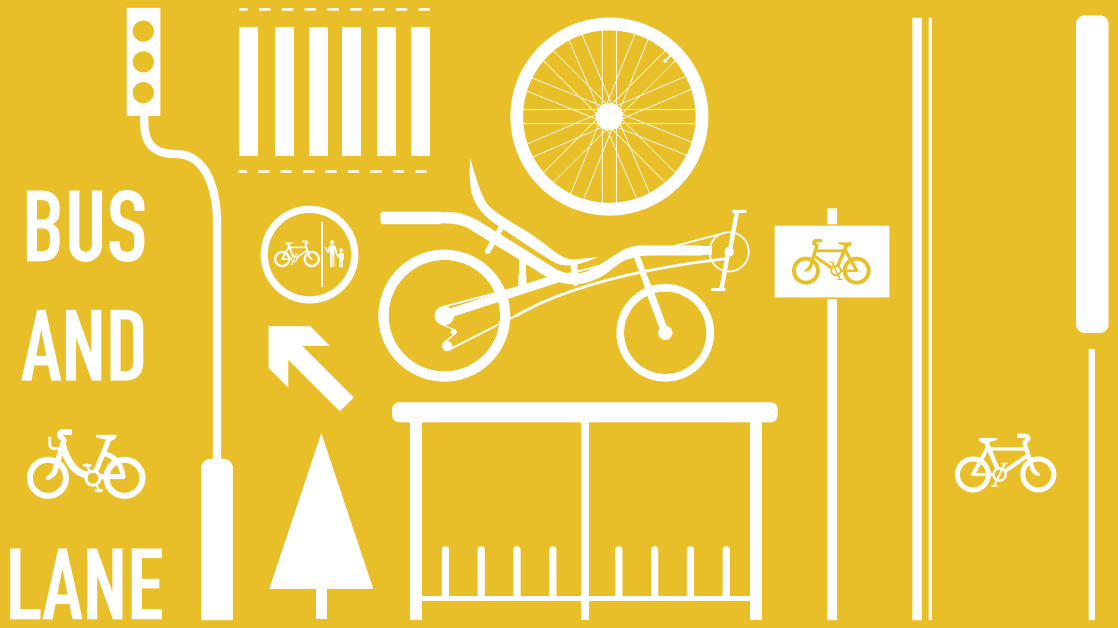
4. Cycle lanes and tracks

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 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 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 Journey time	Ability to maintain own speed on links	Type, width and geometry of cycle facility (including ability to overtake)
Comfort 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 Impact on walking	Highway layout, function and road markings adjusted to minimise impact on pedestrians	Appropriate provision by street type
Attractiveness Greening	Green infrastructure or sustainable materials incorporated into design	Appropriate provision by street type, street profiles and function of segregating strips
Adaptability 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)

Type		Description	Defined by
Cycle lane		Part of a carriageway marked with a formal lane marking and allocated for use by cyclists.	Traffic Signs Regulations (TSRGD, 2016)
Cycle track		A right of way for pedal cycles with or without right of way on foot. It can either be: • Part of a public highway adjacent to a carriageway, or • A separate highway in its own right Pedestrians and cyclists may be separated by physical barriers, by level, or by markings only.	Sections 65(1) and 329(1) of the Highways Act (1980) Section 1 of Cycle Tracks Act (1984)
Footway		A carriageway: a right of way for the public on foot only that exists within the highway.	Section 329(1) of the Highways Act (1980)
Public rights of way	Footpath	A separate highway over which the public have right of way on foot only (eg away from a highway used by vehicles).	
	Bridleway	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.	Countryside Act (1968)
	Restricted byway	Generally, a way open only to pedestrians, cyclists, horse-riders and horse-drawn vehicles.	Countryside and Rights of Way Act (2000)
	Byway open to all traffic (BOAT)	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.	Wildlife and Countryside Act (1981)

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 Stepped track
'Dedicated' cycle lanes	Light segregated lane Mandatory cycle lane
'Shared' lanes	Shared bus/cycle lane Advisory cycle lane
Integration of users	Cycle street 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)

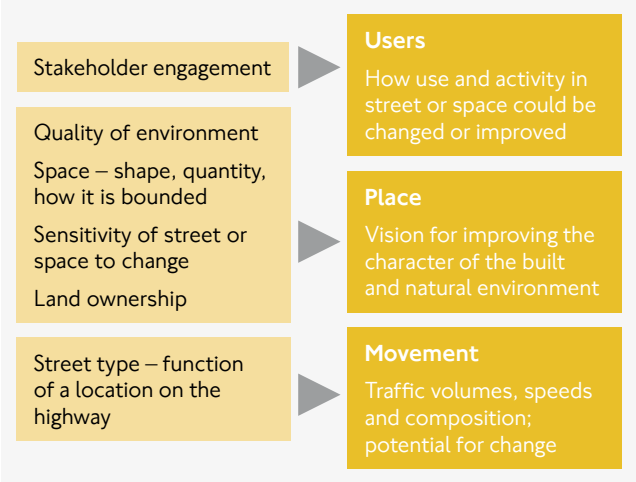
What interventions for cycling are capable of improving the quality of place, in view of the identified street type and the physical characteristics of the street or space? How could the street deliver a better level of service for all?

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

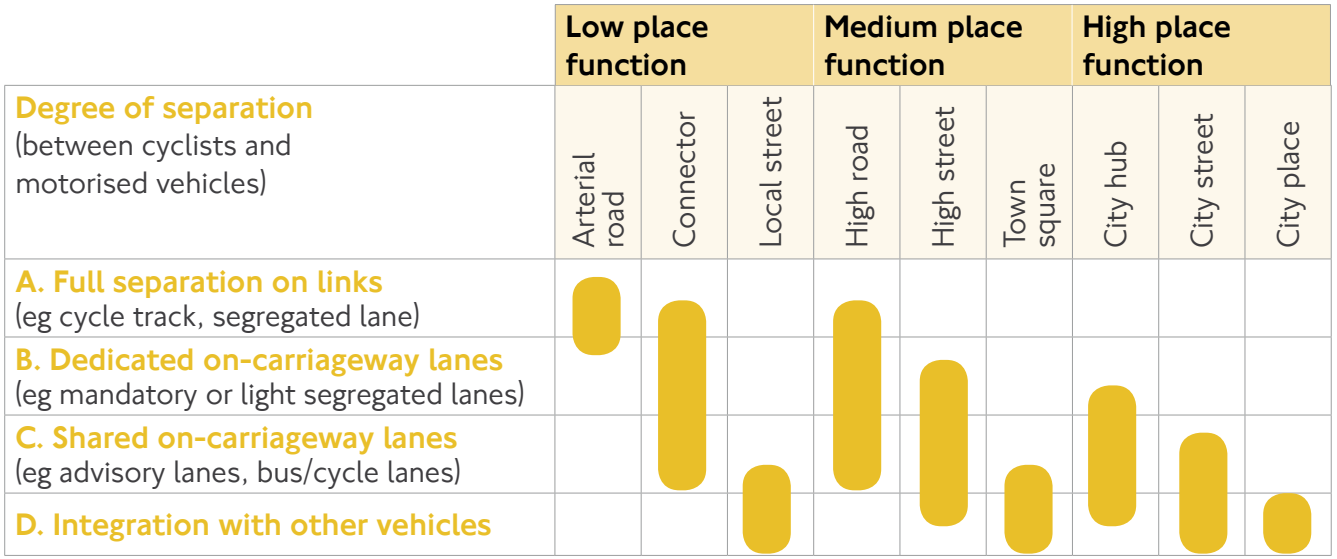
network. Facilities in the higher ranges of the degrees of separation may not be appropriate where pedestrian and cycle desire lines cross regularly, and where there are high flows of both. They could work well, however, where those movements are largely in parallel.

