Transport for West Midlands

West Midlands Cycle Design Guidance

Second edition

May 2019 | Project code: 03923

Transport for West Midlands

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Version Control and Approval

Version	Date	Main Contributor	Issued by	Approved by
A	24 March 2017	Adrian Lord	Adrian Lord	Adrian Lord
F – this version prepared following comments received from Cycle Charter group on previous work done by Birmingham City Council (see introductory notes)	4 Sept 2017	Adrian Lord	Adrian Lord	Adrian Lord
Second edition	5th March 2019	Adrian Lord	Adrian Lord	Adrian Lord
Comments from Cycle Charter Steering Group	14th May 2019	Adrian Lord	Adrian Lord	Adrian Lord

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Preface

This is the second edition of the West Midlands Cycle Design Guidance, updated to include designs made possible following updates to the Traffic Signs Regulations and General Directions, and with recent scheme examples from across the UK.

This design guide represents a starting point for designers to begin the process of catering for cycling within road and street design. Designing for cyclists on multi-purpose roads and streets with long established highway layouts, where choices need to be made about priorities, cannot be wholly governed by a set of standards or guidelines relating just to the one mode. Designers need to refer to a range of technical documents, look at evolving best practice elsewhere, and use their judgement to arrive at the best overall solution. A range of views and inputs, particularly from local stakeholder and user groups will ensure that designs are satisfactory and meet user needs.

This document is 'good practice' guidance. It does not absolve designers from their duty of care under statutory legislation, including the latest Construction Design Management Regulations to ensure that their designs are safe and fit for purpose. Safety Audits should be completed for highway designs at appropriate stages.

Many other complementary cycling design guidance documents are available, the most prominent ones being the DfT Cycle Infrastructure Design (2019), London Cycling Design Standards (LCDS) and guidance available on the Sustrans website.

Local Transport Note (LTN) 1/19 Cycle Infrastructure Design provides national design guidance, while network planning is covered in the Local Cycling and Walking Infrastructure Plans (LCWIP) guidance. These can be found, along with other statutory resources on the website of the Government's advisory body on cycling and walking design; The Active Travel Working Group www.gov.uk/government/groups/cycle-proofing-working-group. This website also lists other useful design documents which can be seen on the cycling pages of the gov.uk website.

A list of useful reference documents can also be found at the end of this document.

When approval for cycling schemes is requested from elected representatives and senior officers, evidence should demonstrate that this design guide has been given due consideration. Justifications for design decisions should be provided.

We gratefully acknowledge the cooperation of Birmingham City Council, other Cycle Ambition grant recipient cities, Transport for London, the Welsh Government and Department for Transport for sharing information. Many thanks to Arup and the Welsh Government for helping to develop and prepare the original material on which the technical drawings appendix is based.

Executive Summary

The West Midlands Cycling Charter sets a goal to achieve a regional average 5% mode share for cycling by 2023 and a 10% mode share by 2033. This document offers advice on infrastructure design to support that aim. It is not a policy document. Political and technical decisions about reallocation of space to accommodate cycling infrastructure are subject to the usual technical analysis and public consultation that applies to any new infrastructure.

The Cycling Charter Steering Group has agreed that common local guidance can apply across the West Midlands. Birmingham City Council produced draft local guidance as a recommendation of the 'Changing Gear' scrutiny report, funded by the Cycle Ambition and Growth Fund. This draft guidance provided the basis for this West Midlands version.

Successful funding applications for national government sustainable transport funding, spending through the Local Transport Plan, improvements alongside major schemes and inward investment from private sector development has added significantly to the extent and quality of cycle infrastructure across the West Midlands. The Cycling Charter ambition is to secure sustainable annual funding equivalent to an investment of £10 per head of population (at 2014 prices).

Many UK cities have embarked on projects that separate cyclists from motor traffic along major road corridors as a more feasible alternative to reducing the speed and volume of motor traffic to levels that make on-carriageway cycling safe and attractive. The resulting growth in cycling in central London and other core cities is beginning to illustrate how good quality segregated infrastructure can cater for mass cycling by a wide range of abilities including children and elderly people. These groups need to feel able to choose cycling if it is to achieve a significant mode share.

This guidance sets out good practice in designing for cycling in different circumstances. It starts by considering what the ideal conditions are for cycling but also what options can be achieved within constraints of existing highway boundaries and traffic conditions.

The first part of the document covers design principles and practice. The appendices include technical layout drawings of typical features that can be used as a basis for customised site-specific designs.

Knowledge about providing cycle facilities is constantly evolving. This document will be produced in web-based pdf format to enable easy updating as new ideas emerge.

1 Introduction

1.1 Foreword

1.1.1 Cycling is good for the environment and economy of the West Midlands and the health of the people who live, work and visit here. In common with urban areas around the world, a high number of daily journeys are only a few miles long - journeys that many people feel are a bit too far to walk and so often use a car. 41% of journeys under two miles in the West Midlands are by car[1]. But the cycle offers an alternative. Travelling a mile in not much more than five minutes, many journeys can be done by cycle in the same time as a car in peak urban traffic conditions. More cycling for short trips will potentially release space for those that most need to use motorized transport. The cycle provides exercise, is clean and quiet, sociable and fun and poses little threat to others. The cycle is an indicator of a healthy, sustainable, progressive and vital city region of the 21st century. Places the world over are turning to cycling. The West Midlands is joining the revolution.

1.2 Aims

1.2.1 Decisions about cycle infrastructure design are made within the context of overarching transport policies and strategies such as Movement for Growth[2]. These strategies form the basis for decisions about the allocation of road space with reference to the dominant strategic function of a given road or street and policies for infrastructure within green spaces and other off-road environments.

1.2.2 Where the decision has been made to provide for cycling, this guide sets out underlying design principles (including consideration of speed limits, traffic volume, pedestrian activity, requirements for kerbside activity (bus stops, loading, parking), available widths and surface conditions) that will give cyclists sufficient safety and priority to encourage this mode.

1.2.3 There are few fixed geometric 'standards' relating to cycle route design (or to design of local roads generally) and so this document has the status of 'guidance'. There are some critical 'minimum dimensions' required to accommodate a moving cyclist which should be adhered to for safety. Most cycling occurs on existing roads, streets and other rights of way that have evolved over time and rarely offer the ideal situation. New infrastructure that is intended to become adopted highway should comply with this guidance and other relevant local highway authority standards and practice for construction, materials and maintenance.

1.2.4 The minimum width dimensions in the guide are based on the dimensions of the cyclist using many different types of cycle as set out in Chapter 2. Failure to meet the minimum dimensions in the guide will exclude some cyclists.

