, calibrated and validated to an appropriate standard and is described fully in TfL's Traffic Modelling Guidelines (2010). Signal design should then be agreed with TfL during the detailed design stage – further information is provided in section 5.4.2.

## 2.4.4 Road safety audits

Road safety audits (RSAs) are well-established procedures, widely applied to cycling and other traffic schemes. RSAs consider the road safety implications of all measures and their impact on the network under all anticipated operating conditions. The effects on all classes of road user are considered. In the hands of competent practitioners, RSAs improve the design and safety of cycle schemes. TfL has produced guidance on its safety audit procedures in the form of document SQA-0170, Road Safety Audit, Issue 5 (2014). For borough roads, procedures required by the relevant highway authority should be followed.

RSAs should inform decisions on risk reduction measures and restrictions that are balanced, proportionate and appropriate for the street environment. Issues raised about a given intervention need to be balanced against the issues that will remain if the scheme is not implemented, particularly where cyclists may be compelled to use an alternative route that involves exposure to equivalent or greater risks. RSAs should contribute fully to good design outcomes for all users, but they should not, in themselves, determine cycling priorities and requirements that will support growth.

Changes to schemes are recommended as the audit team considers appropriate. On receipt of the safety audit report, the scheme engineer/designer should consider its content and amend the scheme accordingly. If the project sponsor authority does not wish to incorporate some or all recommendations of the safety audit they are required to prepare and state in the RSA report the reason(s) why they consider the recommended action is not appropriate.

## 2.4.5 Other pre-construction procedures

As set out in section 2.1.3, 'Stakeholder involvement', an Accessibility Audit or other form of Equality Impact Assessment should be considered for any scheme involving facilities shared between pedestrians and cyclists.

During the pre-construction phase, TMA works approval should be submitted to the relevant highway authority, following procedures set out by that authority. TfL requires the following procedures:

- Works notification should happen by letter to those affected at least 2 weeks before works begin
- Notice required for parking suspensions is 17 days, bus suspensions 3 days and signal switch-offs 3 days
- If the works do not proceed then a cancellation notice should be submitted
- Works permits should be submitted a minimum of 10 days before works start
- Start notice should be submitted by 16.30 the next working day and stop notice should be submitted by 16.30 the next working day following the end of the works
- The CDM coordinator should approve the construction phase plan before any works progress

## 2.4.6 Traffic Orders

Obtaining a Traffic Order (normally known as a Traffic Management Order, TMO, in London) involves several stages:

- Consultation on initial layout / design: obtaining the view of local councillors, emergency services and other relevant institutions
- Advertisement of the Traffic Order, via public notices, for at least 21 days
- Making the Order
- Implementing the Order

The use of Traffic Orders in support of coherent cycling infrastructure is relevant to parking controls, creation of some cycle facilities, provision of cycle parking and exemptions for cyclists from certain banned movements. Since the publication of the revised Traffic Signs Regulations and General Directions (2016), there has no longer been a requirement for a Traffic Order to implement with-flow mandatory cycle lanes.

As described in the Local Authorities' Traffic Orders (Procedures) Regulations (1996), traffic authorities are empowered under the Road Traffic Regulation Act (1984) to make Traffic Orders to regulate and manage the speed, movement and parking and loading of vehicles and to regulate pedestrian movement. The Environment Act 1995 enables Orders to be made in pursuit of national or local air quality management strategies.

Exemptions for cyclists in City of London: Fann Street and Moor Lane

Traffic Orders may be permanent, experimental (up to 18 months) or temporary (in most cases up to 18 months). Temporary Orders are normally used for road works or emergencies. Where they are required, specific consideration should be given to maintaining conditions for cycling on cycle routes. Experimental Orders may be useful where monitoring the effect of and public reaction to an exemption, for example, may help make the case for a permanent change.

## 2.4.7 Procedures for creating cycle facilities

Scheme delivery may also need to build in the process for designating certain infrastructure as being appropriate for cyclists. See section 4.1 for definition of different cycle infrastructure types and legal instruments required to create them.

Cycle tracks and shared use facilities must be formally approved and have effective Notices in place. On highway, this will entail approval (by delegated authority) under Section 65(1) of the 1980 Highways Act. For the TLRN this is carried-out by a TfL designated officer. For roads managed by London boroughs, this is normally delegated to a senior officer. As well as major areas of shared use and cycle track, the shared use sections to either side of Toucan crossings will need to have effective Notices.

The TfL Traffic Orders Team hold copies of all Notices for existing TfL/TLRN cycle track, shared use and adjacent/segregated use. These are recorded under HA Section 65(1), not TROs. London boroughs normally have a similar system within their Traffic Order section.

Shared use path away from the highway, Queen Elizabeth Olympic Park

Footpath part-converted into cycle track, Hackney

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  Pedestrian Comfort Guidance for London (2010)
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- TfL
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- TfL
  Traffic Modelling Guidelines (2010)
- TfL
  Transport Assessment Guidance

# 3. Cycle-friendly streets and spaces

This chapter is about good design for cycling in the context of creating better streets and about balancing user needs. It covers aspects of street design that will help to add economic, social and environmental value to a neighbourhood.

The advice here forms part of a wider suite of advice issued by TfL on street design that includes:

- Streetscape Guidance
- London Pedestrian Design Guidance
- Accessible Bus Stop Design Guidance
- Kerbside Loading Guidance
- Station Public Realm Urban Design Guidance


**Version control**

Version 1 (Dec 2014) – Published

Version 2 (Sept 2016) – Minor amendments following publication of TSRGD (2016)

# 3. Cycle-friendly streets and spaces

## 3.1 Better places for everyone

### 3.1.1 Better streets

The Roads Task Force recommendations emphasise the multi-faceted roles that streets play in the lives of Londoners:

- As fully accessible public places, a focus for the city's economic, cultural and social activity
- As safe places that can help reduce social isolation by supporting the participation of more vulnerable people in social opportunities
- As a major part of the look, feel and reputation of London
- Providing green and open spaces that support biodiversity and resilience to climate change

Many of the best streets for cycling and walking are those that are calmer, more relaxing places to be. Healthy streets are those where people from all walks of life are able to choose to walk or cycle.

Cycle-friendly street design is covered by the Cycling Level of Service Assessment, as shown in figure 3.1.

Figure 3.1 Key street design considerations in CLoS

| Factor | Indicator | Relates in this chapter to |
|---|---|---|
| **Safety**<br>Collision risk | Kerbside activity or risk of collision with door | Integration with parking, loading, bus infrastructure, taxis and private hire |
| **Safety**<br>Social safety | Risk/fear of crime<br>Lighting<br>Isolation<br>Impact of highway design on behaviour | The benefits of making better places for everyone by designing more civilised street environments |
| **Directness**<br>Journey time | Value of time for cyclists compared to private car use<br>Deviation of route on link | Offering shorter routes for cycle journeys than for cars encourages modal shift and helps to rebalance priority between users |
| **Comfort**<br>Deflections | Pinch-points caused by horizontal deflections | Filtered permeability for cycling, application and design of physical traffic calming and other speed reduction measures |
| **Attractiveness**<br>Impact on walking | Highway layout, function and road markings adjusted to minimise impact on pedestrians | Understanding pedestrian needs |
| **Attractiveness**<br>Greening | Green infrastructure or sustainable materials incorporated into design | Area-wide improvements for cycling and methods of civilising street environments |
| **Attractiveness**<br>Minimise street clutter | Signage and road markings required to support scheme layout | Minimising street clutter, particularly in 20mph areas |

## 3.1.2 Healthy streets

Many of the factors that make for a high level of service for cyclists are the same as the components of healthy streets set out in the health action plan, Improving the health of Londoners (2014). This includes being able to enjoy clean air and an environment that feels safe, relaxed, easy to move through and not too noisy.

The 'whole streets' approach described in the action plan serves as a framework for balancing user needs and creating inclusive environments that can be accessed and enjoyed by all.

> "Everybody needs to be active every day. If the mix of people walking in the street does not include certain groups such as children, older people or those with disabilities then the street environment is excluding some people from staying active."


'Whole streets' approach – as set out in Improving the health of Londoners

## 3.1.3 Good design outcomes for streets

The sensitivity of many of London's historic street and off-road environments needs to be respected in designing facilities for cycling that are appropriate to their heritage and context. The quality of the street environment matters as much as its functions, particularly to those on foot and cycle. Streets and public spaces play vital roles in community interaction, commerce and social life and it is essential they are dealt with by highway engineers, transport planners and urban designers as places as well as conduits for movement. Figure 3.2 shows how the six good design outcomes for cycling relate to the place characteristics of streets.

One way in which adaptability, attractiveness and coherence may be supported is by ensuring that existing materials are retained, restored and reused wherever possible, particularly in heritage settings such as conservation areas, world heritage sites and in the vicinity of listed buildings. This may relate to high quality traditional paving (such as York stone paving) and to granite kerbs, or to street furniture and historic signs. Even where this is not possible, materials should be chosen that respect the environment and complement the history of the place.

Figure 3.2 Good design outcomes for streets

| | |
|---|---|
| **Safety** | Design should promote the safe movement of people and goods, minimise conflict between road users and contribute to a healthier and more sustainable environment. Local streets should provide a safe environment for walking, cycling, socialising and play. |
| **Comfort** | Street design should accommodate all users, with particular sensitivity to all mobility and access requirements and with priority for the most energy- and space-efficient modes. Opportunities should be identified and taken to reallocate under-used carriageway space to increase space for pedestrians and/or cyclists. |
| **Coherence** | Good street environments are legible and can be used intuitively by everyone. Street design should respond to the context, to the character of the local built environment, through use of appropriate materials and avoiding the need for excessive signing. |
| **Directness** | Permeability, flexibility and reduced journey times should be achieved for walking and cycling, as modes that require more effort. Priority should first be given to direct pedestrian access to and from destinations, and then to cycle access. |
| **Attractiveness** | Aspects of the wider environment should be cultivated that contribute to a feeling of enjoyment, safety, security and aesthetic integrity. This may include trees and other planting, a sense of space and light, good visibility, harmonious use of materials, historic buildings, and land uses that support appropriate levels of activity through the day. |
| **Adaptability** | Good street design should deliver value for money, and should take into account life-cycle costs and benefits. Streets should be able to cope with changing conditions without needing to be re-engineered. This may require permeable surfaces, stormwater source controls and more tree canopy cover, to build resilience to climate change. |

Trees, local buildings and a motor vehicle restricted route contribute to sense of place

Opportunities taken to add planting and visual interest in a street closed to motor vehicles

Trees and seating provided as part of rebalancing priorities and calming a junction

Planting introduced in a hard public space, and in order to help delineate a cycle track

## 3.1.4 Street design guidance

Design of street environments should take into account other relevant design guidance, including TfL's Streetscape Guidance and borough design guidance at the local level, and Manual for Streets, Manual for Streets 2 and the Traffic Signs, Regulations and General Directions (TSRGD) at national level.

This guidance advocates the more integrated, collaborative process to street design set out in Manual for Streets.

Figure 3.3. Key considerations in street design process (based on Manual for Streets)

| 1. Policy review | 2. Context appraisal | 3. Detailed design issues | 4. Implementation and ongoing management |
|---|---|---|---|
| • Planning policy and area-based strategy<br>• Community priorities<br>• Existing or proposed design guidance or codes<br>• Identified road safety issues<br>• Cycle, bus, HGV and emergency service vehicle routes | • Street network<br>• Demand and usage patterns (including trip generators)<br>• Accessibility<br>• Street character types/form, scale, pattern and character of streets<br>• Environmental and public space conditions<br>• Land uses and types of user<br>• Balance of local versus through traffic<br>• Access management (side streets and private accesses) | • Target and design speeds<br>• Alignments and widths<br>• One- / two-way operation<br>• Horizontal and vertical geometric elements<br>• Public space<br>• Materials<br>• Gradients and drainage<br>• Utilities, lighting and street furniture<br>• Trees and other vegetation<br>• Stormwater controls | • Speed limit<br>• Traffic controls<br>• Road safety<br>• Enforcement<br>• Access controls<br>• Regulation of parking and loading<br>• Maintenance and cleaning<br>• Inspection regimes<br>• Other short-term operational improvements |

## 3.2 User needs

### 3.2.1 Overview

This section sets out design parameters to consider for all infrastructure that cyclists will use, not just cycle-specific infrastructure.

In order to inform a balanced approach to street design, this section also gives an overview of user needs from the perspective of pedestrians, bus operation, loading, parking and taxi and private hire operation.

Taking account of user needs must be an inclusive process. Planners should actively seek views not only from typical existing users but also from under-represented groups, including people with protected characteristics under the Equality Act (2010).

### 3.2.2 Understanding cyclists

Consideration of cyclists is a specialist area of practice and must be properly integrated with other aspects of highway design and transport planning. It should never be an add-on, left until the detailed design stage. It is important that there should be an emphasis on the experience of cycling: what will it feel like to ride on this street? There is no better way to get a feel for this than riding the route and all those involved in design should do this. The CLoS assessment focuses on this 'rideability' aspect of infrastructure.

The intention in London is to provide for all types of cyclist. It is important to consider those who do not fit the stereotypes.

#### Inclusive cycling

Cycle infrastructure should be designed in a way that is inclusive both of larger types of cycle and various models used by disabled people. It is recommended that the concept of 'the inclusive cycle' is embraced – meaning a recognition that, because of the size of many non-standard types of cycle and the possible limitations of riders, a more forgiving environment is required. This reflects the position adopted in the Accessible London: achieving an inclusive environment SPG (2014).

"Boroughs and developers should seek to encourage inclusive cycling thorough considering the spatial requirements of inclusive cycles and tricycles with the design of cycle routes."

There is no need to design a network capable of carrying thousands of inclusive cycles at once but it is important that infrastructure is tolerant of non-standard users and does not exclude or disadvantage them.

People in wheelchairs, powered wheelchairs and mobility scooters, which are all classed as invalid carriages, have no specific right to use a cycle track. However they commit no offence in doing so (unless a local by-law creates one) and they should not be excluded.

#### The effort required to cycle

One of the main things that sets cycles apart from motorised vehicles is that they work on human-generated power, and they are highly efficient in sustaining the momentum generated. This is significant because characteristics of a street that increase the effort required to cycle might deter people from going that way as part of a route, or may put them off cycling at all. Good design for cycling must therefore be sensitive to physical conditions that matter less for other users, such as surface quality, surface material, ability to maintain constant speed, gradients, deflections and undulations.

A network with routes that are direct and allow cyclists to maintain their speed helps to avoid making cyclists stop or deflect unnecessarily. Local environmental conditions, including built form, are also important factors. Trees, for example, can help diffuse the effects of strong winds.

For some cyclists, the experience of cycling does not stop at the street. Where disabled people rely on their cycle as a mobility aid, their cycle journey is a door-to-door one and so the accessibility of transitions between different parts of the public realm and between public and private spaces is particularly significant.

## 3.2.3 Cycle design parameters

The typical dimensions of a conventional bicycle are 1800mm long and 650mm wide. For a solo adult cyclist, 750mm is the typical static width but extra width is needed for moving cyclists.

A reasonable assumption is that this amounts to a total width of 1000mm (as stated in LTN 2/08: Cycle Infrastructure Design), although this varies according to speed and type of cycle. That dimension is often referred to as the 'dynamic envelope' of a cyclist.

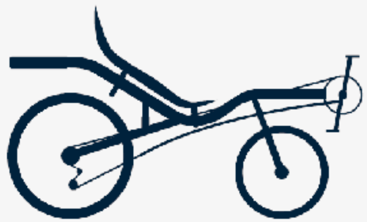
LTN 2/08 states that the turning radius around a fixed object for a standard bicycle is 850mm while a circle of 1650mm radius is required to complete a 180-degree turn. For an inclusive approach, most riders of 'standard' cycles are likely to need more space to turn than this suggests.

Cargo cycle in Amsterdam

Figure 3.4 Indicative dimensions of typical 'non-standard' cycles

Cycle with trailers for children or deliveries
L 2200-2500mm / W <850mm

Cargo cycle / box bike
L 2000-2300mm / W <870mm



Recumbent cycle
L 1700-2240mm / W <750mm

Tandems, including steer-from-rear tandem
L 2100-2500mm / W <750mm

Hand cycle
L 1650-2050mm / W <860mm

Tricycle, including wheelchair-friendly model
L 1400-2100mm / W <850mm

Side-by-side tandem
L 1800-1950mm / W <1070mm

## Non-standard cycles

An inclusive approach to cycle infrastructure means designing for all types of cycle, including freight cycles and those used by people with mobility impairments. Given the variety in lengths and widths, and the different manoeuvring abilities of these various types, there are currently no established standards for meeting all needs. This guidance refers throughout to considerations of non-standard and larger models of cycle, and makes recommendations for how infrastructure might cater for all. However, this is an area that requires more research and testing and so the dimensions and advice provided here should be regarded as provisional.

Key assumptions that should be made in inclusive design for cycling are as follows:

Cargo cycles in Copenhagen

- A width of at least 1.5 metres is needed for any cycle gap or access control point. See section 4.5.15 for guidance on how to incorporate this access while controlling access for users such as powered two-wheelers
- Minimum turning circles need, at the very least, to follow LTN 2/08 guidance – this states that the longest model, a tandem, needs 2250mm around a fixed point and 3150mm for a full turn. Given the likely future use of cycle infrastructure by an even greater range of cycles than is presented in figure 3.4, it is recommended that design allows for these parameters to be significantly exceeded in practice
- Lifts should have minimum dimensions of 1.2 metres by 2.3 metres, with a door opening of 900mm. This is important for access to locations such as cycle parking areas, subways, bridges and station platforms (see chapter 8 for more guidance on inclusive cycle parking)
- Vertical deflections such as speed humps should be minimised as cycles with long wheelbases, such as tandems and some recumbent models, are particularly sensitive to the effects of sudden changes in surface level
- Any upstand of greater than 10mm should be avoided as it can destabilise many types of cycle, particularly when approached from an angle; dropped kerbs should be specified as flush within a tolerance of 6mm
- Pedicabs and other similar vehicles should be assumed to use routes designed for motor traffic

## 3.2.4 Effective width

Effective width refers to the usable width of a cycling facility and depends on how the space is bounded. The experience of cycling depends more on effective width than actual width. A number of factors can reduce this, including physical objects, the width of adjacent traffic lane(s), the speed and type of vehicles moving in the adjacent lane, the volume of pedestrians on adjacent or shared footways/footpaths and the geometry of the cycle lane or track (effective width being reduced on curves and bends). Figure 3.5 summarises the key parameters.

At least 3 metres width is usually needed for comfortable two-way cycling
Cable Street, Tower Hamlets

Figure 3.5 Cyclists' effective width: key considerations

| | |
|---|---|
| Dynamic envelope of a standard cyclist, taking into account 'wobble room' when moving (Note more width should be added for an uphill gradient in order for cyclists to maintain balance) | 1.0m |
| Indicative maximum dynamic envelope of the widest cycle types, assuming less 'wobble room' for types with three or more wheels | 1.3m |
| Recommended minimum clearance between the furthest extremity of a moving motor vehicle and the outside of the dynamic envelope of a cyclist at 20mph or less * | 1.0m |
| Recommended minimum safe clearance at 30mph * | 1.5m |
| Recommended clearance between dynamic envelopes of cyclists moving in the same direction** | 0.5m |

*Greater clearances are recommended for larger vehicles
**Greater clearance should be considered for cyclists moving in opposing directions, particularly at higher speeds

Widths from figure 3.5 have informed the recommendations provided throughout this guidance. For example, it is clear from the above that a 2.5-metre wide two-way track allows for cyclists to pass at the recommended 0.5-metre clearance but that, for wider types of cycle, this becomes an uncomfortably close pass. See sections 4.4.1 and 4.5.7 for more details.

Continuous or intermittent physical barriers around pedal or handlebar height reduce effective width. Allowance should be made for this when designing kerbs. In most cases, 500mm clearance from the kerb is recommended. However, lower kerb upstands, down to a minimum of 50mm, or angled kerbs can mean that it is acceptable to ride closer to the kerb without the risk of catching pedals on the upstand.

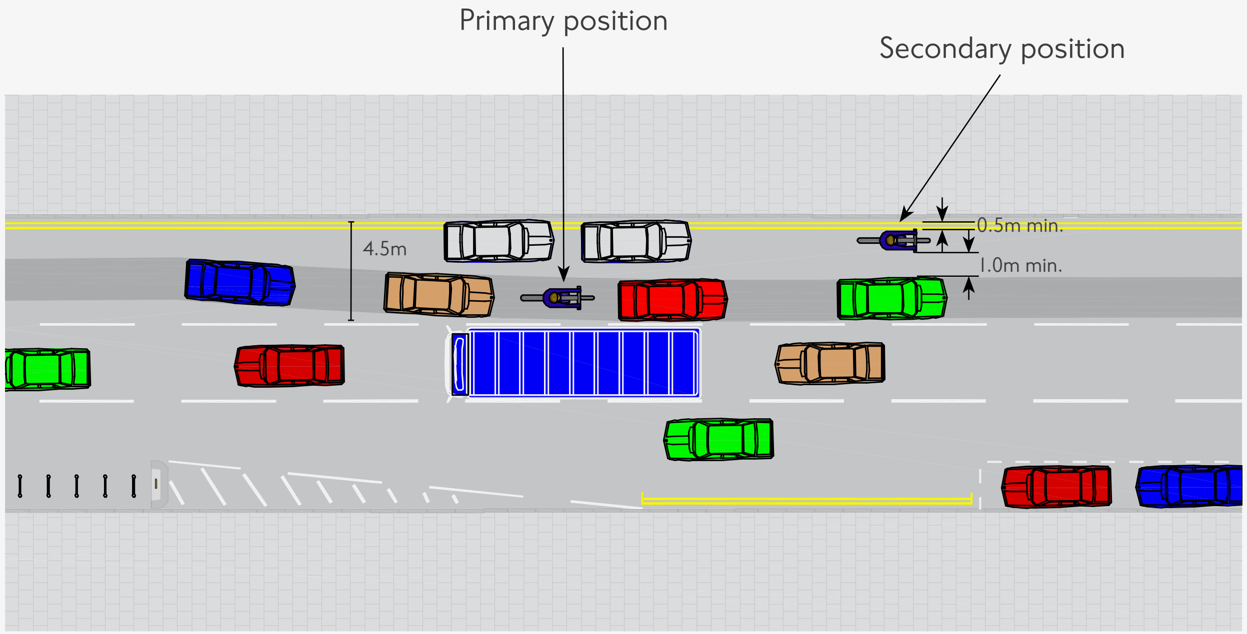
Objects with a vertical profile need a wider clearance than rounded or sloping objects – recommended clearances are given in LTN2/08. This states that intermittent objects like sign posts and lamp columns should have 750mm clearance to the cyclist's wheel (meaning, for standard bicycles, that effective width is reduced by 250mm) while continuous features like walls, railings and hoardings need 1 metre clearance to the wheel (so effective width is reduced by 500mm for a standard bicycle). Much depends on the characteristics of the object in question and designers need to assess site specific conditions to take an informed view on the width required.

## 3.2.5 Primary and secondary riding positions

Effective width and clearance to fixed and moving objects gives rise to consideration of recommended riding position for cyclists – that is to say, the safest position in the road for a cyclist to adopt in any given scenario. Cyclists may safely ride on the nearside of other vehicles if there is sufficient width to be overtaken with adequate clearance – this is known as the secondary riding position. However, if that clearance is not available, the safest course of action for the cyclist will be to ride in such a way that they are as visible as possible and cannot be overtaken – this is the primary riding position.

The primary and secondary riding positions are taken by cyclists relative not just to the available width but also to the presence of other vehicles. Even in a wide lane, the primary position may be the safest position to take if there are parked cars ahead that squeeze the space available so as to make the secondary position uncomfortable and, potentially, unsafe. This is demonstrated in indicative layout 3/01.

Allowing for the effective widths and clearances set out above, the secondary riding position can therefore usually be adopted where:




Indicative layout 3/01: Primary and secondary riding positions

- The nearside traffic lane has a constant minimum width of 4.5 metres or more, or
- A cycle lane of at least 1.5 metres width is provided on the nearside of a general traffic lane of 3.0 metres or more

In other circumstances, it should be assumed that cyclists will, at least some of the time, need to adopt the primary position relative to other vehicles.

Designers need to be aware of these riding positions and design to them, which may enable some good cycling and driving practice to be encouraged and bad practice discouraged. It is important to consider what position cyclists will need to adopt, particularly as the use of a street environment changes through the day, and to avoid situations where parked cars or other obstructions effectively render cycle lanes useless.

## 3.2.6 Understanding pedestrian needs

Pedestrians' needs are described in Manual for Streets and Manual for Streets 2 and in TfL's London Pedestrian Design Guidance. The key factors that affect pedestrian safety, comfort and behaviour are speed and volume of other traffic.

Various Local Transport Notes have been published by DfT that touch on issues of cycle/pedestrian interaction, particularly LTN 1/12 Shared use routes for pedestrians and cyclists.

Other key references are the TRL report, Cycling in Motor Vehicle Restricted Areas (TRL583, 2003) and Phil Jones Associates for Sustrans, The merits of segregated and non-segregated traffic-free paths: a literature-based review, 2011.

Any change to the street environment, including those intended to make streets safer and more attractive for cyclists, must take into account the accessibility needs of all users. It is a legal requirement for local authorities to consider the impact of changes to the built environment on different people. Key sources on this area include Manual for Streets, Accessible London: achieving an inclusive environment SPG (2014) and DfT, Inclusive mobility – a guide to best practice on access to pedestrian and transport infrastructure (2002).

### Key design requirements

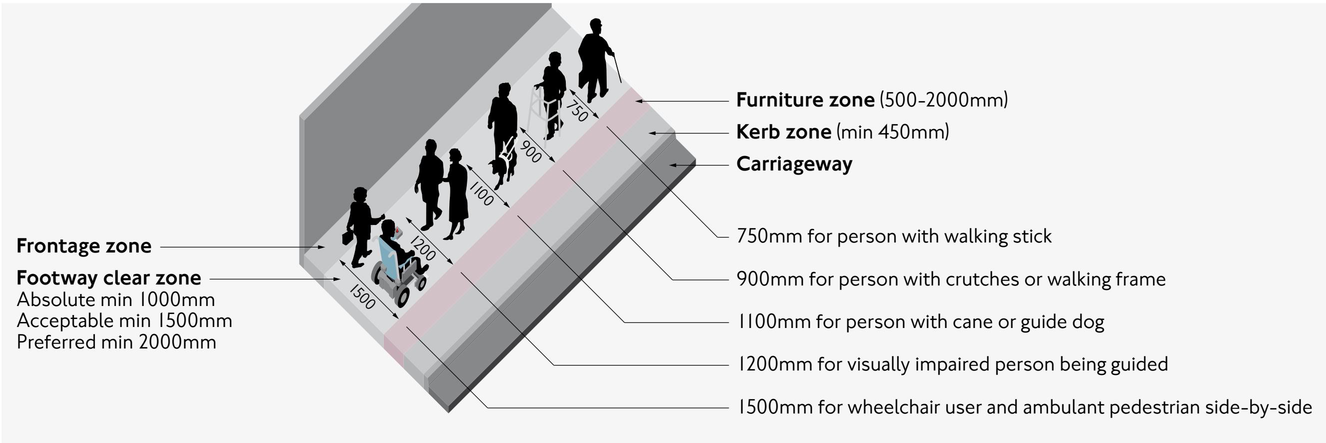
Such things as poorly maintained surfaces, narrow footways, street clutter, abrupt changes in level, gradients and environments that are difficult to navigate are likely to have an adverse impact on many kinds of people. They may be deterred from returning to a place that they cannot use with comfort and confidence. This may relate not only to a person using a mobility aid, or a blind or partially sighted pedestrian, but also to anyone with a hearing impairment, which very often leads to difficulties balancing, and to anyone with learning difficulties or an age-related impairment.

As a key issue for street design, figure 3.6 shows recommended clear widths for comfortable use of the footway. It is recommended that at least 2 metres' clear footway width should be provided or retained wherever possible.

TfL's Pedestrian Comfort Guidance for London (2010) is a comprehensive tool to assess the level of service of footways for pedestrians, based on pedestrian volumes. It should be consulted in the planning stage of schemes and be used as a framework for seeking to improve pedestrian comfort in any intervention for cycling.

Inclusive design does not stop at people with protected characteristics under the Equality Act (2010). It should also include consideration of families with small children, people using push-chairs and buggies and even people with bulky luggage, which is an important factor at public transport interchanges.

Figure 3.6 Footway width requirements (adapted from DfT, Inclusive mobility)



## 3.2.7 Integration with bus and coach infrastructure

Guidance on integration of bus infrastructure with street environments is provided in TfL's Streetscape Guidance. Accessible Bus Stop Design Guidance further assists highway authorities in the development of practical and affordable measures to improve accessibility at bus stops. It provides designers with a wide range of issues that need to be considered when reviewing individual bus stops and their immediate surroundings. Note that liaison with TfL is required when developing any changes to bus infrastructure.

In many cases there may be a desire to prioritise both buses and cycling on the same street, particularly for street types that are commonly used for bus routes, such as connectors, high streets and high roads. This may be done by separating users, providing shared bus/cycle lanes or by calming street environments where there are no dedicated bus or cycle lanes.

### Cycling in bus lanes

Sharing with buses can generally deliver a basic cycling level of service, but it is unlikely to be comfortable and attractive for all types of cyclist. Unless separation for cyclists can be provided on a given link, network and route planning will therefore need to ensure that there are good alternatives to streets and traffic lanes shared with buses.


Interaction with buses can be well designed and offer a basic level of service for many cyclists, but it is unlikely to be attractive and comfortable for all.

Appropriate provision for buses and cyclists depends on: carriageway width, number of traffic lanes, cycle route type, bus frequency and infrastructure, and other permitted vehicle types. In suggested order of preference for cyclists, the following possibilities exist for integrating buses and cyclists effectively:

- Segregated cycle lane/track and dedicated bus lane
- Segregated cycle lane/track and general traffic lane (no bus lane)
- Nearside cycle lane within wide shared bus/ cycle lane
- Cycle lane and general traffic lane (no bus lane)
- Wide shared bus/cycle lane
- Narrow shared bus/cycle lane

See chapter 4 for further details on design of bus lane and bus stop infrastructure in conjunction with cycle tracks and cycle lanes.

### Bus stops

Integration of bus stops with cycle infrastructure is an important issue for level of service for cyclists, bus passengers and other pedestrians. Consideration must also be given to the specific needs of coaches in dedicated coach bays. Coaches tend to be longer than buses, and the space for boarding and alighting needs to be designed so as to accommodate movement of all passengers from a given vehicle at one time.

## 3.2.8 Integration with loading and parking

Interactions of cycling infrastructure with kerbside activity need to be designed and managed in such a way as to minimise risks and stress to cyclists while maintaining all necessary access. This includes design for loading and unloading activity to take place as efficiently as possible. This is important for street types such as high streets, town squares, city streets and city hubs that have a diverse mix of land uses, intensive use of kerbside space and the need for flexibility during the day and week.

> Design that successfully integrates cycling, parking and loading needs an appropriate balance between physical measures and the management of kerbside activity. Enforcement of measures put in place to deal with competing demands is essential.

It is important to make the distinction between short-stay and longer-stay kerbside activity. The former includes loading/unloading, passenger drop-off and short-stay coach parking, is location-specific and generally needs to be retained. The latter largely comprises other parking, which may, dependent on context, be more flexible and amenable to relocation or removal. The parking needs of blue badge holders are a further consideration and provision needs to be retained or improved upon wherever possible – dedicated bays are recommended.

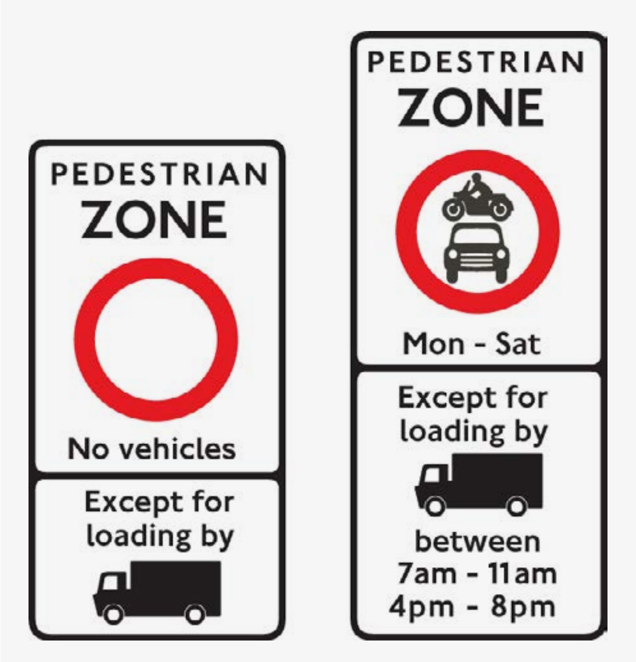
### Procedures

During the route assessment and prioritisation stage, detailed analysis of existing and likely future needs for all these types of kerbside activity, and the extent to which they are tied to a fixed location should be undertaken (see section 2.3). This should include early dialogue with those affected.

Any decision about changing loading arrangements should go through a robust process to allow for different stakeholders to have an input, and for considerations such as the availability and suitability of alternative facilities to be taken into account. This is described fully in TfL's Kerbside Loading Guidance (2009), which describes a hierarchy of considerations for making changes to loading. The Freight Environment Review System is a useful tool for scoping levels of risk associated with freight activity.

### Design considerations

- Creation of dedicated, enforceable kerbside space for loading or parking requires a Traffic Order
- In many areas, loading and parking take place on the carriageway, as indicated by appropriate road markings and signing showing timings and restrictions
- Loading restrictions are indicated by yellow 'blips' marked on the kerb next to a double line: a double-blip marking means no loading at any time; a single blip indicates a time-limited loading restriction, which is explained by accompanying signing (typically this restricts loading to short 20- or 40-minute periods)




Signs showing time-limited loading

- Single and double yellow lines (or red lines for TLRN) indicate waiting restrictions, including parking: waiting is not permitted at any time on a double yellow line; single yellow lines indicate a waiting restriction, operated according to timings given on adjacent signs; loading is permitted unless blips or other signed restrictions are present
- Dispensations may be granted by the highway authority for specific vehicles or for deliveries for certain premises to take place in spite of advertised restrictions: the dispensation is usually displayed in the vehicle's window or incorporated into the local enforcement regime (these are exceptional and design should limit the need for them)

Figure 3.7 summarises types of intervention that could be applied to rethinking parking and loading on a cycle route. Area-wide approaches can be appropriate in many instances, particularly when it comes to creation of Quietways and other local access routes. They can be a good way of simplifying the street environment, enhancing its overall attractiveness and ensuring that access for cyclists, pedestrians and, where appropriate, powered two-wheelers is maintained.

## Restricted parking zones

Restricted parking zones require a Traffic Order in the same way as other restrictions. They can be applied where a restriction is uniform and where exceptions can be captured easily in signing. They avoid the need for yellow or red line markings or kerb markings, and so they can contribute positively to more attractive, less cluttered streets. The balance to be struck is whether this justifies the extra signing that needs to be put up at each entrance to the zone. Many types of restriction are possible: permitting parking and/or loading in designated bays only is likely to be the most useful in support of cycling.

Figure 3.7 Summary of interventions for parking and loading on cycle routes

| | |
|---|---|
| **Separating cycling from kerbside activity at network level** | Where integration of uses cannot be resolved on a given street, it may be possible to rationalise parking and loading across an area to focus it on particular streets, leaving others free of most kerbside activity. This is likely to require rethinking cycle route options at the route assessment stage. |
| **Mechanisms for area-wide management of parking and loading** | In **Urban clearways** there is no stopping on the carriageway for parking or loading (including for cyclists). They can be time-limited, with hours of operation provided on signs.<br>**Controlled parking zones** (CPZs) prohibit waiting throughout a defined area. Signs at entry-points to the CPZ show times of operation and can include 'no loading'.<br>**Restricted parking zones** avoid the need for painted lines at the kerbside by allowing parking and loading subject to restrictions shown by signs. |
| **Relocation of parking and loading locally** | Certain types of loading activity are more amenable to being moved than others, while the extent to which parking can be relocated depends on consultation with businesses and residents whose needs are served by that parking. |
| **Floating parking and loading** | Where segregated or light segregated cycle lanes/tracks are used, parking and loading could be included in bays 'floated' away from the cycle track. Allowance needs to be made for the 'dooring zone' and the kerb height and profiles, all of which of which may reduce the effective width for cycling. (See section 4.2.6) |
| **On-carriageway loading/ parking bays** | Kerbside activity may be rationalised by creating dedicated bays rather than allowing parking and loading generally on a street. This allows kerbside activity to be focused at particular locations and for cycling infrastructure to be designed around it. |
| **Inset loading/parking bays** | Although likely to require a more extensive redesign of the highway, this is a good option for cycling, provided that on-carriageway cycling facilities are appropriately marked so as to deter riding in the dooring zone. It can invite a more flexible use of space, with inset bays effectively forming part of the footway when not in use, depending on the materials used. However, they may not be suitable for all types of delivery. |

### 3.2.9 Changing loading practices

Options for rethinking loading include:

- A Delivery Point Assessment, which may be undertaken to encourage operators to make best use of the available facilities
- Delivery and Servicing Plans can be implemented, in order to coordinate and manage deliveries and make better use of limited delivery space: these plans are owned and managed by the premises where the deliveries are being made
- Loading restrictions and timings may be reconsidered and revised as necessary, recognising that land use and delivery activity change over time: the need for change might be informed by looking at the time and location of freight-related penalty charge notices, indicating where there is an existing mismatch between loading provision and demand
- Deliveries to multiple premises could be consolidated in one location
- Facilities shared with other street users, such as taxis and coaches, could be a more efficient use of space

To avoid peak demand and more congested periods, some deliveries could be 're-timed' to out-of-hours slots. Social impacts need to be considered with this option, which are often already accounted for through noise abatement notices or planning conditions.

However, there are many opportunities at locations that are not restricted. For example, avoiding school start and end times can have significant benefits for safety and for efficient movement. Information and guidance on options for re-timing is provided in the Re-timing Deliveries Consortium's Getting the timing right (2014) and the Freight Transport Association (FTA) and DfT Quiet Deliveries guidance (2014). Note that the London Lorry Control Scheme limits noise pollution in residential areas at night by restricting the movement of HGVs overnight and at weekends. The scheme is enforced by London Councils and applies to vehicles weighing more than 18 tonnes.

The size and location of loading facilities needs to be taken into account when considering these options, as do the time, frequency and volume of the activities taking place, all have an impact. Consideration needs to be given to access to loading facilities and the potential for reversing vehicles to impede the flow of traffic and increase the risk of conflict.

#### Special considerations

Cash-in-transit requires vehicles to stop as close as possible to the delivery point and for the driver to have a clear line of sight to the delivery point, for reasons of safety and security. Where fit-for-purpose facilities are not provided, drivers are likely to choose to stop in any location that they deem to be safest, regardless of any dedicated loading provision that exists in the area.

Deliveries made by the brewery trade require that vehicles may stop at 90 degrees to and a minimal distance from the cellar door, so as to avoid moving heavy barrels over a long distance. Where vehicles are side-opening, as is the case with drays used by the brewery trade, the adjacent kerbside also needs to be free of any street furniture that would obstruct the path of the delivery.

Manoeuvring heavy items can damage the surface of the carriageway or cycle track, thereby increasing the maintenance requirement.

Goods in roll-cages will require dropped kerbs to allow access over kerb-separated or stepped tracks.

#### Relocating loading facilities

Loading can only be expected to take place on a side road where there are no width, height or weight restrictions that would prevent it and where any resulting reversing movements can be managed in such a way as not to constitute a hazard to other road users. At side roads, large vehicles will also need an adequate turning radius to manoeuvre without over-running the footway (other than in exceptional cases). This requirement needs to be balanced with safety and the advantages to pedestrian and cycle movement and quality of public realm that arise from tightening corner radii.

## 3.2.10 Integration with taxis and private hire vehicles

Taxis and private hire vehicles (PHVs) play a key role in London's transport system and so it is important to consider their needs early in any proposed redesign of street space. TfL is responsible for the licensing of taxi (black cab) and private hire services in London. Private hire includes minicabs but also covers a wide range of other services such as limousines, chauffeur services, tour guide vehicles and some school run and community transport services.

Relevant representatives need be consulted with and engaged at an early stage in the design process in order to understand the ways that taxi and PHV services currently operate in different locations. TfL can assist with this process and ensure that the most appropriate representatives are involved. When design options for cycle infrastructure are being considered, it is essential to understand if the area has a high number of taxis or PHVs stopping to pick up and drop off passengers, and to check when during the day this activity takes place.

### Inclusive design considerations

Taxis and PHVs play an important role in providing a door-to-door service for disabled passengers. Allowing step-free, level access between the kerb and taxi/PHV, with all obstacles removed where possible, is a key factor to consider, as is the potential use of wheelchair ramps across cycle facilities. Gaps in physical segregation, use of light segregation or frequent raised pedestrian crossings of the cycle facility can help alleviate some of these concerns.

Where physically segregated cycle facilities are introduced, it is recommended that monitoring of taxi and PHV activity takes place, to check on potential conflict issues. It may be worth considering the need for a dedicated drop-off bay at a suitable, nearby location. These tend to be used only at stations but could potentially be suitable in other locations.

### Taxi ranks

Dedicated taxi ranks provide space for taxis to stop and wait to be hired, which helps to reduce vehicle emissions by reducing the need for taxis to be continuously driving around. Any proposals to build dedicated cycling infrastructure near a taxi rank should be discussed with TfL at the earliest possible stage so full consideration can be given as to how these facilities can be integrated, whether changes can be made to the taxi rank, if multi-use or shared facilities are an option and if alternative locations could be possible.

### Taxis' use of bus and cycle lanes

Taxis cannot use mandatory cycle lanes as running lanes but they can stop to drop-off and pick-up passengers in them, unless the kerbside markings prevent them from stopping. Taxis are generally only excluded from bus lanes when there will be an operational impact on buses but are permitted to travel in the vast majority of bus lanes in London.


Advisory cycle lane marked around a taxi rank – lane would benefit from being wider or having a buffer to the marked rank

PHVs are not permitted to travel in bus lanes when the lane is in operation, but they can enter most bus lanes to pick-up and drop-off passengers. Consideration therefore needs to be given as to how frequently this may be happening in locations where a bus lane provides part of a cycle route. This may be an issue where there are particular uses nearby – for example late-night taxi and PHV activity to serve pubs, bars and clubs.

Potential PHV activity also needs to be taken into account in the vicinity of PHV operating centres. This can mean that there are high volumes of passengers entering and leaving the centres and many PHVs turning in or pulling out nearby.

## 3.3 Civilised streets

### 3.3.1 Traffic calming

Large parts of the cycle network, including the Quietways, are likely to consist of traffic-calmed neighbourhoods and streets rather than cycle-specific infrastructure. The remainder of this chapter therefore covers creating civilised, cycle-friendly streets through area-wide improvements and through traffic calming. This is an important part of an integrated approach to delivering better places and 'healthy streets' for everyone.

Traffic speeds impact directly on the risk of serious collisions and the comfort and attractiveness of cycle routes. Even where cyclists are separated from motorised traffic lanes, reducing motor vehicle speed limits helps to increase the comfort and attractiveness of cycling on an adjacent lane or track, particularly if general traffic is close by.

**Civilising streets through design is recommended over insertion of physical traffic calming measures, although the latter may be required for effective speed control in streets with a higher movement function.**

A study by TRL, 'Psychological' traffic calming (2005), compared different design techniques for traffic calming with more conventional speed reduction methods. Uncertainty was observed to be very effective in reducing speed. The greatest impacts were achieved using combinations of psychological and physical measures. Geometry is a key factor: when motorists are in more doubt about whether the space exists to make a passing manoeuvre, they are likely to overtake more slowly and more carefully (if at all).

Measures that have a function, and contribute to a space that looks and feels like a lower-speed environment, tend to be more successful than 'bolt-on' physical measures and signing.

Features that may support this psychological calming effect include:

- The appearance of road narrowing and reduction of forward visibility
- Removal of road markings, such as centre lines, which give motorists more security than is appropriate, resulting in excessive speed
- Use of different materials, colours, street furniture and planting to make the street environment less 'road-like'
- Frequent active frontages, with high levels of pedestrian activity
- Frequent formal and informal crossing by pedestrians
- Use of the carriageway by large numbers of cyclists

### 3.3.2 Area strategies

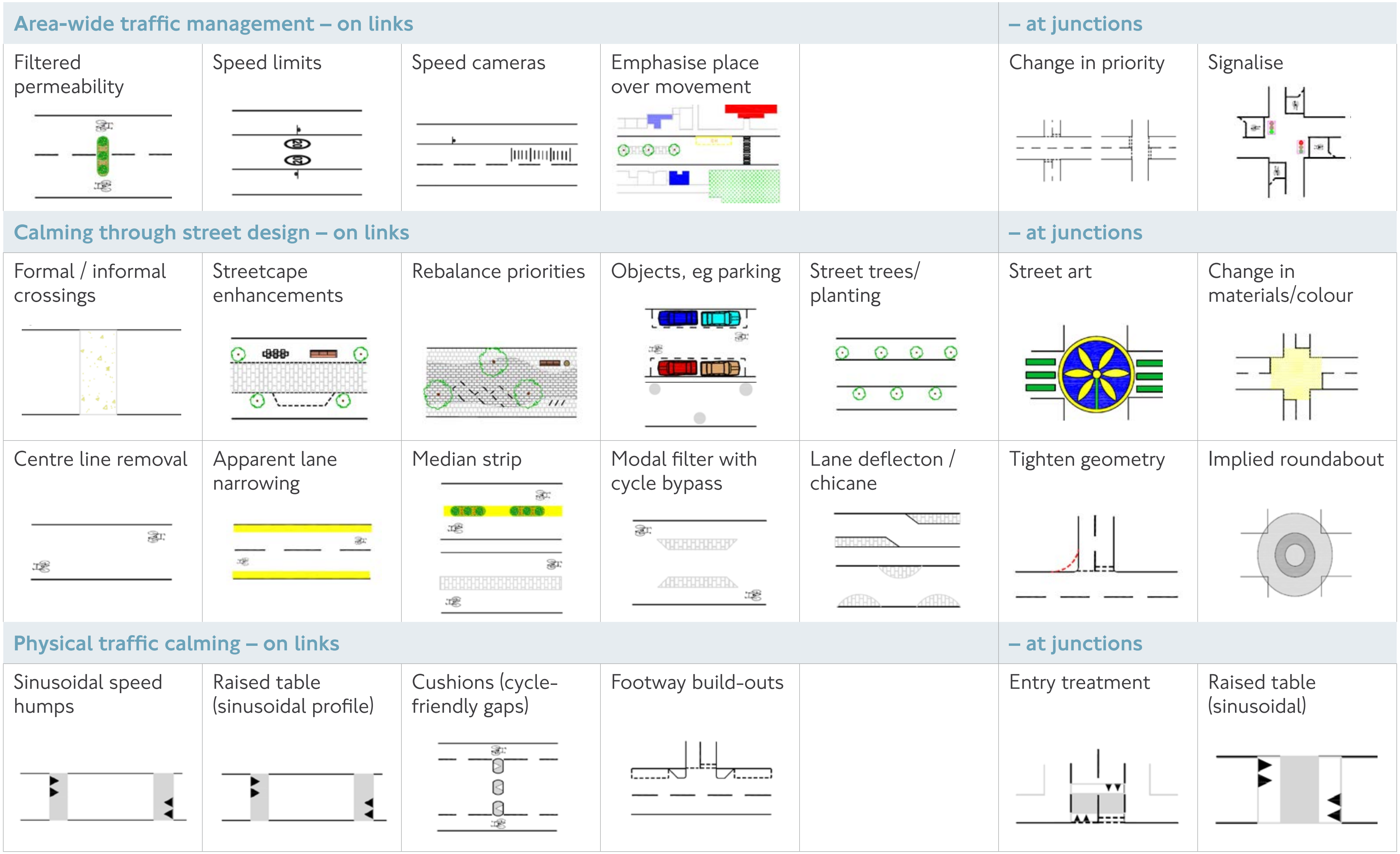
Figures 3.8 and 3.9 set out the recommended options for creating more civilised, cycle-friendly streets. The first covers strategies, the second the types of design intervention that can bring about traffic calming, both on links and at junctions.

Filtered permeability at Goldsmith's Row, Hackney

Figure 3.8 Strategies for civilised streets and neighbourhoods

| Intervention | Recommendation |
|---|---|
| Filtered permeability | Use of streets with restricted access as part of the cycle network is recommended. Permeability (through-movement) and directness should be maximised for cycling and walking and managed for motorised traffic as part of a wider approach to reducing traffic volumes. |
| Civilising streets through traffic calming | Traffic calming, allied to limiting speed and introducing 20mph limits, offers benefits for vulnerable road users. The preference is for strategies that use visual aspects of street design to influence behaviour and reduce motorised traffic dominance rather than harder physical measures. |
| Decluttering and simpler streets | When well designed, interactions between road users may be improved by removing traffic management infrastructure such as signals, traffic signs and road markings. This encourages road users to negotiate the environment more carefully, with greater awareness of others and at lower speeds. |
| Changing the balance of uses and activities | A greater diversity of uses in the street environment can have a civilising and calming effect, either through designating a street as having a special status, such as a Home Zone or cycle street, or through more incremental change. Design strategies can be developed that embrace kerbside activity in an integrated way, as well as more active, people-focused uses such as play, walking and cycling. |

Figure 3.9 Traffic calming techniques



## 3.3.3 Speed limits

An 85th percentile maximum speed of 20mph should be aimed for on roads forming part of designated cycling routes, including local streets, town squares and city places, and on many other high streets and city streets. Locations where 20mph limits would help achieve this should be identified and assessed through area-based analysis or through the review of existing conditions for cycling recommended in section 2.3.2. The limit should be enforceable so that it functions as intended.

Speed limits can be set for individual streets or across zones. Zonal treatments require measures to ensure compliance. These can comprise any of the measures set out in TSRGD (2016) schedule 10, part 4, or in the area-wide authorisation issued by DfT to English local authorities in October 2011, which relaxed the signing requirements for 20mph zones. These changes are summarised in DfT's Area-wide authorisations and special directions guidance note (2012) and included in TSRGD (2016).

### Enforcement

In its guidance Circular 01/2013, Setting local speed limits (2013), which sets out a wide range of scenarios where 20mph limits may be appropriate, DfT advises that 'general compliance needs to be achievable without an excessive reliance on enforcement.' This is likely to require measures to promote psychological and, where necessary, physical traffic calming. As with all speed limits, if the design of the street environment seems inconsistent with the advertised limit, compliance is not likely to be high.

Metropolitan Police Service traffic management officers should be consulted on 20mph proposals, and will seek assurance that they are compliant with Circular 01/2013. Traffic calming will need to be applied where 85th percentile speeds are above 24mph in free-flowing conditions. Enforcement supports design measures and signing, and should not be relied upon as a preventative measure on its own.

Enforcement can also be supported by use of speed cameras. Average speed cameras are being introduced on the TLRN as a trial measure. These can help improve speed compliance over longer stretches of road, rather than bringing about location-specific speed reduction.

20mph zone in mixed town centre environment

20mph zone signing, Golden Lane, Islington

## 3.3.4 Traffic volume reduction

Routes that are lightly trafficked or free from use by motorised vehicles are very attractive for cyclists as well as pedestrians. Delivering these conditions depends on taking area-wide approaches to traffic management in order to achieve targeted traffic volume reduction on certain streets.

Street types that are more likely to be amenable to targeted traffic volume reduction and cycle permeability measures include not just those with lower movement functions and higher place functions, but also types where an appropriate balance can be most challenging to achieve, such as high streets, high roads and city boulevards.

In urban areas where there is a dense grid of streets, adaptations can be made to dedicate or restrict through-routes to selected users. Options for more permeability are more limited in other urban scenarios – for example, strategic routes with few side streets, areas where major land holdings, rivers and infrastructure such as railway lines cause severance, and one-way traffic systems. The ways in which targeted traffic volume reduction may be used in support of cycling are summarised in figure 3.9.

Point closure, allowing cycle access

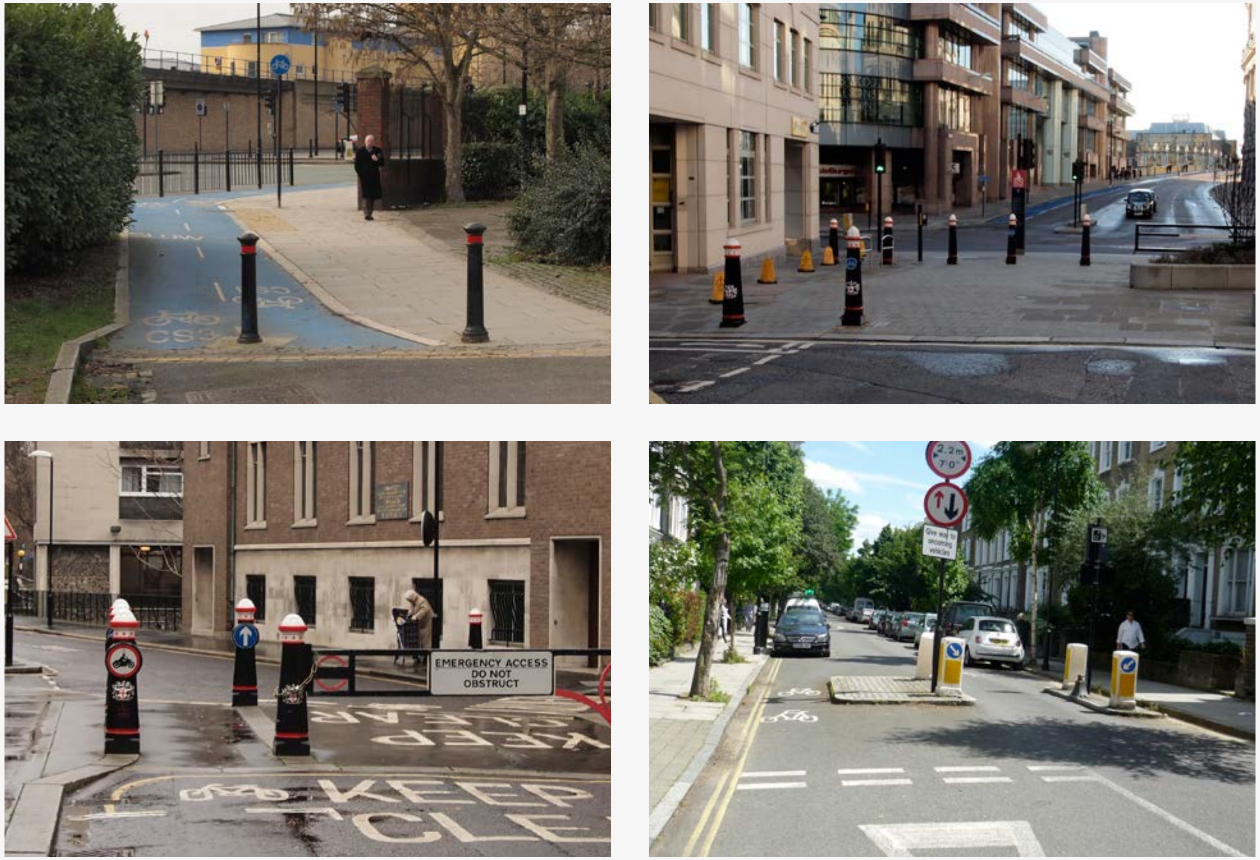

Ban on two-way movement: cyclists excepted

Figure 3.10 Summary of methods for targeted traffic volume reduction

| | |
|---|---|
| **Point closure to through-traffic** | Point closures are used to close streets to general traffic, usually maintaining motorised vehicle access to properties, while keeping them open for cyclists. A Traffic Order is required. |
| **Bans and turning restrictions** | Where selected vehicle movements are banned, cyclists should be exempted, unless this would be unsafe. Additional local measures may need to be taken to ensure the cycle movement can be made safely. A Traffic Order is required. |
| **Height, width and weight restrictions for HGVs** | Subject to considering the need for freight access and deliveries, these can be used to limit the number of HGVs on a given street. They are most likely to be more effective when supported by physical restrictions. Cycle by-passes to width restrictions may be appropriate and these should provide a minimum of 1.5 metres clear width for cyclists. However, the need for freight access for deliveries must always be considered. |
| **Signing strategies** | Signs can be used to direct motorised traffic along suitable roads and away from unsuitable ones such as residential or narrow streets. It is likely to need complementary traffic calming. |
| **Localised traffic calming** | See figure 3.9. |

## 3.3.5 Filtered permeability

As set out in section 2.3.7, an ideal network would be one that maximises permeability for walking and cycling, but exerts tighter controls on through-movement and access for motorised vehicular traffic. When applied to cycling, this approach is often known as 'filtered permeability'. This conventionally involves selective point closures to motor vehicles (or 'modal filters'), contraflow working for one-way streets, and the use of linking off-highway paths and routes through green spaces.




'Modal filters': ways of providing cycle access through places with limited or no motor vehicle access

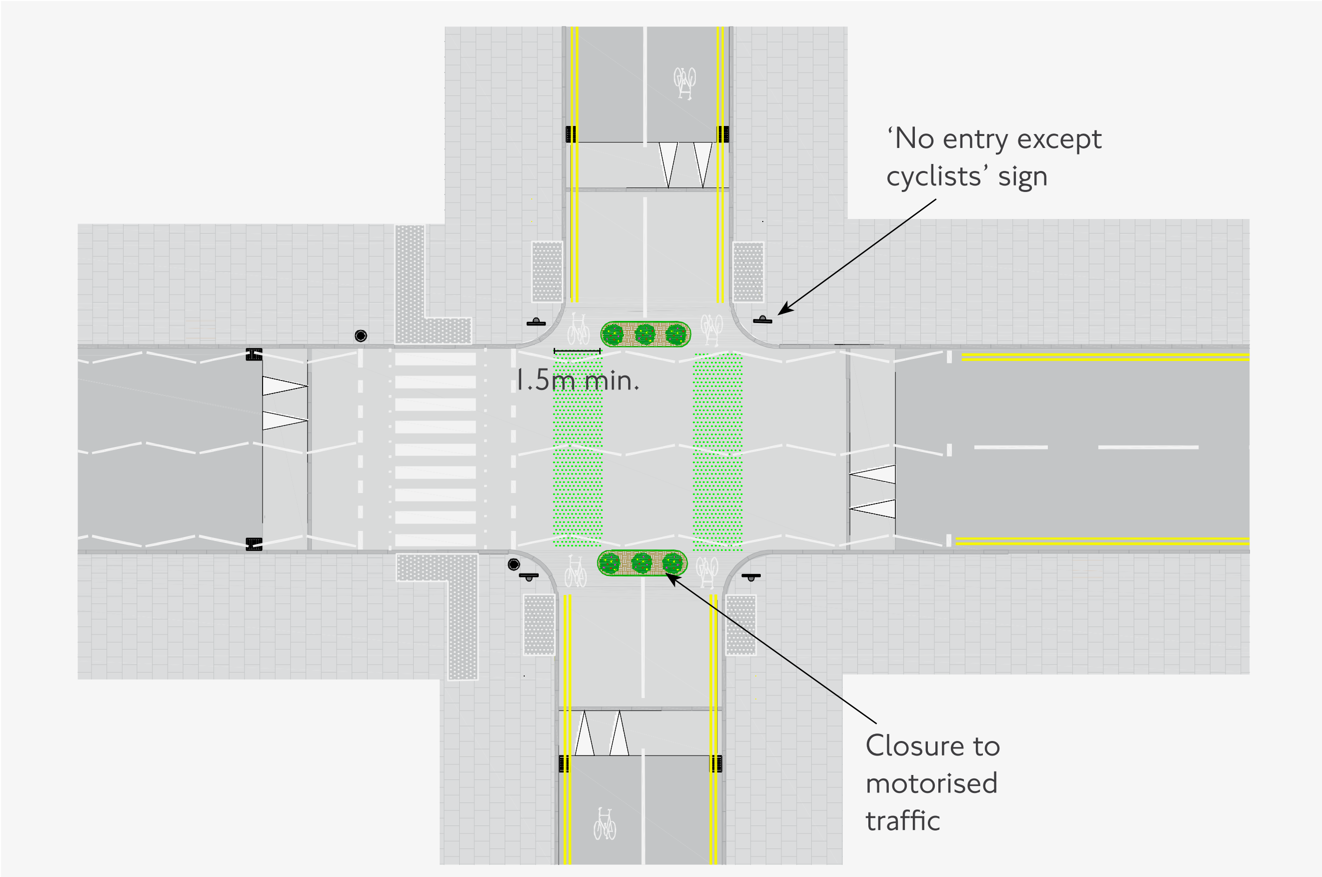
## Access controls

The minimum clear width (eg kerb-to-kerb or kerb-to-bollard) for cycle access through a point closure should be 1.5 metres to allow for access by all types of cycle. A greater width is desirable for two-way cycle gaps, particularly where cycle flows are high – bollards, spaced by 1.5 metres, are usually provided to restrict access to cycles.

Where emergency vehicles need access, a folding bollard is recommended. Where a larger gap is provided, supplementary measures to prevent unauthorised use by motorised vehicles, particularly powered two-wheelers, should be considered. See 'Access controls' in section 4.5 for further details.

Modal filter with greening and folding bollards, Leytonstone

Access controls should be positioned so as to minimise deviation for cyclists and avoid putting them into vulnerable positions relative to parked cars. Allowance should be made for the larger turning radii of many non-standard cycles when considering cycle movements through gaps and past other obstructions (see section 3.2.3).




Indicative layout 3/02: Point closures allowing cycle access only

## Inclusive access

Dropped kerbs are needed to maintain level and comfortable access through a point closure, and are essential for those who need step-free access or for whom pushing a cycle up a kerb is not an option. Access to dropped kerbs should be at least 1.5 metres wide, and wider when the approach creates an oblique angle. Dropped kerbs should be specified with zero upstand within 6mm tolerance; any upstand of more than 10mm could destabilise the rider when approached at an angle.

Safety and security for pedestrians and cyclists need to be carefully considered where routes are closed to motorised vehicles. Provided they are well-lit with natural surveillance, which relies on levels of use and depends on the wider urban context, they can feel safe and be safe. Underpasses, alleyways and tunnels can also provide a good, safe environment for pedestrians and cyclists when designed with good lighting, clear sightlines, no dead ends and ideally a degree of overlooking, or possibly CCTV.

Cycle access through pedestrian-dominated street

Closure with cycle access in Lambeth: public realm improvements add to a feeling of safety and security

## 3.4 Calming through street design

### 3.4.1 Character and context

The character of the street has a measurable effect on traffic speeds: the street width, lane widths, the amount of greenery, the sense of enclosure given by the buildings, the levels of activity and the uses that the street supports. If motorists perceive that they have unbridled priority and that the street has been designed primarily for through-traffic, then they will drive accordingly. Minimising speed differentials between motorised vehicles and vulnerable users, including cyclists, has significant safety benefits.

The 'whole street' approach advocated in Improving the health of Londoners (2014) should be referred to in considerations of street design. This emphasises the roles of streets as places to dwell and relax, and places where there are things to see and do.

### 3.4.2 Street use and activity

Where a street features more active uses, this can have a calming effect on traffic in the carriageway, breaking down perceptions of the space as dominated by the highway. This is related to land use – the opening hours and activities of shops and other businesses have an impact on the way the street environment is used. But it is also about encouraging people to stay in a space as well as move through it. This could be achieved in a variety of ways, including provision of places to sit, planting to offer shade and shelter or even special treatments, such as public art, water features and space for temporary stalls.

Active frontages in Hackney

Special surface treatment in Copenhagen

### 3.4.3 Home Zones, Play Streets and Quiet Lanes

While not intended for cycling, these special designations can contribute to speed reduction generally and to a better balance between road users. They are generally provided within 20mph zones.

Both Play Streets and Home Zones have a recognised regulatory sign – diagram numbers 618 and 881 respectively in TSRGD (see chapter 6 for more details on signing). This formal status allows other road users to recognise the special nature of the street even, in the case of a Play Street, where there may be no other visual indication for most of the time that it is different from any other residential street. This may give rise to more considerate behaviour towards others, particularly vulnerable road users, and to lower speeds.

Home Zones must be designated as such under section 268 of the Transport Act (2000), and require the regulatory signing to diagram numbers 881 and 882 of TSRGD. Play Streets must be indicated by a sign to diagram 618, backed up by a Traffic Order. Consideration could also be given to creation of informal 'Home Zone' environments by using the TSRGD diagram 886 'share space' sign instead.

## Home Zones

Home Zones give added focus to the non-motorised traffic functions of streets by redesign of the street environment, often omitting conventional road markings and using materials that contrast with the wider area to show the street has a different status. This can include painted and patterned surfaces, often as a result of a community-led design process. DfT provides guidance on Home Zones via: TAL 10/01 Home Zones: planning and design (2001), TAL 08/02 Home Zones: public participation (2002) and Home Zones: Challenging the Future of our Streets (2005). See also the Institute of Highway Engineers' Home Zone Design Guidelines (2002).

## Play Streets

Play Streets are temporary closures to through motorised traffic for a single or recurring event, allowing people to occupy the carriageway space for activities such as children's play. They do not allow cycling during the closure, but they can change perceptions about the use of the street and, in time, lead to calls for more permanent redesign of the street environment. They can also be used as a way of trialling modal filtering. Consideration should be given to any necessary cycle diversion around the Play Street.

## Quiet Lanes

In less urban parts of outer London and routes running within green spaces, consideration may also be given to using a 'Quiet Lanes' designation and associated signing. Quiet Lanes are minor rural roads designated by highway authorities as needing special attention to the needs of walkers, cyclists, horse riders and other vulnerable road users. Motorists are permitted, but should be encouraged to slow down and act with appropriate courtesy. A speed limit may be applied separately, but does not form part of the designation. For further information, see Campaign for the Protection of Rural England's Guide to Quiet Lanes (2003).

Home Zones in the UK (top) and Germany (bottom)


Sign to TSRGD diagram 881


Sign to diagram 884


Sign to diagram 886


Sign plate to diagram 618 and surface marking to diagram 1046.1

## 3.4.4 Narrowing and forward visibility

Manual for Streets explains the relationship between visibility, carriageway width and vehicle speeds, demonstrating that limiting forward visibility and reducing carriageway widths have a speed reducing effect. Reducing carriageway widths can also allow for greater footway space to be provided, which helps to promote active uses, or for planting and use of sustainable urban drainage systems, which are a positive contribution to healthy streets.

The advantages of speed reduction through narrowing need to be balanced against increasing the risk to cyclists riding with general traffic. Avoiding pinch-points and lane widths in the range 3.2 to 4.0 metres is essential – see section 4.4 for details.

Narrowing through use of kerbed median strip, Hornchurch. Raised tables act as informal flush crossings.

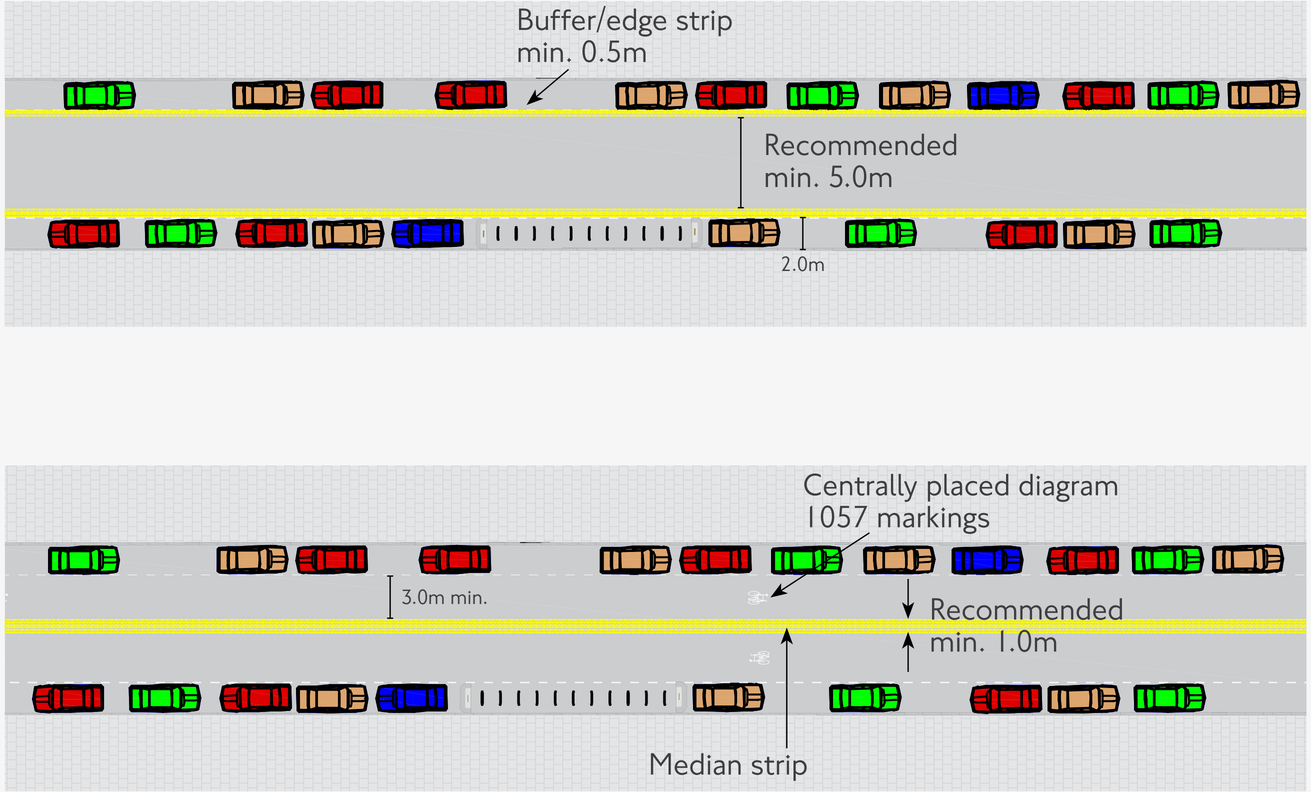
Flush median strip, Bexleyheath

Visual narrowing of the carriageway at Whitecross Street, Islington. Stalls are set out on the paved area when the market is on.

## Median and edge strips

Narrowing may be visual instead of physical, using different surface materials to suggest a narrow carriageway where the usable space is actually wider. This can be a good solution where temporary uses need to be accommodated and can be applied to median strips, provided those medians can be over-run by cyclists. Use of a strip with a domed or flush profile can help achieve this, rather than the conventional median strip with kerbed upstand. A flush median strip can be a good solution to facilitate overtaking of buses in stops or to maintain emergency vehicle access.

Research described in the TRL report 'Psychological' traffic calming (2005) found that use of edge markings, such as hatching, to narrow the carriageway width had a speed reducing effect on motorists. That effect was greater, however, if the markings were substituted for surfaces that appeared unsuitable for driving on. It should be noted that central hatching does not appear to have an equivalent speed reducing effect, according to the DfT's Traffic Advisory Leaflet 01/00, Traffic calming in villages on major roads (2000).




Indicative layout 3/03: Visual narrowing using a) edge strips and b) median strip

## 3.4.5 Parking and loading bays

If designed with marked-out bays and build-outs to create a consistent line in the carriageway, parking and loading facilities can be used as a technique for narrowing. Moving the bays out to create protected space for cycling between bays and footway can be a good way of providing a high level of service for cycling – see section 4.2 for more details. Alternating bays of echelon parking can also be used to create horizontal deflection, and therefore slowing, in the street environment.

Loading bays are indicated by a broken white line and optional 'LOADING ONLY' legend. Time limits and hours of operation are shown on associated upright signs. On a red route, the bays will be shown by broken red lines. Control over the hours of operation can allow for a single bay to be used for loading for part of the day and short-term parking at other times.

The choice of parking or loading facility depends on available carriageway width and the likely impact on the general traffic flow, as well as on the functional requirements of loading and parking and on cycling level of service. It is recommended that parking bays for cars, taxis and motorcycles should be a minimum of 2.0 metres wide and loading bays 2.4 metres.

Minimum dimensions will no longer be prescribed by TSGRD when it is published in 2015. However, the minimum requirement of 6.6 by 2.7 metres for a bay for blue badge holders will remain. Refer to advice in section 4.2.6 on cycle lanes and buffer strips past parking bays.

The location and size of bays also varies for certain goods and certain vehicles. Vehicles with a rear tail-lift will require more clear space at the rear than curtain-sided vehicles, but the latter may require more footway space to the side. Further information on space requirements is provided in TfL's Kerbside Loading Guidance (2009).

Trial measures on Gotgaten, Stockholm: car and cycle parking moved out into the carriageway to create more protected space for cycling. The existing, stepped cycle track has been used for temporary seating

## Maintaining good pedestrian provision

Taking space from the footway may be justifiable in exceptional circumstances for loading, as part of a flexible approach to using space on a busy street, but should generally be avoided for parking. At least 2 metres' width should remain clear for pedestrian movement, depending on existing levels of comfort for pedestrians (DfT, Inclusive Mobility, 2002). No space should be taken from the footway if it cannot achieve at least Pedestrian Comfort Level 'C'. For TLRN, 2.5 metres of footway is recommended in front of shops (TfL, Streetscape Guidance). Consult borough design guidance for further requirements on footway widths and loading facilities.

Fully inset bays have the advantage of keeping the carriageway clear and can help in accommodating multiple uses on the same street, particularly within the high street, city street and city hub typologies. However, where they are at the same level as the footway, the potential impact on vulnerable pedestrians must be considered through consultation with access groups early in the process. Defining and enforcing bays and associated parking contraventions can be challenging. Borough guidance on inset bays should be consulted in every case.


Inset bay, Wallis Road, Hackney


Inset loading facilities to support an office building – Moor Lane, City of London

Loading bay inside advisory cycle lane


Fully inset loading bays to support retail premises – Long Acre, Covent Garden

Where bays are fully inset and at footway level, they should be within the street furniture zone and accessed over a kerb upstand of at least 25mm. A minimum nearside lane width of 3 metres is required alongside any inset bay to maintain safe traffic flow. Consideration also needs to be given to drainage implications of inset bays, which ideally need to have a cross-fall towards the carriageway and the recommended upstand at the interface so that run-off from the carriageway will not flow into the bay. Refer to advice in section 4.3.10 on cycle lanes and buffer strips past parking bays.

The use of bollards is not recommended and should be avoided where bays are shared use or where they obstruct loading to /unloading from side-opening vehicles. In exceptional circumstances where bollards are used they must not become obstacles for pedestrians, particularly visually impaired people. Where used, bollards should be aligned with existing street furniture to provide a pedestrian 'channel'.

## Half-on, half-off bays

Where footway width does not allow fully inset bays, half-on, half-off facilities can be a good compromise to protect accessibility and provide adequately wide footways. In these bays, vehicles are allowed to stop with their nearside wheels on the raised footway. As London is subject to an area-wide footway parking ban, note that a Traffic Order and associated signing is needed to permit vehicles to park on the footway.

Cycle lanes need to be marked around half-on, half-off bays, with a buffer zone, in the manner described in section 4.3.10. Where there are no cycle lanes, the remaining width of the nearside general traffic lane must be no less than 4.5 metres to allow cyclists to stay clear of the door zone. On a bus route, this treatment is not recommended, unless a nearside lane of 5.5 metres can be provided.

Inset parking bays

## 3.4.6 Decluttering

Removing features that give the impression of motorised traffic domination, such as signs, road markings and certain kinds of street furniture, can contribute to psychological calming, to accessible pedestrian environments and to making streets more attractive, aesthetically pleasing places to be.

Minimising street clutter should be applied in line with relevant street design guidance, such as TfL's Streetscape Guidance or borough design guidance. It is particularly important for those street types with a high place function, such as city hubs, city streets and city places, where the aesthetic integrity of streets and the need to accommodate multiple functions are a high priority.

Decluttering is consistent with local and national policy. The Mayor's Better Streets initiative focuses on practical steps to achieve high quality streets, and advocates a staged approach. The five steps it describes represent increasing levels of intervention, with decluttering and merging functions being at the 'easy' end of the scale.

Manual for Streets takes the view that designers should use 'the minimum of highway design features necessary to make the streets work properly' (para 1.1.6, p13). This is an approach supported by the Department for Transport in Signing the Way, explained further in TAL 01/13, Reducing Sign Clutter and reinforced in the revised traffic signs regulations, TSRGD (2016).


Minimal use of road markings – Bunhill Row

Decluttered street environment – Liverpool Street

### Decluttering techniques

Interventions to support decluttering include:

- Removing and consolidating existing signing whenever feasible
- Using existing poles, posts, columns, walls and railings along the route for signing, with permission from the owner where required (the net number of sign posts should be the same or less than previously existed)
- Using agreed street furniture options and palette of materials to ensure that all the various elements are in keeping with their surroundings
- Keeping the variety of materials to a minimum – employing, for example, changes in colour and surface texture only where it serves both a practical and aesthetic purpose
- Co-locating signal heads and lighting on the same column, where feasible
- Ensuring that litter bins, control cabinets, other street furniture and trees are located in the furniture zone adjacent to the carriageway, leaving at least 2 metres' clear width for walking
- Removing pedestrian guardrail, unless it is absolutely necessary
- Attaching street lighting to buildings, with the permission of the owner
- Removing any inconsistent or unnecessary road markings

## Retaining essential street furniture

Careful consideration needs to be given to the role played by street furniture in contributing to a street's sense of place. As the 'whole streets' approach emphasises, it is important that people should feel relaxed, that they have places to stop and that they should enjoy shade and shelter in the street environment.

Provision of adequate, good quality and well located seating is therefore an important contribution to street activity and to accessible environments, and removing it in the name of decluttering should generally be resisted.

Similarly, while cycle parking stands need to be considered in any audit of street furniture, the provision of cycle parking in the area needs to be looked at holistically. Where it is poorly located, good quality parking should be re-provided (see chapter 8 for guidance).