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 • Integration of formal and informal crossings • 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 • Retention of a kerb edge to the footway at least 50mm high • 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 • Deployment of access ramps to the footway from taxis • Provision of disabled parking bays outside the lane or track, or inset into a segregating island • Island separation wide enough to permit movement to more accessible crossovers
Bus and coach infrastructure	• Accessibility of stops • Cycle provision at the stop • Providing inset facilities in wide segregating islands
Loading and parking	• Retaining and managing kerbside activity: appropriate line markings and enforcement, timing of deliveries • Potential for insetting bays or ‘floating’ them (between the cycle lane/track and the general traffic lane) • 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

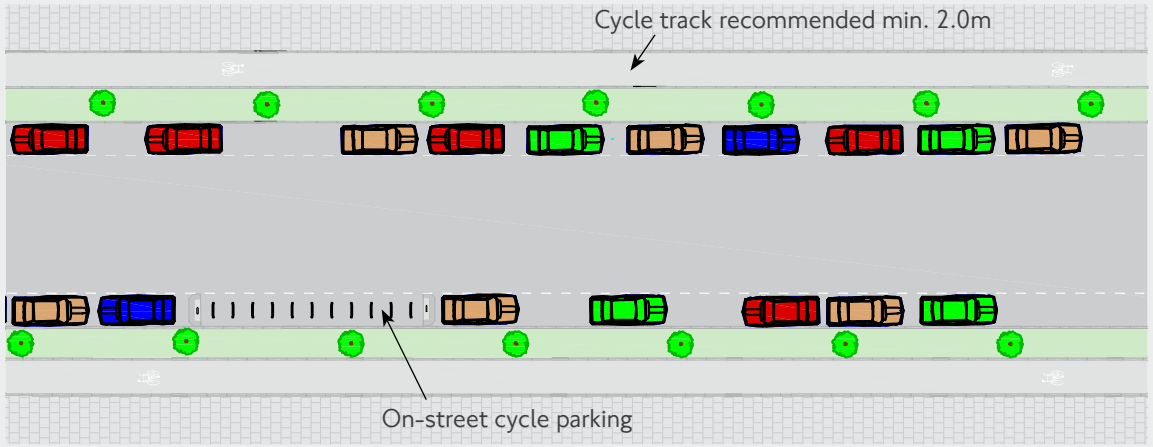
Skinner Street, Islington

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).

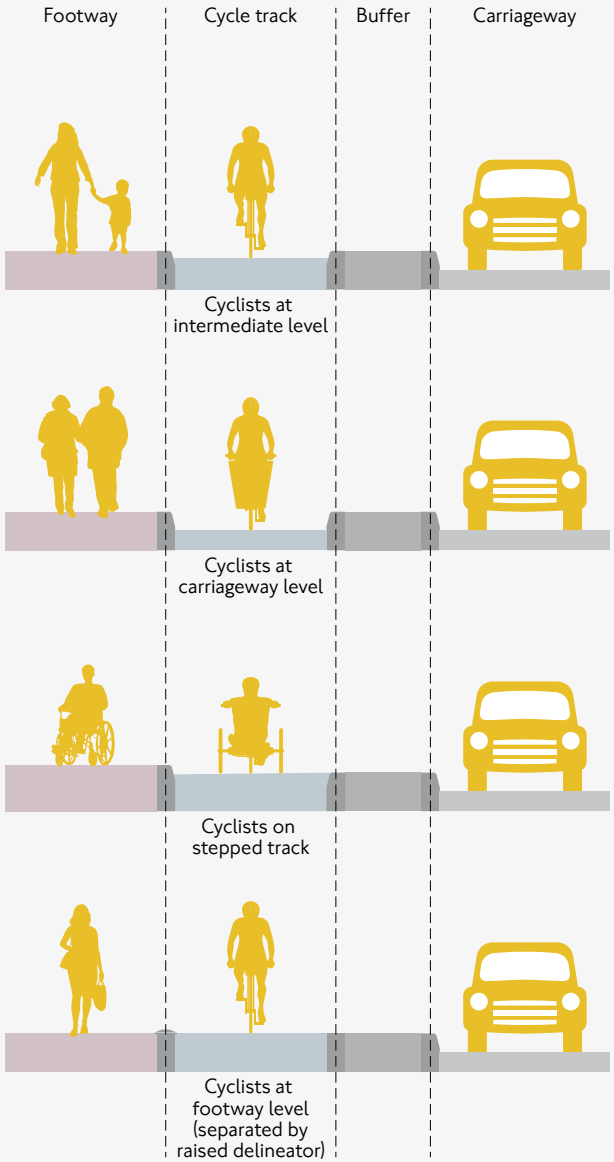
Two-way facilities can lead to awkward transitions when joining with one-way provision (top). Consideration needs to be given to avoiding pinch-points at bends where effective width is squeezed (bottom)

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

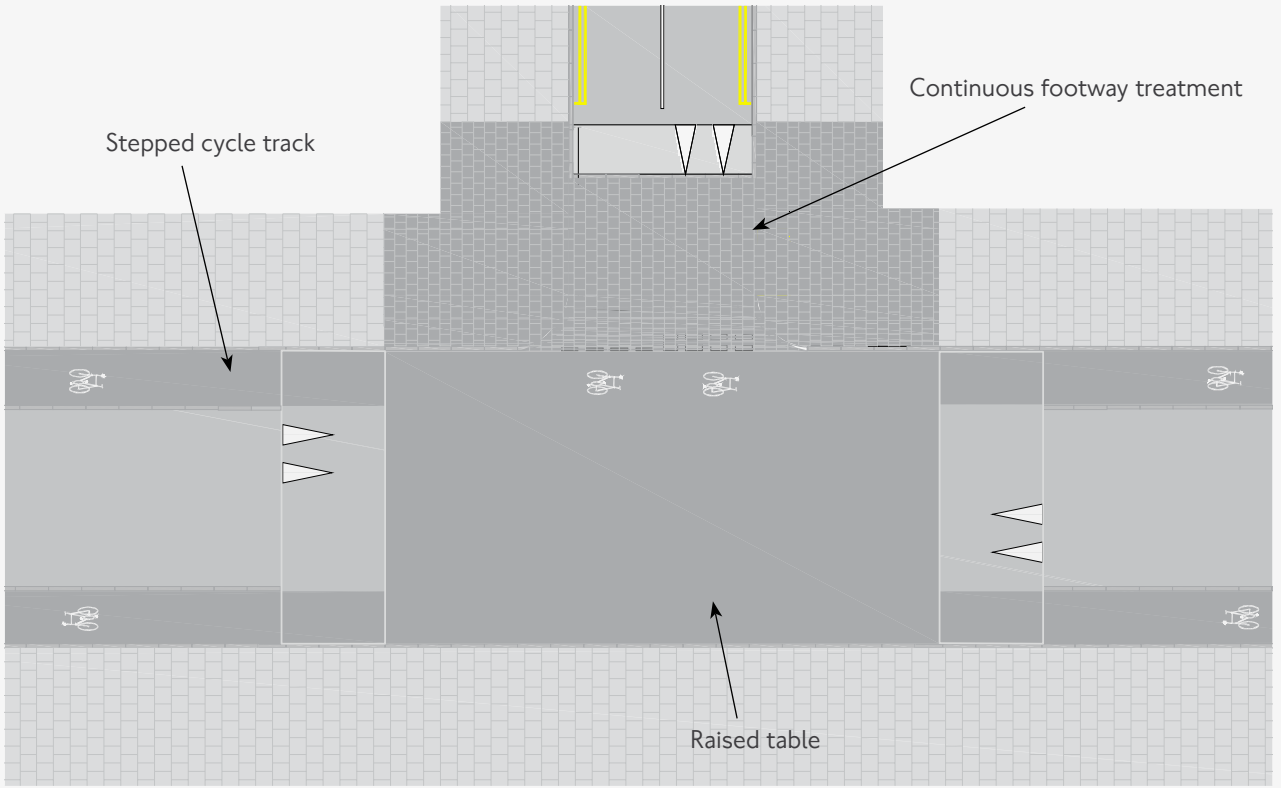
Stepped tracks may be useful where motor traffic conditions dictate that a high degree of separation for cyclists would be desirable but where streets have higher pedestrian flows, more active frontages and/or more kerbside activity – for example, the high road street type.

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.