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[2] Movement for Growth, the West Midlands Transport Strategy

1.2.5 The aims of the guidance are to:

- Ensure consistent and high-quality provision with a more standardised approach that reflects the function and importance of the cycle route within a local network (regardless of whether the space for cyclists is provided via an off-highway route, off-carriageway track, on-carriageway cycle lane or carriageway shared with motor vehicles.). For example, the Rea Valley Route is a strategic cycle route but consists largely of off-road tracks and lightly trafficked minor roads that are not strategically important to other modes.
- Assist with understanding the requirements of cyclists and those wanting to take-up cycling (alongside those of other road users) when making decisions about highway space.
- Set out clearly in one place how cycle infrastructure can be laid out showing relevant signs and markings.

1.3 Relationship with Transport Policy

1.3.1 This is not a policy document. The design concepts are based on proven technical solutions that offer good conditions for more and safer cycling. Good provision for cycling and walking is an essential component of any sustainable transport system. It reduces the necessity for short car journeys and supports use of public transport by providing for multi-modal trips, helping to remove car traffic from bus routes.

1.3.2 The design and extent of space allocated to cycling within highways and other public areas must also be compliant with UK legislation (including the requirements of the Equality Act). The usual channels of local consultation and political approval following consideration of the needs of all road users and local transport priorities shall ultimately determine site specific designs.

1.3.3 Existing streets usually accommodate many modes of transport and other street activities. Regional and local transport policies include a range of measures for public transport, walking, cycling, electric vehicles, freight traffic and increased occupancy of private cars to ensure that the transport network is healthy and efficient. These policies and regional strategies will help to guide designers towards appropriate solutions that meet aspirations and deliver the greatest benefits.

1.4 Who is the Guidance for?

1.4.1 This guidance is aimed at development and highway planners, urban designers, traffic engineers and contractors working within the area. It is intended to offer greater consistency in the approach to providing for cycling in all infrastructure schemes. Design guidance is only 'guidance' and all design proposals should be subject to the usual peer review and safety audit procedures that apply within highway authorities.

1.4.2 Cycling is an important mode of transport for short trips, and in combination with public transport or car for 'bike and ride' journeys that cover longer distances. Transport is not the only reason for cycling; it is also used to promote public health and local leisure/tourism. The West Midlands is committed to creating and maintaining attractive public realm and open spaces in which pedestrians and cyclists play a major part.

1.4.3 This guidance is not just for cycling-specific schemes, as many good cycle facilities are provided through highway improvement, public transport and new development planning. The needs of cyclists (along with pedestrians) should be considered from the outset of any scheme. If cyclists and pedestrians are an after-thought then the resulting provision will possibly not be as good as it could have been. Schemes need to take a holistic view and bring about overall transport benefits.

1.5 Where does it apply?

1.5.1 The guidance applies to all transport infrastructure, including all highways and other ways used by cyclists. Work has been undertaken to identify a regional and Local Cycling and Walking Infrastructure Plans (LCWIPs) setting out a cycle route network (see map below) showing areas of high potential and to help identify priority routes for development. However, changes to any transport or leisure route available to cyclists should include consideration of whether conditions can be improved.

1.5.2 A cycle route network generally comprises of three elements:

- **Strategic or Main Routes** – Largely radial routes serving town and city centres and other major local destinations and generally following main highway corridors.
- **Local or parallel quieter routes**– Other local access routes serving residential, commercial, education, leisure and employment areas and generally not on major highways.
- **Traffic Free Routes** - These are routes that are away from the highway mainly through green spaces and along canal towpaths.

1.5.3 The categorisation of the cycle route network does not necessarily align with that of the road network. It is possible for Strategic/Main and Local/Parallel routes to connect destinations using traffic free links over both longer and shorter distances.

1.5.4 Facilities for secure cycle parking and interchange with other modes are required across the entire network.

1.5.5 Cycle infrastructure may be provided in public open space and parks, canal towpaths, railway stations and private developments away from the public highway. This guidance should be available and relevant to all organisations providing cycle facilities including developers.

Figure 1: The West Midlands Strategic Cycle Network (TfWM)

1.6 How this guidance works

1.6.1 The 'Design Principles' chapter gives a brief description of the elements that make up a cycle route network and sets some universal principles that apply to all types of route regardless of traffic conditions or the intended users.

1.6.2 The infrastructure chapters describe the main elements of cycle routes, looking at the types of links and junctions in terms of:

- What is the most inclusive form of cycle infrastructure that will cater for most people?
- What common hazards and barriers to cycling should be considered and addressed in the design?
- What typical design constraints (available dimensions, topography, drainage requirements and other street activities) need to be considered and how can they be managed?

1.6.3 The signing chapter looks at:

- Regulatory and advisory signs and markings that apply to cycle infrastructure
- Cycle direction signs on the highway

1.6.4 The cycle parking chapter looks at:

- The design of cycle parking appropriate to different locations
- The levels of cycle parking required at differing destinations

1.6.5 Typical Existing road profiles are in Appendix A. Typical layouts of design features are in Appendix B. Additional advice for accommodating cycle facilities around Midland Metro lines is in Appendix C.

Photo Credit: Alison Kennedy, BCC

2 Design Principles

2.1 Planning the Functional Network

2.1.1 Cycle journeys commonly follow corridors that are also used by public transport, cars and pedestrians. The primary function of these routes may differ for different user groups, for example a main road, a district centre high street, a residential street, a parkland path or canal towpath may all form components of a strategic cycle route, but each serves a different function for other users.

2.1.2 It is important to plan and design routes in terms of their function within the cycle route network, as well as responding to the differing requirements of other users. In general, the strategic cycle route network benefits from a greater separation from other modes to offer the highest level of service to cyclists. Four main functional elements of a cycle route network are:

- The **Strategic/Main Network** for moving people through an area efficiently, serving the main transport nodes around the town and city centres and other significant destinations such as major out of town employment sites. It comprises of main road routes and parallel routes that form other corridors near to main roads. Strategic radial routes will typically converge on a town/city centre but may be up to 1km apart at the suburban end, so some connecting routes are required to ensure efficient movement. Multiple centres of activity such as local district centres, suburban business, industrial and retail parks need to be connected into this strategic network. The strategic network is important because it enables more people to travel to key destinations, boosting the economic vitality of the region. The strategic network should also provide opportunities to combine cycling with other modes of transport for longer trips. These routes are typically way marked with standard highway directional signs (both cycle-specific [especially where a route varies from the motor traffic route] and general traffic direction signs)
- The **Local/Parallel Network** is a finer mesh of routes, typically 250m to 400m apart, offering coherent ways to navigate to local destinations using quieter roads and off-road links, with safe ways to cross the busiest roads. These routes serve local schools, shops, housing estates, suburban stations and other destinations. The emphasis on these routes is to address issues that compromise safety or make cycling unattractive, such as busy road crossings or extensive diversions due to one-way systems or physical barriers such as canal, rail and river crossings. The local network is important because it helps to address traffic growth and road safety across residential areas by providing an alternative to numerous short local car journeys that have a big impact on minor neighbourhood roads. Such routes may not all be signed, but may include direction signs leading to the nearest green route or strategic route.
- The **Traffic-free or Green Network** is made up of off-road (away from the highway) in public open space, parkland, canal towpaths, public bridleways and very quiet linking roads that provide an attractive environment for cycling. These routes may be used to access important destinations, but the design objective may also be entirely to stimulate new cycle/walk trips

by providing a largely traffic-free route in attractive surroundings. For many users, cycling for pleasure will be the only purpose of their journey. The leisure network is important as a venue for low-cost exercise, local tourism and healthy living. The West Midlands conurbation benefits from an industrial legacy of extensive canal towpaths, disused railway lines and green spaces that are sometimes overlooked as a leisure and tourism asset. Some of these routes are 'hidden' away from the adjacent roads and streets that connect into local centres and it is important that directions are signed to and from local destinations as well as along the route itself.