## Minimising cycle infrastructure clutter

Cycle infrastructure in the street environment can lead to additional demands for signing, signals and surface markings. To help minimise clutter whenever there is a decision that a higher degree of separation for cyclists is required:

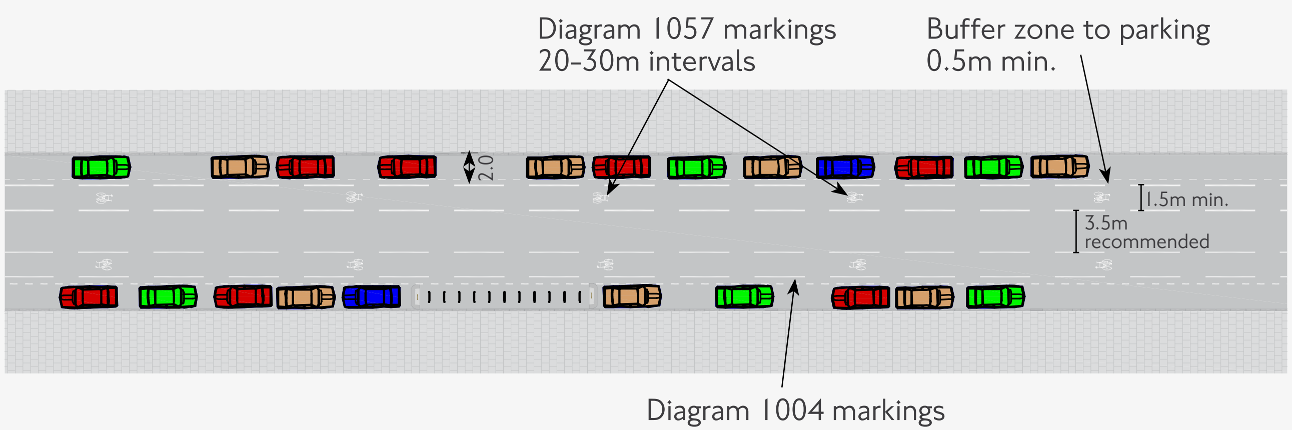
- Ensure the street is as legible as it can be, and that people are able to tell where motor vehicles, cyclists and pedestrians are supposed to be without the need for conventional signing to explain the environment: this can often be done in subtle ways, through changes of material or embedding signing within surface materials
- Make the street environment intuitive, avoiding wherever possible scenarios where road users are put into an unfamiliar relationship with one another: where the context calls for a more 'unintuitive' layout – such as contraflow cycling or cyclists and pedestrians sharing space – signing, markings and tactile paving has to be used to inform road users of how the space operates, and this is likely to undermine efforts to declutter
- Be consistent with cycling infrastructure: on links, keep cyclists either in a one-way or two-way system of tracks for as long as possible without unnecessarily switching between the two
- Use only the amount of regulatory signing that is strictly necessary

## 3.4.7 Centre line removal

Centre line removal is a simple and effective way of achieving a traffic calming effect and is recommended for consideration for any street with only one general traffic lane in either direction. Motorists often drive to the centre line and, where advisory cycle lanes are marked on narrower streets, are more likely to encroach into the cycle lane than the opposing traffic lane. Removing the centre line encourages them to drive to the advisory cycle lane marking instead, and tends to have a speed reducing effect because motorists are more wary of traffic in the opposing direction.

Trials conducted by TfL show a statistically significant speed reduction effect from this intervention at all three study sites, as documented in the report Centre line removal trial (2014). As this report explains, some roads may not be suitable for centre line removal, and markings need to remain where they convey a warning about a particular hazard, such as the presence of an island.

Many calm, two-way residential streets have no centre lines and little width between parking bays




Indicative layout 3/04: Centre line removal to support visual narrowing

## 3.4.8 Rebalancing priorities

Many streets and public spaces have the potential for a more diverse mix of active uses, but suffer from domination by motorised traffic. Rebalancing priorities so that people can use the space more flexibly can have positive effects for pedestrians and cyclists, if it results in a calmer, low-speed environment and encourages more considerate behaviour. This generally involves removing signals, signs and markings and allowing for more interaction between users.

More negotiation of movement, sharing and courtesy between users is a feature of shared space approaches. Described more fully in Manual for Streets (2007) and DfT's Local Transport Note 1/11, Shared Space (October 2011), these could complement efforts to remove formal traffic controls through decluttering and other forms of psychological traffic calming.

### Accessible design considerations

While removal of priorities and calmer traffic conditions can make the street environment more attractive and accessible for many pedestrians – making it easier for them to cross informally, for example – the street environment needs to remain fully accessible for all. How a place can be navigated in safety and comfort by visually impaired people needs to be considered carefully as part of the scheme design. The recommended ways of dealing with this are to:

- Retain footways and kerb upstands of 50mm or more, or

Seven Dials, Covent Garden

- Design in other kinds of 'comfort space' predominantly for pedestrian use that would not be used by vehicles moving through the street

In order to ensure that a scheme properly addresses accessibility and highway authorities' obligations under the Equality Act (2010), it is recommended that the early stages of a project should involve those users who may have concerns about the changes to the environment, and that an Equality Impact Assessment be undertaken. It is important that the legibility of the street environment is such that it can be used in confidence by older and disabled people, including (but not limited to), people with cognitive impairments, neuro-diverse conditions or learning difficulties. The document Accessible London: achieving an inclusive environment SPG (2014) provides further advice on planning and designing for all users.

Bonnington Square, Lambeth

Leonard Circus, Hackney – removal of priorities

New Road, Brighton

## Comfort space

Comfort space may be delineated by physical objects such as street furniture, planting or bollards, or may simply be space that vehicles do not need to track into.

Strong tonal contrast in surface treatments can support delineation of the comfort space. However, care should be taken to avoid complicated patterns that can confuse and disorientate users.

In streets with greater use by vehicles, including cycles, delineation is likely to be needed throughout, in order to deter encroachment onto pedestrian space, although it should not be a continuous barrier. It should link users to safe crossing points. The main objective is to allow blind or partially sighted people to follow a familiar path through the street in comfort, using the building line on one side and the various forms of delineation on the other as navigating features.

## Sharing space

Preconditions for more sharing of space are low or access-only flows of motorised vehicles and low speeds. LTN1/11 recommends a design speed of 15mph or less and advises that 'shared space should present a series of features and events to drivers that require them to increase their awareness and make conscious decisions on how they should negotiate each feature.' With that in mind, techniques to consider include:

- Removal of traffic management related street furniture, eg traffic signals and guardrailing
- Opportunities for tree planting and/or other soft landscaping
- Minimal use of signing
- Indications of priority at minor junctions omitted
- Use of courtesy crossings at surface level instead of controlled crossings
- A 'ladder-grid' movement pattern – encouraging pedestrian crossing at certain points, at regular intervals, through subtle variations to the width of the footway or comfort space
- Dedicated, carefully designed parking/loading bays
- Generous amounts of seating
- Well designed lighting
- Street trees, street art, cycle parking or other items of street furniture in 'unconventional' positions

Application of shared space approaches can be an opportunity to promote greening and use of sustainable drainage. Consideration should be given to use of permeable surfacing and care needs to be taken around the impact on street drainage of any level changes or changes to surface materials.

It is important that the transitions to shared space are well designed, so that drivers and cyclists enter the space at an appropriate speed. Gateway features, raised tables or continuing the footway and cycleway across the entrance to the street are all ways that this might be achieved. Other alternatives include a reduction in road width, visual narrowing, a change in surface material or signing.

Greening the street, Van Gogh Walk, Lambeth

Design of parking and loading in shared space is important, due to the risk that stationary vehicles may obstruct vehicular and pedestrian movement, although parking can be used constructively to help frame the pedestrian space and create horizontal deflections that assist in controlling vehicle speeds. There may be a desire to discourage regular vehicle movements, so short-term parking bays should be avoided, as should parking that reduces the width of the pedestrian space.

## 3.4.9 Surface treatments

Changes in surface material and level surface treatments, where there is no level difference between footway and carriageway can support rebalancing of priorities and shared space approaches. DfT reports in LTN 1/11 that level surfaces are appreciated by many people with mobility, hearing and learning impairments. However, others with mobility and visual impairments may be disadvantaged by lack of a kerb edge and so a form of delineation should be provided. This could take the form of comfort space or, as recommended in LTN 1/11, corduroy tactile paving.

Level surface treatment, Coventry

Some of the calming and aesthetic effects of level surfaces can be achieved by using a low kerb upstand. It is important this should be a minimum of 50mm in order to be detectable by anyone using a long white cane or guide dog.

Changes in surface material are often used to suggest an environment where priorities are different – less dominated by motorised traffic.

Level surface on a quiet street

Venn Street, Lambeth

This can usefully be applied to crossing locations, where the contrast in surface material might serve the dual purpose of highlighting the crossing as well as suggesting to vehicles that they should slow, even when they are allowed to move through the crossing area. In this way, a 'suggestion' of a raised table may be provided without any vertical deflection.

Minimal kerb upstands – Byng Place, Camden and Church Lane, Leytonstone

Imprint surfacing used for calming effect at pedestrian crossing at Kingsland High Street

## 3.5 Physical traffic calming

### 3.5.1 General principles

Speed reduction through 'psychological' measures are preferred for most circumstances. However, there may also be a need for physical speed control measures as part of area-wide road safety treatments in order to enforce a speed limit, helping road users to stay comfortably within it.

Cyclists are susceptible to being destabilised by abrupt changes in road surface level or being made to deviate sharply from their course. This is particularly uncomfortable or painful for disabled cyclists. For those reasons, methods of traffic calming that are a problem for cyclists should be avoided. This includes:

- Vertical deflections such as rumble-strips or steep humps that destabilise cyclists or force them to lose momentum
- Sharply-angled footway build-outs that require cyclists to deviate abruptly from a direct path
- Destabilising ramp surfacing material, eg bumpy or slippery surface
- Central islands where pinch-points are created (see section 5.2.8 for more information on the use of islands as refuges for pedestrian crossings)

Note that central hatching, which is often necessary to protect traffic islands, should not otherwise be used as a speed control measure, as it typically leads motorists to drive closer to kerbside cycle lanes.

Speed control measures should not: direct vehicles or pedestrians into the path of cyclists or vice-versa, make cyclists deviate sharply from their course, destabilise cyclists, force cyclists to stop or significantly lose momentum, or increase cyclists' anxiety or discomfort.

The preferred forms of physical traffic calming in support of cycle infrastructure are:

- Use of raised entry treatments and raised tables to slow turning movements
- Forms of narrowing set out in the section above (including the use of parking)
- Selected types of horizontal calming, such as build-outs and traffic islands – but these should be used with caution because of their localised effects on width and, therefore, passing distances

Vertical traffic calming should only be used where other forms of calming are not deemed adequate to bring down speeds. Raised entry treatments, raised tables and road humps must always have a sinusoidal or shallow profile.

Legal requirements relating to vertical traffic calming features are set out in the Highways (Road Humps) Regulations 1999. Advice on their use is given in DfT's Local Transport Note 1/07: Traffic Calming.

### 3.5.2 Raised entry treatments and raised tables

Research has shown that raised entry treatments have significant safety benefits for cyclists, particularly where provided in conjunction with other street enhancements. A reduction of around 30 per cent in cycle collisions was found at over 1,000 sites in London. (TRL report PPR092: Effect of Side Raised Entry Treatments on Road Safety in London, 2007).

Raised entry treatments to side roads adjacent to a main road are therefore recommended for a cycle route on the main road. However, all vertical forms of traffic calming, even well designed examples, add some discomfort for cyclists riding over them. Where a cycle route crosses a main road that is also well used by cyclists, a balanced view needs to be taken of the benefits they offer to cyclists moving in one direction relative to the downsides for those moving in the other.

Entry treatment with asphalt table, Gray's Inn Road/Heathcote Street, Camden

Block-paved entry treatment with tight corner radii – Walworth Road, Southwark

Typical entry treatments in the City of London, with visual contrast with carriageway: at a narrow street with cycle contraflow (Cloak Lane, left) and at a two-way street (Trump Street, right)

## Raised entry treatments

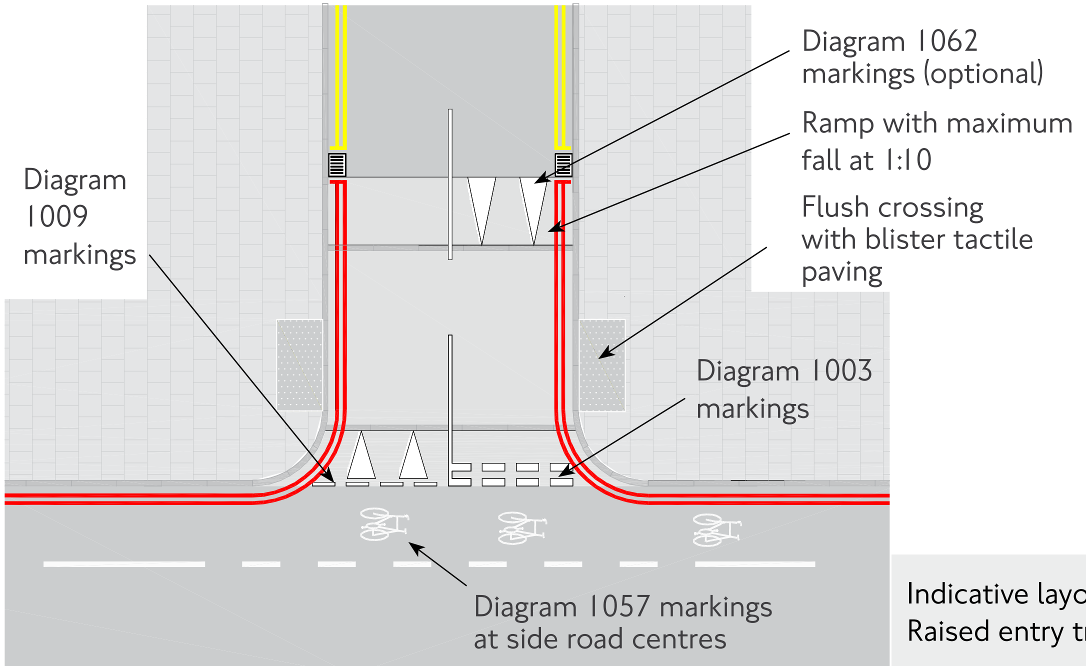
To provide the highest levels of service for cyclists, and to encourage motorists to make careful turning movements into and out of side roads, raised entry treatments may:

- Narrow the side-road carriageway to between 5.0 metres and 6.5 metres
- Use a corner radius of kerb-line below 3.0 metres – see section 5.1.4 for further guidance
- Raise the carriageway by 50-100mm, up to the same level as the adjacent footway
- Use materials that have a visual contrast with the carriageway surface to raise awareness (bearing in mind guidance in chapter 7 of this document and in other streetscape and local design guides on appropriate surface materials, particularly from a maintenance perspective)
- Use approach sinusoidal or shallow ramps, with 1:10 gradient (shallower gradients may be needed on bus and emergency-service routes)
- Be constructed using asphalt ramps or other non-skid material
- Provide flat pedestrian crossing areas of at least 3 metres width with blister tactile-paving to indicate crossing location
- Avoid upstands of more than 6mm where pedestrians cross (as this is likely to interfere with the movement of people in wheelchairs)

- Consider providing cycle stands on footway space created by the entry treatment where demand for them is reasonably anticipated, allowing for considerations of visibility: these can help deter vehicles from over-running the footway area

Shallow ramp up to entry treatment, Gresham Street, City of London

Raised table, Mercer Street, Westminster




Indicative layout 3/05: Raised entry treatment

## Raised tables

Raised tables extend the logic of raised entry treatments across all arms of a junction or crossing area, which can be effective in slowing turning movements but, again, puts in place a vertical shift for cyclists moving through a junction. Where assessment of the junction indicates that there would be a net benefit from a safety and comfort perspective in constructing a raised junction table, these are recommended, provided they are constructed in accordance with the above advice. Like raised entry treatments, junction tables convey to motorists not to expect to have priority over other road users, and to turn with appropriate caution.

## Heights

Raised entry treatments and raised tables do not require Traffic Orders but as a form of road hump they are covered by the Highways (Road Humps) Regulations 1999. The maximum permitted height of a road hump is 100mm from the carriageway surface, but DfT advice in Local Transport Note 1/07: Traffic Calming recommends a maximum of 75mm as this gives similar speed reducing benefits while reducing discomfort for vehicle occupants. In order to construct a raised entry treatment flush with the footway, some raising of the carriageway surface in the area leading up to the entry treatment may be necessary.

## 3.5.3 Continuous footways and cycleways

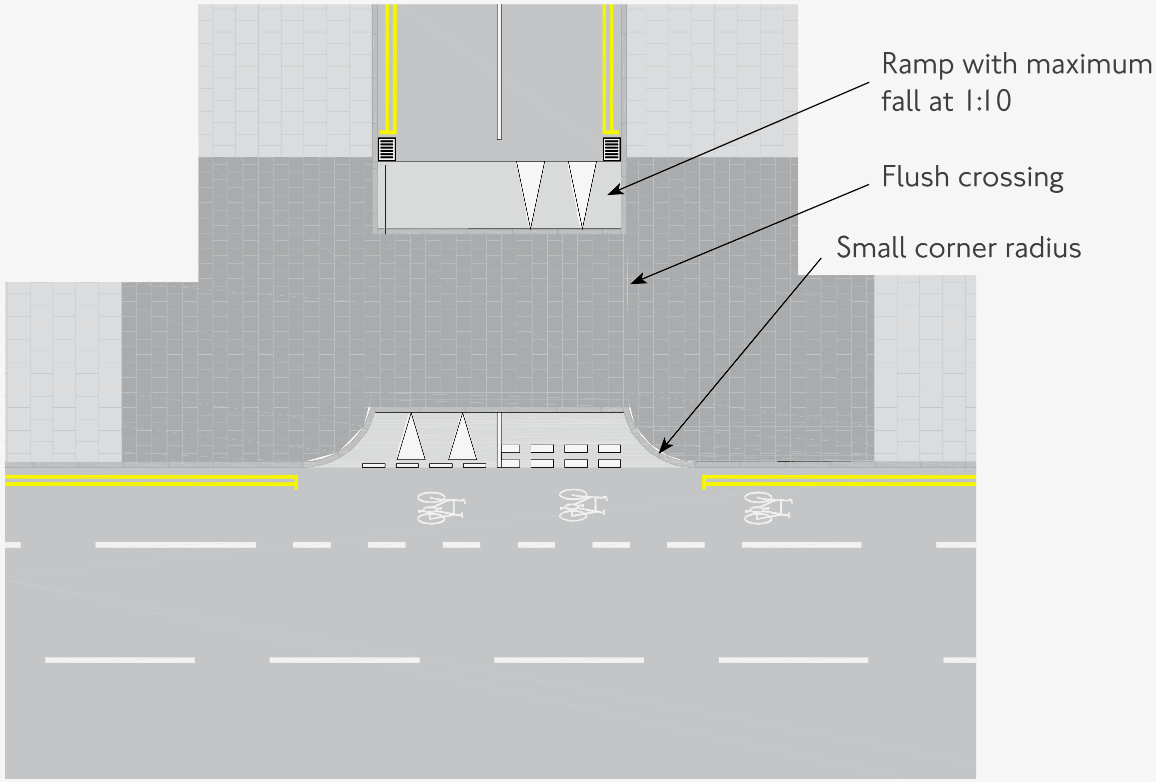
Consideration may be given to continuing footway and cycleway treatments across the mouth of the side road to convey further necessary priority for pedestrians and cyclists. Turning vehicles will need to negotiate a change in level, and they must enter and pass through a zone that looks and feels different and where there is a strong indication they should cede priority to other users. This is not practised often in the UK but has been applied in cities such as Copenhagen and Stockholm. A short dropped kerb section is sometimes provided to enable more comfortable access for cyclists and others.

An alternative method employed in Copenhagen is to run a stepped cycle track with a continuous treatment past a side road and continue the footway through but in a different material from the rest of the footway.

Continuous footway treatments in Stockholm. Note the dropped kerb to allow level access by cycle

Continuous footways in Copenhagen – with footway materials continued through (left) and varied (right)

Both of these methods should currently be regarded as experimental in the UK. Further development of the concept is needed, in consultation with access groups, to determine acceptable approaches, given concerns over the lack of delineation between the footway and the area accessible to vehicles that runs over the entry treatment. Any proposal should be subject to an Equality Impact Assessment.




Indicative layout 3/06: Continuous footway treatment

Continuous footway treatments in Lambeth

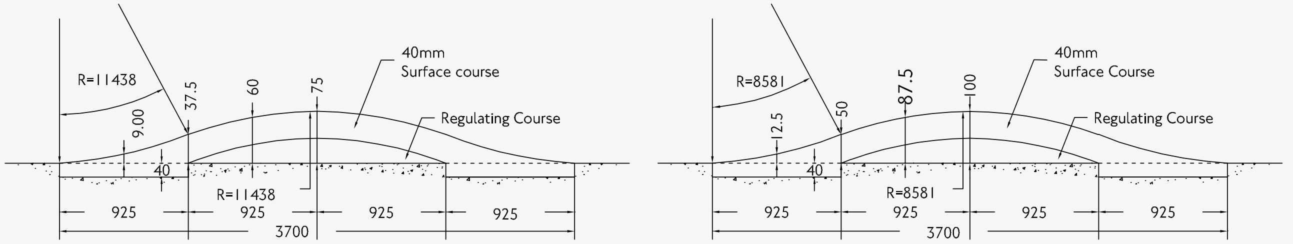
Continuous footway treatment in Hackney

## 3.5.4 Road humps

Road humps can be very effective at reducing vehicle speeds but need to be carefully designed so that their presence does not deter cyclists from using the road. Sinusoidal humps allow cyclists to maintain speed and they generate lower levels of vibration than flat-topped humps. Mixed or rough profile on humps must be avoided, as they slow cyclists more than other vehicles. For a shallow humps with level change of 50mm or less, a sinusoidal profile is not required.

> Where used, humps should always be cycle-friendly – meaning a shallow or sinusoidal profile.

On routes used by buses, only sinusoidal or shallow-ramped flat-topped varieties of hump may be used. Humps may not be acceptable on any route used by emergency service vehicles.




A. 75mm High hump B. 100mm High hump

Sinusoidal hump profile

### Ramp gradients

Linear ramp gradients should normally be between 1 in 10 and 1 in 20. It is recommended that the new surface of the hump is continued 500mm beyond the ramp into the existing carriageway surface to produce a smoother profile. Steeper gradients will provide greater speed reductions, and may be suitable for less trafficked roads, but will be more of an inconvenience to cyclists as well as motorists. Where there are higher flows, then flatter gradients and lower humps may be more appropriate. The TfL note BP2/05, Traffic calming measures for bus routes (2005) provides further advice in this area.

Type of flat-topped hump to be avoided

## 3.5.5 Speed cushions

Speed cushions are not recommended for cycle use, if avoidable, but are often introduced in preference to humps on routes used by buses and emergency vehicles. They rarely have a significant speed-reducing effect on certain wider-based vehicles and on powered two wheelers. Where they are used, they need to be carefully positioned to allow the cyclists to continue on a line that is at least 0.5 metres from parked cars and their door-opening space, and the gap between cushions should be clear of gulleys and 1.5 metres wide.

Parking controls are likely to be beneficial, but where frequent parking adjacent to the cushions cannot be avoided, gaps should fit cyclists' normal alignment. The route for cyclists and powered two-wheelers should be clear and direct, avoiding the need for either to deviate from a direct line.

Careful consideration should be given in placement of cushions to the likely path taken by motorised vehicles: avoid situations where three cushions are aligned so as to induce motorists to straddle the central cushion into the path of an oncoming cyclist. Similarly, the relative positions of speed cushions and traffic islands can, if poorly designed, create uncomfortable close passes between motorists and cyclists by forcing cyclists to the kerbside when they would better served taking a primary riding position.

The safety and comfort of cycle trailers and non-standard cycles (including tricycles and handcycles) must be considered when specifying cushions. Unless a nearside gap of at least 1.5 metres is provided, then the width of the cushion needs to be sufficient to allow users of cycle trailers and tricycles to ride over the top of the cushion and the ramp profile on the cushion needs to meet the same standards as for speed humps.

Gaps between speed cushions are in line for cyclists, reinforced by cycle symbol positioning. However they are not the recommended width apart and would be uncomfortable for users of many types of non-standard cycle

Gaps force cyclists to deviate from their line and into the door-opening space of parked cars

## 3.5.6 Materials for vertical traffic calming

Bituminous materials are inexpensive, quick to construct and recommended for humps and ramps. In other locations, block-paving tables may give a clearer pedestrian route but need to be well constructed to avoid potentially hazardous deformation when over-run by larger vehicles. Contrasting colour or texture will make the feature more visible and have a greater slowing effect. Good skid-resistance is important particularly where there are turning movements.

Humps and ramps constructed of granite setts are difficult to provide in a way that is durable and cycle-friendly and are therefore not generally recommended. They can be effective at slowing motor vehicles because of the rumble effect, although they can be manufactured and laid smooth. The surface must be smooth enough to be comfortable for cyclists, particularly the (edge) section most used by them. However, in higher usage situations granite can polish, becoming slippery and creating stability problems for cyclists and other two wheeled vehicles. Granite setts are also not likely to be a durable choice of material when frequently over-run by larger vehicles.

## 3.5.7 Footway build-outs

Footway build-outs at priority junctions may be used in conjunction with raised entry treatments to enhance some of the vehicle-slowing aspects of the design and also create either additional footway space or an opportunity for tree planting and greening of the street.

Build-outs provide pedestrians with shorter crossing widths and additional visibility when crossing the road at junctions and island sites (see section 5.2.8 for further discussion of use of refuge islands). However, it is essential from both a road safety and movement perspective that build-outs do not cause pinch-points, forcing cyclists to deviate into the path of vehicles, or restricting cycle flows.

For any proposed build-out, remaining one-way widths should be consistent with the guidance on pinch-points provided in section 5.2.8. For local streets and others in 20mph zones, build-outs can be used that reduce the remaining (two-way) carriageway width to 5.5-6.0 metres.

Footway build-out with contraflow cycle provision

Footway build-out incorporating cycle parking

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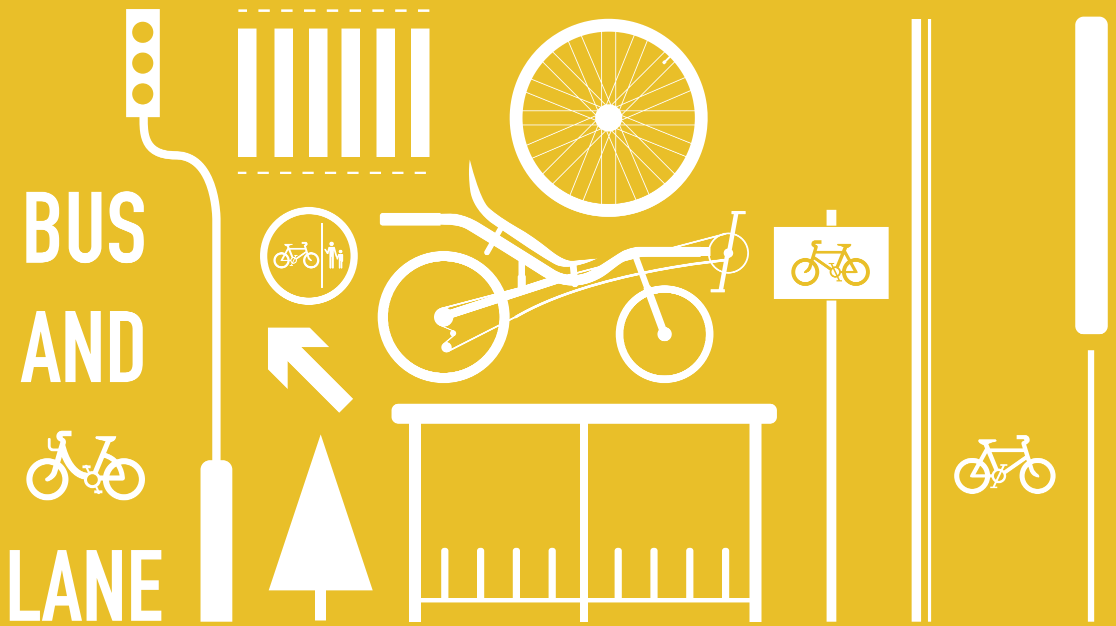
# 4. Cycle lanes and tracks

This chapter considers specific infrastructure for cyclists on links and how to achieve consistency and coherence across the network, including off-highway.






**Version control**

Version 1 (Dec 2014) – Published

Version 2 (Sept 2016) – Minor amendments following publication of TSRGD (2016)

# 4. Cycle lanes and tracks

## 4.1 Types of cycling facility

### 4.1.1 Cycle facilities on links

Cycle lanes and tracks are an important part of the overall traffic management toolkit. They can help:

- Give safety and comfort benefits based on the degree of separation from motor traffic provided and the quality of the cycling surface
- Allocate space to cycling
- Confirm a recommended route for cyclists
- Raise awareness of cycling as a serious mode of transport and thereby encourage more people to cycle

Quality of provision for cyclists on links is covered by the Cycling Level of Service assessment, as shown in figure 4.1.

Cycle infrastructure must be fit-for-purpose for its users. Good design depends on a proper understanding of cyclists themselves – how much room they need, how they behave and how diverse they are. This information is provided in section 3.2. Design should accommodate all types of cycle user, including children, freight cyclists, disabled cyclists and any other user of a wider or longer model than the standard bicycle.

Figure 4.1 Key cycle lane and track considerations in CLoS

| Factor | Indicator | Relates in this chapter to |
|---|---|---|
| **Safety**<br>Collision risk | Kerbside activity or risk of collision with door | Appropriate provision by street type, width of cycle lanes next to parking/loading and floating bays |
| | Collision alongside or from behind | Appropriate nearside lane widths |
| **Safety**<br>Feeling of safety | Separation from heavy traffic; speed/volume of traffic; HGV interaction | Appropriate provision by street type and according to traffic conditions and composition |
| **Directness**<br>Journey time | Ability to maintain own speed on links | Type, width and geometry of cycle facility (including ability to overtake) |
| **Comfort**<br>Effective width without conflict | Allocated riding zone range; lane allocation in each direction | Accommodating different types of cyclist, understanding effective width, setting lane and track widths |
| **Attractiveness**<br>Impact on walking | Highway layout, function and road markings adjusted to minimise impact on pedestrians | Appropriate provision by street type |
| **Attractiveness**<br>Greening | Green infrastructure or sustainable materials incorporated into design | Appropriate provision by street type, street profiles and function of segregating strips |
| **Adaptability**<br>Flexibility | Facility can be expanded or layouts adopted within area constraints | Considerations of degree of separation and width in order to accommodate growth over time |

## 4.1.2 Definitions of cycle infrastructure types

The definitions in figure 4.2 draw on: LTN1/12, Shared use routes for pedestrians and cyclists and Sustrans' Connect 2 and Greenways Design Guide, chapter 15, which provides more detail on public rights of way. Distinctions between cycle lanes, tracks and other types of infrastructure that can legally accommodate cycling are important from a user perspective and because they have implications for signing and, in many cases, enforcement.

Figure 4.2 Cycle infrastructure definitions (highlighted types permit cycling)

<table>
<tr><th colspan="2">Type</th><th>Description</th><th>Defined by</th></tr>
<tr><td colspan="2">Cycle lane</td><td>Part of a carriageway marked with a formal lane marking and allocated for use by cyclists.</td><td>Traffic Signs Regulations (TSRGD, 2016)</td></tr>
<tr><td colspan="2">Cycle track</td><td>A right of way for pedal cycles with or without right of way on foot. It can either be:<br>• Part of a public highway adjacent to a carriageway, or<br>• A separate highway in its own right<br>Pedestrians and cyclists may be separated by physical barriers, by level, or by markings only.</td><td>Sections 65(1) and 329(1) of the Highways Act (1980)<br>Section 1 of Cycle Tracks Act (1984)</td></tr>
<tr><td colspan="2">Footway</td><td>A carriageway: a right of way for the public on foot only that exists within the highway.</td><td rowspan="2">Section 329(1) of the Highways Act (1980)</td></tr>
<tr><td rowspan="4">Public rights of way</td><td>Footpath</td><td>A separate highway over which the public have right of way on foot only (eg away from a highway used by vehicles).</td></tr>
<tr><td>Bridleway</td><td>A right of way on horseback and on foot. Cycling is permitted (provided that cyclists give way to pedestrians and horse-riders) unless an order or by-law specifically prohibits it.</td><td>Countryside Act (1968)</td></tr>
<tr><td>Restricted byway</td><td>Generally, a way open only to pedestrians, cyclists, horse-riders and horse-drawn vehicles.</td><td>Countryside and Rights of Way Act (2000)</td></tr>
<tr><td>Byway open to all traffic (BOAT)</td><td>This is open to all vehicle users, including cyclists, but BOATs rarely have sealed surfaces and tend to be used in similar ways to footpaths and bridleways.</td><td>Wildlife and Countryside Act (1981)</td></tr>
</table>

## Creating cycle tracks

Procedures for creating cycle tracks are covered in detail in LTN1/12. In summary:

- All or part of the width of a footway can be converted into a cycle track through the Highways Act (1980): section 66(4) is used to 'remove' the footway and section 65(1) to provide a cycle track with right of way on foot
- All or part of a footpath may be converted by using section 3 of the Cycle Tracks Act (1984) and the Cycle Tracks Regulations (1984)

A right of way by pedal cycle and on foot may also be created through permissive agreement between local authority and landowner, usually for a fixed period of time. A permanent right of way may be created if the landowner is willing to dedicate the land as public highway. Permissive rights should be in the form of a freehold or leasehold interest rather than through a licence.

## Cycling in pedestrian areas

Cycling on a footpath, away from a road, is normally a trespass in law (a civil offence). It is only a criminal offence if cycling is prohibited by by-law or by local traffic regulations (made under the Road Traffic Regulation Act 1984), in which case a 'no cycling' sign should be displayed. In practice even without enacting one of the above procedures, cycling on a footpath can be acceptable if it has taken place openly and without causing damage on the path for a period of 20 years (usually) and if the landowner has shown no sign of objecting.

In areas that have been pedestrianised, cycling can be permitted by amending the relevant Order. Such an Order would have removed the right to use vehicles on the specified highway either under section 249 of the Town and Country Planning Act (1990) or section 1 or 6 of the Road Traffic Regulation Act (1984).

## Lane or track?

The dividing line between cycle lane and cycle track can be unclear. As figure 4.2 sets out, lanes are usually created from the carriageway and tracks from a footway or footpath. However, cycle facilities physically separated from the main carriageway are commonly known as and signed as cycle tracks, even if they have been created from the carriageway.

Kerb-segregated facilities at carriageway level therefore alternate between the status of a lane and track, being tracks on links (physically separated and without lane markings) and breaking to become lanes through junctions.

A cycle lane, created from the carriageway

Cycle tracks, away from the carriageway

Cycle tracks at carriageway level that break to become lanes across accesses and side roads

## 4.1.3 Degrees of separation

The different categories of cycling provision used in this guidance, and described in the remainder of this chapter, are set out in figure 4.3 below. Types are defined according to the degree of separation they offer – which in turn dictates the level of service for cyclists. Separation between cyclists and motorised vehicles is the key issue on-carriageway and is described in more detail in figure 4.4. Elsewhere, it is separation between cyclists and pedestrians that is the determinant of level of service for both sets of users. These degrees of separation are covered in sections 4.5 and 4.6.

Note that the 'maximum separation' option would be to separate users at the network level. This means that, in the process of planning cycling routes, an option that offers the best level of service to cyclists may be to dedicate different routes to them across a wider area and avoid streets where provision may be inadequate. Network planning is covered in section 2.3.

Figure 4.3 Degrees of separation on links

| **Cycle facility on-carriageway (separation of cycles and motor vehicles)** | |
|---|---|
| **Full separation** | Segregated lane/track<br>Stepped track |
| **'Dedicated' cycle lanes** | Light segregated lane<br>Mandatory cycle lane |
| **'Shared' lanes** | Shared bus/cycle lane<br>Advisory cycle lane |
| **Integration of users** | Cycle street<br>Mixed traffic |

| **Cycle facility alongside the carriageway or off-road (separation of cycles and pedestrians)** | |
|---|---|
| **Full separation** | Cycle track and separate footpath or footway |
| **Partial separation** | Footway or other right of way separated between cyclists and pedestrians |
| **Sharing** | Shared use footway or other right of way |

Figure 4.4 On-carriageway degrees of separation on links

## A. Full separation (on links)

### Segregated lane/track

Cycle lane or track separated by a continuous or near-continuous physical upstand along links (usually verges or kerbed segregating islands).

### Stepped tracks

Vertically separated cycle tracks at an intermediate level between the footway and main carriageway, with or without a buffer.

## B. 'Dedicated' cycle lanes

### Light segregated lane

A facility separated and protected by intermittently placed objects. These generally include formal, mandatory lane markings.

### Mandatory cycle lane

A marked lane for exclusive use of cyclists during the advertised hours of operation. It is an offence for other vehicles to enter, unless they are exempted. Separate parking restrictions are needed in order for them to be fully effective.

## C. 'Shared' lanes

### Shared bus lane

Cyclists may use the full width of the bus lane during and beyond its hours of operation. Applies to nearside, with-flow bus lanes, and should extend to contraflow and offside types.

### Advisory cycle lane

An area intended for, but not legally restricted to, cyclists' use. Other vehicles are permitted to enter or cross it.

## D. Integration

### Cycle street

A street where cyclists have assumed priority in a speed restricted area, variously marked with or without formal cycle lanes or indicative areas for cycling.

### Mixed traffic

A street or space without cycle lanes or tracks, often including cycle symbols on carriageway. Motorised traffic is either absent or at low volumes and speeds. May include space shared between all users

## 4.1.4 Selecting the right provision on links

Whether cyclists should mix with general traffic, have their own dedicated space on-carriageway or be taken off carriageway depends primarily on the functional and aesthetic characteristics of streets as places, on what activities might take place on the street, on the movements of other modes of traffic and on the role of a given street or route within the network. The chosen facility should be capable of delivering all the good design outcomes:

- **Safety** – an appropriate degree of separation for cyclists and pedestrians
- **Comfort** – facilities that are fit-for-purpose and appeal to existing and new cyclists
- **Coherence** – consistent, predictable provision, not constantly changing between types
- **Directness** – a choice that promotes direct cycle movement, without unnecessary delay
- **Attractiveness** – facilities that contribute positively to the urban realm and wider neighbourhood
- **Adaptability** – provision for cycling that can be altered to meet changing needs over time including substantial growth in cycle numbers

The best provision for cycling for any street is one that delivers:

- A highly rideable outcome, as measured by the Cycling Level of Service
- A practical balance between user needs, ensuring that the needs of more vulnerable people are met as a priority
- A high quality of place, appropriate to the street type

To achieve this, it is recommended that three criteria are applied sequentially:

### 1. People (user needs)

What user requirements should be accommodated, and need to be better served, and which should be prioritised?

### 2. Place (vision)

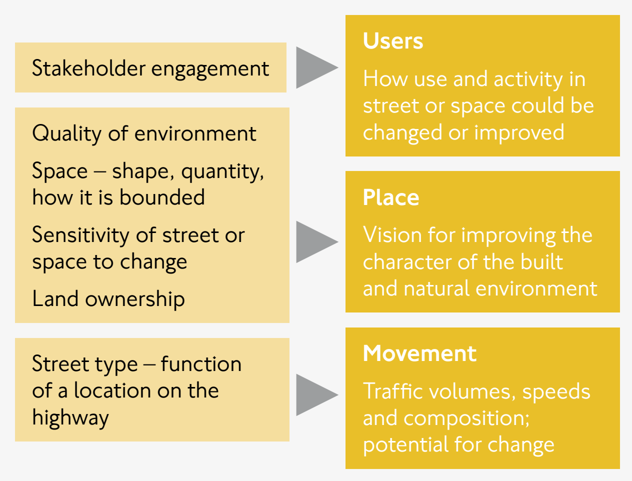
What interventions for cycling are capable of improving the quality of place, in view of the identified street type and the physical characteristics of the street or space? How could the street deliver a better level of service for all?

### 3. Movement

How could the movement characteristics of the street be adapted to deliver this vision and meet identified needs, and how could user separation contribute to this (or detract from it)?

Figure 4.5 demonstrates how the three criteria apply to choice of facility and how cycling provision should contribute positively to any place. The vision may be derive from planning or strategic objectives or may need to be drawn up as a set of context-specific objectives.

Figure 4.5 Selecting an appropriate degree of separation for cycling on links




## User considerations

Accessibility and inclusive design must be at the forefront of considering user needs: interventions for cycling should not introduce barriers to access for all and any opportunity to make places more accessible should be taken.

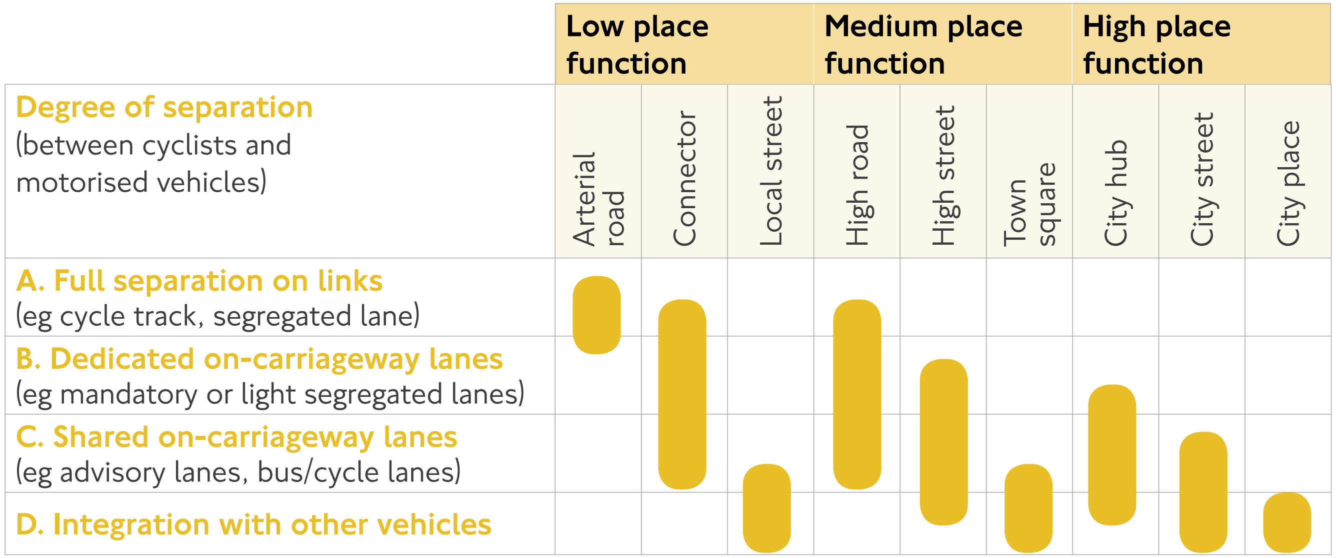
Patterns of use by cyclists and pedestrians should be informed by an understanding of where attractors and desire lines are and by the function of a street within a wider route or network. Facilities in the higher ranges of the degrees of separation may not be appropriate where pedestrian and cycle desire lines cross regularly, and where there are high flows of both. They could work well, however, where those movements are largely in parallel.

Use includes activities that serve adjacent properties, such as access, loading and car and cycle parking (see section 3.2). Some facilities can be moved but where frequent kerbside activity needs to be retained in its current location, such as loading bays for certain types of delivery, cycle infrastructure needs to be chosen carefully and designed flexibly in order to retain access. It is important, however, to bear in mind adaptability and the likelihood of those needs continually changing in the future.

## 4.1.5 Application of street types

The concept of street types can serve as a proxy for many of these considerations of use and place – high streets, for example, are likely to see high levels of kerbside activity and much more complex patterns of pedestrian movement than other streets. Guidance on the role of street type in the decision-making process is provided by figure 4.6. Indicatively, for streets with a higher movement function, there is likely to be a positive relationship between the degree of separation and the level of service for cycling.

Figure 4.6 Recommended on-carriageway cycle facility provision by street type




Within any given street type, the sensitivity of the street environment to physical interventions needs taking into account. Where there are street trees, for example, the default should be to retain them and find a type of cycling provision that allows for this. Where there are particular requirements about materials and use of signs, road markings and colour (for example in conservation areas), more subtle choices may need to be made and certain more intrusive elements such as shared use areas with large amounts of tactile paving will generally need to be avoided.

These considerations inevitably constrain the choice of cycle infrastructure, but they should not be taken to mean that, in certain circumstances, nothing can be done for cyclists. Changing the physical conditions is always possible – for example, through traffic calming, reconfiguring the space, taking opportunities that may arise from future development or changes in land ownership, or reallocating space between users.

## 4.1.6 Traffic speed and volume

This approach to cycle infrastructure provision replaces the speed/volume matrix and graph from the 2005 edition of LCDS. Motorised traffic speed and volume remain important, but they are understood to serve the place function of the street and all user needs. They are an integral part of the CLoS framework, but need to be considered alongside all the other rideability criteria. Key movement factors from CLoS include:

**Motorised traffic speeds**
Where 85th percentile speeds are above 30mph, either calming or a higher degree separation is required. If cyclists are not separated, level of service is highest where 85th percentile speeds are below 20mph.

**Traffic volumes and composition**
Where volume is above 1,000 vehicles during the peak hour, separation for cyclists or reduction of traffic volume is required. A basic level of service for cyclists can be achieved if peak volumes are between 500 and 1,000 vehicles per hour but only if the proportion of HGVs is below 5 per cent. For lower degrees of separation, the highest levels of service come with peak volumes below 200 vehicles per hour.

## 4.2 Full separation on links

### 4.2.1 Overview

Separation on links can provide a high level of service for cyclists, offering comfort and subjective safety. The main planning and design challenges arise at junctions and in relation to kerbside activity, particularly at bus stops. For that reason, full separation is likely to be most readily applicable to streets with a low place and high movement function, such as arterial roads, connectors and high roads.

Kerbed separation, Southwark Bridge

The type of separation used has a direct relationship with the degree of protection and subjective safety offered to cyclists. The greater the width of the separation, and the more continuous it is, the higher the degree of protection, but this has to be balanced with meeting other user needs.

### 4.2.2 Balancing user needs

Should a high degree of separation be warranted (see section 4.1 above), the impact on other users and on the place function of the street need to be considered carefully. The key factors are summarised in figure 4.7 below and should all be assessed as part of planning a fully separated cycling facility.

Designers' obligations under the Equality Act (2010) are particularly significant, given that segregated cycle lanes and tracks can introduce infrastructure that could be difficult to negotiate for people with protected characteristics under the Act. Cycle facilities must also cater for those using non-standard cycles, including any model adapted for use by a person with an ambulant disability. Early engagement with access groups and representatives of disabled cyclists, and the preparation of an Equality Impact Assessment, are recommended.

Segregated lanes and tracks should meet the good design outcomes for cycling. Pedal cycles are vehicles and there should be identifiable advantage for cyclists in providing facilities that separate them from other vehicles, in terms of directness, coherence, comfort and attractiveness – as well as safety. While short stretches of segregation can help give protection from specific risks, for example localised protection of cycle lanes where conflicting traffic movements may be taking place, their use needs to be balanced with the benefits that arise from the coherence and legibility of cycling infrastructure over a distance.

Figure 4.7 Key user considerations for segregated cycle infrastructure

| Implications for | Considerations |
|---|---|
| Pedestrian movement | • Pedestrian desire lines and legibility of infrastructure<br>• Integration of formal and informal crossings<br>• Ensuring kerbs are not potential trip hazards |
| Blind or partially sighted people | • Provision of crossings with correct tactile paving, and dropped or raised as appropriate<br>• Retention of a kerb edge to the footway at least 50mm high<br>• Any physical segregation between cyclists and other users should be detectable by those with little or no vision; ground level detection should be available to ensure that long cane users can identify the segregated area |
| People using wheelchairs, pushchairs or buggies, or those with ambulant disabilities | • Breaks in the segregation to allow level access, using dropped kerbs or ramps as appropriate<br>• Deployment of access ramps to the footway from taxis<br>• Provision of disabled parking bays outside the lane or track, or inset into a segregating island<br>• Island separation wide enough to permit movement to more accessible crossovers |
| Bus and coach infrastructure | • Accessibility of stops<br>• Cycle provision at the stop<br>• Providing inset facilities in wide segregating islands |
| Loading and parking | • Retaining and managing kerbside activity: appropriate line markings and enforcement, timing of deliveries<br>• Potential for insetting bays or 'floating' them (between the cycle lane/track and the general traffic lane)<br>• Access for blue badge holders |
| Personal security | • Appropriate lighting and visibility to and from the cycle facility where it is separate from the main carriageway |
| Vehicular access generally | • Breaks in segregation at junctions and to allow access to properties |

## 4.2.3 Segregated cycle lanes/tracks

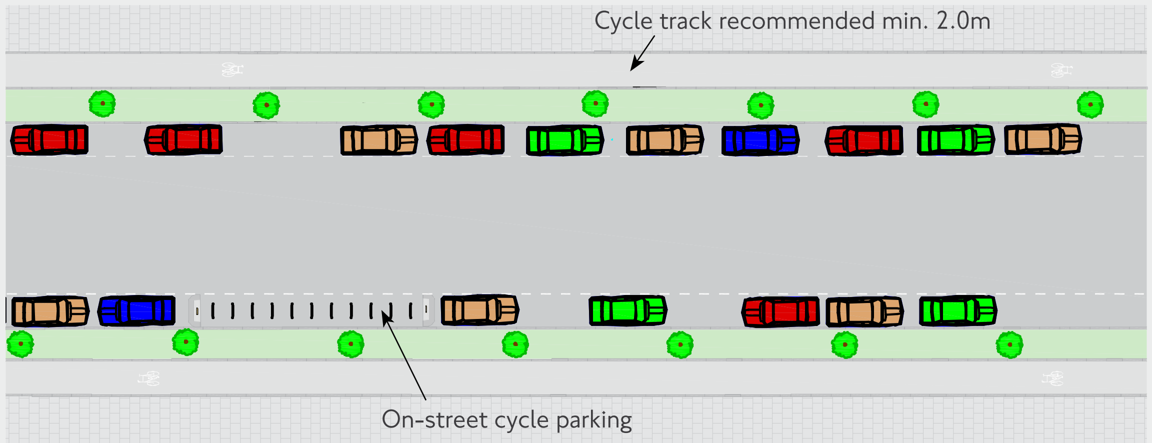
Skinner Street, Islington

Bunhill Row, Islington (contraflow)

Segregated lanes and tracks involve the use of features such as kerbs, separating strips, islands, grass verges or lines of planting to create a continuous physical barrier between moving motor vehicles and cyclists on links. Parking and loading bays may also form part of the buffer space. This provides a high degree of separation and, if the space is sufficiently wide, it can be designed to provide additional amenities for the street – cycle stands and planting, for example.

Provided they are well constructed, with a smooth, preferably machine-laid asphalt riding surface, and are well maintained, segregated lanes/tracks can offer a high degree of comfort. They should be designed with regular breaks, for drainage and the required pedestrian and vehicular access, and to allow cyclists to exit and enter as required. Any gap for cyclists should be at least 2 metres wide to allow for passage of all types of cycle.

Separation by planted strip, Allen and Pike Streets, New York




Indicative layout 4/01: Segregated cycle track behind verge

## Dimensions

Lanes/tracks should be designed with adaptability and growth in cycling numbers in mind. It should be noted that physical barriers reduce the effective width of the facility – 200mm for a low upstand such as a kerb. Indicatively, high cycle flows – over 800 cycles per hour at peak one-way, or 1,000 two-way – will require widths of 2.5 metres one-way or 4.0 metres two-way (see section 4.4 for details on widths).

To maximise the effective width of kerb-separated facilities, the level of the lane/track can be raised above that of the carriageway, reducing the height of the kerb upstand on the cyclists' side to a minimum of 50mm. Use of angled (battered or splayed) kerbs can also help reduce loss of effective width and lower the risk of cyclists catching a pedal on a high kerb. See section 7.1.6 for further details on options for kerbs.

Width of cycle lane/track, frequency and size of gaps and type of kerb all need to be considered in relation to access by vehicles for maintenance, cleaning, clearing of leaves and winter gritting. Where the facility is too narrow for such vehicles, wide breaks in the segregating island need to be provided to allow access. A demountable bollard in such gaps may be desirable.



Segregated lanes/tracks with low kerb upstands – in Utrecht (left) and Stockholm (right)



Skinner Street, Islington: battered kerbs and gaps to allow for uncontrolled pedestrian crossing

## Start of segregation

At the start of a segregating island, consideration should be given to inclusion of a bollard or flexible post in order to highlight the kerb upstand to all road users. Passively safe, flexible products that 'give' when struck should be chosen. Bollards should not show a 'keep right' sign but should be blank to allow all vehicles to pass on one side and cycle-only traffic on the other. Bollards or flexible posts must have a retro-reflective element so that they are identifiable in all lighting conditions.

A bollard or flexible post is only needed if there is a significant risk that the normal path taken by any road user may bring them into close proximity with an island that may not be clearly identifiable as an upstand. Where there are various turning movements, that risk is likely to be higher and so highlighting the island is recommended. Circumstances in which consideration might be given to omitting the bollard or post may include:

- On a link, where a mandatory cycle lane becomes a segregated cycle lane without any likely turning movements at that location
- Where segregation breaks and recommences at a pedestrian crossing
- Where lane markings clearly direct other road users away from the island (with hatching as necessary)

Preconditions for omitting the bollard or flexible post should be that there is good visibility (well-lit at all times of day and night) and visual contrast between kerb and carriageway surface.

Blank bollard (without recommended clearance)

## Width of kerbed islands

Guidance in Chapter 1 of the Traffic Signs Manual suggests that 450mm clearance should be provided between a sign and the carriageway, and this is good advice where motorised traffic passes a post, signal equipment or bollard. However, on any side where only cycle traffic will pass, less clearance may be acceptable – although any clearance less than 250mm is not recommended. Risk should be assessed on a site-by-site basis, balancing the benefits of reducing island width with the disbenefits of reducing effective width for the cyclist. For example, where effective width of a one-way cycle facility already allows ample space for overtaking (indicatively, a lane or track 2 metres wide or more), the risk of providing less than 450mm clearance to a sign is low. Risk will increase with two-way cycle movement and where space dictates that overtaking and passing manoeuvres are likely to bring cyclists close to the kerb edge.

The appropriate width for a segregating island depends on many factors and there is insufficient established practice in the UK to be able to give reliable dimensions. It is recommended that a risk assessment on a site-by-site basis should inform those decisions related to safety. One key consideration should be that consistency of width of the cycle facility and of the adjacent general traffic lane are more important than consistency of island width, which can vary considerably on a link. Some indicative widths to accommodate various functions are shown in figure 4.8.

Figure 4.8 Recommended minimum widths for islands segregating one-way, with-flow cycle traffic

| Minimum width | Function |
|---|---|
| 0.5m | On a link |
| 0.8m * | At the beginning of the segregation to accommodate a flexible post (100mm wide) |
| 1.0m * | At the beginning of the segregation to accommodate a blank bollard (300mm wide) |
| 1.0m | Where an adjacent parking or loading bay is provided |
| 1.0m | Where any planting other than trees is included in the island |
| 1.2m | For uncontrolled / informal pedestrian crossings |
| 1.3m ** | For an island with low-level signal pole |
| 1.5m ** | For an island with standard traffic signal pole |
| 1.8m | For controlled pedestrian crossings |
| 1.8m | Where pedestrians or wheelchair users from disabled or community transport vehicles set down |
| 5.0m | At priority junctions to accommodate fully one vehicle turning in and giving way to the cycle track |

Notes:

* Based on 450mm clearance on one side and 250mm on the other

** In some circumstances, the signal may be cranked to make the best use of space

Where 450mm clearance has been impossible to provide (due to utility services) the signal head has been cranked

## Function of segregating islands

The strip or island can contribute positively to the quality of the streetscape, with the potential to accommodate greening and sustainable drainage. The function and future use of such areas should be clear from their design. If the island is intended for pedestrian use, and resembles the footway, then this needs to be clear from the outset. If pedestrian use is not anticipated, the island may need to be designed to look deliberately different from the footway.

Segregating strip used for cycle parking, Utrecht

Planted segregating strip, Utrecht

Two-way and contraflow segregated lanes/tracks: Tavistock Street (left) and Bury Place (right)

## 4.2.4 Two-way cycle tracks

Segregated lanes/tracks and stepped tracks should generally be designed to be one-way, on either side of the road, with cycle traffic running in the same direction as adjacent general traffic lanes. If a facility is created from the footway as a cycle track (see section 4.1 above for explanation), then it is two-way unless made one-way by a Traffic Order.

Two-way tracks on one side have practical advantages for some street types where a high degree of separation is required – for example, where there are many more side roads and greater levels of kerbside activity on one side than the other, or where that condition can be created.

Where cycle flows are tidal (with significantly larger flows in one direction during the peak periods), two-way tracks can represent a more flexible use of space than one-way tracks. This is because cyclists can move out into the 'opposing lane' within the cycle track to overtake. They are likely to require less space than one-way tracks where cycle movements are separated in time and space from those of other vehicles at signal controlled junctions.

Consideration of cycle flow and, in particular, likely behaviour at peak times is important for informing the choice about one- or two-way tracks. Enough width is needed to minimise the risk of head-on collisions between cyclists in two-way tracks. See section 4.4 for further guidance on widths.

Cycle track by a major arterial road – CS3

Use of a centre line (to TSRGD diagram 1008) and/or cycle symbols (diagram 1057) on two-way tracks in the direction of travel can remind users that the track is two-way, and will help distinguish it from an adjacent footway. Consideration should be given to seeking authorisation for a half-width (50mm) diagram 1008 marking for use as a centre-line (see section 6.2.4 for more details).

Two-way track at Goodman's Yard, City of London

Track at Tavistock Street, Camden, forming a parallel carriageway and simplifying movement through a four-arm junction (but note the need for the left-turn ban).

## Pros and cons of two-way tracks

The model of using segregated two-way tracks on one side of a street should be applied very selectively. UK and international practice shows that there are some circumstances in which two-way tracks on one side can be a choice that offers a high level of service; two-way tracks on both sides has more merit still. Opportunities and challenges associated with two-way tracks are summarised in figure 4.9. As the list of challenges suggests, more substantial traffic management is generally associated with two-way tracks, but this may be justified in some circumstances in order to achieve effective separation.

Figure 4.9 Two-way cycle tracks: opportunities and design challenges

| Opportunities | Challenges |
|---|---|
| Where buildings, active uses and side roads are entirely or largely on only one side (a waterside location, for example) | Can be unintuitive and generate risks associated with motorists and pedestrians not looking both ways when crossing a track |
| Where kerbside activity or side road access may be reconfigured so as to take place largely on one side | Complex arrangements at junctions and side roads, often with some confusion about priorities (see section 5.3.4 for more details) |
| Arterial roads such wide dual carriageways with infrequent crossings | Complex transitions from one-way, with-flow to two-way cycle provision |
| One-way systems and gyratories | Connectivity for cyclists to and from the track can be difficult to manage |
| | Need for substantial signal control, for the above reasons |

Visualisation of Cycle Superhighway scheme for Blackfriars Road, where side roads and active uses are predominantly on the east side and a two-way track is therefore proposed for the west side.

Regarding collision risk at priority junctions, an appropriate balance needs to be struck between safety and cycle priority, with additional signing or vehicle slowing measures provided as necessary. On one hand, a cyclist riding in the opposing direction from all other traffic will normally have good intervisibility with the driver of a motorised vehicle about to turn left into a side road. However, a driver about to turn left from a side road into the main carriageway will not be expecting a cyclist approaching from the left unless there is clear signing that this may happen.

## Transitions

Transitions from and to and connectivity with two-way tracks generally needs to be addressed by bespoke junction design. For example, waiting spaces need to be designed in to allow for movements on and off the facility to take place. Where cyclists re-enter the carriageway from a two-way track, transitions should be smooth and designed with a focus on cycle safety (see section 4.6.4 for more detail on transitions).

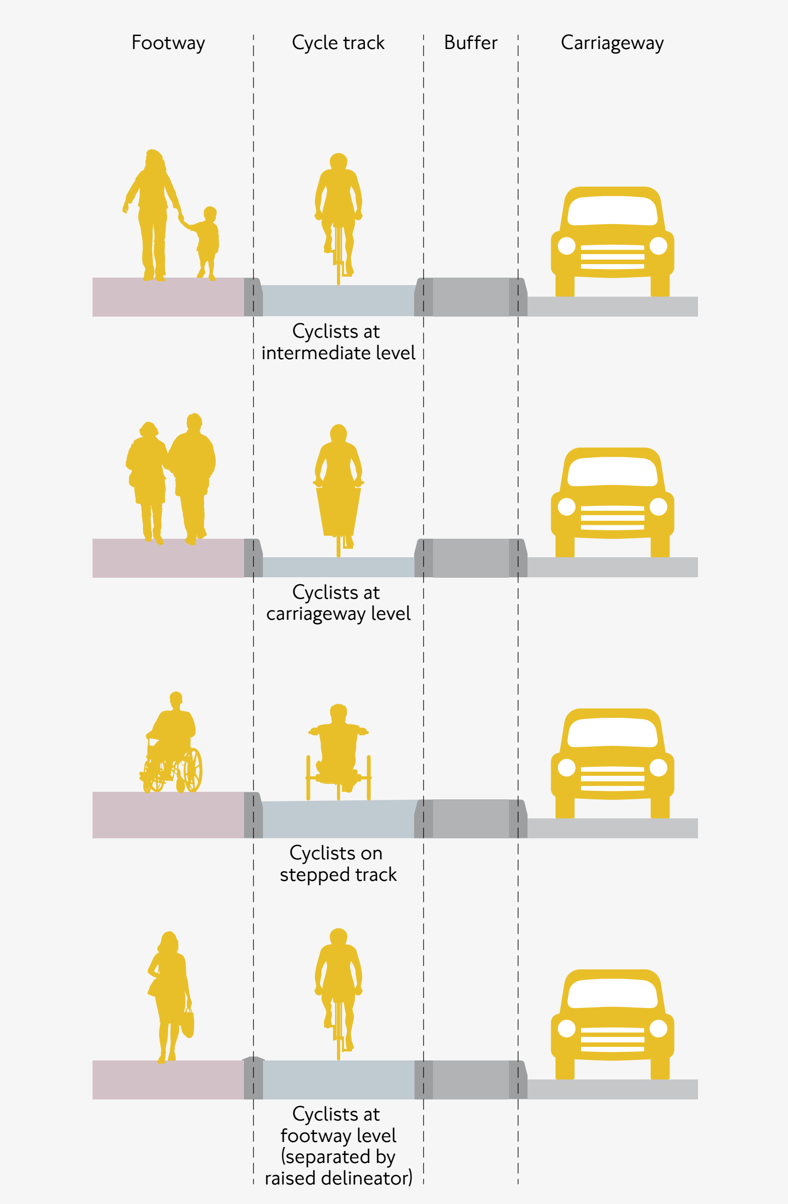
Two-way facilities can lead to awkward transitions when joining with one-way provision (top). Consideration needs to be given to avoiding pinch-points at bends where effective width is squeezed (bottom)

Visualisation of proposed junction with waiting spaces

## Vertical separation

Since two-way tracks can be unintuitive for pedestrians, there may be advantages in having the track at carriageway level to differentiate it from the footway. This is often the case where tracks are created from the carriageway. However, this can make tracks more visually intrusive in the street environment and it makes them more difficult for pedestrians to cross.

Tracks at footway level may integrate better with the street, but they are also likely to invite more pedestrian/cyclist interaction with some users unsure of where they are supposed to be or unaware of the distinction between areas. Two-way tracks at intermediate level, with a kerbed island between track and carriageway, can be a good compromise.




Level of cycle track compared to footway and carriageway

## Central cycle tracks

International practice also shows occasional use of two-way cycle lanes/tracks in the centre of the carriageway, often using light segregation (see below) to separate from adjacent general traffic lanes and heavier forms of segregation at points of potential conflict. Cyclists in both directions have space to overtake yet remain in an expected position in the carriageway, and there is no interaction with kerbside activity to manage so it may be a treatment suitable for bus and cycle priority routes. However, central tracks are likely to need certain vehicle movements to be banned and more complex signalisation than would otherwise be required. At time of writing, there is no UK practice to draw on and no standard design details.

Central two-way cycle track, Cours des 50 Otages, Nantes (with bus-only lanes on either side)

## 4.2.5 Stepped cycle tracks

Stepped cycle tracks are vertically separated from the footway and main carriageway in order to provide greater protection, safety and comfort than a cycle lane. They offer less separation and less protection than kerb-segregated lanes/tracks, but they may be regarded as a more subtle intervention and can offer more flexible access to the kerbside. The level change between footway and cycleway can also help legibility, with clarity about the function of different spaces for cycling and walking.

Stepped tracks are suitable for one-way with-flow or contraflow provision but should not normally be used for two-way cycling. There are few examples in the UK of this type of infrastructure, so there is little established guidance. The model described here is based on Copenhagen's typical cycling provision, and has been successfully applied to several locations in Brighton and Hove (see photo, right).

There is no established process for creating stepped tracks. If created from the footway, they would require use of section 3 of the Cycle Tracks Act but practice from Brighton and Hove indicates that they may be able to be created using the same procedures as mandatory cycle lanes.

Stepped cycle tracks in Copenhagen (left) and Stockholm (right)

### Track priority

The treatment of stepped cycle tracks at priority junctions and accesses is a particularly important issue to address. Options include returning the track to carriageway level as a lane or continuing it past the junction or access at the same level and seeking to mark it in such a way that it is clear to turning motorists that they must give way to ahead cycle traffic. See section 5.3.4 on priority of cycling facilities for further details. Raised entry treatments or continuous footway/cycleway treatments (see section 3.5.3) could be used to support the seamless continuity of a stepped cycle track across a side road.

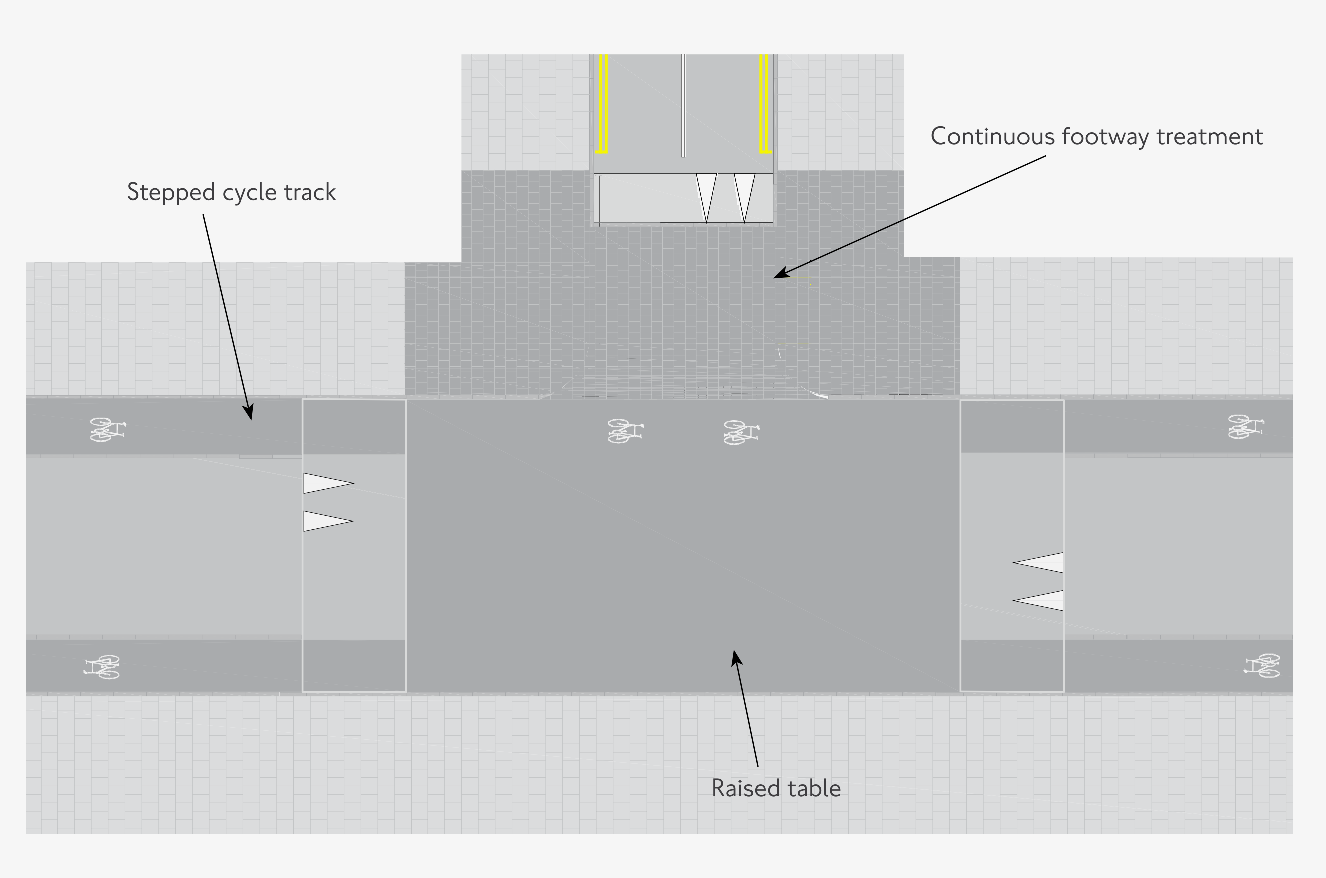
## Design considerations

Stepped tracks may be useful where motor traffic conditions dictate that a high degree of separation for cyclists would be desirable but where streets have higher pedestrian flows, more active frontages and/or more kerbside activity – for example, the high road street type.

Key considerations in figure 4.7 give rise to a number of indicative design parameters:

- Flush, step-free surfaces need to be provided for pedestrians at informal and formal crossings – the track is likely to need local ramping up to footway level or dropping down to carriageway level to achieve this, and appropriate tactile paving must be provided
- The kerb height at each step should be at least 50mm so that they are detectable by anyone using a long cane or guide dog
- Shallow ramps will be needed wherever the track returns to carriageway level to provide a smooth transition for cyclists
- Buffer space is likely to be needed between cycle movement and parking bays or the nearside general traffic lane: one way to do this would be to suggest to cyclists, through use of a different surface treatment, that they ought not to ride in the 0.5 metre-wide zone nearest the edge
- Loading bays may be floated outside the cycle tracks, but consideration will need to be given to ramping up or dropping down at such bays
- There is a risk that motorists may mistake the track for parking bays: appropriate signs, including those that show parking restrictions, should be provided selectively, so as to minimise street clutter

The main drawback of stepped cycle tracks is likely to be the complexity of construction. Material generally needs to be imported into the carriageway space to install them and gullies will often need relocating. If they are created from footways, excavation is involved, and location of lighting columns can be a problem. Stepped tracks can also require more substantial carriageway reconstruction as the crossfall of the road can be affected.



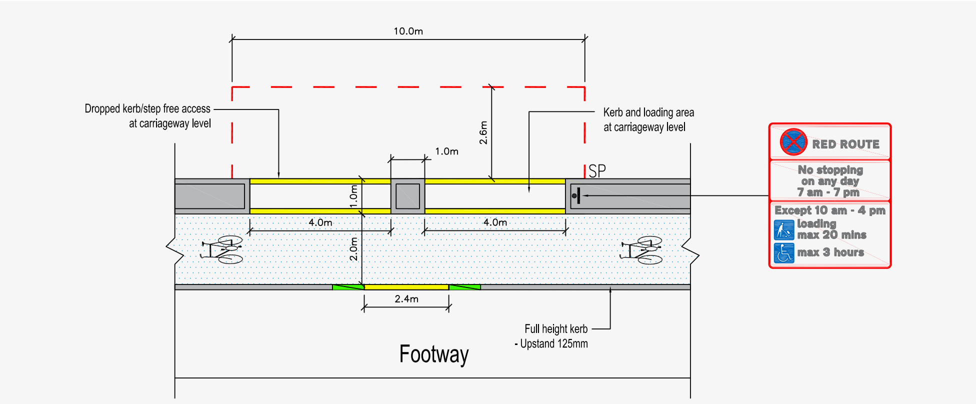

Indicative layout 4/02: Stepped tracks at priority junction, with continuous footway

## 4.2.6 Integration with parking and loading

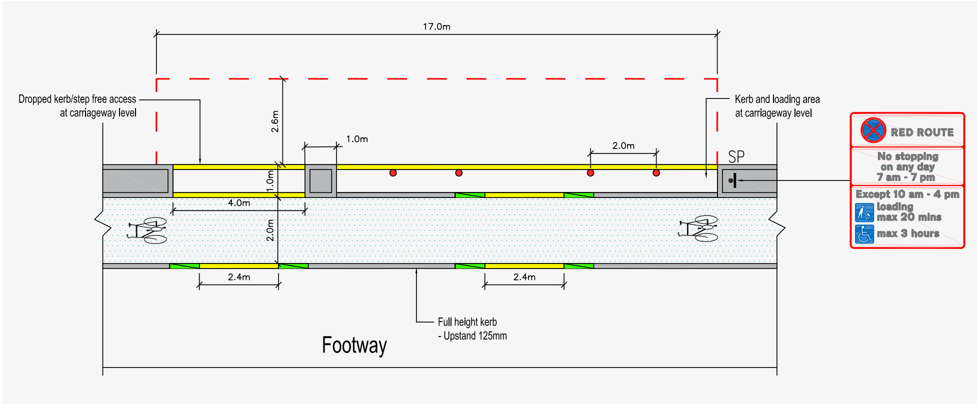
Introduction of segregated cycle lanes/tracks generally requires loading activity to take place in marked bays on the offside of the cycle tracks, provided that goods that can be delivered across the tracks. Much depends on the type and width of cycling facility and on the goods being delivered. Where there are wide, stepped tracks, for example, off-peak loading of lighter items could take place half on the cycle track – this is observed in leading cycling cities.



Loading across stepped tracks with low step up from the carriageway – Utrecht (top), Copenhagen (bottom)




Indicative layout 4/03 10m-wide flexible parking/loading bay with kerbed segregation



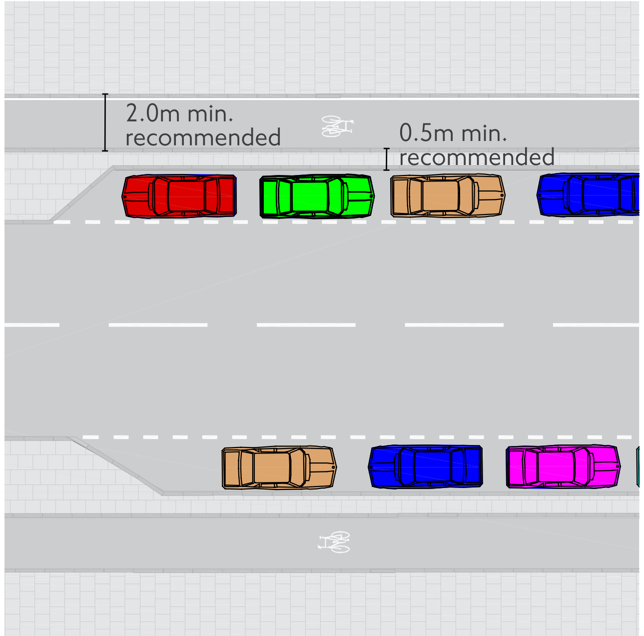

Indicative layout 4/04 17m-wide flexible parking/loading bay with kerbed segregation

In some locations, it may be possible to provide flexible bays to serve multiple purposes – for example, loading and disabled parking. Illustrative layouts 4/03 and 4/04 below show options that have been developed for this purpose. Where kerbs are dropped for a length of kerbside greater than 5 metres, bollards should be considered to prevent encroachment of motorised vehicles into the segregating strip (which would reduce the effective width of the cycle track).

## Using parking/loading as separation

Continuous separation between cycles and motorised vehicles can be achieved through positioning the cycle lane/track between parking or loading bays and the kerb. Kerbed island separation or light segregation (see below) that provides a buffer zone of at least 0.5 metres between cyclists and parked cars is recommended in order to minimise risk of collision between cyclists and car doors.

When compared to marking lanes on the offside of parking, this method requires little additional space, is unlikely to lead to any overall loss of parking and represents a high level of service for cyclists in terms of safety and comfort. It could be used for any suitably wide street with parking, but is most appropriate for street types that justify higher levels of separation, such as connectors and high roads.

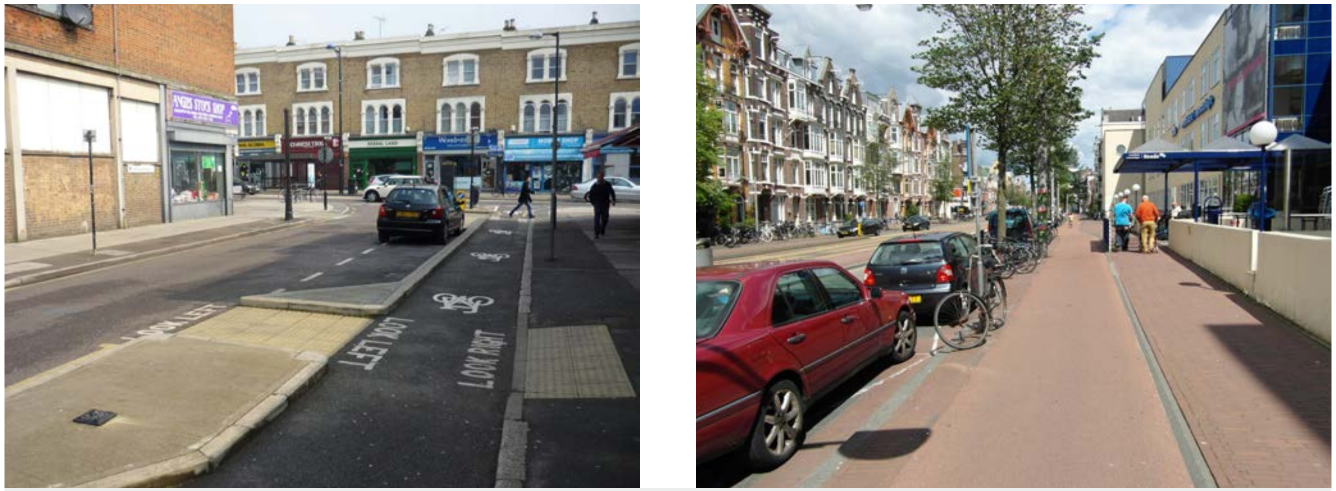



Indicative layout 4/05 Parking bays inset into separating island

Tracks should be at least 2 metres wide wherever possible: wide enough to allow one cyclist to overtake another comfortably. Bearing in mind the impact of parked cars on effective width, a 1.5 metre-wide facility with 0.5 metre-wide buffer may be appropriate on a route with a low to moderate peak cycle flow. Kerbs with an angled face on the side of the cycle track can help to maximise effective width. See section 7.1 for further details.