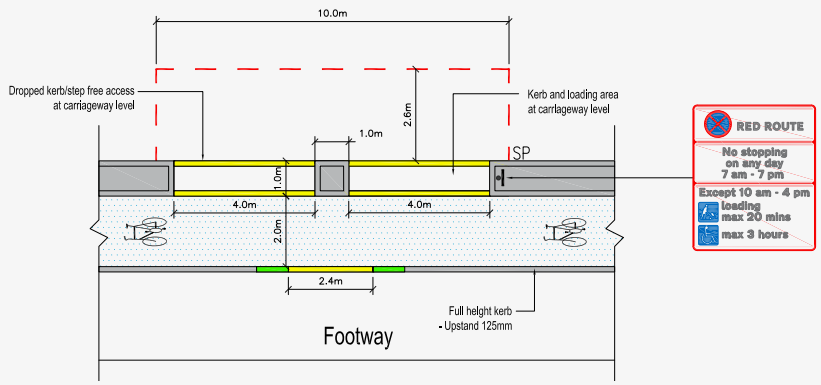


Indicative layout 4/02: Stepped tracks at priority junction, with continuous footway

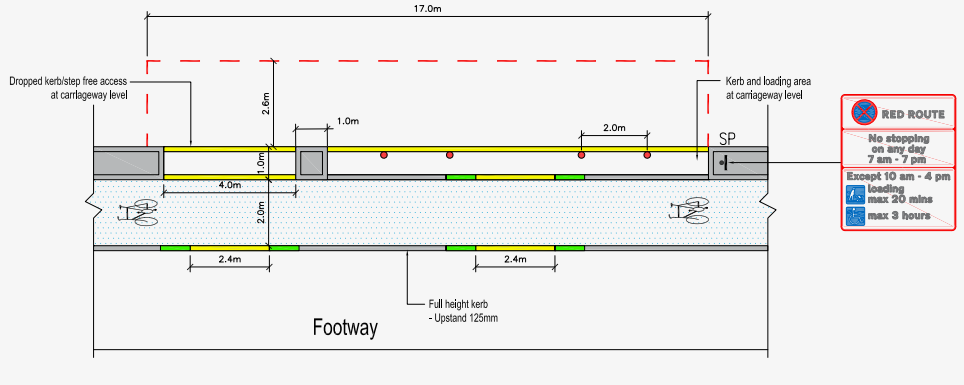
4.2.6 Integration with parking and loading

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



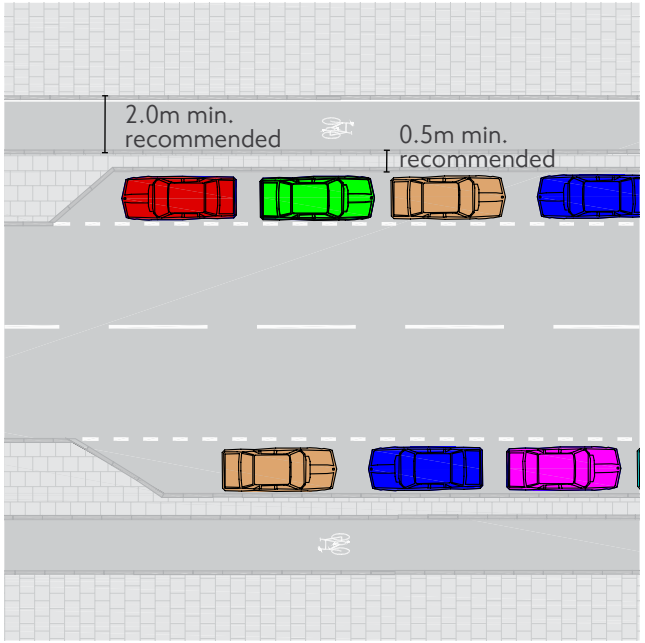
Indicative layout 4/04 17m-wide flexible parking/loading bay with kerbed segregation

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

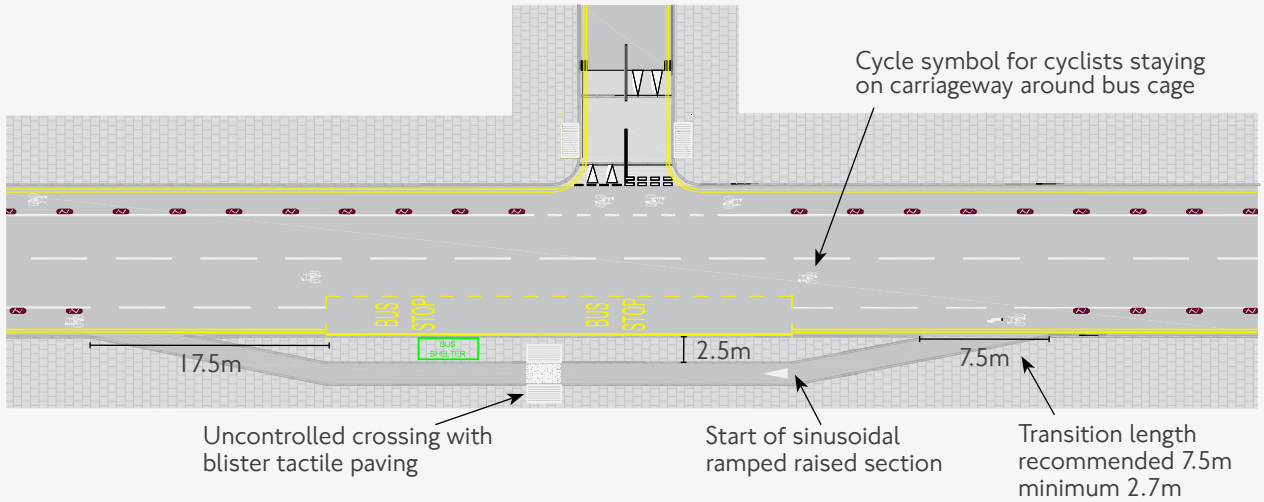
Pedestrian crossings

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** **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) **Shared bus/cycle lane** **Advisory cycle lane** **Cycle street**	Those with higher levels of kerbside activity – local streets and high streets 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.

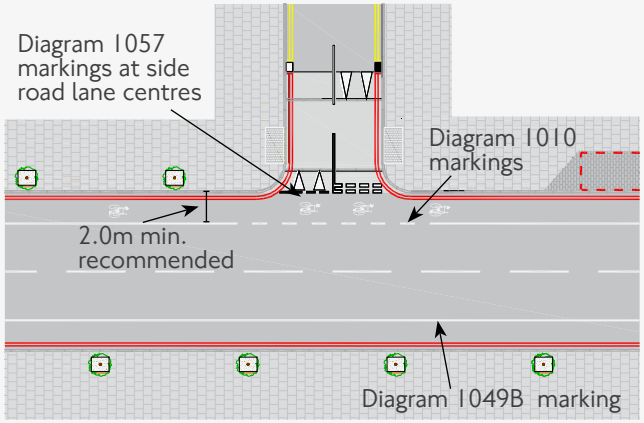
It is important that there should be consultation with stakeholders in order to understand and take into account the needs of other users, such as the emergency services and commercial vehicle operators.

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.

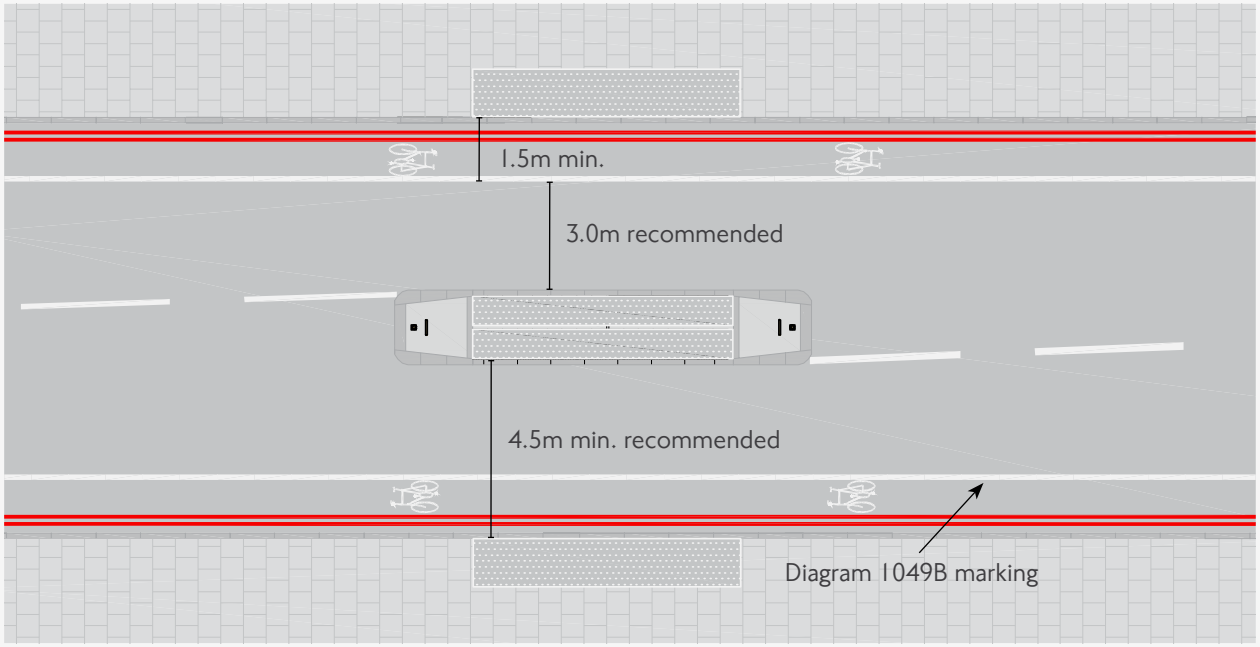
Mandatory lane becomes dashed past side road (lane marked away from kerb and side road)

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.