- **Interchanges.** For a longer journey, a cycle can easily be combined with car, bus, rail or tram if there are suitable facilities which may include cycle carriage, cycle hire, secure cycle parking or 'park and ride'. This gives people much greater flexibility in using the whole transport network, leading to overall efficiencies. It is important that the location of secure cycle parking and cycle hire is clearly waymarked outside and within an interchange.

2.1.3 In practice, these functional distinctions are often not clear cut, but provide a conceptual framework that can be used to think about which of the core principles of design are most important on a given route. The crucial thing, if cycling and walking are to service existing and future trip patterns, is to make connections between typical journey attractors as shown below. It is not the case that every main road should also be a main cycle route because alternative more direct and safe routes may be available to cyclists. For example, a two-way cycle route between Constitution Hill and Lancaster Gate is provided in Hyde Park, London as a direct traffic-free alternative to a large and busy gyratory system.

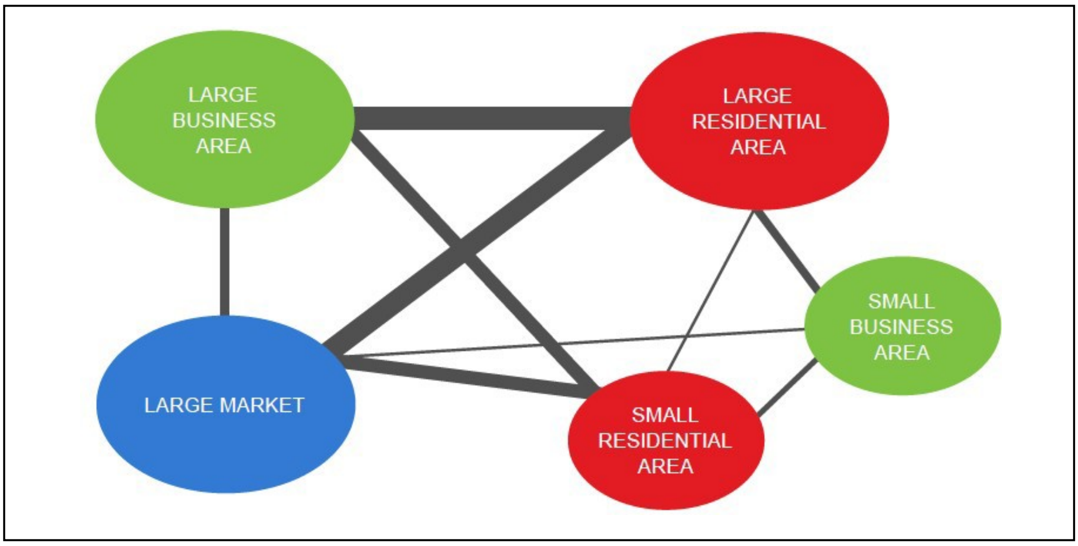

Figure 2: Typical Network Desire Lines (from Welsh Active Travel Design Guide)

2.1.4 Further tools are evolving to assist with network planning, route selection and prioritisation based on trip potential, such as the National Propensity to Cycle Tool (PCT) (http://pct.bike/) and the Local Cycling and Walking Infrastructure Plan (LCWIP) published by DfT (https://www.gov.uk/government/publications/local-cycling-and-walking-infrastructure-plans-technical-guidance-and-tools) .

2.2 Place and Movement Contexts in Network Planning

2.2.1 Roads and streets are generally dominated by the requirements of motor traffic, which needs space in which to operate safely, for parking, and to minimise delays. These aspects are generally associated with 'movement and access', but do not add to the sense of 'place'.

2.2.2 Pedestrians and cyclists have movement requirements and need cycle parking, but also value places to walk and sit in pleasant surroundings. People outside cars therefore often give equal value to the 'place' function of roads and streets; although on busier roads and at junctions they need to be able to travel at a convenient speed and cross opposing traffic in safety.

2.2.3 If the basic requirements for non-motorised traffic are not met, the transport system as a whole suffers. Narrow and congested footways, cluttered with signs and other street furniture, streets that are too busy and dangerous for residents to enjoy spending time in will perpetuate motor traffic because travelling on foot or cycle is unpleasant, hazardous or even inaccessible (steps on cycle routes, footways blocked by parked vehicles exclude some users altogether).

2.2.4 If the 'place' function of residential streets and local centres is neglected, strategic transport corridors also become congested with people making local short trips by car because they see no alternative. The most economically successful and attractive places offer safe access from the surrounding area and high-quality public space. If the streets feel comfortable and safe, people spend more time and money locally.

2.2.5 Context is very important when selecting the type of cycle infrastructure. The appropriate infrastructure will depend on how a site can fulfil the dominant function of the street. For example, Victoria Square lies at the very heart of Birmingham city centre where several cycle and pedestrian routes converge and cross, but its primary function is as a 'place'.

2.2.6 Typical environments within the West Midlands include:

- **Town and City Centres**. The core areas of towns and cities are typically where there is great potential for high quality, attractive streets, squares and spaces, and convenient, walkable connections. The design approach will therefore generally place the greatest emphasis on pedestrians, followed in order by cyclists, public transport users, service vehicles, and last of all private cars. However, town centres typically also have to accommodate access for car parking, deliveries and public transport interchange. Providing well designed facilities for walking and cycling is a key ambition, to be achieved alongside other requirements and within the context of design principles. A connected, legible and bio-diverse streetscape will encourage walking and cycling and promote sustainability.

Traffic within the core central retail and commercial areas is primarily entering for access to parking and deliveries so there is no requirement for speeds above 20mph, reducing the need to provide physically separated infrastructure for different modes. Within vehicle restricted areas, cyclists should ride at speeds appropriate to pedestrian proximity, giving pedestrians due clearance, giving way or dismounting if necessary. Being able to use the whole width between buildings can help reduce the potential for conflict. Making the core permeable to cyclists and allowing intuitive direct journeys is a key approach. This can be achieved by exempting cyclists from traffic management measures such as one-way streets and mode filters that exclude other traffic.