Special consideration needs to be given to the transition in and out of a facility such as this. The visibility of cyclists to other road users on the carriageway may well be greatly reduced as they emerge from behind parked cars, particularly at junctions.

Separation using car parking in Seville (left) and Copenhagen (right)




Separation using car parking in Newham (left) and parking and street furniture in Amsterdam (right)

## 4.2.7 Integration with bus stops

Options for cycle infrastructure at bus stops depend on the nature of the general provision for cycling on the corridor, and on bus infrastructure and operation. Factors to be taken into account include:

- Cycle flows, and flow variation during the day and week
- Degree of separation of cyclists
- General motorised traffic volumes
- Volume and frequency of buses stopping (including the frequency with which more than one bus is likely to use the stop at any one time)
- Access for wheelchair users
- The number of bus passengers using the stop at different times
- The pedestrian routes to and from the bus stop
- Pedestrian comfort in using the adjacent footway

TfL's Accessible Bus Stop Design Guidance (2015) should be consulted for further guidance.

Where cyclists are segregated from motorised traffic on links, one option is to return them to the carriageway through bus stop areas, in which case the guidance in section 4.3.8 below on cycle lanes at bus stops should be followed.

## 4.2.8 Bus stop bypasses

Drawing on successful examples of similar infrastructure in other cities in Europe, the concept of the bus stop bypass is being developed in the UK for consideration in such scenarios, in order to deliver a higher level of service to cyclists. In a bus stop bypass, a segregated cycle lane or track continues through the bus stop area behind the shelter, thereby creating an island for passengers boarding the bus and alighting to the stop.

The bus stop bypass is a measure that is still in a trial phase. Off-street trials conducted by the Transport Research Laboratory (TRL) for TfL have been completed but on-street trials and dialogue with user groups are ongoing. In all cases, any proposal for a bus stop bypass should be discussed at the earliest possible stage with potential users, particularly groups representing those with a visual, mobility or cognitive impairment who may be put at a disadvantage by having to cross a cycle track to access a bus stop. The advice given in this document is aimed at outlining some general principles and requirements while accepting that some evolution of preferred designs still has to take place.

### Pedestrian accessibility

Infrastructure such as this must be designed with recognition of the complications that arise for many pedestrians in boarding a bus and alighting at a stop through often busy and unknown environments. This includes not just blind or partially sighted people but anyone, for example, with a mobility impairment, with a pram or push-chair or carrying heavy luggage. Bus stop bypasses therefore give rise to certain accessibility issues that do not pertain to most other bus stop types and that need to be addressed in any design proposal:

- The ability of anyone with a visual impairment to find the crossing of the cycle track to reach the island and to find the bus stop once they are on the island
- The level of comfort and confidence for the user in crossing the cycle track – cyclists need to be encouraged to act courteously, particularly to more vulnerable pedestrians, slowing on the approach to the crossing and giving way as necessary
- Consistency of basic layout, so that anyone who has been guided through using one bus stop bypass could expect to use any such facility with confidence, even though dimensions and other design details will change with the context


Examples of bus stop bypasses – clockwise from top left: Stockholm, Seville, Brighton & Hove, Copenhagen

## Design considerations

To address some of the above comfort and accessibility issues, any bus stop bypass design should incorporate the following recommendations.

- Appropriate delineation of footway, cycle track and island should be provided, preferably through differentiation by level. Any kerb upstand should be at least 50mm and angled kerbs should be considered, to maximise effective width for cycling when upstands are higher
- A pedestrian crossing-point must be provided, clearly identified with blister tactile paving and with kerbs that are flush with the cycle track. Long bypasses may need more than one crossing-point
- Cycle slowing measures should be considered ahead of the crossing to encourage cyclists to slow and let pedestrians cross (see section 4.5.16 for options). Signing may support this message, particularly when the facility starts being used
- Visual contrast should be provided between the crossing area and the remainder of the cycle track, both to alert cyclists to the crossing and to highlight it for anyone with low vision

As well as ensuring that the crossing and the bus stop is fully accessible, a fit-for-purpose bus stop bypass should fulfil the following requirements.

- Good inter-visibility between cyclists and pedestrians must be achieved. Siting of any bus stop shelter that incorporates advertising/ information panels needs to be done in a way that avoids blocking sight-lines
- The cycle track must accommodate comfortable passage by any cycle, which means sufficient width and suitable geometry (to account for non-standard cycles and for current and projected cycle flows), flush longitudinal transitions and avoidance of vertical deflections other than sinusoidal or shallow ramps – see section 4.5.8 for guidance on cycle track design and geometry
- The size of the island should be adequate for the number and frequency of bus services and for current and predicted future pedestrian flows. The layout trialled by TRL, which featured an island 2.5 metres wide and with a usable length of 18.2 metres (ie length excluding tapers), was capable of accommodating 68 waiting passengers in comfort
- Pedestrian amenity on the footway should not be adversely affected by introduction of a bus stop bypass, with pedestrian comfort level 'C' achieved as a minimum. It is recommended that 2 metres' clear width of footway should be retained

Bus stop bypass at Stratford High Street, showing pedestrian crossing over cycle track

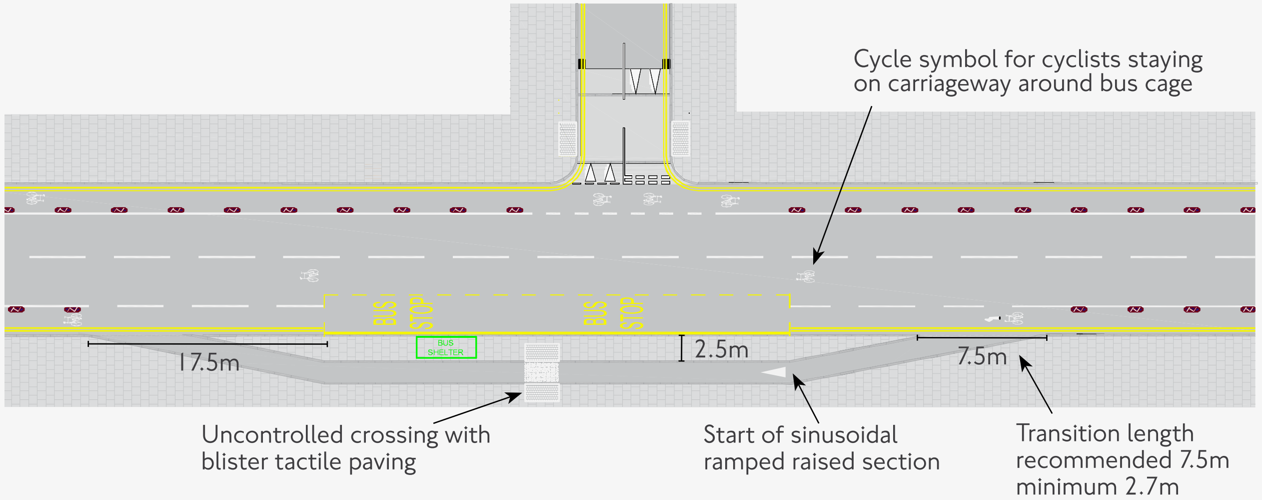
## Pedestrian crossings

The cycle track crossing should be on the main identified pedestrian desire line. It is recommended that it should be raised on a table, providing a level surface for pedestrians and those in wheelchairs to access the island, while reducing speed and encouraging courtesy from cyclists. More than one crossing-point should be considered where there is more than one flag at a given stop or, potentially, where there are large numbers of bus passengers and pedestrian desire lines do not align with a single crossing location.

Greater priority for pedestrians may be desirable, particularly where there are high flows of both cyclists and pedestrians. Following the publication of TSRGD (2016), a variant type of zebra crossing has been available for use on cycle tracks to achieve this. Criteria for its use will be developed through on-street trials. See sections 5.2.10 and 5.3.4 (indicative layout 5/07) for details on options for crossing cycle tracks.

## Coach stop bypasses

A similar approach can be taken to running a cycle track behind a coach stop. However, consideration needs to be given to different user needs at such a stop. Far fewer stops will be made but, when they are, the number of people boarding or alighting will be much greater. This may give rise to the need for a longer, wider island (bearing in mind that coaches are generally longer than buses), for a wider crossing area and for signing warning coach users of the presence of a cycle facility.




Indicative layout 4/06: Bus stop bypass where cycling provision is on-carriageway, with light segregation (based on Brighton and Hove example)

## 4.3 Cycle lanes

### 4.3.1 Cycle lane types

Provision of cycle lanes helps to:

- Facilitate cycling in the carriageway and simplify movements through junctions
- Allocate space for cycling that must or should not be entered by other vehicles
- Legitimise undertaking of slow-moving or stationary traffic
- Allow cyclists to maintain momentum with more confidence on uphill gradients
- Support motorised traffic speed reduction by visually narrowing the street
- Demonstrate to all road users that cyclists will be present on the street

Cyclists are not, however, obliged to use cycle lanes. Many may not in any given street, particularly if they are not of the recommended width, and definitely not if obstructed. This behaviour needs to be kept in mind by designers.

This guidance makes a distinction between dedicated and shared cycle lanes, as set out in figure 4.10 below. Section 4.1 and the Cycling Level of Service assessment (section 2.2) should be consulted for further detail on application to street type.

Figure 4.10 Types of dedicated and shared cycle lane

| Category | Description | Type | Application to street type |
| --- | --- | --- | --- |
| **Dedicated** | Lanes kept clear of other vehicles and available for cycling 24 hours a day, 7 days a week | **Light segregated lane**<br><br>**Mandatory cycle lane** (24/7) | Reasonably high movement function, but where speeds and volumes are not excessive, such as high roads, connectors and city hubs |
| **Shared** | More flexible lanes, allowing for general or occasional entry by other vehicles, all or part of the time | **Mandatory cycle lane** (with limited hours of operation)<br><br>**Shared bus/cycle lane**<br><br>**Advisory cycle lane**<br><br>**Cycle street** | Those with higher levels of kerbside activity – local streets and high streets<br><br>Not generally to be used for busier streets (indicatively, with traffic volumes in excess of around 500 vehicles per peak hour), without a 20mph limit |

There can be good, site-specific reasons for using shared lanes, but new cycle lanes should generally be dedicated mandatory lanes, properly enforced and well maintained in order to provide a high level of service for cyclists. Any need for further protection of such a lane could be met through use of light segregation.

Guidance on design and signing of different types of lane is provided through the remainder of this section. Lanes may have coloured surfacing applied but the colour has no regulatory meaning. For London-wide consistency, use of colour should generally be confined to potential conflict points only (see section 6.2.6 for more details).

## 4.3.2 Level of service offered by cycle lanes

A key question in determining whether or not to provide cycle lanes is how it may affect road user behaviour. Cycle lanes can add confidence and comfort for cyclists by giving them 'ownership' over some road space. TRL's report, Drivers' perceptions of cyclists (TRL report no. 549, 2002) suggests, however, that drivers' confidence increases with visible cycle infrastructure and this may lead to potentially risky behaviour such as higher vehicle speeds when encountering cyclists.

For that reason, cycle lanes should be provided at the widths recommended in section 4.4. Integrating cyclists with other traffic but applying some of the traffic calming approaches described in chapter 3 may, in many instances, give a higher level of service than providing lanes below the recommended minimum. However, conditions and behaviour will vary by site and designers should make a judgement based on the context and on the input of prospective users (of all modes).

## 4.3.3 Mandatory cycle lanes

Mandatory cycle lanes, with a solid lane marking, are spaces on carriageway dedicated to cyclists within the signed hours of operation (if this is limited). As a default, mandatory cycle lanes should be provided without such limits. International best practice shows that dedicated, wide, properly enforced on-carriageway lanes such as these are a valuable option for cycling networks.


Mandatory cycle lanes, including an example of a sign to diagram 959.1 of TSRGD

Creating enforceable space for cycling on-carriageway can also be a step towards securing more separated space, particularly if funds and/or political support are not immediately available

New York: lanes can be a precursor to different forms of separation, such as stepped tracks

for more radical change in one phase. There are several examples in New York of this staged approach to delivering cycling infrastructure.

## Enforcement

Traffic Orders are no longer required to create with-flow mandatory cycle lanes, following the publication of TSRGD (2016). A contraflow mandatory cycle lane still requires a Traffic Order.

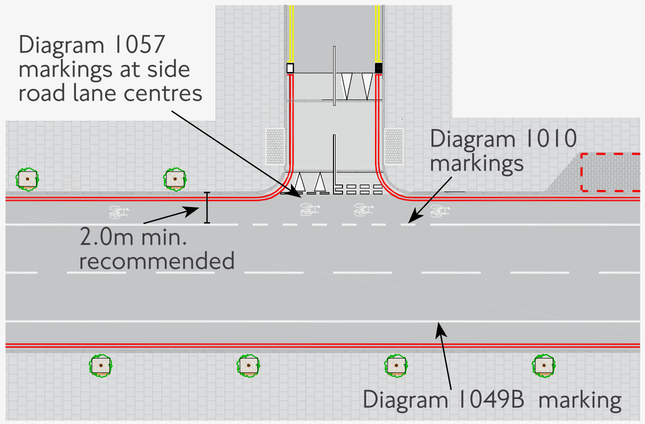
It is important that there should be consultation with stakeholders in order to understand and take into account the needs of other users, such as the emergency services and commercial vehicle operators.

It is an offence, enforceable by the police, for motorised traffic to enter a mandatory cycle lane. However, traffic may enter them to stop, load or unload where this is not prohibited, and taxis are normally allowed to stop to drop off and pick up passengers. To keep them clear, mandatory cycle lanes will therefore benefit from being provided with appropriate parking and loading restrictions which can be enforced by civil enforcement officers.

## Signing

Signing requirements from TSRGD (refer to chapter 6 for details) are as follows:

- Diagram 1049B: 150mm-wide lane markings; 250mm-wide markings may be used for lanes of 2 metres' width or more, to reinforce the separation from general traffic
- Diagram 959.1 'with-flow cycle lane' sign at the start of the lane and repeated at intervals along the lane according to advice given in Chapter 3 of the Traffic Signs Manual; in 20mph zones, these repeaters can be omitted
- Diagram 958.1 'with-flow cycle lane ahead' sign can be used but may not be needed where the cycle lane is clearly visible to drivers – this is a judgement for designers to make on a site-by-site basis
- Diagram 1057 cycle symbol in the lane, where it begins and at any joining-point, helps to clarify that it is a dedicated cycle facility; this is important where lanes are 2 metres or more wide and could be mistaken for a general traffic lane




Indicative layout 4/07 Mandatory cycle lane at priority junction

## Lanes through junctions

Mandatory cycle lanes may be continued through priority and signal-controlled junctions using a dashed diagram 1010 marking. This is to raise motorists' awareness of crossing another traffic lane, to which they should give way, as directed by the Highway Code – see section 5.3.3 for details.

As set out in the Traffic Signs Manual (chapter 5, paragraph 16.5), mandatory cycle lanes can be continuous across certain accesses where a Traffic Order defines the exemption. This is typically done where crossing is unlikely to be frequent, such as access to private residential properties. For other accesses, such as the entry to petrol stations, it is usually recommended to break mandatory cycle lanes to allow motorised vehicles to cross legally (while giving way to cycle traffic).

In other instances where consideration needs to be given to breaking a mandatory cycle lane, a judgement by the designer is required, based on risk assessment. This may apply to situations where localised narrowing of the carriageway leads to a remaining width that cannot comfortably accommodate lanes to the widths recommended in this guidance and may lead to close passing of cyclists by motorised vehicles. In these cases, an advisory cycle lane or use of cycle symbols may be preferable.

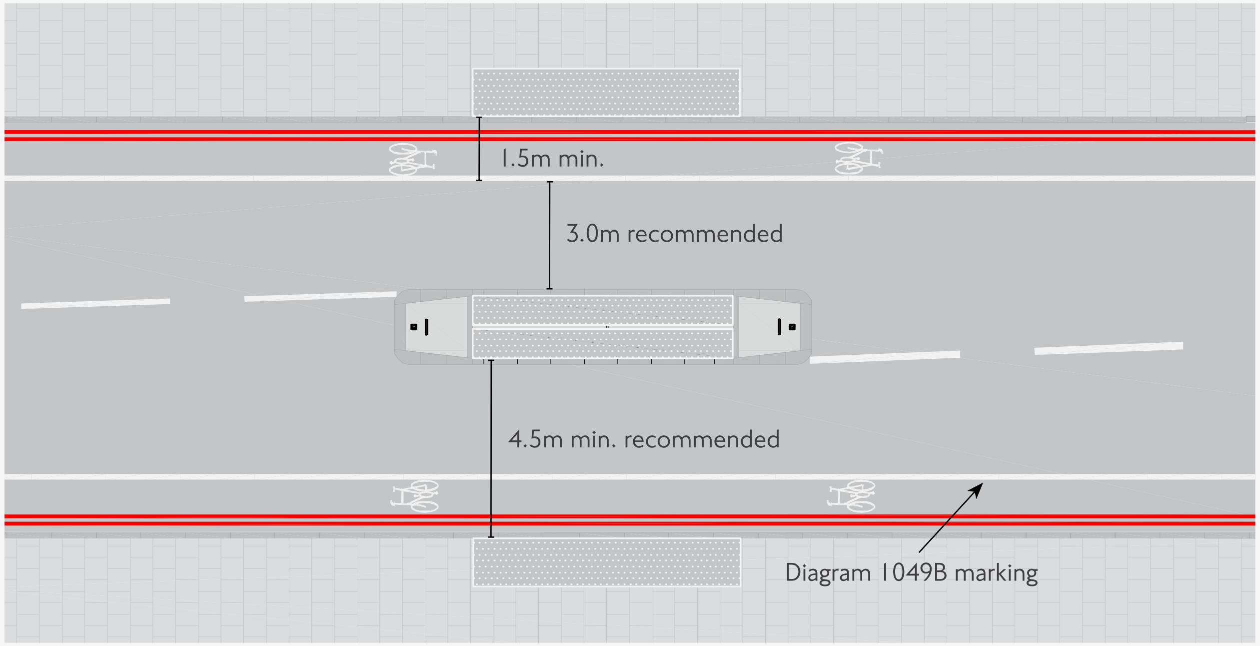
Mandatory lane becomes dashed past side road (lane marked away from kerb and side road)

Dashed markings used to show continuity of lanes through junctions

## Protecting lanes

Mandatory cycle lanes can be given extra protection to discourage motorised vehicles from entering. This may be particularly useful at side roads. One method is light segregation – see below. Another is to create a buffer between the general traffic lane and the cycle lane by using two parallel sets of lane markings, separated by TSRGD diagram 1041.1 'chevron' markings.

Cycle lane with buffer and intermittent island protection – Baylis Road, Lambeth




Indicative layout 4/08: Cycle lanes at pedestrian refuge island

Intermittent islands can be used to add extra protection and assist pedestrian crossing, provided they do not lead to a pinch point for cyclists (see section 5.2.8). In this arrangement, one lane marking should be to diagram 1004 (dashed, advisory) and one to diagram 1049B (solid, mandatory). Whether the solid lane is on the cyclists' or the motorists' side depends on the extent to which either road user might be invited to enter the buffer zone.

Light segregation with posts in Minneapolis

Use of concrete 'lacasitos' in Seville

## 4.3.4 Light segregation

Light segregation refers to the use of physical objects intermittently placed alongside a cycle lane marking to give additional protection from motorised traffic. While there are many international examples, there is little established practice in the UK. On-street monitored trials are needed to help in ascertaining the benefits and risks of different products and types, and to clarify certain design requirements.

In effect, light segregated lanes are a variant of mandatory cycle lanes, offering some of the benefits of continuous separation in terms of feeling of safety. In all cases, it is important to follow guidance on recommended widths (see section 4.4) as cycle safety and comfort cannot readily be improved if motor traffic is passing a narrow cycle lane with little clearance.

Interim results from off-street trials show that, in comparison to lane markings only, users felt safer when light segregation was placed next to the marking. Cyclists stay further from lower separating objects but are more comfortable riding nearer to moving motor vehicles where they are separated by high objects such as flexible posts. This is an important consideration for the effective width of the cycle lane, and the potential for overtaking within the lane.

### Light segregating objects

Types of light segregation that may be considered include:

- Pre-formed separators made out of rubber, recycled plastic or concrete, including small humped separators: these are placed inside (not on top of) mandatory cycle lane markings, and are easy to install and cheap to replace
- Planters, narrow versions of which are available and can help to delineate cycle routes; they present some risk of causing an obstruction at a turning point, and installing them also has maintenance implications
- Flexible posts, which provide a strong visual indicator of separation of space, and even come with illuminated tops; however, they can look temporary and diminish the attractiveness of a street; where used in the carriageway, flexible posts must have at least 60 per cent of their surface covered in retro-reflective material

Whatever object is used for light segregation, it should not resemble an existing road marking or obstruct a road marking in a way that might make it unidentifiable.

Pre-formed separators used next to cycle lane markings (note that only one lane marking should be used)

Planter and pre-formed separators

Flexible posts used for a temporary buffer to a cycle lane

Light segregating objects will need maintaining and, very often, will need replacing when damaged. In all cases, it is important to follow manufacturers' instructions on installation, particularly with regard to fixing to the carriageway surface, to ensure the product performs as it should and does not fail when struck. It is also important to ensure that a safe maintaining strip can be provided to support the safety of maintenance operatives when repairing or replacing objects in the carriageway.

## Design considerations

The considerations set out in figure 4.7 for kerbed separation generally also apply to light segregation, for example:

- Any use of objects in the carriageway should be done in a way that does not compromise accessibility for any person with a mobility impairment; gaps and step-free access needs to be provided at formal and informal crossings
- Reflective and light-coloured elements are needed on such objects to make them visible at night
- An understanding is needed of where allowing continued access to the kerbside is necessary (noting that most forms of light segregation can be crossed relatively easily by most vehicles); this relates particularly to emergency service vehicles, community service vehicles and taxis, where they need to deploy ramps
- Access to the kerbside will often need to be maintained to allow for drainage, road sweeping and general maintenance

As is the case with full kerb segregation or stepped tracks, consultation with user groups – particularly local businesses, residents, access groups and commercial vehicle operators – is essential to ensure that user needs are met appropriately.

Light segregation should not be used where general traffic is expected to straddle it, although it may be suitable (depending on the product) to be over-run where there is a need for occasional crossing movements to access the kerbside.

Although this has yet to be tested fully, it is reasonable to assume that advice in section 4.2.3 above and in section 5.3.4 on how to begin and end kerb segregation (including how far ahead of a priority junction should it be ended) might also apply to light segregation.

As applied at Royal College Street, light segregation could be provided without road markings where there is no ambiguity for road users about the route for cyclists. This can work very well in 20mph areas, since there is less emphasis on communicating important messages to fast moving motorised traffic that have to be processed quickly. However, the areas set aside for cyclists cannot legally be enforced for cyclists' use. Good will between road users is required to ensure they are used as intended. For this reason, parking and loading restrictions are very often important to keep the 'lanes' clear of motorised vehicles, particularly motorcycles.

Flexibility of infrastructure at Royal College Street, Camden has allowed for adjustment of lane widths and relatively easy replacement of damaged separators and planters

## Benefits

Light segregation has many benefits over full segregation in that it is easier to install, usually costs less, is more adaptable and does not create barriers to pedestrian crossing movements. Generally, it will not require excavation, physical adjustments to the structure of the carriageway or repositioning of drainage or utility covers. It should not constrain cyclists in the same way as full segregation, although this depends on the objects used and how they are spaced. In order to maintain an acceptable level of protection, spaces between objects should be no less than 2.5 metres and no greater than 10 metres on links. Tighter spacing can be considered on bends and junction approaches.

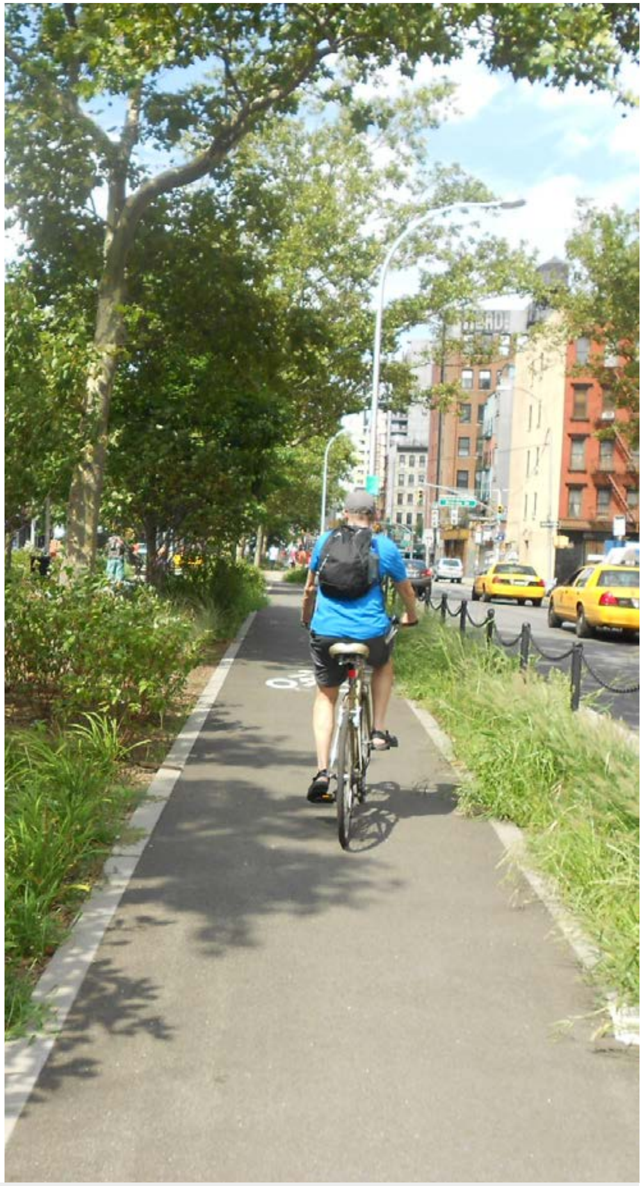
Most types of light segregation can be adjusted or removed relatively easily, making it suitable for trialling temporary measures to reallocate carriageway space. Just as mandatory lanes may be a step towards other, more substantial forms of separation, so light segregation could be an interim stage to a more permanent form of segregation.

## Road safety considerations

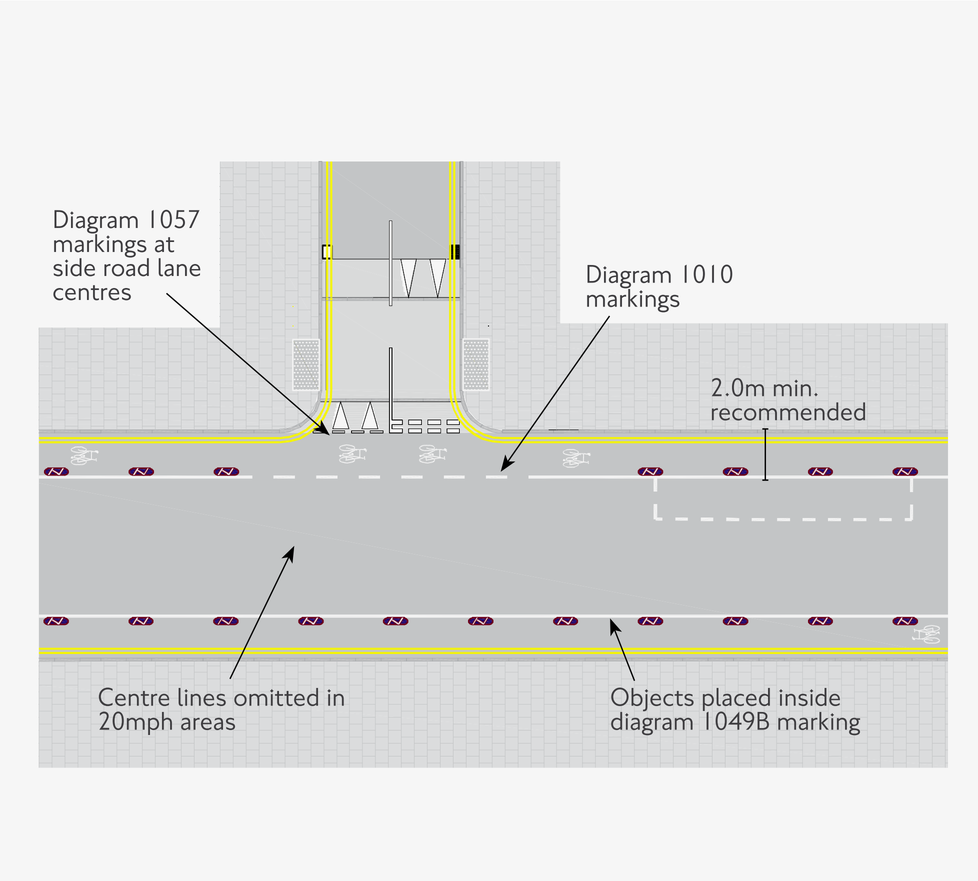
Where any object is used in the carriageway it may be struck by a vehicle. Whatever the speed, this will have destabilising effects, to which cyclists and motorcyclists are most susceptible. These risks must be taken into account when designing infrastructure, particularly when it comes to widths and treatment of the beginning of a run of separating objects.

Consideration may be given to providing a more visible object – such as a flexible post, planter or island – at the beginning of a run. Trials in Salford have shown that these are effective in increasing the clearance that vehicles give to the cycle lane and preventing damage to the separators.
For streets with 85th percentile speeds of 30mph or more, this treatment is recommended.

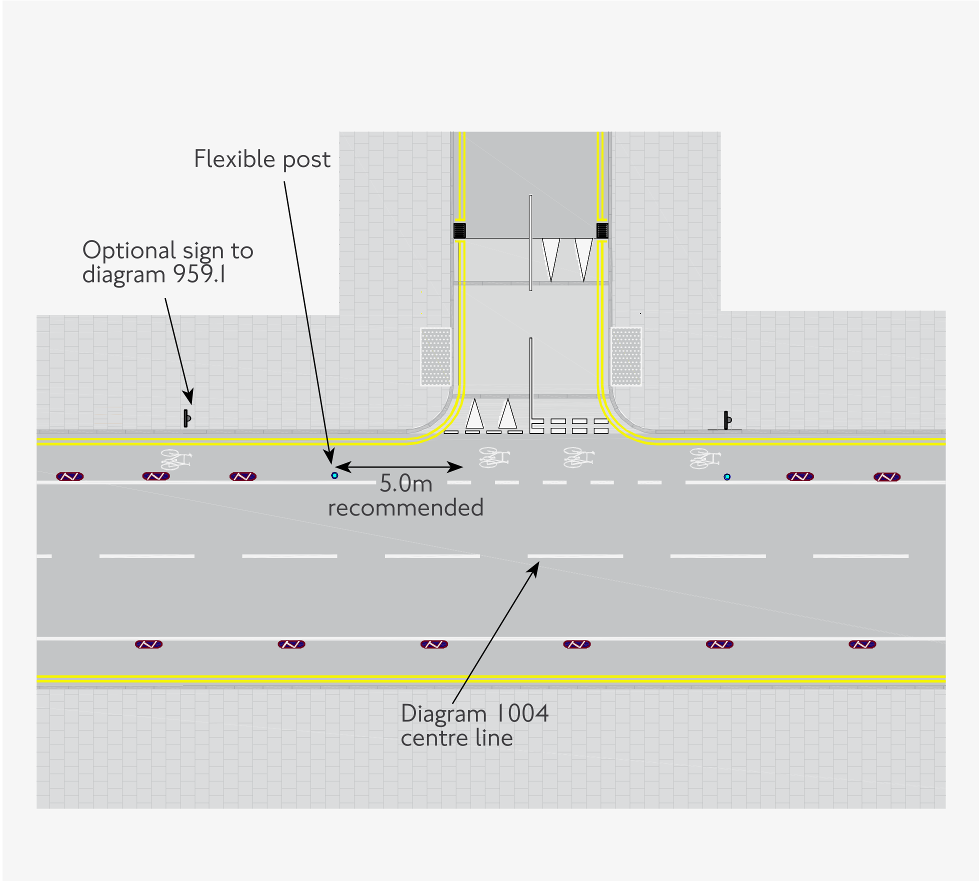
Temporary island at the beginning of a run of separators (Salford trial)

Trialling layouts using light segregation in New York: 'light' reallocation of space can help to make the case for more substantial re-engineering of the carriageway in time




Indicative layout 4/09a: Light segregation at priority junction




Indicative layout 4/09b: Light segregation at priority junction (30mph street)

## 4.3.5 Advisory cycle lanes

Advisory cycle lanes delineate an area of the carriageway that is intended for the use of cyclists and should indicate a recommended (but never required) line of travel for cyclists. They instruct other vehicles not to enter unless it is unavoidable. They are indicated by broken white line (diagram 1004) and associated sign (diagram 967). To minimise street clutter, the sign should only be used in locations where interpretation of the road markings is not otherwise clear.

Advisory lanes are a practical option where flexibility is required, often where motorised vehicles frequently need to enter or cross the lane. Unless such a requirement exists, dedicated mandatory cycle lanes should be the default provision. The main recommended ways in which advisory cycle lanes might be used are:

- Where there is insufficient space for a mandatory lane of 2 metres or more to be introduced but where parking restrictions can be applied – for example, a 2 metre-wide advisory cycle lane that is occasionally entered by other vehicles but where parking is not permitted outside of dedicated bays is preferable to a 1.5 metre-wide part-time mandatory lane
- In conjunction with low speed limits and centre line removal, to indicate that there will need to be some sharing of the carriageway but to encourage motorised vehicles to leave nearside space free for cyclists

Widening of advisory cycle lanes adjacent to inset parking bays, with cycle symbol placed well away from the kerbside

Advisory lanes on two-way streets with no centre-line – wide (left) or buffered (right) to account for parked cars

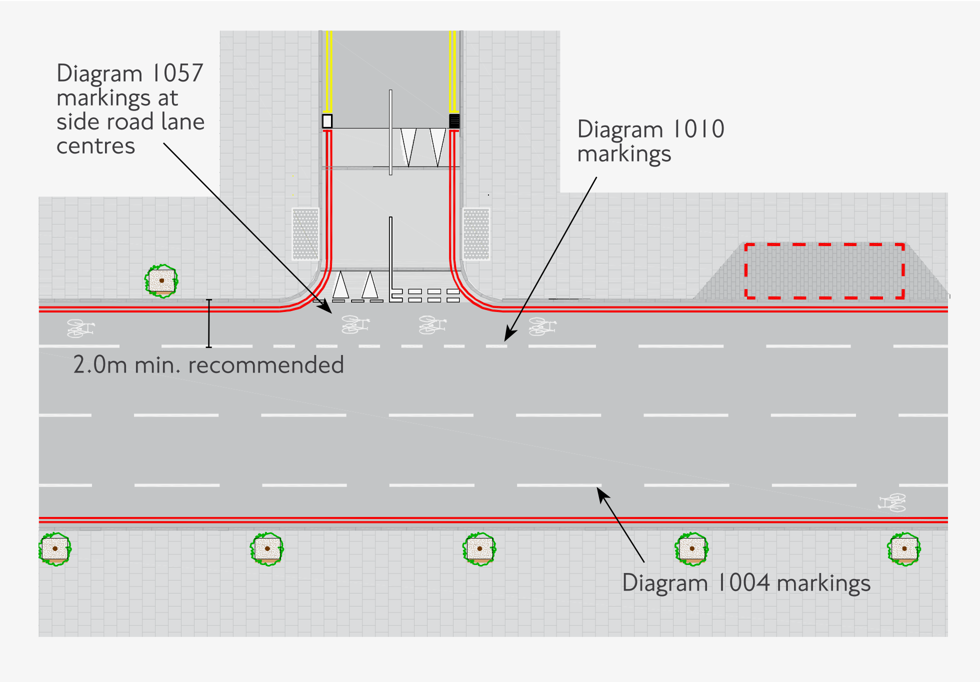
- Where kerbside activity is high and any cycle lane will need to be crossed frequently to access loading and parking bays – in such instances the advisory lane needs to be at least 2 metres wide or with a suitable buffer between it and the bays

## Kerbside activity

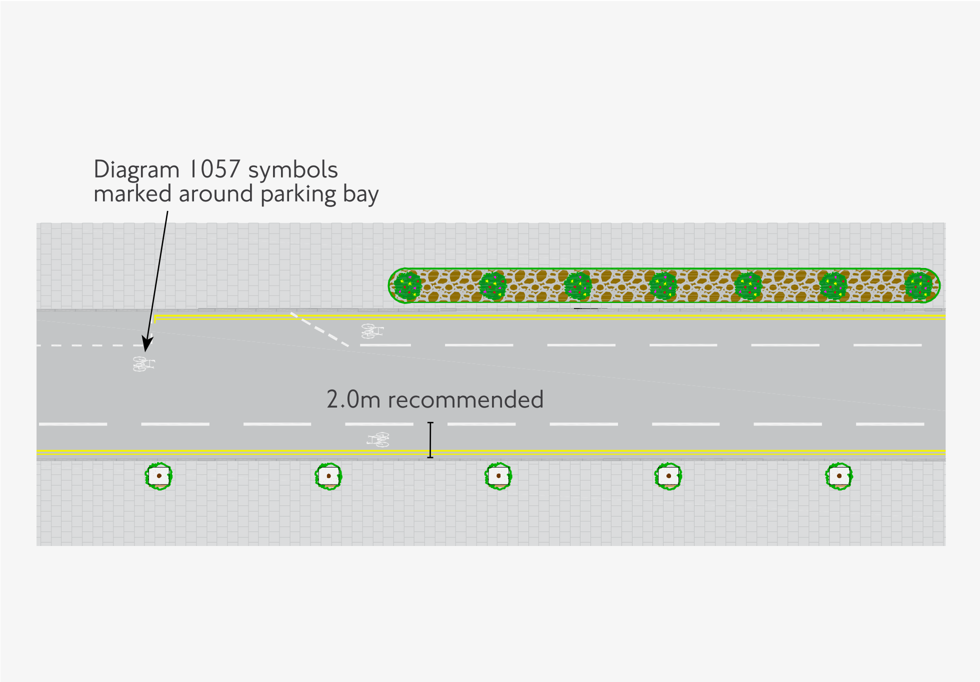
For intermittent kerbside parking, loading or cycle parking bays, the advisory lane can be marked around the bays, provided it has a buffer zone of at least 0.5 metre and provided that any resultant narrowing of the adjacent general traffic lane does not lead to close passing by motorists of cyclists using the cycle lane (passing with less than 1 metre clearance). Where a combined width of cycle lane and adjacent lane of 4.5 metres or more cannot be achieved, TSRGD diagram 1057 cycle symbols should be marked past the parking bay rather than advisory cycle lanes (see section 4.3.10, indicative layout 4/18). Note that omission of the centre line can allow for more flexible use of the carriageway space and may enable use of an advisory lane with sufficient clearance to moving motorised traffic.

## Lanes through junctions

Like mandatory cycle lanes, advisory cycle lanes may be continued through priority and signal-controlled junctions using a dashed diagram 1010 marking – see section 5.3.3 for details.




Indicative layout 4/10: Advisory cycle lanes at priority junctions




Indicative layout 4/11: Street with advisory cycle lanes and centre line removed

## 4.3.6 Cycle streets

Cycle streets are a type that exists in several European countries, but with differing formal definitions. Motorised vehicles have access and there is a conventional footway, but the carriageway is dominated by cyclists in a manner indicated by the design of the street. Indicatively, a cycle street treatment is appropriate for a street:

- That cyclists already use in large numbers
- Where motorised traffic volumes and speeds are already very low or could be significantly reduced
- Where it is possible to use traffic management across the wider area to bring down speed and volume of motorised vehicles
- Where the street is, or could be made, access-only for motorised vehicles

Dutch guidance (CROW, Design manual for bicycle traffic in The Netherlands, 2006) shows three types of cycle street, 'fietstraat', which have in common narrow carriageways, low speeds and low motorised traffic volumes:

- **Cycle street with mixed traffic**
These tend to have few road markings and, throughout the whole carriageway, have the same coloured surfacing as cycle tracks or a distinctive surfacing that marks them out from a conventional carriageway.


Example from Utrecht: (left) cycle street with mixed traffic, (right) cycle street with cyclists at the side.

- **Cycle street with cyclists at the side**
Cyclists ride on wide advisory cycle lanes (recommended 2 metres wide) either side of a single, narrow general traffic lane, without centre line (no more than 3.5 metres on a two-way street). Motorists can only pass a cyclist if there are no oncoming cyclists by straddling into the opposing cycle lane.
- **Cycle street with cyclists in the middle**
Cyclists ride on the central, often coloured lane. Border strips, often in black or grey or a different surface material, allow for cars to move through. The central strip should be no more than 3 metres wide, with around 0.75 metres for the border strips.


Standard 'cars are guests' signing in the Netherlands

Dutch guidance also indicates that cycle streets should have (or have the potential for) flows of at least 1,000 cyclists a day and that cyclists should generally outnumber other vehicles by 2 to 1 during peak hours. An important component is the sign, which states that 'cars are guests' in the street. Further information may generally be found in Sustrans, Technical Information Note 32: Cycle Streets (2014).

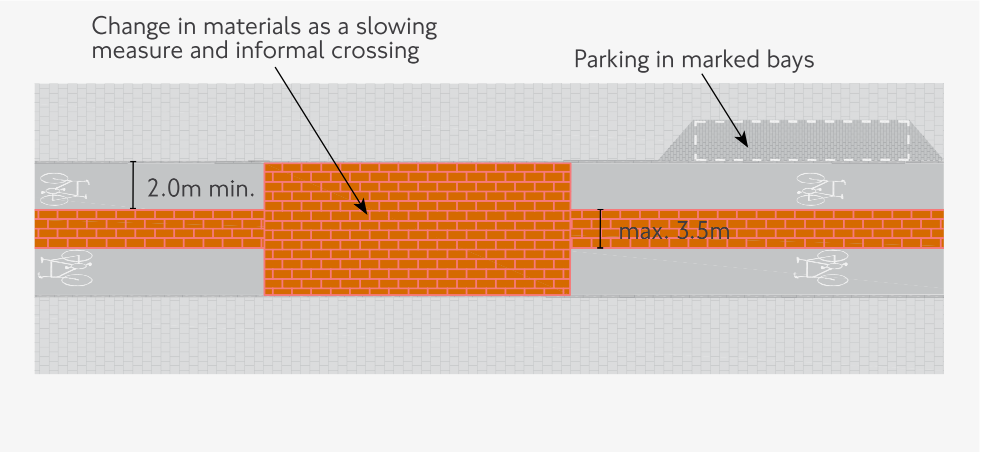
However the concept is articulated, cyclists should enjoy priority at any junction with the cycle street itself, and the difference in street environment should be visible and obvious from any side street. It is likely that parking and loading will need to be incorporated in bays rather than freely allowed and kerbside activity needs to be carefully considered as the design is developed, taking account of use throughout the day.

## Speed limits and overtaking

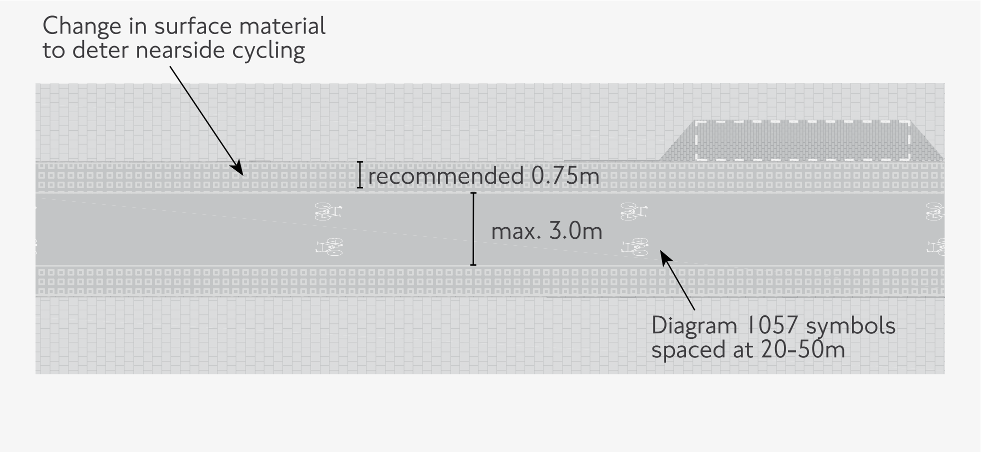
As set out in the consultation document accompanying the draft revised traffic signs regulations, TSRGD (2014), DfT is willing to work with highway authorities on developing cycle street concepts for trial. Although no formal definition of a UK cycle street has yet been developed, DfT indicated it could include an advisory, non-enforceable speed limit of 15mph and designs that prevent or strongly discourage motorised vehicles from overtaking cyclists.

In the UK, 20mph zones or Home Zones may be practical first steps to introducing and refining the concept. In this case, the base plate below the 20mph sign could be adapted to convey a message about the special status of the street, such as a safety campaign logo. (Note that this plate cannot carry any advertising material or political slogans).

Surface marking shows cycle street status




Indicative layout 4/12: Cycle street concept – cyclists at the side




Indicative layout 4/13: Cycle street concept – cyclists in the middle

## 4.3.7 Shared bus/cycle lanes

Bus lanes provide a high level of continuity and priority – benefits that can easily be transferred to cycling – and they represent an existing means of controlling kerbside activity. Cyclists are by default allowed to use with-flow bus lanes and such infrastructure can provide direct and useful links, capable of achieving a basic level of service for cyclists, although not higher levels. Shared bus/cycle lanes are most likely to be appropriate on street types with a medium to high movement function, such as high roads and connectors.

With-flow bus lanes are available for cycle use for, and beyond, their hours of operation, although the level of service for cyclists outside hours of operation is likely to be lower. Where there is clear demand for cycling on a bus route, operation hours should be considered for extended times.


With-flow (left) and contraflow (right) bus lanes - note that 'bus and cycle only' marking is no longer prescribed

### Signing

To highlight a Superhighway route, the default treatment option in bus lanes is the use of the project symbol as a route continuity indicator within the lane. This has been authorised by DfT for the Cycle Superhighways only, but needs agreement with the relevant highway authority. The only caveat is that it must not interfere with or form any part of the usual bus lane-specific markings


Cycle Superhighway project symbol

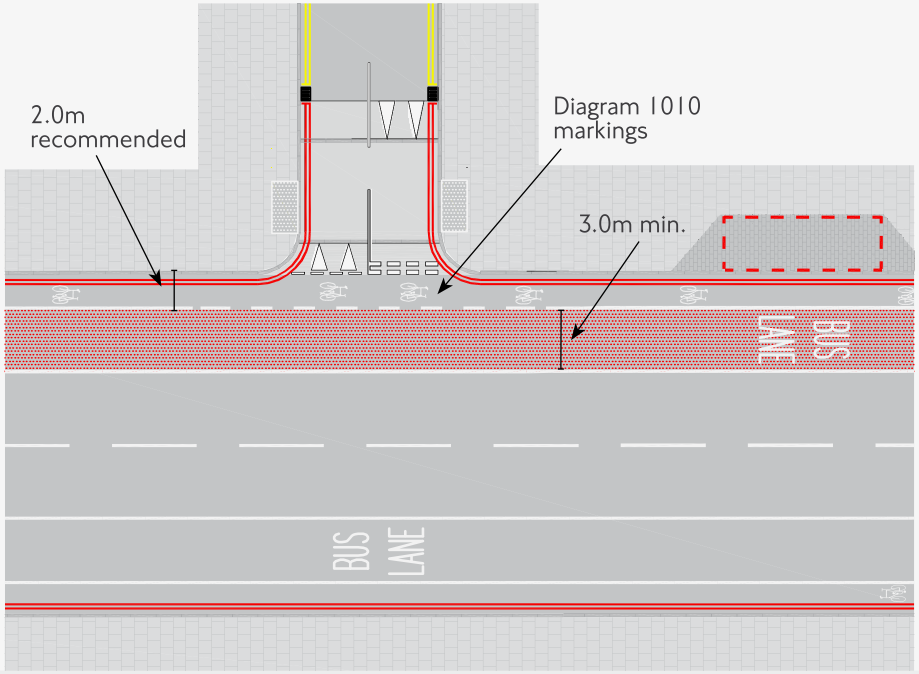
## Parking and loading

Parking and loading is often permitted outside of the operational hours of a bus lane. In such instances, it is preferable if the lane is at least 4.5 metres wide (as recommended in section 4.4 below) and if marked bays are provided, to encourage parking closer to the kerb – that way the lane remains usable for cycling. Alternatively, parking and loading could be provided in inset bays, in adjacent side roads or permitted in the bus lane in one direction only during peak times (ie the direction opposite the main tidal flow).

## Mandatory cycle lane in a bus lane

For bus lanes of 4.5 metres or above, a mandatory cycle lane of at least 1.5 metres in width may be included on the nearside. This offers cyclists some degree of separation from other users of a bus lane for what is likely to be a relatively short stretch between bus stops. The advantage it will confer, and the level of subjective safety it may offer, will also tend to diminish with higher flows of cyclists.


Mandatory cycle lane inside bus lane – Blackfriars Bridge (left), Waterloo Bridge (right)




Indicative layout 4/14: Mandatory cycle lane inside bus lane

## Contraflow bus and cycle lanes

Cycles should be allowed in contraflow bus lanes wherever possible, and sufficient room provided to enable cyclists to overtake comfortably at bus stops. Lane widths less than 4.5 metres should be avoided, but a 3.0- to 3.2-metre shared lane, where bus and cycle cannot overtake one another, can provide a basic level of service if all other options have been exhausted. For contraflow bus lanes of 4.0 to 4.5 metres, a risk assessment should be undertaken on a site-by-site basis.

It is recommended that the Metropolitan Police Service Traffic Management Officer be consulted at planning stage on any proposal for cycling in a contraflow bus lane of less than 4.5 metres, or if the authority is considering banning cycles from a bus lane. Note that, if cycles are not permitted in contraflow bus lanes, the managing highway authority must take on responsibility for the safety and other issues relating to alternative routes that cyclists must use.

The diagram 1048.1 marking, 'bus and cycle lane', is not prescribed in TSRGD (2016). The diagram 1048 marking, 'bus lane' should be used with signing clarifying which users are entitled to use the bus lane.

## Bus and cycle priority

Bus gates and other bus priority signals should be carefully designed to ensure that appropriate priority benefits are also given to cyclists. At the signals, automatic cycle detection, where possible, or a push-button should be provided for cyclists where a long wait time would result if signals were only linked to bus detection. Joint bus and cycle gates can provide bus priority and advanced release for cyclists and so should be considered for these multiple benefits. In some cases, where space allows, a cycle by-pass to bus priority signals may be desirable and, where feasible, this should be provided.


Lane ends at bus stop cage, with cycle symbols marked around cage


Combined cycle track and bus boarder

## 4.3.8 Integration with bus stops

Where cyclists are being provided for in lanes or mixed traffic on-carriageway, they should be kept on carriageway through the bus stop area and enabled to overtake stationary buses with safe clearance.

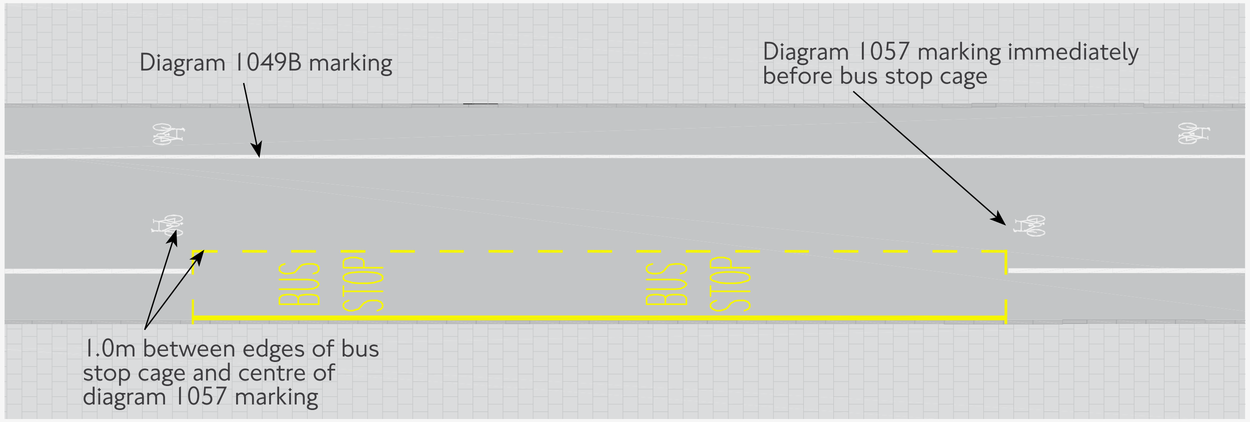
A cycle lane will generally need to terminate before a bus stop cage and recommence after it. The continuity of cycling provision can be maintained by marking TSRGD diagram 1057 cycle symbols around the bus stop cage to raise the awareness of other road users to the likelihood of cyclists moving out to overtake a stationary bus (see section 6.2.5 for guidance on cycle symbol placement).

It may be possible to continue a cycle lane around a bus stop cage without deviation – where, for example, the stop has parking or loading bays ahead of it, marked on the nearside of the cycle lane. A mandatory lane will need to be converted to an advisory lane. Speed reduction measures are recommended, given that the cycle lane needs to be regularly crossed by a large vehicle.

Preferably, a bus stop should be provided within a bus lane of 4.5 metres' width or more (see section 4.4 for more details). If provided in a narrow, 3.0- to 3.2-metre bus lane, consideration needs to be given to cyclists moving out into the adjacent general traffic lane to overtake. Speed reduction measures are recommended, but this still requires an assertive move and is not likely to represent a good level of service for all cyclists. On low traffic volume streets with bus routes, centre line removal is recommended in order to promote lower speeds and flexible use of carriageway space around the bus stop.

Moving or reducing the length of bus stops should generally be avoided. Scheme designers or promoters should liaise with TfL Bus Network Development and Infrastructure at the earliest stage if these are being considered as options. An evaluation of bus passenger disbenefits will need to be provided in any such circumstance.

Cycle lane continued around bus stop cage




Indicative layout 4/15: Mandatory cycle lanes at bus stop

## 4.3.9 Two-way cycling in one-way streets

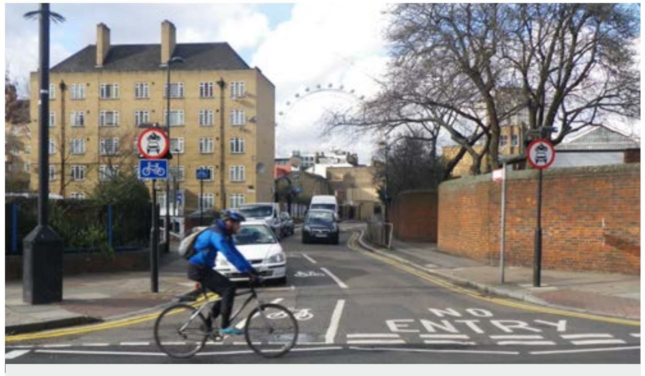
Cycle lanes to enable two-way cycling in one-way streets are an established measure, described in TAL 6/98, Contraflow Cycling. If space is available to include mandatory or advisory lanes at the recommended width, and with management of parking that keeps sufficient width clear, then these are recommended. Contraflow cycling may also now be permitted without lane markings, allowing it to take place on narrower streets (with low motor traffic volumes). Whether enough space is available depends on patterns of use as much as on width, so this needs to be determined by risk assessment on a case-by-case basis. Refer to section 4.4 on lane widths and section 3.2 on user needs to inform assessment of risks and benefits.

Contraflow mandatory cycle lane – Long Acre

Contraflow with island separators, and showing the diagram 960.1 sign

**Unless there are over-riding reasons not to, there should be a presumption that contraflow cycling should be provided for in any one-way street.**

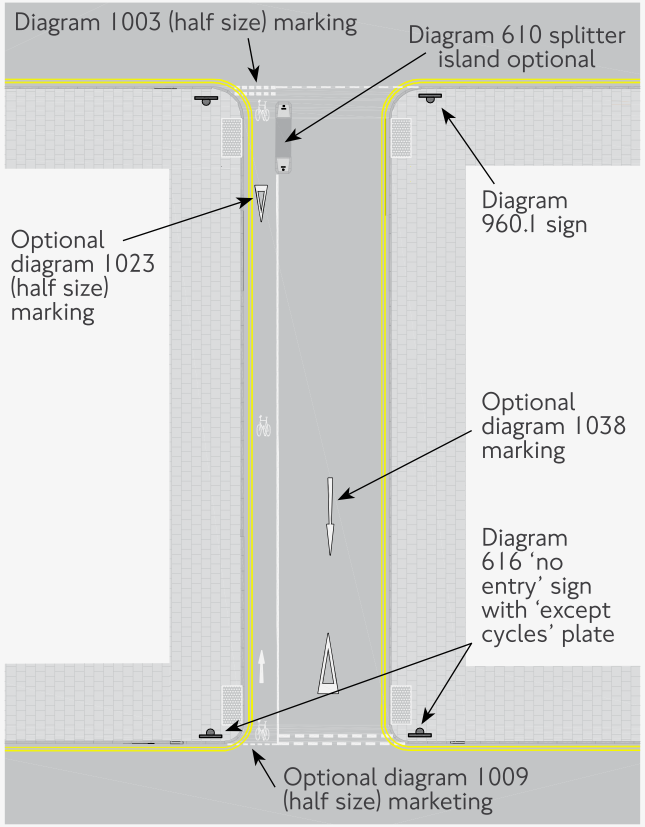
Mandatory or advisory contraflow cycle lanes should be designed to the above guidance on such lanes, but with the contraflow cycle lane sign to TSRGD diagram 960.1 (mandatory lane) or 960.2 (advisory lane). Where a lane is provided, it should normally be mandatory by default.



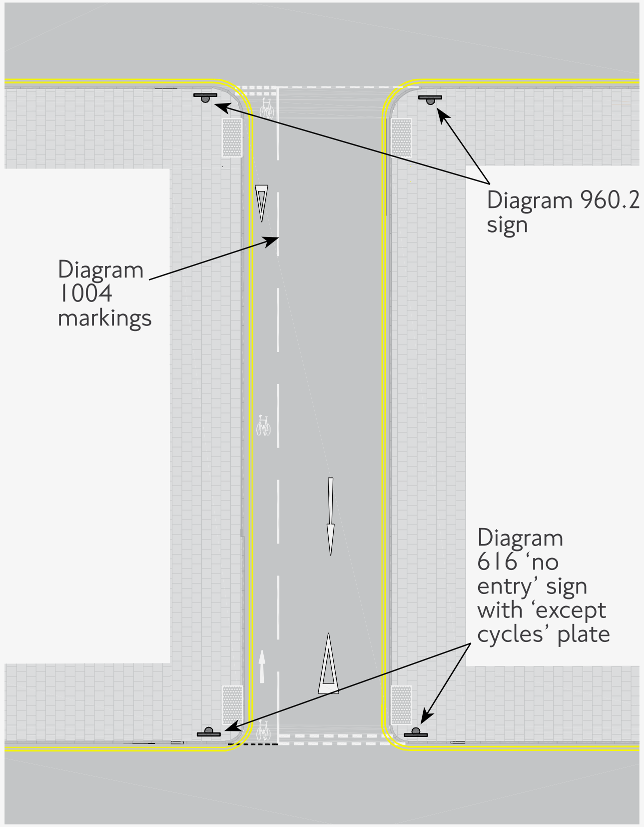

No motor vehicles, cyclists permitted – Frazier Street, Lambeth

No entry with 'except cycles' plates, and raised table entry

The standard signing arrangement at the entrance should be a 'no entry' sign (TSRGD diagram 616) with the 'except cycles' plate underneath. This requires a Traffic Order and should be subject to appropriate local consultation.




Indicative layout 4/16a: Mandatory contraflow cycle lane



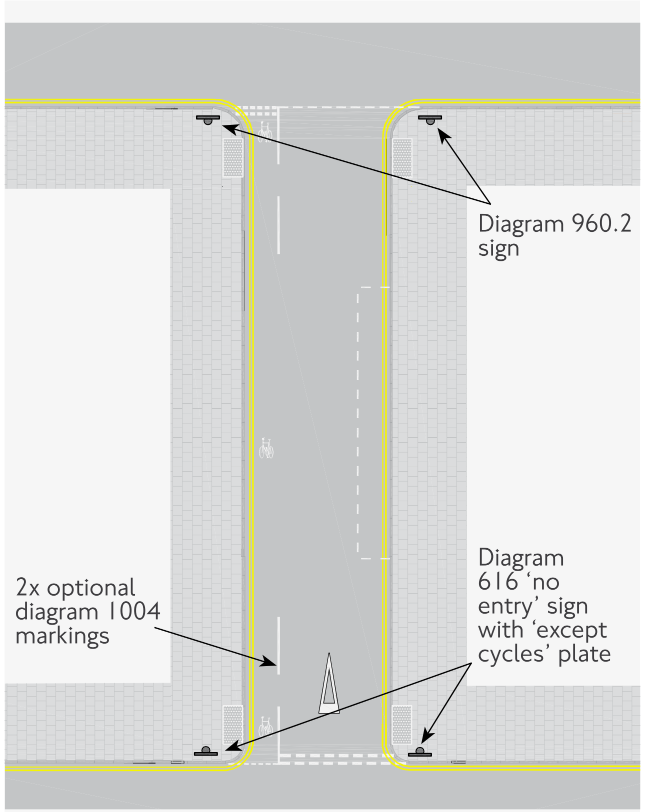

Indicative layout 4/16b: Advisory contraflow cycle lane

## Protection on entry and exit

In order to manage contraflow movement and provide some protection for cyclists at potential points of conflict, physical separation by traffic islands can be provided as necessary, with a sign to diagram 955 (route for use by pedal cycles only) on a bollard.

There is generally a greater need for segregation at the exit point, given the likelihood of vehicles turning in without accounting for contraflow cyclists. At both entrance and exit, tracking movements of larger vehicles may justify inclusion of protecting islands. Consideration needs to be given to the impact on pedestrians of providing additional islands: whether they are a barrier to accessibility on a pedestrian desire line, for example, or whether they may attract informal crossing at an unsuitable location.

Consideration also needs to be given to side roads, accesses and parking bays to ensure that all road users have adequate warning of priority and each others' movements. Parking bays and build-outs can create pinch-points for cyclists, particularly when encountered immediately upon entering the street. There is a good case for designing in some waiting space for a cyclist at such a location to allow them to wait for an oncoming vehicle to pass.




Indicative layout 4/17: Contraflow by exemption only

Contraflow cycling in City of London using the diagram 960.2 sign: advisory contraflow at Aldermanbury Street (left) and at Noble Street (right) using advisory lane markings only at the junction

## Minimising sign clutter

Where lane markings are omitted on the link, provision of two TSRGD diagram 1004 advisory lane markings on entrance and exit is recommended. Contraflow without lane markings was made possible by amendments to TSRGD in 2011, and confirmed in TSRGD (2016). Diagram 1057 cycle symbols with optional arrows may be used to add clarity to the layout.

Generally, the arrangement and placement of cycle symbols, arrows and protection should 'speak for itself' in slow moving environments without the need for additional vertical signage. Although regulatory requirements must be followed, the right amount of signing for contraflow cycling depends to a large extent on the discretion of the designer. A balance needs to be struck between avoiding street clutter and informing all road users of what may be an unexpected arrangement. This decision should be informed by analysis of patterns of use and movement in the street, particularly the likelihood of many pedestrians making informal crossing movements without realising that cyclists may come from both directions.

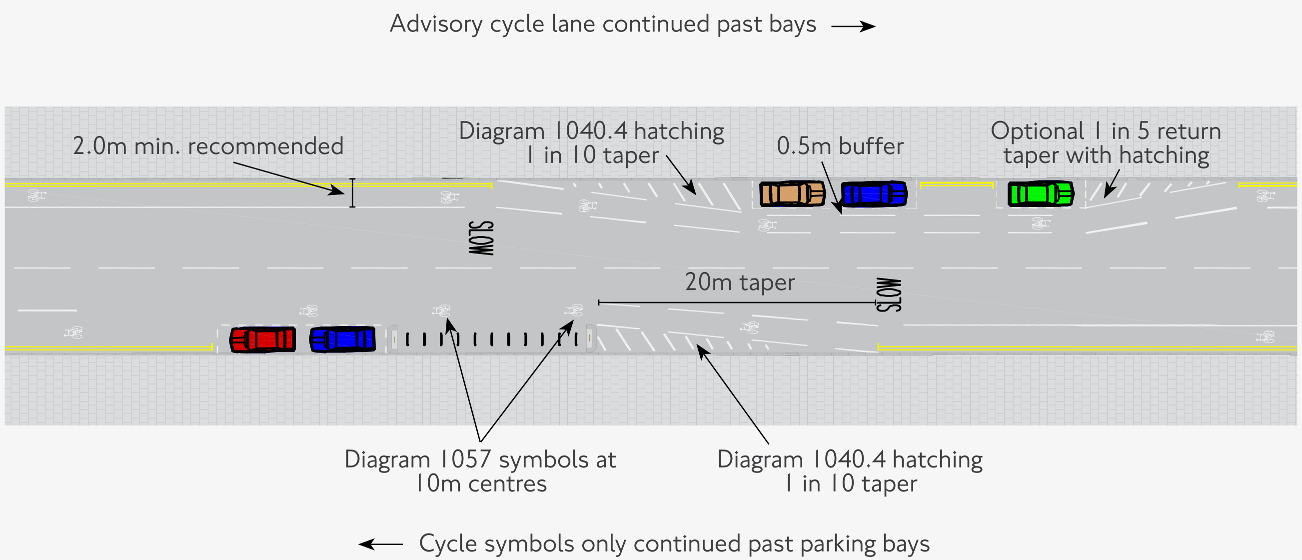
## 4.3.10 Integrating cycle lanes with parking and loading

To maintain the safety, comfort, coherence and directness of cycling infrastructure, loading and parking should not be permitted in cycle lanes and shared bus/cycle lanes during their hours of operation. Cycle lanes that are regularly blocked by vehicles are a poor quality facility and very often worse than no dedicated cycling facilities at all. Cycle lanes should therefore be provided with parking and loading restrictions that can be enforced accordingly. (See section 3.2.8)

Operating hours need to be determined with reference to anticipated demand and to the conditions that cyclists may experience outside of the times of operation. 24-hour mandatory lanes with 24-hour parking and loading restrictions are preferred, although there may be substantial benefit in adjusting hours of operation. Cycling peaks have been observed to begin earlier and end later than peaks for other modes of transport: indicatively, 6am to 10am and 4pm to 8pm. Lane operation until 8pm, either through extending the hours of bus lanes and/or extending parking and loading restrictions for a further hour, could therefore constitute an effective facility for both cyclists and buses during the evening peak.

### Minimising risk of dooring

Traffic lane widths are important when it comes to cycling provision outside parking or loading




Indicative layout 4/18: Options for cycle infrastructure around on-carriageway parking bays

bays, particularly where those lanes are narrow and larger vehicles are likely to encroach on (advisory) cycle lanes. Where cyclists are required to move out and around an obstruction such as a parked car or a delivery vehicle, the principal considerations should be that they have time and space to make that adjustment, and that they are not put into conflict with other moving vehicles or with car doors in doing so.

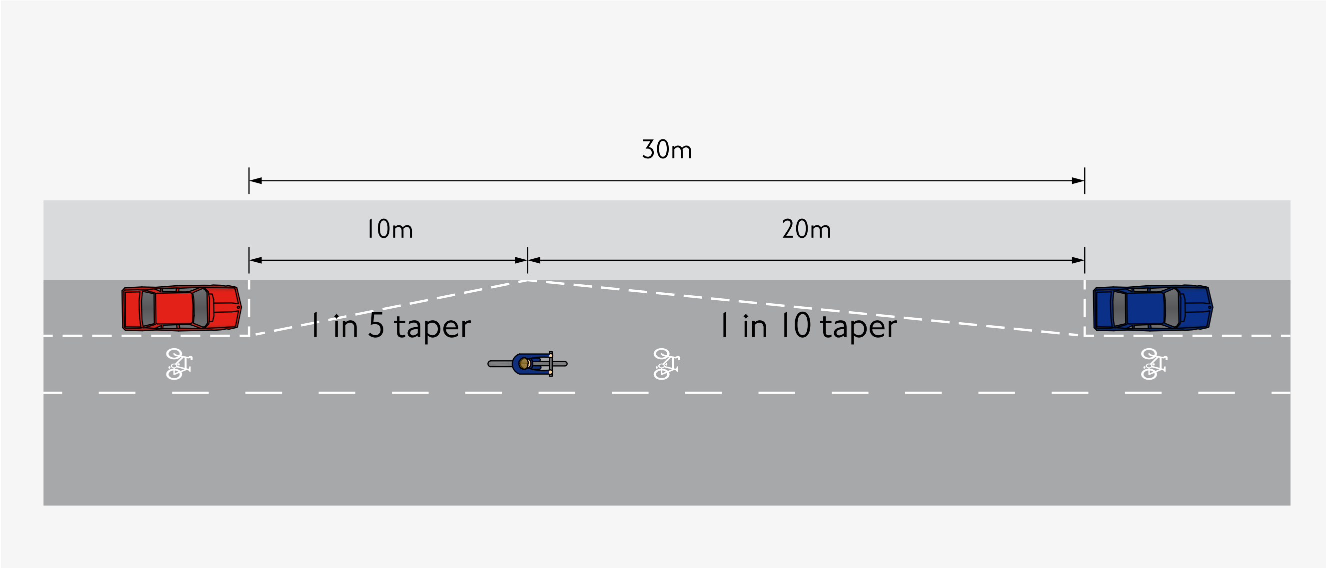
Cycle lanes marked on the outside of on-carriageway or half-inset loading or parking bays will usually need to be advisory so that they can be crossed, and a recommended minimum of 2.0 metres wide (1.5 to 2.0 metres by exception – see section 4.4 below). A buffer zone of 0.5 to 1.0 metre should be provided to protect cyclists from the risk of 'dooring'. This arrangement should not be used if it narrows the usable carriageway in such a way as to mean that motorists frequently encroach on the advisory cycle lane: TSRGD diagram 1057 cycle symbols should be used around the bay instead, encouraging cyclists to adopt a primary riding position.

In design of cycling facilities adjacent to parking and loading, consideration should be given to the blind spot areas immediately in front of and to the side of larger vehicles. Drivers rely on indirect vision aids (ie mirrors) but some older vehicles are exempt from the requirement for class IV and V mirrors, which improve vision at the front and nearside of the vehicle. Note that the Safer Lorry Scheme is aimed at addressing this issue.

## Returning lanes to the kerbside

Where there are short gaps between parking or loading bays, including at junctions, then a cycle lane should maintain its position in the road rather than zig-zag back to the kerb-line. On most streets, cycle lanes should only ever be considered for return to the kerbside when the gap between bays is 30 metres or more. This is based on an assumption of 1:5 exit tapers and 1:10 entry tapers. As this will depend on cyclists' individual speeds, gradients, carriageway widths and other conditions, it is recommended that the need for it should be assessed on a site-by-site basis.

Exceptions to this advice may include low-speed, mixed traffic environment with 'special' status, such as a Home Zone. Here, use of parking bays that prompt horizontal deflection of vehicles at low speed may be part of an overall strategy of traffic calming. The intention would be that vehicles would need to divert into gaps between bays.




Cyclists keep a constant line past short breaks between parking/loading areas

## 4.4 Widths for cycling on carriageway

### 4.4.1 Recommended lane and track widths

Advice on widths in the section should not be read as fixed dimensions, but as a guide to help in ensuring that a cycling facility is fit for purpose. Site-specific factors, different user needs, traffic conditions and anticipated levels of cycling take precedence over rigid imposition of standard widths. However, failure to meet recommended minima represents a low level of service and may prompt reconsideration of street design or the choice of cycling infrastructure in a given location.

The widths in figure 4.11 allow for comfortable use by people using non-standard cycles. As the notes explain, however, site-specific conditions may dictate that less width can still provide for a single cyclist to ride in safety and comfort. To cope with substantial growth in cycling numbers in specific locations, the recommended minima should be comfortably exceeded. Note that lane widths are measured from kerb face to centreline of markings.

Figure 4.11 Summary of guidance on widths on carriageway

| | Recommended minima | | |
|---|---|---|---|
| **Cycle lanes** [1] | **2.0 metres** | | |
| | Lanes of 1.5 to 2 metres may be acceptable provided that the adjacent traffic lane does not have fast-moving traffic and a high proportion of HGVs and is not less than 3.2 metres wide. | | |
| **Nearside lead-in lanes to ASLs** [2] | **1.5 metres** | | |
| | This should be for short lead-ins only, allowing space for cyclists to pass waiting traffic and access the ASL. Site-specific physical and traffic conditions may dictate that a 1.2- to 1.5-metre lead-in is preferable to no lead-in. | | |
| **Bus/cycle lanes** | **4.5 metres** | | |
| | A 'narrow bus lane' of 3.0 to 3.2 metres may be provided in constrained scenarios – this does not allow for overtaking[3]. Bus lanes of 4.0 to 4.5 metres can be acceptable, depending on site-specific conditions (risk associated with bus or cycle crossing into adjacent lane when overtaking).[4] | | |
| **On-carriageway segregated cycle lanes/tracks** [5] | | one-way | two-way |
| | very low / low flow | **1.5 metres** | **2.0 metres** |
| | medium flow | **2.2 metres** | **3.0 metres** |
| | high / very high flow | **2.5 metres +** | **4.0 metres +** |

**Notes:**

(1) The maximum comfortable clearance suggested by consideration of the dynamic envelope of the cyclist and passing distances to fixed and moving objects indicates that at least 2 metres should be provided. However, designers need to take a reasonable view on the benefits or disadvantages of providing a lane in any given context. Cycle flows are part of this: for very low flows, a 1.5 metre lane could be fit for purpose. Refer to the 'collision risk' and 'effective width without conflict' factors in CLoS for information on how lane width relates to level of service for cyclists.

(2) See section 5.3 for further details on ASLs. A view should be taken on the behaviour of other traffic at each location, as to whether there is benefit in seeking to keep space clear for cyclists to enter on the nearside – a narrower feeder can be acceptable in places where there is usually queuing traffic, but it is less advisable where conditions are normally free-flowing. If a central feeder is used, it must be at least 2.0 metres wide.

(3) Bus lanes of 3.0 to 3.2 metres are most likely to be appropriate where bus frequency and cycle flows are both low (up to 20 buses per hour or 100 buses and taxis per hour). They should be avoided where there is a significant uphill gradient or where there are high levels of infringement by unauthorised vehicles. For uphill gradients (over 500 metres or more), a wider bus lane is recommended. For offside and contraflow bus lanes, a narrow bus lane (ie not allowing for overtaking) may be appropriate, but any decision should be informed by a risk assessment for the site in question.

(4) Consideration of 4.0 to 4.5 metres lanes should be informed by widths of other traffic lanes, by speeds and volumes generally, and by an understanding of overtaking behaviour at stops. Overtaking a stationary bus in a 4.0 metre lane is unlikely to be a comfortable manoeuvre, but can be acceptable if the adjacent lane is lightly trafficked and generally free of large, wide vehicles.

(5) Flow categories are provided in figure 4.12 below. Edge conditions need to be taken into account with an extra 0.5 metres provided next to any object more than 50mm high. More width is also often needed around bends.

Figure 4.12a Peak hour flow categories for cyclists

| | Peak hour | |
|---|---|---|
| | 1-way lane/track | 2-way track |
| Very low | <100 | <100 |
| Low | 100-200 | 100-300 |
| Medium | 200-800 | 300-1,000 |
| High | 800-1,200 | 1,000-1,500 |
| Very high | 1,200+ | 1,500+ |

Figure 4.12b Daily flow categories for cyclists on carriageway

| | 6am to 8pm | | 24-hour | |
|---|---|---|---|---|
| | 1-way | 2-way | 1-way | 2-way |
| Very low | <600 | <600 | <800 | <800 |
| Low | 600-1,000 | 600-2,000 | 800-1,600 | 800-2,000 |
| Medium | 1,000-4,000 | 2,000-6,000 | 1,600-5,500 | 2,000-8,000 |
| High | 4,000-5,000 | 6,000-8,000 | 5,500-6,000 | 8,000-10,000 |
| Very high | 5,000+ | 8,000+ | 6,000+ | 10,000+ |

If separate cycle movements are taking place at signals or other intersections, with some division of the space within a lane or track, then space needs to be provided for cyclists to wait. This generally means localised widening of the lane or track.

Visualisation, showing cycle movements separated at signalled junction

Cyclists in Utrecht using the crossing to turn left are directed to wait on the right, to allow ahead cycle movement to continue

## 4.4.2 Traffic lane widths

Where cyclists are using a lane (bus lanes or general traffic lanes), either

- Enough space needs to be provided for a motorised vehicle and a cyclist to pass one another comfortably (with 1 metre clearance in areas with a 20mph limit and 1.4 metres clearance where speeds are higher), or
- The lane should be so narrow that overtaking is not possible.

> The rule-of-thumb is to avoid situations where motorised vehicles and cyclists are expected to move together through a width between 3.2 metres and 4 metres.

Where lane widths are between these two dimensions, there is uncertainty about space for overtaking and a high risk that other vehicles will seek to pass cyclists too closely thereby putting the more vulnerable road user at risk. This includes the typical lane width adopted in much UK practice of 3.65 metres. Use of this lane width should be avoided.

Traffic composition also needs to be taken into account. Where there are larger vehicles, the minimum nearside lane width for safe, comfortable overtaking should be 4.5 metres. It should also be noted that widths greater than 4 metres are preferable for most non-standard cycles because of their additional width.

### Influence of mandatory and advisory cycle lanes

Where mandatory cycle lanes are provided, the adjacent general traffic lane must be at least 3.0 metres wide, meaning that the half-road width should be at least 5.0 metres for a 2.0-metre cycle lane.

Similar advice applies to advisory cycle lanes. Where parking is permitted on the nearside of advisory (or part-time mandatory) cycle lanes, at least another 2.5 metres needs to be added to the width (and more still for loading bays and disabled parking bays). This comprises 2 metres for the bay (less if the bay is half on, half off the carriageway) and a 0.5-metre gap between the bay and the adjacent cycle lane.

There may be circumstances in which it is beneficial to use advisory cycle lanes next to narrower general traffic lanes, usually with the centre line omitted and with other calming features in place. A 7-metre wide carriageway could, for example, be divided into 1.5-metre advisory lanes either side of a 4-metre two-way general traffic lane. While this means that there will be encroachment into the cycle lanes by other vehicles, it should occur at lower speeds and in a more cautious way than in more ‘conventional’ arrangements. On one-way streets where speeds can be kept very low (85th percentile speed well below 20mph), 1.5-metre advisory cycle lanes either side of a 2.5-metre general traffic lane may be a good use of available carriageway space.