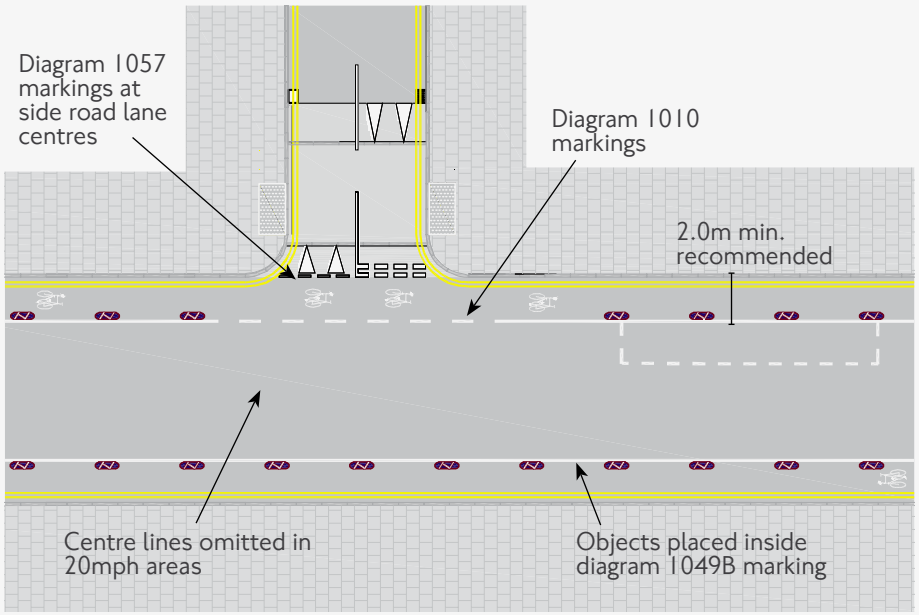
Road safety considerations

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.

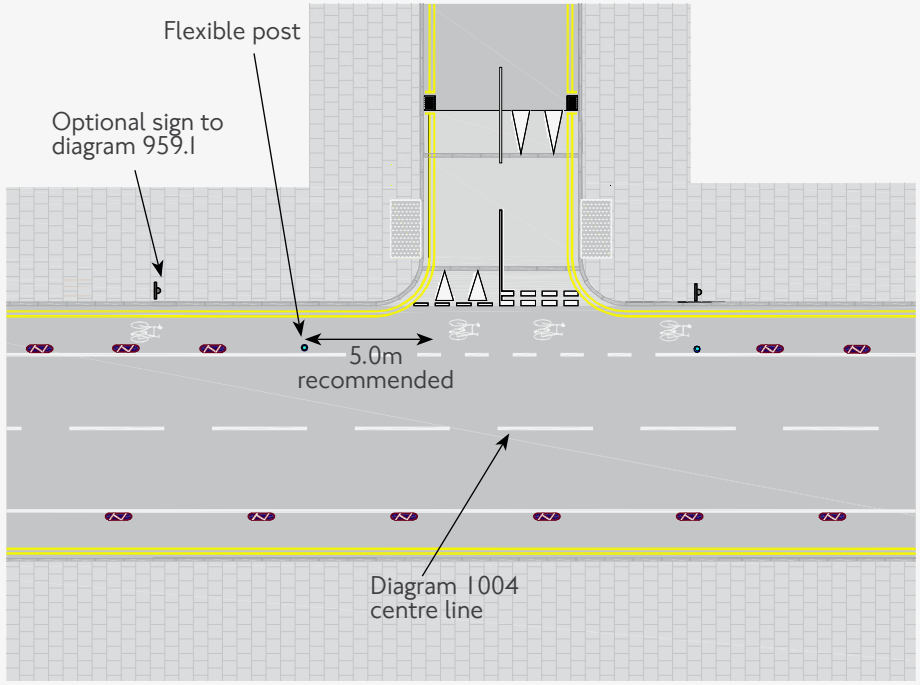
Consideration may be given to providing a more visible object – such as a flexible post, planter or island – at the beginning of a run. Trials in Salford have shown that these are effective in increasing the clearance that vehicles give to the cycle lane and preventing damage to the separators.
For streets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

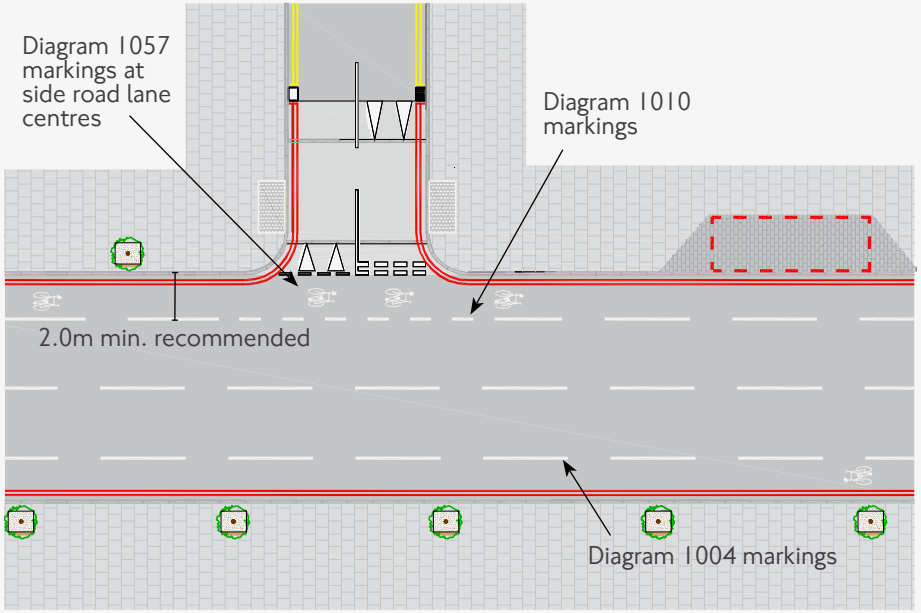
- Where kerbside activity is high and any cycle lane will need to be crossed frequently to access loading and parking bays – in such instances the advisory lane needs to be at least 2 metres wide or with a suitable buffer between it and the bays

Kerbside activity

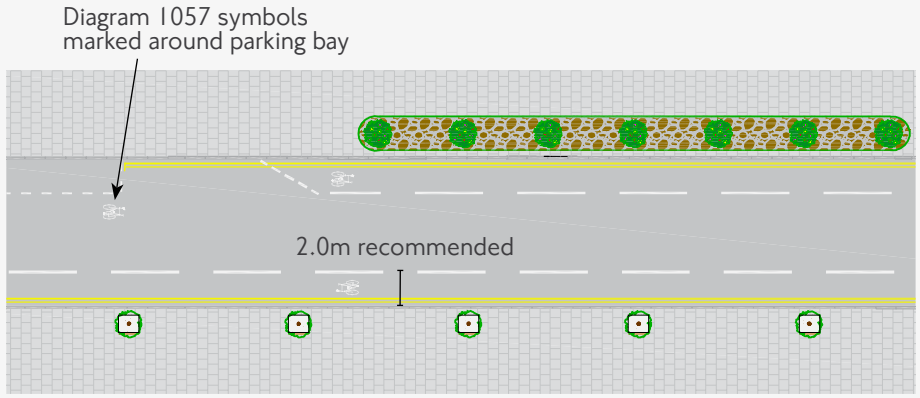
For intermittent kerbside parking, loading or cycle parking bays, the advisory lane can be marked around the bays, provided it has a buffer zone of at least 0.5 metre and provided that any resultant narrowing of the adjacent general traffic lane does not lead to close passing by motorists of cyclists 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).