- **Local centres and high streets** that sit on main radial roads are common across the West Midlands and need to strike a balance between 'place' and 'movement' functions. If through traffic cannot be diverted onto a suitable bypass route, the optimum design treatment may be to reduce traffic speeds to enable cycling on the carriageway and to provide opportunities for pedestrians and cyclists to cross main roads safely to reach local attractors. Wider footways offer better opportunities for people to spend time, on public benches or street cafes, and this visible high level of pedestrian activity and space relative to the carriageway width helps to modify driver behaviour, reinforcing lower speed limits. This may require moving parking to side streets (which can also help resolve localised congestion on the main road) or formalising it into bays. Restricting turning, parking and loading activities can help to improve local safety by reducing the number of conflicting vehicle movements, making it easier for drivers, cyclists and pedestrians to take in the range of activities. Multiple kerbside activities (bus stops, loading bays, parking bays), frequent crossings and side roads that are typical in local centres do not usually offer good conditions in which to provide continuous fully segregated cycle tracks, but cyclists may need specific assistance at places within the street such as early start signals or a bus stop bypass.
- In **residential areas,** the principle of 'filtered permeability' can be used to offer short cuts and through routes for cyclists on tracks that are unavailable to motor traffic, although the streets themselves should also have low speed limits to protect residents, especially children.
- In **industrial areas** there is a high percentage of HGV traffic and the geometry (wide roads and sweeping corners) required to accommodate this enables higher speeds by other vehicles. The combination of high speeds and HGV traffic suggests greater segregation is required for cyclists even though the flows of traffic may be low. This situation also occurs in some local centres that are close to industrial areas or motorway junctions.
- **Off-road and leisure routes** typically use surfaces that cyclists share with pedestrians, with the expectation that most cyclists will modify their behaviour when pedestrians are present.
- **Busy Corridors** may demand off carriageway tracks within the highway where there are high speeds or flows of motor traffic and should generally be fully separate from pedestrians unless pedestrian use is very low. With few frontages and infrequent side roads, motor traffic speeds will naturally be faster and cyclists and pedestrians will require greater separation from motor traffic. On roads with few frontages, the number of cyclists is always likely to

exceed the occasional pedestrian traffic and there is no need for separation of pedestrians and cyclists on the track itself.

2.3 Principles of Segregation and Integration

2.3.1 The overall width available, the intensity of use and the relative speeds of the different types of user are safety critical factors where cyclists share a surface with other modes. This principle applies to pedestrians and cyclists as well as to cyclists and motor traffic.

2.3.2 The aim should be to reduce the speed differential as far as possible, and to eliminate or control conflicting movements at busy junctions and crossings.

2.3.3 If conflicting movements or speed differences cannot be eliminated, there is an increased necessity to provide wider surfaces (to enable users to avoid one another on a shared surface) or fully separate facilities for each mode.

2.3.4 Greater segregation should also be considered when planning routes that will attract large numbers of inexperienced cyclists, such as access to schools. There are various ways to assess the existing and potential cycling environment such as 'Cycling Level of Service' (CLOS) that can be used to highlight which streets or junctions need interventions, and which offer generally acceptable conditions (see Sections 2.6 – 2.13).

	MORE SEGREGATION	→	MORE INTEGRATION
ON-CARRIAGEWAY	 Light segregation	 Cycle lane	 All-purpose traffic lane
NEXT TO CARRIAGEWAY	 Level segregation	 Visual/tactile segregation	 Shared foot/cycle way
AWAY FROM ROADS	 Kerb segregation	 White line segregation	 Shared towpath

Figure 3: Different options for cycle route provision

2.4 Five Core Design Principles

2.4.1 The infrastructure should be accessible to all. Five widely accepted core principles for all cycle routes taken from the original Dutch guidance[3] are:

- **Safety**. Routes should be safe to use and should feel safe for all users. 'Feeling safe' is sometimes referred to as subjective safety, and includes feelings of vulnerability to crime as well as fear of traffic danger (regardless of whether there is an actual record of crime or injury accidents). Cycling is generally a safe activity and there are few accident clusters within the region, but fear of traffic danger is the major deterrent to more people cycling[4]. Routes along busy and/or high-speed roads should therefore offer protection from motor traffic where possible. Routes away from roads, in open spaces and in subways should have good visibility and lighting. The fear of crime affecting personal security is the major deterrent to walking, but according to research, less of a concern for cycling1 compared to traffic danger. Subways are generally regarded as poor provision for pedestrians (due to fear of crime) but are often valued by cyclists if they are well designed and offer a traffic free non-stop route through a complex junction. This is because the combination of delay and safety issues at toucan crossings or signalised junctions is often a worse inconvenience than the fear of crime within a subway.
- **Directness.** Routes should connect origin and destination using the least distance and least delay as possible, by minimising the requirement to stop at junctions and crossings. The alignment should generally cover the minimum distance between two points, however it is sometimes advantageous to avoid steep gradients or major junctions by using an alternative route that is slightly longer but more convenient and easy to use. For example, crossing the ring road is a barrier to cycling in Birmingham mainly due to the large and complex multi-lane roundabouts. Cyclists and pedestrians may have options to cross on safer and more convenient link sections that are away from these high capacity roundabouts.
- **Coherence.** A network may comprise of many different elements but the aim should always be continuous provision, with no 'gaps' at difficult locations. This is one of the most important issues to address because routes that are discontinued due to a major barrier or width constraint are of limited value. Clear signing is particularly important where cycle routes use minor roads and tracks that are not signed for other traffic. Coherence involves the whole journey, including easy access to secure cycle parking at home and at the destination. Highway improvement works are often focussed on a particular location, but there should be an underlying plan for phased implementation to build up a coherent route over time.
- **Attractiveness.** Infrastructure should be attractive to the intended users, for example wide enough to cycle side by side, with no sharp corners or restricted sightlines and easy to follow. Routes should generally aim to cater for a wide range of cycling abilities, safe enough for slower cyclists but still convenient for experienced and faster cyclists.

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[3] Design Manual for Bicycle Traffic, CROW, 2007
[4] Understanding Walking and Cycling, Pooley et al, Lancaster University, 2011

- **Comfort.** Routes should be physically comfortable, with a good quality surface. Riding in traffic can be stressful, especially if the intended manoeuvre is unclear, has many obstacles or is poorly signed. Designs should therefore be mentally intuitive and 'feel' safe, with clarity at junctions, protection from opposing traffic movements, separation from pedestrians and clear of street furniture. Routes designed for leisure cycling should be able to accommodate cycling two abreast, while on-carriageway commuter facilities should ideally provide sufficient width for a cyclist to overtake another cyclist without having to move into an adjacent motor traffic lane.

2.5 Adaptability

2.5.1 As with all-purpose roads, facilities that are adequate for a small number of cyclists need to be adapted as cycle traffic increases. This may involve replacing cycle lanes with cycle tracks, which can also help remove slow-moving cyclists from bus lanes and carriageways. More separate facilities will usually attract greater numbers, particularly women and child cyclists, due to offering enhanced safety and convenience. Successful operation relies to some extent on public acceptance and compliance with priority for cyclists at side roads and driver compliance with parking regulations. West Midlands Police have been working with local authorities in recent years to improve driver behaviour through education initiatives such as the 'close overtaking' enforcement, and support for enforcement of 20mph speed limits.