### Narrow general traffic lanes

The introduction of a cycle lane will not necessarily require removal of an existing general traffic lane or result in a negative effect on the overall capacity of a link. In many situations, reducing the width of general traffic lanes can create the space required for a cycle lane, although caution should be applied where there are high numbers of buses and HGVs. Manual for Streets 2 (2010) states that narrower lanes are easier for pedestrians to cross and can encourage lower traffic speeds without causing a significant loss of traffic capacity (p53, paragraph 8.6.2).


Traffic lanes narrowed to incorporate nearside feeder to an ASL – Aldersgate Street, City of London

If the proportion of HGV and public service vehicle traffic is less than 10 per cent then, subject to the carriageway geometry and speed and volume of traffic, motor traffic lane widths may generally be reduced to between 2.5 and 2.9 metres. Lanes adjacent to cycle lanes or bus lanes, however, should be a minimum of 3.0 metres wide.

## 4.4.3 Street profiles

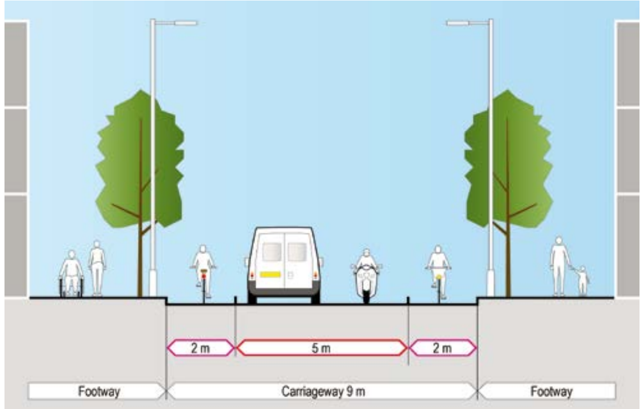
This section demonstrates indicatively how the above guidance on cycle facility types, street types and width can be brought together to derive options for a range of circumstances. The profiles show that, for a given carriageway width, different configurations are possible through adjustment of various parameters:

- Type of cycling provision (degree of separation from motorised traffic)
- Width of cycle lanes/tracks
- One-or two-way working of general traffic in the street
- Number and width of general traffic lanes and bus lanes
- Parking on one or both sides of the street (where parking has to be accommodated on the carriageway rather than in bays)

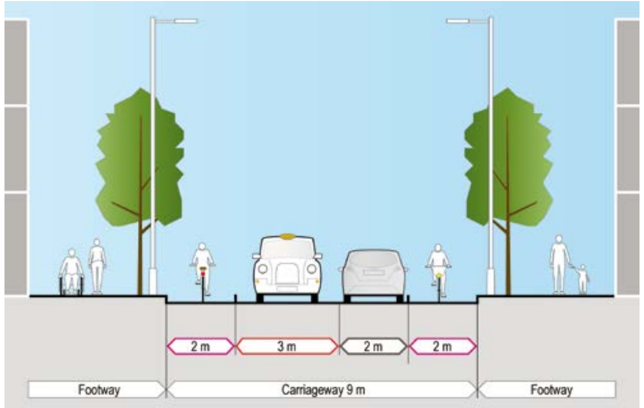
### 9-metre wide carriageway

Local street / Connector / City street

Wide cycle lanes can be accommodated on both sides. Remaining space for general traffic is 5 metres, so advisory cycle lanes and/or centre line removal will allow passage of all vehicles.

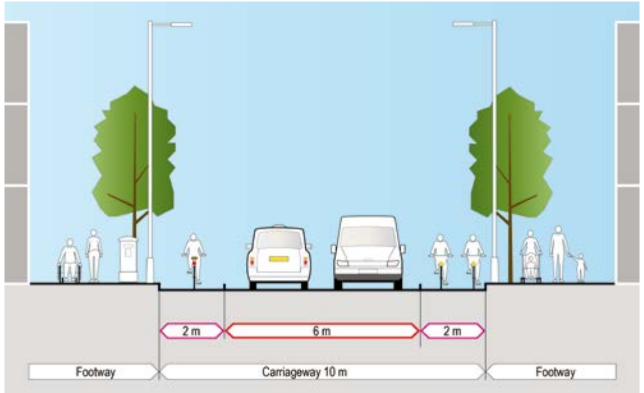



If the street is one-way to general traffic, parking can be accommodated, and 'floated' to one side (meaning that parking is located between carriageway and cycle facility) and give protection to the cycle lane/track. Consideration could also be given to light segregation for the with-flow cycle lane. However, one-way motorised traffic movement brings about other problems, so generally avoid creating one-way streets.

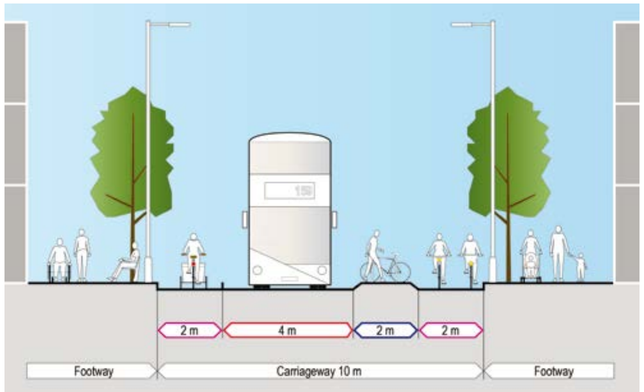


## 10-metre wide carriageway
### Local street / Connector / City street

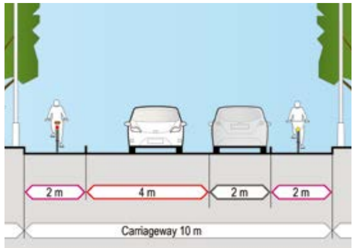
Wide, mandatory cycle lanes can be accommodated without parking and with sufficient space for two-way general traffic in 3-metre wide lanes.




If the street is one-way, a wider form of separation may be used.

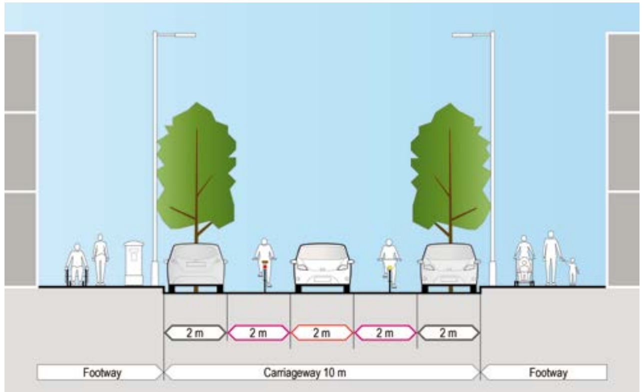



Rather than be used for a separating island, the buffer space could accommodate 'floating' parking and/or loading.



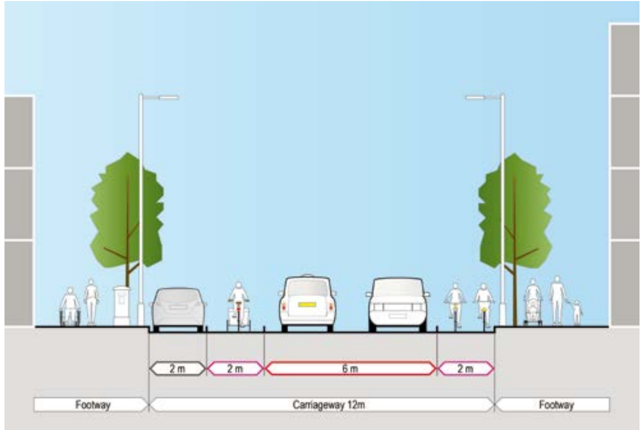

## 10-metre wide carriageway
### Local street

An alternative for a local street where parking is needed on both sides could be a 'cycle streets' approach with advisory cycle lanes. This would permit two-way access to all vehicles but at slow speeds, with cyclists having effective priority.

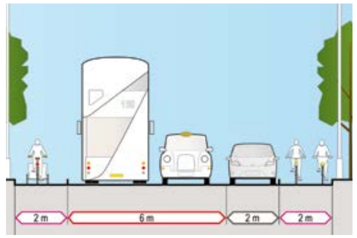



## 12-metre wide carriageway
### Connector / High street

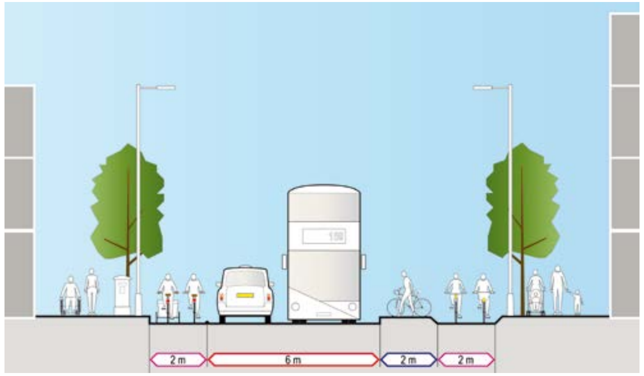
Wide cycle lanes can be accommodated, together with parking on one side, leaving 6 metres for two-way general traffic.




The parking could also be 'floated' without losing any space.

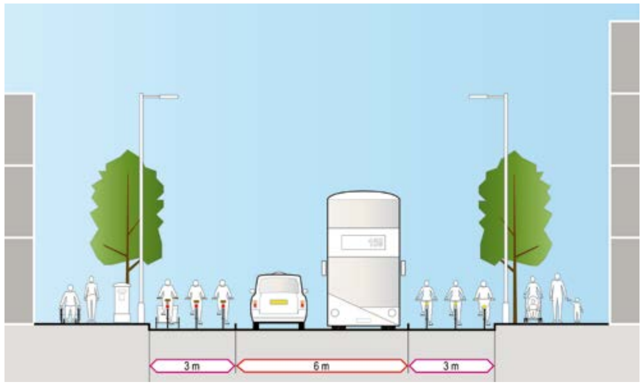


For a street with a higher movement function, full segregation could be provided on one side instead of a continuous bay – parking/loading could sit within the segregation.



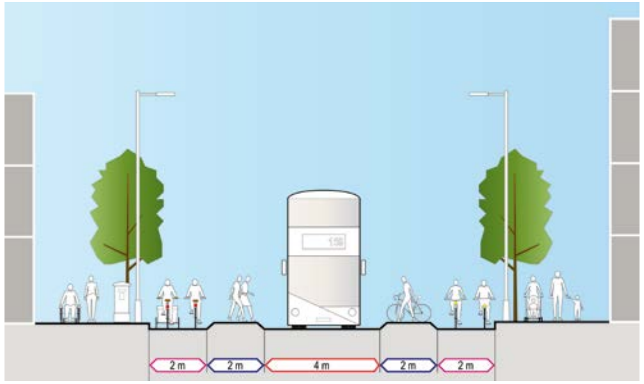

## 12-metre wide carriageway
### Connector / High road

Where cycling numbers are very high, parking could be relocated to accommodate cycle lanes as wide as 3 metres. This still allows two-way working for general traffic. This is only likely to be appropriate where there is very little kerbside activity.



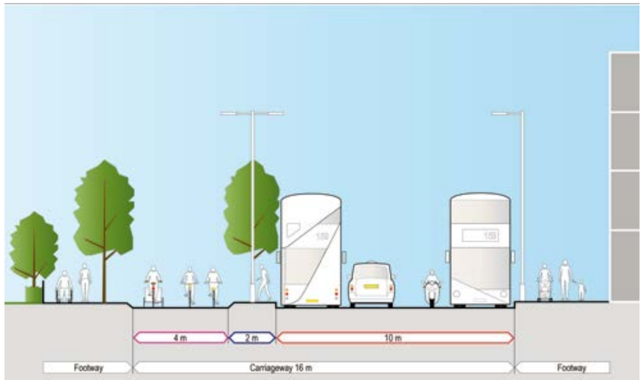

## 12-metre wide carriageway
### High road / City hub

A further variant on this approach could be a bus/cycle priority street, where cyclists are segregated either side of a dedicated, one-way bus lane. A similar approach could be applied to a street open to one-way general traffic.




## 12-metre+ carriageways
### Arterial roads / High roads / City hubs

Wider carriageways offer more possibilities for accommodating cycling on links. Where kerbside activity is concentrated on one side of the road, two-way cycle tracks are an option and could fit within the profile as shown below.



## 4.5 Off-road cycle facilities

### 4.5.1 Off-road design principles

This section covers design for cycling in off-road environments, including:

- Parks and other green spaces
- Watersides, such as canal towpaths
- Links not open to motorised traffic, including those through public spaces

Although some common design principles can be applied to these off-road environments, it should be recognised that each of these categories constitutes a distinct context in terms of patterns of use and quality of place. Parks and canal towpaths, for example, are multi-functional spaces, and the types and levels of activity they attract vary considerably during the day, week and year. Many parks also host events and need to be designed to cater for the movements of large numbers of people. Flexibility in design rather than standardised solutions is appropriate in such cases.

Off-road, cyclists are the faster, less vulnerable user and design decisions about cycle infrastructure need to reflect this. On links likely to be shared with pedestrians, a slower speed of cycling should be designed for, to encourage more courteous behaviour and greater homogeneity of mass, speed and direction.

Shared use towpath on the Lea Navigation

Shared use path – Broad Walk, Regent's Park

Partial (white line) separation in London Fields

Public space closed to motor vehicles, Sutton

This section is informed by several key sources of information and guidance on the design of off-road cycle infrastructure, namely:

DfT, LTN2/08 Cycle infrastructure design (2008)

DfT, LTN1/12 Shared use routes for pedestrians and cyclists (2012)

Sustrans, Connect 2 Greenways Guide (2009)

The evidence base arises largely from the above guidance, from Phil Jones Associates, The merits of segregated and non-segregated traffic-free paths: a literature-based review (2011), and from Atkins, Shared use operational review (2012). Similar, London-based research by Atkins, referred to in the Phil Jones report, has also informed this guidance in the sections on cyclist and pedestrian behaviour and flows and widths.

## 4.5.2 Balancing user needs

It is essential that design of cycle infrastructure in off-road environments is informed by a good understanding of patterns of use and by the needs of other users. The level of service that parks and towpaths are able to offer varies according to time of day and intensity of use by others. The proximity of playgrounds and sports pitches influences what kinds of users will be in the area, and when they are likely to be around. This dynamic should influence the planning of routes, the design of infrastructure and the management of access to the spaces in question.

In most off-road scenarios, pedestrians are as likely to be enjoying their surroundings as walking purposefully, so movement is not the principal consideration. Parks and other urban green spaces serve multiple functions, only some of which are about movement. Paths usually, therefore, have a high place function and any separation may not be noticed or appreciated by those pedestrians who are using the space to relax.

## 4.5.3 Good design outcomes

Design for cycling off-road should deliver fit-for-purpose, safe and comfortable infrastructure for both cyclists and pedestrians in a way that meets accessibility requirements fully. Good design outcomes are summarised in figure 4.12.

Off-road routes are capable of providing all types of cyclists with attractive riding conditions, so their place in a network strategy needs to be carefully considered (see chapter 2). Providing for cyclists through a park or by a waterside, for example, does not remove the need to improve on-highway conditions for cycling, particularly given likely issues with 24-hour access to parks and canals. Where peak cycle flows are growing, better cycle infrastructure on-highway may well be a more sustainable approach than encouraging more cyclists to use a busy route through a park.

Figure 4.12 Good design outcomes for off-road routes

| | |
|---|---|
| **Safety and comfort** | Surface quality that offers comfort for all types of cyclist<br>Infrastructure designed appropriately for the amount of users<br>Design that reinforces exercise of care and courtesy by cyclists when riding near to pedestrians<br>Where they are necessary, slowing measures and access controls that do not exclude certain users<br>Pedestrian priority on shared paths |
| **Directness** | Off-road routes providing key links in the cycle network<br>On-highway alternatives where 24-hour access cannot be secured |
| **Coherence** | Good signing and wayfinding to and from off-highway links<br>Legible and consistent infrastructure that helps cyclists and pedestrians to act with courtesy towards one another |
| **Attractiveness** | Cycle provision that adds to the qualities of a park or waterside environment and encourages a wide range of uses and activities<br>Better access to all facilities served by a park or waterside space, supporting their use with good quality cycle parking |
| **Adaptability** | Good management of access to off-highway facilities by cyclists, in order ensure a high level of service for all users<br>Provision that could be adapted to meet future growth in cyclist and/or pedestrian numbers |

## 4.5.4 Degrees of separation

Design choices for off-road provision are mainly concerned with design details but there are some basic differences between types of provision – largely the question of whether or not to separate users. More separation generally requires more space but, as figure 4.14 shows, behavioural factors play an important role in the interaction between cyclists and pedestrians.

The principal design objective is to manage users in a way that removes discomfort, conflict and the perception of conflict.

Consideration of degree of separation, and of the impact on people with protected characteristics under the Equality Act (2010), is best addressed through undertaking an Equality Impact Assessment on any proposal involving a degree of sharing. Early consultation with access groups on any such schemes is highly recommended.

Comparison between shared and separated provision needs to have regard to site conditions, the respective flows of users, how those flows vary over time, cycle speeds and ensuring the comfort and safety of all users. This relates particularly to people with visual impairments, children and older people, all of whom may feel intimated by sharing space with cyclists.

Figure 4.13 Degrees of separation between cyclists and pedestrians off-road

| | | |
|---|---|---|
| **Full separation** | **Cycle track / separate footpath**<br>Cyclists have dedicated tracks, pedestrians dedicated footpaths. May be in areas closed to motor traffic or away from the highway entirely. |   |
| **Partial separation** | **Separated path**<br>A path divided between users by painted markings or a low, raised delineator, often punctuated by fully shared areas. Away from the highway, different kinds of signing may be used. |    |
| **Sharing** | **Shared use path**<br>A path fully shared without any form of separation. Examples include canal towpaths, other waterside routes, paths through parks and cut-throughs away from the highway. In some instances, a route for cyclists may be 'suggested' by subtle changes in surface materials and inlaid signing. |    |

Figure 4.14 Comparison of fully shared and partially separated off-road cycling provision

| | Fully shared | Partially separated |
|---|---|---|
| **Activity and behaviour** | More considerate behaviour among all users, especially with code of conduct and coherent design<br>Lower cycling speeds<br>More minor interactions between users but less conflict | Pedestrians may walk in cycle track, especially during periods of low cycle activity<br>Non-compliance can increase potential for collisions<br>Cyclists tend to comply unless pedestrians are in cycle track |
| **Physical design** | Efficient use of width<br>Could enable more sympathetic design and sense of place | May require more width for a given level of activity to support adequate levels of separation at peak periods<br>May require more significant levels of infrastructure |
| **Priority, codes of conduct and signing** | Clear, coherent and consistent code of conduct may encourage considerate use, but would need conveying to other user groups<br>Supports more effective management of network | May require greater number of signs in order to give information along route<br>May be less suitable if frequently intersected by formal and informal cross-routes, where priority may not be consistent with path design |
| **Maintenance** | Maintenance regime taking into account seasonal planting growth and surface degradation<br>May require more maintenance if surface is unbound | May require stricter and more costly maintenance regime to support suitable separation<br>Impact of seasonal planting growth and surface degradation can affect compliance with separation |
| **Public satisfaction and perceptions** | User satisfaction tends to decrease with user age<br>User consultation and public engagement should emphasise the opportunities as well as site-specific challenges<br>Information about detailed path designs can help build consensus | Public perceptions may favour separation (although this recedes with early engagement)<br>User consultation and public engagement should emphasise the opportunities as well as site-specific challenges |
| **Cost** | Potentially lower implementation and management costs | Potentially more costly to implement and manage |

## 4.5.5 Cycle and pedestrian flows

This section should be used to assist decision-making on whether separation is desirable, as well as giving guidance on widths required. The two main factors at play are cycle speed and compliance with the separation. Cycle speeds are usually higher in separated facilities, which can lead to conflict where there are many pedestrians walking on the cycle side of the separation. Evidence also shows that the number of unexpected interactions and potential conflicts is lower in shared environments than on paths separated between users.

Where cyclists are completely separated from pedestrians, guidance provided in section 4.4 applies to considerations of cycle flow and track width: 2.0 metres minimum for flows below 300 cycles per hour, 3.0 metres for 300-1,000 per hour and 4.0 metres for flows of over 1,000 per hour. On partially separated and shared routes, cycle flow must be considered relative to pedestrian flow and so the categories provided in figure 4.15 below apply instead.

Figure 4.15 Flow categories for partially separated and shared routes

| Peak flow categories | Pedestrians per hour | Cyclists per hour |
|---|---|---|
| Very low | 0-120 | 0-60 |
| Low | 120-200 | 60-150 |
| Medium | 200-450 | 150-300 |
| High | 450-900 | 300-450 |
| Very high | 900+ | 450+ |

Figure 4.16 summarises the main advice arising from research on flows and widths off-highway, relating it to choices about degree of separation. The main factors that this takes into account are:

- Compliance with separation by pedestrians is higher if cycle flows are high
- Peak flows rarely coincide: peak cycle flows tend to match commuting times (particularly evenings during summer) while peak pedestrian flows occur at weekends or in the middle of the day
- Separation can therefore be a reasonable option where flows are more predictable
- Shared use works better where there is a greater need for flexibility

Figure 4.16 How pedestrian and cycle flows relate to degree of separation

<table>
<tr><th></th><th>Higher cycle flows</th><th>Lower cycle flows</th></tr>
<tr><td>Higher pedestrian flows</td><td>Partial separation unlikely to be complied with, so sharing preferred.<br>Forms of sharing may work for most of the time but be uncomfortable during peaks.<br>Longer term, cycle routes may need to be reassessed at the network scale.</td><td rowspan="2">Sharing is advisable, provided cycle flows likely to remain relatively low.</td></tr>
<tr><td>Lower pedestrian flows</td><td>Consider both options. Partial separation could be workable, depending on site-specific conditions, to keep some space free for walking during peak cycling times.</td></tr>
</table>

## 4.5.6 Choosing degree of separation

It is important to note that flows may not be the principal determinant of appropriate infrastructure type. If the desire lines of pedestrians and cyclists cross within a given space, and the density and complexity of movements is high, then sharing is likely to make more sense than seeking to separate.

Where pedestrian flows are very high, but more or less predictable by time of day, access by cyclists could be managed through signing and a code of conduct – for example, cycling on a given link may be allowed only at certain times of day. Not only would this add to pedestrian comfort, but it can help cyclists avoid places where, in practice, they will not be able to ride because of the volumes of pedestrians.

In all cases, the potential impact on more vulnerable users must be taken into account in decisions about separation. The proximity of schools, residential accommodation for older people, hospitals, health centres and facilities for disabled people can have a significant influence on the composition of pedestrian flows. It may highlight the need for cycle-slowing measures or even rethinking cycle routes to avoid the need for shared use.

## 4.5.7 Width requirements

Calculation of width requirements also needs to consider disabled users, including disabled cyclists as well as wheelchair users and anyone with a mobility impairment:

- Shared paths should not normally be less than 2.0 metres in width (and then only if cycle flows are expected to be low) because DfT's Inclusive Mobility guidance recommends that 2.0 metre width is required to allow wheelchair users and people with child buggies to pass one another in comfort
- Cyclists using wider, adapted vehicles – see section 3.2.3 for dimensions – will generally need widths higher than those in the 'very low / low flow' category. They will otherwise encroach on the pedestrian area where users are separated
- The likelihood of this encroachment occurring needs to be taken into account when deciding on whether to separate and on the form of separation, as a raised delineator could destabilise a user who needs to cross it

Figure 4.17 summarises the recommended effective widths for shared and partially separated paths. To achieve the desired level of service for both users, further width could be added to take into account edge conditions, as described in the notes. However, any proposal for increasing path width needs to be balanced with consideration of all the uses served by a park or urban green space; it is not desirable in most cases to urbanise spaces that provide a refuge from the rest of the city, even in pursuit of transport connectivity. No minima are given in figure 4.17 in recognition of the constraints in many environments, such as canal towpaths, that are likely to prevent the recommended effective widths from being attained. Figure 4.18 demonstrates how the recommended widths have been derived.

Figure 4.17 Recommended effective widths for partially separated and shared routes

| | **Partially separated** | **Shared** |
|---|---|---|
| Very low / low cycle flow | 3.0m (cycle track 1.2m to 1.5m)* | 2.2m |
| Medium / high cycle flow | 4.5m (cycle track 2.5m to 2.8m)* | 3.0m |
| High / very high cycle flow | 5.9m (cycle track 2.5m to 3.5m)* | 4.5m |

* Ranges are given to account for variations in pedestrian flows (at the time of peak cycle flows). Where pedestrian flows are expected to be high or very high, then more width than is shown in the table above may be needed.

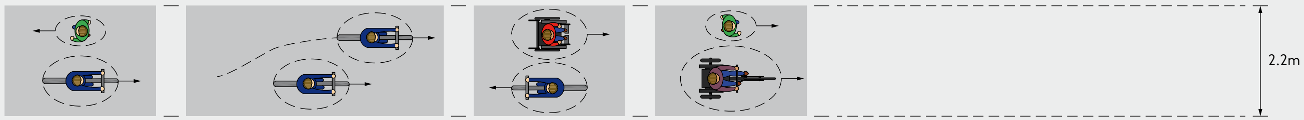
The following additional widths must be provided to account for edge conditions:

- 200mm for a low upstand, up to 150mm in height
- 250mm for a vertical feature, 150mm to 600mm
- 500mm for a vertical feature above 600mm

Figure 4.18 User interaction for different path widths

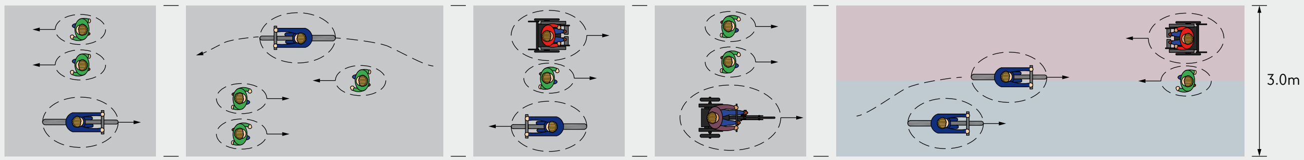
**2.2m-wide path** **Shared use** **Separated**

If flows are low, users can pass with minimal clearance in some cases, so cyclists will need to slow. There are few opportunities for overtaking.



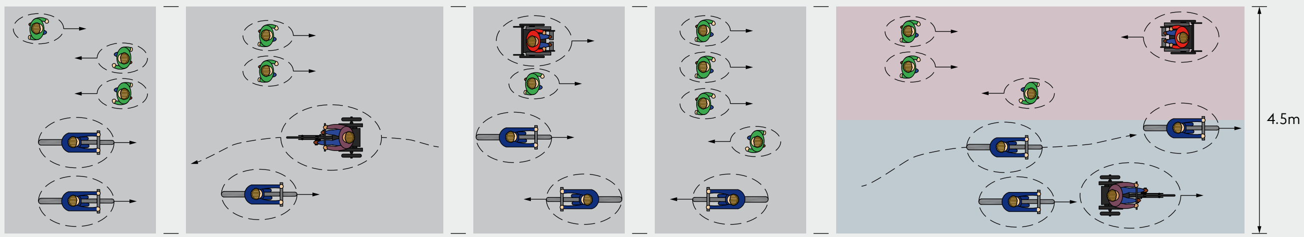

**3.0-wide path**

There are more opportunities to pass, and to do so with greater clearance, but this becomes uncomfortable with more users. Cyclists start to have to weave and to slow considerably. Separation can be acceptable if flows are very low, but capacity is quickly reached and compliance with the separation cannot be achieved.




**4.5m-wide path**

Shared use option permits users to arrange themselves and pass with reasonable comfort – cyclists less likely to have to weave. Separation may be effective with low to moderate flows with cyclists able to overtake each other entirely within the cycling side of the path but, again, compliance breaks down with larger numbers of users.




**Key to dynamic envelopes of different users**

- 0.6m Pedestrian
- 1.0m Wheelchair user
- 1.0m 'Standard' cyclist
- 1.3m Largest types of cycle
- 1.3m Two pedestrians walking side-by-side
- 1.5m Wheelchair user and pedestrian side-by-side

## 4.5.8 Off-road design parameters

LTN2/08 gives basic design parameters for off-road cycle infrastructure, as shown in figure 4.19. These relate to standard bicycles; recommended curvature to maintain a given design speed will need to be increased in order to provide an equivalent level of service for all types of cycle.

Figure 4.19 Design parameters (from LTN2/08)

| | Design speed | Min. stopping sight distance* | Min. curve radius |
|---|---|---|---|
| **Commuter route** | 20 mph | 25m | 25m |
| **Local access route** | 12 mph | 15m | 15m |

*Minimum stopping sight distances need to be increased by around 50 per cent for unsurfaced tracks – although unsurfaced tracks are not recommended for basic quality, accessible cycle provision.

Considerations of speed and track and path geometry depend to a great extent on available space, on context and on patterns of use by cyclists and pedestrians. Where cycle tracks are separate, or where pedestrian flows are low (particularly during peak cycling times), higher design speeds may be applied – according to the description 'commuter route' in figure 4.19.

The 'local access route' parameters are more likely to be applicable for shared paths and other places where pedestrian and cyclist numbers are both high and/or space is constrained. In some London contexts, such as busy parks and canal towpaths, a design speed as low as 8 to 10mph may be appropriate, particularly where there is a specific need to slow cyclists (see section 4.5.16 below).

Cycling speeds are also influenced by gradient and by surface quality. It should be noted that the effect of downhill gradients tends to be more pronounced for separated than for shared use routes. Cycling speeds are also higher on asphalt surfaces than on bonded pea shingle or bound gravel.

Forward visibility governs the ability of cyclists to respond in time to a hazard ahead and to anticipate the actions of others. Without these, collision risk increases, the environment starts to feel less safe from a personal security perspective and maintaining momentum becomes difficult for the cyclist. Geometry that allows for appropriate stopping sight distance is therefore important for the attractiveness, safety and comfort of any off-road route.

Physical constraints will often make the minima in figure 4.19 difficult to achieve; this should be taken into account when considering the level of service that any given route is able to offer, particularly the difficulties it may present for users of larger cycles.

Cycle tracks should also avoid instantaneous changes of direction. Curvature on links should be based on a minimum radius of 14 metres. At intersections where cyclists may not need to stop, a minimum external radius of 4 metres should be applied.

## 4.5.9 Design of full and partial separation

Where the width is available, separation by verge, planted strip or other suitable materials could provide a high level of service for both users.

Waterfront tracks and separate footpath in Stockholm

Separation by level difference can be an effective way of avoiding some of the typical problems of non-compliance with partial separation as well as giving pedestrians comfort space. Kerbs should be at least 50mm high and design of transitions and crossings needs to be considered carefully in order to maintain level access across the facility for pedestrians. Generally, follow guidance on segregated track or stepped track design in section 4.2 above.

Separated track and footpath in Copenhagen

Separation by level difference in areas closed to motorised traffic – Skerne Walk, Kingston

Separation by level difference in areas closed to motorised traffic – (left) Separated track and footpath in Copenhagen and (right) Steatham Street, Camden

Partial forms of separation typically include:

- White line delineation and use of pedestrian and cycle symbols on the path
- Use of a raised delineator to diagram 1049.1 of TSRGD (12-20mm in height) to reinforce the separation
- Strong continuous visual contrast between cycle and pedestrian sides

## Signing

Signing for off-highway environments should meet the managing authority's guidance. Recognisable signs can help in enforcing rules and codes and conduct in park environments. Centre lines in cycle tracks are an option, to show two-way cycling and to help cyclists keep to one side, but they may increase cycle speeds and therefore increase risk to all users in partial separation scenarios. 'Double dash' and triangular give way markings (TSRGD diagrams 1003 and 1023) relate to vehicular traffic only so, while they have some meaning off-highway in compelling cyclists in one direction to give way to cyclists in another, they should not be used to instruct cyclists to give way to pedestrians.

For reasons of maintenance, quality of place and lack of any enforceable status, use of regulatory road markings on off-highway routes should generally be avoided.

The cycle symbol (TSRGD diagram 1057) and shared use symbol (diagram 956) are widely recognised and can be useful in showing areas where it is legitimate to cycle. Authorities may wish to adapt the symbol to their own signing, or develop innovative, low maintenance ways of using it, such as inlaid tiles with the symbol. (See chapter 6 for more information on signing).

Ladder and tramline tactile paving is not a requirement away from the highway, but may be considered where there is partial separation. Consultation with access groups is recommended before installing any such tactile paving as it is important that infrastructure to support accessibility should be consistent and predictable through the area (see chapter 7 for more guidance on use of tactile paving).

White line separation, with centre lines on cycle track – Camley Street, Camden

Separation using colour, symbols and tactile paving (note that regulatory 'give way' markings should not be used here)

## 4.5.10 Shared use in parks

Shared use paths are often the most flexible ways of providing for all users in parks. How well they work depends on many site-specific factors: width, edge conditions, surface quality, amount and height of adjacent planting, lighting, forward visibility and path geometry. These all have a bearing on cycle speeds, on comfort and on feeling of safety and security in the space. Cycle slowing measures should be considered where there are frequent pedestrian crossing movements, or in the vicinity of facilities such as play areas or cafés.

Consideration of the needs and potential vulnerability of all users of any shared use path is vital for informing the planning and design process, so that the facility is safe and comfortable for all. This may include early engagement with people with mobility and sensory impairments, equestrians, joggers, anglers, maintenance officers (who may also require vehicular access) and cyclists. An Equality Impact Assessment can help to inform this process. It should also take into account the personal safety of cyclists, including where they are likely to come into close contact with wildlife, particularly geese, and with dog walkers.

Where investment in cycling improvements results in provision of any new shared use path, it can be an opportunity to improve pedestrian facilities through better surface quality and better lighting.

The needs of wheelchair users could, for example, be better accommodated by upgrading an existing footway to be suitable, either in part or as a whole, for use by cyclists – provided that efforts are made to ensure that cyclists act courteously.

Shared use 'greenway' in Stockholm

## 4.5.11 Shared use by watersides

Waterside routes, particularly canal towpaths, have different types and patterns of use from parks and other green spaces. Space is usually highly constrained, with no possibility of widening a path, and the intensity of use at certain times can be high. Those who need to be accommodated include not only cyclists, people on foot and wheelchair users but also anglers, users of horse-drawn and manually-drawn boats and users of boat moorings. The Canal and River Trust's Towpath Design Guidelines should be consulted when designing any towpath environment in order to provide well for all these different users.

Built heritage and ecological considerations apply in most canal locations and design of towpaths needs to respond sensitively to these contexts. An Environmental Appraisal is required at the scoping stage of any towpath project. Improvement of towpath facilities can be opportunities to enhance biodiversity through management of verges, trees and shrubs, and ensuring better links to adjoining habitats.

Shared use on a canal towpath

Margins, grassed verges and paved areas to one or both sides of the main towpath, are important as refuge areas, allowing people to stop and enjoy the environment away from the main flow of movement. These spaces should be retained in any redesign, particularly grass verges as these represent a continuous green corridor, they help to maintain a rural character and they provide space for fishing. Wherever possible, a verge of at least 0.5 metres should be retained at the water's edge.

## 4.5.12 Shared use in other public spaces

Away from parks and towpaths, shared use facilities may also be considered for public spaces or short links where cyclists are catered for in spaces otherwise dedicated to pedestrians. The best level of service for cyclists and pedestrians would be to avoid such scenarios by providing high quality facilities on-carriageway. Cyclists are not best served by routes that shift them from one type of provision to another where different priorities apply, and dedicated space is preferable for pedestrians

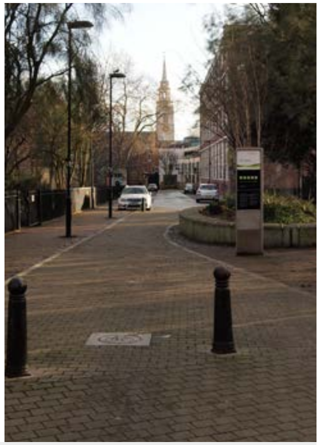
Shared use to provide a cycle and pedestrian link in a residential area

However, where a space provides an important link in the cycle network, and excluding cyclists from it would lead to longer, less comfortable cycle trips and more exposure to risk, designers should seek ways of accommodating both users while minimising conflict. The preference is to provide a dedicated cycle track, separated physically or by level, as described above.

On short, narrower links with low flows of both user, sharing the space may be the most practical option, but for the comfort and safety of pedestrians, methods of slowing cyclists should be explored.

## 4.5.13 Designing for shared use

It can be beneficial in such circumstances to provide subtle ways of legitimising cycling through the space – through, for example, application of



Suggested routes through pedestrian areas: Sutton town centre, Trinity Street, Southwark; Spa Fields, Islington bespoke studs or cycle symbols, or varying surface materials that suggest that the space has some different characteristics. This can help to raise awareness of the shared status and even to suggest a route through the space for cyclists. An area that is problematic to divide formally between users and that needs to be fully shared may nevertheless see most cyclists taking a certain line through the space, and so this technique can be useful.

For the safety and comfort of people with visual impairments, using street furniture and planting to provide comfort space should be considered in conjunction with this approach (see section 3.4.8). Subtly demarcated routes through shared areas should stop short of the carriageway at crossings, so as to encourage cyclists to give way to pedestrian movement along the footway.

Larger public spaces, where patterns of movement are likely to be more complex, will require a bespoke design approach. A dedicated cycle track that looks and feels like the carriageway and with defined formal and/or informal crossings for pedestrians may be appropriate in some circumstances. However, it may also compromise other design objectives, such as a desire to promote a range of uses of a space, make it fully accessible and allow pedestrian domination of it. Suggesting a route through for cyclists or fully sharing the space should only be considered if they can be done in conjunction with other cyclist slowing measures.

Subtle indications that cycling is permitted in a shared area: Munich (top), Stockholm (bottom)

Illuminated studs may be considered in some off-highway locations, provided they do not resemble road markings. These have the advantage that they can be controlled so as to be illuminated at times when more cyclists may be using the facility. Flexible application of lighting and other markings that help to manage conflict in shared use areas during certain parts of the day or week could be a good way of addressing many of the concerns that arise from all sides about these types of cycling facilities.

In such areas, pedestrians continue to have priority and courteous behaviour from cyclists is essential if they are to work well, without conflict. Care should be taken to avoid indicating to cyclists that they have any priority over pedestrians.

### 4.5.14 Promoting courteous cycling

Pedestrians and cyclists tend to behave in a manner they think is suitable to the context, based on their perception of risk. Civilising that interaction through more subtle aspects of environmental design tends to work better than applying 'traffic management' approaches to off-road situations.

Clear, consistent signing – designed to guidelines produced by the relevant managing authority – can help to keep all users, particularly cyclists, aware of sharing and the need for courteous behaviour. It can be helpful to communicate to pedestrians the legitimate right of cyclists to be in a given space, and to instruct cyclists to behave considerately – very often by asserting that pedestrians have priority.




Pedestrian priority signage off-highway

Wide shared use paths in open spaces through parks may comfortably be able to accommodate higher cycling speeds during periods of low pedestrian flow without any conflict. However, in most cases, the design objective should be to keep cyclists in park environments to lower speeds, through path geometry and the techniques set out in the section 'Cycle slowing measures' below.

Separated track and footpath in Copenhagen

## 4.5.15 Access controls

Most park and towpath environments need to operate some form of controlled access, either to prevent entry by motorised vehicles or allow for timed closures. In some spaces, such as large parks, these need to be designed in ways that can occasionally accommodate large volumes of pedestrians when events are being hosted. It is important that these controls do not exclude certain users, particularly those who have difficulty negotiating narrow gaps and sharp changes in direction, such as people in wheelchairs, people with prams and pushchairs, people with child seats on their bicycles and users of larger models of cycle.

Bollards, usually a single bollard placed in the middle of the entrance to a path or track, are the simplest way of preventing unauthorised access by cars and other larger vehicles.

Multiple bollards should be spaced a minimum of 1.5 metres apart and can be staggered, so long as this minimum spacing is achieved. Removable versions are available, to allow for occasional larger vehicle access. Bollards can, however, be hazardous on unlit routes and at sites where forward visibility is restricted, or if cyclists cannot approach them straight-on.

Improvements at Vanbrugh Gate, Greenwich Park. Before (top), barriers inhibit access by many types of user. After, barriers are more accessible, surface quality is improved, materials are better integrated with the setting and flush granite setts help to control cycle speeds ahead of the gate

Physical barriers, such as A-frames and chicanes, are not generally recommended. The costs, benefits and disbenefits of introducing them must be made clear in any design process. Consultation with user groups should be informed by clear and accurate information about what the options are and by the obligation to maintain access for people with protected characteristics under the Equality Act 2010.

Cycle access needs to be understood as access for all types of cycle, including recumbents, tricycles, cargo cycles and any model adapted for a person with a mobility impairment.

Where concerns are raised about access by powered two-wheelers, clear codes of conduct, better enforcement and/or use of double humps (see below) are all preferable to barriers and chicanes. Barriers are only acceptable as a last resort, where the problems that they are intended to deal with are shown to remain after applying other measures.

### Towpaths

Access to towpaths often involves a change of level and use of ramps, which can lead to cyclists entering the towpath at high speed, particularly where they have just left a busy street environment. Again, barriers are not recommended as a primary means of managing this kind of access. Promoting courteous behaviour is the preference: for example, through use of codes of conduct and signing, and through ensuring that sight-lines are as good as they can be. Instructions to slow, path art and rumble strips can all be useful ways of reminding cyclists that they need to ride considerately and that this is a space with multiple uses and activities.

Ramp to Regent's Canal towpath, Danbury Street: use of 'slow' markings and rumble strips to remind cyclists to ride slowly downhill. Well maintained vegetation helps to maximise width and visibility

## 4.5.16 Cyclist slowing measures

Where cyclists need to be encouraged to slow, it is better to give the required messages through design rather than physical calming features or additional signing. Other than access points and gateways, discussed above, locations where some intervention may be required include:

- Areas of high or specific pedestrian activity including play areas, entrances to shops and cafés and where desire lines cross
- Path/footway junctions
- Blind bends
- Steep gradients
- Subways and pedestrian/cycle bridges

Figure 4.20 summarises different off-road cyclist slowing measures by five types:

- Use and activity, or the suggestion of it
- Visual techniques aimed at suggesting that cyclists do not have a 'clear run'
- Horizontal calming – deflection of cyclists' line of travel
- Vertical calming
- Enforcement and management techniques

As with traffic calming, the existence of adjacent uses, and the attraction of pedestrians to them, can have a calming effect. Suggested crossing-points, achieved through changes in surface material, can encourage cyclists to slow and may be useful where paths cross or near entrances to adjacent facilities. However, care should be taken not to create a 'road-like' environment by formalising crossings – pedestrians should be allowed to occupy any part of a shared space.

Deflection of cyclists' line of travel – Van Gogh Walk, Lambeth

Change in surface material at entrance to city from Goldsmith's Row, Hackney

## Visual techniques

Coloured surfacing or path art that is suggestive of specific activities taking place, such as children's play or a meeting point, can also help to encourage cyclists to take more care as they pass through the space.

Any subtle change to the path environment that makes it appear less like a 'mini-highway' for cyclists can help to bring down speeds. Omitting highway-type markings is recommended. Elsewhere, apparent narrowing may be achieved by planting, or by using different surface materials or colour towards the edges of the path, although some caution should be applied to this technique when used in an environment where width is already restricted, such as a canal towpath.

Figure 4.20 Off-highway 'cycle calming' techniques

| | | | | | |
|---|---|---|---|---|---|
| **Use and activity** | Crossing points | Pathside activity | Mixing uses | Path art | |
| **Visual techniques** | Street trees / planting | Apparent narrowing | Apparent table | Coloured surfacing | Removal of markings |
| **Horizontal calming** | Tighten geometry | Deflection | Narrow rideable width | Objects, eg cycle parking | Chicane with gate |
| **Vertical calming** | Sinusoidal speed humps | P2W speed deterrent humps | Rumble strips | Positive texture | |
| **Enforcement / management** | Signs | Speed limits | Non-rideable closure to cyclists | | |

An 'apparent table' introduces a change in surfacing across the path rather than at its edges and may also function as a suggested crossing-point. The table, and any setts that form part of it, should be flush with the rest of the path surface.

## Narrowing

Physical narrowing of the path, or use of build-outs to reduce widths, can have a speed reducing effect. However, this technique could promote more conflict by forcing cyclists and pedestrians into closer proximity and should be used with caution. It could be effective when used in conjunction with other, subtler forms of calming so that the interaction through a narrower space is already likely to take place at lower speed. Similarly, objects that have a narrowing effect should only be employed where speeds are already low.

## Horizontal calming

Barriers or chicanes are not recommended as speed control measures. Where they are used, the gap must provide at least 1.5 metres of clear width to allow all types of cycle to pass. The stagger between openings needs to be designed in a way that allows people in wheelchairs and those using larger types of cycle to turn and proceed (refer to turning circles for non-standard cycles in section 3.2.3). Barriers and chicanes may not only slow cyclists but also cause congestion on the route, which may lead to further conflict.

## Vertical calming

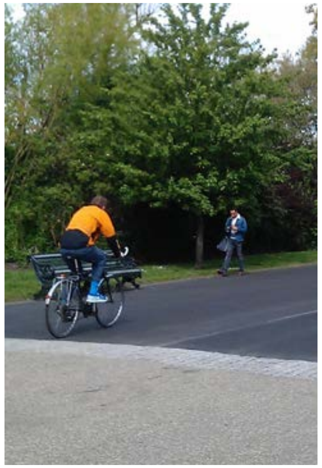
Caution needs to be applied to any suggestion of the use of vertical calming as all techniques are likely to increase discomfort for any pedestrian or cyclist with impaired mobility. Raised humps are a last resort, but should be sinusoidal in profile if used. Where access control to prevent use by powered two-wheelers is required, double-humps are recommended – which must be sinusoidal in profile.

Double humps in Utrecht to prevent use of the route by powered two-wheelers

## Surface texture

Rows of setts can be useful in providing a change in texture as well as a visual contrast that could have a slowing effect. They must be flush and not polished so as to avoid unseating riders as well as unduly adding discomfort.

Over a very short distance, rougher surface texture, with aggregate size of about 20mm can be used for slowing. Rough surfaces should only be used at conflict points as otherwise they can require too much physical effort on the part of cyclists and so reduce the attractiveness of the route. Unbound surfaces are not recommended, as they exclude many types of cyclist and many pedestrians with mobility impairments. Rough and unbound surfaces are particularly uncomfortable for people using wheelchairs, handcycles and tricycles.


Granite setts in the form of a hump, top left, may slow cyclists but will create discomfort for some users. Setts laid flush, top right, represent a change in surface material and provide visual contrast, rather than relying on the roughness of the surface for their slowing effect. In the example from Stockholm above, setts are used as cycle slowing measures where footpaths intersect

## 4.6 Cycle facilities alongside the carriageway

### 4.6.1 General principles

This section concerns interactions between cyclists and pedestrians on-highway but off-carriageway. Many of the considerations are similar to those set out in the section on 'degrees of separation' off-road above. However, shared or partially separated facilities on footways are even more problematic than on paths in off-highway environments and should be avoided wherever possible.

The highest levels of service for cyclists come with dedicated facilities, not footways shared with pedestrians.

Key sources for this area are DfT, Inclusive mobility (2002), GLA, Accessible London: achieving an inclusive environment SPG (2014), TfL, Pedestrian Comfort Guidance for London (2010) and Sustrans' Connect 2 Greenways Guide (2009).

Cities with good quality, joined-up cycling networks do not generally rely on footways shared between pedestrians and cyclists in inner urban areas. That is not to say that shared facilities might not have their place in exceptional circumstances in London, but to stress that they offer a low level of provision and ought to be explored only when options that provide separated space have been exhausted.

Only where there are very wide or little used footways should they be considered for reallocation. In those instances, the aim should be to provide effective separation. Minimum footway widths of 2 metres should be retained and improved upon wherever possible. Where the footway has a Pedestrian Comfort Level (PCL) C or less, space should not be reallocated for cycling or any other use.

It is not desirable to take space from pedestrians to provide for cycling, nor to create cycling facilities that resemble the footway.

It is essential to base any proposal for shifting the balance between users on a comprehensive understanding of how people currently use the footway space. This needs attitudinal surveys and views from residents, retailers, town centre managers, community safety officers, local access groups and mobility officers as well as data related to flows of different users. Refer to section 1.3.3 on authorities' and designers' obligations under the Equality Act (2010).

## 4.6.2 Degrees of separation

As set out in figure 4.21, the design choice by the carriageway is between three different degrees of separation. This is based on the assumption that separating cyclists from motorised vehicles on the carriageway is appropriate and justified (see section 4.1 above). It should be noted that pedestrians have the right to use any part of the highway, so all these options are, in one way or another, shared.

The full separation option, which is equivalent to the segregated lanes and tracks described in section 4.2.3, is recommended. It provides cyclists with a high level of service on links, based on CLoS, provided it is sufficiently wide (see section 4.4). It is the best way of providing for all pedestrians, particularly people with visual or mobility impairments, with footways being capable of achieving Pedestrian Comfort Level C or above.

## 4.6.3 Shared use footways

Partially separated and shared use footways are not generally recommended alongside the carriageway where there are better ways of providing for cyclists. They suffer from many of the drawbacks outlined for equivalent off-road facilities in section 4.5 above, with regard to compliance, compromising pedestrian comfort and deterring use by many people who find sharing with cyclists intimidating, including people with mobility or visual impairments.

Figure 4.21 Degrees of separation alongside the carriageway

| | | |
|---|---|---|
| **Full separation** | **Cycle track and separate footway**<br>Route parallel to the carriageway with continuous visual and physical separation between users by verge, kerbed islands or change of level. |  |
| **Partial separation** | **Separated footway** ('segregated shared use')<br>A footway divided between users by painted line markings or a low, raised delineator, often punctuated by fully shared areas. Marked with a sign to diagram 957 of TSRGD. |   |
| **Sharing** | **Shared use footway or area** ('unsegregated shared use')<br>Footway fully shared between users and marked with sign to diagram 956 of TSRGD. May exist in a limited area, usually to allow cyclists to make a crossing movement and/or transfer from on- to off-carriageway provision. |   |

They also represent a low level of service for cyclists.

Physical constraints and specific user needs may nevertheless dictate that sharing a footway could be the only way of providing a vital link in the cycle network, particularly if it provides access to a school or other community facility. An example might be an arterial road or high road with an existing narrow footway, where pedestrian flows are light, and which is separated from the carriageway by a verge and/or trees.

Where there is no alternative but for cyclists to use the footway, advice given in section 4.5 above on shared use off-road should generally be followed, including the use of cycle slowing measures as necessary. The emphasis in such areas should be on removing points of obvious conflict and promoting courteous behaviour on both sides.

In these circumstances, it is essential that early engagement takes place with users, particularly access groups, before reaching a recommendation on how to accommodate cyclists and pedestrians. An Equality Impact Assessment is also recommended to identify specific issues and help to generate solutions.

## Consistency and coherence

Other than reducing footway widths, a key drawback of partial separation on footways is the difficulty of maintaining the separation over significant lengths. It must be broken and converted to fully shared use each time pedestrians need to cross it – therefore at every access or crossing – and at every road junction. Breaks need to be accompanied by signing to diagram 957 of TSRGD and ladder and tramline tactile paving (see section 7.3 for details). This adds significantly to street clutter, and can make facilities for both cyclists and pedestrians incoherent and potentially confusing. If large amounts of tactile paving appear to be required in any scheme, then it is likely that the design is not sufficiently coherent or legible and needs to be revisited.

(Top) Raised delineator and ladder and tramline paving on a partially separated footway. (Bottom) Stop-start cycle facilities where partially shared provision briefly becomes a shared area

## Short links

It is possible, however, for partial separation on short links between junctions to be done in a way that maintains a high level of service for both cyclists and pedestrians. Although a level difference of 50mm or more is preferable, cyclists and pedestrians may both be at footway level but separated by a raised delineator to diagram 1049.1 of TSRGD. This may be beneficial, for example, if a cycle route briefly joins a main road where a high degree of separation from motorised traffic is warranted. Any additional width needed for the cycle facility should come from the carriageway rather than the footway. This technique is not, however, recommended for longer links.

## Maintaining quality of pedestrian provision

Pedestrians have right of way in shared areas and the onus should be on cyclists to moderate their behaviour. Wherever possible, pedestrian-dominated areas should look different from any dedicated cycle infrastructure, to encourage cyclists to behave in a way that minimises conflict.

The clearest and best understood convention is that paving slabs constitute the footway and an asphalt surface shows space for cycling. Various contrasting surface treatments are possible. Consistency should be sought within the framework provided by documents such as TfL's Streetscape Guidance and design guides produced by individual boroughs.


International examples, from Utrecht (above) and Malmo (below) showing visual contrast between adjacent spaces for different users

Smaller areas of shared use are often provided at crossings and junctions to permit cycle movements away from the main carriageway. Although these techniques are occasionally justified in order to connect links for cycling, they should be avoided wherever possible by providing the necessary separation on-carriageway rather than on-footway.

Use of regulatory surface markings for cycling should be avoided on the footway as it tends to give the impression that the rules of the carriageway apply on the footway. Note that give way markings to diagrams 1003 or 1023 cannot be used to compel cyclists to give way to pedestrians.

## 4.6.4 Transition between on- and off-carriageway

Occasionally it will be necessary to provide a transition from on-carriageway cycle lanes to off-carriageway provision and vice versa. This transition should be clear, smooth, safe and comfortable for cyclists, ideally running parallel to the carriageway. Cyclists should not be required to look behind themselves at difficult angles in order to re-enter the carriageway.

Minimum vertical and/or horizontal deviation for cyclists should be the objective. It is particularly important not to have a vertical change in level along a line running along the general direction of travel. This can happen if cyclists are directed to cross at a shallow angle over a dropped kerb that has not been laid properly. Such situations can destabilise cyclists' steering.

Transitions between on- and off-carriageway cycling: Rye Lane, Peckham (left) and Stockholm (right)

A well designed dropped kerb allows for a legible and comfortable transition, and should be marked with the diagram 1057 cycle symbol. See example illustrated in chapter 5, page 37.

When they re-enter the carriageway, cyclists should not have to give way to vehicles already on it; if the facility is well designed, it should allow for a smooth reintegration into the traffic. Ideally, cyclists should re-enter into a dedicated facility such as a cycle lane.

Where cyclists leave the carriageway onto provision alongside or shared with pedestrians, the transition usually needs to be long, with cycle slowing measures as necessary. Slowing measures are preferable to give way markings, which should not be used on the footway. Cyclists can inadvertently act too assertively when making sudden shifts into shared areas (which is another good reason for avoiding shared footways).


Long transition from on- to off-carriageway provision, with wide dropped kerb. Give way markings should not be used here

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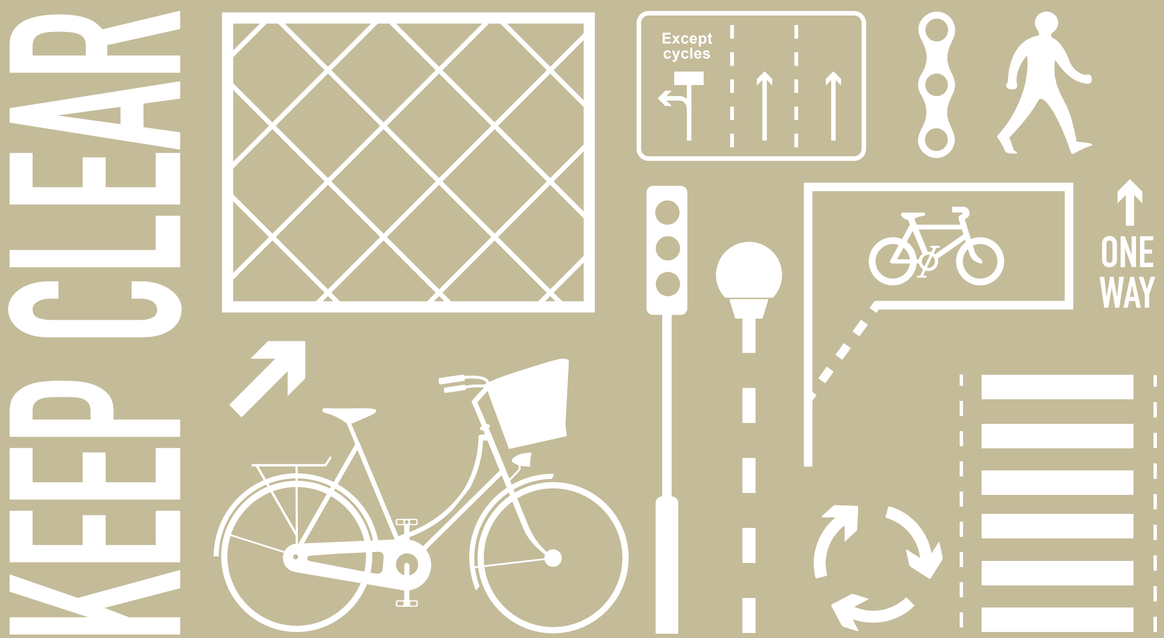
# 5. Junctions and crossings

This chapter provides design guidance on the use and adaptation of junctions and crossings to form safer, coherent and comfortable cycling provision.






**Version control**

Version 1 (Dec 2014) – Published

Version 2 (Sept 2016) – Minor amendments following publication of TSRGD (2016); minor updates to section on low-level cycle signals and ASLs

# 5. Junctions and crossings

## 5.1 Junction design issues

### 5.1.1 User needs

Junctions are where actual and perceived risk to cycle safety are highest, and usually represent the most uncomfortable parts of any journey for cyclists. Even where degree of separation on a link may not warrant being high, more separation may well be justified at junctions, both from motorised vehicles and pedestrians. As with links, all user needs must be taken into account (see section 3.2), particularly the movement of emergency service vehicles and pedestrians.

Key considerations include:

- Facilitating all cycle turning movements at any junction, including right turns and turns from nearside segregated cycle infrastructure
- Addressing left- and right-hook collision risk from turning motorised vehicles
- Designing for all types of cycle, including wider and longer models and those adapted for use by people with physical, sensory or cognitive impairments (likely to be significant for any protected area, any segregated approach to an ASL, any special arrangement for right-turns and any provision of gaps to enable turning movements)

Figure 5.1 Key junction considerations in CLoS

| Factor | Indicator | Relates in this chapter to |
|---|---|---|
| Safety: **Collision risk**<br><br>**Feeling of safety** | Left/right hook at junctions<br>Other vehicle fails to give way or disobeys signals<br>Separation from heavy traffic | Junction design: separation of cyclists in space and/or time, use of traffic signals, advanced stop lines (ASLs). |
| Directness: **Journey time** | Delay to cyclists at junction | Separation of cyclists from other vehicles while maintaining appropriate priority for cyclists. Long delays at signals will deter cycling and reduce compliance. |
| Directness: **Value of time** | Value of time | |
| Coherence: **Connections** | Ability to join/leave route safely and easily | Use of crossings, appropriate provision at priority junctions and cycle infrastructure at signal-controlled junctions to ensure all desired cycle movements are accommodated. |
| Attractiveness: **Minimise street clutter** | Signing required to support scheme layout | Avoiding over-complication in junction design, so that cycling infrastructure is consistent and intuitive. |

Quality of provision for cyclists at junctions and crossings is covered by the Cycling Level of Service Assessment, as shown in figure 5.1. This, together with the junction assessment tool, is recommended as the measure for how safe, comfortable, direct, coherent, attractive and adaptable is the provision for cyclists at a junction. Adaptability is worth emphasising, given the need to plan for a growing number of cyclists, and evolution of practice through trial and experimentation.

## 5.1.2 Cycle-friendly interventions

Figure 5.2 indicates the 'cycle friendliness' of the types of intervention covered in this guidance, by way of providing an overview of the content of the chapter. Any of these interventions may be suitable for a given cycle route type – it is the place and movement characteristics of a location and the level of service for cyclists that dictate how appropriate or successful any given intervention might be. Where '+/-' is shown, the intervention is likely to have some negative consequences for cyclists as well as benefits, depending on the context. Note that the table does not cover impact on other users.

### Trialling junction improvements

Providing for cyclists at junctions is an area where trialling and learning from international practice have had, and will continue to have, a strong influence on design practice. Improvements made by TfL and the London boroughs at junctions and crossings represent an evolving body of practice, and ongoing monitoring and research carried out on such infrastructure schemes will continue to aid understanding of impacts and benefits, and inform future guidance.

Figure 5.2 Types of intervention at junctions

| Technique | Intervention / impact on cycling level of service | |
|---|---|---|
| Exert more control over different vehicle movements | Separate signal control for cyclists (separation in time) | ++ |
| | Protection for cyclists from turning movements (separation in space) | ++ |
| | Conversion to cycle-friendly roundabout | +/- |
| | Ban selected movements for motorised vehicles | +/- |
| | Conversion of priority to signal-controlled junction | +/- |
| Allow more (low risk) interaction; reduce control | Reducing speeds on turning – corner radii, tables, raised entry treatments | ++ |
| | Change priorities (to favour selected cycle movement) | + |
| | Cycle bypass of traffic signals | +/- |
| | Convert signal-controlled to priority junction | +/- |
| | Provide lane markings through/past junction | +/- |
| | Remove all priority | +/- |
| Facilitate cycle turning movements | Enable right turns by cyclists in two stages | + |
| | Introduce a crossing and/or refuge islands to help cyclists to turn out or in | +/- |
| | Advanced stop lines | +/- |

From 2012, TfL began working with DfT and other key stakeholders, including borough representatives, on a series of off-street trials at the Transport Research Laboratory (TRL) test track. Some interim findings from this research have fed into this document but some conclusions may not be available until 2015, and so will be incorporated into guidance at a later stage. Wherever possible, innovations in the trial stage have been highlighted in this chapter in anticipation of their eventual full inclusion in LCDS, subject to trial results.

## 5.1.3 Junction analysis

It is important for any junction improvement to be based on a comprehensive understanding of the place and movement functions of the location. Sources of information on this include:

- Collision history, showing locations, severity of injury and details of the circumstances
- Area-wide analysis: relationship between the junction in question and cycling routes, location of public transport stops, information about bus routes, the strategic importance of the streets, kerbside activity, motor traffic speeds
- Traffic flow data (including cycling), broken down by time of day and by mode, and traffic modelling
- Pedestrian flows, including trip generators and variation by time of day – this should include where crossings currently exist and show pedestrian desire lines

When considering cycle flows, it is important to note that certain cycle movements may be low because they are difficult and uncomfortable to make rather than because there is no demand for movement in that direction. If parallel, but less direct routes have high cycle flows, then a 'junction avoidance' effect may well be operating.

> For any junction, greater numbers of traffic lanes generally make for more hostile cycling conditions. Simplifying junction layouts and reducing the amount of lane-changing that takes place on junction approaches can be of great benefit to cyclists.

The junction assessment tool (see section 2.2.5), or similar method of analysis, should be applied to any planned intervention, firstly to establish conflicts and cycling movements that are difficult or uncomfortable to make, and then to assess the extent to which a proposal addresses those issues. It is important, however, to keep in mind all desired outcomes: tackling a specific conflict issue could compromise another key outcome, such as directness (avoidance of delay) and may result in poor compliance and more risk taking.

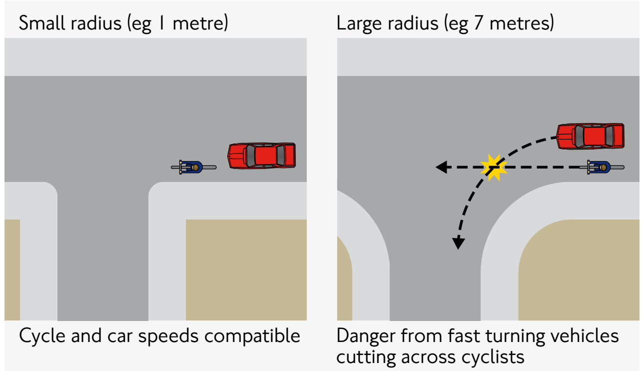
Key conclusions that can be drawn from past research and from analysis of collisions include the following:

- 'Some of the most significant benefits come from reducing motor vehicle speeds through reducing traffic lane widths, taking out slip lanes and reducing corner radii' (TRL, Infrastructure and Cyclist Safety PPR 580, 2011)
- 'Behavioural factors are prominent, with the two most common contributory factors being "failed to look properly" and "failed to judge other person's path or speed" – this indicates that infrastructure that influences road user behaviour generally may be more significant than interventions that seek to target specific safety issues' (TfL, Pedal cyclist collisions and casualties in Greater London, 2011)

## 5.1.4 Corner radii

Relatively minor adjustments to junction geometry can have a significant effect on the speed of turning vehicles. The advantages to safety that arise from reducing speed need to be balanced against the need to provide adequate visibility and allow larger vehicles to turn.

Small corner radii, often used in conjunction with raised entry treatments or raised tables, can reduce the speed of turning traffic, help simplify tactile paving layouts and reduce crossing distances for pedestrians and cyclists. They are also of benefit to cyclists both on- and off-carriageway because they reduce the zone of risk. Unnecessarily large corner radii can encourage higher speeds by motorists and should be reduced where feasible, particularly at priority junctions and where there is an identified relationship with cyclists or pedestrian casualties.




Comparison of small and large corner radii (adapted from Manual for Streets)

Many existing streets operate in a satisfactory way with minimal corner radii, even a kerb quadrant only. The most appropriate radius depends on site-specific conditions. Variables to take into account include:

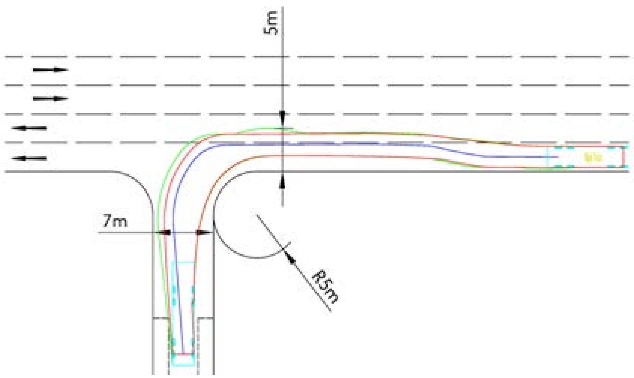
- Motorised vehicle speeds
- Carriageway width and number of lanes (larger vehicles may straddle lanes to turn where there is more than one, thereby justifying a smaller radius)
- Traffic volume and composition (where many larger vehicles are turning, their ability to do so by moving out to turn may be constrained)
- Angle of intersection at junction (larger radius is likely to be needed for any turn through less than 90 degrees)
- Pedestrian crossing arrangements (two stage crossings require islands that may necessitate larger radii in order to allow turning movements by larger vehicles)
- Uphill or level gradients (rear-end shunts could be an issue downhill where turning vehicles may decelerate abruptly to turn)

Designers should start from the assumption that corner radii should be minimised to benefit vulnerable road users, and then test whether this raises any issues. Junction design and the size of corner radii need to support calming and speed reduction measures, as described in section 3.3. Indicative ranges of corner radii to support speed limits on the street in question are:

- 0-3 metres for 20mph speed limit
- 2-6 metres for 30mph
- 3-10 metres for more than 30mph

## Tracking large vehicle movements

As part of the design process, swept path analysis should be used to track the paths of larger vehicles around corners (Manual for Streets, 6.3.13). It is usually acceptable for large vehicles to enter the opposing general traffic lane or adjacent with-flow lane in order to turn, provided there are no physical constraints to them doing so. There may need to be some local strengthening of the footway to allow for larger vehicles occasionally overrunning, although this is not generally desirable because of its impact on pedestrian safety and comfort.




Swept path analysis

It is important not to design geometry solely based on occasional use by large vehicles, such as refuse or removal trucks. In all instances, the designer should take into account the individual site characteristics when choosing the appropriate corner radii. Provided drivers can make the turn within the overall road space available, it is rarely necessary to design so that they can do so while remaining entirely in a single nearside lane.

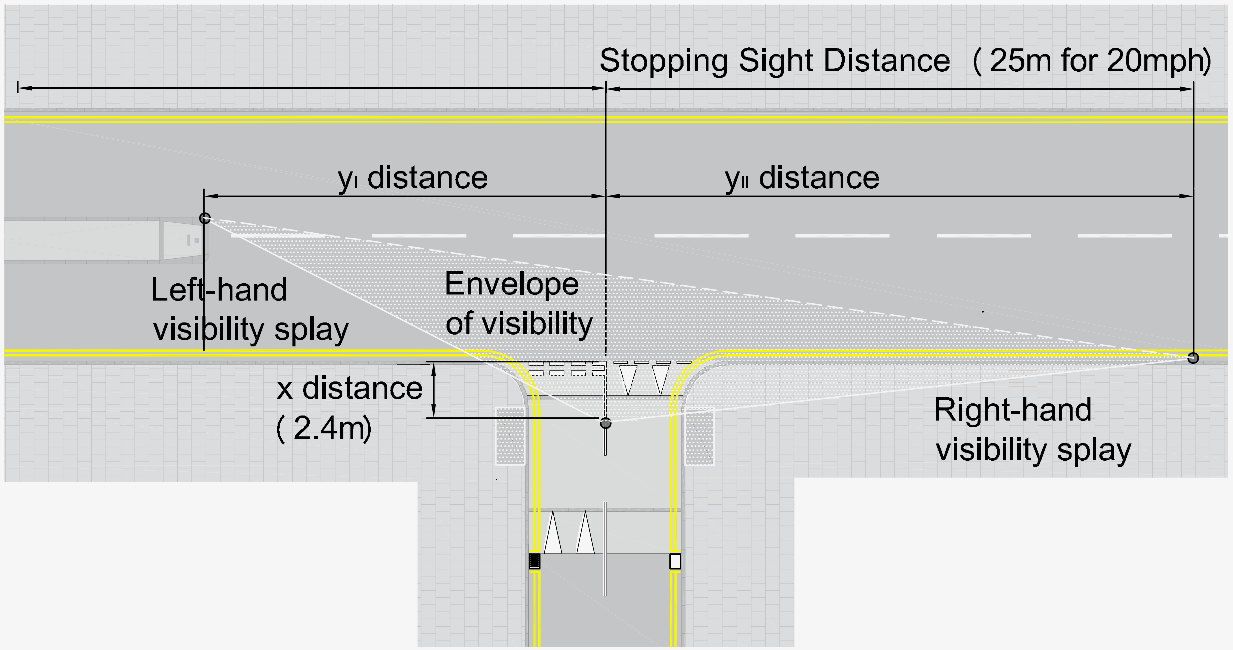
In most circumstances, the safety benefits to cyclists of tighter geometry and the slowing of motorised vehicle turning movements outweigh risks to cyclists that exist in relation to larger vehicles moving out to the centre of the carriageway or a different traffic lane to make a left turn. Turning vehicles should, according to Highway Code rule 183, give way to a nearside cycle lane, while cyclists should not seek to undertake at priority junctions where any possibility exists that a vehicle may be turning left. A risk assessment on a given site should be undertaken to identify the risk of larger vehicles turning well away from the nearside and to examine whether other mitigating measures (such as further speed reduction techniques or banning turns) might be of more general benefit.

## 5.1.5 Visibility splays

Any change to junction geometry should also take into account the impact on sight-lines, which are needed to ensure adequate visibility at junctions. Conformity with Manual for Streets guidance is recommended:

- For side roads, the minimum 2.4 metres 'X' distance should be used – allowing full visibility for the driver of an emerging vehicle without needing to cross the give way markings
- In low flow situations, 2.0 metres may be acceptable, although it is likely to require some protrusion into the main carriageway
- Where traffic speeds are already low, or have the potential to be substantially lowered, and where shorter 'Y' distances would not pose a significant risk at such a junction, reducing forward visibility might have a further calming effect, as is described in Manual for Streets.

Reducing visibility should not compromise cycle safety at priority junctions and a risk assessment should be undertaken to check whether reduced 'Y' distances and tighter geometry generally are acceptable from a cycling perspective. There may, for example, be occasions where horizontal deviations to improve cyclists' sight lines or speed humps should be added on the approach to a crossing, junction or shared-use area.




Indicative layout 5/01: Visibility splays at priority junctions

## 5.2 Crossings

### 5.2.1 Crossing types

Crossings are a significant part of the cycling network in London for three quite different reasons:

- Crossings that cyclists can use are important for safely negotiating roads with high movement function, for linking cycle routes and for giving coherence to cycling networks. The type and location of these crossings has a bearing on the directness, coherence, comfort and safety of cycling provision
- Crossings can occasionally act as a traffic calming measure and contribute to generating gaps in traffic flow that cyclists can use to turn from minor roads to major roads and vice-versa. So, even where a cyclist cannot use or is unlikely to use a given crossing, it can still contribute to their level of service
- Pedestrian crossings of cycle facilities, whether part of the main carriageway or elsewhere, need to be planned to maximise accessibility and to avoid excluding vulnerable pedestrians when introducing certain types of cycle infrastructure

Crossings over carriageways with the potential for cycle use may be categorised into six types, as shown in figure 5.3. Refer to TfL's London Pedestrian Design Guidance for more detail on crossing types.

Figure 5.3 Cycle and pedestrian crossings over general traffic lanes

| | **Junctions under signal control** | **Stand-alone locations** |
|---|---|---|
| Crossings that may be used by cyclists | [1] Parallel pedestrian/cycle **<br>[3] Shared pedestrian/cycle | [2] Signal-controlled cycle-only<br>[3] Signal-controlled shared (ie toucan)<br>[4] Priority (parallel) pedestrian/cycle ***<br>[5] Mid-link cycle priority<br>[6] Uncontrolled / informal |
| No cycling* | Pedestrian-only | Signal-controlled pedestrian-only (pelican, puffin) |

**Notes**

* While these types do not allow cyclists to use the crossing, they can support nearby cycle movements in instances where the cycle desire line is offset from the crossing, as described above.

**At a stand-alone location, signal-controlled parallel cycle and pedestrian crossings would require conversion to a junction so this is, in effect, type [1].

***Type [4] has been available since the publication of TSRGD (2016). It is preferred to type [3] in any situation where at least one of the two facilities that it links has separate provision for pedestrians and cyclists

For the purposes of this guidance, stand-alone toucan crossings and shared pedestrian and cycle crossings at signal-controlled junctions are dealt with as a single type – type [3] – although there are technical and operational differences between them.

## 5.2.2 National guidance on crossings

The Traffic Signs Regulations and General Directions (TSRGD, 2016) provides the regulatory framework for crossings, superseding the Zebra, Pelican and Puffin Pedestrian Crossings Regulations and General Directions (1997). Further advice and guidance is provided by DfT in LTN1/95, Assessment of Pedestrian Crossings, LTN 2/95, Design of Pedestrian Crossings, TAL5/05 Pedestrian facilities at signal-controlled junctions and Signing The Way (2011).

Reference should also be made to Guidance on the use of tactile paving surfaces, which describes requirements for accessible crossings – key advice from this is summarised in section 7.3.3.

All crossings should be step-free, which can be achieved either through dropped kerbs or by placing crossings on a raised table or entry treatment. There may also be advantages for people with visual impairments or lowered vision in using a surface material for the crossing that has a strong tonal contrast with the carriageway (see section 7.3). Relevant streetscape and local design guidance should be consulted for advice about materials.


Crossing on a raised table and with contrasting surface treatment, Waterden Road, Hackney

Wide crossing, consisting of two parallel stand-alone, signal-controlled crossings, with contrasting surface treatment, St Paul's Churchyard, City of London

## 5.2.3 Selecting the crossing type

For a cycle route crossing a carriageway, the most appropriate crossing choice generally depends on the traffic conditions of the street – indicative flows by crossing type are shown in figure 5.4. Since signals are expensive to install, operate and maintain and tend to have a negative impact on the street environment, good alternatives to signalisation should always be explored. For that reason, types [4] to [6] are generally recommended for lower-intervention Quietways and other local routes, although new signals may be needed in some locations, particularly to help cyclists cross busy roads.

The appropriate crossing option for a given location also depends on the character of the place in question and considerations of street clutter and accessibility. Type [6], an uncontrolled crossing, is the 'lowest intervention' form and likely to be fit-for-purpose only with relatively low levels of use by those crossing and where traffic speeds and volumes are low enough to allow safe opportunities for crossing.

Figure 5.4 Cycle crossing options

| Type of crossing | Flows (24hr) | | |
|---|---|---|---|
| | All vehicles (carriageway) | Cycles (crossing) | Pedestrians (crossing) |
| 1. Parallel signal-controlled pedestrian/cycle | > 8,000 | Medium-High | Medium-High |
| 2. Signal-controlled cycle-only | > 8,000 | Medium-High | None |
| 3. Shared pedestrian/cycle or toucan | > 8,000 | Low-Medium | Low-Medium |
| 4. Priority pedestrian/cycle (parallel) | 3,000-8,000 | Medium | Low-Medium |
| 5. Mid-link cycle priority | 3,000-8,000 | Low to Medium | n/a |
| 6. Uncontrolled (central refuge) | 3,000-8,000 | Low | Low |

## 5.2.4 Crossings at signal-controlled junctions

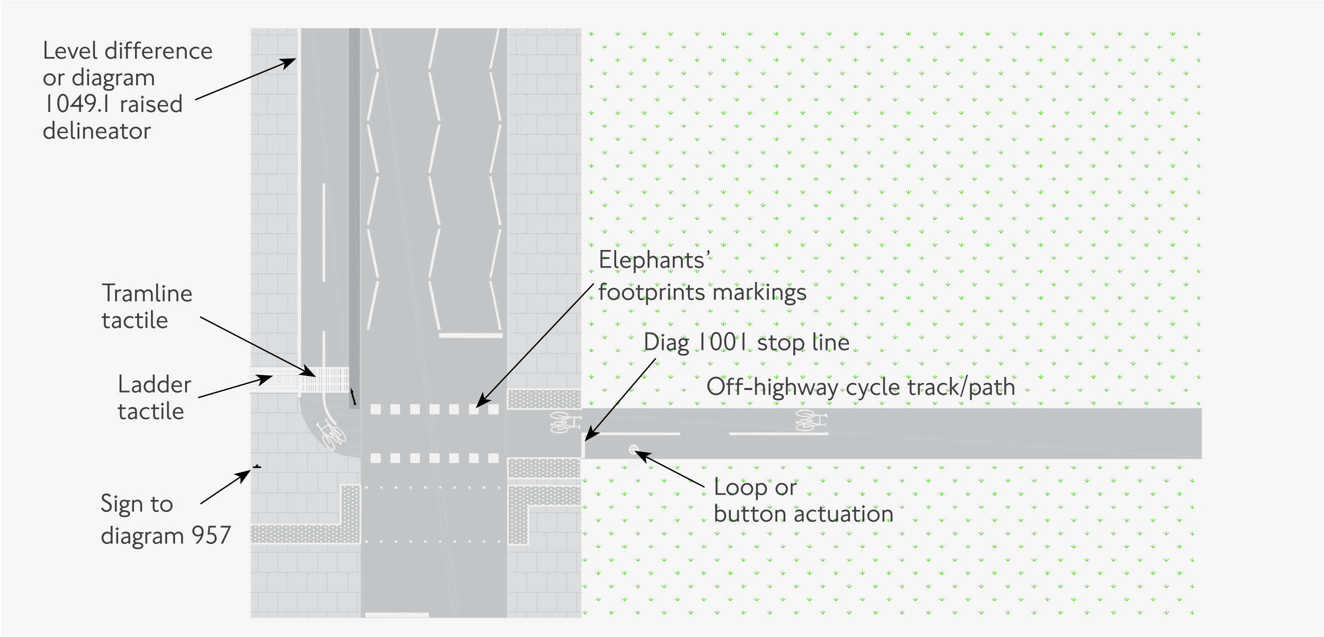
Cycle tracks may be joined across one arm of a junction under signal control by using types [1], [2] or [3].