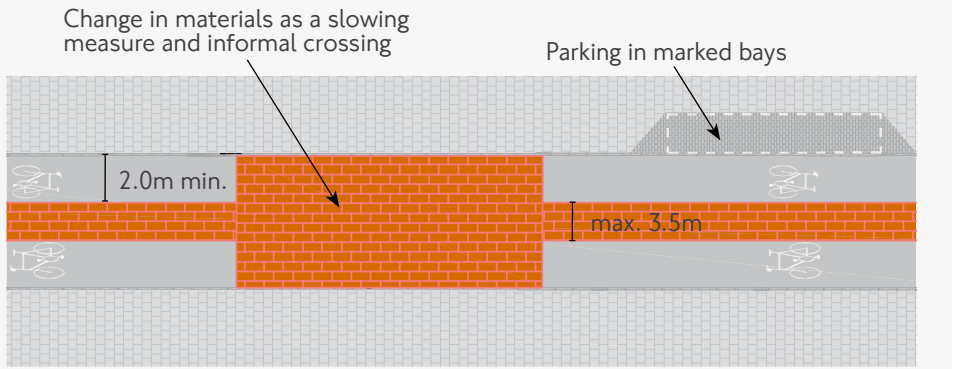
However the concept is articulated, cyclists should enjoy priority at any junction with the cycle street itself, and the difference in street environment should be visible and obvious from any side street. It is likely that parking and loading will need to be incorporated in bays rather than freely allowed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

Speed limits and overtaking

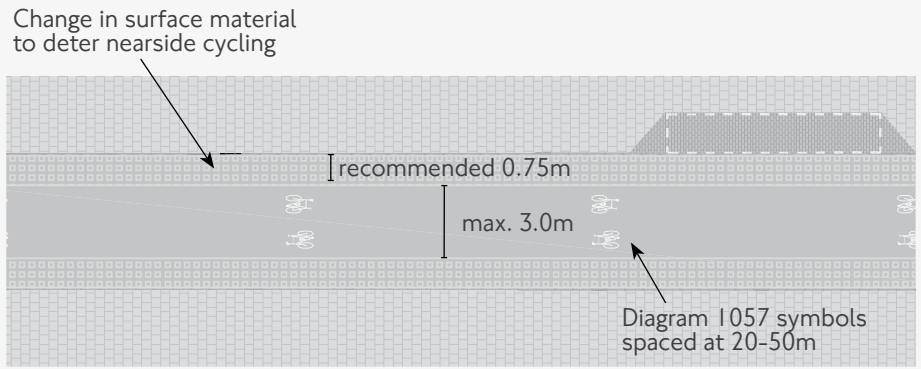
As set out in the consultation document accompanying the draft revised traffic signs regulations, TSRGD (2014), DfT is willing to work with highway authorities on developing cycle street concepts for trial. Although no formal definition of a UK cycle street has yet been developed, DfT indicated it could 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

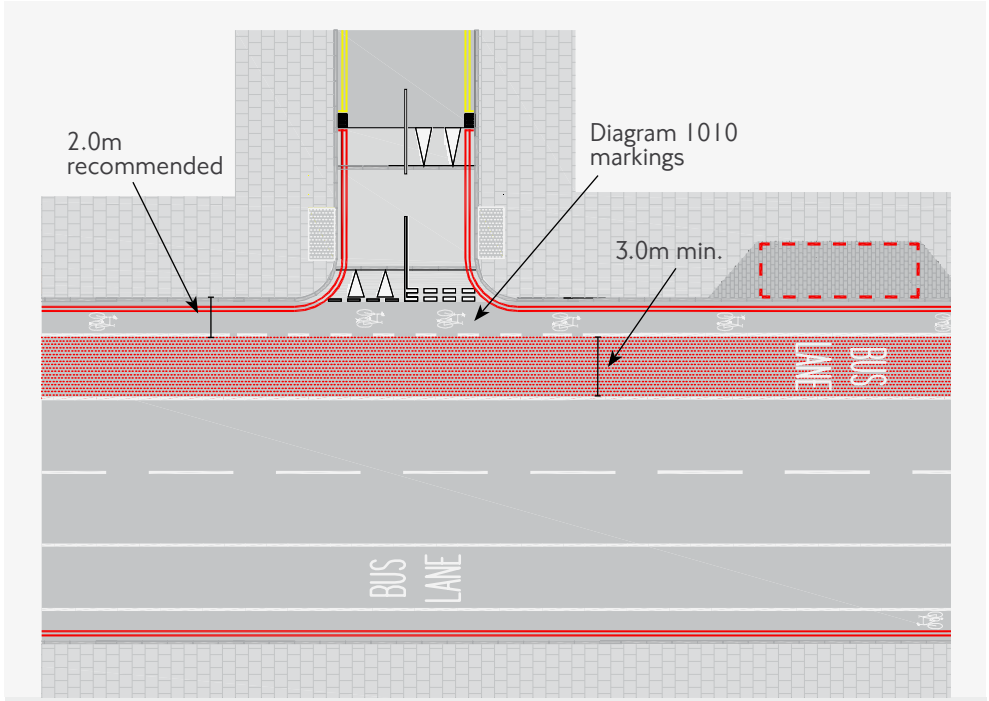
Parking and loading

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

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.



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.

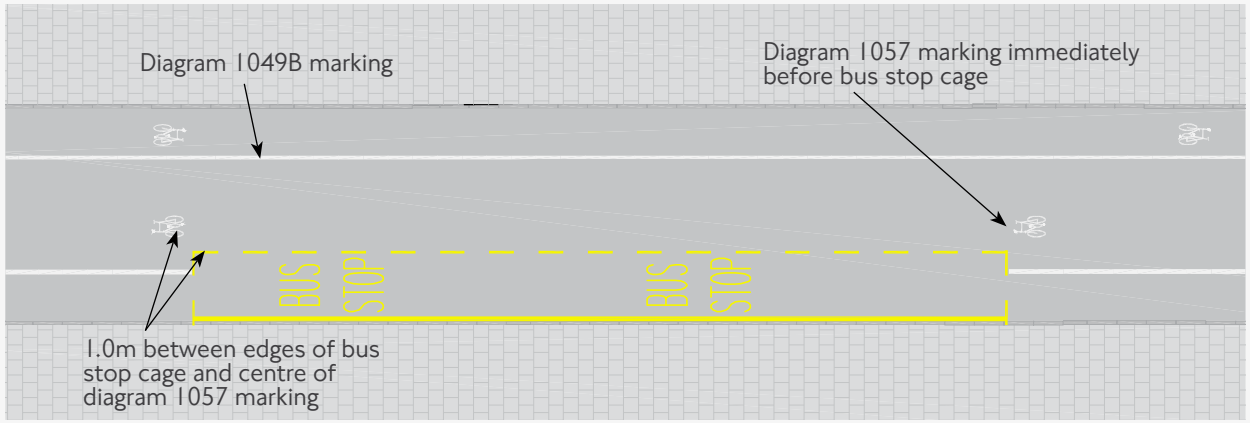
A cycle lane will generally need to terminate before a bus stop cage and recommence after it. The continuity of cycling provision can be maintained by marking TSRGD diagram 1057 cycle symbols around the bus stop cage to raise the awareness of other road users to the likelihood of cyclists moving out 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

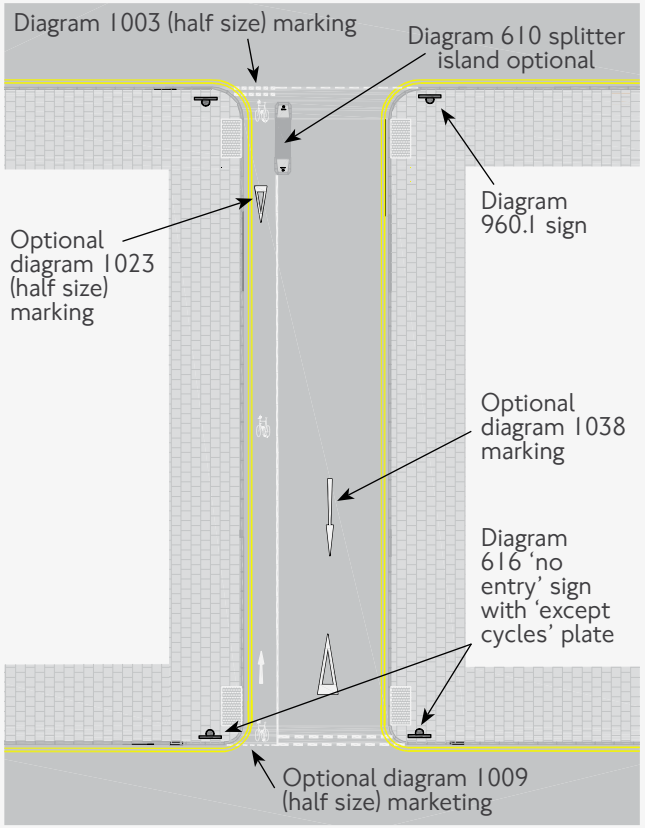
Unless there are over-riding reasons not to, there should be a presumption that contraflow cycling should be provided for in any one-way street.