2.5.2 The experience in London, New York and Copenhagen, all of which have seen a rapid increase in cycling but where infrastructure was originally poor or non-existent, suggest that the sixth criteria of 'Adaptability' should be added to the list. The monitoring in these cities provides evidence that the rate of increase gathers pace as cyclists start to form a significant part of the traffic. As the number of cyclists increases, there is greater justification for providing more road space and giving additional time at traffic signals and crossings.

2.5.3 It is always difficult to decide which potential cycle routes should be prioritised. DfT's LCWIP guidance offers a demand-based process through collation of travel data in combination with local knowledge. Where a functional 'link and place' classification is applied, the 'Link status' of a proposed cycle route can be boosted to ensure that cyclists are given due consideration when prioritising space allocation. Schemes may be prioritised that will improve public health or access to employment to address local issues.

2.5.4 The recent growth in cycling across the region suggests that there is no reason why the West Midlands cannot emulate other areas that have successfully tapped the latent demand for cycling.

2.6 Who are we designing for?

2.6.1 Urban cycling in the West Midlands is currently mainly undertaken only by people who are able and willing to cycle in existing traffic. They have the skills, confidence and commitment to do so.

However, this does not mean they find it a comfortable, hazard free experience and would not prefer a more comfortable cycling environment.

2.6.2 Cycling will never appeal to everybody, but where sufficiently comfortable, safe and convenient conditions are provided it becomes a viable transport choice for many people. This is increasingly the case as electric cycles that make cycling much easier are becoming more widely available, making cycling accessible to older and less-mobile people. This requires the perception of hazards from motor vehicles to be reduced sufficiently for people who simply want to use a bike for some trips. For example:

- A child or teenager cycling to school
- A new commuter
- Enjoying an active Sunday as a family
- A shopping trip
- Meeting friends for coffee or a night out

2.7 Dimensions of a solo cyclist and non-standard cycles

2.7.1 A moving cyclist travelling in a straight line has an effective width (sometimes called the dynamic envelope) of 1.0m. This is the shoulder width of the cyclist plus a small (0.2m) allowance for deviations from a straight path to maintain balance (See Figure 3). At very low speeds of under 5mph on uphill gradients and near junctions, the ‘wobble’ required to maintain balance is exaggerated (up to 0.8m) and additional width is recommended. Where there are metal drain gulleys at the edge of the carriageway, cyclists need sufficient space to avoid them. The typical length of a standard bicycle is 1.8m.

2.7.2 Child trailers, tricycles, three wheeled recumbent cycles and hand-cycles for people with disabilities generally have an axle width of around 0.9m. The additional width and length of non-standard cycles should be considered to ensure infrastructure is accessible to a wide range of users. Tandems are 2.5m long and solo cycles with a ‘trailer-bike’ can be up to 2.8m long. Cycles for the disabled can be 1.2m wide. Cycling facilities need to be constructed to accommodate these dimensions.

2.7.3 Most types of cycle may be fitted with electric-assist. This does not usually alter the dimensions but adds to the weight of the cycle, making it difficult or impossible to lift off the ground. Facilities that require a rider to dismount or to lift a cycle will exclude some people.

2.7.4 Allowing for the wobble-factor and a 0.5m separation between cyclists, Figure 4 illustrates a 2.5m dynamic envelope for two side-by-side cyclists.

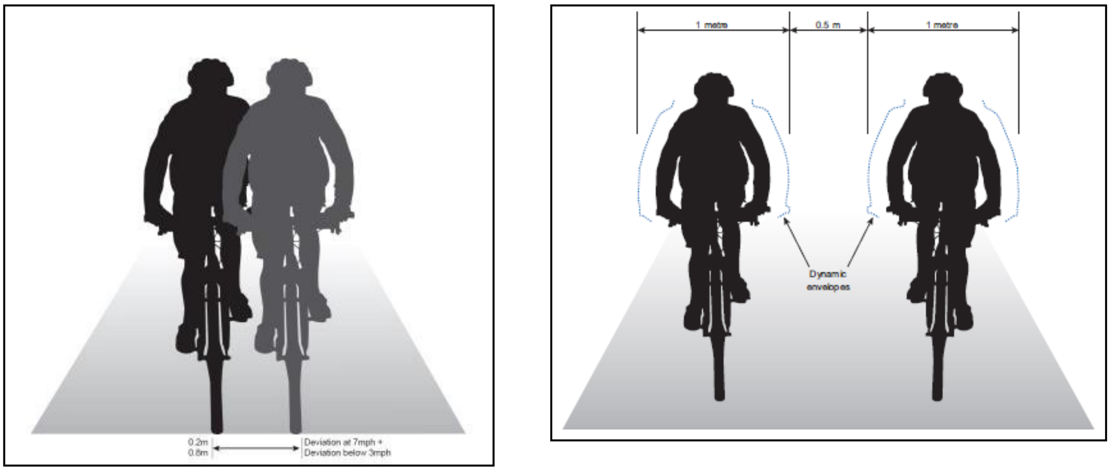


Figure 4: Dynamic envelope of cyclists[5]. (DfT)

2.8 Distance to fixed objects

2.8.1 Where a cycle track or lane is bounded by a solid vertical feature such as a wall, fence or hedge, cyclists will require 1.0m clearance (from the centre line of the cyclist) to avoid hitting it. This clearance is reduced to about 0.25m for a smaller upstand such as a low kerb (Table 1).

2.8.2 Cyclists require some additional width at bends and corners to enable them to lean into a corner and to maintain momentum. Adverse camber should be avoided.

Minimum design distances to fixed objects	
Distance from wheel (centre of cyclist)	**Object**
0.25m	Kerb <50mm
0.50m	Kerb >50mm
0.75m	Street furniture: sign pole, lamp column etc.
1.0m	Wall, railing, bridge parapet, parked vehicle

Table1: Separation to fixed objects (DfT)