Type [1] is recommended where there is high demand by both cyclists and pedestrians, thus reducing potential conflicts between the two modes on the crossing. This may be particularly useful where cyclists are approaching from a different direction from pedestrians, as is often the case when one route is a side street closed to motor traffic.

Type [2] is a variant where there is no parallel pedestrian crossing facility. For this type, reliable cycle detection should be used so that demand can be prioritised and delay minimised. Where the cycle crossing cannot align with the cycle route in a way that allows cyclists to remain on carriageway, a shared use area will be required to allow access to the crossing.

Type [3] is less desirable from a pedestrian and cycle level of service perspective, but may be needed where the crossing joins shared use facilities on either side, or where it is impossible to separate cycle and pedestrian movement because their desire lines intersect.

Type [1]: parallel crossings at Westferry and West India Dock Road. Ladder and tramline tactile paving are used for transition from track to shared area




Indicative layout 5/02: Parallel signal-controlled crossings

Square elephants' footprints markings, to TSRGD diagram 1055.3, are recommended for both type [1] and [2] crossings, although pedestrian crossing studs are also sometimes used for this purpose. Elephants' footprints to mark a cycle route at a crossing under signal control or as part of a parallel priority crossing are prescribed in TSRGD (2016) and therefore no longer need site-specific approval. This should add consistency and will bring the UK into line with other parts of Europe on use of a square-format marking for cycle crossings.

## Transitions to and from carriageway

Consideration should be given to how cyclists join and leave such crossings – how cycle movement on the tracks or shared use paths may join cycle movement on the main carriageway.

Certain arrangements may put cyclists in conflict with pedestrians on, or waiting at, the crossing. Layout and design of signal control should avoid encouraging cyclists to move through the crossing area during the pedestrian green phase.

This is simpler to achieve with shared use arrangements, where a dropped kerb ahead of the crossing may allow cyclists to make a clear transition from on- to off-carriageway, and then to wait with pedestrians. See example illustrated in chapter 5, page 37.

Type [2]: stand-alone cycle crossing at Goswell Road


Signal-controlled cycle crossings, using elephant's footprint markings through the junction

## Cycle gaps

At some signal-controlled locations, providing cycle gaps through islands may be more appropriate than marking elephant's footprints across the carriageway. It can be helpful to use 'Keep Clear' or yellow box markings so that queuing traffic on the carriageway does not block the crossing. Providing such markings needs to be balanced with impact on other users and on the street scene. They should only be used in exceptional circumstances.

## 5.2.5 Shared/Toucan crossings

Crossings shared between pedestrians and cyclists at stand-alone signals (type [3] in figure 5.4 above) are toucan crossings. As part of signal-controlled junctions, the design issues are similar. In a toucan crossing, the surface of the crossing and footway areas immediately on either side are shared, although there may be some separation of the footway up to that point. If there is separation on either or both sides, then the parallel crossing should be used instead of a toucan.

Because of this sharing, and the impact on the comfort and sense of safety of vulnerable pedestrians, toucan crossings and associated shared use footways are not generally recommended unless it has been properly established that there are no better alternatives.


Cycle gaps

Variants to the standard toucan layout are possible for locations such as side road junctions that can enable more direct crossings. The DfT provides guidance in TAL 10/93, Toucan: an unsegregated crossing for pedestrians and cyclists and in TAL 4/98, Toucan crossing development.

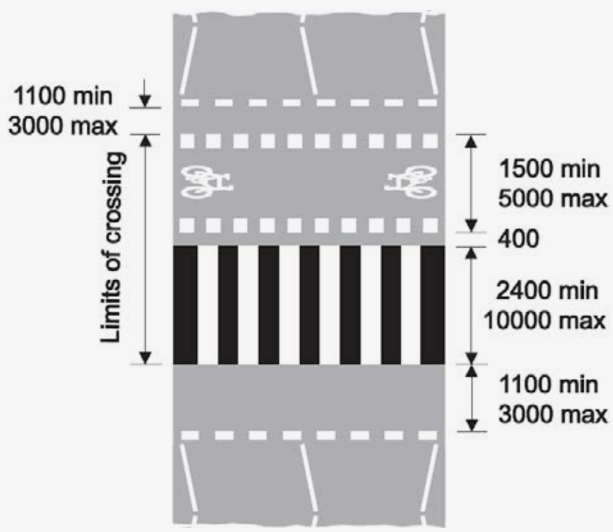
Typical toucan crossing arrangements, with shared use and tracks on either side (colour optional)

Toucan crossings are often used to carry off-carriageway tracks through or around junctions


Nearside push-button control for toucan crossing

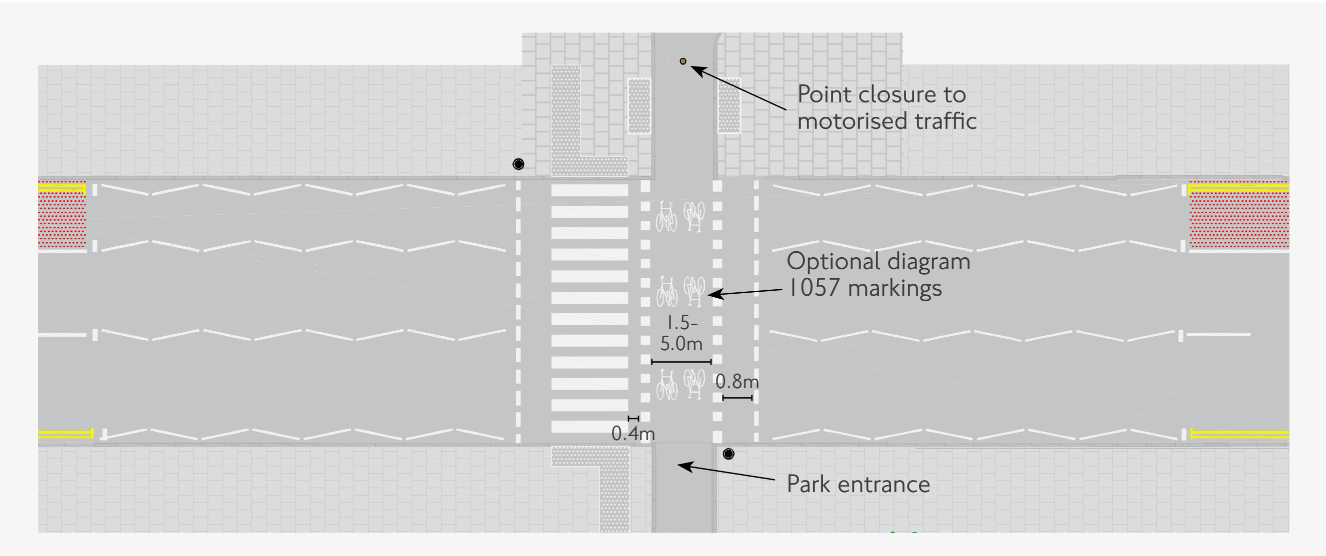
## 5.2.6 Priority crossings

Since the publication of TSRGD (2016), a new crossing type has been available, allowing for parallel pedestrian and cycle crossings without the need for signal control. This priority crossing is similar in appearance to a zebra crossing but with a parallel route for cyclists, marked with diagram 1055.3 'elephants' footprints' within the controlled area of the crossing.




TSRGD Diagram 1001.5


The case for parallel priority crossings. In the UK (left), regulations have not previously allowed for a parallel cycle route at a priority crossing – cyclists are asked to give way twice. A much simpler approach exists in Stockholm, right, where cycle crossings with elephants' footprints are provided within the controlled area of the 'zebra-type' priority crossing.




Indicative layout 5/03: Parallel priority crossings

## Transitions

As with the signalised equivalent, careful consideration is needed of cycle transitions between the crossing and the main carriageway in order to minimise conflict between cyclists and crossing pedestrians.

However, design of transitions (and other conditions likely to arise) depends on details yet to be established in regulations and practice. For example, two sets of elephants' footprints markings on one crossing, should it be permitted, could help clarify cycle movements and reduce conflict.

Design of areas either side of the crossing is important. Ideally, the crossing should be used where cyclists and pedestrians have separate provision on both sides and where cyclists can be kept separate throughout. Although less desirable, the parallel crossing is likely to be preferable to the toucan crossing where only one side is separate and the other shared. The crossing should not, however, be used to link one shared use facility with another.

## Cyclists' use of shared priority crossings

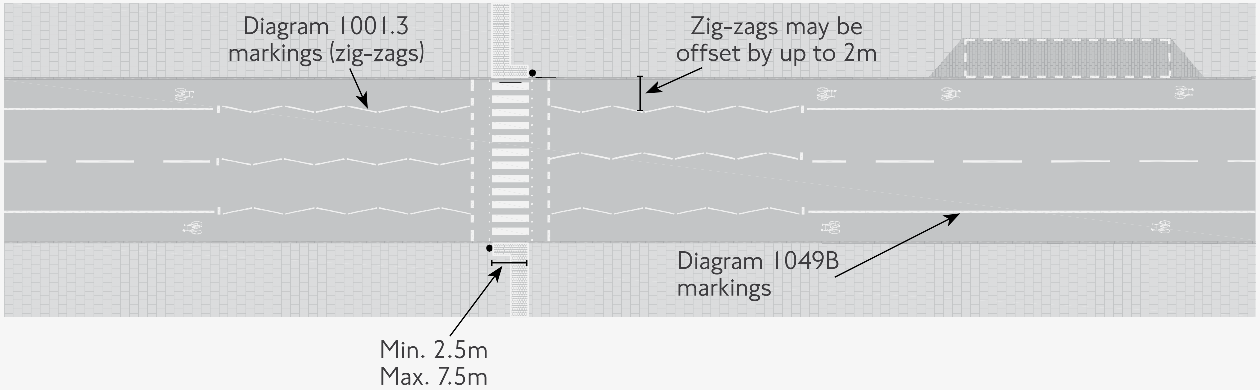
A priority crossing type shared between cyclists and pedestrians may be a further possibility for inclusion in the regulations. This would effectively be a version of the zebra crossing that would allow cyclists to cross with pedestrians, which is desirable because the legal position on cyclists' use of zebra crossings is such that it is not recommended that they be planned and designed for use as part of the cycle network.

TfL's position, drawing on conclusions from TRL's Shared Zebra Crossing Study (2006), is that it is not illegal for cyclists to ride over zebra crossings. However, while the markings give pedestrians formal priority over traffic using the carriageway, this priority is not afforded to cyclists. Highway authorities should take legal advice if they wish to use zebra crossings to link cycle provision (tracks or shared use footway) on either side of a carriageway.

## Cycle provision through zebra crossings

Where a zebra crossing is marked across a street with a cycle lane, the lane markings may not be continued through the zig-zag markings that show the controlled area of the crossing. However, TSRGD (2016) allows for the zig-zags to be moved away from the kerbside by up to 2 metres to align with the cycle lane markings and allow for greater visual continuity of the cycle facility. Diagram 1057 cycle symbols may be placed between the zig-zags and the kerb in this instance, but no other markings are permitted.

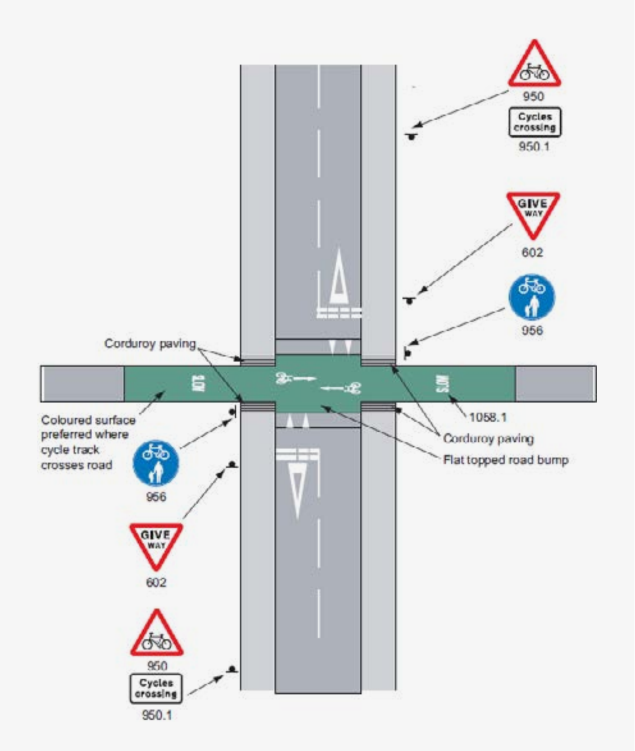
By exception, the number of zig-zag markings may be reduced from eight to two, depending on site-specific conditions such as visibility and the existence of other parking controls. Where the number of zig-zags is reduced, it may be advisable to widen the crossing, especially where the approach is not straight. For carriageway widths of 6 metres or less, the central set of zig-zags may be omitted.




Indicative layout 5/04: Continuity of cycle lane at priority crossing

## 5.2.7 Mid-link cycle-only priority crossing

Where a cycle track crosses a road, it is possible to give it priority on a hump using a layout shown in LTN 2/08, Cycle Infrastructure Design. Its applicability is likely to be limited to scenarios where there is no pedestrian provision on or beside the track and no case for providing a crossing type that would allow pedestrians and cyclists to cross.




Mid-link cycle priority crossing (from LTN2/08)

LTN2/08 gives a number of further caveats about this arrangement, emphasising the need for all of the signing shown on the diagram in order to mitigate the risk of motorists not giving way where the road markings instruct them to. The importance of good visibility is also highlighted.

## 5.2.8 Uncontrolled crossings and refuge islands

Some locations are marked for crossing without any formal control of traffic on the carriageway – generally on less heavily trafficked streets with a single lane in either direction.

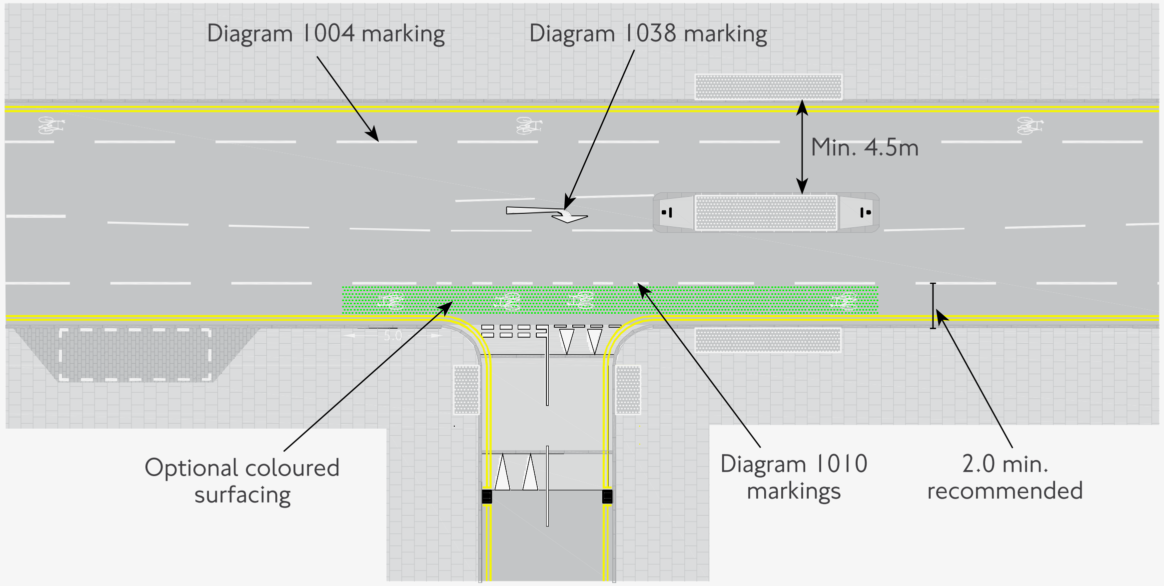
These uncontrolled crossings are step-free (either through use of a dropped kerb or raised table) and usually marked with an 800mm strip of blister tactile paving.

They often include refuge islands to enable crossing of each half of the road separately. The island should be at least 2.0 metres deep to allow a person in a wheelchair or with a pram to use it safely. See TfL's London Pedestrian Design Guidance for full details of these types.

These crossings can either facilitate a conventional crossing movement, helping cyclists make direct links between facilities on either side of the road, or enable difficult turning movements to be made in more than one stage.


Uncontrolled crossing and refuge islands ('look left' and 'look right' markings not normally needed)

Islands on a main road near to the mouth of a priority junction, for example, can help provide some refuge space for cyclists seeking to turn in or out. Cyclists can cross half of the carriageway and then wait in the shadow of the island to enter the traffic at a convenient moment. Care is needed when designing such an arrangement to avoid encouraging cyclists, particularly users of longer or wider cycles, to wait in locations where they are vulnerable to vehicle turning movements.




Indicative layout 5/05: Island-protected cycle right turn into side road


Pedestrian refuge island assists cycle right turn

## Avoiding pinch points

Although not a technique that greatly increases level of service for cyclists, providing islands to protect a turning movement can be beneficial, provided it does not create pinch points for cyclists using the carriageway – see guidance on widths in figure 5.5 below. Some speed reduction measures on the carriageway will also be necessary either in a scenario where the island narrows the lane below 3.2 metres wide or where the lane width remains over 3.9 metres. The impact on other road users of significant narrowing over a long stretch also needs to be assessed, particularly for emergency service vehicles.

Where cycle lanes on the carriageway can be continued past a pedestrian refuge island and still meet the width requirements set out in section 4.4.1, then they should be retained. Where such consistency cannot be achieved, then it may be desirable to replace an informal crossing with a formal pedestrian crossing and achieve consistently wider cycle lanes.

Figure 5.5 One-way lane widths at refuge islands where no cycle lane, track or bypass is provided

| 85th percentile traffic speed | Traffic calmed, no buses or HGVs | No calming, no buses, HGVs etc. | No calming, with buses, HGVs etc. |
|---|---|---|---|
| < 20 mph | <2.5m | <2.5m or 4.0m+ | 3.0m-3.2m or 4.5m+ |
| 21 – 30 mph | 4.0m+ | 4.0m+ | 4.5m+ |
| > 30 mph | - | 4.0m+ | 4.5m+ |

## Cycle bypasses

An alternative is to design a bypass to a pinch-point. This should avoid deviating cyclists or creating conflict with pedestrians, and must be accessible to users of all types of cycle. Any vertical change required for use of the bypass by cyclists should not exceed 1:10, transitions should be smooth and step-free and a minimum width of 1.5 metres between obstructions should be provided.

The bypass should be designed to prevent blocking of the entrance and exit by other vehicles, which may require waiting and loading controls but preferably should be done without relying on enforcement. The facility must be designed so that cyclists can rejoin the carriageway without giving way.

Cycle bypasses used as part of traffic calming measures – note that blank bollards should be used rather than the 'keep right' sign, which would not allow cyclists to pass to the left

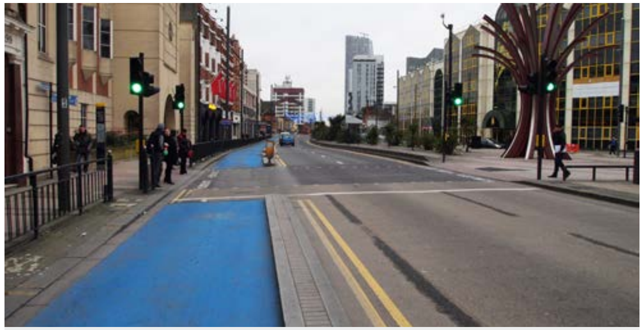
## 5.2.9 Informal crossings

In many other 'informal crossing' locations, pedestrians use islands and median strips in the carriageway to cross in multiple steps, even where those islands were not intended for that purpose. A more deliberate informal approach may be taken, using materials and streetscape features to 'suggest' that a crossing facility exists. This encourages drivers to slow down through the space and give way as necessary to anyone wanting to cross. These facilities do not confer any priority on the user seeking to cross, but can have a positive influence on driver behaviour.

## 5.2.10 Crossings of cycle lanes and tracks

For segregated and light segregated lanes, pedestrian crossings should preferably extend from footway to footway. In that way, the cycling facility is included within the controlled area of the crossing. Crossing times must be calculated to take into account the combined width of general traffic and cycle lanes.

'Suggested' crossing places in high street environments in Bexleyheath (above) and Hornchurch (right), using streetscape features such as raised tables, median strips, planting and a distinctive palette of materials to help break down dominance of the environment by motorised vehicles


Crossing extending over carriageway and cycle lane


Uncontrolled pedestrian crossing of cycle tracks (at a bus stop bypass)

For stand-alone pedestrian crossing of cycle tracks, the basic options are:

- **Uncontrolled crossing**
  As with uncontrolled crossing of the main carriageway, this consists of a dropped kerb, or raised table or hump, with appropriate blister tactile paving. Further signing may be added to promote courteous behaviour, and additional cycle speed calming measures may be appropriate (see section 4.5.16). Contrasting tone and surface material may be considered, to support legibility by people with low vision
- **Signal-controlled crossing**
  This is not generally recommended unless as part of a larger junction. Blister tactile and tactile tails are required
- **Zebra crossing**
  As established in TSRGD (2016), a conventional zebra crossing may be applied to a cycle track and give priority to pedestrians crossing. Used in this way, the zebra crossing does not require zig-zag markings and belisha beacons are optional. Blister tactile, including tactile tails, is required to help people with visual impairments to find the crossing. Where the crossing is on a hump, then the Highways (Road Humps) Regulations 1999 apply, meaning that the crossing must be centred on the hump.

Tactile paving requirements for crossings are summarised in section 7.3.3.


'Mini zebra crossing' over a cycle track, Stockholm


Pedestrian crossing over a cycle track in Seville, with extra warning for cyclists

## Pedestrian accessibility

In deciding between these options, the most important considerations are step-free access and the legibility of the environment for people with visual impairments and those with low vision. Depending on the context, crossing a cycle track may be an unfamiliar arrangement, particularly when parallel to another carriageway, and so it is important that the design of any crossing enables people to find the crossing point and use it in safety and comfort. Whether cycle traffic on the track is one-way or two-way will also have an effect on pedestrian comfort and accessibility, with more control likely to be necessary for two-way tracks.

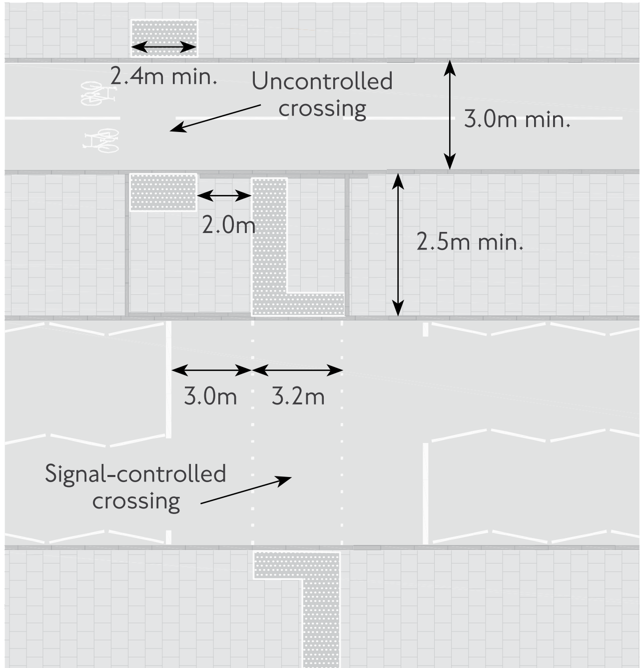
Additional signs and markings, both to alert pedestrians to the existence of the cycle track and to encourage slower cycling, may be considered. These techniques are often found in other European countries where pedestrian crossings are marked over cycle tracks.

## Combined crossing of main carriageway and cycle track

Where a pedestrian crossing over a cycle track is provided at the same location as a crossing of the main carriageway, the options are:

- Uncontrolled crossing of both cycle track and main carriageway. These crossings may be aligned or staggered
- Uncontrolled pedestrian crossing of the cycle track, and priority (zebra) or signal-controlled crossing of the main carriageway. Crossings must be staggered
- Priority pedestrian crossing of the cycle track, and priority or signal-controlled crossing of the main carriageway. Crossings should be staggered other than in the case of two zebra crossings, which can be aligned provided they are separated by an island of at least 2 metres' width
- Both crossings under signal control, which may be needed for high flows of both user. The preference is for pedestrians to cross in one stage, with crossings aligned. Separate signal control of the cycle track and main carriageway crossings, which would need to be staggered, is not generally recommended unless there are no other alternatives, given the delay to pedestrians that this would introduce and the unintuitive arrangement it would set up

Where a stagger is required, it is recommended that 2 metres is sufficient. The width of the island should be a minimum of 2.5 metres.




Indicative layout 5/06: Uncontrolled crossing of cycle track/signal-controlled crossing of main carriageway

## 5.3 Priority junctions

### 5.3.1 Cycle-friendly interventions

The majority of highway junctions are of the 'priority' type – crossroads and T-junctions – where vehicle priority is given to traffic on the major road. The priority is usually indicated by give-way or stop-lines and associated signs. In some cases no road markings may be considered to be necessary where vehicle speeds and flows are low.

For cyclists, key issues relate to the safety and comfort of moving ahead through a priority junction while motorised traffic seeks to turn in or out, and the safety, comfort and directness of cycle turns into and out of junctions. Any turn for cyclists that involves moving across more than one lane of motorised traffic in one step is likely to be uncomfortable for most users. In all cases, speed reduction on the link and on turning are recommended as measures that increase level of service for cyclists but are also beneficial for pedestrians – particularly raised entry treatments and reduced corner radii.

Figure 5.6 Summary of options for cycle-friendly interventions at priority junctions

| | |
|---|---|
| **Reduce speed on link** | Speed reduction generally is recommended. Changes to geometry that can support this include: raised tables, kerb realignment, reduced corner radii, reduced width of junction mouth and footway build-outs. (See chapter 3) |
| **Reduce speed on turning** | Selective use of raised entry treatments can address common risks on turning and suggest visual priority for cyclists and pedestrians. Preventing or restricting parking and loading close to the junction is an important supporting measure in most cases, helping to maintain good visibility. (See chapter 3) |
| **Change or reverse priority/ Ban specific movements** | If made to benefit a route well used by cyclists, changing priority can help address specific conflicts between turning motorised vehicles and cyclists and enhance the directness, safety and comfort of a cycle route. Such interventions need to be part of a wider traffic management approach. |
| **Convert to signalised junction** | Justification for this would need to be made in the manner described in TfL's Design standards for signal schemes, SQA064 (2014). (See section 5.4.2) |
| **Introduce new crossing or refuge island(s)** | If provided near the priority junction, these can support cycle turning movements, but only where avoiding the creation of pinch-points with unacceptable widths, and only in conjunction with other interventions to calm traffic speeds. (See section 5.2.8) |
| **Road markings through junction** | Visual priority can be supported by a combination of: TSRGD diagram 1057 cycle symbols, dashed diagram 1010 markings across the mouth of the junction and coloured surfacing. These interventions raise road user awareness of the presence and legitimacy of cycling and specific cycle movements. |

### 5.3.2 Road user behaviour

Cycle lanes and tracks should enjoy priority over turning traffic. This is essential not just for directness and continuity, but also safety. A high proportion of collisions involving cyclists arise from motor vehicles turning across cyclists, either through failing to see a cyclist or failing to observe good practice on road user behaviour and priority as set out in the Highway Code (rule 183): 'When turning, give way to any vehicles using a bus lane, cycle lane or tramway from either direction'.

Methods for giving unambiguous priority provided by UK regulations are limited in scope (which is a key difference between the UK and countries that operate a legal requirement for turning traffic to give way to ahead movement on its nearside) and so 'suggested' visual priority through design is an important tool.

### 5.3.3 Cycle lanes at priority junctions

Several different strategies are available to highlight to other road users the movement of cyclists, and the need to give way to ahead movement in the nearside lane (as the Highway Code recommends).

- Widening the cycle lane
- Providing a buffer space of 0.5 metres or more between the give way (TSRGD diagram 1003) markings at the side road and the cycle lane
- Continuing the lane marking across the side road using a short, dashed diagram 1010 marking – these are edge-of-carriageway markings and so do not mean 'give way' but are recognised as lines that should not be crossed without due care (see section 6.2.2)
- Using surface colour to highlight the potential conflict (see section 6.2.6)
- Using diagram 1057 markings to highlight the cycling facility (see section 6.2.5)
- Minimising corner radii and providing raised entry treatments to slow turning vehicles (see sections 5.1.4 and 3.5.2)

As these suggest, visual cues can encourage motorists to slow and/or be more aware of the presence of cyclists before turning.

Buffer between lane and give way markings, and use of colour

Dashed markings and coloured surfacing used for cycle lane

DfT's Signing the Way (2011) cites qualitative research with cyclists to support the desirability of using lane markings through junctions from a cycle safety perspective. (AECOM, Traffic Signs Policy Review: Research Project into the Awareness of the Meaning of Traffic Signs Project PPRO 04/16/24, 2011) The TRL report for DfT Infrastructure and Cyclist Safety (PPR 580, 2011) is also supportive of cycle lanes continued through junctions.

Dashed lane markings continued past side road with raised entry treatment

#### Diagram 1010 markings

The 1000mm-long diagram 1010 marking, a shorter dash than the 4000mm-long advisory cycle lane marking, should be used for lanes through junctions. This gives all road users a visual indication of a change in hazard associated with the junction. Use of the diagram 1010 marking for this purpose was established in TSRGD (2016).

## Cycle symbols

On streets without cycle lanes, TSRGD diagram 1057 cycle symbols may be used across junctions and accesses. These are usually positioned at the points where a cyclist should enter and exit from the side road and, in that way, help to guide appropriate cyclist positioning, as well as alerting other road users to the presence of cyclists. They remove any need for other warning signs to diagrams 962.1 (cycle lane) or 963.1 (cycle lane – look right) except for situations where contra-flow cycling is permitted.

## Impact on riding position

In all instances, analysis of cyclist movements through the junction should be undertaken prior to any decision about placement of lane markings or symbols. Care should be taken not to direct cyclists into taking inappropriate riding positions through the junction – see guidance on primary and secondary positioning in section 3.1. Where there is insufficient space through a junction for a large vehicle to overtake a cyclist, for example, a marked lane should not be provided as cyclists should be discouraged from adopting a secondary riding position.

At side roads with restricted access or less than 5 metres wide, kerb-to-kerb, one rather than two diagram 1057 markings may be used. On Cycle Superhighways, the CS project symbols (diagram 1057 marking with route number on a coloured patch) may be used to mark continuity of a cycle facility through a priority junction.

TSRGD diagram 1057 symbols positioned so as to mark a cycle route through a junction

## 5.3.4 Segregated lanes and tracks at priority junctions

Some different considerations apply when lanes or tracks are physically separated from the carriageway. In all cases, speed reduction through use of methods such as raised tables, entry treatments and reduced corner radii is highly recommended. Visibility plays a significant role, so raising awareness among other road users of the presence of cyclists moving past a side road is important. For one-way cycle tracks, this visual priority may be achieved in one of three ways:

- Continuing the track through the junction without deviation where it is or could be raised above carriageway level
- Ending the separation ahead of the junction mouth, converting track to lane (or segregated lane to unsegregated lane) and returning the cyclist to carriageway level through the junction – also known as 'bending in' the cycle track
- 'Bending out' the cycle track away from the major road and into the mouth of the minor road, thereby giving any vehicle turning in space to wait and give way to a cyclist using the track

The first of these has the potential to offer the highest level of service for cyclists. The second can work well but is unlikely to contribute greatly to cyclists' sense of safety. The third is the only one that gives formal priority to cyclists, but is less desirable in various other ways: it is less direct for the cyclist, adds to visual clutter, tends to require deviation of pedestrians from their desire lines, and requires more space than is usually available at a priority junction.

For any of these scenarios, coloured surfacing may be applied to reinforce the visual priority and highlight a location where conflicting movements will be taking place, but should not be relied upon alone to confer any sense of priority (see section 6.2.6).

## Continuity without deviation

Continuing and raising a track through a junction without deviation has proved to be successful for stepped tracks. Although little UK practice exists, the principles are also applicable to kerbed segregation, subject to detailed design and undertaking a site-specific risk assessment. It requires a raised entry treatment and corner radii that are as tight as possible, forcing any turning movement in or out of the side road to take place at very low speed.

Consideration should be given to applying give-way markings for vehicles turning from the main carriageway into the side road, should space be available to do so, but the treatment relies more on visual priority than on any specific use of signing. This is likely to work well in combination with continuous footway and cycleway treatments (see section 3.5.3).

## Reintegration ahead of junction

The second option relies on reintegrating cyclists with other traffic in the area around the priority junction, in order to maximise their visibility. This allows cyclists to adopt an appropriate riding position away from the nearside. The options set out above for treatment of cycle lanes at priority junctions may then be followed. Lanes should be marked as mandatory, with the TSRGD diagram 1049B marking, from the point where the segregation ends and then marked across the side road itself with diagram 1010 markings, as described above, with coloured surfacing optional.

Continuity of cycle tracks through priority junction: Old Shoreham Road, Brighton

Off-street trials conducted by TRL and recorded in the report PPR703: Trials of segregation set-back at side roads (2014) have generated some interim recommendations about set-back distances at priority junctions where kerbed segregation is provided for cyclists:

- Set-back should be 5 metres or less where 85th percentile motorised traffic speeds are lower than 30 miles per hour and the street geometry is tight
- Set-back should be 20 metres or more where 85th percentile speeds are greater than 30mph, allowing cyclists to reintegrate and take up a more visible position on the nearside
- The range 5 to 20 metres should be avoided, as this constrains cyclists but does not have a significant impact on the speed of turning motorised vehicles

These have not been corroborated in on-street trialling, and so caution is recommended in applying these recommendations. It is advisable to introduce speed reduction measures and implement other measures to highlight the intended priority of cycle traffic on the nearside.

## ‘Bending out’

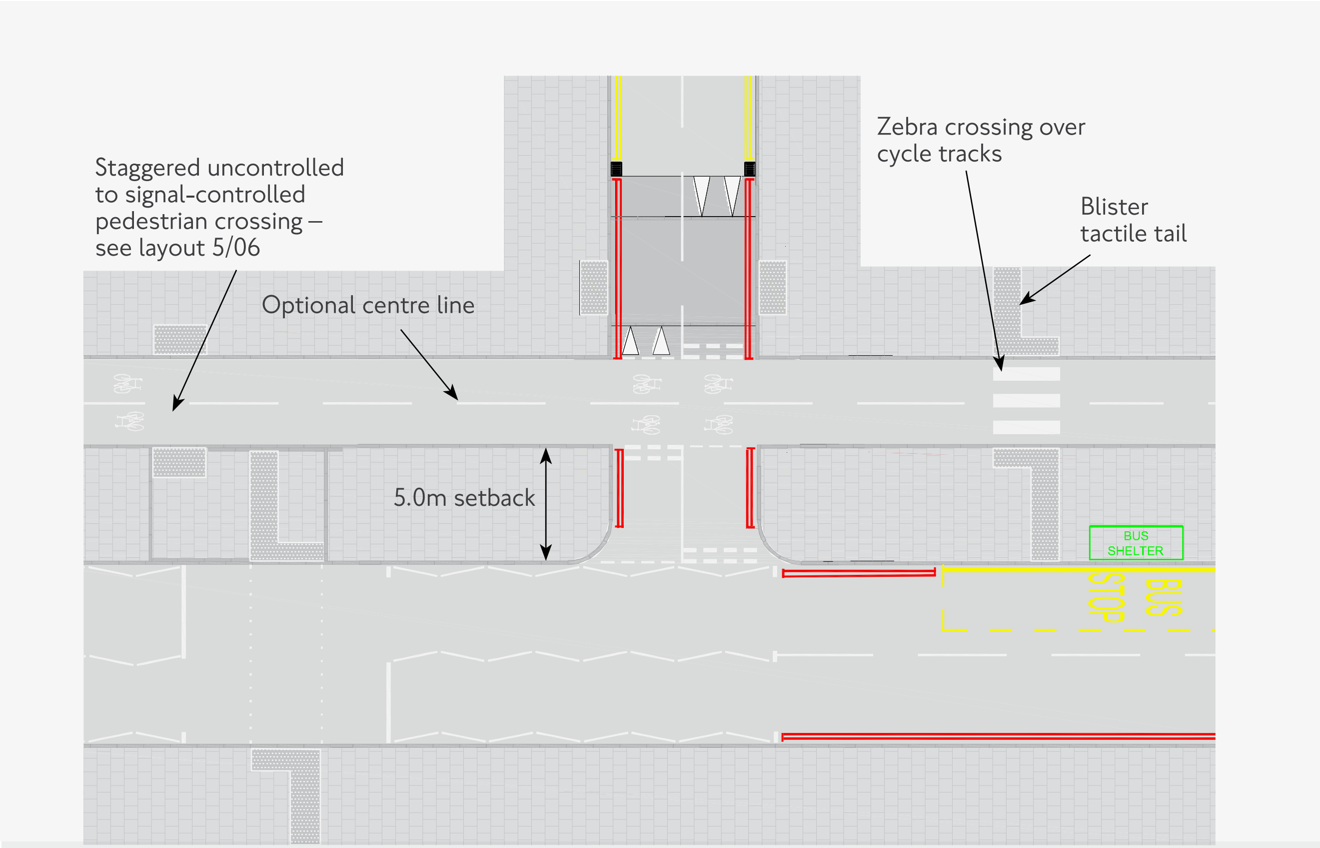
‘Bending out’ involves continuing the cycle track across the side road on a road hump, set back at least 5 metres from the carriageway. Both the TSRGD diagram 1003 (double-dash) and diagram 1023 (triangle) markings are marked on either side of the hump, requiring motor traffic to give way to crossing cycle traffic. This technique can also be used with less than 5 metres set-back if the side road is one-way, leading to the main road. Appropriate set-back, if any, should be determined by visibility considerations for vehicles exiting the side road, bearing in mind the need to give way to the cycle track.

Bent-out cycle tracks with priority at Waterden Road, Hackney. Note that elephants' footprints should not be used to mark this kind of crossing

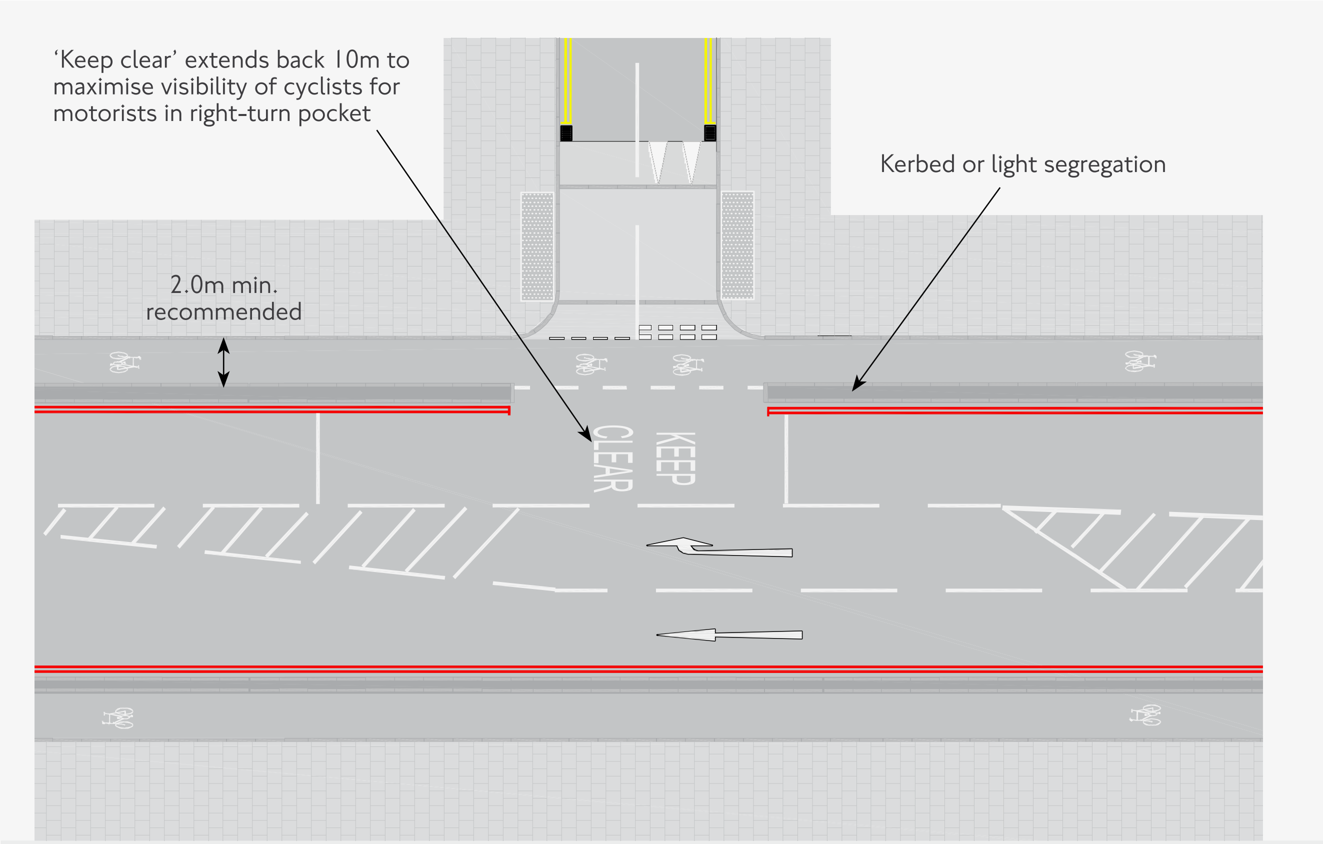
The previous requirement for flat-topped road humps for bent-out cycle tracks on streets with speed limits of 30mph or less was removed in TSRGD (2016). Although the hump is no longer required, advice in the Traffic Signs Manual (paragraph 3.25) on other road markings should still be followed: for example, use of TSRGD diagram 1062 triangular markings and diagram 1023 'give way' markings.

For two-way tracks crossing two-way side roads, 'bending-out' by 5 metres is the recommended option. Where island separation is wide, this can be achieved with little or no deviation of the cycle track. Continuing a two-way track through a priority junction without deviation is possible, but brings with it various risks, related to the visibility of cyclists to turning motorised traffic.

It is not recommended unless traffic speeds and volumes are very low and other measures can be put in place to enhance visibility of cyclists – even then, it should be subject to a site-specific risk assessment. Closing side streets to motorised traffic is likely to be the only reliable way of dealing with these risks.




Indicative layout 5/07: Two-way cycle track with priority over side road, showing options for pedestrian crossing of cycle tracks




Indicative layout 5/08: Cycle track with keep clear at priority junction to maximise visibility for right-turning motorists

Two-way track continued across priority junction without deviation in a traffic calmed street – Cable Street, Tower Hamlets

Difficulties in highlighting to all road users that a two-way cycle track is crossing a side road – Tavistock Place, Camden

## 5.3.5 Cycling facilities across minor accesses

At access crossovers, priority may be given to cyclists without following the same options as for priority junctions. Where feasible, the access should be raised and narrowed. For larger accesses, a give way triangle (TSRGD diagram 1023) may be used to provide further warning to drivers leaving the access that they must give way to cyclists. At wide accesses, such as those at petrol filling stations, measures to slow down vehicles should also be considered, such as entry treatments and tightened geometry.

It is important to retain good visibility of the cyclists for drivers of vehicles intending to turn left across the cycle track. This means keeping the kerbside clear of street furniture and parked vehicles. It is also necessary for drivers leaving the access to have adequate visibility of approaching cyclists.


Track with suggested priority over minor side road entry

## 5.4 Signal-controlled junctions

### 5.4.1 Cycle-friendly interventions

Improvements to cycle safety and comfort, and to the directness and coherence of cycle routes may be achieved through remodelling, removing or introducing signal control at junctions, particularly where signal timings can be changed to reallocate time between road users and generate time saving benefits for cyclists. Intervention types covered in this section are summarised in figure 5.7.

### 5.4.2 Procedures for traffic signals

For any scheme involving traffic signals, authorities are required to comply with procedures set out in Design standards for signal schemes, SQA064 (2014) and any subsequent document updates. TfL Traffic Infrastructure prepares these design standards and is the Signals Authority for London, responsible for the design, installation, commissioning, maintenance and decommissioning of traffic signals and associated equipment. TfL Network Performance is responsible for the management and operation of London's traffic signals and their accompanying systems, technologies and equipment.

The Traffic Management Act 2004 places a Network Management Duty on all local traffic authorities (LTAs) in England. The Duty requires

Figure 5.7 Summary of options for cycle-friendly interventions at signal-controlled junctions

| | |
|---|---|
| **Signalisation to remove conflict** | Complete separation at junctions involves signalling cyclists separately to remove all conflicting movements with other users. |
| **Managing conflict with turning vehicles** | This may be done by giving cyclists an advantage in time or space, or by seeking to move the point of crossing conflict away from the junction itself (managing the conflict). |
| **Support for cycle right turn** | As part of a segregated cycling system or a wider strategy on a route or a series of junctions to keep cyclists in a predictable position on the nearside, cyclists could be assisted with right turns by staying on the nearside and making the turn in two stages. |
| **Cycle bypass of signals** | In some instances, particularly through signalised T-junctions, cyclists making certain movements may be permitted a bypass of the signal control. |
| **Using ASLs and feeder lanes** | Advanced stop lines (ASLs) can help cyclists move away from a safer, more advantageous position at a signal-controlled junction at the start of a stage and so, selectively, can assist cycle movements through a junction. |
| **Banning selected motorised vehicle movements** | Generally in conjunction with other measures listed here, certain vehicle movements could be banned to improve cycle safety and directness. This should be done as part of a wider traffic management approach rather than on a case-by-case basis. |
| **Convert to a priority junction** | Signal removal can have some beneficial effects where the volume and mix of traffic and nature of conflicting movements does not necessarily justify the existence of a signal-controlled junction. See section 5.3. |
| **Remove all priority and declutter** | As part of an integrated, area-wide approach, designers may explore the potential benefits of removing signal control and priority altogether in order to promote more consensual road user behaviour generally. See section 3.4 on calming through street design. |

the LTA to 'ensure the expeditious movement of traffic on its own road network, and facilitate the expeditious movement of traffic on the networks of others' (noting that this includes pedestrians and cyclists).

TfL Network Performance therefore uses journey time reliability as a practical measure to help clarify the legal responsibility. Modelling is the tool used to measure scheme impact on the network and effects on journey time reliability. The way this is applied across London is described in the Traffic modelling guidelines (version 3), issued in September 2010.

The primary purpose of traffic control by light signals is to separate conflicting traffic by the division of time, within the available road space, in a safe, efficient and equitable manner. (Traffic Advisory Leaflet 1/06, General principles of traffic control by light signals, 2006, Part 1) In the UK, traffic responsive detection technology is widely used to optimise the operation of traffic signals. This allows for sequence flexibility if no users are detected and for green signal optimisation during busy periods.

### Pros and cons

Benefits arising from being able to control movements of road users at traffic signals need to be weighed up against the potential disadvantages to cyclists, and to pedestrians. Minimising delay is a primary objective in achieving a level of service that attracts new cyclists: few advantages are to be gained from signals for cyclists that require them to wait a long time at signals. TfL's guidance states that at junctions with pedestrian crossing facilities, signal cycle times should only exceptionally be longer than 90 seconds.

Decluttering by minimising use of, or removing, traffic signals is positive for more attractive streets. Although it offers some adaptability through the ability to manage signal timings, junction remodelling with substantial changes to traffic signal infrastructure, may also place limits on the growth of cycling on a given route and necessitate further re-engineering in the near future.

> Care should be taken to avoid introducing signal control where it is not justified. This can result in increased journey times for all users and is costly to install and maintain. Over-complicated signal staging and operation can lead to excessive waiting times for cyclists and an increase in frustration and non-compliance.

In seeking to improve cycle safety, comfort and directness at junctions, the timing of signals should generally be reviewed and optimised to minimise delay for cyclists, taking account of the needs of all traffic. When calculating inter-green timings allowance must be made for cycle movements to ensure cyclists can safely clear the junction. This is particularly important where cycle speeds are likely to be lower due to gradients.

## 5.4.3 Traffic signals for cyclists

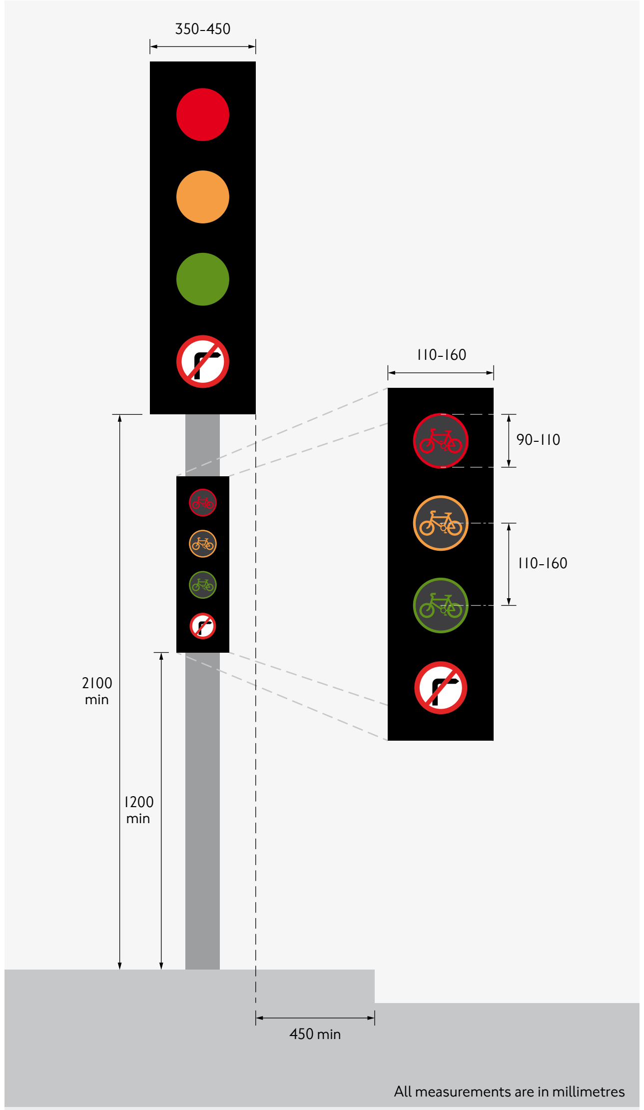
The options covered here are generally trial measures that are being developed to enable separation of cyclists' movements through junctions. They all have the potential to become important parts of the toolkit for cycling infrastructure in the UK. Tried-and-tested designs and layouts will emerge in time but in order to develop agreed, standardised approaches, it is recommended that any proposals to use any of these measures are discussed with TfL or DfT from an early stage.

### Red cycle aspect on standard traffic signal head

A standard traffic signal head can be used to control traffic consisting solely of pedal cycles. This signal includes green and amber cycle aspects and, following the publication of TSRGD (2016), can also incorporate a high-level red cycle aspect.

Off-street trials commissioned by TfL confirmed that a red cycle aspect on a standard traffic signal head is equally well understood and complied with by cyclists when compared with a full red aspect.

Standard signal heads with green cycle aspects




High-level and low-level signal head sizes and mounting heights, showing an optional box sign with banned right turn (low-level signal is acting as a repeater)

## Low-level cycle signals

Following off- and on-street trials and changes to regulations (TSRGD 2016), low-level cycle signals may be used as alternatives to high-level, full-size signal heads. These have a minimum mounting height of 1200mm (to the underside of the signal head). They may be mounted on a pole used by high-level signal equipment or on their own 3 metre-high, wide-based pole.

TfL Traffic Infrastructure has developed guidance, SQA0651 Design for low-level cycle signals, that draws on TRL off-street trial research, on-street trial results, information about equipment and generic design considerations. The following paragraphs give a summary of that guidance. For further technical detail, consult SQA0651.

A low-level cycle signal may be used:

- As a primary signal, to control traffic exclusively made up of cyclists
- For early release, where the cycle signal gains right of way before its associated vehicle signal
- As a repeater, mounted at cyclists' eye-level under full-sized signal heads and showing the same information as the high-level signals

A primary low-level cycle signal may only be used in conjunction with a stop-line.

## Box signs

One 100mm-diameter box sign may be mounted under the green cycle aspect of a low-level cycle signal, giving a four-in-line configuration. This may be required to indicate a prohibited or exclusive movement for cyclists: for example, TSRGD diagram 606 (proceed in the direction indicated by the arrow), 612 (no right turn) or 613 (no left turn). Where a low-level signal acts as a repeater, any box sign must replicate information displayed by the high-level regulatory box sign.

## General layout considerations

A minimum horizontal clearance of 450mm should be provided between the edge of the carriageway and a low-level cycle signal. Less clearance is needed to a cycle track, indicatively a minimum of 250mm but to be determined on a site-specific basis (see section 4.2.3 on segregating island width). This means that any island that accommodates a low-level cycle signal alone effectively needs to be a minimum of 1.0 metre wide. Any island with a low-level signal mounted on a signal pole with a high-level signal should be at least 1.2 metres wide.

A primary low-level cycle signal should be 1.2 metres from and aligned at 45 degrees to the stop-line. A shallower angle can be considered for segregated lanes/tracks in order to avoid see-through problems and account for other site-specific conditions.

Where a secondary low-level cycle signal is installed, it should be aligned to a point in the middle of the carriageway or cycle lane/track and 2 metres upstream of the stop line. It should be within a 30 degree offset of the middle of the lane.

Detail of low-level cycle signal

High-level red cycle aspect with low-level cycle signal used as repeater

## 5.4.4 Cycle early release

Cycle early release signals allow cyclists to move away ahead of general traffic at signalised junctions. In most circumstances, early release should be applied to a layout with an advanced stop line (ASL), using a low-level cycle signal mounted under the associated primary traffic signal on a high-level signal pole.

On a single-lane approach, or where a formal two-stage right turn facility is provided, the low-level cycle signal should be mounted on the nearside signal pole only.

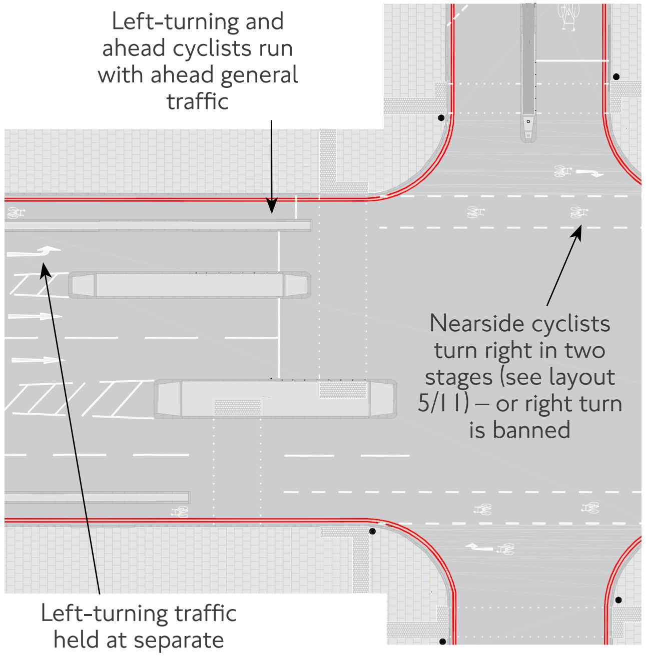
The amount of time given to cyclists by the early release depends on the junction dimensions and signal operation. It should be a minimum of 3 seconds, and above 5 seconds only in exceptional circumstances. At the end of green, the low-level cycle signal must lose right of way at the same time as the associated traffic signal.

Fourth aspect on standard signal head, giving cycle early release at Hills Road, Cambridge

## 5.4.5 Hold the left turn

TfL is planning to trial an arrangement that involves separately signalling cyclists and left-turning vehicles. This requires some segregation of lanes, a dedicated left-turning lane for general traffic, space for inclusion of islands for signal infrastructure, and provision for right-turning cyclists. It has potential for locations where there is a moderate volume of left-turning traffic and a large cycle flow ahead and/or left. Some separation at the stop line may also be needed of left-turning and ahead cyclists.

Visualisation showing proposal for 'hold the left turn'




Indicative layout 5/09: 'Hold the left turn' concept

## 5.4.6 Cycle gate

A 'cycle gate' is an alternative method of giving cyclists some time and space to move away from a junction ahead of motorised vehicles. It could be applied where there are a large number of left-turning motorised vehicle movements, or 'scissor movement' conflicts, although it requires a substantial amount of space in terms of road width and depth of reservoir. It is essential that the signal operation gives cyclists enough time to clear potential points of conflict.

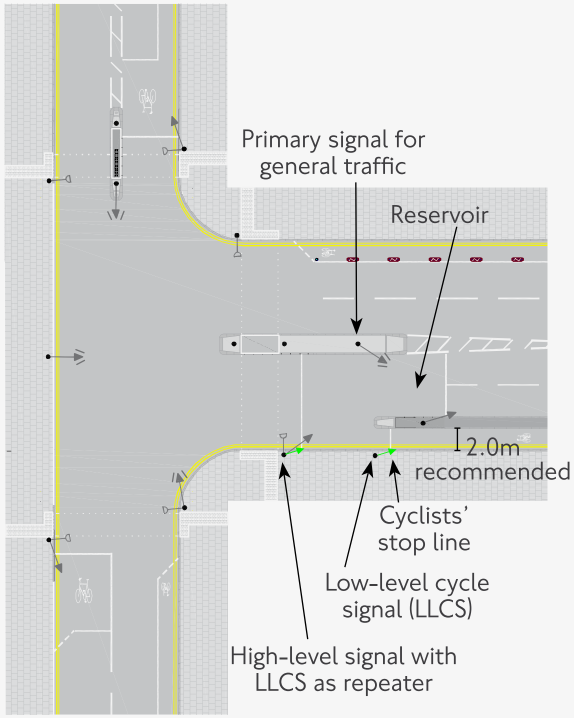
The cycle gate relies on there being two sets of signals and two stop lines for cyclists – the first acts as a 'gate' to allow cyclists into a 'cycle reservoir' ahead of general traffic to await a green light at the second stop line. The reservoir should not be marked in such a way as to make it appear like an ASL – for example, it should not have coloured surfacing or be marked with cycle symbols. Consideration for pedestrian waiting and crossing times also needs to be made, particularly in areas of high pedestrian flow.

Cycle gate at Bow: (top) segregated approach and first cycle stop line, and (bottom) advanced cycle stop line. Trial low-level cycle signals (used as repeaters) are mounted below the main signal heads

Layout principles for cycle gate are as follows:

- The cycle lane/track on the approach must be physically segregated, at least 1.5 metres wide, preferably 2 metres, to allow for overtaking. It may have coloured surfacing, up to the first cycle stop line
- The general traffic stop line should be positioned behind the advanced cycle stop line
- The segregating strip should widen to allow clearance for mounting the traffic signal head; for a signal head mounted in front of a traffic signal pole, the segregating strip should be at least 1.3 metres
- The distance from the first cycle stop line to the advanced stop line at the junction (the depth of the reservoir) should be at least 15 metres; this is to disassociate the two stop lines from each other and reduce the see-through issue between the two sets of traffic signals

Signal layouts with dedicated cycle phases may also be considered. Typically this is appropriate where one or more arms of the junction allow access for cyclists only, but it may also be applied where cyclists are physically segregated from other traffic.




Indicative layout 5/10: Cycle gate, from SQA0651 (note that actual layout of each installation must be in accordance with the appropriate signal section site requirements)

## 5.4.7 Two-stage right turn

Traffic signals for cyclists have also been proposed for use with two-stage right turns – this is being explored in off-street trialling. Making a right turn in two stages while staying on the nearside of other traffic is an approach used in some other European countries (for left turns) and is a potential solution to the problem of enabling cyclists to turn right when they are in segregated infrastructure on the nearside. The alternative would be to provide a gap in the segregation well ahead of the junction to allow right-turners to move out into general traffic and make the turn in the 'conventional' manner.

Two-stage left-turn marking at junction in Stockholm (top); and cyclists in different streams in Copenhagen (bottom) – left turners are heading to the waiting area to the right

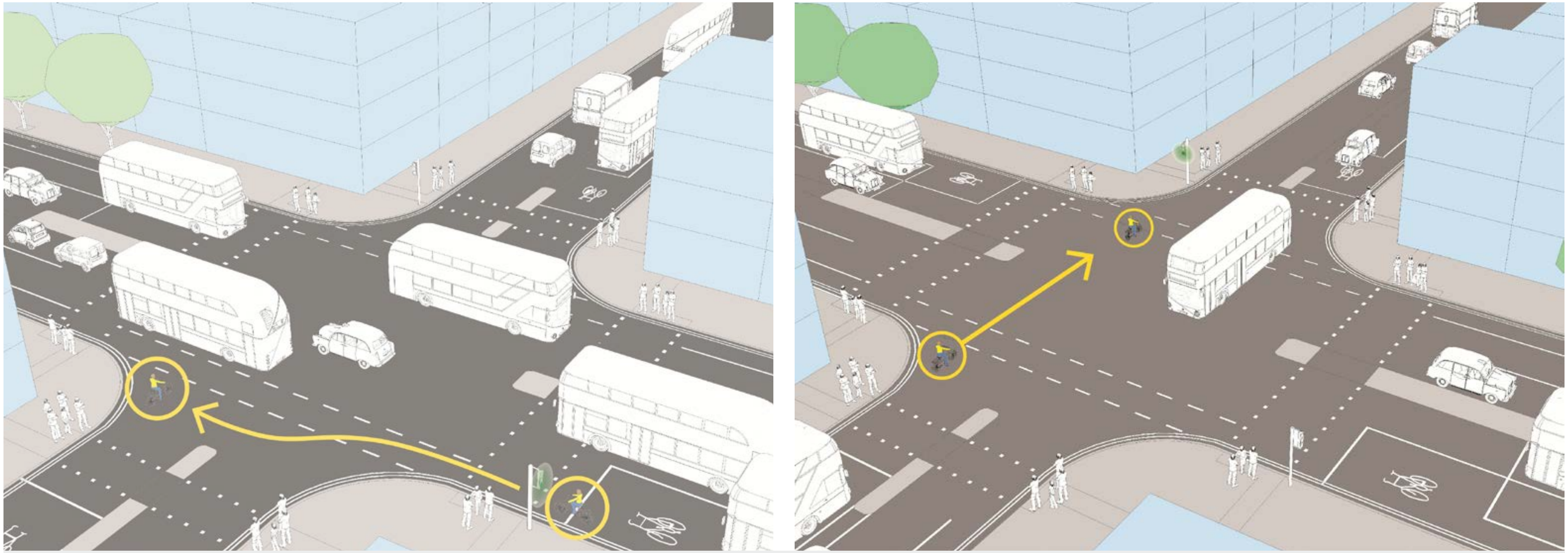
It is already possible to make a right turn informally, although this not yet supported by specific road markings and signs. The cyclist crosses one arm of the junction in an ahead movement, pulls into the left and stops beyond the pedestrian crossing studs on the arm adjacent where they started. They then turn through 90 degrees to face their exit arm and wait for the traffic signals to allow them a second ahead movement. In this way, they can stay on the nearside and avoid having to move across lanes of traffic in order to turn right.

Lanes marked through junctions can assist cyclists making two-stage right turns informally by giving them lines to wait behind in between the two stages of their turn. In other countries, where two-stage right turns have more formal status, road markings and surface colour are often used to mark waiting areas or lines to assist making the second stage of the turn.

## Formal two-stage right turn

TfL trialled a junction design off-street that enables a 'formal' two-stage right turn, with a marked waiting area and early release for cyclists. On-street use of this arrangement is being monitored, together with a two-stage left turn from a two-way cycle track on one side of a carriageway. SQA0651 Design for low-level cycle signals contains guidance based on the trial layout. Key points of advice are:

- Early release for cyclists in the ahead waiting area should be provided by a far-sided secondary signal



Informal two-stage right turn from the right-hand arm to top arm

- These cyclists must have a clear-sighted view of this signal, which should not therefore be a low-level signal, but should have a standard, high-level signal head, with a 200mm green cycle aspect as the fourth aspect (either to the left or in a four-in-line configuration)
- This secondary signal must turn to green at the same time as the low-level cycle signal for early release for cyclists waiting behind the stop line; the green cycle aspect must then terminate once the associated traffic phase gains right of way

Any proposal for a formal two-stage right turn should be discussed with TfL as early as possible.

## Signing

It is proposed that a sign will be created to instruct cyclists how to undertake the turn ahead of the junction. This is likely to be based on the map-type sign to diagram 2601.2 of TSRGD.

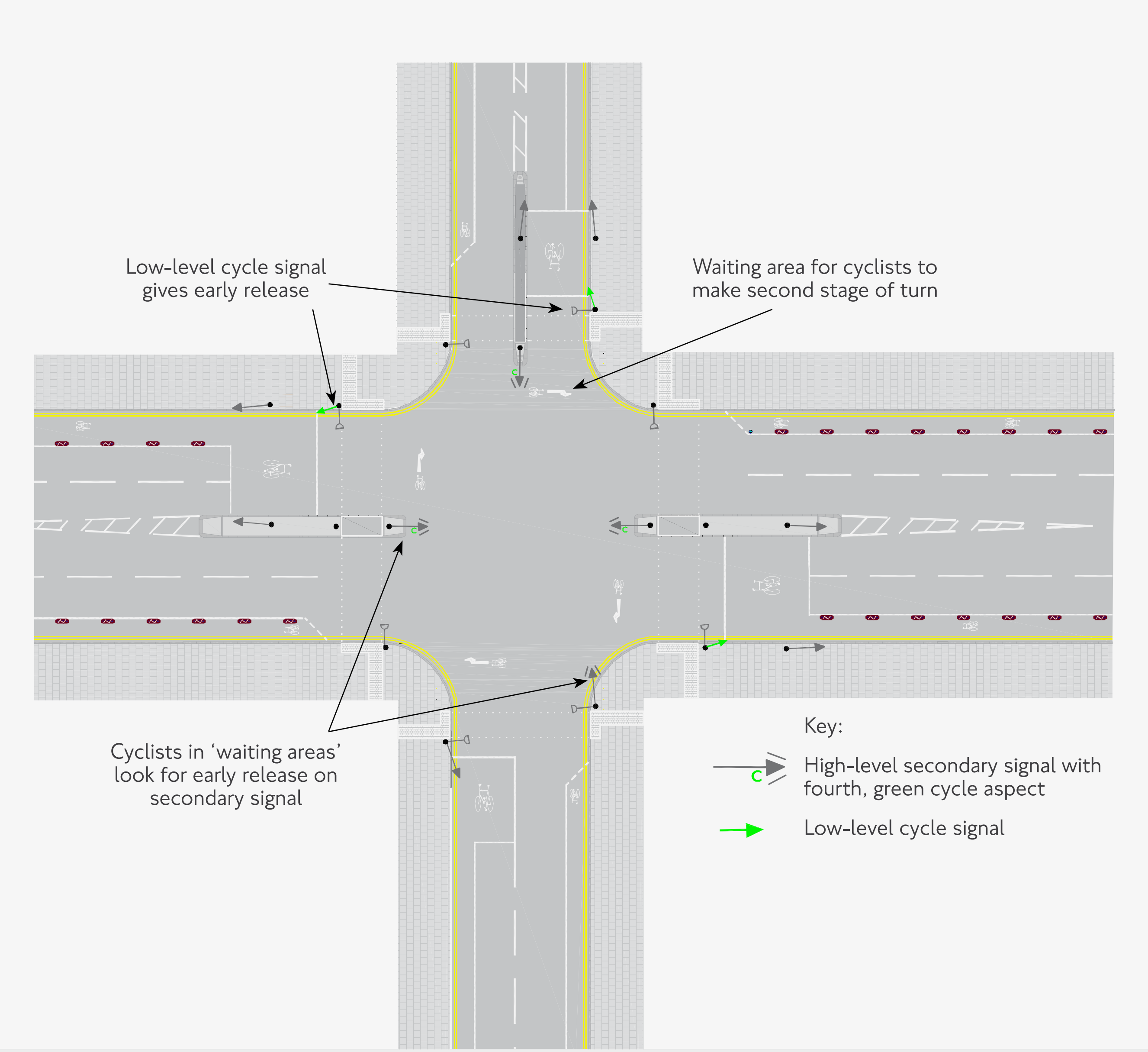
The waiting area for the second stage of the turn should be marked with the cycle symbol to diagram 1057 and the cycle route direction arrow to diagram 1059. An important layout factor is the location of the waiting area in relation to the pedestrian crossing – there must be sufficient space to allow cyclists to move left of ahead traffic in the first stage of their manoeuvre, turn towards the waiting area and then position themselves correctly for their second stage. This should be calculated with the dimensions and turning circles of larger model of cycle in mind.

Trial of two-stage right turn, showing low-level cycle signals for early release

One other option for turning right in two steps is to allow the cyclists to leave the carriageway to the left and turn right by waiting and using a nearby crossing. This is usually done by introducing a dropped kerb ahead of a crossing that can be used by cyclists (stand-alone or as part of a signal-controlled junction) – a technique mainly used to provide a transition between on- and off-carriageway cycle facilities.

For turning right, this kind of arrangement, which is also illustrated in LTN2/08, page 64, is sometimes known as the G-turn or 'jug handle' layout.

Dropped kerb providing cycle access to shared use footway and shared crossing




Indicative layout 5/11: Trial two-stage right turn and early release arrangement, from SQA0651

## 5.4.8 Other methods of managing conflicts

Where junctions are signal-controlled, separate signalling for cyclists and other traffic is the preferred way of dealing with left-turn conflicts by giving cyclists some protection in space and/or time.

Where the turning conflict cannot be removed, designers should seek to manage it and reduce the risk and severity of any collision. Calming traffic movements through the junction so that any interaction happens at lower speed is recommended – see guidance in chapter 3 generally. Tightening junction geometry and using junction tables can allow cyclists and slow-moving motorised vehicles to move through junctions with reduced risk of conflict. In low-volume and low-speed traffic conditions, ASLs and feeder lanes can be of benefit to cyclists, allowing them the advantage of an advanced position at the junction itself.

### Banning turns for motorised traffic

Not allowing selected turns for motorised traffic can deliver a high cycling level of service. This can help in design of signal operation at the junction as well as removing a potential source of conflicting movements. Such a decision, however, should be taken in the light of a wider strategy for the road network around the junction in question. Banning a movement in one place could transfer that movement, and a risk to cycle safety, to another location. The design should support the ban and be self-enforcing, which generally means that physical measures are needed as well as signing.

### Cycle bypass to signals

It may be possible to allow cyclists to bypass signals for general traffic, thereby enabling cyclists to clear the junction while other left-turning vehicles are held at a red signal. However, this is challenging to integrate with pedestrian crossing facilities and can generally only be done on a junction arm where there is no such crossing. Any such proposal should also avoid reducing pedestrian comfort levels through taking space from the footway to achieve a bypass.

Bypass to traffic signals for left-turning cyclists, Hills Road / Cherry Hinton Road, Cambridge

## Dealing with left-turning general traffic lanes

Other scenarios, particularly those on street types with a higher movement function, will usually require different interventions. A particular risk is posed by left-turn general traffic lanes, multiple lanes for different movements at gyratories and free-flowing entry and exit slip lanes (usually for left-turning vehicles). Reduction in vehicle speeds, particularly on the turning movements, may help but it is also advisable to seek to reduce the distance where cyclists are vulnerable and move the point of potential conflict away from the junction itself.

The ideal solution is the removal of slip lanes by reconfiguring the junction, which can also release significant space for pedestrian and urban realm enhancements. If a slip lane cannot be removed, its length could be minimised by reducing the taper to 1 in 3 for 30mph roads and 1 in 5 for 40mph roads.

Where it is not practical to reduce the taper adequately, then continuing the ahead cycle lane past the left-turn slip lane will require left-turning vehicles to cross the cycle facility. The cycle lane should be projected ahead, without deviation, from the start of the left-turn flare. This can help add caution to driver behaviour and minimise last-minute lane-changing, particularly if the cycle lane is marked prominently – with surface colour, cycle symbols (to TSRGD diagram 1057) at 5-metre intervals and dashed lane markings (diagram 1010) to highlight the conflict, as appropriate.

However, it is not an ideal solution and cannot deliver anything more than a basic level of service for cyclists. Appropriate measures for managing the conflict at the point of crossover will depend on site-specific conditions such as available width, motor vehicle speeds and flows and mix of vehicles.


Long central lead-in to allow for left-turn flare, positioned to facilitate overtaking stopped buses

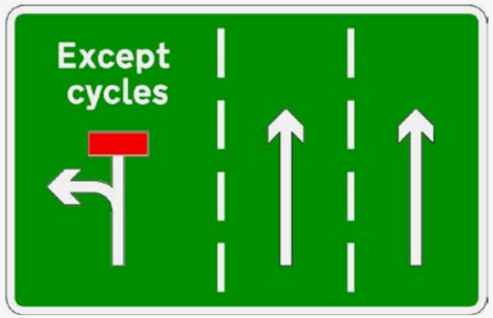

Use of dashed lane markings and surface colour to highlight a cycle lane to motorists seeking to enter a left-turn lane

## Shared nearside lane

In some circumstances, it may be more appropriate to omit the cycle lane on the junction approach to encourage cyclists to take a primary position in the ahead lane. In that case, consideration should be given to marking and colouring the nearside lane in such a way as to suggest to motorised vehicles that they are merging into a cycle lane to turn left, rather than using a conventional left-turning general traffic lane.

On Cycle Superhighway pilot routes, use of this method showed no negative effect on conflicts and an increase in the separation distance between motor vehicles and cyclists, compared with a non-treated equivalent. Although offering only a basic level of service, this option may be useful where ahead movements from the nearside lane are restricted (eg to buses and/or cyclists only) and there are high proportions of left-turning motor vehicles. In this situation, signing to TSRGD diagram 877 (see Chapter 6) should be provided to permit specified road users to proceed ahead using the nearside lane at the junction.


Shared nearside lane




Variant of sign to diagram 877 of TSRGD (site-specific authorisation required)

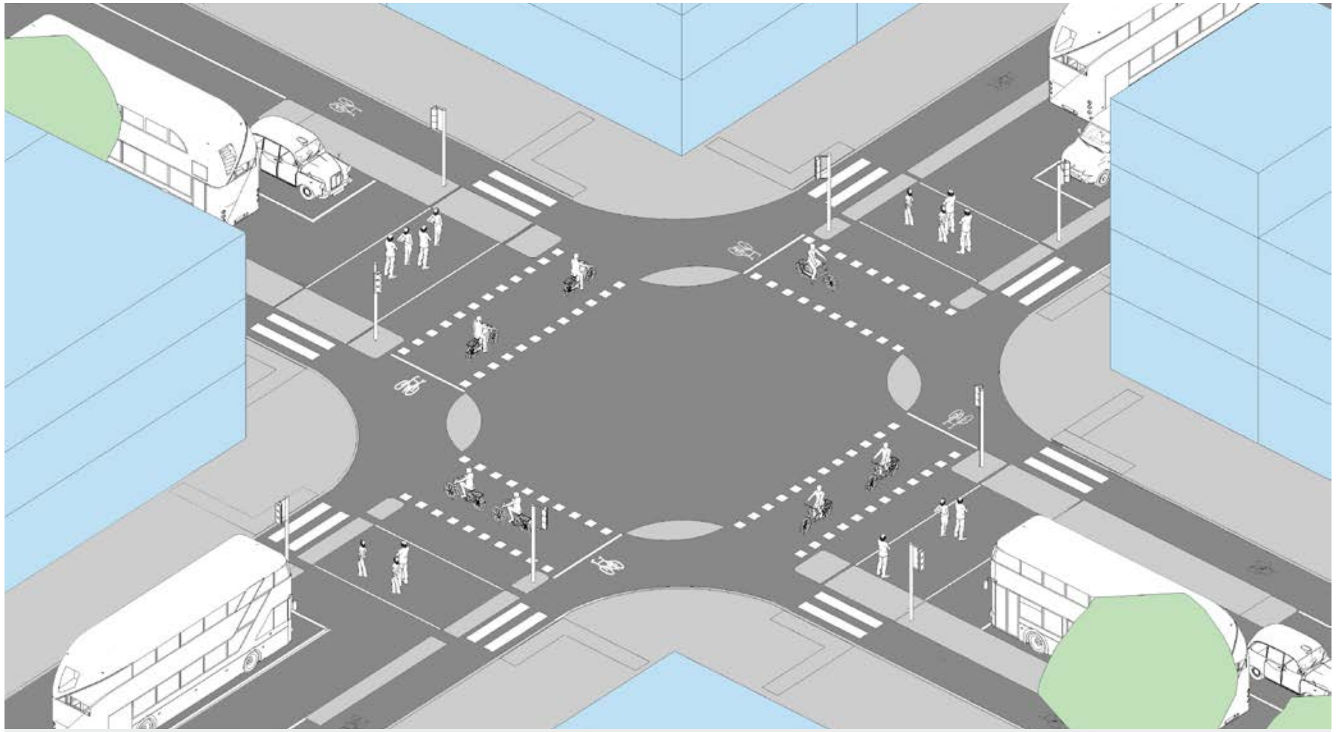
## Cycle priority and protection at the conflict point

Where a slip road joins a main road, the cycle lane on the main road may, again, be continued through the conflict area and highlighted for other road users using surface colour and appropriate markings. Diagram 1003 give-way markings should also be used on the nearside of the cycle lane, to require vehicles joining the main road to give way to cyclists and other vehicles on that road.