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.

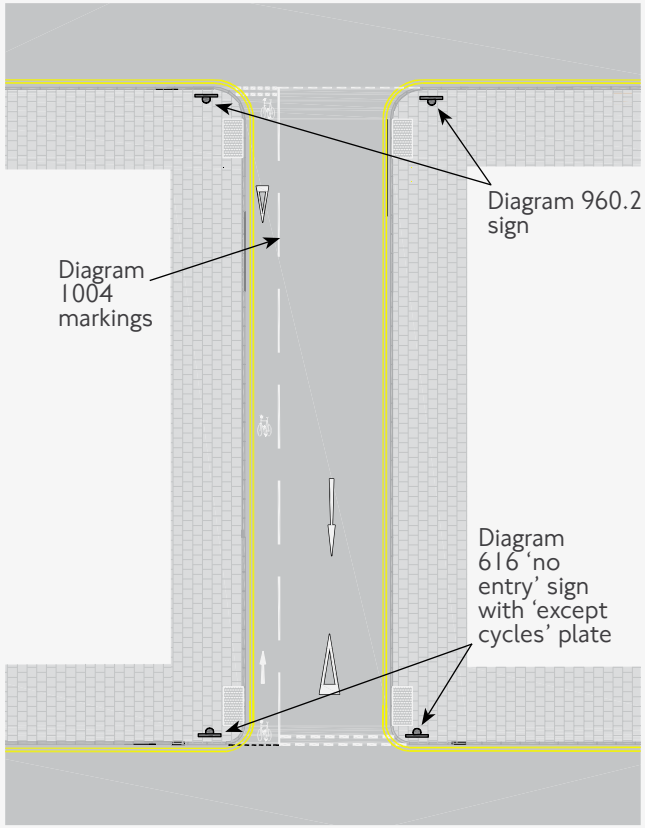
No motor vehicles, cyclists permitted – Frazier Street, Lambeth

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



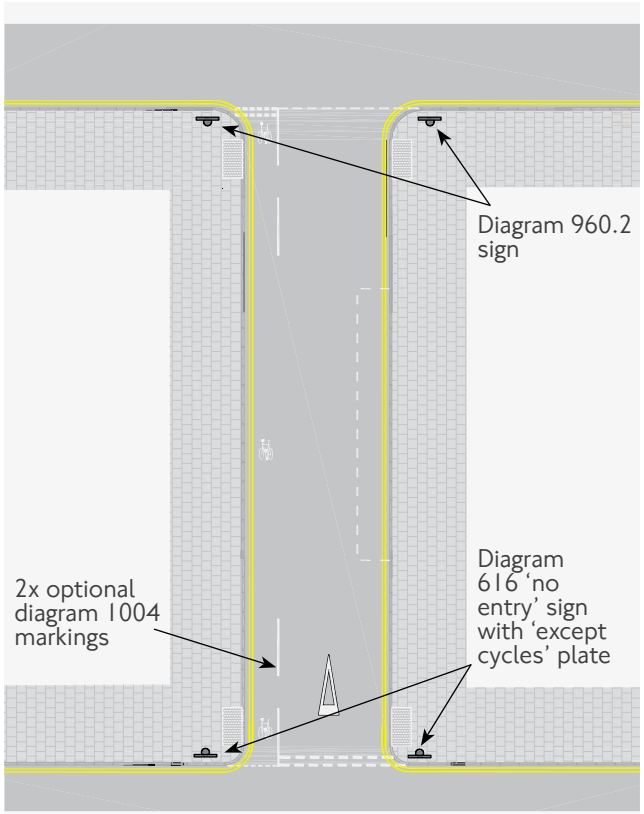
Indicative layout 4/16b: Advisory contraflow cycle lane

Protection on entry and exit

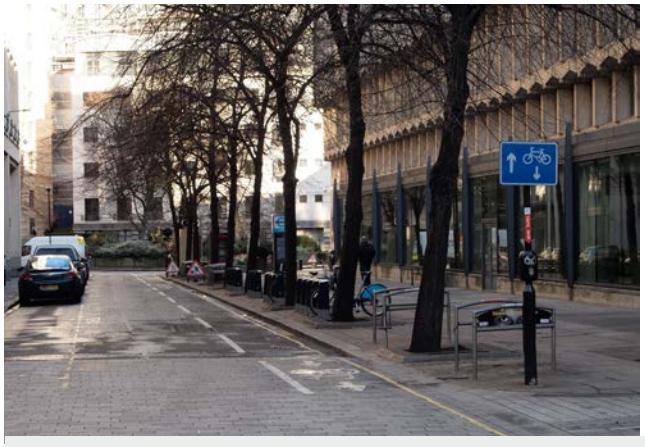
In order to manage contraflow movement and provide some protection for cyclists at potential points of conflict, physical separation by traffic islands can be provided as necessary, with a sign to diagram 955 (route for use by pedal cycles only) on a bollard.

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

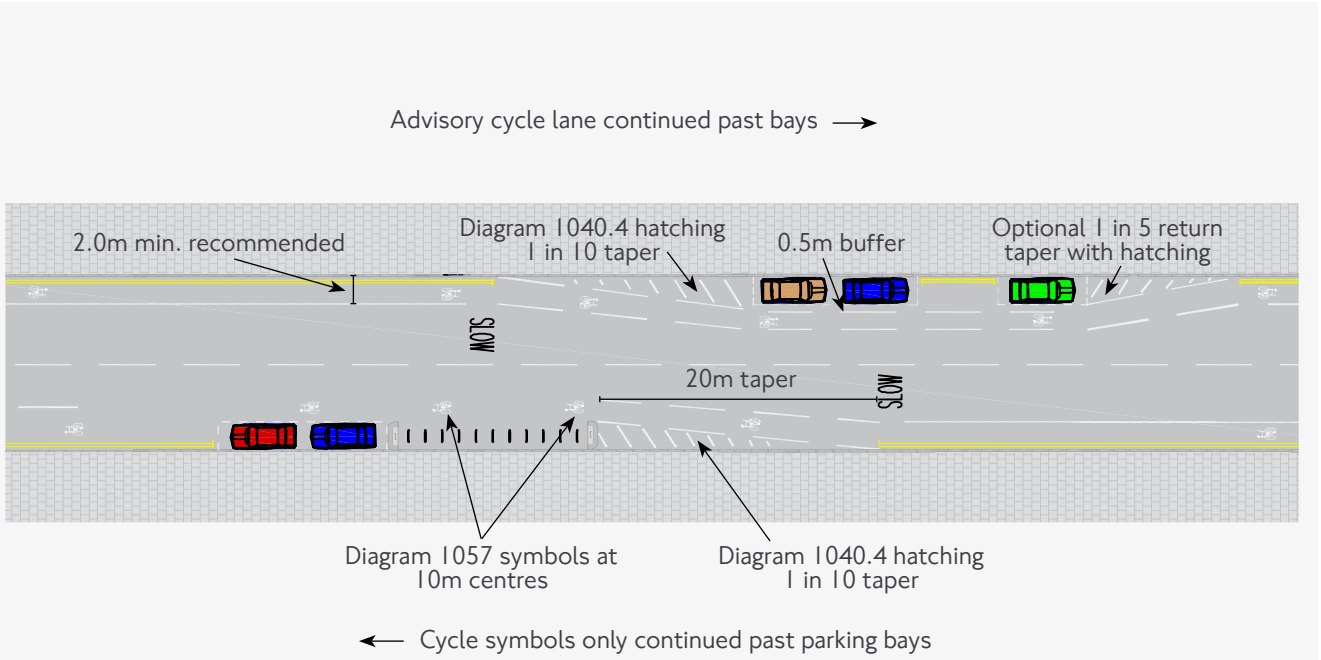
To maintain the safety, comfort, coherence and directness of cycling infrastructure, loading and parking should not be permitted in cycle lanes and shared bus/cycle lanes during their hours of operation. Cycle lanes that are regularly blocked by vehicles are a poor quality facility and very often worse 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 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.