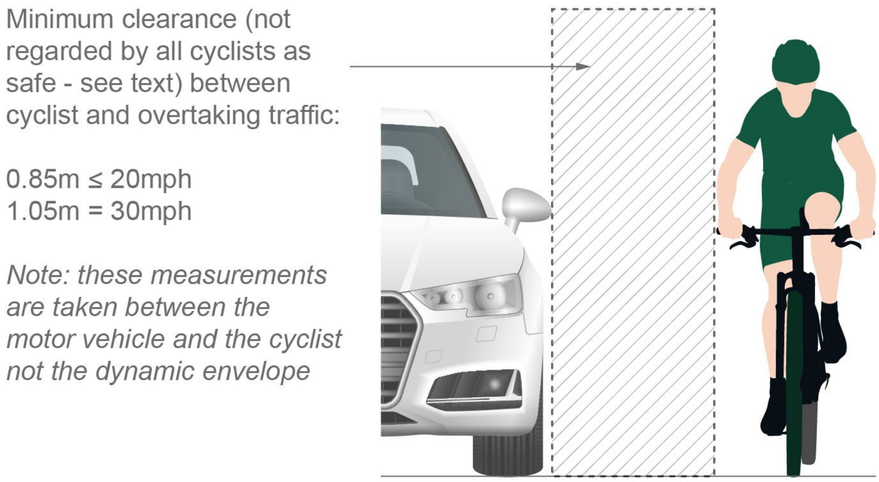
2.9 Distance to other traffic

2.9.1 Research by the Transport Research Laboratory (TRL) has shown that, under test conditions, nearly half the cyclists studied felt unsafe when cars travelling at 20mph passed them with a clearance of 0.95m. However, Dutch research has established that motorists driving at this speed are willing to overtake cyclists leaving a clearance of only 0.85m. This distance increases to

[5] LTN 2-08 Cycle Infrastructure Design

1.05m when passing at 30mph. Suggested minimum separation from overtaking traffic[6] is shown below in Figure 5. Generally, designers should seek to enable the cyclist to ride in a position where they have at least 1.0m clearance to overtaking vehicles and at least 0.5m between the bicycle wheel and the nearside kerb (to avoid gulleys and allow some 'wobble' space for maintaining balance at low speeds as in Figure 5).

2.9.2 These distances are widely adopted, for example it is written into French law that drivers overtaking cyclists should give a clearance of at least 1.0m at 30kmh (19mph) and 1.5m clearance at 50kmh (31mph). West Midlands Police run periodic campaigns in partnership with local authorities to make drivers aware of safe overtaking clearances.



Design minimum safe passing distance (measured from outside of cyclist's dynamic envelope)	
20mph	1.0m
30mph	1.5m

Figure 5: Separation from passing vehicles

2.10 General Traffic Lane Widths

2.10.1 A common issue when retrofitting cycle facilities in the UK is that a localised narrowing such as a pedestrian refuge, and general lane widths typically between 3.2m and 3.9m are wide enough for a motorist to overtake a cyclist without crossing the centre line, but without the 1.0m to 1.5m clearance that makes it feel safe and comfortable. This lane width is also hazardous when HGV traffic attempts to overtake without crossing the centre line. TRL studies have shown that drivers generally use the centre line as their primary reference point for adopting road position. Close passes are particularly uncomfortable for cyclists on uphill gradients where the slow-moving cyclist needs additional room to balance and the speed differential with passing cars is greatest.

[6] Cycling England Design Portfolio

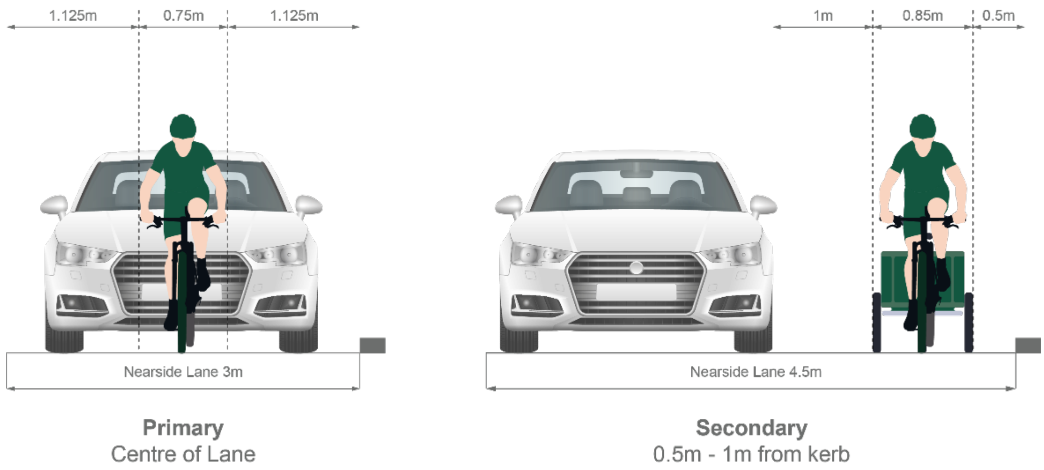


Figure 6: Primary and Secondary positions (note 20mph passing clearance) (DfT)

2.10.2 For this reason, cycling within a shared carriageway (i.e. no cycle lanes) should generally be accommodated by either 3.2m lanes (or less) that require drivers to consciously overtake by moving into an opposing lane or centre hatching, or lanes of 4.0m width (or more) so that drivers can overtake within the lane and leave adequate clearance. These widths also enable cyclists to safely adopt the 'primary' and 'secondary' riding positions that are taught in Bikeability training (Figure 6). Designers should also be aware that cyclists are likely to be overtaken by drivers on the approaches to pinch-points such as refuges, so a tapered kerb to deter drivers from passing and then cutting in, or a bypass for cyclists, is preferred.

2.10.3 In predominantly residential areas that also carry significant volumes of traffic at peak times it may be helpful to include 'throttle' features that prohibit access to wider vehicles and provide a 'gateway' to remind drivers that they are entering an area where lower speeds and more pedestrian and cycle activity are expected.

2.10.4 Figure 7 provides an indication of what overall carriageway widths can accommodate and Figure 8 illustrates the size of vehicles that individual traffic lane widths can accommodate. Widths pertaining to trunk roads are given in TD27, although it should be noted that TD50 permits lane widths as narrow as 2.25m in certain circumstances on the approaches to traffic signal stop lines. Further guidance on traffic lane widths is given in Manual for Streets 2.