Light or island segregation may be considered as a way of protecting cyclists. This can protect the junction approach and focus the point of crossover, encouraging motorists to keep their distance from the cycle lane.

The principle of using island separation could be applied to bespoke junction redesign in order to give protection to cyclists. Separation of this kind is likely to form the basis for future experimental layouts, in conjunction with innovative use of traffic signals. Any proposal using these methods should be regarded as a trial.


Kerbed island up to an ASL helps to maintain space for cyclists as vehicles turn in a gyratory system. Drivers have to make a clear and early lane change ahead of the segregation in order to turn right



Concept sketch for a junction redesign involving island protection

## Highlighting the conflict point

Through the junction itself, marking and potentially colouring the cycle lane can highlight to other road users the likely ahead movement of cyclists and encourage a more cautious approach to turning across such a facility.

The markings should support good road positioning, but it is not necessary for cyclists to stay within the area marked – the principal function of these markings is to influence driver behaviour on turning, not the behaviour of cyclists. Lane markings should be to TSRGD diagram 1010 markings (or variant as necessary), used together with cycle symbols to diagram 1057.

This method is best used when cyclists approach from a nearside lane or track and should remain on the nearside for ahead as well as left-turning movements. This may well be the case for segregated infrastructure and where a two-stage right turn arrangement is in place. Where there is no nearside lane or track before or after the junction, or where cyclists should adopt a more central riding position through the junction, this technique should not generally be used.

Lane markings and surface colour continued through junctions on Cycle Superhighways

Use of coloured surfacing for cycling through junctions in Copenhagen

## 5.4.9 Advanced Stop Lines

Where provision for cyclists is on-carriageway and unsegregated, signalised junctions should incorporate an advanced stop line (ASL). Where they are properly enforced, ASLs and associated facilities can be used to give cyclists a basic level of service and some degree of priority, and they can help to raise driver awareness of cyclists. The TRL report, PPR240, Behaviour at advanced cycle stop lines (2005) covers observed benefits, describing how, with an ASL, more cyclists are able to access a position at the front of queuing traffic and how encroachment into the pedestrian crossing area by cyclists is reduced.

ASLs should not, however, be relied upon alone as a measure to cater adequately for cyclists at signalised junctions as the benefits they offer are conditional upon the stage of signal cycle when the cyclist arrives at the junction, and on how they are accessed under different traffic conditions. They may also be of limited use to people riding non-standard cycles, particularly wider models, if inadequate space is available to access the stop line. All ASLs and their methods of access need careful consideration at the design stage, taking into account junction layout, traffic flows and movements and signal operation.

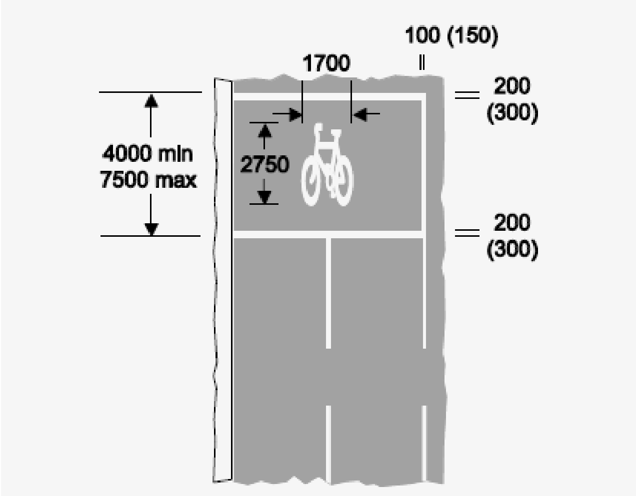
Important considerations include ASL capacity and the practicality and comfort of making right-turn manoeuvres using the ASL

Where they are well designed and can be accessed by all users of all types of cycle, ASLs can help cyclists to: position themselves in drivers' line of sight, avoid conflict with left-turning vehicles (when arriving on a red light), wait away from direct exhaust fumes, and enjoy a head start over motorised traffic.

## Design requirements

The ASL waiting area may be between 4 and 7.5 metres deep, as established in TSRGD (2016). Under most circumstances, 5 metres should be used, with up to 7.5-metre deep ASLs considered for locations with high cycle flows.

A set-back of 1.7 to 3 metres is required between the advanced stop line and pedestrian crossing studs. 1.7 metres is recommended for cycle routes as it can lead to cyclists waiting in safer and more visible locations ahead of stationary traffic and can allow for tighter geometry at the junction. Swept path analysis must inform the choice: a greater set-back distance may be required to avoid encroachment from the swept path of large vehicles where there are no splitter islands. Alternatively, a part-width ASL may be appropriate.




TSRGD (2016) diagram 1001.2B – separate stop line for pedal cycles, without lead-in or gate entry

The solid longitudinal lines that bound the ASL box on either side must be provided, unless that part of the carriageway is delineated by a raised kerb. In practice, this is usually the case for the nearside and relates to the offside where there is an island. Colouring the ASL box is not required unless there is an identified need to highlight the location as a point of particular conflict.

Narrow lead-in lane on street with no centre line, so vehicles tend not to queue over the lead-in lane

ASLs with lead-in lanes are also used in other countries – as in this example from Utrecht

## Nearside lead-in lanes

A mandatory lead-in lane to an ASL is recommended, although advisory lead-ins and gate entry are also possible. A balance needs to be struck between the added protection and subjective safety that a mandatory lane is able to offer over an advisory lane, and the greater flexibility in use of space that an advisory lane gives.

In some circumstances, an advisory lead-in lane wider than 1.5 metres next to a narrow (3 metres or less) general traffic lane may be preferable to a narrow (1.2 metres) mandatory lead-in next to a wider general traffic lane, if it encourages drivers to give more space on the nearside.

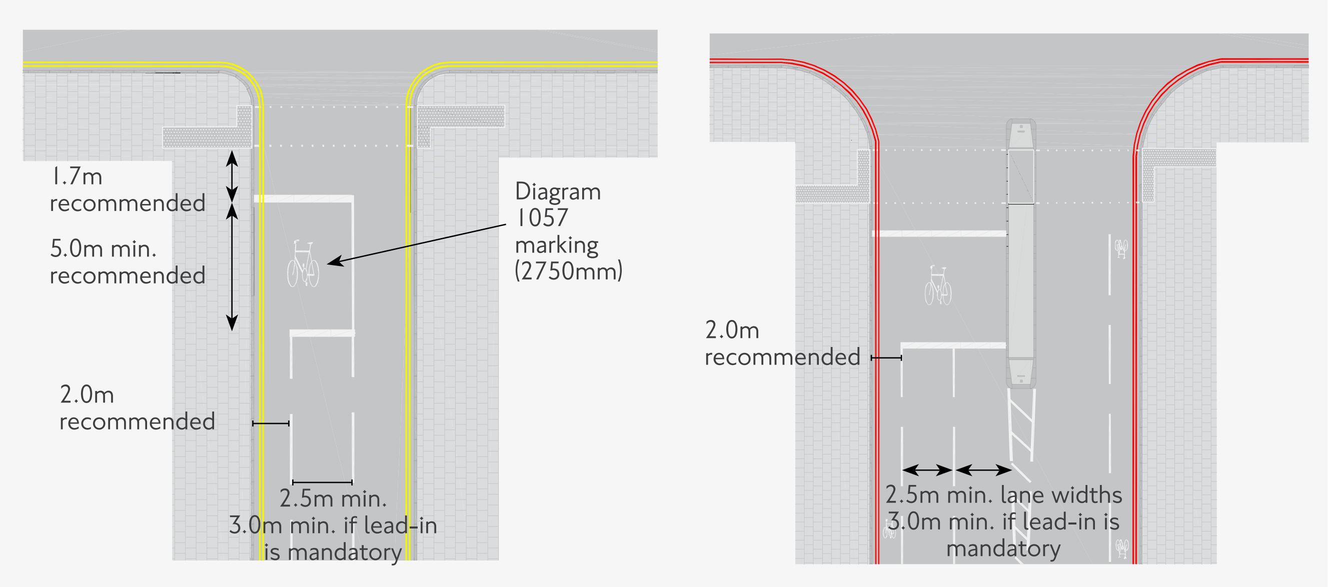
ASL lead-in lanes and gates are optional because TSRGD (2016) allows for cyclists to cross the first stop line at any point.

Where a lead-in is provided, it should be at least 1.5 metres wide. A width of 1.2 metres may be preferable to no lead-in, depending on the likely level of encroachment by motorised vehicles, but it will not permit access entirely within the lane by all types of cycle. Lead-in lanes may benefit from colour, where there is a need for conflicting movements to be highlighted, and TSRGD diagram 1057 cycle symbols to discourage encroachment.

Ideally, the lead-in should be as long as the maximum general traffic queue length during peak periods. The benefits of a long lead-in need to be balanced against the risks of encouraging cyclists to pass waiting vehicles on the nearside. Where buses and HGVs are present, a short lead-in may be more appropriate.

Protection for the lead-in lane may be considered. Road user behaviour under different traffic conditions needs to be taken into account, with the aim of encouraging drivers to give as much space on the nearside as possible. The need for consistency of provision should also be taken into account – if mandatory lead-ins are provided on a given road, they should ideally appear at every signalised junction.

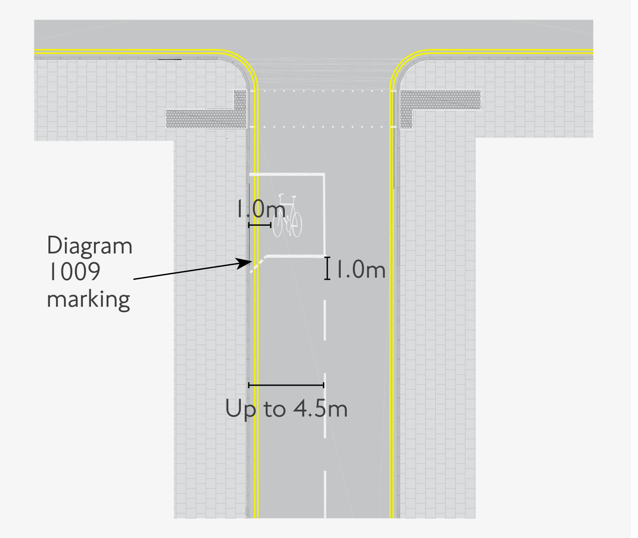
The general traffic lane adjacent to a lead-in should be a minimum of 3 metres wide. If an advisory lead-in lane is 2 metres or more wide, then the adjacent general traffic lane may be reduced down to a minimum of 2.5 metres wide, although this is likely to mean some encroachment on the lead-in at busier times. Where there are narrow traffic lanes and only a narrow lead-in is possible, it is likely to be preferable to omit the lead-in altogether and encourage cyclists to take a primary position in the nearside lane through use of centrally placed cycle symbols.




Indicative layout 5/12: Nearside advisory lead-in lane to ASL: adjacent to a) one and b) two general traffic lanes

## Gate entry

Provision of 1 metre-wide 'gate' entry to an ASL, using the TSRGD diagram 1001.2A marking, is an option that allows legal entry for cyclists to the reservoir where a lead-in lane cannot reasonably be provided. In all cases, a lead-in lane is preferable; gates represent a lower level of service. Nearside gate entry was included in amendments to TSRGD in 2011. However, since TSRGD (2016) allows for an ASL with a solid first stop line (diagram 1001.2B), there will rarely be a need for designers to include gate entry, particularly where the gate entry would have been on the offside.

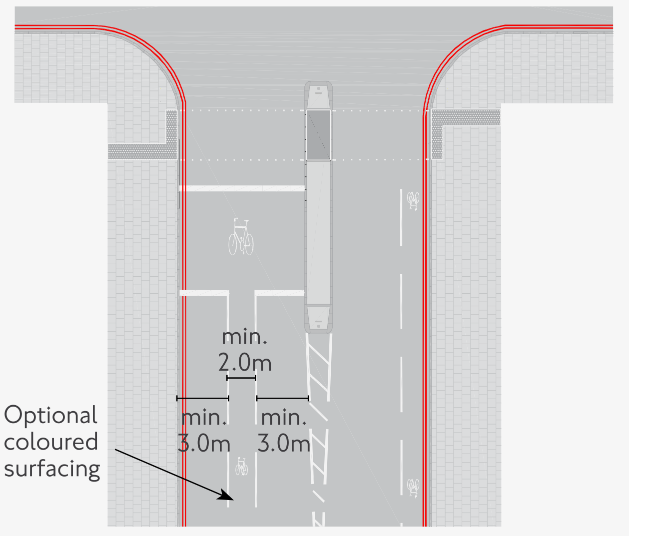



Indicative layout 5/13: Gate entry to ASL

## Central or offside lead-in lane

Another option to reduce the risk from left-turning motor vehicles is a centrally located or offside ASL lead-in lane. Central lead-in lanes should be at least 2 metres in width and should be used in conjunction with speed calming measures that reduce the level of risk arising from crossing movements. As is the case with all ASL lead-in lanes, the option of omitting the lane altogether is very likely be preferable to a facility with sub-standard widths and may be considered in cases where the width can be provided, depending on traffic conditions. Refer generally to the advice above on cycle lanes marked on the nearside of left-turning lanes, including the use of segregation to protect the junction approach.

Gate entry




Indicative layout 5/14: Central lead-in lane to ASL

Central and offside lead-in lanes at signal-controlled junctions

## Part-width ASLs

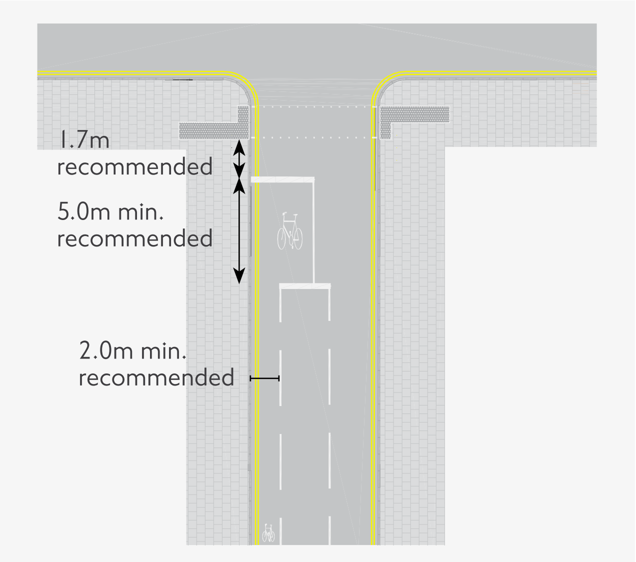
In some situations, part-width ASL boxes may be appropriate. These are not prescribed in TSRGD (2016), so site-specific authorisation is required. They do not cover the full width of all the approach lanes and tend to be better observed by motorists than full-width ASLs. They may be applicable where:

- Right turns are not permitted (for cyclists or all vehicles)
- There are multiple right-turning lanes
- Tracking of vehicle movements into the arm of the junction shows that they would encroach on the ASL reservoir if it were full-width
- A nearside lane is controlled with a left-turn filter signal

## Split ASLs

Split ASLs are possible on a single junction arm where movements are separately signalled and where lanes are physically separated by an island.

Part-width ASL used where right-turning vehicles would over-run a full-width ASL – Ruckholt Road, Waltham Forest



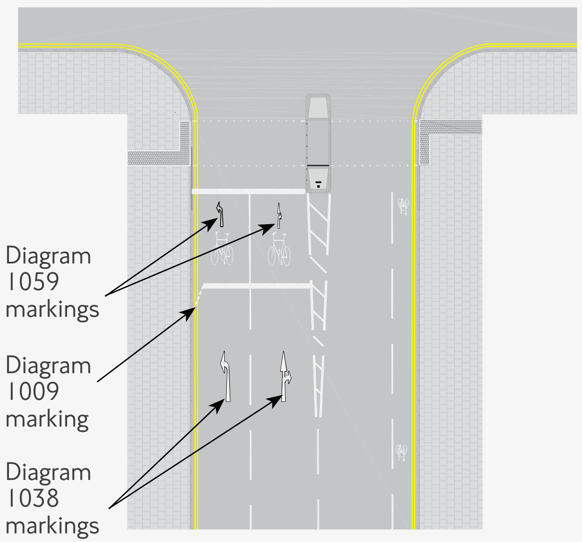

Indicative layout 5/15: Part-width ASL

ASL across two lanes only from one-way street (offside lane is a bus lane) – Gower Street, Camden

Split ASLs with island, Curtain Road, Hackney

Where there are multiple traffic lanes, there may be a case for marking recommended positioning for different cyclist movements through use of a split ASL with a dividing line and direction arrows for cyclists.

A good example would be where there is a left filter movement for general traffic that precedes the ahead movement, and where it would be appropriate to indicate specific suitable places to wait for cyclists undertaking different movements. Site-specific authorisation is required for this technique.




Indicative layout 5/16: Split ASL

Following the publication of TSRGD (2016), ASLs can be used at stand-alone signalised crossings as well as signalised junctions. Since zig-zag markings are required, it is not possible to have a cycle lead-in lane or gate entry in this instance – a solid (diagram 1001.2B) first stop line should be used. The zig-zags may, however, be offset by up to 2 metres from the kerb, as described above.

## Blind-spot safety mirrors

At junctions with ASLs, blind-spot safety mirrors mounted on signal poles can help give motorists a better view of cyclists in a lead-in lane on their nearside and in the ASL box. Their use is prescribed in TSRGD (2016), having previously been subject to an area-wide authorisation by DfT to local authorities in England in February 2012.

There is currently little evidence of the safety benefits of blind-spot safety mirrors and trials of their effectiveness have been inconclusive.

Any decision to include blind-spot safety mirrors should be taken by the authority responsible for signing (rather than traffic signal equipment). However, since they are mounted on signal poles, their installation will need to be considered and assessed by TfL Asset Management Directorate in a similar way to any other signal equipment. A risk assessment should also be made, with mirrors being most appropriate at junctions with both ahead and left-turn movements and where there are high cycle and HGV flows.

To achieve the optimum position, and reduce the risk of tampering and vandalism, mirrors will usually be mounted on the nearside primary signal pole, with 2.4 to 2.5 metres clearance to the footway. Ongoing maintenance costs must be considered by the scheme sponsor.


Blind-spot safety mirror showing view of nearside lead-in lane

## 5.5 Roundabouts and gyratories

### 5.5.1 Cyclists' use of roundabouts

Roundabouts and gyratories are rarely comfortable facilities for cyclists to use. It is essential to understand cyclists' desire lines and manoeuvres in order to provide for their safety.

At many UK roundabouts, the geometry creates difficulties for cyclists by not sufficiently reducing motor vehicle speeds. On the other hand, the ability to keep moving through the junction with no loss of momentum makes some types of roundabout, when well designed, potentially more appealing to cyclists under some circumstances than signal-controlled junctions.

Most collisions involving cyclists arise from vehicles entering the roundabout and colliding with cyclists who are on the circulatory carriageway. For all types, general approaches that can help reduce risks to cyclists include:

- Reducing entry, circulatory and exit speeds, eg by tightening entry and exit geometry and reducing excessive visibility
- Reducing motorised traffic volumes
- Reallocating unused carriageway space, such as reducing number of approach lanes to one
- Minimising the need for drivers to change lane on the roundabout
- Raising driver awareness of cyclists
- Giving cyclists clear, unobstructed passage up to, through, and on the exit from the roundabout
- Encouraging cyclists to take a visible position away from the nearside when circulating
- Managing traffic and conflicting manoeuvres through the use of signals
- Providing an alternative route or by-pass for cyclists that does not result in additional delay

As a rule, **the larger the roundabout, the greater the problems for cyclists**. On cycle routes, large roundabouts and gyratories should be considered for conversion to simpler signalised junctions or more cycle-friendly roundabout types. Where roundabouts remain, speed reduction is highly recommended.

### 5.5.2 Roundabout types

Roundabouts vary greatly in the UK by type, location and usage. The size of a roundabout, and the volumes and speeds of motorised traffic it accommodates, has an impact on the subjective safety of vulnerable road users, particularly cyclists. Pedestrians also suffer where they are required to undertake circuitous and often hazardous routes to negotiate a large roundabout. Types are defined in DMRB TD16/07 (2007), as follows, with a comparison provided in figure 5.8.

**Normal** – a roundabout with a kerbed central island at least 4 metres in diameter, usually with flared entries and exits. Small versions have a single-lane circulatory carriageway. Larger versions can have multiple lanes, or enough width on the circulatory carriageway and on the arms to accommodate two or three vehicles alongside one another.

**Compact** – a roundabout having a central island, with single-lane entries and exits, and with a circulatory carriageway that does not allow two cars to pass one another.

**Mini** – indicated by a domed or flush circular solid white road marking to diagram 1003.4 of TSRGD, between 1 and 4 metres in diameter, instead of a central island.

**Signalised** – a roundabout having traffic signals on one or more of the approaches and at the corresponding point on the circulatory carriageway itself. Design guidance for signalised roundabouts is provided in DMRB TD50/04 (2004).

**Double** – a junction comprising two roundabouts (normal, compact or mini) connected by a short link and designed as a single system rather than two separate roundabouts.

Figure 5.8 Comparison of roundabout types

| | Roundabout type | | | |
|---|---|---|---|---|
| **Design feature** | **Normal** | **Continental** (TAL 9/97) | **Compact** (TD16/07) | **Mini** |
| Approach arms | Ideally perpendicular but can be skewed | Perpendicular | Perpendicular | Preferably perpendicular but can be skewed |
| Entry width | Add one lane to entries | One lane, usually 4m | One lane, usually 4m | Variable |
| Entry radius | 20m, 6m minimum | Not specified but about 10m | Not specified but about 10m | Not specified |
| Entry angle | Preferably 20° to 60° | Approx 30° to 45° | Preferably 20° to 60° | Deflection desirable |
| Entry path curvature | Not to exceed 100m | Not to exceed 100m | Not to exceed 70m | Not specified |
| Exit arms | Easy exits | Tight perpendicular exits | Tight perpendicular exits | Not specified |
| Exit radius | 40m desirable, 20m minimum | Approx 10m | Approx 10m | Not specified/max 5m |
| Exit width | Add extra lane | Single lane | Single lane 4-5m | Not specified |
| External diameter | 28-100m | 25-35m | 28-36m | Dependent on movements |
| Island diameter | Min 4m | 16-25m | 4-18m (including overrun area) | 1-4m |
| Circulatory carriageway | 1-1.2 times entry width | Single lane 5-7m | Single lane < 6m | 5-7m |

## 5.5.3 Normal roundabouts

Normal roundabouts with single approach lanes and low flows will normally be satisfactory for cyclists as long as the geometry is 'tight'. Large conventional roundabouts, however, pose greater risks and are likely to be deemed too hazardous to use by a significant number of cyclists.

### Signalised roundabouts

One intervention that has been shown to have safety benefits is to signalise the roundabout. A study of before and after collision data of 28 roundabouts that had signals installed found a statistically significant decrease in the number of collisions involving cyclists (TRL, PPR 436, Literature review of road safety at traffic signals and signalised crossings, 2009).

This report also cites a TfL study from 2003 of 20 junctions, finding significant safety benefits for cyclists from signalisation for the at-grade types (F. Martin, An analysis of accidents at roundabouts 'before' and 'after' signal implementation, London Accident Analysis Unit, 2003). Despite this, large roundabouts are likely to remain a deterrent to non-cyclists or less confident cyclists even after signalising them.

As described in DMRB TD50/04, signalised roundabouts vary significantly: some or all of the arms may be signalised; the signals may be on the external approaches only, or on both external approaches and on the circulatory carriageway;

and the signals may operate full-time or part-time. Taken together with differences in numbers of arms and lanes, there are therefore many permutations governing how they operate. Whether they provide good facilities for cyclists tends to depend on the detail of how potential conflicts have been managed.

## Minimising risks to cyclists

The greatest degree of separation that could be implemented would be to remove cyclists from the circulatory lane of the roundabout altogether. Subject to design considerations set out in section 7.5, grade separation can be effectively achieved through use of subways and bridges. Alternatively, cyclists on each entry arm may be led off-carriageway to cross other arms on parallel pedestrian/cycle or toucan crossings. For large roundabouts, pedestrian and cycle access through the centre of the roundabout may be a good option to explore.

In this instance, the potential for delay to cyclists and for pedestrian-cyclist conflict from shared infrastructure needs to be balanced with the safety benefits of removing cyclists from the carriageway. The needs of vulnerable users, both pedestrians and cyclists, must be taken into account. This includes providing adequate widths and dropped kerbs to ensure accessibility for users of all types of cycle.

Off-carriageway cycling at roundabout in Berlin – motorists give way to crossing cyclists

Other ways to reduce the risks to cyclists include:

- Minimise the number and width of entry, exit and circulatory lanes; more than one entry lane greatly increases the number of potential conflicts involving cyclists at the roundabout see figure 5.8 for guidance on lane widths
- Reduce circulatory speeds by introducing over-run strips around the central island of the roundabout, thereby reducing the width of the circulating carriageway
- Minimise entry and exit flares (between 20 degrees and 60 degrees) generally, aim to provide arms that are perpendicular, rather than tangential to the roundabout
- Provide entry deflection to the left on entering the roundabout
- Provide islands to segregate cyclists at entry/exit and greater deflection for motorised vehicles
- Remove unused carriageway space and increase size of deflector islands while ensuring pinch-points for cyclists are not created
- Provide spiral lane markings for general traffic to improve lane discipline
- Put the whole junction on a table, which can help reduce speed on entry and exit, but is unlikely to make a difference to speed on the circulatory carriageway

Note that many of these measures suggest conversion to another roundabout type – a compact or continental form. For a cycle route, this is preferred to modifying a 'conventional' roundabout.

## 5.5.4 Mini-roundabouts

Mini-roundabouts are not generally recommended for inclusion on cycle routes. The main problems they raise are failure of vehicles to observe give way due to the geometry and failure to reduce speed through the junction. Where they exist, they should be considered for replacement where they have more than one entry lane and/or where there is an angle approaching 180 degrees between the entry and exit arms (and therefore little horizontal deflection).

Interventions that could improve existing mini-roundabouts for cycling include:

- Minimising entry and circulatory widths and speeds
- Altering geometry to create greater deflection angles
- Making it impossible for vehicles to overtake within the roundabout circulatory area
- Reducing single lane carriageway to a maximum width of 5 metres
- Increasing the central dome marking (to TSRGD diagram 1003.4) to 4 metres' diameter to slow general traffic
- Incorporating a speed table to reduce speeds on entry and exit
- Incorporating additional deflector islands for motor traffic (and considering omission of 'keep left' bollards from those islands wherever possible, as these can impair the visibility of turning motor vehicles and their indicator lights – such a proposal should be subject to a risk assessment)

## 5.5.5 Compact and continental roundabouts

These two types of roundabout are described, respectively, in DMRB TD16/07 (2007) and in TAL 9/97, Cyclists at roundabouts: continental design geometry (1997). They can be useful in addressing cycle and pedestrian safety issues because they reduce motor vehicle speeds significantly and they prevent weaving and overtaking on the circulatory carriageway, making it easier for cyclists to adopt the primary riding position around the roundabout.

Compact roundabout in UK with overrun strip

'Continental' roundabout in Lund, Sweden

As outlined in TAL 9/97, 'continental' roundabouts, which may be suitable for flows of between 5,000 and 20,000 vehicles per day, are likely to have a positive impact on cyclists' safety and comfort because:

- Their tighter geometries encourage all vehicles to take the junction more slowly
- They provide only one lane on entry and exit on every arm
- The central island is larger relative to the overall size of the junction when compared to a 'conventional' roundabout, meaning that the entry path curvature of circulating vehicles is increased (they are deviated more and therefore cannot take the roundabout at higher speeds)
- They are recommended for use in lower speed, lower traffic volume contexts (towards the lower end of the 5,000 to 20,000 vehicles per day range)

They are also advantageous for pedestrians because the tighter geometry allows for pedestrian crossings on desire lines much closer to the entry to the roundabout than would be the case for conventional roundabouts.

International best practice shows that roundabouts of this type may also be appropriate in situations where cycle flows are heavy (cyclists comprising a very high proportion of all traffic). This has been seen to be reinforced in some instances by prominent use of the cycle symbol on the circulatory carriageway.

Roundabout in Nantes, France

Compact roundabouts, as described in DMRB, are similar to 'continental' types, having single-lane entries and exits, but are tighter still. They are described as being suitable for roads of 40mph or below, with up to 8,000 vehicles per day. Importantly, the width of the circulatory carriageway is such that motor vehicles cannot overtake each other. Entries and exits should be tight, without flares, and the central island may need an overrun area to account for the movements of larger vehicles.

The Irish National Cycle Manual shows a similar model, the 'Shared Roundabout', with cycle symbols on the circulatory carriageway, but suggests that the maximum traffic flow for such a facility ought to be 6,000 vehicles per day.

## 5.5.6 Roundabouts with segregated cycle lanes

Unsegregated cycle lanes around the periphery of roundabouts are used in some European countries where drivers are accustomed to giving way when turning, but are very unlikely to operate in the same way in the UK and therefore not recommended for cycle routes.

In the UK, motorists are not accustomed to giving way on exit to other circulating vehicles and therefore need instruction and incentive to do so. TSRGD diagram 1003 (double dashed) and diagram 1023 (triangular) 'give way' road markings may help to promote that behaviour but, in order to reduce substantially risk of collision with cyclists, separation is recommended, effectively creating segregated lanes around the roundabout.

This leaves the problem of circulating cyclist priority over vehicles entering and exiting from the arms of the roundabout – a similar problem to the generic issue of lane or track priority across side roads (see section 5.3). Marking parallel cycle and pedestrian crossings across each arm in such a way that the cycle crossing aligns with the annular cycle lane is one way of addressing this issue. This will be available when the revised TSRGD comes into force in 2015. However, see section 5.2.10 for discussion of pedestrian crossings over cycle tracks and the potential need to stagger certain arrangements.

Roundabout with off-carriageway tracks in Amsterdam

### 'Dutch style' roundabout

A type of roundabout where cyclists are segregated from other road users with orbital cycle tracks has been trialled off-street by TfL. A 'Dutch style' roundabout of this sort has one general traffic lane with parallel cycle and pedestrian crossings on each arm, close to the roundabout itself, to minimise deviation of pedestrians from desire lines.

The geometry is arranged such that motor vehicles leaving the roundabout approach the crossings at an angle close to 90 degrees to maximise inter-visibility. The focus of the trial is on functionality and safety – ensuring that all users understand and use the roundabout in the way that is intended, particularly the various requirements to give way.

'Dutch style' roundabouts are a trial measure and the various components are yet to be tested on-street. Any proposal for a new or remodelled roundabout incorporating separation for cyclists and cycle and pedestrian priority on each arm should be discussed with TfL at an early stage. Outputs from the trials and any further testing will be added to this guidance when available.

Dutch style roundabout

## 5.5.7 Informal 'roundabouts'

If well designed, removal of formal priority to bring about more cautious user behaviour (see section 3.4.8) can be applied at junctions to imply a roundabout – by incorporating circular patterns in the surface treatment. These are a flexible alternative to priority junctions in lower-traffic scenarios. There are no set dimensions for such a feature.

Where there is little traffic present, vehicles can progress through the 'roundabout' as they would at any priority junction. Where traffic is heavier, vehicles are encouraged by the appearance of the feature to act as if it were a roundabout and give way to the right. Informal roundabouts can be advantageous to cyclists, allowing them to progress through a junction without having to stop and start, and generally encouraging lower speeds.

## 5.5.8 Gyratories and one-way systems

Gyratories in London vary from area-wide one-way systems to large, 'roundabout-type' junctions. This variation in types means that each needs looking at on its own merits, as part of a wider network management approach. It is essential that an area-wide analysis takes place and that all opportunities for improvements of the local area and for better pedestrian accessibility are taken into account. The junction assessment tool (see chapter 2) can assist in analysing cycle movements through various junctions that may form part of a gyratory.

For cycling, the issues that gyratories and one-way systems present generally include the following:

Informal roundabouts at Moor Lane, City of London and Bexleyheath town centre, both of which have a 'roundabout-like' feature in the carriageway

- Little feeling of safety through close proximity to large volumes of fast-moving traffic and/or large vehicles – factors identified in chapter 2 as leading to particularly low levels of service for cyclists
- Lack of directness – one-way movement generally leads to longer journeys and does not allow cyclists to follow desire lines
- Lack of legibility – movement through such junctions tends not to be intuitive and requires extensive signing
- Intimidating road conditions – the prospect of moving across lanes of moving traffic to get into the appropriate road position

## Gyratory redesign

Gyratory removal and a return to two-way working, although likely to be a major project, is an option that can help address the above issues. It is more intuitive, likely to be lower speed, almost always leads to more direct journeys and can enliven and 'humanise' streets that previously were blighted by fast-moving bursts of one-way traffic, helping to foster a more diverse range of active street and land uses.

The focus of any gyratory redesign should be on enabling more direct journeys with less delay, particularly for pedestrians and cyclists, and on allowing more 'conventional' approaches to be taken to cycling provision and to management of motor traffic speed and volume. This may only entail part-removal or partial remodelling of a gyratory or one-way system.

## Return to two-way working

Other selected interventions can also be made to improve conditions for cyclists. Taking a filtered permeability approach and allowing cyclists to make movements that are banned for other vehicles, together with opening up one-way sections to contraflow cycling, are of obvious benefit for cyclists from a coherence and directness perspective. However, care needs to be taken to avoid putting cyclists into conflict with fast-moving opposing traffic. A higher degree of separation, such as use of full or light segregation, might be appropriate in such cases.

Where one-way systems are likely to remain, and where space is available, an opportunity exists to run cyclists in contraflow around much of the system. This can constitute a high level of service, provided each junction within the system is designed so as to minimise conflicts and delays for cyclists. It can help in avoiding issues related to integration with bus infrastructure.

General traffic lane converted to off-carriageway tracks at Wandsworth Gyratory

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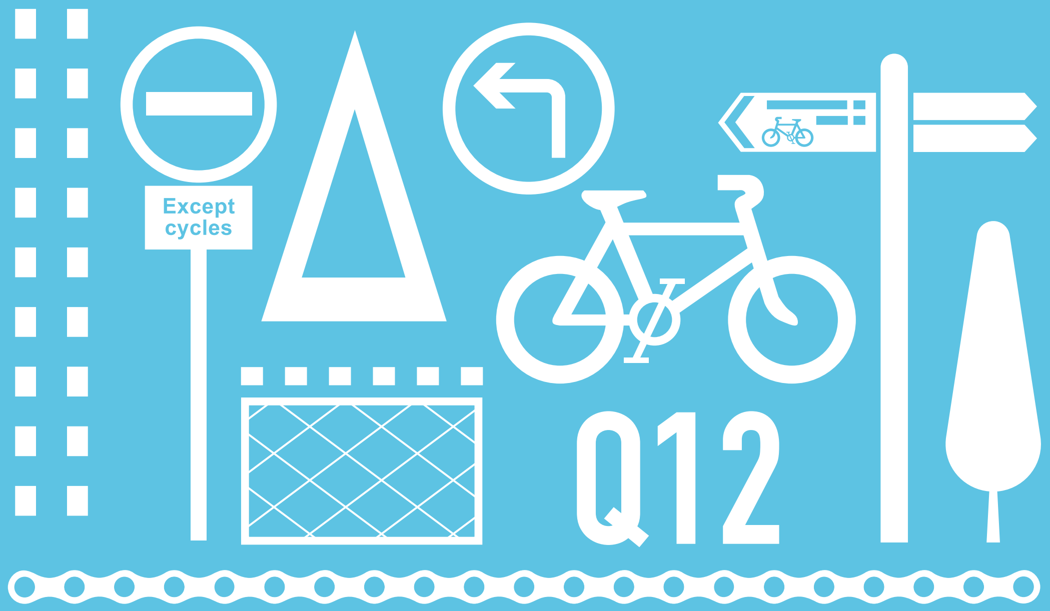
# 6. Signs and markings

This chapter gives an overview of requirements on signing to support cycling, both for dedicated infrastructure and for cyclists' general use of the highway.






**Version control**

Version 1 (Dec 2014) – Published

Version 2 (Sept 2016) – Amendments throughout following publication of TSRGD (2016)

## 6.1 Signing requirements

### 6.1.1 Signing principles

On the public highway, all signs and road markings must be taken from and comply with conditions for application set out in the Traffic Sign Regulations and General Directions (2002), referred to in this document as TSRGD. Any variations require further authorisation from the Secretary of State for Transport. This usually takes the form of a site-specific authorisation, but DfT may also authorise the limited use of a sign or marking by a single authority on any of its highways. This can be particularly useful for the purposes of conducting on-street trials of non-prescribed signs.

**TSRGD revision, 2014-15**

The Department for Transport (DfT) is undertaking a full revision of TSRGD and published its Consultation on the draft Traffic Signs Regulations and General Directions 2015 in May 2014. The proposed changes this brings about are referred to throughout LCDS, and many have already been authorised for use on the TfL network. However, others may not be used until the new TSRGD comes into force in mid-2015.

Signing plays an important role in supporting and enforcing safer, more comfortable, legible and coherent cycling infrastructure. Road signs and markings are defined, together, as 'traffic signs' within the Road Traffic Regulation Act 1984. References to 'signing' in this chapter therefore include both. Signing has three main functions:

- Regulatory – traffic management signing that is enforceable
- Warning and informatory – traffic management signing that warns of hazards and guides vehicle positioning
- Wayfinding – location and direction signing

It is important to understand these multiple roles, particularly where one is regulatory, as the sign must meet regulatory requirements in order to support enforcement activity practised by the highway authority.

Signing contributes to the level of service for cycling, as set out in figure 6.1.

Off-highway, signing is important to indicate where cycling is allowed and recommended, and to support cycle wayfinding. It will need to comply with guidance and standards produced by the managing authority. Recognisable elements from on-highway signing – such as the cycle symbol, route numbers and any branding or colour associated with cycle routes – should be incorporated into such signing wherever possible to support legibility.

Figure 6.1 Key signing considerations in CLoS

| Factor | Indicator | Relates in this chapter to |
|---|---|---|
| Coherence: **Connections** | Ability to join/ leave route safely and easily | Fit-for-purpose signing, conforming to regulatory requirements |
| Coherence: **Wayfinding** | Signing | Wayfinding and direction signing |
| Attractiveness: **Minimise street clutter** | Signing and road markings required to support scheme layout | Minimising the need for signing |

### 6.1.2 Applying the principles

Signs and markings should be applied sparingly in order not to add unnecessarily to street clutter. There are many types of information that can be better conveyed through informal cues in the environment than through formal signs. For example, cycle facilities should ideally be physically separate from pedestrian facilities, or at least look different, thereby reducing the need to instruct users about where cycling is and is not permitted.

Without adding unduly to clutter, designers should seek the most appropriate combination of signs and markings to help guide cycle positioning and direction. Sign posts can be unsightly and obstructive and should be kept to a minimum, unless used as a short-term measure to support legibility on a new route. Surface markings are very often preferable, but they can wear quickly and result in higher maintenance costs and they may be unacceptable in certain locations such as Conservation Areas.

Where it is essential to use signs on streets, then lighting columns, existing sign-posts, walls, railings and bollards should be considered as a sign fixing point in the first instance – subject to seeking permission from the owner and to a wind loading assessment as appropriate.

Maintenance of signs and markings is as important as design and implementation of signing. Highway authorities should adopt a maintenance schedule (see section 7.4.2 for further details) to check that signs are present, in good condition and correctly mounted, and that surface markings are relevant, clear and safe. Inappropriately placed cycle signing and signing in a poor state of repair or inadequately illuminated must be rectified, removed or replaced as a priority.

Such inspections should take place at least every two years. It is also important that the state of road markings is inspected following reinstatement after resurfacing or utilities works.

### 6.1.3 Regulatory changes

Regulations and national guidance are increasingly promoting a more flexible approach to signing, which will allow the principles set out above to be implemented more effectively. The revision of TSRGD, published in 2016, followed a national traffic signs policy review and the publication of the policy paper, Signing The Way (2011). Key themes from this review included:

- Providing greater discretion for local authorities to design and deliver traffic signs that meet local needs
- Greater emphasis on the role and responsibility of traffic engineers and sign designers
- Reduction in the need for central approval of non-standard signing
- Improved signs and signals that will promote safer cycling and walking
- Reducing the environmental impact of signs
- Welcoming innovation and trialling

Area-wide authorisations issued in October 2011 made it possible to add an 'Except cycles' plate to a 'no entry' sign to permit contraflow cycling

In advance of the revision of TSRGD, DfT issued a series of area-wide authorisations to all local authorities in England, covering a range of new signing measures. These included the ability to use the 'except cycles' plate with the 'no entry' sign, greater flexibility in signing for 20mph zones, and cycle safety mirrors. These can be used without further approval from DfT. The authorisations can be found on the DfT website and in the Area-wide authorisations and special directions guidance note (2012).

In January 2012, TSRGD was amended to include a range of new signs, including some that are beneficial for cycling (Traffic Signs (Amendment) (No. 2) Regulations and General Directions, 2011).

Flexibility in sign use: small version of the shared-use path sign as part of context-sensitive design

These included signing for contraflow cycling in one-way streets and new cycle route signing (see Traffic Advisory Leaflet 1/12).

The 'Schedule of signs' (section 6.4) summarises most of the signs used for cycling infrastructure in the UK, over and above those that form part of the general traffic signing regime. This references the TSRGD (2016) diagram numbers. Supplementary advice on the correct application of signs and road markings can be found in the Traffic Signs Manual (HMSO/ Stationery Office).

## 6.1.4 Signs requiring enforcement

Traffic Orders require regulatory signs and markings to give them effect and enable enforcement. These orders are particularly relevant to on-carriageway restrictions, such as cycle exemption from 'no entry' or banned turns. Similar provision can be made in many cases at traffic signals, but different diagram numbers apply. See section 5.4.2 for guidance on procedures for schemes involving traffic signals.

Traffic Orders are not normally needed for off-carriageway cycling other than in the case of one-way operation of cycle tracks (see section 4.1.2).

TSRGD (2016) now prescribes variants of diagram 877 that allow for 'Except buses and cycles' or 'Except cycles' to be added to lanes dedicated to left-turning general traffic but also used by buses and cycles. This and similar signs should only be used where road markings do not provide sufficient clarity.


Cycle exemptions to general traffic restrictions

diagram 606 – proceed left/right

609 – turn left/right

612 – no right turn for vehicular traffic

613 – no left turn for vehicular traffic

616 – no entry for vehicular traffic

816 – no through route for vehicular traffic


Exemption to box sign restriction

Other markings such as yellow 'box junction' markings to diagram 1043 and 1044 can be provided at junctions where cyclists' movements would otherwise be obstructed. This can be particularly useful at a cycle-only crossing of another road where queuing traffic is common. Note that requirements as to the shape and extent of these junctions have been updated in TSRGD (2016).

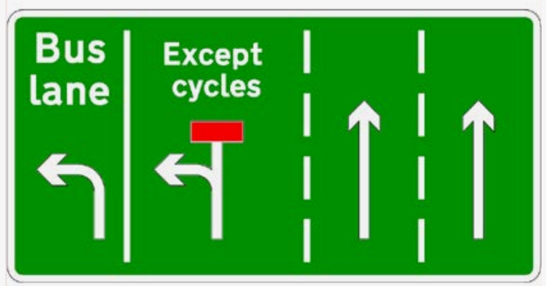



Diagram 877 variant

## 6.1.5 Signing to support wayfinding

This section sets out general principles for direction signing in support of effective cycle wayfinding, with further information on use of surface markings and signs provided in sections 6.2 and 6.3. It applies primarily to Cycle Superhighways and other branded routes in London. A new signing system is being developed for Quietways, examples of which are shown below. Further details are provided in the separate document, Quietways Signing Guidance (2016).

Direction signing helps cyclists find their way and assess the physical and mental effort needed to complete their journey. Providing direction signing also adds conspicuity to cycling facilities: it advertises the route to existing and potential new cyclists and alerts other road users to the likely presence of cyclists.

Effective wayfinding needs to build on people's own 'mental maps', helping them to find their way by linking together landmarks and to choose routes that are efficient but also safe and comfortable. Many cyclists, existing and new, will do much of this through pre-journey planning and personalised on-route wayfinding provided by tools accessed from smartphones. However customer research shows that there will still be a role for on- and off-road signing that is easy to read at a glance and that can both give information and reassure the user.

Signing to support wayfinding for branded routes should therefore be provided in three main ways:


Indicative Quietways signing

- To give directions ahead of or at a decision-point – through directional signs and finger posts, which may list destinations in one or more direction, or may show the continuation of a route through a 'map-type' element (if following such a route is not intuitive)

- To confirm the route at and after a decision-point – through surface markings and see-through confirmatory signs
- To give reassurance – primarily through surface markings mid-link

Sections 6.2 and 6.3 give more information about recommended signs and markings for wayfinding. Consult programme-specific requirements for further guidance on how to apply this signing.

Direction sign at decision point


See-through confirmatory sign

Marking for reassurance

## Direction signing strategy

For each route, a direction signing strategy should be prepared, to ensure that signing is coherent, consistent and easy-to-follow. This should take account of and maintain appropriate continuity with existing signing of cycle routes along and crossing the route. It should have the input of all authorities responsible for managing the highways or other spaces through which the route passes.

The strategy needs to recognise existing cycling provision and networks and links in the vicinity. It is an opportunity to identify and, where appropriate and feasible, enable cycle movements that are currently banned, such as contraflow provision or exceptions to banned turns. It should include a schematic diagram of the route with adjoining routes and destinations for agreement among stakeholders to ensure a joined-up approach.

Preparation of the signing strategy should ideally be part of the route planning and scheme design process. A base plan should be prepared, taking account of:

- Crossing-points with other routes or other unbranded cyclist desire lines, identified from route rides, the highway authority's own information about cycling in its area and input from local cycling stakeholders
- Potential strategic and local destinations
- Existing cycle and vehicle signing – signs recorded photographically
- Locations for proposed direction signing – preferably existing posts or lamp columns

A draft schematic ('spider') diagram should then be prepared, showing the route considered and the destinations proposed. Destinations should be taken from a schedule of primary and secondary locations agreed through programme-specific requirements.

## 6.2 Surface markings

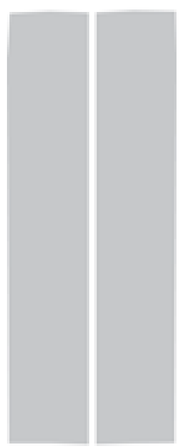
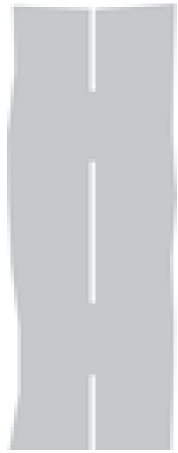
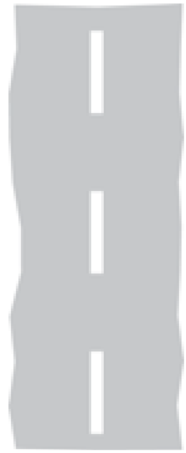
### 6.2.1 General requirements

Surface markings are used to communicate regulatory traffic management and directional information to cyclists on-carriageway. All markings are classified as traffic signs and are covered by TSRGD. The markings set out below should all be provided in retro-reflective material. These markings should not generally be used off-carriageway (on footways, footpaths or shared use areas).

It is essential to check the condition of surface markings on a regular basis, particularly in areas also used by motor vehicles, and to take swift remedial action when needed. This checking should form part of regular maintenance regimes – see section 7.4.

### 6.2.2 Lane markings

Although the diagram 1009 marking should have the 1 in 10 taper for mandatory cycle lanes, an angle of 30 or even 45 degrees may be adequate for advisory cycle lanes because it is not so essential to deflect vehicles in advance of it (Traffic Signs Manual, chapter 5, paragraph 16.10). The taper is not necessary where a cycle lane ends before and recommences after a junction, bus stop cage or crossing zig-zag marking.

|  |  |  |  |  |
|---|---|---|---|---|
| **[1049B]** Mandatory cycle lane marking (or division of a route between pedal cycles and for pedestrians) | **[1004]** Advisory cycle lane marking (when used in conjunction with diagram 967) | **[1055.3]** 'Elephants' footprints' (to define a controlled, cycle-only route across a carriageway) | **[1009]** Entry taper to cycle lane (recommended 1:10 taper where cycle lane begins) | **[1010]** Lane through junction (or edge of carriageway marking) |
| 150mm wide or 250mm where lanes are 2m+ wide | 100 or 150mm wide 4000mm dash 2000mm gap | Square, with gap equal to length of one side, anywhere in range 250-400mm | 150mm wide 600mm dash 300mm gap | 150mm wide 1000mm long 1000mm gap |

A longer dashed advisory cycle lane marking exists (diagram 1004.1, 6000mm dashes with 3000mm gap) but its use is not recommended because it is for roads of 40mph or more, where an advisory cycle lane is unlikely to be appropriate.

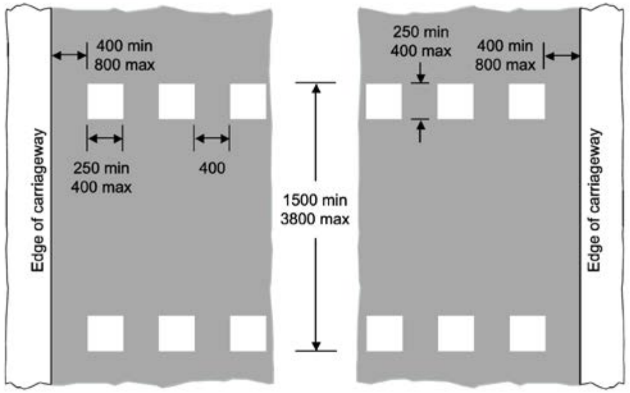
Where a cycle lane is at least 2 metres wide, consideration should be given to using the 250mm-wide version of the diagram 1049B marking, as prescribed in TSRGD (2016).

The use of diagram 1010 markings for the continuation of cycle lanes across junctions is established in TSRGD (2016).

## Elephants' footprints

Following the publication of TSRGD (2016), diagram 1055.3 'elephants' footprint' markings can be used to delineate a route dedicated to cycles through a signal-controlled junction. The markings may be between 250mm and 400mm wide.

These markings should also be used for the cycle part of a parallel priority pedestrian and cycle crossing (see section 5.2.6).




TSRGD diagram 1055.3, marking a route for vehicular traffic consisting solely of pedal cyclists either across a signal controlled junction or across a parallel crossing

Elephants' footprints markings at Royal College Street / Crowndale Road junction, Camden

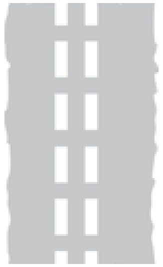
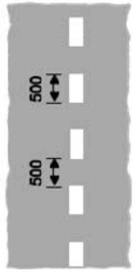
International practice: use of elephants' footprints in Copenhagen

## 6.2.3 Give way markings

Single-dash give way markings are used for zebra and parallel pedestrian/cycle crossings (TSRGD 2016).

Give way markings should not be used at linear transitions between cycle tracks and cycle lanes. They must also only be used for vehicle-vehicle give way movements – they cannot be used where cyclists should give way to pedestrians.

'Keep Clear' (TSRGD diagram 1026), yellow box, hatching and chevron road markings may also be useful for warning drivers to give priority to cyclists crossing or moving in the same direction. They can help remind drivers to give cyclists enough space to pass safely. 'Keep Clear', often employed for safeguarding access for emergency vehicles, can also be used to help keep cycle gaps unobstructed by parked vehicles (although they are not enforceable).

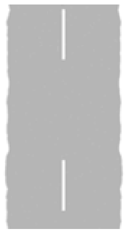
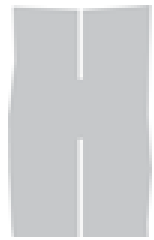
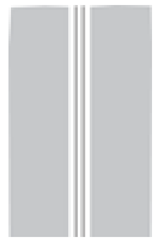
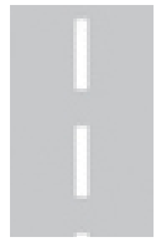
| | | |
|---|---|---|
|  |  |  |
| [1003]<br>Give way double-dashes | [1023]<br>Give way triangle | Give way single-dashes |
| 300mm dashes<br>1500mm gaps<br>300mm gap | 3750x1250mm full-size but 1875x625 recommended for cycle use | 200mm wide<br>500mm dashes<br>500mm gaps |


Chevron markings used with islands

Keep clear markings allow space for cyclists to cross

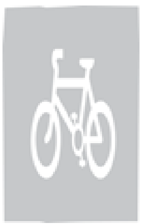
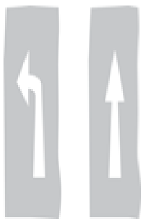
## 6.2.4 Other markings for cycle tracks

For two-way cycle tracks, centre line markings should consist of 50mm-wide diagram 1008 markings generally, with two sets of the longer diagram 1004 markings used where the track adjoins an intersection or shared use area (where more conflicting movements are likely). Where centre lines are omitted – for example, where flows are expected to be tidal and designers wish to suggest there is more flexibility in use of width – an alternative may be the use of pairs of diagram 1057 cycle symbols in opposing directions.

| | | | |
|---|---|---|---|
|  |  |  |  |
| **[1008]**<br>Centre-line marking for two-way cycle tracks | **[1004]**<br>Centre-line marking for use at intersections | **[1049.1]**<br>Raised marking to divide a route between pedal cycles and pedestrians | **[1009]**<br>Edge of carriageway on cycle track |
| 50mm wide (when used as a centre line)<br>2000mm dash<br>4000mm gap | 50mm wide (when used as a centre line)<br>4000mm dash<br>2000mm gap | 150mm wide, with 50mm top face<br>12-20mm high<br>May need 20mm gaps at 3m intervals for drainage | 100mm wide<br>300mm dashes<br>150mm gaps |

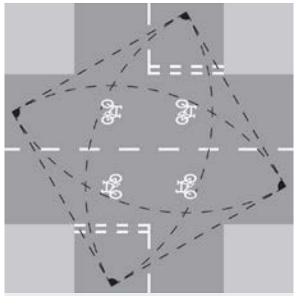
## 6.2.5 Cycle symbols and direction signing

Diagram 1057 cycle symbol markings should be selected according to the width available: usually medium-sized, but small for cycle tracks and large for ASL boxes. They are used, orientated in the direction of travel for cyclists, in three distinct and well recognised ways:

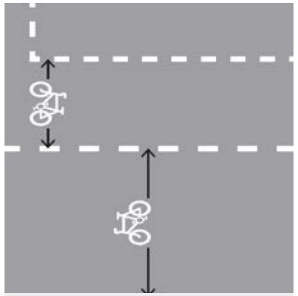
| | | |
|---|---|---|
|  |  |  |
| **[1057]** Cycle symbol marking | **[1059]** Route direction arrows | **[1057.1]** Number of a cycle route |
| 750x1215, 1100x1780 or 1700x2750mm | 1000 or 2000mm high Smaller size recommended for direction signing | 705, 1305 or 1600mm high Select to match use of 1057 and 1059 |

- For conspicuity: alerting other road users to expect the presence of cyclists
- For positioning: suggesting a recommended line of travel for cyclists
- For wayfinding: indicating a route, particularly at a decision point

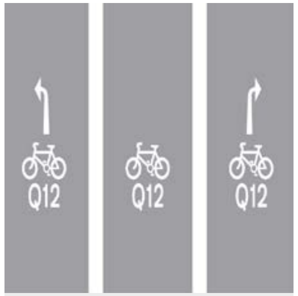
Any use of this marking should either meet all three functions, or positioning and conspicuity without an explicit wayfinding function.



Cycle symbols for conspicuity



Cycle symbols for positioning




Cycle symbols for wayfinding

The cycle symbol should never be used for wayfinding where it compromises the positioning function, particularly at junctions and past parking and loading bays. Although only some cyclists will take cues on positioning from the cycle symbols, location of the symbols should be such that they reinforce where cyclists will have been trained to position themselves in any given situation.

The diagram 967 sign should only be used with the diagram 1057 road marking where there is an additional need to alert other road users to the presence of a cycle route. This is consistent with advice in Traffic Advisory Leaflet 1/13, Reducing Sign Clutter, on interpreting TSRGD (2002) guidance flexibly.

Diagram 967 sign

For cycle lanes and tracks, cycle symbols should be provided at the start of the facility and then immediately after each decision point thereafter: after a side road has joined the route, and before and after parking bays, loading bays and bus stops.

Cycle symbols can also be used to mark a cycle route where a lane or track is not provided. They should be located before and after side roads, loading/parking bays and bus stops.

## Positioning at side roads

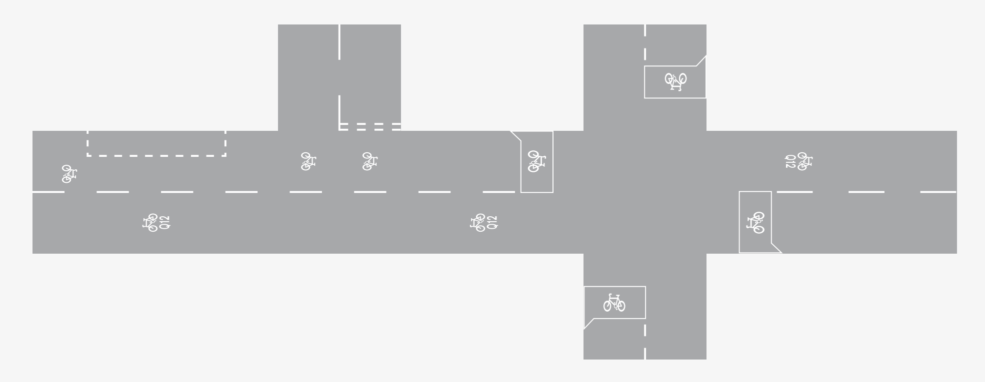
Cycle symbols marked at the entry to and exit from side roads joining a cycle route are used to alert motorists and pedestrians of the presence of cyclists. They remove any need for warning signs to diagrams 962.1 or 963.1 except for situations where contra-flow cycling is permitted. At side roads with restricted access or less than 5 metres wide, kerb-to-kerb, one rather than two diagram 1057 markings may be used.

## Positioning in narrow, shared lanes

Symbols should never be placed so as to encourage a riding position closer than 0.5 metres from a kerb, side road or obstruction. Where conditions are appropriate for primary position riding, which generally means in general traffic lane widths of less than 4 metres, symbols should be placed in the centre of running lanes.

## Symbols in opposing directions

Cycle symbols in opposing directions should usually be placed so that there is at least 10 metres between the edges of the opposing symbols. Exceptions are permitted where additional symbols are provided to identify decision points and where, on two-way cycle tracks, there is a specific need to mark two cycle symbols together in opposing directions to indicate two-way movement (usually when there is no centre line in the track).



Indicative layout 6/01 Cycle symbol placement in narrow general traffic lanes (Note that the large diagram 1057 symbol should be used with ASLs, and the medium-size elsewhere)

## Repeaters

Over and above this minimum provision, the placement of repeater symbols is dependent on the place and movement characteristics of the street and on wayfinding requirements associated with cycle routes. In some cases, it may be beneficial for each symbol to be visible from the previous symbol, for route continuity, but this may not be necessary on local streets where it is intuitive that cyclists should not turn off. Indicatively, the longest gaps should be no more than 250 metres, and a working minimum on links is 20 metres. Where practical, cycle symbols should be placed close to street lights, to maximise visibility after dark. Recommended spacing of cycle symbols is summarised in figure 6.2.

Diagram 1057 symbols showing continuation of cycle route and recommended road position

Figure 6.2 Recommended spacing of diagram 1057 markings for route continuity

| Location | Spacing/ layout |
|---|---|
| Local streets / Quietway | 150-200m |
| Off-carriageway cycle track (surfaced) | 100-200m |
| Cycle lanes on-carriageway (normal) | 20-100m |
| Cycle lanes (high stress) | 20-30m |
| Main road route (no lanes) | 20-30m |
| Cycle feeder lane to ASL | 10-30m |

## Symbols marked through junctions

Cycle symbols may be used as a substitute for lane markings through junctions (see section 4.3). This may be most appropriate where a route is signified by diagram 1057 symbols only before and after the junction, as it provides continuity. Placement of symbols across junctions should ensure that a smooth, continuous alignment for cyclists is maintained. Where bus stops or loading/parking bays mean that cycle symbols are placed well away from the nearside in the vicinity of a junction, that same line for symbol placement should be continued through the junction.

Well-placed cycle symbols through a junction to show a recommended route for ahead cyclists (top). Poorly placed cycle symbol on a bend (bottom)

## Signing direction of a route

For signing a change of direction of a route, diagram 1059 markings may be used in conjunction with the diagram 1057 marking. If a branded route is numbered, the number may also be provided using the diagram 1057.1 marking.


Care should be taken in such circumstances not to suggest to cyclists that they must move in the direction indicated. This can be a problem, for example, at a T-junction where a local street joins a main road, where it may be unwise to suggest to road users that cyclists will always be turning in the direction indicated or where the marking may be obscured by queuing vehicles. This technique is therefore best used:

- On streets with low traffic volumes and existing calming measures, where directional surface signing is unlikely to be covered or misinterpreted
- To sign where a route turns off to a minor street or cut-through where it is clear that continuation on the current alignment is equally valid for cyclists (provision of visible cycle infrastructure on that street can help in that regard)
- To sign different cycle movements within a cycle track at a signal-controlled junction (in which case there is no ambiguity because more than one direction is indicated)

Signs rather than road markings can be used to indicate change of direction of a cycle route, but only where misinterpretation of a direction arrow increases collision risk for road users.

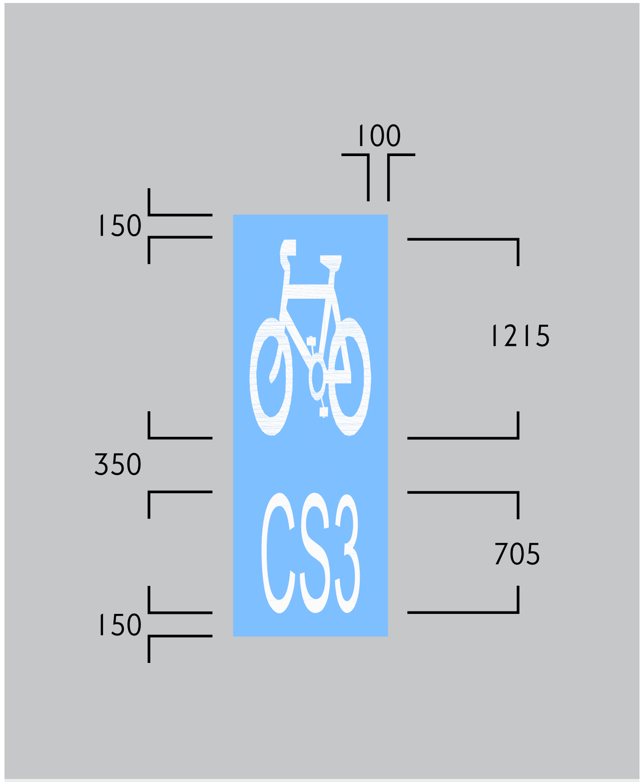
## 6.2.6 Coloured surfacing

Coloured surfacing has no legal meaning and may be applied to cycle-specific infrastructure. It should only be used in conjunction with regulatory signing (including markings). Use of colour is optional and the benefits should be considered against capital and maintenance costs and impacts on the streetscape.

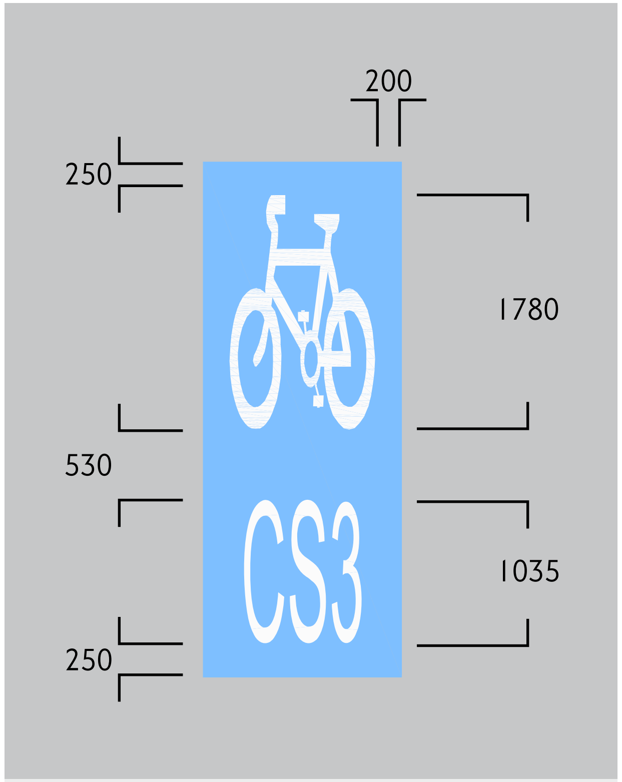
It is recommended that coloured surfacing should be used selectively to emphasise road markings, such as the cycle symbol. It may therefore highlight for all road users the likely movement of cyclists at locations where motorised vehicles may encroach upon or cross their path. It should be reserved for conspicuity and not used for wayfinding purposes.

Examples of where surface colour may be considered include lanes marked through priority and signal-controlled junctions and alongside on-street parking or loading bays. Risk assessment should inform the approach in every case; surface colour should not be applied generally at all such locations.

On Cycle Superhighways, the cycle symbol on a blue patch may appear with a route number, but this application should still fulfil the conspicuity criteria.




Small Superhighway patch (2570x950mm)




Large Superhighway patch (3845x1500mm)

## 6.3 Signs

### 6.3.1 Direction signs

Most regulatory cycle direction signs, such as advanced direction signs and finger post signs, can be created using the 'menu approach' based on item 8 in TSRGD (2016), schedule 12, part 2.

#### Advanced direction signs

These are used prior to junctions, route intersections or other decision-points. They give directional information, but may also serve to give warning of the junction and enable initial manoeuvring to take place. Advanced direction signs may be appropriate in advance of a right turn or where the recommended path through the junction for cyclists is not otherwise obvious. The main types are:

- Simple direction sign, where an arrow shows how a cycle route continues
- Stack signs, where different destinations are listed above each other
- Map-type signs, which show a pictorial representation of the junction and can also include destinations and route types

A map type sign, or map-type panel within a sign, can show a precise route through a junction, distinguishing between on- and off-carriageway provision, and showing priorities and crossings.


Map-type signs to TSRGD diagram 2601.2


Stack sign


Simple direction sign showing route number


Quietway direction sign (route- or site-specific approval will be required)

#### Finger posts

Finger posts can provide simple information about directions or incorporate destination names and route types as necessary. They should be placed at the junction or decision-point itself and point in the appropriate direction using a chevron-type arrow.


Examples of finger posts incorporating different route branding

## Confirmatory signs

Route confirmation signs have a separate diagram number, 2602.2, in TSRGD (2016). They may be used either as see-through confirmatory signs at junctions, located on the far side of a junction to confirm the continuation of a route for cyclists, or as repeaters on long sections of cycle routes. Both should preferably be used on existing posts or lamp columns, and both may substitute for surface markings when area-specific guidance may preclude use of the markings.

Repeaters should be provided at least after each decision point. Where only one route number is given, sign size is 165mm wide and 230mm high. Note that the cycle route sign to diagram 967 may also serve as a confirmatory sign.

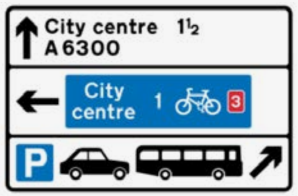
## Route and branding information

As the above sign types show, route numbers and branding colours can be incorporated into the blue-background signs, if used in conjunction with the cycle symbol. Coloured patches for Quietways are purple and for Superhighways rubine red. Route symbols may also be included, with DfT authorisation, as is the case with Cycle Superhighway finger post signing.


Confirmatory/repeater signs with patches referring to branded cycle routes. Routes in brackets are accessed indirectly in the direction followed.

Sign to diagram 967 of TSRGD

Signing information for cyclists may also be added to other direction signs as a panel using item 7 in TSRGD (2016) schedule 12, part 9. This gives cycle route information on a blue background as part of a 'conventional' direction sign for all road users and may incorporate coloured patches in the same way as the signs above.




Panel indicating a national cycle route, incorporated into a non-primary route direction sign


Panel with patch showing a Quietway route

## Sign design

Detailed sign design requires specialist traffic engineer input, reference to the Traffic Signs Manual and TSRGD and use of appropriate computer software. Overall, the size of signs should be kept as small as possible while clearly conveying the necessary information.

Where destinations are listed, closest destinations should be at the top of the sign, with more distant and strategic destinations below. For Superhighways, time to destination in minutes should be used, followed by 'mins'. Journey times should be rounded up to the nearest five minutes, except where a journey is expected to last less than 20 minutes.

Timings should be calculated using an average on-carriageway cycling speed of 10 miles per hour (16 kilometres per hour, as used in the TfL Journey Planner) and confirmed by riding the route at different times and conditions so that a realistic and accurate average time is provided. Off-highway – through parks and canal towpaths, for example – a lower speed of 8 miles per hour may be applied if appropriate.

'Via' and other wording can be introduced on signs to clarify a route, e.g. via park, common, towpath, bridleway, subway, bridge, shopping centre. The size of this lettering should be 80 per cent of the normal size, ie 25 x-height if 30 is used on the rest of the sign.

## 6.3.2 Off-highway direction signs

Signs off-highway should conform with branding and standards operated by the managing authority for the park, green space or canal towpath in question.

Route branding elements may, however, be adapted to existing signing. This may be done with finger posts, showing a Quietway route in one direction on one finger with one or two locations on the route and the time to destinations. Route information may also be applied to other information sign types used in park and towpath environments.


Quietway branding applied to canal towpath sign

## 6.3.3 Warning signs

The sign to diagram 963.1 of TSRGD, warning pedestrians of a cycle track, may occasionally be necessary, but a carefully positioned diagram 1057 cycle symbol may be a suitable alternative. On cycle tracks, a diagram 955 sign (route for pedal cycles only) can serve a dual purpose by removing the need for a 963.1 sign.

To alert blind or partially sighted pedestrians to the presence of a cycle track, a level difference is recommended or, if this cannot be provided, raised delineator marking to TSRGD diagram 1049.1 (see sections 4.5.9 and 4.6.3 for further details).


diagram 963.1

diagram 955

diagram 950

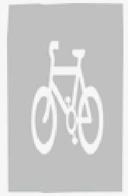


diagram 1057

Where there is a high risk of conflict between cyclists and motor vehicles and where the conflict cannot be eliminated by design, signs to diagram 950 can be used to raise motorists' awareness of the likely presence of cyclists ahead. To maximise the impact of this sign it should not be used frequently.

Where it is necessary to warn cyclists of a hazard such as a low bridge or other obstruction giving a vertical clearance of less than 2.3 metres, then a warning of the specific hazard, eg 'Cyclists beware – low headroom' should be used together with a height warning sign stating the actual headroom available. Signs not prescribed in TSRGD will require authorisation from the DFT.

## 6.3.4 Signs for pedestrian zones

Town centre pedestrian priority zones are usually created under Section 249 of the Town and Country Planning Act and should be marked with an appropriate combination of signs to diagram numbers 618.2, 618.3, 619, 620 or 620.1 of TSRGD to show what restrictions are in place and when they apply. Diagram 619, 'no motor vehicles', means that cycling is permitted, while diagram 617, 'no vehicles', means that it is not.

Schedule 8 of TSRGD (2016) allows for a clearer distinction between pedestrian zones that do and do not permit cycling. The sign to diagram 618.3C, 'Pedestrian and Cycle Zone', should be used where cycling is allowed.

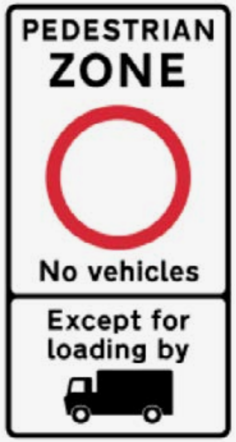



Diagram 618.3B, 'Entry to, and waiting in, a pedestrian zone restricted', with diagram 620.1, 'Exemption for loading/ unloading'. Cycling would not be permitted here.


Diagram 618.3C 'Pedestrian and Cycle Zone' sign


Diagram 620 plate can be used instead of diagram 620.1.

### Inlaid symbols

Cycle symbol paving slabs and other inlaid symbols have been used in some areas to clarify that cycling is permitted, although these do not have any legal status on-highway and do not remove the need for vertical signing for shared use areas. Off-highway, they can be a useful way of showing that cycling is permitted.

Non-prescribed uses of the cycle symbol, to show that cycling is permitted

For all cycle routes serving town centres and other pedestrian priority areas, a management and enforcement plan is desirable. This should detail proposals for reducing the obstruction and risk to cyclists and pedestrians from unlawful and inconsiderate driving/riding and car parking.

## 6.3.5 Signs to minimise or avoid

There are a number of signs that were featured in TSRGD 2002 for use in conjunction with cycle facilities, but are confusing, unnecessary, or in some way compromise wider objectives of promoting safety, comfort, coherence and directness in cycling. This category includes:

958.1 (sign) Advanced warning sign for with-flow cycle lane ahead

965 (sign) End of lane, route or track

966 (sign) Cyclists dismount

1058 (marking) END

**A cycle route should never disappear abruptly**

'End' signing and 'Cyclists Dismount' signs should not be used because they show that consideration for cyclists has simply ended. Where an off-carriageway track ends, signed provision must continue. In most circumstances, this will be on the carriageway – therefore the diagram 966 sign 'Cyclists Rejoin Carriageway' should be used instead of 'Cyclists Dismount', as set out in the 2011 amendments to TSRGD.

## 6.3.6 Minimising sign clutter

Signs should not create more visual impact than is necessary to convey the right information to those who need to see it. The signs in figure 6.3 below, usually seen as 300mm-diameter signs, can be used at smaller sizes (down to 150mm on unlit bollards for diagram 956 and 957), which may be particularly useful for environmentally sensitive areas as well a general contribution to decluttering. When used as repeater signs, they may be fixed to bollards where practicable, rather than posts.

Figure 6.3 Signs that may be used at a smaller size

| | TSRGD diagram no. and name |
|---|---|
|  | [951]<br>'Riding of pedal cycles prohibited' |
|  | [955]<br>'Route for use by pedal cycles only' |
|  | [956]<br>'Route for use by pedal cycles and pedestrians only' (ie shared use) |
|  | [957]<br>'Route comprising two ways... for use by pedal cycles only and by pedestrians only'<br>(ie with partial separation, by line or raised delineator) |

Bollard-mounted signs, to diagram 955 for a cycle route (left) and diagram 956 for shared use (right)

For other signs the smallest practicable plate size should be considered, taking into account the prescribed options in TSRGD. See 'Schedule of signs' (section 6.4) for further details.

Although sign size should be minimised wherever possible, it is still essential to ensure they are legible. To minimise plate sizes on direction signs for cyclists, 25mm x-height text (the smallest permitted size, in mm) should normally be used, as described in TSRGD (2016). It is seldom necessary to use the larger size texts, except where the viewing distance is large (in excess of 30 metres), in which case an x-height of 30mm should suffice in most instances.

The Traffic Advisory Leaflet TAL 1/13, Reducing sign clutter gives guidance on reducing the environmental impact of signs. TfL Streetscape Guidance gives further recommendation on methods of avoiding clutter, based on 'Better Streets' principles. See figure 6.4 for a summary of options for minimising clutter.

DfT Circular 01/2016 explains the contribution of TSRGD (2016) to decluttering: "The Department sets the legislation governing what traffic signs look like and mean, but decisions about which traffic signs to place and where to place them is a matter for local authorities. TSRGD 2016 gives authorities more tools than ever before to tackle the scourge of too many signs."


Cycle Superhighway direction signing attached to an existing sign-post (top) and wall-mounted cycle exemption to a restriction on a narrow street (bottom)

Figure 6.4 Summary of methods for minimising signing clutter

| Option | Notes and justification |
|---|---|
| Combine existing signs and incorporate cycle signs into general direction signing. | See the menu approach to cycle direction signs in Schedule 12 of TSRGD (2016) |
| For branded routes, consolidate existing signing wherever possible and use existing poles and columns along the route. | Show existing and proposed posts and signs on scheme drawings to allow for review and rationalisation as necessary. |
| Omit vertical signing in favour of road markings, which avoids the need for sign posts and can be more convenient for cyclists and pedestrians, given their field of view. | This should be a site-specific consideration, bearing in mind visibility in the dark, maintenance, the impact of more surface markings on all two-wheelers and the possibility of markings being covered or obscured by other vehicles. |
| Use restricted parking zones and 'permit holders only past this point' area-wide parking controls (avoiding the need for road markings to indicate waiting restrictions and parking bays). | The 2011 amendments to TSRGD prescribed the use of 'restricted parking zone' signing. These permit parking only in signed bays, removing the need for yellow lines. Under the area-wide authorisation issued in October 2011, local authorities in England may also remove yellow lines from pedestrian zones where appropriate repeater signs are placed. |
| For 20mph and 30mph roads, reduce the width of red or yellow line markings to 50mm (for higher speeds retain 100mm markings). | This is recommended by TfL for TLRN in Streetscape Guidance. It helps to minimise visual clutter and incursion of markings into nearside cycling space. Authorities should determine their own approach, bearing in mind the need for consistency. |
| For streets with a carriageway width of less than 5 metres, omit one regulatory sign (two are normally provided at the street entrance). | TSRGD allows for this – eg one diagram 616 'no entry' sign. Note that, for all signs other than speed limit signs, the centre of the single sign should be within 2 metres of the edge of the carriageway. |
| For off-highway routes, use smaller sign sizes, as they only need to be visible to cyclists and pedestrians. Also consider reducing frequency of repeater signs. | The 2011 TSRGD amendments specify a minimum of one repeater sign, in place of the earlier need to provide them at 'regular intervals', thus giving designers the flexibility to place only those signs they deem necessary. This is confirmed in TSRGD (2016). |

## Other sign design requirements

Legibility, attractiveness and visibility in the dark and when wet and in snow, all need to be taken into account when designing signs and road markings. It is difficult for a sign to compensate for poor lighting or for a road layout that is not easily legible. The design of the street, and detailing such as borders, paving or surface colour, can assist cyclists and others by complementing and reinforcing signs and markings and, in some cases (but not where the signs have a regulatory function), superseding the need for them.