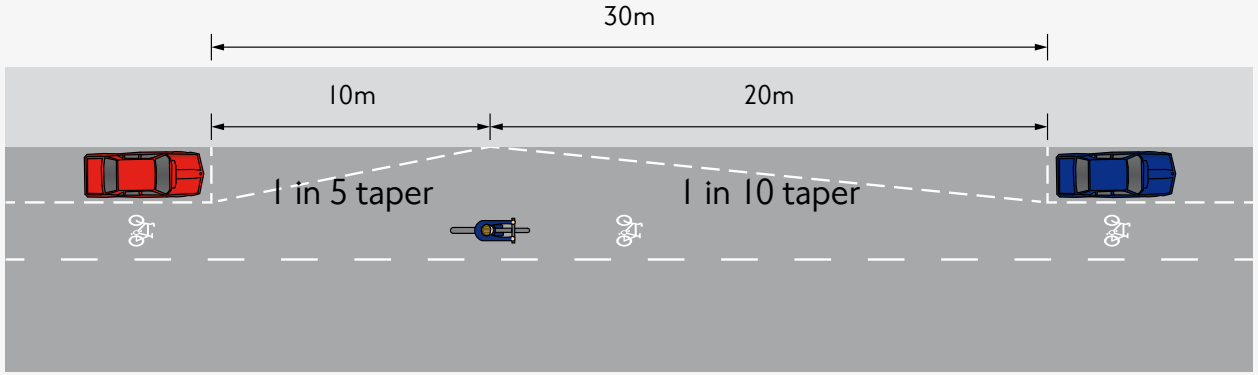
Indicative layout 4/18: Options for cycle infrastructure around on-carriageway parking bays

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 4.1 1 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 4.1 1 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

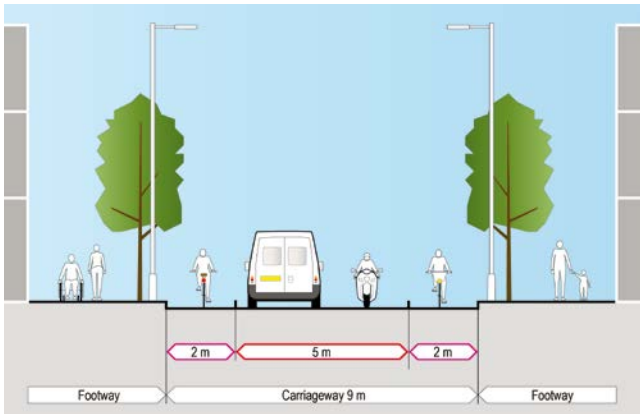
This section demonstrates indicatively how the above guidance on cycle facility types, street types and width can be brought together to derive options for a range of circumstances. The profiles show that, for a given carriageway width, different configurations are possible through adjustment of various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

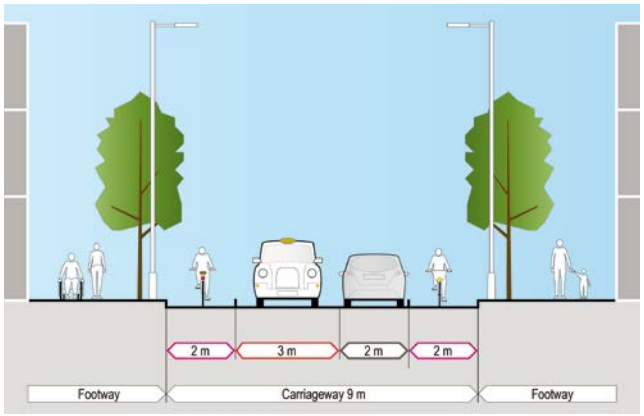
9-metre wide carriageway

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.

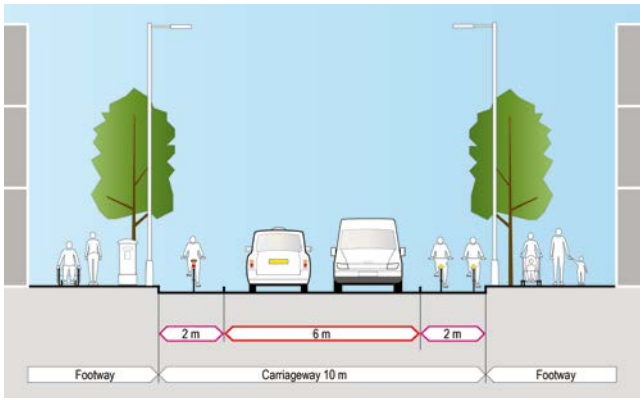


If the street is one-way to general traffic, parking can be accommodated, and 'floated' to one side (meaning that parking is located between carriageway and cycle facility) and give protection to the cycle lane/track. Consideration could also be given to light segregation for the with-flow cycle lane.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

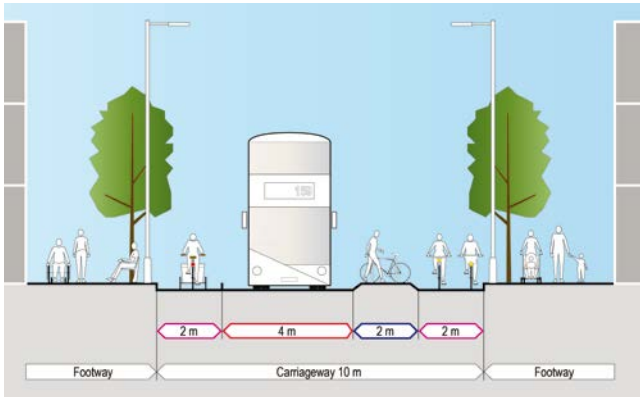


10-metre wide carriageway
Local street / Connector / City street

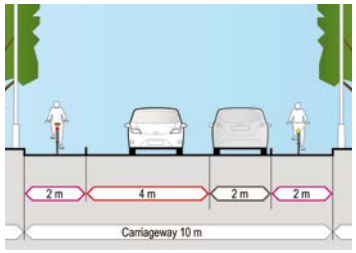
Wide, mandatory cycle lanes can be accommodated without parking and with sufficient space for two-way general traffic in 3-metre wide lanes.



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

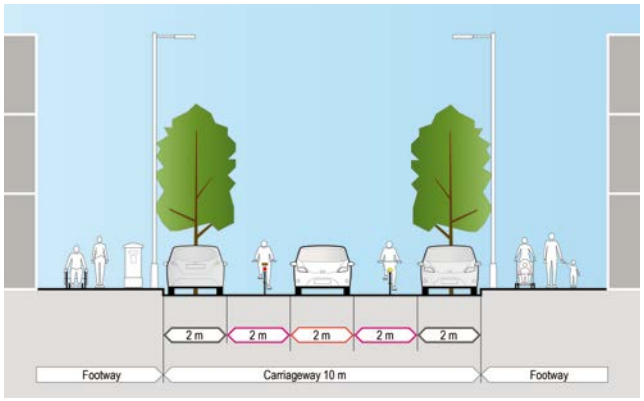


Rather than be used for a separating island, the buffer space could accommodate 'floating' parking and/or loading.



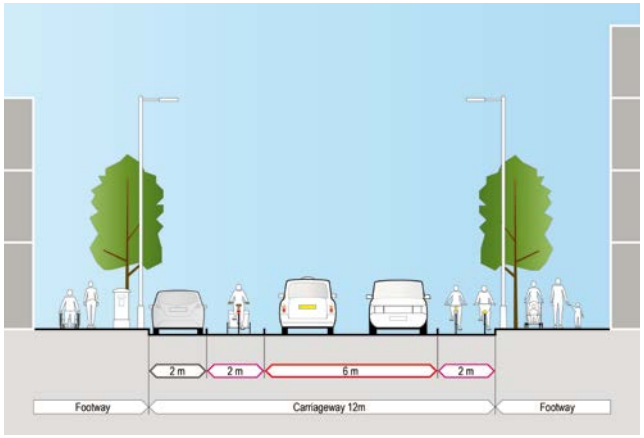
10-metre wide carriageway
Local street

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.

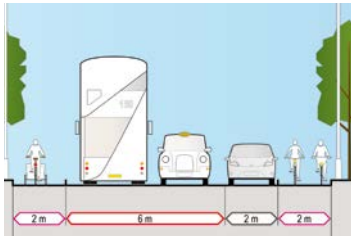


12-metre wide carriageway
Connector / High street

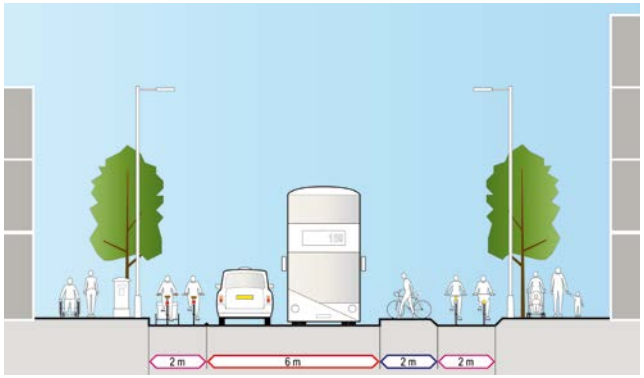
Wide cycle lanes can be accommodated, together with parking on one side, leaving 6 metres for two-way general traffic.