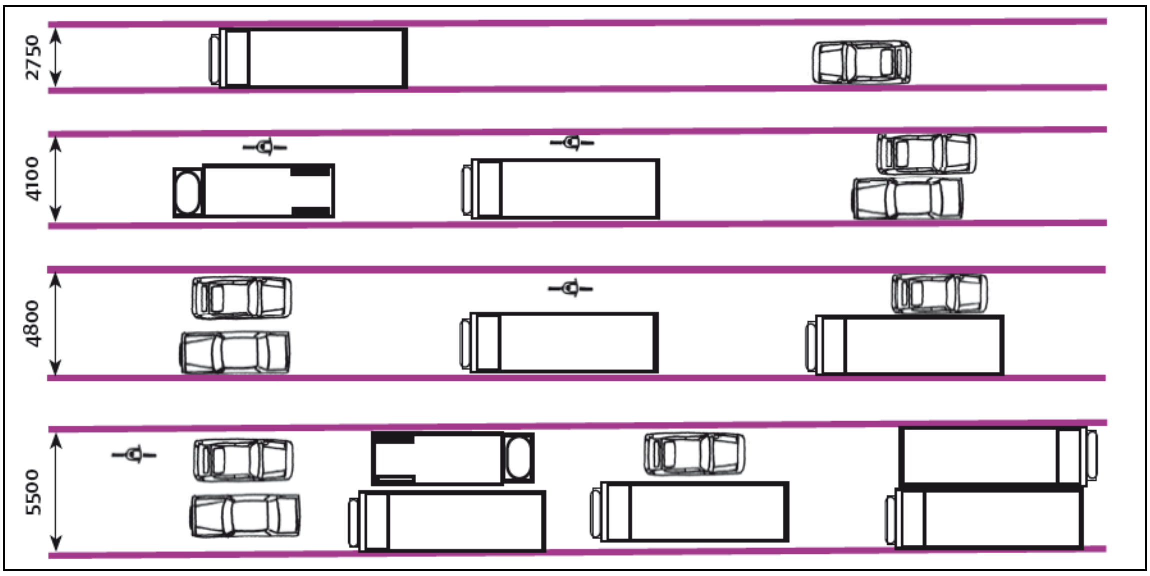


Figure 7 - Illustration of what various carriageway widths can accommodate[7] (DfT)

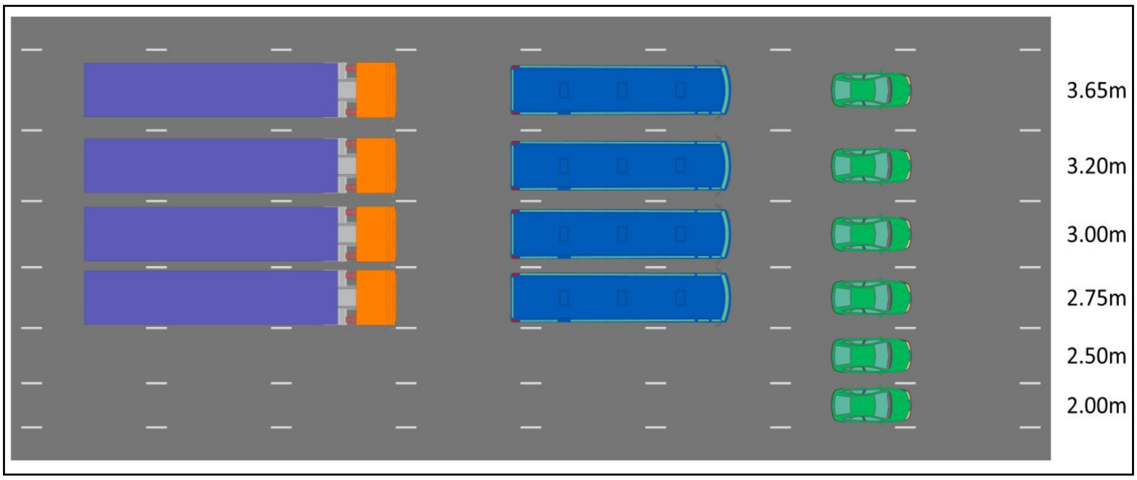


Figure 8 - Vehicles and Lane Widths (IHT)

2.10.5 Whilst traffic lane widths of 3.65m (metrication of 12 feet) have often been provided as standard in the United Kingdom, lane widths of 3.0 metres have been used in many parts of the country on urban roads for some time and can successfully accommodate most typical vehicles (including HGVs) at speed limits up to 30mph[8]. N.B. Modern HGV safety mirrors and overhanging loads can make the vehicles up to 3.09m wide so narrow lanes should not be used where frequent bus and HGV traffic is anticipated.

[7] Manual for Streets, DfT, 2007
[8] Transport and the Urban Environment, IHT, 1997

2.10.6 Where flows of large vehicles are low, and actual speeds are modest (less than 35mph), lane widths as narrow as 2.75m can accommodate car-only traffic comfortably. Larger vehicles can pass one another at this width at lower speed with care, although some drivers will need to encroach slightly outside of lanes (into cycle lane) to pass due to the width of their mirrors. Lanes below 3.0m (only advisable if no buses or HGVs) require agreement within the highway authority.

2.10.7 Safe and unimpeded access by emergency services and refuse vehicles will always be required.

2.10.8 Where general lane widths exceed these values, designers should take the opportunity to reallocate space to walking and/or cycling. Where lane widths are in the critical range of 3.2m to 3.9m, conditions will be unsuitable for cycling on the carriageway unless traffic speeds and volumes are low enough for drivers to cross into the opposing lane or centre hatching to pass a cyclist comfortably.

2.10.9 New developments should either provide sufficient carriageway width for safe on- carriageway cycling within lanes, or off-carriageway cycle tracks (with appropriate provision for crossing the carriageway where necessary and without frequent delays).

Low-speed street design and prominent cycle parking in new development, West Bromwich town centre (Sandwell Council)

Physical width restrictions (in association with a TRO restriction) can be used to exclude larger vehicles from using residential areas with narrow roads as through routes. Access for emergency vehicles (such as the gate in this photograph) must be retained. (Adrian Lord)

Road closures such as the one on the left (which may be for traffic/speed management or crime prevention, or to prevent traffic from using residential service roads) often make roads more attractive to cyclists due to the consequent reduction in traffic. Cycle 'gaps' at road closures offer a 'mode filter' for cyclists where motorised through traffic is being restricted (as in the picture on the right). Measures should be included to ensure that they are not obstructed by parked vehicles. (Adrian Lord)

2.11 Width requirements of infrastructure types

2.11.1 The following section explores the width of different infrastructure, considering the conditions that are typical in the West Midlands.

2.11.2 Table 2 provides a summary of the widths required by the elements that typically make up a cycle route. Because of the need for greater separation as traffic speeds and volumes increase, the table includes options for higher speed roads, and for roads with high frequency of buses or HGV traffic. The widths for off-carriageway surfaces refer to usable width bearing in mind additional clearance required for vertical features such as walls and traffic sign poles. The widths for on carriageway refer to distances to middle of the white lines.

A variety of vehicles classed as a cycle might use a cycle route (Wheels for Well Being).

2.11.3 Dimensions in Table 2 below are based on Local Transport Note (LTN) 1/19 Cycle Infrastructure Design. The dimensions given are those commonly used as minimums and used for construction in situations generally encountered on urban highways and in parkland. The dimensions have been found to accommodate the flows of cyclists and pedestrians usually encountered. Where site conditions allow it and where the level of use is anticipated to be higher than usual, more generous dimensions can be used. Table 5 provides advice on what users consider to be acceptable infrastructure in different traffic conditions.

2.11.4 Site constraints may dictate dimensions less than those given to maintain route continuity, although every effort should go to minimise the length of sub-standard sections. To accommodate site constraints, it may be appropriate to change from a segregated to an unsegregated route (which take up less width) for example. The precise dimensions to be used in constrained locations should be assessed (given available widths and likely flows) for each site but designers should be mindful of the minimum widths needed for cyclists and pedestrians to pass one another safely. The Absolute minimum dimensions give some indication of the narrowest route advisable.