Black-backed signs are preferred to grey-backed signs in order to provide sufficient visual contrast for visually impaired people. This is a requirement on TLRN and in Central London (see TfL Streetscape Guide) and is highly recommended elsewhere. Cycle-specific signs should have reflective, anti-graffiti coating. Single- or double-faced signs can be used, as appropriate to the location.

## 6.3.7 Sign installation and mounting

Signs that indicate the existence of off-carriageway cycling facilities should be sited no more than 10 metres from the start and end of the facility. Ideal spacing for intermediate signs can vary between 20 metres and 200 metres, depending on the frequency of interruptions such as side roads and bus stops.

Signs should be mounted in such a way as to be easily visible to the intended user. However, where their placement might be a hazard for other users – typically when they are on the footway – minimum clearance will be needed. The possibility of parked or moving vehicles or pedestrians obscuring the sign may also have a bearing on the chosen mounting height.

### Vertical clearance

In general, any sign likely to be a hazard to pedestrians should be mounted at a minimum height of 2.1 metres to the underside. A minimum of 2.3 metres is required where cyclists can cycle beneath them. For wall or bollard mounting, heights of between 0.8 metres and 1.5 metres are preferred.

Signs may be mounted at lower heights where they do not represent a hazard to pedestrians, cyclists and motor vehicles, such as on grass verges and in parks. Care needs to be taken to avoid interfering with verge-cutting equipment, so a set-back will normally be required on paths off-highway. Away from the footway, the recommended mounting height, measured to the lower edge of a sign, its backing board or any supplementary plate, is between 900mm and 1500mm above carriageway level (Traffic Signs Manual, chapter 3, paragraph 1.21).

### Lateral clearance

For signs, poles and signal posts, guidance on recommended dimensions for lateral clearance, based on advice in the Traffic Signs Manual, is as follows:

- Signs should be sited no more than 1.0 metre away from the relevant surface, to avoid confusion
- Where moving motorised vehicles are passing to the side, posts and signs should normally have a minimum of 450mm lateral clearance (or more if the crossfall of the carriageway is greater than 2.5 per cent) – this is in order to prevent damage by vehicles having a lateral overhang, bearing in mind their likely swept paths
- Less than 450mm clearance may be possible on any side where cyclists are the only vehicles passing (minimum 250mm is recommended, although appropriate clearance should be determined by a risk assessment on a site-by-site basis)
- Posts and signs should not encroach into travel envelope of cyclists
- All bollards on cycle routes must have tamper-proof reflective stripes or signs

## Anti-rotational fixing

Where there is a risk that signs could be rotated (eg by wind or vandalism), anti-rotational fixings should be used, particularly on finger-post direction signs. Products available include channel clips and clamp-type fittings sometimes with set-screws, rather than banding. Dealing with rotation of finger post signs should be a key part of maintenance regimes.

Signs with fixing channels and mounting clips

## Illumination requirements

TSRGD (2016) introduces greater discretion for local authorities to determine appropriate illumination for signs. Unless the sign is internally illuminated, it can generally either be directly illuminated by a sign lighting unit or by ambient lighting from surrounding street lights.

This change has the potential to reduce costs for authorities in providing and maintaining electrical supplies to many signs. However, authorities are advised not to assume that sign lighting units are no longer required for regulatory cycle signs, warning signs and direction signs. Street lighting is likely to provide adequate illumination for many signs, but there are some cases where, on balance, the costs and risks associated with direct sign lighting can be justified.

In each case, a risk assessment should be carried out to determine what type of illumination will allow the sign face to be sufficiently conspicuous in its immediate surroundings. When taking these decisions, risk to the public and to highway operatives should be taken into account.


Illuminated sign

## 6.4 Schedule of signs

This table is for general reference only and contains requirements current in TSRGD (2016). Please refer to TSRGD and the Traffic Signs Manual for further details of sign application.

| | |
|---|---|
|  | **[612] No right turn for vehicular traffic**<br>Normally 600mm diameter<br>Can be used with [954.3] 'except buses and cycles' or [954.4] 'except cycles' plates (or with equivalent signs in a signal head at 300mm diameter) |
|   | **[616] No entry for vehicular traffic**<br>Can be used with [954.4] 'except cycles' exemption plate<br>Normally 600 or 750mm diameter<br>300mm variant (non-illuminated) can show no-entry for cycles at one-way off-carriageway cycle tracks, but this requires site-specific authorisation<br>Authorisation of use of [954.4] 'except cyclists' plate was made through the Traffic Signs (Amendment) (No.2) Regulations and General Directions 2011 (SI 2011 No. 3041) and is established in TSRGD (2016).<br>The diagram 954.3 'except buses and cycles' plate may also be used with 'no entry'. Variants include 'except local buses and cycles' and replacement of 'and' with '&'. |
|   | **[617] All vehicles are prohibited except non-mechanically propelled vehicles being pushed by pedestrians**<br>Normal size 600mm<br>Not be used on cycle routes as it would exclude cycles<br>**Play Street exemption plate** prohibits all vehicles from the street during the period indicated, except for access |

### [619] No motor vehicles (ie cycles permitted)

Normal size 600mm (also 450, 750, 900 and 1200mm)

Can have exemption plates [620] 'Except for access' and [620.1] 'Except for loading by goods vehicles' attached.

For other permitted variants see TSRGD Schedule 3, Part 2, Item 12

A [967] cycle route sign can be used with this sign to emphasise cycle only access


### [877 - variation] Appropriate traffic lanes for different movements at a junction ahead

Permitted variants include 'Except cycles' or 'Except buses and cycles'

Normal size 900mm height (also 1200, 1500 and 1800mm)


### [881] Start of Home Zone / [882] End of designated Home Zone

### [884] Start of Quiet Lane / [885] End of Quiet Lane

Normal size 540mm width (also 675mm)

The plate on [881] and [884] contains the name of the Home Zone or Quiet Lane – this may occupy two lines

### [950] Cycle route ahead

Can be used with [950.1] exemption plate stating 'Cycles crossing', 'Cycle event', 'Child cycle tests' or 'Child cycle training'

Normal size 600mm (also 750, 900, 1200 and 1500mm)

Subject to risk assessment, direct illumination is very often not required (see section 6.3.7 above)

[572] 'Distance ahead to hazard' plate or [573] 'Distance and direction to hazard' may be used with this sign

### [951] Riding of pedal cycles prohibited

Normal size 270, 300mm (450 and 600mm not recommended)

Indicates the effect of a statutory prohibition and is placed at the beginning of the restriction

### [953] Route for use by buses and pedal cycles only

Normal size 600mm (also 450, 750 and 900mm)

Indicates the effect of a statutory prohibition and is placed at the beginning of the restriction. TSRGD provides variants involving other combinations of road users.


### Except buses and cycles plate

### Except cycles plate

An x-height approximately one tenth of the main sign height is normally appropriate from the prescribed options: 37.5, 50, 62.5, 75 and 100mm. 37.5 is recommended for 'Except cycles'

The plates indicate the effect of a statutory prohibition – they may be used in combination with [606] or [609], 'vehicular traffic must proceed in the direction indicated by the arrow'

May also be used with [612] or [613], 'no right/left turn for vehicular traffic' but when such a turn is into a contra-flow bus lane or bus/cycle only street, protected by a [616] 'no entry' sign, an alternative is to use [953] 'route for use by buses and pedal cycles only' or [960] 'contra-flow bus and cycle lane' to overcome restrictions on plates with 'no entry' signs

However, 'except cycles' may be used with [616] 'no entry' and [816] 'no through road for vehicular traffic'


### Exception to a statutory prohibition at traffic signals:

### [954.5] for cycles

### [954.6] for buses and cycles

### [954.7] for buses, taxis and cycles

As [954.3 and 954.4] above, but in the form of 300mm diameter circular signs for use as box signs within traffic signal heads

The x-height for [954.5] is 37.5, for [954.6] 35 and for [954.7] 30

Must be internally illuminated at all times except when the signals they are fixed to are being maintained or repaired

May be used in combination with [606], [612] or [613], to indicate an exception to a statutory prohibition

### [955] Route for use by pedal cycle only

Sizes: 150mm (recommended for bollards), 270mm (for illuminated bollards), 300mm (for sign posts), 450mm (for illuminated use), and 600mm (not normally necessary)

On-carriageway, this sign indicates a Traffic Order defining a route where only cyclists are permitted

Off-carriageway, it indicates the effect of a statutory prohibition (erected by a Council Resolution under the Highways Act) and is placed at the beginning of the defined section

The 2011 TSRGD amendments changed the minimum requirement for repeater signs to one

### [956] Route for use by pedal cycles and pedestrians only

### [957] Route comprising two ways, separated by the marking shown in diagram 1049B or 1049.1 or by physical means, for use by pedal cycles only and by pedestrians only

### [956.1] Route for use by pedal cycles, horses and pedestrians only

Normal size 300mm on posts; 100mm and 150mm may be used on bollards and 270mm on illuminated bollards; 450mm may be appropriate for a terminal sign that is otherwise difficult to see, eg against a cluttered background; 600mm is rarely warranted

These signs indicate the effect of a Traffic Order and are placed at the beginning of the defined section and along a route

The 2011 TSRGD amendments changed the minimum requirement for repeater signs to one

For [957] symbols may be reversed in a mirror image to represent the arrangement on the ground


### [958] With-flow bus lane ahead that bicycles, powered two-wheelers and taxis may also use

Two sizes: 800x825mm recommended (also 960x990mm)

This sign indicates the effect of a statutory order; the word 'taxi' may be omitted and 'local' may be included on the bus if appropriate (as shown below on [959] ); permitted vehicles and times of operations may be varied as necessary

Use of [958.1] 'With-flow cycle lane ahead' is not recommended, although there may be a case for it in situations where general traffic is moving at 30mph or more and/or where the number of general traffic lanes has been reduced to fit in a cycle lane


### [959B] With-flow bus lane that pedal cycles may also use

Two sizes: 450x825mm recommended (540x990mm is not normally recommended unless speed limit is 40mph or greater)

This sign indicates the effect of a statutory prohibition and is placed at intervals along the route

The word 'taxi' in white letters may be added alongside the cycle symbol, and 'local' may be added to the bus symbol; a solo motorcycle symbol may be included

### [959.1] With-flow cycle lane

Two sizes: 375x825mm recommended (and 450x990mm)

This sign is for mandatory lanes and is placed at intervals along the route; reverse may be used for offside lanes but requires site specific authorisation

### [960.1] Contra-flow (mandatory) cycle lane

Two sizes: 475x825mm recommended (and 570x990mm)

This plate indicates the effect of a statutory prohibition, and is placed at intervals along the route

The number of arrows showing vehicle lanes may be varied depending on number of lanes, normally one

### [960.2] One-way traffic with contraflow pedal cycles

Two sizes: 475x650mm recommended (and 570x780mm)

Should be used with an advisory contraflow cycle lane, or no lane marking

This sign was authorised by the Traffic Signs (Amendment) (No.2) Regulations and General Directions 2011 (SI 2011 No. 3041), having been included in Signing The Way (2011), and is confirmed in TSRGD (2016).


### Times of operation of a bus or cycle lane plate

Two sizes prescribed: 825 and 990mm

'x-heights' 50 and 60mm to match the size of sign used

Method of illumination for this plate must be the same as the sign which it is placed in combination with, unless the illumination for the sign adequately illuminates the plate

This sign is for mandatory lanes and is placed at intervals along the lane, in combination with [958], [958.1] or [959]

Time of day and day of the week may be varied


### [962.1] Cycle lane on the road at junction ahead or cycle track crossing the road

50mm 'x-height' recommended

Unlikely to be necessary and should only be used where specific problems are encountered – [1057] cycle symbols positioned on the cycle lane on main roads are preferred as a method of warning emerging drivers of the likely presence of cyclists

Lane may be varied to track, and the cycle symbol and arrow may be reversed for a contra-flow; if a sign is needed, and there are lanes in both directions, the arrow should be omitted and 'lane' varied to 'lanes'; reference to the times of operation of the lane may be added if appropriate


### [963.1] Cycle lane with traffic proceeding from right (sign for pedestrians)

Two sizes: 40mm 'x-height' recommended (and 50mm)

This sign should not be routinely used; it is sometimes helpful to warn pedestrians when cyclists travel from an unexpected direction eg on a two-way cycle track, but it will often be sufficient to place the cycle marking to diagram 1057 in the lane or track at the point where pedestrians cross

'RIGHT' may be varied to 'LEFT' or 'BOTH WAYS', symbols may be reversed, and 'LANE' may be varied to 'TRACK'

| | |
|---|---|
|   | **[966] Cyclists Rejoin Carriageway**<br>Two sizes: 40mm 'x-height' recommended if used (and 50mm)<br>Sign has no statutory meaning: text replaced 'Cyclists Dismount' as the recommended wording on this sign through the 2011 amendments to TSRGD |
|  | **[967] Route recommended for pedal cycles**<br>Two sizes: 300x440mm recommended (and 375x550mm)<br>The sign is for advisory cycle lanes and cycle routes on carriageways<br>[959.1] should be used in conjunction with mandatory lanes |
|   | **[968/968.1] Cycle parking**<br>170x170mm + 250x170mm recommended<br>(250x250mm + 420x250mm not recommended)<br>This sign is usually unnecessary; it may be used in conjunction with signing denoting a combined cycle/motorcycle parking facility |

## Bibliography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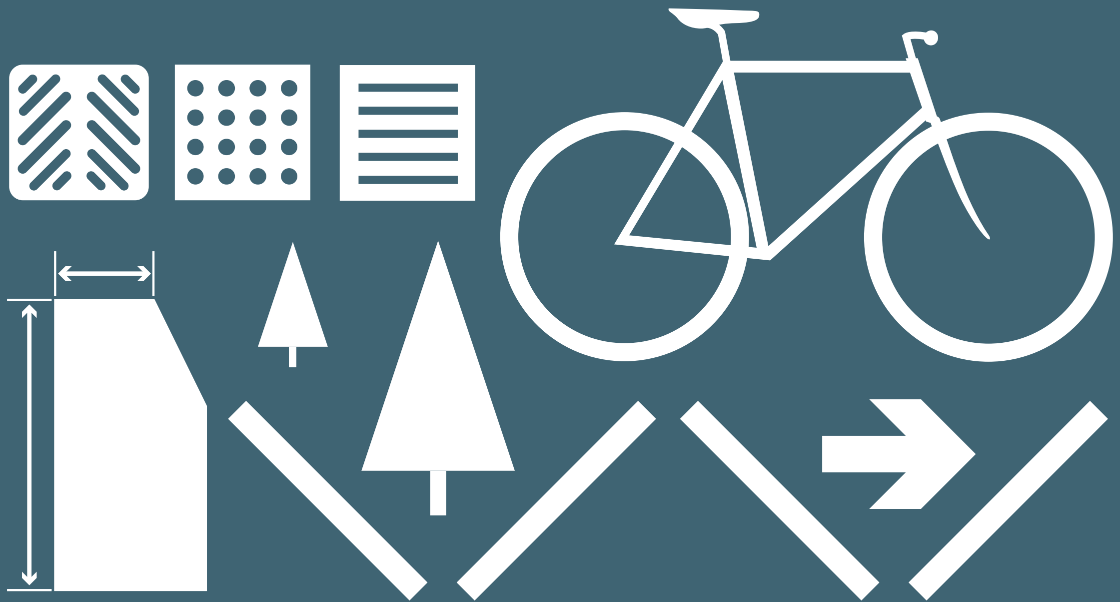
# 7. Construction, including surfacing

This chapter covers aspects of construction and maintenance that are vital for making cycle infrastructure as safe, comfortable, attractive, accessible and durable as possible.



**Version control**

Version 1 (Dec 2014) – Published

Version 2 (Sept 2016) – Minor amendments following publication of TSRGD (2016)

# 7. Construction, including surfacing

## 7.1 General requirements

### 7.1.1 Responding to context

Streetscape issues need to be considered in all aspects of design and construction. Cycle schemes should seek to reinforce the distinctive character of places and neighbourhoods and to improve environmental quality by lessening the predominance of motor traffic and traffic-related street furniture.

Street designers are directed to chapter 3 of this document and to the TfL Streetscape Guidance as well as borough streetscape guidance documents and streetscape-related supplementary planning documents.

The sections below set out general advice to inform design development. In all cases, the highway authority and its standard details for carriageway and footway construction should be consulted. This is particularly important wherever the authority is expected to adopt the facility: non-compliance with the relevant standards could lead to rejection.

Quality of construction for cycle infrastructure is covered by the Cycling Level of Service assessment, as shown in figure 7.1.

Figure 7.1 Key construction considerations in CLoS

| Factor | Indicator | Relates in this chapter to |
|---|---|---|
| Directness: **Directness** | Deviation of route | Major infrastructure such as bridges and tunnels to make direct connections |
| Comfort: **Surface quality** | Non cycle friendly ironworks, raised/sunken covers and gullies | Machine-laid sealed surfacing, flush kerbs at crossings and transitions, drainage design and road marking materials |
| Coherence: **Surface material** | Construction | |
| Attractiveness: **Greening** | Green infrastructure or sustainable materials incorporated into design | Use of permeable surfaces as appropriate |

### 7.1.2 Lighting

An appropriate level of lighting is important for all cycle routes; the highway authority's lighting unit will need to be consulted on all lighting proposals. This may entail upgrading existing lighting or the provision of new lighting in open spaces, particularly where there are concerns for personal security. In some areas lighting units may be targeted and damaged by vandals, so this will need to be taken into account in the provision. Where vandalism is an issue, piped music has proved to be effective in some locations as a deterrent.

For aesthetic and conservation reasons, lighting may not be acceptable through parks and other green corridor areas. Low-level timed, motion-sensitive or solar stud lighting may be considered in such circumstances. Further guidance on providing adequate lighting in sensitive areas may be found in Sustrans' Technical Information Note 29: Lighting of cycle paths (2012) and the Campaign for the Protection of Rural England's (CPRE) report, Shedding Light (2014). If adequate lighting is not feasible on routes away from the highway then alternative night-time routes should be provided.

## 7.1.3 Construction principles

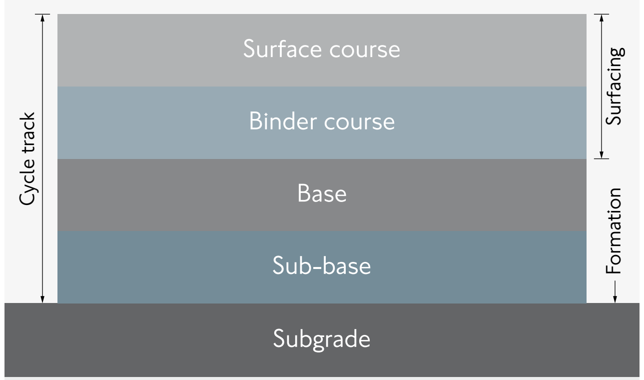
Practicalities such as cost, consideration of future maintenance and availability of materials have a significant bearing on decisions about construction of paths, tracks and cycle lanes. However, from the perspective of the user, the riding quality and reliability of the surface are the most important construction considerations (see section 7.2 below). This means providing machine-laid surfacing, effective drainage and disposal of surface water, and well constructed dropped kerbs and transitions.

A standard carriageway construction is appropriate for all cycling infrastructure on carriageway. Some modifications to the surface may be required to incorporate cycle lanes, advanced stop lines, or traffic speed control measures (traffic calming). Dimensional tolerances should follow normal highway standards, and when a new cycle route is installed a check should be carried out to confirm that this is the case.

Off-carriageway, cycle tracks and shared paths will have a similar construction to footways or footpaths, but they will generally have few vehicle loading requirements. Depending on ground conditions, different construction approaches may be considered in locations where there is only occasional use by motorised vehicles, very often for maintenance.

For cycle tracks, a maximum gradient of 3 per cent is recommended but this can rise to 5 per cent over a distance of up to 100 metres. Where it is unavoidable, a gradient of up to 7 per cent over a distance of no more than 30 metres is acceptable. In some circumstances, steeper gradients than 7 per cent over short distances on a cycle route may be preferable to failing to provide the route at all.

Typical off-carriageway facility




Typical cycle track construction. Diagram from Mineral Products Association, Asphalt applications: construction and surfacing of footways and cycleways using asphalt (2009)

## 7.1.4 Basic contruction requirements

For all types of construction, the surface is built up in a number of layers – typically surface course, binder course, base and sub-base. The binder, base and sub-base should be chosen and applied in accordance with the local authority's highway design standards, and in a manner appropriate to the context. When considering what depth of construction to adopt, it should be borne in mind that one of the most common reasons why some cyclists use the main carriageway, in preference to a cycle track alongside the road, is that the riding quality of the main road carriageway is better.

The riding quality of any cycle track should be at least as good as that of the adjacent road. Refer to local design and streetscape guidance for more details.

The depth of each layer will depend on the materials and local ground conditions – the presence of tree roots, for example, may require a deeper construction depth. Indicatively for a cycle track, a surface course may be around 25mm, the binder and base course may be another 50mm and the sub-base 125-225mm. Away from the highway, a higher grade binder course with an increased laying depth may be considered rather than separate surface and binder layers.

In all cases, consideration should also be given to:

- The impact of construction and the choice of materials on drainage
- Responsible sourcing and re-use of construction products (bearing in mind that certain types and colours of aggregate, for example, may not be local and will need to be transported over a long distance)
- Local character, and selection of materials appropriate to the context, as covered in local design or streetscape guidance
- Reducing use of bituminous materials away from the highway by applying a surface dressing, or using alternative materials such as resin-bonded gravels

The porosity of surface, binder and base materials should be a consideration for any integrated approach to sustainable drainage.

Any new carriageway construction should be to normal highway standards unless there is kerb segregation of the cycle lane. Carriageway construction depth depends on ground conditions and expected loadings – indicatively, this may be around 600mm. This can entail the relaying and/or protection of utilities plant (electricity, gas, water, foul and surface water drainage, telephone, cable TV, tram cables etc).

### Edge restraints

For cycle tracks and shared footways, adequate edge restraint should normally be provided in the form of edging to restrict the deformation and erosion of the facility. Standard 50mm wide, 150mm deep concrete edging is normally suitable, which can be laid flush to allow water run-off, or raised as a low (50mm) kerb if adjacent to a pedestrian way if required.

Alternatively 125x150mm kerbs, either bull-nose, battered or half-battered, can be used. For some towpath environments, timber edge restraint may be more appropriate to the context. On cycle tracks across open spaces, parkland and old railway alignments, edge restraints may be omitted to reduce the impact of a sealed surface path.

### Maintenance considerations

Maintenance of the riding surface to match the original standard and colour after construction is essential to ensure the facility delivers a high level of service. This includes proper reinstatement following works by statutory undertakers. Close attention to drainage is necessary so that ponding is avoided as this provides a poor level of service and can result in cyclists moving into positions where conflict with other traffic is more likely to occur. To avoid this, surfaces should be machine-laid for all new-build facilities and where extensive repair works are undertaken.

## 7.1.5 Drainage

Gully location and levels are critical for cyclists to ensure good route drainage. This is particularly important where cyclists join or leave the carriageway, at all at-grade crossings, where there is physical separation or where current levels of provision are known to be problematic.

Acceptable gully characteristics are as follows:

- No gaps between the frame and cover wider than 15 mm
- Transverse bars or ‘portcullis’ type bars on the cover
- Recessed gully frames raised to be flush (tolerance +/- 5mm) with the surface
- Suitable for their location to take public highway loadings
- Open in a manner suitable to be cleansed by a normal gulley cleansing or jetting machine under the relevant highway authority contract

Dished and other gratings unsuitable for cycling across should be replaced. Side-entry gullies or perforated kerb type gullies (such as Beany Blocks) may be suitable in some circumstances, particularly where there is restricted width and where cyclists will be close to the kerb. Drainage on cycle lanes and tracks may need additional gullies as well as appropriate falls to facilitate run-off. A minimum grating size of 300 x 300mm is recommended, as the smaller size gully gratings that are sometimes used in off-carriageway situations tend to get blocked.


Perforated kerb gullies, as used in a cycle track


Grates should be perpendicular to direction of travel

Non-slot 'pedestrian style' gratings should be used wherever possible, particularly in and around crossings or shared public realm. Alternatively, the orientation of slots should be perpendicular to the expected direction of travel, which removes the possibility of cycle wheels sticking in gullies.

Falls of at least 1:40 cross-fall and 1:200 longitudinal are preferred. With non-machine laid surfaces steeper longitudinal falls will be required. Falls on roads (including 'summit and valleying') often get reduced or removed during re-surfacing, and so may need to be corrected. Any areas of ponding on a cycle route that will have an adverse effect on cyclists should be addressed, including where splashing from a carriageway onto an adjacent cycleway occurs.


Problems caused by ponding

## Off-carriageway drainage

For cycle tracks and off-road routes, drainage requirements are best served by ensuring that the design of the path sheds water away from the centre of the track or path. The crossfall should be between 1 and 2.5 per cent to ensure adequate drainage but avoid creating discomfort for disabled users.

Additional stone grips or French drains may need to be considered to help achieve this. Drainage should be designed to feed new or existing ponds, develop new wetland habitats or simply soak away, rather than be fed back into existing piped systems. Raised delineators may need regular gaps to allow surface water to drain away.

## 7.1.6 Kerb construction

Low kerbs at least 50mm high can allow better use of restricted space by maximising effective width – allowing cyclists to travel closer to them without risk of catching pedals on the kerb. Dropped kerbs need to be provided to allow comfortable access for those for whom a 50mm upstand will still be an obstacle, such as people with mobility scooters, prams or buggies.

It is important that people using guide dogs or long canes are able to detect a kerb edge. One study by the University College London Accessibility Research Group (Childs et al 2009) showed that a 60mm upstand was readily detectable by all participants but recommended that further research be undertaken to establish whether 50mm, being a more common dimension and being well received by many users, might be a more practical minimum.

### Angled kerbs

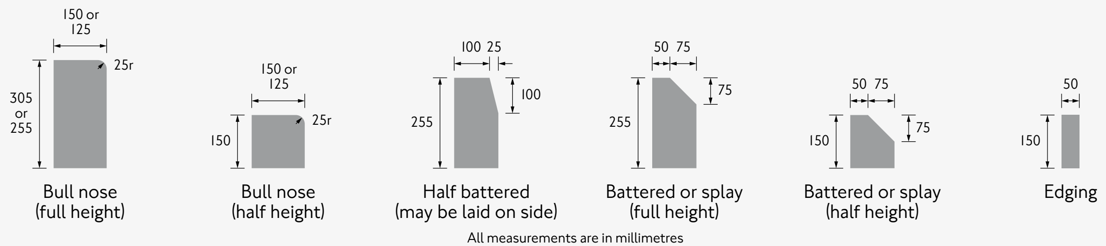
Angled kerbs – splayed, battered (45-degree faces) or half-battered – can also be used to help maximise effective width, and are more comfortable for disabled cyclists to negotiate than low, square-faced kerbs. Red-brick and block-battered units are also available. Transitions from angled kerbs to other profiles can be complex to construct and so it is recommended that angled kerbs are used consistently on a link and that any island should be specified with angled kerbs on all sides.

It is recommended that design decisions on use of low or angled kerbs should be a site-specific analysis of current patterns of movement, by consultaion with access groups and by an Equality Impact Assessment, as appropriate.

### Dropped kerbs

All dropped kerbs should be specified as flush, within a tolerance of +/-6mm of the adjacent surfaces, to provide a comfortable surface for cyclists and people in wheelchairs. Particular care is needed with channel levels to ensure that ponding does not occur at crossing points. Upstands of anything over 10mm, parallel to the direction of travel, can destabilise cyclists if struck. Upstands cannot be safely and comfortably traversed by all cyclists when approached at right angles if more than 15mm high, or by wheelchair users if more than 6mm high.

Angled kerbs as used in London, above and the Netherlands, below. Note that block paving should only be used over short distances, if at all, because it can be uncomfortable to ride over




Typical kerb profiles

## 7.1.7 Kerbed island construction

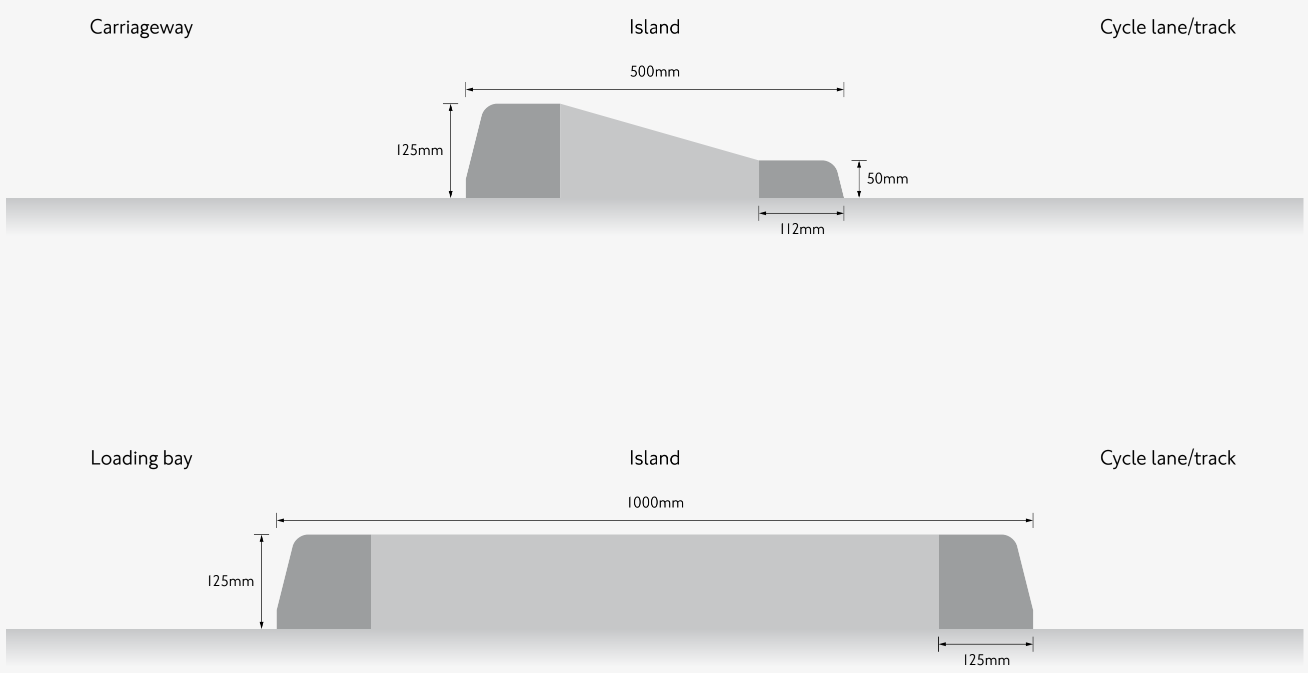
The edges of cycle tracks and segregated lanes need to be detailed so as to provide clear but safe delineation between carriageways and footways. Depending on width and on context (particularly in conservation areas), suitable materials for the edge strip or segregating island may include: paving slabs, block paving, granite setts, or coloured surfacing. Any change in material should be laid with a flush edge to the adjacent surface

A strip or island installed to create segregated cycling facilities may also incorporate parking bays, lighting columns and other street furniture. Features such as low walls and planting may be appropriate to either protect the cycling area or improve the ambience.

Where the island incorporates cycle parking, its dimensions should take into account the need to accommodate longer cycles, allowing them to turn safely and be stored without overhanging the kerb.

Guard railing and crash-barriers can create dangerous squeeze points, particularly where heavy goods vehicles turn, so they should be used only with caution, and with consideration for impact on cycling provision on-carriageway.

The segregating strip should be visually differentiated from the cycle lane or track by using a contrasting material. Paved strips with granite kerbs may be appropriate in more central urban settings but grass verges may also be suitable. They are relatively easy to maintain and provide suitable space in which to take avoiding action in case of an emergency.




Angled kerb sections for segregating islands not used by pedestrians and segregating island next to loading bays

Any planting should be designed with consideration of safe and effective operation of the cycling facility. Plant height and growth, for example, should not affect forward visibility, and thorny bushes should be avoided adjacent to the edge of the cycling facility. Planting needs to be regularly maintained, particularly between March and October, to ensure that the cycle facility remains fully usable and that there is no reduction in effective width and overall visibility.

Refer generally to TfL Streetscape Guidance and relevant borough street design guidance and standard construction details for more information on kerbs.

## 7.2 Surfacing

### 7.2.1 Basic requirements

Good surface riding quality is essential for cyclist safety and comfort. This is the case whether cycling is on- or off-carriageway. Cyclists need a smooth riding surface, which should not be undulating and should have skid resistance appropriate to the location.

- The surface should be machine-laid, avoiding changes of level or 'steps' of more than 6mm, as these destabilise cyclists and are a significant factor in cycle safety
- Inspection covers and transitions between on- and off-carriageway must be flush, within a tolerance of 6mm
- The surface should be laid on adequate, well compacted base materials so that subsequent settlement does not occur
- Pot-holes, rutting and other defects must be rectified immediately through patching, resurfacing or deeper trench reinstatements as necessary
- Where anti-skid surfacing is used, it should continue over ironwork particularly where cyclists are likely to be changing direction

### 7.2.2 Surfacing materials

This section sets out the most common materials that are used to create a good quality surface for cycling, whether on carriageway, on a dedicated track or on a shared use path – see figure 7.2 below. The road network in urban areas is primarily a machine-laid bituminous or asphalt surface. Surfacing for the cycling network should be of the same standard, except for off-carriageway locations where a bound surface would be inappropriate.

Types to be avoided for general cycling use include:

- Paving slabs/flags – lower wet skid resistance and risks of trips and rocking
- Cobbles (pebbles in concrete) – uncomfortable surface with poor skid resistance
- Ungraded aggregate such as shingle, ballast or scalping – poorly graded materials will be too rough and cycle wheels will sink in

Where cobbles need to be retained as a heritage feature, it may be possible to lay 'paths' in different surface material through such areas in order to enable better access for cycles, wheelchairs and other mobility aids.

Figure 7.2 Surfacing materials and surface-applied treatments

| Surfacing material | |
|---|---|
| **Asphalt** | This should be the default provision for cycling, in the form of asphalt concrete or a thin surface course system, hot laid as specified in BS594987. Hot-rolled asphalt, historically used for carriageways, is not recommended. (See 'asphalt surfacing' below). |
| **Micro asphalt surfacing** | A cold-applied, low-carbon alternative to conventional surfacing treatments, this is not suitable for general use on-highway but could be applied to cycle infrastructure off-highway or to specific low-use areas on-highway. It provides similar finishes to hot mix 6mm and 10mm dense bitumen macadam surfacing but is unlikely to have the same stiffness. It seals the surface, improving visual quality and skid resistance. |
| **Concrete** | Historically used on estate roads and can be useful where large numbers of HGV or bus turning movements take place. Good for cycling if the joints and slabs are in good condition, but surface markings tend not to be clearly visible. Avoid tamped finished surfaces as this creates a bumpy / uneven ride. Brushed finishes are better. |
| **Brick or block paving** | Acceptable for cycling on over relatively short stretches but skid resistance can be low on some brick paving types and so not so cycle-friendly when wet, particularly when turning movements need to be made. Can be beneficial where high cycling speeds are not appropriate. Can be uneven leading to ponding or unseen edges and so maintenance requirements may be high. |
| **Natural stone blocks** | May be suitable if bedded on mortar/concrete and surface is not uneven or smooth, and has good skid resistance. |
| **Granite setts** | Too rough and uneven for some cycles, but if laid flush can be acceptable in limited areas. Can polish with use and be slippery when wet. |

| Surface-applied treatments | |
|---|---|
| **Surface dressing** | An even spray application of an emulsion bituminous binder through a purpose-built spray tanker onto an existing road or path surface followed immediately by the even application of aggregate chippings to 'dress' the binder – for example, pea shingle or granite stone. This seals the surface, improving visual quality and skid resistance. It can be a good choice off-highway, having the appearance of loose gravel but in the form of a bound surface. It can be used to change the colour or texture of a surface, provided that it is applied to a surface that is already well constructed and in good condition. |
| **Slurry sealing** | A cheap maintenance layer, suitable for temporary cycling use only. |
| **Self-binding surfaces** | Often used for rural paths, but remain loose and dusty, have poor skid resistance, are not very durable and not therefore recommended anywhere for utility cycling other than some environmentally sensitive areas where a bound surface would not be acceptable. Includes limestone fines to dust, Coxwell gravel (which has a reddish colour) and hoggin (a well-graded mixture of sand, gravel and clay). Requires a 100mm aggregate base. |
| **High-friction surfacing (anti-skid), cold applied** | Normally acceptable for cycling but laying methods resulting in ridges should be avoided (ie lay in longitudinal strips rather than transversely). |
| **Coloured veneer coat** | Specialist coloured surfaces in blue, green, red, etc laid onto wearing courses, normally anti-skid. |

Paths with bound surfaces in Kingston: Skerne Walk (top) and Thames Path (bottom)

## 7.2.3 Off-carriageway surfacing

Surface materials should be chosen to fit the context. For routes across parks or commons, polymer-bound materials are preferred, to ensure that a smooth and durable surface is provided.

Sealed surfaces tend to be more expensive to construct but last longer, so the level of service for cycling is significantly better and whole-life costs are usually much lower. Self-binding surfaces and surface dressings are chosen in some circumstances away from the highway, where machine-laid bituminous or asphalt surfaces cannot be applied. See Sustrans, Cycle path surface options, technical information note no.8 (2012) and Sustrans, Handbook for cycle-friendly design (2014).

It may be appropriate to omit formal concrete or timber edging and allow the edge to gradually deteriorate and become overgrown. This will result in a loss of edge width and this needs to be planned for in designing effective width. Alternatively, treated timber edge restraints may help maintain the durability of the path and sub-base but still be sympathetic to the environment.

## 7.2.4 Asphalt surfacing

The typical choice for the carriageway, and for many footways, is an asphalt surface. Asphalt used for roads and paths contain bitumens and aggregates which give a durable, joint-free surface that is relatively straightforward to construct and maintain.

Different products are available, each with their own properties. The main variables are the aggregate size, aggregate content, binder content and binder grade, which have an effect on stiffness, resistance to cracking and other physical properties of the asphalt. The smoothness of the riding surface tends to be dictated by the texture depth of the asphalt – the higher the texture depth, the rougher the surface and vice-versa.

Asphalt surface treatments for carriageways, cycle tracks and footways generally come in one of three forms:

**Asphalt concrete** (also known as bitmac or dense bitumen macadam)

A close-graded, 6mm asphalt concrete is a good choice for footways and cycle tracks as it gives a consistent and smooth surface finish. Designers should also consider porous asphalt concretes to help reduce surface, water, spray and ponding.

**TSCS, a thin surface coarse system**

This is often applied to carriageway surfaces, typically using a 10mm or 14mm aggregate, although 6mm is an option for footways. The advantage of using TSCS is that these materials come in a variety of texture depths and also colours. The use of clear bitumens and coloured aggregates allows these materials to be used as decorative asphalts. However this is not recommended in areas of load unless assurances are sought from material suppliers. Note that proprietary types of TSCS have replaced generic stone mastic asphalt (SMA).

**HRA, hot-rolled asphalt**, (with or without pre-coated chippings)

HRA is not recommended for cycle infrastructure. Its use has been in decline due to its positive texture, which means it generates more noise than some other treatments, and time and complexity of construction. For HRA with pre-coated chippings, hard-stone (often granite) chippings are rolled into the asphalt surface course while it is still hot. They add texture to the surface and therefore increase its skid-resistance properties. The chippings are pre-coated with a binder, which can contain coloured pigment if necessary. They must be hard-wearing but with a high polished stone value (PSV), so that they are durable and do not polish over time.

The use of all these materials is described in the European Standard Specification EN13108 and thicknesses should be specified using the British Standard BS594987: 2010, Asphalts for roads and other paved areas – specification for transport, laying compaction and type testing protocols, in conjunction with the local highway authority's design and construction standards. Full guidance on using the British Standards is provided in PD 6691 Guidance on the use of BS EN 13108 Bituminous Mixtures - material specifications (BSI, 2010).

### Sustainable drainage

In selecting a suitable type of asphalt for a given location, consideration should be given to the wider approach to sustainable drainage – specifically the extent to which the surface material may contribute to run-off into gullies and drains, or may be capable of holding water in situ during a rainfall event and allowing it to permeate slowly into the ground or on highway drainage systems.

The porosity of TSCS and HRA is very low but open-graded asphalt concrete, where finer particles are eliminated from the aggregate mix, is more porous and more suitable as part of a SUDS-led approach.

## 7.2.5 Coloured surface treatments

See section 6.2.6 for guidance on where coloured surfacing may be appropriate. In London, where colour is used for marking cycling facilities, it should be deep chrome green (No 267 BS381C: 1988) or blue on Cycle Superhighways (RAL5015).

The colour of asphalt surfaces depends largely on the colour of the aggregate used. This can be emphasised by using a clear binder – often a synthetic or vegetable-based binder. Coloured pigment can also be added but the colour of the aggregate endures much longer than any added colour, which tends to fade over time as the bitumen is worn from the riding surface. Coloured aggregate may cost up to twice as much as the standard shades of black/grey.

In conservation or other sensitive areas, natural stone-coloured chippings on HRA or natural stone-coloured asphalt concrete can be used. These colours can have longer life and better colour retention than other colours, but are often less conspicuous and less likely to have an enhanced driver awareness benefit compared to blue or green.

## 7.2.6 Comparison of surface materials

Among the most important considerations in choosing an appropriate surface material are cost (and variation by colour), durability and skid resistance. Polished stone value (PSV) gives a measure of skid resistance. A PSV of 55 is normally acceptable for road skid resistance.

Figure 7.3 shows, indicatively, a comparison of different surface materials and treatments according to these criteria. Only materials costs are included here. Laying costs can vary considerably depending on the area ($m^2$) and the required traffic management arrangements – difficult and restricted access, in particular, is likely to increase costs. The cost per square metre will also be higher for smaller areas. In each case, more accurate figures should be obtained from suppliers.

Figure 7.3 Surface treatments and indicative costs

| Surface Material | Life (years) | Skid resistance (PSV) | Indicative cost per square metre (£) | | |
|---|---|---|---|---|---|
| | | | Normal | Red | Blue/Green |
| 6mm asphalt concrete | 20 | 60+ | 8 | 12 | 25 |
| Coloured TSCS, 30-50mm thick | 20 | 55+ | - | 25+ | 25+ |
| Block paving | 20 | 55 | 20-30 | 20-30 | - |
| Brick paving | 20 | - | - | 20-40 | - |
| Concrete paving flags | 10 | - | 20-30 | - | - |
| Tactile paving | 10 | - | 30-40 | - | - |
| York stone flags | 20 | - | 160 | - | - |
| Granite paving flags | 20 | - | 100 | - | - |
| Thermoplastic High-Friction Surfacing | 4-6 | 70+ | 13 | 16 | 16 |
| Resin High-Friction Surfacing | 8-10 | 70+ | 15 | 18 | 18 |
| Cycle Track Veneer (thermoplastic slurry) | 5 | 55+ | 8 | 8 | 8 |
| Cycle Lane Veneer (polymer binder) | 10 | 55+ | 10 | 12 | 12 |
| Slurry Seal (poor colour and life) | 5 | 55 | | | |
| Surface Dressing – Granite Stone (bituminous binder) | 20 | 60+ | | | |
| Surface Dressing – Granite Stone (clear binder colour enhance) | 20 | 60+ | | | |
| Surface Dressing – Pea Shingle Stone | 20 | 50 | | | |

## 7.2.7 Road marking materials

A consistent standard of road markings is required, as described in TSRGD and the Traffic Signs Manual, chapter 5. For cycle symbols to diagram 1057, pre-formed markings are preferred.

Re-surfacing works can be an opportunity to review, address and upgrade various aspects of construction quality (falls to prevent or address ponding, gulley positions, grating types, chamber covers) and provision for cyclists (lane widths, pinch-points, corner radii, road markings).

Where extensive re-surfacing requires the removal of existing red or yellow line markings, highway authorities should consider providing replacement lines at the minimum permitted width. In addition to reducing visual intrusion and saving on materials, this can help to visually accentuate the width of cycle lanes or coloured surfacing and reduce the risk of cyclists skidding on road markings in the wet. 50mm line width is technically acceptable for design speeds of up to 30mph, and 100mm above this. Design teams should take account both of enforcement requirements and reasonable consistency of appearance.

Road studs, or cat's eyes, are an authorised marking, primarily a means of illuminating other road markings. These must comply with the requirements of TSRGD (2016), Part 2, Item 7 and may only be used in conjunction with those markings stipulated. This does not currently include diagram 1049B mandatory cycle lane markings. Any proposal to use them on cycle lane markings would need to be raised with DfT and trialled.

## 7.3 The pedestrian environment

### 7.3.1 Guidance on design for pedestrians

The main general sources of advice in this area are TfL's Streetscape Guidance and London Pedestrian Design Guidance and relevant borough street design and accessibility guidance.

In any interaction with cycle infrastructure, the layout of pedestrian facilities should be as simple and logical as possible and be consistent along a route. In particular, the needs of people with mobility and visual impairments and those with learning difficulties must be a priority in the design of footways and footpaths.

Specific advice on the provision of surface textures to assist pedestrians with visual impairments can be found in DfT's Guidance on the use of Tactile Paving Surfaces (2007). The following documents also provide useful guidance on general issues and those specifically related to integration with cycling facilities.

- CABE, Sight Line (2010)
- RNIB, Building Sight (1995)
- Joint Committee on Mobility of Blind and Partially Sighted People (JCMBPS), Adjacent Facilities for Pedestrians and Cyclists (2004)

### 7.3.2 Accessibility requirements

Tactile paving must be applied to street environments to ensure they can be used comfortably and reliably by people with visual impairments. For cycle facilities, this refers particularly to crossings, where separate but adjacent facilities are provided for cycling and pedestrians, and for any shared infrastructure. This section covers each of these scenarios.

Consideration for users is the most important principle. National guidance should be followed, in order to maintain legibility and consistency, but always with common sense in mind. The characteristics of a place, and the movement patterns it gives rise to, will dictate whether a given arrangement is fit-for-purpose. Design needs to be as supportive as it can be, while avoiding over-complication, illegibility or confusion.

Over-provision of tactile paving will cause confusion and discomfort, disbenefit streetscapes and be costly. Where possible, the street environment should be designed so that minimal tactile paving is required.

#### Tactile paving depth

Tactile paving should be provided so that all users can detect it and therefore needs to be no deeper than the length of the longest likely stride.

Research undertaken in 2010 by University College London concluded that 'the blister profile is readily detectable when it is 800mm wide', leading TfL to make a recommendation that the minimum width for longitudinal blister tactile paving on TLRN should be reduced from the 1200mm recommended in national guidance to 800mm, ie two rows of 400x400mm flags.

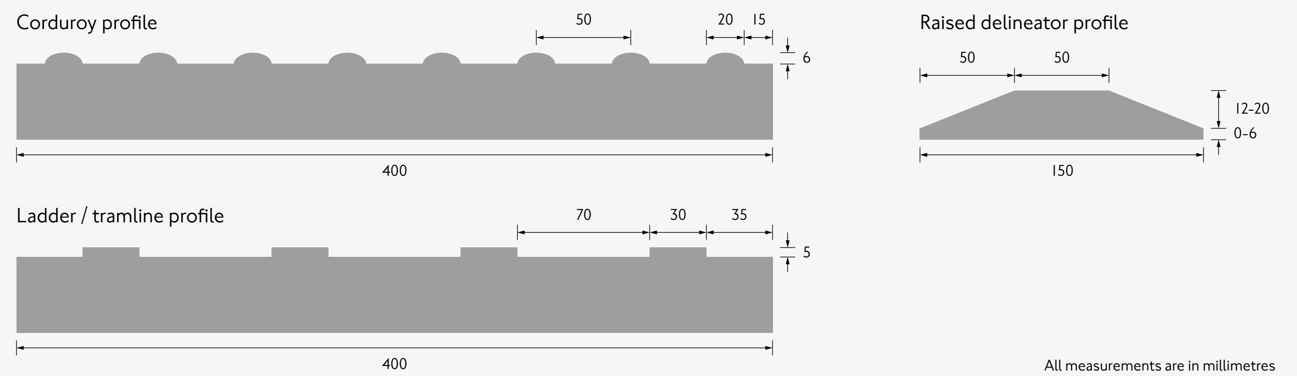
It may be reasonable to assume that, where any kind of tactile paving is intended to be understood only by pedestrians, the minimum depth should be 800mm, and to apply this logic to types such as ladder and tramline. TfL intends to undertake further research to test this.

Seeking to rationalise the amount of tactile paving used in a scheme makes sense from the perspective of legibility and comfort.

Moving across many types of tactile paving can be uncomfortable for both pedestrians and cyclists and therefore they should, ideally, be used sparingly.

Figure 7.4 Summary of tactile paving types used with cycle infrastructure

| | Description | Use |
|---|---|---|
| **Blister** | Paving with parallel rows of flat-topped 'blisters': 25mm diameter, 5mm high domes. Available in red, buff or various shades of grey. Usually provided as 400x400 modular paving with 6x6 or 7x7 domes. | 800mm depth at controlled and uncontrolled crossing points where the footway and carriageway are level with one another. Controlled crossings also have 800mm deep tactile tails of blister paving. |
| **Ladder and tramline** | Flat-topped ribs, 30mm wide, 5mm high, spaced 70mm apart. Available in light or dark grey, buff, or green, so that a consistent colour background can be achieved. Usually provided as 400x400 modular paving with 4 ribs. | National guidance sets out 2400mm depth to show a transition between an area shared between cyclists and pedestrians and an area separated between the two. As set out above, it is proposed that this may be reduced to 800mm minimum. Forthcoming TfL research will explore this proposition. On the cycling side, the 'tramline' tactile is aligned with the direction of movement. On the pedestrian side, it is laid transversely in a 'ladder pattern' – across the direction of movement. |
| **Corduroy** | Rounded ribs, 20mm wide, 6mm high, spaced 50mm apart. Buff, grey or charcoal colour tactile paving is available to match the footway. | 800mm depth to warn visually impaired people of the presence of specific hazards such as steps, level crossings or on-street light rapid transit platforms. Also used where a footway or footpath joins a shared route, conveying the message 'hazard: proceed with caution'. |




Comparison of corduroy and ladder/tramline tactile paving, in profile

## 7.3.3 Tactile paving at crossings

The advice in figure 7.4, taken from Guidance on the use of Tactile Paving Surfaces (2007) and Inclusive Mobility (2005), applies to pedestrian crossing of cycle tracks as well as crossing the carriageway. The most important principles for use are:

- Red blister tactile at controlled crossings (zebra crossings or signal-controlled crossings), with a tail to enable the crossing to be located
- Buff-coloured blister tactile, or a tone that provides clear visual contrast with the surrounding footway, at uncontrolled crossings (red should never be used at uncontrolled crossings)
- In some exceptional circumstances, such as Conservation Areas, a strongly contrasting grey may be acceptable at controlled crossings

Local streetscape guidance should be consulted for site-specific requirements.

At controlled crossings, 800mm-wide 'tails' run between the blister paving at the crossing-point and the back of the footway or building line. Appropriate tail lengths should ideally be derived from understanding pedestrian movement at each crossing, ensuring that the tail is perpendicular to the predominant pedestrian flow. For further details and examples, consult Guidance on the use of Tactile Paving Surfaces (2007).

## 7.3.4 Tactile paving at shared use areas

As figure 7.4 describes, Guidance on the use of Tactile Paving Surfaces (2007) recommends that ladder-and-tramline tactile paving should be applied to shared use areas to allow people, particularly those with visual impairments, to detect a transition between a shared area and separate spaces for pedestrian and cycle movement. Cyclists should be able to recognise when they leave a dedicated area and enter a shared area: there is an even greater obligation to act with care and courtesy in such environments.

Appropriate signing should also be provided: the sign to diagram 956 of TSRGD for shared use and to diagram 957 where a footway or footpath is divided between users. This should be adequate without needing surface markings although it can be helpful to provide these in some circumstances as inlaid tiles (see section 6.3.4). Where cyclists and pedestrians are separated but at the same level, the 20mm raised delineator strip to diagram 1049.1 of TSRGD should be used.

TSRGD diagram 956

TSRGD diagram 957


Red blister tactile paving used at controlled crossings. Note the buff blister tactile at the uncontrolled crossing of the cycle tracks, bottom

## Legibility and coherence

Designers need to consider the legibility of the street environment and the desirability of minimising sign clutter when it comes to signing shared use areas. Over-use of tactile paving and signing can lead to unattractive, incoherent and confusing provision.

- It is more or less impossible to account for every direction or angle of possible pedestrian movement – this makes it difficult to provide tactile paving that is fit-for-purpose
- Cyclists can slip on tramline tactile paving, particularly in wet or freezing conditions – their wheels can become deflected by the longitudinal grooves
- It is recommended that all other alternatives should be explored before relying on tactile paving to distinguish between different areas preferably, this should include clear physical – and/or visual distinction between an area for cycling and a shared area

Where a cycling scheme appears to require a large amount of tactile paving and signing to diagrams 956 and 957, this usually indicates that the design solution is not fit-for-purpose and it should prompt a re-design.

If cyclists cannot be accommodated in safety and comfort on the carriageway, or vertically separated from pedestrians off-carriageway, then fully shared use is often preferable to short, 'stop-start' sections of separated use at footway is level.

## Ladder and tramline

Where ladder and tramline is provided, Guidance on the use of Tactile Paving Surfaces advises that 2400mm depth should be used. TfL is proposing that this may be reduced, potentially to a minimum of 800mm, in line with conclusions about depth of blister paving, and will undertake research to test this.

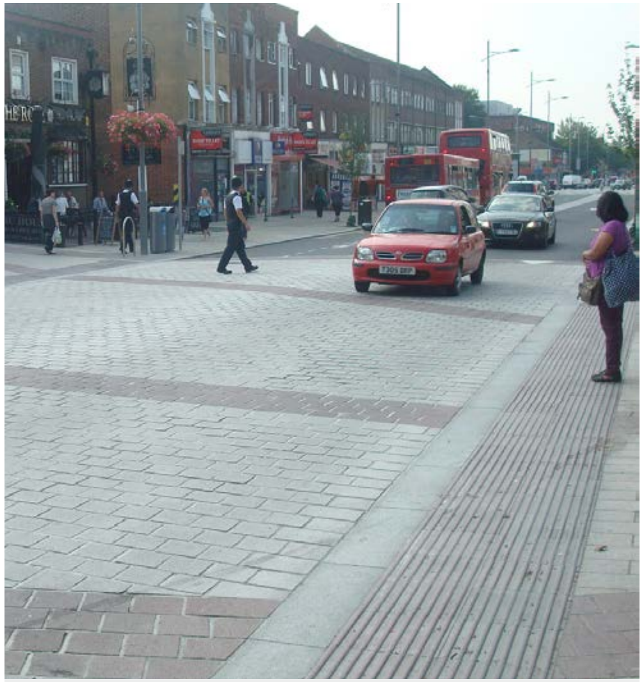
It is possible to use tramline tactile paving on its own at the start of a cycle track and accompanied by cycle track sign TSRGD diagram 955, or at the start of a segregated path with the sign to diagram 957. However, it is preferable that other visual cues should be used to identify a facility as a track or path for cyclists before resorting to tactile paving.


Ladder and tramline at 2400mm depth (left) and 1200mm (right)

## Corduroy

Where a footway or footpath joins a shared route, Guidance on the use of Tactile Paving Surfaces advises that 800mm depth of corduroy tactile paving be used at the transition. Corduroy, which is normally used at steps or other changes of level, is similar to ladder/tramline but its ribs are rounded and more tightly spaced and so it feels different underfoot. It is important not to confuse these two types of tactile paving and corduroy should never be laid in line with cycle movement as it can destabilise riders.

Corduroy tactile paving material has also developed a 'variant' use (ie one not described in DfT guidance) as substituting for a kerb edge in schemes where a level surface treatment has been applied. This is in order to help blind and partially sighted pedestrians find the edge and is intended to assist cane users in particular. Whether this treatment is appropriate will depend on the overall design for a street. It should not be applied without broader consideration of the needs of all users as part of a scheme and without assurances from user groups that it will convey the intended message.



Corduroy paving used instead of a kerb edge at Bexleyheath

## 7.3.5 Pedestrian guardrailing

The Mayor's Manifesto (2012) said: 'The capital has too many guardrails, restricting the movement of pedestrians and also presenting a hazard for cyclists.' TfL has produced Guidance on the Assessment of Pedestrian Guardrail (2012), based on the experience of analysing and removing pedestrian guardrail at around 150 junctions and 200 staggered crossings in central London.

The assessment procedure should include a road safety audit, starting from the assumption that all the guardrailing is to be removed. Guardrails can be especially hazardous for cyclists as they block a potential escape route in the event of collision. Removal of guardrail does, however, reduce opportunities for informal cycle parking and at least an equivalent number of stands should be re-provided in the vicinity.

## 7.4 Maintenance and asset management

### 7.4.1 Why maintenance is important

The maintenance of cycle routes and cycle facilities is essential if they are to encourage cycle use. Attention to maintenance for cycle routes should be higher than generic highways standards described in DfT Roads Liaison Group, Well-maintained highways (2005) and elsewhere. Even minor defects can unseat a rider and poor surface quality can increase the effort required to cycle to the extent that it deters cycle use.

Highway authorities should consider obligations under the Equality Act (2010) with regard to level of service and disabled cyclists. Poor maintenance affects non-standard cycle users disproportionately. Any user of a cycle with more than two wheels cannot avoid pot-holes without putting themselves at increased risk. For those who use their cycle as a mobility aid, damage to their cycle can negatively affect quality of life.

Relevant to effective maintenance are ownership issues and the New Roads and Street Works Act, 1991. NRSWA provides a legislative framework for street works activities by all undertakers, with the aim of coordinating them efficiently for the benefit of all road users. In some instances, certain responsibilities under the Highways Act (1980) and NRSWA are devolved to contractors.

### 7.4.2 Maintenance regimes

Importantly, cycle routes need to be inspected and resurfaced regularly. Occurrences of any of these defects should be rectified in order to maintain the comfort level of service rating. It is recommended that each highway authority should:

- Integrate routine inspection of cycle facilities into its in general highways maintenance regime
- Integrate consideration of cycle facilities into planned road maintenance programmes – for example, identifying what improvements for cycling can be made as part of planned resurfacing
- Make use of the local cycling community in identifying road faults, obstructions and maintenance issues (smartphone technology can contribute to this)

Winter maintenance needs to be considered separately, due to the additional risks that this presents to cyclists and likelihood of people being deterred from cycle use during the winter months. Cycle lanes and tracks can become unusable without adequate salting or gritting. However, excessive grit accumulating by the road, in cycling facilities, is also a problem. Snow and ice cleared from the carriageway should never be allowed to accumulate in cycle lanes. Issues identified in regular inspections should be raised with the relevant borough winter maintenance manager, or equivalent.

Consideration of maintenance routines needs to include ensuring that there is access for the use of maintenance vehicles to all parts of the cycle network, and that such vehicles are appropriate for winter use and snow and ice clearance. Segregated lanes, for example, are likely to need small sweepers.

Visual inspection by cycle and on foot are the simplest methods but cycle- or motor vehicle-mounted equipment can be a useful additional tool in measuring surface quality on a regular basis.

### Maintenance hierarchy

TfL has developed the following hierarchy based on cycle flows and the relative importance of designated routes:

**Prestige**
Policy priority route, with very high flows (>2500 cyclists/day) and/or part of the Cycle Superhighway or Quietway network

**Primary**
High flows (1000 to 2500 cyclists/day) and/or sites that are part of other designated cycling routes

**Secondary**
Medium / low flows (<1000 cyclists/day) and/or local access and links

**Cyclists excluded**
Any section of highway from which cyclists are legally excluded

## 7.4.3 Surface quality

Uneven surfaces can affect the balance and stability of bikes, or generate swerving manoeuvres, which can contribute to the risk and seriousness of injury. As set out in section 7.1 above, to ensure cycle safety and comfort, upstands of over 10mm parallel to the direction of travel and over 15mm at right angles need to be avoided for any cycle facility. These should inform the thresholds for intervention for each of the surface quality issues set out in figure 7.5.

Some streets are more sensitive than others to the negative effects of surface defects and, through maintenance regimes, should be prioritised. These sensitive streets include feeder access routes to schools and parks, or any other street often used by children, older people or people carrying children on cycles.

Figure 7.5 Typical maintenance issues affecting cyclists

Standing water due to uneven or slack gradients, blocked gullies, rutting of surface or leaking water valves

Surface cracking or excessive rutting (top) Worn/smooth manhole covers (bottom)

Unsuitable road gullies: dished, with longitudinal waterway gaps or with frame set below adjacent surface

Missing surface material or failed reinstatement

## Standing water

Standing water is a risk as it results in an unnecessarily slippery surface and cyclists swerving to avoid spray from passing vehicles. It needs to be treated as a priority all year round and not just in cold weather. It can also conceal other hazards, such as broken glass or a pot-hole, or indicate a drainage problem. Blocked gullies or inadequate drainage should be identified and rectified during normal maintenance routines. Leaking water valves are the responsibility of the water authority and NRSWA coordinator.

## Ironwork

Ironwork should be checked during routine inspections so that skid resistance is compatible with that of the surrounding road surface, particularly where surface coatings have been applied. Covers sitting low or loose in frames can be a source of discomfort or even a safety risk for cyclists where they need to swerve to avoid the cover.

Most inspection covers (other than gullies and other surface water chambers) are the responsibility of service providers: replacement covers must be ‘badged’ identifying the owner (as set out by NRSWA, 1991). These companies may have their own intervention levels but these may not adequately meet the needs of cyclists.

Highway authorities may replace covers but may not be able to recover costs.

Poor maintenance practices can result in the tops of gullies being set unnecessarily low, which is not only a problem for cyclists but also results in vehicle impact loading and early failure. To avoid this issue, contract specifications should address materials and construction details, and supervision of work is required.

## 7.4.4 Debris and other obstructions

Some maintenance issues will need to involve relevant borough street cleansing and refuse collection teams in a programme of inspection and checking, or in the identification of problem areas such as spillages from refuse vehicles. Inspections should focus on typical problem locations, such as the areas around bus stops and petrol stations.

Broken glass or other debris often blown across by motor traffic can cause danger to cyclists trying to avoid it. This can be a particular problem when segregated cycle lanes are introduced and debris ceases to be deflected by the normal flow of vehicles. Any changes to the cleansing contractor’s schedule will need to be notified and agreed, and should be recorded in case cleansing problems arise.

Obstructions such as skips, hoardings, scaffold and building materials left on cycle lanes and tracks should be identified in inspections and reported to the relevant borough licensing team for highway works. Effective planning, programming and supervision of works is required to avoid contractors and statutory and private utility companies obstructing cycle infrastructure with compounds, machinery, plant and equipment. Obstructions caused by advertising material or other unofficial street furniture, or by persistent parking, should be dealt with through enforcement and reported to the borough NRSWA team.

Building materials left on cycle track

Contractors obstructing cycle route

## 7.4.5 Landscape growth

Growth of adjacent planting over the edges of cycle lanes and tracks can seriously reduce the width available to cyclists. It can reduce sight lines to create blind spots, sometimes giving rise to social safety issues. Cyclists can find it harder than pedestrians to avoid branches due to their speed, and their height off the ground.

Vegetation needs to be kept in check by regular trimming, typically using mechanical hedge cutters, and by periodic major pruning. Light pruning will not address the creeping forward of the main trunks of shrubs and trees in locations such as canal towpaths. The mowing or hedge pruning zone needs to be kept clear of obstructions, to allow machines to be used for this maintenance.

Inspections need to be proactive and enforcement letters issued to private owners (under section 154 of Highways Act, 1980) before the problem becomes unacceptable. The authority must have in place a procedure for inspecting the works in default of a notice and a regime for their own trees. Issues around grass encroaching on cycle tracks should be addressed to the relevant borough street cleansing manager, or equivalent.

Stinging nettles, brambles and other trimmed-back thorn bushes need to be thoroughly removed after cutting to ensure that punctures do not result. (Wherever possible, avoid cycle tracks and such plants in close proximity).

Consider proximity of trees and bushes when planning and maintaining signs

## 7.4.6 Street furniture, signing and lighting

Maintenance inspections should highlight where any street furniture close to the kerb represents an obstruction for cyclists. This includes permanent, temporary or fly-posted signs attached to poles and lighting columns. Any missing or damaged signs should also be noted during inspections and reported to the relevant borough highway engineering manager.

Damaged sign obstructing cycle track

Obstruction by street furniture

Signs can be rotated, removed unofficially, not replaced after collision damage, or made illegible with graffiti. Problems such as these can give the impression of a route with issues of social safety as well as indicating lack of importance given to cycling by the managing authority. Anti-rotational brackets should be fitted to appropriate signs, particularly 'finger' direction signposts – see section 6.3.7. Square-profile posts can also help to remove this problem.

Surface markings are likely to become worn, and may be removed by trench digging or by resurfacing. These defects should be rectified as soon as they become illegible. Markings can also become difficult to read if they have been part-reinstated. Contractors should be instructed to repaint the whole of any road marking, rather than just the part directly affected by their works.

Inadequate lighting of cycling facilities ideally needs to be addressed through proper design and/or improvement schemes. Frequent inspections can help identify issues, which should be raised with the relevant borough highway engineering manager or equivalent.

## 7.5 Structures

### 7.5.1 Overview

Making difficult connections can often only be done by taking cycling facilities over or under other features such as highways, railways and waterways. Because these usually require cyclists to deal with gradients, and because they are likely to be costly, a strong case will need to be made for their construction. However, bridges and subways can play an important role in cycling networks, and they can offer a high degree of safety and directness.

Opportunities should be taken to improve access generally with investment in cycling infrastructure, which can help contribute to the business case. Structures should therefore enable better pedestrian access and improved access for people with visual and mobility impairments, in line with duties under the Equality Act (2010).

### 7.5.2 Bridges

White House Lane bridge, Hackney – before and after. Conversion to a fit-for-purpose cycling link

New bridges should allow for comfortable and direct cycle and pedestrian movement. Although separation may be considered for wide structures, subject to the advice given in sections 4.5 and 4.6, shared use is likely to be practical. It also works better where any turns need to be made by cyclists as this will be difficult to achieve while staying one side of any separation.

Consideration should be given to the likely growth in cyclist numbers due to network improvements and making a new link locally. It is recommended that new pedestrian/cycle bridges in urban areas should be built with at least 4 metres' clear width.

## Gradient

Bridges for cyclists' use should be designed so as not to require cyclists to dismount and use steps, which is usually best achieved through access ramps. Ramps should have a shallow gradient – generally be no greater than 1 in 20 (5 per cent). A 1 in 12 (8 per cent) gradient over short stretches with flat landings every 10-15 metres may be preferable to a long or convoluted 1 in 20 ramp.

Where multiple ramps are needed, they should preferably avoid 90- or 180-degree angles where they turn. Turning circles of larger cycles and of mobility scooters need to be taken into account in the design of ramps and landing areas (see section 3.2.3).

A ramp as steep as 1 in 12 is likely to be difficult to negotiate for many other users. DfT's Inclusive Mobility guidance recommends that gradients up to 1 in 20 (5%) are acceptable only over short distances for manual wheelchair users. Should a bridge have a ramp exceeding 5%, it should be provided with a lift, to specifications set out in section 8.2.1, enabling access for people with larger models of cycle who may not be able to use a steep ramp.

Bridges with separate pedestrian and cycling facilities in Stockholm (left) and Minneapolis (right)

Ravensbury Park shared use bridge, Merton

Access ramp, Richmond

## Parapet height

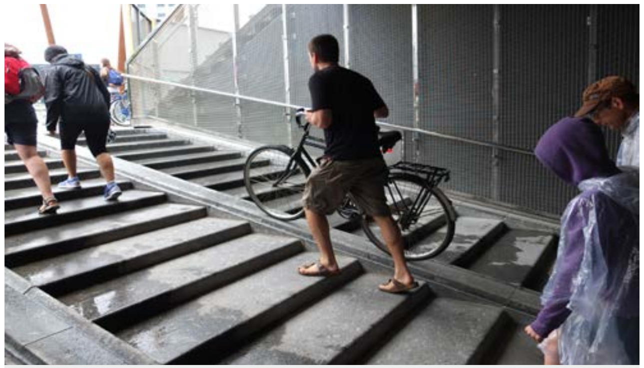
On footbridges intended for shared pedestrian and cycle use the minimum parapet height stipulated by DMRB, section BD 29/04 is 1.4 metres. Where pedestrian and cycle use is separated, this requirement only applies to the cycle side. On other structures and situations it is recommended that a risk assessment be carried out to inform design options. The Sustrans guide, Parapet heights on cycle routes: Technical information note no. 30 (2012), includes guidance on undertaking such a risk assessment.

High bridge parapets

## 7.5.3 Wheeling ramps

Where steps are unavoidable at bridges and subways, or as a short-term, low-cost measure pending replacement, concrete or steel-section wheeling ramps on one or both sides of steps should be considered, giving cyclists an alternative to using lifts or carrying their cycle. Retrofitting wheeling ramps should be considered whenever bridges, railway stations and underpasses are refurbished. Steel-section ramps, with a high-friction surface for the ramp channel, should be at least 100mm wide and 50mm deep, and mounted at least 200mm away from the wall.

Wheeling ramps are of limited use to those with non-standard cycles and are not a substitute for step-free access, which will generally need to be served by providing a lift. If step-free access cannot be secured, signing ahead of the bridge or subway is needed to indicate this and to provide alternative, step-free directions.



Concrete wheeling ramp, Netherlands

## Pedestrian accessibility issues

In fitting wheeling ramps, care needs to be taken to avoid compromising the accessibility needs of pedestrians, particularly young children, older people and people with mobility impairments, all of whom may need to rely on close proximity to the handrail. Ideally, a sufficient number of handrails should be provided at the edges and at the centre of the steps to allow for two sides to be dedicated to pedestrian use and two to cyclists.

Where this is not achievable, a wheeling ramp may be installed directly below a handrail so that they do not interfere with one another. This requires enough space for the cycle to be wheeled without catching the handlebars on the handrail. Angling the channel of the wheeling ramp outwards may help. Otherwise, a wheeling ramp for cyclists on one side only may be the best solution.

Wider stone or brick infill sections for wheeling cycles are often easier to use, and can also offer some assistance to people with prams and pushchairs. For the above reasons, these should only be used if users still have full, close access to handrails (on another part of the steps).

Wheeling ramps

## 7.5.4 Tunnels and subways

A dedicated cycle tunnel or subway, or one shared with pedestrians, may be a viable option as part of an urban cycling network. It can help:

- Avoid circuitous, possibly motorised traffic-dominated routes
- Give protection from weather and, provided it is not used by other vehicles, a good riding surface
- Offer consistent provision where the tracks join off-carriageway facilities on either side

A well designed tunnel or subway could become an attractive, distinctive and memorable part of any cycling route. However, this will require good lighting, high standards of maintenance and ramps to provide access to and from the facility, so construction and maintenance costs are likely to be high. Angled approach ramps can create blind corners and lead to social safety concerns so, wherever practical, subways designed to give good through-visibility are preferred.

### Design considerations

Due to the probable need to turn corners, shared use is likely to be preferable to separation and sufficient widths should be provided to retain comfortable movements for all users. Noting the need to provide for growing numbers of people walking and cycling, a working minimum of 4 metres should be applied wherever possible, widening on busier sections of path or where separation of users is considered to be necessary.

DMRB section BD 78/99 sets out tunnel design requirements for vehicular traffic, much of which also applies to tunnels for cycle and/or pedestrian use only. The DMRB definition of a road tunnel is ‘a subsurface highway structure enclosed for a length of 150 metres, or more’. Most of the basic design and management requirements set out in DMRB are assumed to apply to tunnels largely dedicated to cycling.

Headroom through tunnels and subways should be a minimum of 2.4 metres for cyclists (DMRB, section TD 36/93) and 2.1 metres for pedestrians. In many cases, such as on canal towpaths, this cannot be achieved because of structural constraints. Reduced headroom should be highlighted using an explanatory sign with appropriate text (such as ‘Cyclists beware – low headroom’), and stating the actual height available. Existing structures that have headroom less than 2.4 metres should not be precluded from inclusion within a cycle network, and should be signed appropriately.

Sustrans’ Technical Information Note No.29, Lighting of cycle paths (2012) provides further information on design considerations for tunnels, underpasses, subways and bridges.

Subway for cycle crossing of busy road, Netherlands

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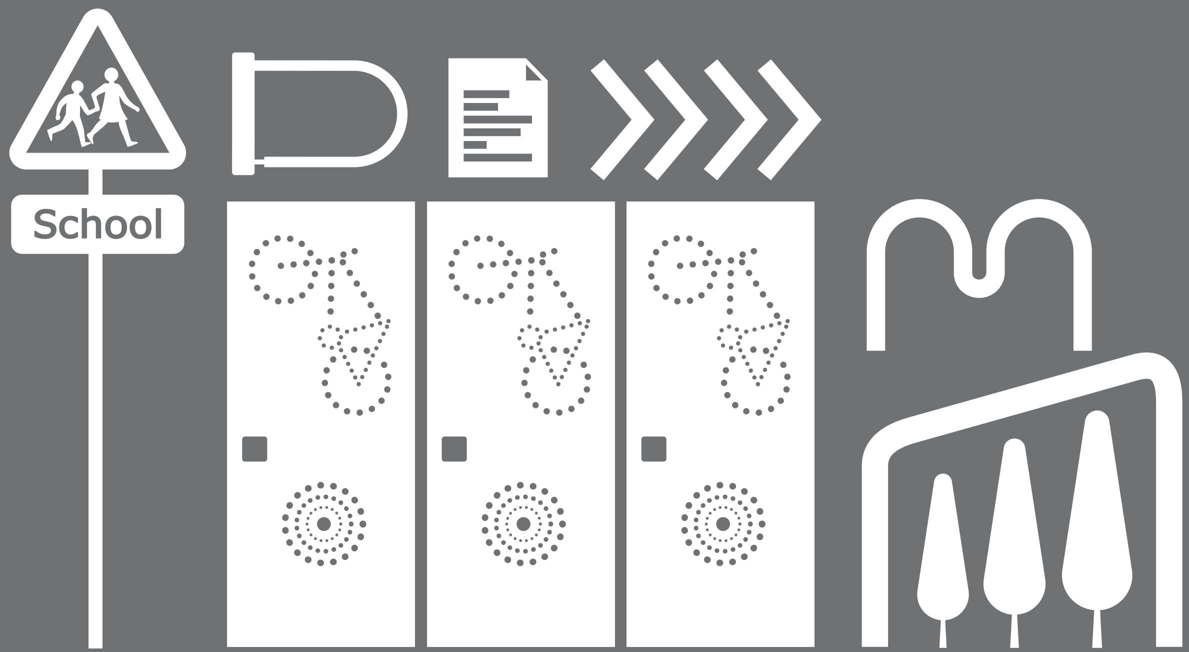
# 8. Cycle parking

This chapter focuses on the planning and design of high quality parking facilities for all cycle users – fit-for-purpose, secure and well located.




**Version control**

Version 1 (Dec 2014) – Published

Version 2 (Sept 2016) – Minor amendments following publication of TSRGD (2016)

# 8. Cycle parking

## 8.1 Why cycle parking is important

### 8.1.1 Supporting cycling policy

'We will deliver 80,000 additional cycle parking spaces in residential locations, stations, workplaces and other trip destinations by 2016. We will put them where people most need them.' Mayor's Vision for Cycling (2013)

Provision of cycle parking and its security are essential for supporting the development of cycling as a practical transport choice. A lack of appropriate cycle parking facilities is often cited as a barrier to cycling and cycle ownership and use, and could be a constraint on the future growth of cycling.

The number, quality and range of types of cycle parking spaces available must not only keep pace with the growing use of cycles in London, but also needs to allow for the substantial future growth set out in the Mayor's Vision for Cycling. Some, more accessible locations will see higher-than-average increases in cycling, and so will need cycle parking to support this level of use.

Opportunities to provide more and better cycle parking should not have to come exclusively through programmes and projects aimed at promoting cycling. Various streetscape and highway improvements offer the possibility of raising the quality of cycle parking provision in the public realm.

Cycle parking also needs to be a key consideration for any new development that people are expected to travel to and from – just as journeys on foot, by public transport and by private car are planned for. Through the planning process, high quality cycle parking should be regarded as an integral part of a scheme, an essential part of the attraction of a development – never just an add-on to meet minimum policy requirements.

### 8.1.2 Cycle parking principles

Cycle parking should be:

**Fit-for-purpose** – meeting identified current and future demand, with an appropriate balance of short-stay and longer-stay provision, and accommodating all types of cycle.

**Secure** – stands in secure private or indoor spaces, or in visible, well-lit places that have high levels of natural surveillance.

**Well-located** – convenient, accessible, as close as possible to the destination, and preferably sheltered.

Planning and design of cycle parking needs to take into account the different types and sizes of cycle that exist – including, for example, handcycles, upright and recumbent tricycles, tandems and solo cycles with adaptations to suit the rider's specific needs (see section 3.2 for further details and dimensions). This is important for ensuring that any cycle user with a physical, sensory or cognitive impairment can enjoy access to good quality cycle parking. An inclusive approach to cycle parking is recommended and includes:

Cycle parking in Covent Garden

- Step-free access, which may require provision of shallow ramps or lifts large enough to carry all types of cycle
- Signing to accessible facilities at locations where the type of cycle parking is difficult or impossible for all to use
- Making available spaces for larger models and, potentially, reserving allocated spaces for disabled cyclists

## 8.1.3 Quality of provision

Local authorities and developers are expected to make appropriate provision for cycle parking to support targets for cycling. In order to fulfil that role effectively, the quality of cycle parking will be as important as the quantity. A number of key issues around the quality of cycle parking have been raised in the London Assembly report, Stand and Deliver: Cycle Parking in London (2009) and in TfL's Cycle Security Plan (2010).

Achieving the best quality of provision, in terms of location, design and type is important in order to:

- Ensure that adequate facilities are available for those who already cycle
- Reduce cycle theft through appropriate facilities to lock and store bikes
- Encourage more people, and a more diverse range of people, to choose cycling as a mode of transport
- Encourage inclusive cycling
- Reduce obstruction and other nuisance caused by ad-hoc parking
- Relocate any under-used cycle parking
- Help more children and older people to cycle

## 8.1.4 Planning requirements

The planning process should be used to help deliver high quality cycle parking through:

- Applying London Plan and Local Plan policies and standards to new development
- Ensuring that development and transport plans include proposals for addressing existing gaps in provision
- Using planning obligations and conditions to help deliver additional high quality, inclusive cycle parking facilities to meet those identified gaps

The London Plan requires better cycle parking through planning. In the Further Alterations to the London Plan (2014) new cycle parking standards are proposed for new or re-development in London by use class, drawing from research conducted for TfL by SKM Colin Buchanan: Cycle parking standards supporting evidence report (2014).