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

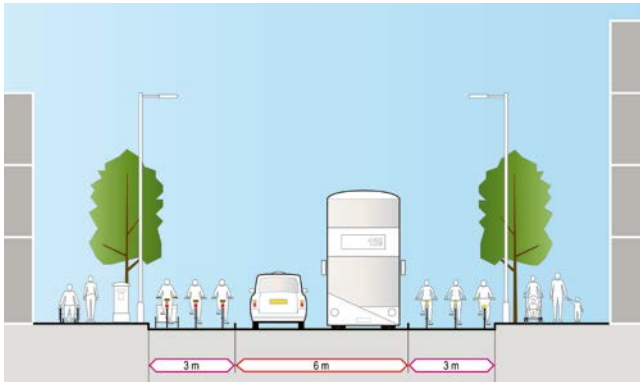


For a street with a higher movement function, full segregation could be provided on one side instead of a continuous bay – parking/loading could sit within the segregation.



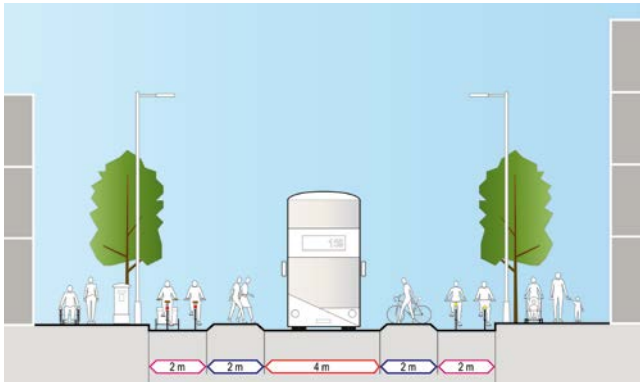
12-metre wide carriageway
Connector / High road

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.



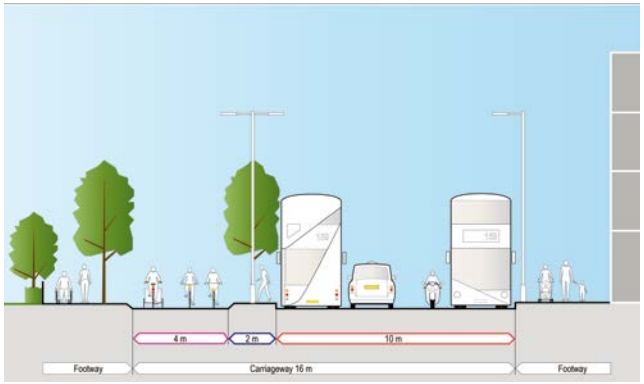
12-metre wide carriageway
High road / City hub

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 Infrastructure designed appropriately for the amount of users Design that reinforces exercise of care and courtesy by cyclists when riding near to pedestrians Where they are necessary, slowing measures and access controls that do not exclude certain users Pedestrian priority on shared paths
Directness	Off-road routes providing key links in the cycle network On-highway alternatives where 24-hour access cannot be secured
Coherence	Good signing and wayfinding to and from off-highway links 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 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 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** 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** 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** 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 Lower cycling speeds More minor interactions between users but less conflict	Pedestrians may walk in cycle track, especially during periods of low cycle activity Non-compliance can increase potential for collisions Cyclists tend to comply unless pedestrians are in cycle track
Physical design	Efficient use of width 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 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 Supports more effective management of network	May require greater number of signs in order to give information along route 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 May require more maintenance if surface is unbound	May require stricter and more costly maintenance regime to support suitable separation 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 User consultation and public engagement should emphasise the opportunities as well as site-specific challenges Information about detailed path designs can help build consensus	Public perceptions may favour separation (although this recedes with early engagement) 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

	Higher cycle flows	Lower cycle flows
Higher pedestrian flows	Partial separation unlikely to be complied with, so sharing preferred. Forms of sharing may work for most of the time but be uncomfortable during peaks. Longer term, cycle routes may need to be reassessed at the network scale.	Sharing is advisable, provided cycle flows likely to remain relatively low.
Lower pedestrian flows	Consider both options. Partial separation could be workable, depending on site-specific conditions, to keep some space free for walking during peak cycling times.	

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

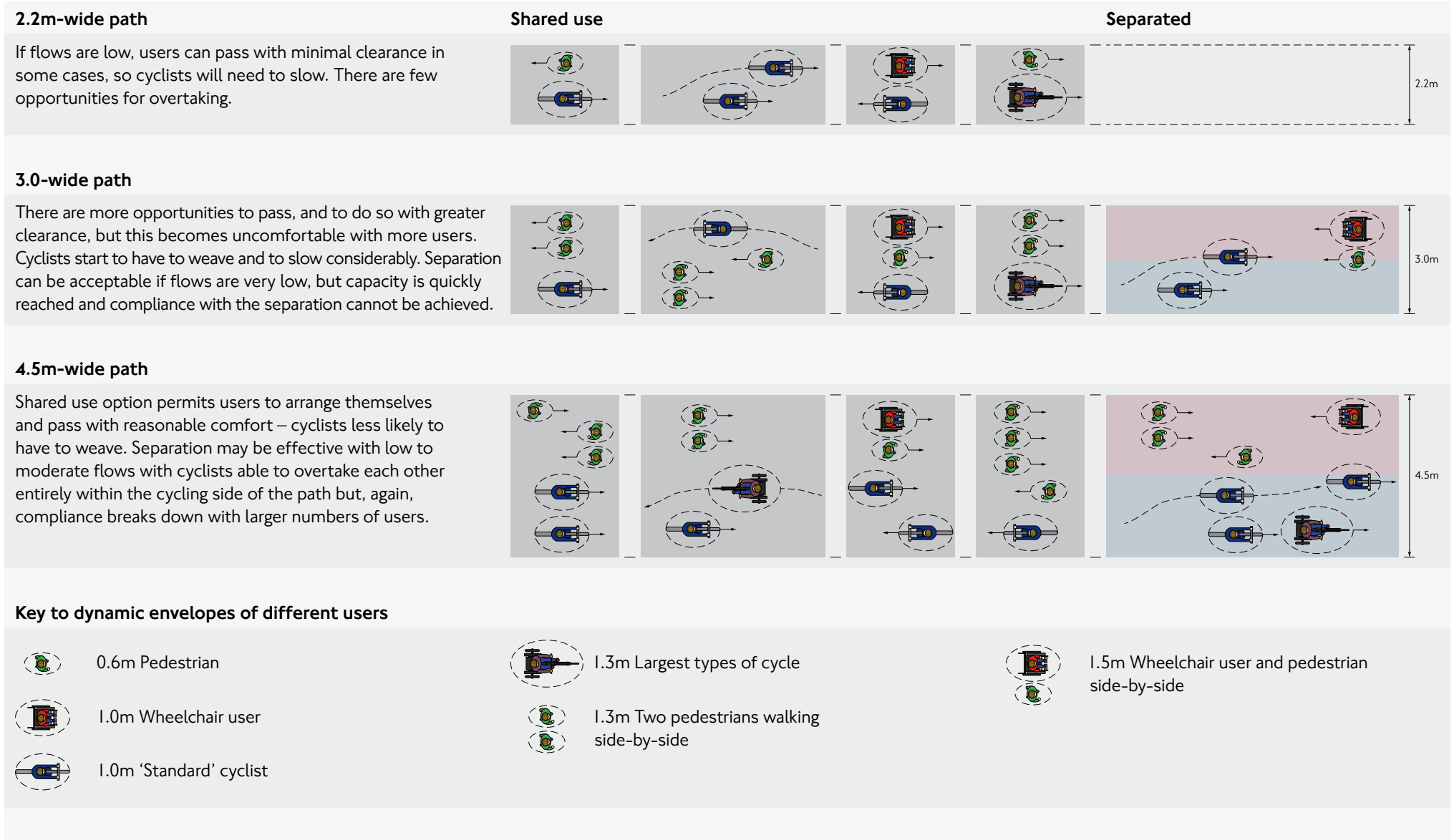
	Partially separated	Shared
Very low / low cycle flow	3.0m (cycle track 1.2m to 1.5m)*	2.2m
Medium / high cycle flow	4.5m (cycle track 2.5m to 2.8m)*	3.0m
High / very high cycle flow	5.9m (cycle track 2.5m to 3.5m)*	4.5m

* 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



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** 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') 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') 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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