The new standards include specific requirements for both long- and short-stay parking (see section 8.3.1 for explanation of long- and short-stay). While these standards establish minima for cycle parking provision, clients, designers and planners should seek to identify and meet identified future demand, which will invariably lead to a higher level of provision than the minimum standards.

Applicants should also note that the Accessible London supplementary planning guidance (2014) – which has been prepared to support the London Plan policy 7.2 on inclusive environments – articulates Mayoral support for promoting cycle use by people with physical, sensory and cognitive impairments. Implementation point 21 states that 'boroughs and developers should seek to encourage inclusive cycling through providing an element of secure parking suitable for inclusive cycles, cargo cycles and tricycles, within general cycle parking, that is accessed via a step-free route'.

Growing demand for cycle parking

## 8.1.5 Determining cycle parking requirements

Providing the right cycle parking for a place requires an understanding of the dynamics of current and likely future cycle use in an area, and ideally should be planned in an integrated way with cycle routes. Qualitative criteria are just as important as the quantity of cycle parking provided.

There is a clear case for providing cycle parking where there is existing evidence of use but simply serving existing demand is unlikely to accommodate the projected growth in cycle use. Setting targets for cycle parking in locations where use is currently low, but where an authority may wish to promote cycling, will depend on the potential to attract use and to provide facilities that meet the standards set out in this document.

Cycle parking may well be needed to serve a demand that is currently suppressed. Analysis of trip generators and the relationship between likely origins and destinations can help inform this projection of future demand.

The right amount of cycle parking for a site or area would be at a level that:

- Meets existing baseline demand
- Meets the potential demand generated by the existing and proposed land uses in the area
- Ensures there further is allowance for spare capacity (ideally, at least 20 per cent)

### Destinations

All destinations should be served by cycle parking that can accommodate employees, customers, residents and visitors. Key destinations include:

- Residential areas, including housing estates and private houses and flats
- Shopping centres and high streets
- Workplaces
- Hospitals and health centres
- Council buildings
- Education establishments including schools, colleges and universities
- Community facilities and services eg libraries, pre-school and day-care facilities
- Entertainment and leisure venues
- Public transport interchanges such as: National Rail, Docklands Light Railway and London Underground and Overground stations, and docks providing river boat services

### Assessing potential demand

Methods include:

- Surveys of existing patterns of cycle parking, taking into account formal and informal parking areas, existing cycle stands in public and private areas, and 'fly parking' to street furniture and guard railing

Cycle parking serving destinations

- Surveys at different times of the day, week and year – cycle parking demand in winter tends to be approximately 60-80 per cent of the demand in summer, while identifying variations by time of day and day of week can reveal peaks and give indications of trip purpose
- Making a broader assessment of where trip generators are, and where and when people are likely to, or could, travel there by cycle – this includes identifying where and when new developments are proposed locally
- Trialling temporary stands, including stands for larger types of cycle – temporary parking for events or in support of trial layouts can help demonstrate how much cycle parking could be accommodated with more permanent solutions


Temporary cycle parking provided as a trial measure

Provision of new or increased cycle parking should also be informed by consultation with cyclists, pedestrians, retailers and local residents, many of whom will be able to give a more rounded view about variation of cycle parking demand through the day, week and year.

This should be proportionate to the level of investment and the likely impact on other users.

For new development, applicants should consult the latest version of the London Plan to verify minimum requirements, and should check with the local planning authority, which may have its own minimum standards in its Local Plan. Developers and planners should seek greater provision than the minimum wherever possible, particularly in locations where trips by cycle could grow substantially. The quantity and quality of cycle parking is likely to become an ever more important factor in attracting potential buyers, occupiers and customers.

### Constraints

The feasibility of providing cycle parking in a given location needs to be considered alongside assessing demand. Carriageway or footway space and underground utilities or structures will determine whether locations are suitable. Clarity about these constraints is important before consulting on any options for new cycle parking.

A Traffic Order is necessary for on-carriageway cycle parking, but not for off-carriageway (ie on the footway), although this may be an effective form of consultation in some sensitive areas. Alternatively, a temporary Order may be secured more quickly for a temporary use of part of the carriageway for cycle parking, for up to 18 months. See section 2.4.6 for guidance on procedures for Traffic Orders.

## 8.2 Fit-for-purpose cycle parking

### 8.2.1 Cycle parking for all

In addition to the considerations of security and location covered in sections 8.3 and 8.4, fit-for-purpose cycle parking should:

- Be accessible to all and signposted as necessary
- Meet recommended space requirements but use space efficiently
- Serve identified uses, with an appropriate balance between long- and short-stay
- Provide for flexible use during the day and week
- Be integrated well with other uses of a street or public or private space

Cycle parking needs to take into account all user needs, so as not to exclude or disadvantage riders of certain types of cycle. This includes people who use handcycles, tricycles, tandems and models adapted to suit the rider's specific needs, as well as cargo cycles.

Larger cycles can be accommodated where tubular stands are used, in or outside of a building, shelter, cage or compound, provided they have step-free access and sufficiently wide door openings (see below). The most practical method is to ensure that stands are provided in short runs with large gaps between runs to allow a larger cycle to be secured to each end stand. It is recommended that at least 5 per cent of all spaces should be capable of accommodating a larger cycle.

Space at the end of a run of stands in Copenhagen


Dedicated spaces for larger cycles, Houten station cycle park, Netherlands

### Space requirements for larger cycles

Where cycle parking is inside a building, it should have step-free access, wide doorways and spacious corridors. Accessing the parking area should involve passing through no more than two sets of doors, with a recommended minimum external door width of 2 metres. Lifts or shallow gradient ramps should be provided to any basement cycle parking. To accommodate all types of cycle, lifts should have minimum dimensions of 1.2 by 2.3 metres, with a minimum door opening of 1000mm, and any door to a cycle parking area should be automated – push button or pressure pad operated.

## 8.2.2 Signing to cycle parking


The signing strategy in an area should help people to find cycle parking and to continue their journey from the parking area. TSRGD contains a standard sign, diagram 968, for this purpose on-highway. Wherever it is necessary, any such sign should be mounted so as to avoid creating additional sign clutter in the public realm.

Off-highway, owners or managing authorities should provide their own signing. They may wish to demonstrate where step-free parking for non-standard cycles is available by using signing such as 'trailer/tricycle/disability cycles parking' at the end of bays. Kerb-free access from such spaces to the carriageway will be required, so a suitably positioned section of dropped kerb will need to be provided.

For any parking area where access is not step-free, or where stands are difficult to use by people with larger models of cycle or who cannot lift a cycle, signing should provided to accessible cycle parking areas. This is likely to be the case where two-tiered stands are used.

## 8.2.3 Efficient use of space

Space available is always likely to be a constraint, although the choice of cycle parking type should not be dictated by space alone. To calculate indicative space requirements, at least 1.4 square metres should be allowed for per space if using Sheffield stands that accommodate two cycles per stand. An area of at least 1,400 square metres is therefore required for every 1,000 spaces, in the most ideal circumstances.

A higher figure will be needed where there are physical constraints and where stands are arranged in bays with generous gaps (to allow for access for all types of cycle). Some stands may be more space efficient: 0.7 square metres per parking space should be allowed for if using two-tiered stands.

Some indicative space requirements are summarised in figure 8.1, based on the Sheffield stand. There are many other products on the market, particularly those that private owners may consider within their property, and space requirements will need to be calculated based on the characteristics of each type. The Cambridge cycle parking guide (2008) and Cambridge cycle parking guide for new residential developments (2010) are good sources for further guidance on the range of different types of stand and on space requirements for standard cycles.

Figure 8.1 Recommended cycle parking space requirements
(based on bays of multiple Sheffield stands in a parallel arrangement)

| | Recommended | Minimum |
|---|---|---|
| Bay width (length of cycle parked on a stand) | 2m | 2m |
| Access aisle width (if larger cycles are accommodated on end of bay) | 3m | 1.8m |
| Access aisle width (if larger cycles need to use the aisle) | 4m | 3m |
| Width needed for access aisle + bay on one side | 5m - 6m | 3.8m - 5m |
| Width needed for access aisle + bay on both sides | 7m - 8m | 5.8m - 7m |
| Spacing between stands | 1.2m | 1.0m |

## 8.2.4 Meeting demand flexibly

It is important to ensure that the spread of demand across the day is considered, in conjunction with planning for provision that is appropriate for trip purpose and length of stay.

In most workplaces, it may be assumed that the demand for spaces will occur at peak times during the working day, and there will be a low turnover in use of a given space in one day. In these instances, visibility of cycle parking is not critical, although it can be important for encouraging more people to take up cycling.

In contrast, a Sheffield stand located in a busy shopping area is likely to offer a convenient facility, suitable for short stays, and should be located in a highly visible area with good natural surveillance, covered if possible. This parking is also likely to have a higher daily turnover of use.

## 8.2.5 Tubular stands

Sheffield stands, bolted to the surface or embedded in the ground, are the most common type of tubular stand. They offer a simple, robust and cost-effective cycle parking solution: two cycles can be parked on one stand and a range of locking positions are possible.

For consistency, it is recommended that the finish of stands on the highway should be either black, signal grey or stainless steel. On the TLRN, black, nylon-coated stands are the standard for central London and town centres, with stainless steel being standard for arterial roads. Designers are advised to consult guidance on street furniture issued by the relevant highway authority.

Consideration must be given to helping visually impaired people identify areas of cycle parking. Stands on the footway should not be placed in obstructive locations – they should be in an identified street furniture zone keeping at least 2 metres' clear width for pedestrian movement (see section 8.4 for more details). They must also have a strong visual contrast with the surrounding environment. Use of visibility bands in a contrasting colour on Sheffield stands is generally a good approach (white on black or black on stainless steel are the requirements on the TLRN). A tapping rail is also recommended for the end cycle stand, so that an empty stand can be identified by anyone using a cane.

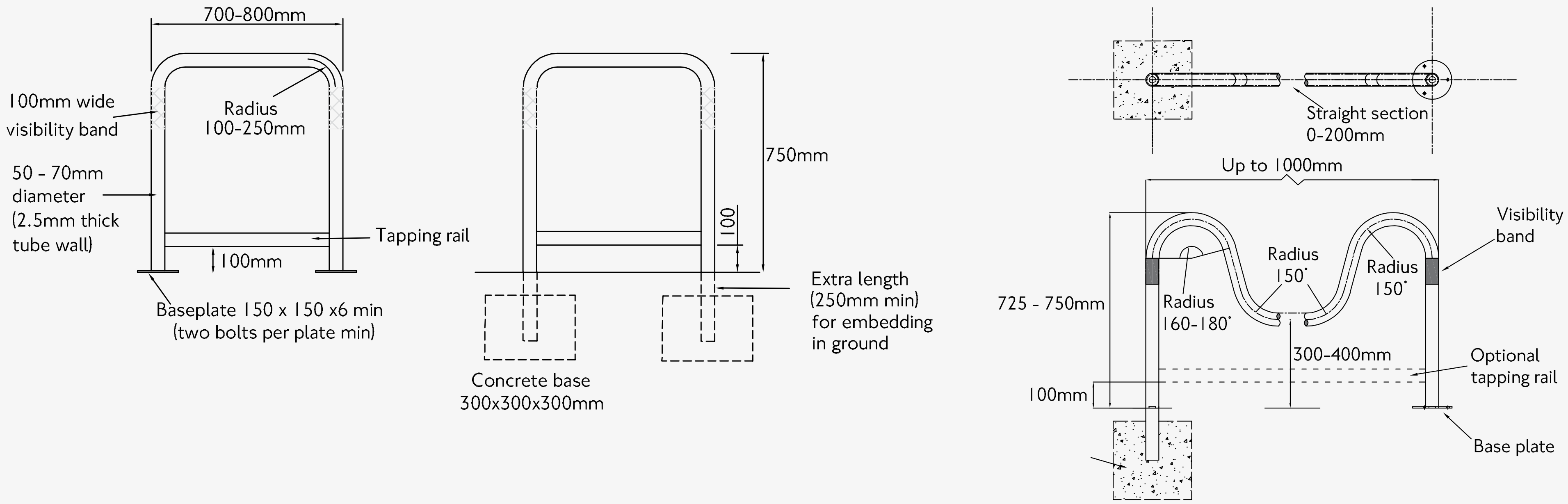
Sheffield stand, with visibility bands and tapping rail

M-profile stand

Typical use of stands between footway and carriageway

An alternative to the Sheffield stand is the M-profile stand, which has been designed specifically to facilitate double locking.

Other tubular cycle parking designs are available on the market, and may be suitable in many locations. While it is important to take a flexible approach to the design of cycle parking stands, they should always fulfil the main function of allowing for two-point frame and wheel locking.




Standard details and dimensions for Sheffield stand (left) and M-profile stand (right)

## 8.2.6 Two-tier stands

Where they are of good quality, durable, easy-to-use, and in secure or well overlooked locations, two-tier cycle racks are an innovative solution to space constraints and high demand for cycle parking. The racking system stores cycles above each other, with a retractable upper tier, which increases the capacity of the site. Racking systems are best provided in locations where instructions for use can be given to ensure that cyclists use the facilities safely.

A minimum aisle width of 2500mm beyond the lowered frame is required to allow cycles to be turned and loaded. An overall aisle width of 3500mm should ideally be provided where there are racks on either side of aisles, though this may limit the density advantages of two tier stands. The minimum height requirement is 2600mm.

Two-tiered, high capacity cycle parking at Euston station

Two-tier stands tend not to be suitable for all users and all types of cycle – using the upper tier, in particular, would be difficult for many people. They should therefore be used in conjunction with other types of stand in the vicinity, with signposting to more accessible stands as necessary.

Careful consideration should be given to:

- The location of stands, minimising conflict with pedestrians using the surrounding area
- The level of natural surveillance surrounding the stands to ensure users feel confident to lock their cycles using the stand
- The design of the chosen stand, to ensure cycles can be locked by securing at least one wheel and the frame – it is possible to specify two-tier racks with an additional security bar, to enable both wheels and the frame to be secured

## 8.2.7 Cycle lockers

Cycle lockers can offer secure and dry parking, and other storage facilities for longer stays. However they require more management than other cycle parking solutions.

Consideration should be given to:

- The design of the locker, particularly any moving parts, which are particularly vulnerable to vandalism or leverage by thieves
- The space available and cycle parking demand – some cycle lockers, particularly those that store cycles horizontally rather than vertically, have a large footprint
- Accommodating all sizes of cycle
- A management system, which may be provided by the supplier or planned separately
- The level of supervision of locker sites, ensuring they do not suffer from vandalism or misuse
- The location of lockers within a site, to ensure the facility is convenient and accessible
- The operation and management system of lockers when installed and sustainability of any system in the future, allowing access to anyone who wants to use it
- Liability for securing contents, which may need to be clearer than with open parking
- The ability to open and search lockers for security reasons

Cycle lockers

## 8.2.8 Secure shelters and compounds

Secure shelters, compounds and cages can be used to provide additional security for longer-stay cycle parking at locations such as public transport interchange points, workplaces or high density residential developments.

Access can be enabled by a fob or swipe card operated by a registered user. Any control box should be mounted at a maximum height of 1400mm to allow for access by all users.

Some shelters are designed for use in the street environment, making more efficient use of space previously dedicated to car parking. They are particularly useful in areas of terraced housing where space for cycle storage is often in short supply.

For any secure shelter or compound, careful consideration should be given to:

- Access to the facility, ensuring spaces are available to registered users
- Administration of the access system and responsibility for keys/access cards, including a deposit system for cards and whether a charge is levied
- Type of cycle parking racks, allowing cycles to be secured within the compound and enabling parking of larger models of cycle
- Personal security of those accessing the compound, including lighting, CCTV, visibility in the compound, doors opening away from the carriageway
- Maintenance and operational costs
- Management of the facility – if managed by a private company, legal agreements may be needed to enable this use of highway space
- Retaining access for street cleaning
- Ensuring that drainage is not adversely affected

Shelter in car parking space on residential street in Hackney

Secure compound

## 8.3 Secure cycle parking

### 8.3.1 Secure locations

Where it is in the public realm, cycle parking should be in a location that people feel safe using at all times of the day – visible, accessible, well-overlooked and well lit. Otherwise, the preference is for parking areas that can be secured and with controlled access, or where efforts have been made to address security concerns, such as installation of CCTV.

> Users need to feel both that their cycle will be safe where it is parked, and that they will be safe accessing and using the parking.

A key consideration is the balance between long- and short-stay cycle parking. Long-stay is for residents, employees and others who may be leaving their cycle over a night or more, and normally has limited, controlled access. Short-stay is for visitors, customers and other, more flexible uses, and tends to be in the public realm with open access.

Long-stay cycle parking is best located in a building, for example in a basement parking area, provided the entrance is well overlooked and well lit. Access needs to be considered carefully, particularly for those using non-standard cycles, with clear signing from the main entrance of the building to the parking area. It is recommended that external doors are a minimum of 2 metres wide. Refer to advice given on use of shallow ramps and lifts in section 8.2.1 above.

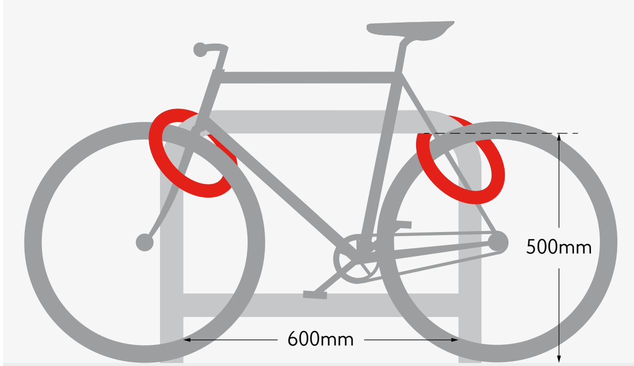
Where location in a building is not possible, bespoke shelters and lockers are an option, but consideration needs to be given to planning requirements. Cycle parking outside of buildings should be:

- Sited in locations that are clearly visible and well overlooked with high levels of natural surveillance, and CCTV where necessary
- Designed with consideration of sight lines into and out of the cycle cages, compounds or secure store
- Adequately lit and overlooked, particularly at night-time or where the parking is under cover

### 8.3.2 Secure locking

A wide range of cycle parking products are available, but the cycle parking design chosen, and the location of the cycle parking should, as far as possible: allow the frame and both wheels of the cycle to be secured, and provide support for any type of cycle without damaging it.

In order to allow for securing the cycle by the frame and both wheels, locking points should be approximately 600mm apart and 500mm above ground. The stand shape should provide locking within 100mm of these points to facilitate the use of two 'D' locks, ie a range of 400-800mm in width and 400-600mm above ground. It should be noted that stands thicker than 75mm will stop the use of a 'D' lock.




Recommended double locking practice

Damaged or vandalised cycles left in public often signal the insecurity of cycle parking and, in some areas, cycle parking facilities are unlawfully occupied by motorcycles and scooters, sending a similar negative message. It is therefore important that cleaning and maintenance of areas of cycle parking is considered during the planning and design of new facilities. Regular inspections should be made by the managing authority to identify where maintenance of stands and parking areas is required, including the removal of damaged cycles after a suitable warning period.

## 8.4 Well located cycle parking

### 8.4.1 Serving destinations

A good location for on street cycle parking is essential so that facilities will be well used and integrated with other street functions as appropriate. Parking should be located in close proximity to user destinations and accessible to local services. Boroughs should consider advertising cycle parking locations on their websites and elsewhere.

> The preferred way to integrate street cycle parking with other functions is to locate it in carriageway rather than footway space.

Proximity to a destination influences a cyclist's choice of where to park, so cycle parking should be convenient and well located. As a general rule, and bearing in mind the need to integrate with other user needs, cycle parking should be provided:

- As close as possible to the final destination
- Within 15 metres for short-stay parking serving a single destination
- Within 25 metres for short-stay parking serving multiple sites
- Within 50 metres for longer-stay parking
- In convenient locations for entrances to and exits from the destination
- Where there is step-free and comfortable access – eg through use of dropped kerbs, cycle routes and crossings
- In such a way as to allow for parking larger cycles

### 8.4.2 Cycle parking in the carriageway

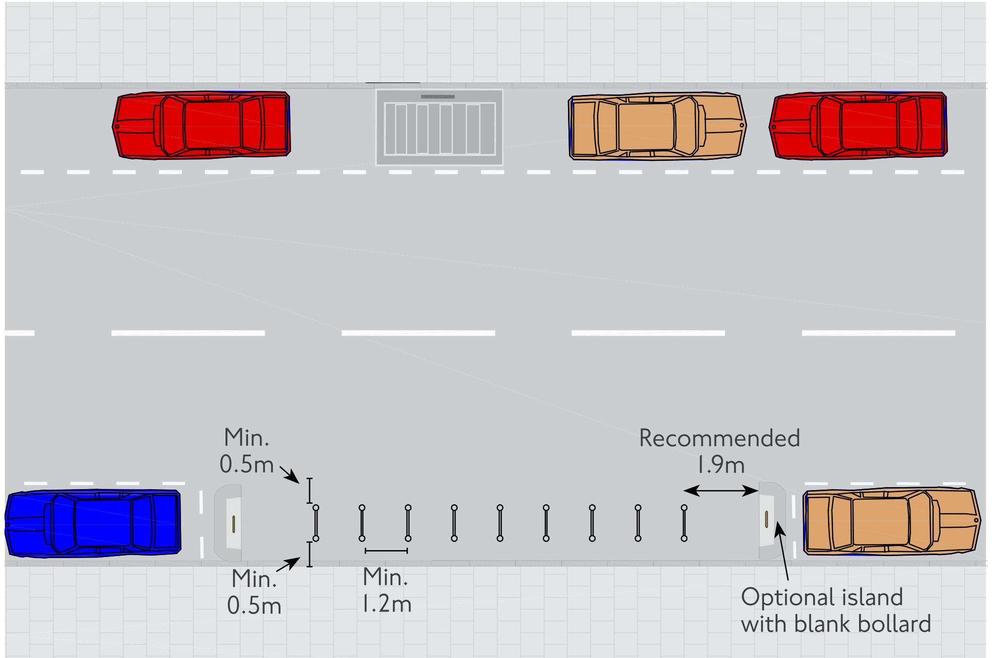
In a street environment, cycle stands should be located in space taken from the carriageway wherever possible, inset or with island protection as necessary. This requires a Traffic Order and needs careful planning and consultation in relation to potential loss of car parking or carriageway space, but it is the best way to avoid taking up footway space and creating conditions that require mitigation for visually impaired people. It can work well in streets where access is closed or restricted for motorised vehicles.

Footway build-outs can serve a similar function without reducing footway space, although impacts on users of the carriageway need to be assessed (see chapter 3 for further details). Cycle parking on, or inset into, segregating islands for cycle infrastructure is also recommended.


On-street cycle parking in Hackney

Considerations for cycle parking in the carriageway, on build-outs or on segregating islands include:

- Impact on kerbside access to properties, particularly for deliveries and disabled parking (although the issues are similar for footway cycle parking)
- Impact on informal pedestrian crossing desire lines
- Provision of a buffer space to moving traffic, to allow cycle users safe access and allow for cycles protruding well beyond the stand
- Maintaining access to utilities
- Potential obstruction of drivers' view at junctions or near pedestrian crossings




Indicative layout 8/01: Cycle parking stands in the carriageway

## 8.4.3 Cycle parking on the footway

Where there are no other alternatives, footway cycle parking should be located in an identified street furniture zone adjacent to the carriageway, in order to leave clear space for pedestrians – 2 metres is recommended wherever possible.

Design considerations are similar to those for on-carriageway cycle parking. An emphasis is needed on not obstructing pedestrian desire lines and movement, or access for deliveries from shops and other premises. Care should also be taken to allow for car doors to open, if there is parking at the kerbside, and to avoid obstructing access or egress onto buses. Provision also needs to be made for visually impaired people to identify the potential obstruction that cycle parking stands on the footway represent.

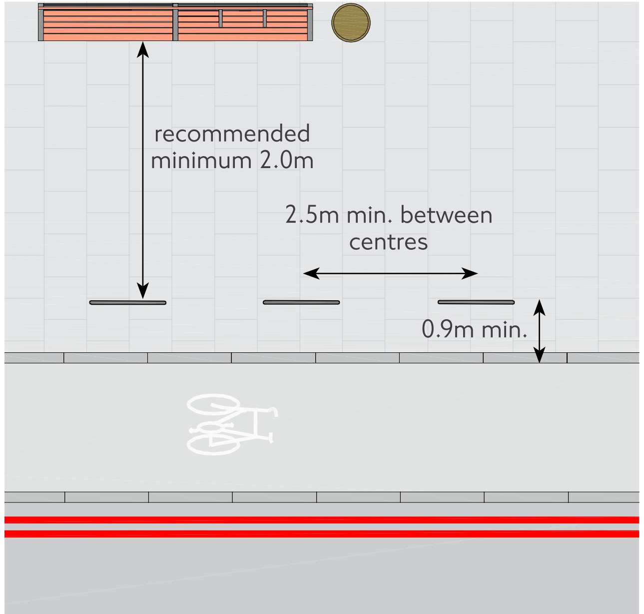
Cycle parking products fitted to lamp columns and other street furniture can, if well sited, help minimise clutter although they cannot facilitate double locking and may not be suitable for all types of cycle. They must meet guidance in this document on minimum clearance from the kerb edge and they should integrate well with existing street furniture (ie be the same colour as the post or column). They must avoid reducing pedestrian comfort levels or creating new obstacles to pedestrian movement, particularly for visually impaired people.

## 8.4.4 Layout of stands

On-street cycle parking should be highly visible, well-lit and clear of pedestrian and vehicle sight lines. Recommended practice for design of layouts is provided by TfL's Streetscape Guidance and this must be followed on TLRN. Separate guidance on cycle parking may be provided by individual boroughs and will apply to borough roads. TfL's recommendations are as follows:

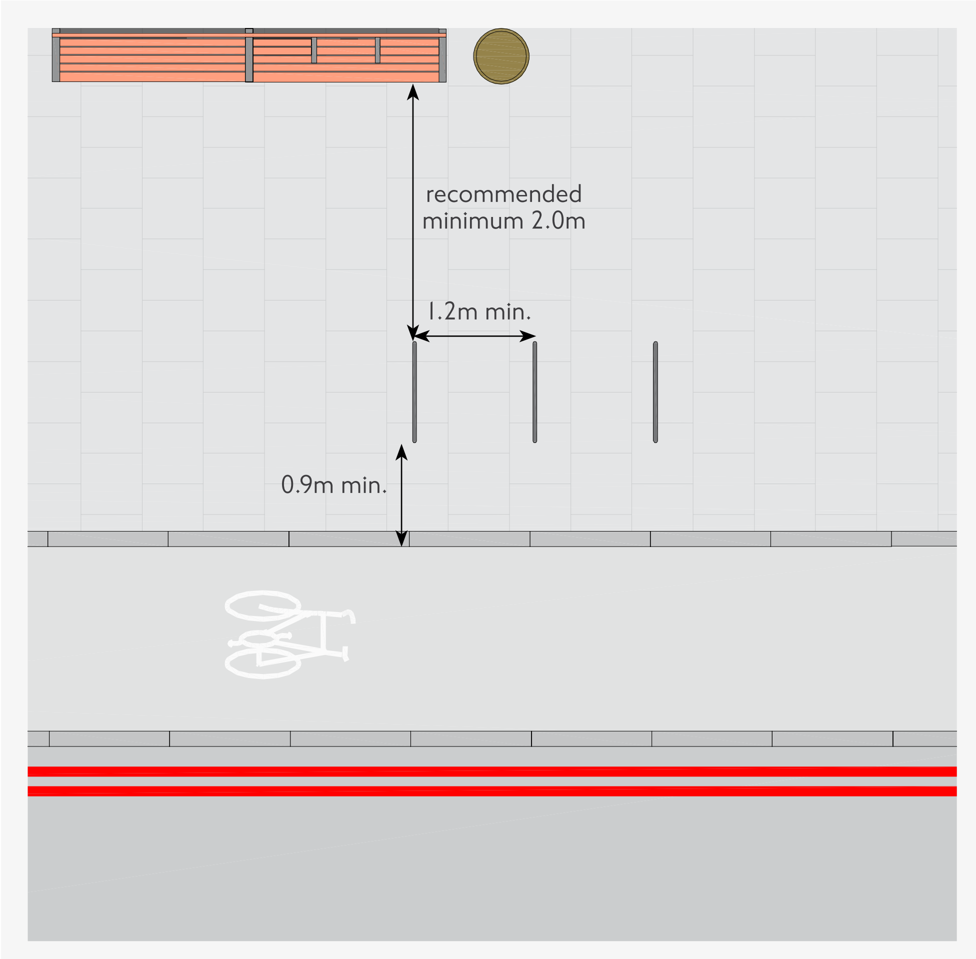
- Sheffield-type cycle stands on the footway should be placed in the furniture zone adjacent to the kerb, not at the back of the footway
- Stands should be placed so that the clearance between the kerb edge and any cycle parked on any stand is at least 450mm to the carriageway or cycle track (layouts in this section give indicative dimensions to help achieve this)
- Placement of cycle stands on the footway should not lead to a reduction in pedestrian amenity below Pedestrian Comfort Level C – in most cases, this means retaining a minimum of 2 metres clear width for pedestrians
- When cycle stands are grouped together, a minimum spacing of 1000mm should be provided between stands to allow access – 1200mm is preferred
- Cycle stands should be set at either 45 or 90 degrees to the kerb – in this arrangement they occupy a smaller area for a greater number of stands (note that, where stands are angled, spacing is measured using the perpendicular distance between stands)
- In some locations, cycle stands can acceptably be provided parallel to the carriageway – this is a less efficient use of space and consideration of the impact on pedestrian crossing movements is needed
- The visual impact of cycle stands can be reduced if they are placed between other items of street furniture, especially tree planting within an organised street furniture zone on-footway
- De-mountable stands might be considered to aid maintenance at locations where cycles and stands are subject to vandalism
- There should be at least 600mm clearance between a stand and any another object higher than the kerb face
- At least one stand in any group should be placed to allow for a larger cycle to be parked – this is usually a matter of leaving enough clear space at the end of the run

While the advice on layout given in TfL and borough guidance represents good practice, innovative approaches to overcoming space constraints are often required and should be considered on a case-by-case basis.

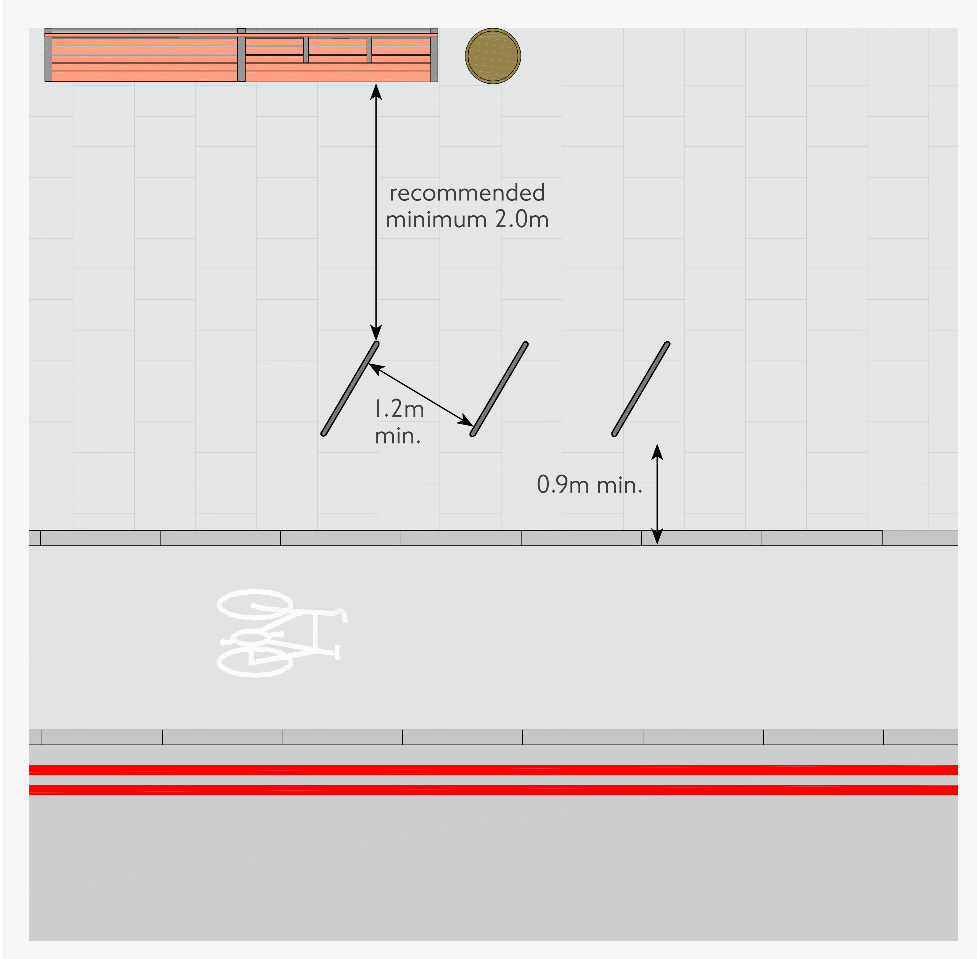



Indicative layout 8/02: Parallel cycle parking stand layout

Sheffield stands parallel to the carriageway




Indicative layout 8/03a: Perpendicular cycling parking stand layout




Indicative layout 8/03b: Echelon cycle parking stand layout

## 8.4.5 Integration with street design

Cycle parking should be considered as an integral part of street design. Where an area has particular characteristics that are reinforced by street furniture, cycle parking should complement the approach adopted.

Cycle parking located poorly on narrow sections of footway not only creates hazards for pedestrians but also contributes to the cluttering of the street. In situations where footway space is limited, under-used areas of carriageway on the edges of squares may offer better opportunities for cycle parking.

Stands in the middle of the carriageway on median strips or adjoining traffic light and pedestrian crossing facilities can work well as part of an overall streetscape design. Care should be taken when proposing this kind of solution. While centrally located stands have advantages in being able to serve destinations on both sides of a street, if traffic conditions make it difficult to cross or to leave or re-enter the carriageway from the cycle parking area, or the distance to destinations is too great, then they may not be well used.



Informal, moveable cycle parking can add to the qualities of an area, provide facilities while works are taking place and serve local businesses

Echelon cycle parking on the footway

A fit-for-purpose stand is also one that is appropriate for its context, and alternative types may be needed for sensitive areas. By using bespoke types, cycle parking can also serve a place-making function as part of an integrated approach to public realm improvement.

Cycle stands for DLR stations

## 8.5 Supporting different uses

### 8.5.1 Public transport interchanges

The Mayor's Vision for Cycling promises more cycle parking at central London termini and suburban stations, which will enable better integration between transport modes and help embed types of travel behaviour that support trip-chaining. The Vision also introduces the idea of cycle hubs and superhubs, which will provide extensive and secure parking and include related facilities and services.

The type and location of cycle parking at stations varies greatly across London. Space constraints at stations in central London are often addressed through use of freely available, high capacity stands, while outer London stations more often feature stands in covered, secure locations. Cycle hire also plays an increasingly important role in facilitating choice in access to and onward journeys from a transport interchange.

There is increasing evidence of the link between cycling and rail use, and increasing demand for cycle parking at stations in London. Generous cycle parking provision at stations, including secure, longer-stay parking, is essential to allow stations to act as hubs for interchange and to cope with the projected increase in numbers of cyclists resulting from investment in cycling infrastructure.

Covered cycle parking at Shoreditch High Street station

At larger stations, the projected demand for cycle parking is likely to be so high that it will be difficult to accommodate stands in the public realm or in existing buildings. In many cities in continental Europe, good quality cycle parking has been provided in bespoke new buildings, or in underground facilities.

#### Principles

Cycle parking at stations and public transport interchanges should be:

- Located within footprint of the station, with convenient access to all entrances and exits
- Accessed via a step-free route, particularly for stands capable of accommodating larger cycles (with spaces reserved for disabled users)
- Served by lifts to platforms large enough to accommodate types of cycle used by people with physical, sensory and cognitive impairments (who will need to take their cycle onto the train)
- Provided through different types of stand (ie not all two-tier)
- Well managed and maintained
- Overlooked, with high levels of natural surveillance and CCTV coverage
- Well integrated with pedestrian facilities (ie not an obstruction)
- Clearly signed, in and outside of the station, and shown on station maps and websites
- Compliant with security standards for National Rail (eg Transec compliant)
- Included in travel information provided to passengers

Further information and guidance about cycle parking at railway stations may be found in Association of Train Operating Companies (ATOC), Cycle-Rail Toolkit (2012).


Entrance to underground cycle parking at s'Hertogenbosch station, Netherlands


Cycle parking at Houten station, Netherlands

Cycle parking at Malmo station, Sweden

Bus stop cycle parking, Nantes, France

## Making the case for cycle parking

A study of existing cycle parking at London railway stations by Mott MacDonald on behalf of TfL (Cycle Parking Standards at Rail Stations Report, 2010) found that demand either exceeded supply or cycle parking was close to capacity at central London termini, zone 1 and strategic interchanges. With the increase in cycling since this report was produced, pressures will have grown further. Provision at stations therefore needs to be made that significantly exceeds current demand, enabling greater modal choice and freeing up capacity on other forms of transport.

Commercial relationships between train operating companies and third parties may complicate the installation of cycle parking facilities at some stations. In these instances local authorities should work in partnership with train operating companies to make the case for cycle parking. They should demonstrate what the future is likely to hold in terms of an increasing mode share for cycling and rising demand for cycle parking, which will in turn have a role to play in supporting the various transport-related and commercial activities of the interchange.

### Security

The right balance needs to be struck between serving the demand for cycle hire, short-term/freely available cycle parking and secure, long-stay facilities. Where secure facilities are provided, consideration needs to be given to how access will be operated and whether there will be a charge or deposit requirement. The parking stands within a secure facility need to be capable of allowing the frame and at least one wheel to be secured. Parking stands outside of secure areas need to allow for the frame and both wheels to be secured.

Levels of staffing at railway stations vary across London. Open-access Sheffield stands can be provided at staffed stations but more security is needed at unstaffed stations. Where it is not possible to accommodate demand by using lockers or a secure compound, measures such as CCTV might be employed to prevent vandalism occurring and to ensure users feel confident to use the facilities provided.

## 8.5.2 Cycle parking hubs

A cycle parking hub provides not only stands but also a range of other, related facilities. It should be able to offer both a high quantity and quality of cycle parking to meet existing and future demand and to promote modal integration, helping to open up possibilities for people with long commutes who may wish to cycle for part of their journey.

Cycle repair and CCTV as part of station parking facility in s'Hertogenbosch, Netherlands

At a successful hub, a cluster of related businesses and facilities should be feasible: this could play an important role in making cycling even more attractive.

In addition to the issues for cycle parking at public transport interchanges listed above, further considerations for a cycle parking hub include:

- Appropriate tariff for the parking, to ensure the facility can attract users
- Monitoring the level of demand for paid cycle parking as well as open access facilities
- Type of cycle parking used within the hub, to ensure it is securable and easy to use
- Staffing levels required to maintain a security and good quality service
- Design and location that will allow access at all the hours required by users
- Collaboration with cycle retailers and other partners to provide additional services – this could include cycle sales, cycle repair and information on cycling in the area
- Incentivising integrated cycle and train journeys through ticketing and hub membership offers
- Allocation of space to expand future parking capacity
- High level of service for cyclists on streets around the station
- Good signage and publicity for the facility

## 8.5.3 Residential cycle parking

A lack of cycle parking in residential areas was identified by the London Assembly in its report Stand and deliver: cycle parking in London (2009) as a significant factor discouraging people from taking up cycling as a mode of transport. Parking serving all types of home should be designed to be:

- Secure, with access for residents only, and with stands/racks allowing both the frame and at least one wheel to be secured
- Well located: close to the entrance of the property and avoiding obstacles such as stairs, multiple doors, narrow doorways (less than 1.2 metres wide) and tight corners
- Covered
- Fully accessible, for parking all types of cycle
- Managed, where possible, in order for access to be administered and to provide ongoing maintenance

Where cycle parking is provided within buildings, guidance in section 8.2.1 above should be followed. This includes providing level access, and avoiding multiple and narrow doorways.

Individual or communal cycle storage outside the home should be secure, sheltered and adequately lit, with convenient access to the street. It is best arranged in clusters and run by established clubs with identified members. For each individual cluster, a small number of members thereby have secure access.

Options for long-stay, secure facilities for residents may include cycle compounds, shared garages or other indoor facilities and cycle lockers.

Requirements for visitors' parking are different, but it also needs to be convenient and secure. Visitor cycle parking is usually provided in the public realm, and must be convenient and visible, overlooked and close to the building entrance. It must be sufficient to meet visitor demand and stands/racks must allow for the frame and both wheels to be secured. Sheffield stands are usually fit for purpose for this use.

### New developments

New developments must take every opportunity to overcome barriers to cycling for their prospective residents and for visitors. Good quality cycle parking is a selling-point.

Planning obligations should be used not only to require enough cycle parking, but also to ensure that it is of high quality: well located, secure, visible, well overlooked and fit for purpose. Developers have much to gain from making cycling an integral part of their transport strategy and should be encouraged to approach the issue positively.

As a bare minimum, London Plan requirements must be met – preferably a level of cycle parking should be provided that meets projected future demand, plus 20 per cent.

Secure cycle parking should be managed to ensure it is utilised and that maintenance is included. There will be a cost to this but residents generally are willing to pay for it if it is a good quality service. Registered social landlords should be encouraged to implement and manage cycle parking for schemes they develop.

Additional guidance on providing cycle storage in new residential development is given in the London Housing Supplementary Planning Guidance, adopted in November 2012. Cycle storage inside the home can work well, if it is provided over and above the minimum gross internal floor area and minimum storage and circulation space requirements. Cycle storage identified in habitable rooms or on balconies is not considered acceptable.

## Existing houses

Where space for cycle parking can be found by using private gardens or forecourts, then this is a good option for individual owners. Possibilities also exist for groups of neighbours or formal residents' groups to negotiate collective solutions.

Careful management of access to facilities such as these is needed, as well as a means for all those involved to contribute financially, as required. The use of shelters on-street is a good example of how this can work in practice, and local authorities should endeavour to give support and advice to ideas such as these whenever possible, including help with Traffic Order procedures as necessary.

One issue may be determining which households should be prioritised for access to secure cycle storage, and it may take local authority leadership to determine this even if residents intend to manage the facility themselves. Criteria could include whether residents could use private outdoor or indoor space, whether they would have to negotiate stairs, how frequently they cycle and the number of cyclists in the household.

## Existing flats and housing estates

Constraints on private and shared space in communal blocks often lead to cycle parking being neglected. Residents have to resort to parking informally in places that may not be suitable or storing cycles within their homes, which can create security and safety hazards such as blocking sharing hallways and staircases.

Housing estates do, however, offer opportunities for developing good quality, secure and well-used communal cycle parking. Under-used internal spaces, such as garages, bin stores and pram sheds, can make good cycle parking facilities with relatively simple adjustments. In other instances, lockers and cages may be more suitable, as cyclists typically prefer using facilities that provide access to a small number of users.

Cycle lockers in Waltham Forest

When promoting the retrofitting of cycle parking into estates, local authorities should also engage with other key stakeholders who may provide support or need 'convincing'. This includes:

- Registered social landlords / housing associations
- Health and well-being boards, who may support cycle parking as a contribution to improving public health
- Police, who have a duty to provide crime prevention advice to residents and boroughs
- Local neighbourhood teams, responsible for management of streets, whose role is also likely to include maintaining cycle parking facilities on estates
- Residents' associations, who may be able to apply for funding and gain local support for new facilities
- Local cycling organisations

## 8.5.4 Places of work

Businesses operating from central London offices often struggle to provide enough secure cycle parking for staff and visitors. More people being encouraged to cycle in London will place further pressure on employers to find ways of meeting demand. Commuters often need to use on-street facilities that were designed for short-stay parking. Not only is this less secure than formal workplace cycle parking, but it removes capacity for short-term parking to support other uses in the area.

According to TfL's Travel in London survey 3 (2010), which included survey information from new users of Barclays Cycle Superhighways 3 and 7, a significant number of people who began cycling to work on the Superhighways cited improved cycle parking facilities at work as a contributory factor – 18 per cent for users of CS3.

Cycle parking at workplaces is often an outcome of development control obligations or Workplace Travel Plans that help promote sustainable transport for staff. Investment in workplace cycle parking helps promote a mode of transport that has health and productivity benefits as well as reducing the strain on the local transport infrastructure. TfL's Workplace Cycle Parking Guide (2006) provides more information on initiatives such as these.

In order for secure cycle parking facilities to be well used, employers will need to engage with employees to identify the level of demand for cycle parking as well as employee's needs and expectations. Setting up a cycle user group can be a useful contribution to ensuring quality of provision for staff.

Use of limited space for workspace cycle parking

### Principles

Well designed cycle parking for staff should be:

- Secure, with access for staff only
- Designed to allow the frame and at least one wheel to be secured
- Covered
- Conveniently located, with step-free access from outside and inside
- Fully accessible, for parking all types of cycle
- Introduced with complementary facilities: showering and changing facilities with accessible features, storage (lockers) and equipment for basic maintenance, such as pumps

Consideration should be given to storage within buildings, cycle compounds, areas with controlled access and cycle lockers, in order to help serve the need for long-stay cycle parking for staff. There may be opportunities within many buildings to convert part of under-used areas, such as basements and car parks, into cycle parking. As is the case with new residential developments, these parking areas need to be fully accessible.

Visitors also need to be catered for. Either their cycle parking needs could be accommodated within the staff cycle parking area, or they may need separate provision outside of the building. This must be convenient, close to the entrance, visible, overlooked and with stands that allow the frame and both wheels to be secured. Information about cycle parking facilities, as well as cycle routes to the building, should be included in correspondence with visitors.

## Shops and services

Most of these issues also apply to retailers. Staff should be offered good quality, long-stay cycle parking without having to use short-stay parking on-street. Customer cycle parking serving individual shops or retail parks needs to be accessible, conveniently located for building entrances and well-overlooked and secure during all opening times.

Particular attention needs to be paid to accommodating larger models, such as cargo cycles, and to how cyclists access parking areas safely, particularly where they must do so through a car park.

Cycle parking serving a restaurant and studio spaces in Hackney Wick

In many cities with high levels of cycling, retailers often provide their own temporary cycle parking for customers during opening hours, moving the stands back inside overnight. This is based on understanding that convenient cycle parking is vital for their businesses.


Moveable cycle parking stand outside a shop

### 8.5.5 Public buildings

Large, multi-access sites such as hospitals, universities and colleges tend to have large numbers of people working and visiting. Cycle parking provision is likely to cater for both long-stay demand for staff and students, but also for short to medium stays, given that they have a high daily turnover of users.

Such sites often have a number of entrances and exits. Cycle parking therefore needs to be carefully planned in clusters, convenient for users, and located near to the entrances and exits that have higher levels of natural surveillance and footfall. However, areas should be avoided where conflict is likely with motorised vehicle access to and from car parks or drop-off points.

At sites where access may be permitted for 24 hours or beyond the normal working day, particular consideration is required of lighting and levels of surveillance after dark, and how safe the user feels accessing the parking.

Schools and other educational establishments are usually open only during certain hours, are staffed and are on private land. It may therefore be that existing security in the school grounds is adequate and that a secure compound is not required. It may be advisable, however, to operate a system where staff lock and unlock facilities at the beginning and end of the school day so as to protect any cycles left overnight.

Good quality cycle parking facilities at schools plays an important role in influencing the travel choices of young people. The right provision will depend on the age group of the children, and the range in sizes of cycles to be parked, as well as the cycle parking needs of staff and of parents or carers accompanying children on cycles.

Good quality cycle parking at schools should be:

- Located within footprint of the facility
- Easily accessible – clustered close to entrances/exits
- Visible, open and overlooked – to serve staff, students and visitors
- Covered

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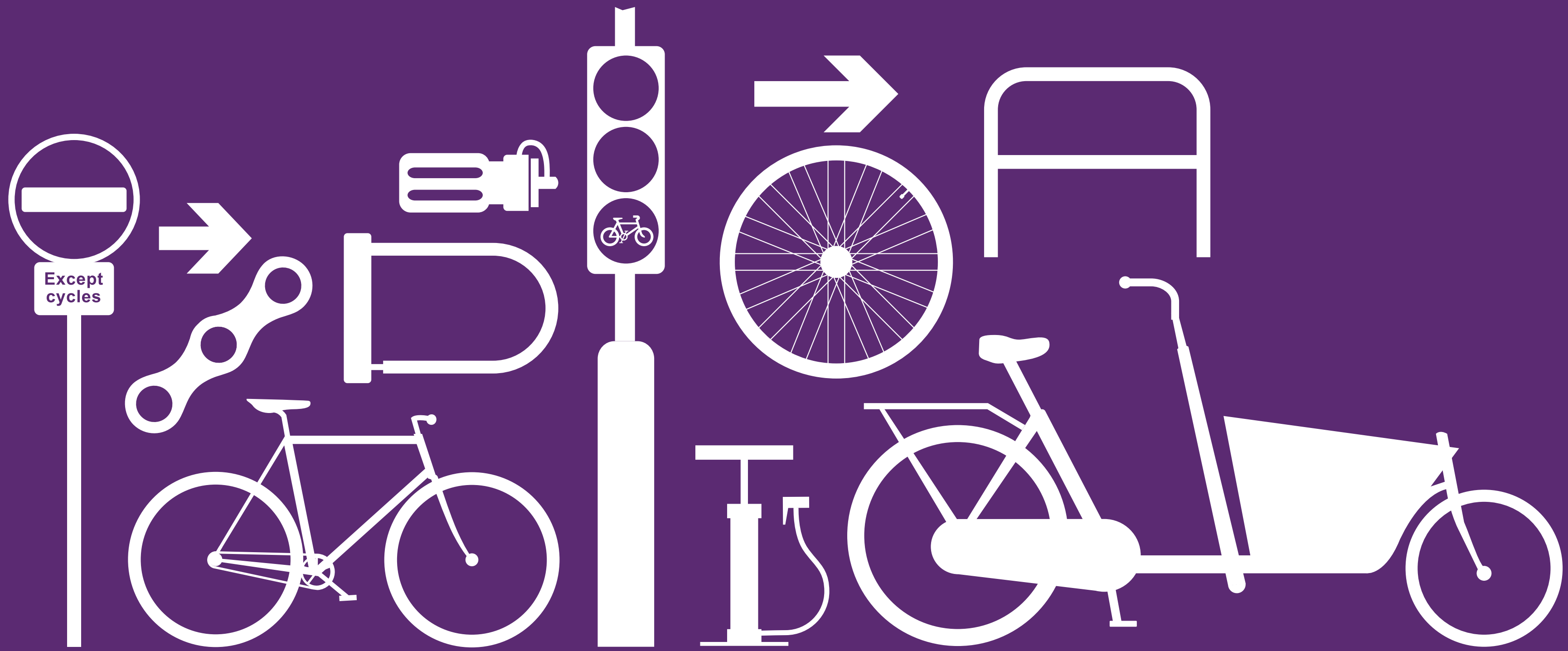
# Index and glossary

This section provides an A-Z index to the eight chapters of the main document, together with a glossary of common cycle infrastructure design terms.



## Index

## Glossary

### APPCG – All-Party Parliamentary Cycling Group

Group created to help promote cycling inside and outside the Houses of Parliament. Launched a cross-party inquiry into cycling in 2012, which led to publication of the 'Get Britain Cycling' report in 2014.

### Area permeability (or porosity)

In relation to cycling, a measure of how many locations there are for cyclists to comfortably enter, pass through and leave a given area, very often an area bounded by main roads or other constraints.

### Advisory cycle lane

A dashed white line marking an area of the carriageway designated for the use of cyclists. Motor vehicles may need to cross the markings but generally should not enter the lane unless it is unavoidable. Parking and loading is allowed unless specific restrictions are in place to prevent it.

### Angled kerb

A kerb with an angled profile, thereby increasing the effective width for cyclists, compared with a vertically profiled kerb. Various types exist, including splayed, battered and half-battered.

### ASL – Advanced stop line

Stop line for cyclists at traffic signals ahead of the stop line for general traffic, with a waiting area marked with a large cycle symbol and extending across some or all of the traffic lanes. ASLs may be accessed by an optional lead-in lane or gate. Regulations were changed in 2016 to allow cyclists to cross any part of the first stop line to enter the waiting area.

### Better Junctions

TfL programme of junction improvements, aimed at making them safer and more attractive for cyclists and other vulnerable road users.

### Bikeability

A programme of skills and confidence training for cyclists and a standard or measure of the level of skill and confidence achieved. Level 1 covers the basics of balance and control. Level 3 equates to the ability to plan and make a journey with confidence on busier roads.

### Blind-spot safety mirror

A mirror mounted at junctions in such a way as to give turning motorists a better view of cyclists in front and on the nearside of their vehicles. Area-wide authorisation for the use of blind-spot safety mirrors was granted by DfT to local authorities in England in February 2012.

### Blister paving

A type of tactile paving, consisting of a pattern of raised dots provided in a strip at the kerbside (very often where the kerb is dropped) to tell people that they have reached a place to cross. Blister paving in an 'L' shape, with a 'tail' in line with the crossing denotes a controlled crossing.

### Bollard

Any short, vertical post used in managing the movement of vehicles and people. They may be used variously to control access (to vehicles of a maximum width), to instruct users to keep to one or the other side, to warn of a low upstand or to separate different traffic streams.

See also Flexible post.

### Box sign

A regulatory sign (such as a prohibited movement sign), lit, 300mm in diameter and designed to be attached to a traffic signal head, very often next to the green aspect.

### British Cycling

A membership organisation that oversees all forms of cycling in Britain, including competition, leisure, commuting and utility cycling.

### Buffer

Space alongside a cycle facility intended to reinforce the need for other road users to give cyclists appropriate space. Often used between cycle lanes and parking/loading bays. Sometimes but not always marked with hatching.

### Bus lane

Lane designated for bus use during the signed hours of operation. Signs also advertise whether other vehicles, such as cycles, are permitted in the lane during those times. In London, with-flow bus lanes on TLRN are generally open to cycles, taxis and powered two-wheelers.

### Bus stop bypass

A bus stop layout in which through-movement for cycles is away from the carriageway and from the bus stop cage. Can be achieved with shared use or partially separated footway around the bus stop but usually features a dedicated cycle track passing behind the bus shelter. In this case, bus passengers cross to and wait on an island between the cycle track and the main carriageway. Sometimes also known as a 'floating bus stop'.

### Bypass

See bus stop bypass, cycle bypass.

### Carriageway

That part of a road or highway constructed for the use of vehicular traffic (including cycles).

### Central London Cycle Grid

A central London network of high quality, high volume cycle routes, combining Cycle Superhighways and Quietways.

### Chicane

A horizontal deflection in the carriageway used as a speed-calming measure.

### CLoS – Cycling Level of Service

An evaluation framework for assessment of the performance of cycling infrastructure from a 'rideability' perspective. Its purpose is to frame discussion about design options so that schemes are attractive both for existing cyclists and potential new cyclists.

### Coloured surfacing

Any surfacing material that changes the appearance of a conventional blacktop wearing course.

### Combined cycle track and bus boarder

A bus boarder is a build-out from the kerbside at a bus stop to improve access and egress for bus passengers.

A combined cycle track and bus boarder is a layout in which a raised cycle track passes between a bus stop and a bus cage. Passengers board and alight across the cycle facility.

### Comfort space

Space effectively dedicated to pedestrians in otherwise shared environments. It is usually achieved through placement of physical objects such as street furniture, planting or bollards.

### Continuous footway

Technique used at priority junctions and other vehicular accesses to assert visual priority for pedestrians over turning vehicles by continuing the footway material across the access or the mouth of the junction. A 'continuous cycleway' can be added in a similar way if a cycle lane or track is present.

### Contraflow or Cycle contraflow

A facility allowing cyclists to travel in the opposite direction to one-way motor traffic. Requires a Traffic Order and can be implemented using lane markings, which may or may not have some other form of physical protection, or by using signing only.

### Corduroy paving

A type of tactile paving featuring a dense pattern of raised, parallel ribs. It is used to warn visually impaired people of the presence of a specific hazard, such as steps.

### Corner radius

A measure of the geometry of a kerb at a junction, usually determined by the turning radius of the largest vehicles using the junction. Tighter radii have the effect of slowing turning movements, and shortening crossing distances for pedestrians.

### Courtesy crossing

Location designed to invite pedestrians (or cyclists) to cross and to encourage vehicles on the carriageway to give way – although there is no legal obligation to do so. Often used as part of a design approach aimed at reducing vehicle speeds.

### CRISP – Cycle Route Implementation and Stakeholder Plan

An enhanced feasibility study to support scheme planning, design and implementation of improvements for cyclists along a link. It was developed to support planning and implementation of the London Cycle Network and has largely been superseded by the Route Delivery Plan.

### Crossings

See: Courtesy crossing, Parallel crossings, Pedestrian-only crossings, Toucan crossing, Uncontrolled crossing, Zebra crossing.

### CSAP – Cycle Safety Action Plan

Plan for promoting cycle safety in London, developed by various organisations represented on the Cycle Safety Working Group and related to the wider Road Safety Action Plan for London. TfL published the first version in 2010 and an updated version in 2014.

### CTC – Cyclists Touring Club

National charity aimed at promoting cycling for people of all ages, backgrounds and abilities.

### Cycle (in the context of traffic signal operation)

One complete sequence of the operation of traffic signals. The time taken is the 'cycle time'.

### Cycle bypass

Form of physical separation for cycles enabling them to avoid a controlled feature for other road users – eg traffic signals or a pinch-point requiring 'give way' to oncoming traffic.

### Cycle gate

Form of physical separation and signal operation featuring two stop lines and sets of signals for cyclists. The first signal controls access in a 'reservoir' or holding area, the second allows progress into the junction.

### Cycle hub / Cycle superhub

Large-scale cycle parking area with good security, cycle routes radiating from it and other associated facilities such as cycle repair, lockers and changing rooms. Most likely to be planned at public transport interchanges.

### Cycle lane

See: Advisory cycle lane, Mandatory cycle lane.

### Cycle network

A continuous system of connected cycle routes and cycle-friendly areas. A system providing clear, well signposted access for cycling between local centres and other destinations.

### Cycle route

A continuous, linear series of links and junctions, signed and/or branded as a coherent facility from A to B – usually planned and delivered as a single facility or in identified phases.

### Cycle street

A street where the carriageway is dominated by cyclists and, by virtue of the width and design of the street, all motor traffic moves at the speed of the slowest cyclist. May in the future be given more formal regulatory definition by DfT in relation to maximum speed and overtaking behaviour.

### Cycle Superhighway

A strategic cycle route type aimed at enabling safer, faster and more direct cycle journeys both for regular and new cyclists into and out of central London.

### Cycle track

A cycle facility physically separated by kerbs, verges and/or level changes from areas used by motorists and pedestrians. It may be next to the road or completely away from the carriageway and may either be at footway level, carriageway level or in-between.

### Decluttering

Rationalisation of street furniture, signs and signals aimed at minimising the amount of such objects in the street environment, thereby reducing visual and physical clutter.

### Deflector island

Island in the carriageway located to deflect traffic, usually at larger junctions, including roundabouts.

### Delineation

Means of separating areas designated for use of pedestrians and cyclists respectively, usually by introducing a low vertical upstand, such as a raised delineator, or a change of level between the two areas.

### Desire line

The line taken by a significant number of users through a space, related to common origins and destinations. Very often refers to taking the shortest possible distance between A and B.

### DMRB – Design Manual for Roads and Bridges

A multi-volume document that provides standards, advice notes and other documents relating to the design, assessment and operation of trunk roads, including motorways, in the United Kingdom.

### Dooring

A type of collision brought about by a motor vehicle driver or passenger opening a door into the immediate path of a cyclist.

### Dropped kerb

Feature to facilitate access, usually between the footway and the carriageway. Must be flush when provided for pedestrians, wheelchair users or cyclists.

### 'Dutch-style' roundabout

A type of roundabout where cyclists are physically separated from other road users with orbital cycle tracks. It is one of many types of roundabout seen in the Netherlands.

### Dynamic envelope

The width required by a moving cyclist. Usually assumed to be 1000mm but varies by type and speed of cycle, being greater for wider models and at lower speeds.

### Early release (at traffic signals)

Form of signal operation where the cycle signal gains right of way before its associated vehicle signal. This allows cycles to move away ahead of other vehicles – for example, at ASLs.

### Effective width

The usable width of a cycle lane or track, ie the actual width minus the clearance required to vertical objects and stationary or moving motor vehicles.

### Elephants' footprints (WBM 294)

Square-format road markings used to delineate a path for cycles and help them negotiate a complex junction layout or crossing. They are used in controlled situations where there are no conflicting movements with motor vehicles.

### Entry treatment or Raised entry treatment

Raised carriageway surfacing at a side road junction, taking the form of a hump with ramps on either side and usually provided at footway level. The purpose is principally to slow vehicle movements at the junction.

### EqIA – Equality Impact Assessment

Process for assessing the impact of a policy or change to the physical environment on accessibility generally and, in particular, on people with protected characteristics under the Equality Act (2010).

### Equality Act (2010)

Legislation that requires public bodies to have due regard to the need to advance equality of opportunity between persons who share a relevant protected characteristic and persons who do not share it. This applies to the street environment and to public transport services and covers people using cycles as mobility aids.

### Filtered permeability

An area-based network planning approach to improving conditions for cycling by removing through motorised traffic in zoned areas. Cyclists can pass freely through motorised traffic restrictions (such as modal filters) between zones and so are favoured in terms of journey time and convenience.

### Flexible post

A type of bollard that 'gives' when struck, and can be struck repeatedly without needing to be replaced. Some types may be used as forms of light segregation.

### Footway build-out

Area of footway that extends out further than the previous kerb edge and narrows the carriageway.

### FORS – Freight Operator Recognition Scheme

A free, voluntary scheme operated by TfL for road freight operators who deliver in and service London, or who intend to do so. It promotes safe working practices, legal compliance and safety of road freight operations in London. A certification system exists to manage the process by which companies can become FORS accredited.

### Greenways

Various shared use route types largely or entirely off-highway – generally designed for people of all abilities to use on foot, cycle or horseback, for leisure, local connection or commuting.

### Highways England

The government company responsible for operating, maintaining and improving motorways and major A roads in England.

### Homezone

A group of streets and spaces designed primarily to meet the needs of non-motorised users and where the speed and dominance of motorised traffic is reduced. A 10mph limit normally applies.

### Horizontal traffic calming

Forms of traffic calming that work by changing the width available for driving. Typically these take the form of static elements such as build-outs or traffic islands, but they may also utilise car parking or temporary features.

### HRA – hot rolled asphalt

Type of positive-textured asphalt surfacing often used for carriageways.

### Intergreen

In traffic signal design, the safety clearance between the end of the green signal giving right of way for one phase, and the beginning of the green signal giving right of way for the next phase.

### Junction table or Raised table

Raised carriageway surface (often to footway level) at a junction, used as a speed control measure and a way of supporting pedestrian movement and pedestrian priority.

### Jug handle

Dropped kerb and short ramp ahead of a junction or crossing allowing cyclists to leave the carriageway and access a dedicated or shared area to allow a turn to be made using the controlled facility.

### Ladder-and-tramline

A type of tactile paving, consisting of flat-topped, widely spaced, parallel rib markings. It signifies a point of transition between a partially separated footway and a shared use footway and is usually applied in conjunction with a raised delineator strip.

### Legible London

An easy-to-use wayfinding system, primarily aimed at pedestrians, presenting information in a variety of ways, including on-street signs and printed maps.

### Light segregation

The use of intermittently placed objects to separate and protect a cycle facility (usually a marked cycle lane) from motorised traffic.

### LCC – London Cycling Campaign

A 12,000-strong membership charity representing everyone who cycles, or wants to cycle, in Greater London.

### LCN – London Cycle Network

A set of numbered and branded cycle routes delivered from 1995 onwards.

### LCN+

A programme that set out to extend the LCN to a network of 900km of radial and orbital routes.

### LLCS – Low-level cycle signal

A traffic signal dedicated to controlling cycle movements. Compared with a conventional signal head, it is smaller, features cycle symbols on the aspects and is mounted at a height closer to cyclists' eye level.

### LTDS – London Travel Demand Survey

A continuous household survey of travel patterns in the London area. It has been undertaken and published by TfL every year since 2005/06.

### LTN – Local Transport Note

Issued by the Department for Transport, these provide guidance for local authorities and summarise the latest and most important ideas about traffic management.

### Mandatory cycle lane

A section of the carriageway marked by a solid white line that is designated for the exclusive use of cyclists during the advertised hours of operation. During those times, motor vehicles must not drive or park in these lanes, although there are some exceptions.

**Manual for Streets**

National guidance, published in March 2007, for practitioners involved in the planning, design, provision and approval of new streets, and modifications to existing ones. It aims to increase the quality of life through good design that creates more people-oriented streets. While the document focuses on residential streets, its principles may apply to any urban street. Manual for Streets 2, published in 2010, provides further detail on extension of the guidance to other contexts.

**MAP – Model Auditing Process**

A method for ensuring that traffic models are developed, calibrated and validated to an appropriate standard, as described in TfL's Traffic Modelling Guidelines (2010). MAP is a requirement for schemes that have an impact on the TLRN or Strategic Road Network.

**Mesh density**

A network planning tool and measure of how tight or loose is the grid formed by the cycle routes comprising the cycle network in a given area.

**Mini-Hollands**

A programme of intensive investment in three outer London town centres, focused on transformational infrastructure measures to promote cycling and including public realm improvements aimed at bringing wider benefits to the area.

**Mini-Zebra**

See Zebra crossing.

**Modal filter**

A feature that prevents through-movement by some types of vehicle but allows it for others, typically cycles and emergency service vehicles.

**NCN – National Cycle Network**

A 14,000-mile long national network consisting of traffic-free paths and quieter on-road cycling and walking routes. Routes are numbered and signed, usually on red-coloured patch.

**Network Management Duty**

As established by the Traffic Management Act (2004), a requirement on local traffic authorities to manage their networks with a view to securing the expeditious movement of traffic (including pedestrian and cycle traffic) on the authority's road network.

**Parallel priority crossings or 'parallel crossing'**

A cycle crossing next to a zebra crossing where users of the main carriageway have to give way to both pedestrians and cyclists crossing that carriageway. Introduced in TSRGD (2016).

**Parallel signal-controlled crossings**

Signal-controlled crossings that operate at the same time but where cyclists and pedestrians have separate signals, waiting areas and marked crossings of the carriageway.

**Partial separation**

A type of marked provision for cyclists adjacent to and at the same level as a footway or footpath. The area for cycling is shown with a line marking or a raised delineator strip. Also known as 'segregated shared use'.

### PCaTS – Pedestrian countdown at traffic signals

Additional feature at Ped-X and far-sided Toucan crossings providing users with a digital countdown in order to see how much safety crossing clearance time remains.

### PCU – Passenger car unit

A unit of traffic flow, calibrating different users to a typical car, which equals 1 PCU.

### Ped-X crossing

A signal-controlled pedestrian crossing type featuring far-sided pedestrian signals (ie for the pedestrian, the invitation to cross is visible on the other side of the road) and fitted with optional pedestrian countdown aspects.

### Pedestrian crossings

One of various crossing types for pedestrians that do not allow cycle access. Includes signal-controlled types (Pelican, Puffin and Ped-X crossings) and priority crossings (Zebra crossings).

### Pedestrian refuges

See Refuge islands.

### Pedestrian Zone

Area closed to vehicles, including cycles – often marked with exceptions for loading. Cycles may also be specifically exempted, or they may be included by designating a 'Pedestrian and Cycle Zone'.

### Pelican crossing

A signal-controlled pedestrian crossing type with far-sided pedestrian aspects (ie for the pedestrian, the invitation to cross is on the other side of the road) and where the green man is followed by a flashing green man for pedestrians and a flashing amber for vehicles.

### Phase (in traffic signal design)

Sequence of conditions applied to one or more streams of traffic (including pedestrians), which receive simultaneous identical signal indications. One complete sequence of all the phases (ie all the vehicle and pedestrian movements) is known as the signal cycle.

### Pinch point

Locations where the carriageway narrows, often as a result of traffic calming measures or addition of refuge islands. Unless well designed, they can add to collision risk and discomfort for cyclists by forcing them into close proximity with motorised traffic.

### Play Street

Temporary closures to through traffic for a single or recurring event, allowing people to occupy the carriageway space for activities such as children's play.

### Pocket

A short additional lane on an approach or within a junction reserved for a specific movement, and which may or may not be protected by a refuge island. Some pockets provide for cycle-only movements.

### Point closure

Method of closing a street to through-traffic, ideally in the form of a modal filter (ie allowing access for cyclists).

### Priority junction

A junction where the priority is shown by 'give-way' road markings – ie the minor arm gives way to the major arm.

### Primary riding position

One of two recommended ways of cycling on-road, defined in relation to the movements of other vehicles. If there is insufficient space to adopt the secondary riding position safely, the best course of action for the cyclist is to ride in such a way that they are as visible as possible and cannot be overtaken.

### Primary signal

A traffic signal associated with the stop line, normally mounted on the left-hand side of the carriageway.

### PSV – Polished stone value

A measure of the skid resistance of a surfacing material. Carriageways should have a minimum PSV of 55.

### P2W – Powered two-wheeler

Generic term for motorcycles and mopeds.

### Puffin crossing

A signal-controlled pedestrian crossing type featuring near-sided pedestrian aspects (ie for the pedestrian, the invitation to cross is next to the push-button) and without a flashing green man and flashing traffic amber. Detectors allow for the extension of crossing time if pedestrians remain on the crossing, or for cancellation of the 'green man' if it is no longer needed.

### Quietway

A branded cycle route type established by the Mayor's Vision for Cycling (2013). Quietways are strategic routes using less heavily trafficked local streets and off-carriageway facilities.

### Raised delineator

A raised strip, between 12 and 20mm high, that separates areas used by cycle and pedestrians when they are at the same level. It is defined in TSRGD (as diagram number 1049.1) and therefore has legal status as a road marking.

### Refuge islands

Islands in the carriageway to support either pedestrian crossing or vehicle right turns (which may include cycle-only turning pockets). Their placement and design should avoid creating hazardous pinch-points for cyclists.

### Restricted Parking Zone

A type of parking restriction that can be applied uniformly across an area and avoids the need for yellow or red line markings or kerb markings. It can be defined in such a way as to allow parking or loading only in marked bays.

### Road Traffic Regulation Act (1984), or RTRA

An Act of Parliament providing powers to regulate or restrict traffic on UK roads.

### Route Delivery Plan

A report produced for each Quietway route, exploring delivery options, feasibility and costs, and focusing on the main locations for intervention.
Rumble strip

A series of raised strips across a carriageway or along its edge that changes the noise a vehicle's tyres make on the surface, thereby warning of speed restrictions or the edge of the road.

### Safety strip

See Buffer.

### Scramble

See Simultaneous greens.

### SCOOT – Split Cycle Offset Optimisation Technique

A tool for managing and controlling traffic signals on a second-by-second basis. Traffic light sequences can be adapted so as to respond to traffic conditions quickly and effectively.

### Secondary riding position

One of two recommended ways of cycling on-road (see also primary riding position), defined in relation to the movements of other vehicles. Cyclists may safely ride on the nearside of other vehicles if there is sufficient width to be overtaken with adequate clearance.

### Secondary signal

A repeater traffic signal duplicating the display of the primary signal.

### Segregated cycle lane/track

Cycle facility separated by a continuous or near-continuous physical upstand along links (usually verges or kerbed segregating islands). Whether it is technically a lane or a track depends on how it was created.

### Segregated shared use

See Partial separation.

### Shared use area, footway or path

A footway, footpath or part of any public space shared between pedestrians and cyclists but where motorised vehicles are not permitted. It is identified by the shared use sign – a blue circle with white pedestrian and cycle symbols. In these spaces, pedestrians have priority.

### Shared space

A design approach that seeks to change the way streets operate by reducing the dominance of motor vehicles, primarily through lower speeds and encouraging drivers to behave more accommodatingly towards pedestrians and cyclists.

### Shared surface (level surface)

A street or space either with no distinction between footway and carriageway or no kerb upstand between the two.

### Sheffield stand

A type of tubular cycle stand, common on London's streets.

### Sinusoidal hump
A 'cycle-friendly' road hump, having ramps with an 'S'-shaped profile and being relatively comfortable for cyclists to ride over while having a speed-reducing effect for other vehicles.

### SMA – Stone mastic asphalt
A generic term for certain types of asphalt road surfacing, including thin surface course systems (TSCS).

### Speed cushions
Small speed humps installed across the road with gaps at distances that, ideally, allow certain users such as buses and large emergency service vehicles to pass easily, but force most other motorised vehicles to slow down to negotiate the humps.

### Speed humps
Raised areas, typically placed horizontally across the carriageway, designed to reduce traffic speeds. The ramps either side of the hump should have a sinusoidal profile so as to minimise discomfort to cyclists.

### Splitter island
A traffic island used to split different traffic streams, which could include users of a cycle lane and a general traffic lane.

### SSD – Stopping sight distance
The distance a road user needs to see in order to stop completely – usually applied to sight-lines at a junction.

### Stage (in traffic signal design)
The period within a traffic signalling cycle that gives right of way to one or more particular traffic movements. A stage starts when the last of its associated phases commences and ends when the first of its associated phases terminates.

### Stepped track
A cycle track at an intermediate level between the footway and main carriageway, with or without a buffer. Also known as a hybrid track.

### Street types
A method of categorising streets by the combination of their 'place' and 'movement' functions, as established by the Roads Task Force. TfL is working with London boroughs to classify every street into one of the nine identified street types.

### Stroke width
A measure of the spacing between lines on a traffic sign. See x-height.

### Suggested route
Informal indication of the presence of or a likely route for cyclists in a shared use area, often achieved through changes in material or inlaid signing.

### Tactile paving
Textured paving that helps people with sight impairments to read the street environment around them by feeling the change in surface underfoot and/or seeing the change in material (see tonal contrast). Types include: blister, corduroy, ladder-and-tramline and the raised delineator.

### TAL – Traffic Advisory Leaflet

Information leaflet issued by the Department for Transport, providing information and guidance for using traffic equipment and implementing traffic regulations and policies.

### Tiger crossing

A ‘cycling Zebra’ or priority crossing with the crossing area shared between cyclists and pedestrians. It is a hypothetical crossing type that does not currently exist in UK regulations.

### TLRN – Transport for London Road Network

The roads for which Transport for London is directly responsible – also known as ‘red routes’. They make up around 5% of the road network in London and carry over 30% of the traffic.

### Traffic Management Act (2004), or TMA

An Act of Parliament that sets the regulations governing street works.

### TRL – Transport Research Laboratory

An independent private company offering a transport consultancy and research service to the public and private sector. It was established by the Government in 1933 as the Roads Research Laboratory and privatised in 1996.

### Traffic Regulation Order (TRO) or Traffic Management Order (TMO)

A mechanism under the Road Traffic Regulation Act (1994) allowing highway authorities to regulate and manage the speed, movement and parking and loading of vehicles and to regulate pedestrian movement on their network. TMO is the more commonly used term in London. TMOs require a statutory consultation period and are required for various kinds of infrastructure, including mandatory cycle lanes, cycle exemptions and cycle contraflows.

### TSRGD – Traffic Signs Regulations and General Directions

The document setting out regulatory signs (including road markings) and conditions for their application on the public highway. The current version was published in 2016.

### Tonal contrast

Use of tone rather than colour to enable features such as street furniture or tactile paving to be distinguished from the surrounding environment by anyone with reduced vision.

### Toucan crossing

A signal-controlled crossing type featuring combined far-sided pedestrian and cycle signal (ie for the pedestrian/cyclist, the invitation to cross is visible on the other side of the road) that can be used by pedestrians and cyclists and where the waiting and crossing areas are shared between the two users.

### Turning circle

The smallest circle that vehicle or wheelchair can make in order to change direction without needing to reverse – usually to make a 180-degree turn.

### Two-stage turn

A manoeuvre allowing cyclists to make an opposed turn at a junction in two stages, without having to move across lanes of moving traffic. Between two traffic signal stages, the cyclist waits in the junction, away from the traffic flow.

Typically this enables a right turn from a nearside lane ('two-stage right' or '2SR') but it may also allow a left turn across opposing traffic flows where there is a two-way cycle track on one side of the carriageway.

### Uncontrolled crossing

A pedestrian and/or cycle crossing where vehicles do not legally have to give way but may do so out of courtesy. They are used where vehicle flows and speeds give safe opportunities for crossing the street without the need for a controlled facility.

### Unsegregated shared use

See Shared use.

### Urban clearway

A road where stopping on the main carriageway is not permitted during the advertised hours of operation, except to pick up or drop off passengers.

### Value of time

The opportunity cost of the time spent on a journey, ie the amount that a traveller would be willing to pay in order to save time, or the amount they would accept as compensation for lost time.

### Vertical traffic calming

Forms of traffic calming that rely on a change of level in the carriageway for slowing effect – typically speed humps or speed cushions.

### Visibility splay

The physical space at an access or junction through which a road user exiting from the minor arm needs good, clear visibility in order to see potential conflicts or dangers in advance of the distance they need in order to break and come to a stop (ie the Stopping Sight Distance).

### x-height

A measure of the size of text on a sign. It refers to the height of the lower case 'x' in a given typeset. Other aspects of the sign are measured in relation to the x-height, such stroke width (sw), the spacing between lines. One stroke width is equivalent to one quarter of the x-height.

### Zebra crossing

A controlled pedestrian crossing over a carriageway, distinguished by white stripes, zig-zag markings and belisha beacons. Users of that carriageway are required to give way to allow pedestrians to cross.

Cyclists are not committing an offence by riding across a zebra crossing, but the law does not demand that vehicles give way to them in the same way that they are required to do so for a pedestrian (or a cyclist wheeling their cycle across).

TSRGD (2016) allows for a simpler version of the zebra crossing (without zig-zag markings and with belisha beacons as optional) to be used for priority pedestrian crossings of cycle tracks.