2.11.5 Dimensions given are unbounded – i.e. at least 0.5m beyond kerbs to any structure. If edges feature vertical structures then 0.5m needs to be added to the path width to accommodate an edge to a vertical boundary. It is assumed that kerbed cycle tracks elevated adjacent to a carriageway will feature a minimum 0.5m buffer strip (ideally with a deterrent surface) to limit running off the track and loss of control down a kerb into the carriageway.

Table 2: Widths of Infrastructure

Design feature	**Desirable construction widths**	**Absolute Minimums (constrained locations*)**	**Notes**
Shared and Segregated Cyclist and Pedestrian routes – away from roads			
Traffic free (two- way shared with pedestrians)	Unsegregated – 3.0m Segregated – 5.0 m (3.0m cycles and 2.0m pedestrian)	Unsegregated – 2.0m Segregated – 3.8m (2.0m cycles and 1.8m pedestrians)	Where there are fewer cyclists or pedestrians a narrower route might suffice (2.5m is commonly used) If routes are to be segregated, 3.8m is the minimum workable overall segregated width. Below this routes must be unsegregated. Segregation is not compulsory above 3.8m, it is possible for routes of any width to be unsegregated and this is common practice with off-highway routes.
Canal Towpath	2.0m	1.5m	Given common canal edge to boundary widths, 2m is the width the Canal and River Trust seeks to achieve.

Design feature	Desirable construction widths	Absolute Minimums (constrained locations*)	Notes
Shared and Segregated Cyclist and Pedestrian routes - next to carriageway			
Footway (pedestrian only space or pedestrian side of segregated facility)	2.0m	1.8m or *1.5m clear space where footway bounded by vertical features.	Footways in busy areas require additional width where possible to offer a good level of service.
Unsegregated footway/cycle track (2-way) within highway with full kerb height to carriageway	3.0m	2.0m	Where there are fewer cyclists or pedestrians a narrower route might suffice. Deterrent paved buffer zone of 0.5m adjacent to kerb highly desirable (not needed if a verge exists) **Shared Use of what was previously a footway is NOT a desirable option except on inter-urban roads with very few pedestrians.**
Cycle side of segregated facility or Cycle only track	3.0m two-way 2.5m one-way	2.0m two way 1.5m one-way (assumes no overtaking over a limited length pinch point)	It is important that there is sufficient width to overtake/ride two abreast especially where it is impossible to leave the facility due to level difference or kerbed barrier.
Hybrid/half height/terraced 1-way track adjacent to carriageway and footway	2.5m	1.8m	It is important that there is sufficient width to overtake, at least intermittently, especially where it is impossible to leave the facility due to level difference or kerbed barrier.

On carriageway Cycle Lanes			
Advisory cycle lane with flow	2.0m (busy or 40mph limit) 1.5m (generally acceptable with a 30 mph limit) 1.3m may be acceptable for a nearside ASL feeder but will exclude some cycles.	1.5m (40mph limit) 1.3m (30 mph limit)	1.3m lane can typically be used on one side of a standard 7.3m carriageway where speed limit is 30 mph. 1.5m lanes usually adequate within 30mph roads. Many people will however find this unacceptable (e.g. people cycling with children).
Mandatory cycle lane with flow	2.0m (busy or 40mph limit) 1.5m (generally acceptable with a 30 mph limit) 1.3m may be acceptable for a nearside ASL feeder	1.5m (no overtaking within lane over a limited length)	2.0m lane allows sufficient space for overtaking or riding two abreast within the lane on roads with higher traffic speeds/flows.
Contraflow cycle lanes (advisory or mandatory)	2.0m	1.5m*	*flows <1500 vehicles per day, average speed <25mph may also be suitable for unsegregated contraflow. Use of a hatched buffer strip as a lane demarcation is preferred (rather than a lane line only)
Protected mandatory cycle lane (Light segregation)	2.5m (i.e. 2.0m lane plus segregation)	1.8m	0.3m – 0.5m width required for separation feature. Cyclists may move out of lane to overtake if necessary.
All Purpose Traffic Lanes			
Traffic lane (cars only, speed limit 20/30mph)	3.0m	2.75m	2.5m only at offside queuing lanes where there is an adjacent flared lane
Traffic lane (bus route or >8% HGVs, or speed limit 40mph)	3.25m	3.0m	3.65m width on routes not used by cyclists such as flyovers and underpasses.
2-way traffic lane (no centre line) between advisory cycle lanes	5.5m	4.0m	4.0m width only where 12-hour flow <4000 vehicles and/or peak hour <500 vehicles with minimal HGV/Bus traffic.

Other Features			
Bus Lane shared with cyclists	4.5m	3.0m	Avoid widths of between 3.2m and 3.9m to deter close overtaking.
Bus lane where off- peak parking is permitted	4.5m	3.9m	Allows 1.5m space alongside parked cars (2.4m bay plus 1.5m cycle lane).
Buffer Zones and Verges (kerb segregation feature, hatched area where cycle facility adjacent to parking bays, verge between cycle track and carriageway with 40mph+ speed limit)	>0.5m	0.5m	Increased separation required where traffic speeds and volumes are greatest.
Central reserve at uncontrolled crossing	>2.5m	2.0m	Typical cycle length is 1.8m. Requirements for trikes, family bikes and disabled bikes should be considered and dimensions adjusted accordingly. Tandems are 2.5m and bikes with trailer bikes 2.8m.
Car parking bay	2.0m	2.0m	
Disabled parking bay	2.7m	2.0m	
Loading bay	2.7m	2.7m	Minimal width must be achieved for bay to be enforceable.
Street furniture (sign poles, lamp columns etc.) distance from kerb	Locate off the cycle track or footway	0.5m	Street furniture should preferably never be placed within cycle tracks and footways.

**The minimum widths should not be used on steep gradients where slow moving uphill cyclists require additional width for balance and control and fast moving downhill cyclists require additional clearance from objects and other users.*

2.11.6 Cycle tracks in the West Midlands rarely witness extremely high flows of cyclists. Facilities in London, Cambridge, Oxford and York do see occasional congestion and the authorities are actively looking at opportunities to increase capacity with a width of 4.0m for two-way tracks on Cycle Superhighways. LTN 1/19 suggests the widths in Table 3 for cycle tracks in relation to cycle volumes based on Dutch guidance and observations of actual flows on the TfL network (requirements are for cycles only, not shared with pedestrians).

Table 3: Cycle Track Width in Relation to Flow

Cycle Route Type	Direction	Peak hour cycle flow (either one-way or two-way depending on Cycle Route Type)	Desirable Minimum Width* (m)	Absolute minimum at constraints (m)
Protected space for cycling (including light segregation, stepped cycle track, kerbed cycle track)	1 way	<200	2.0	1.5
		200-800	2.2	2.0
		>800	2.5	2.0
	2 way	<300	3.0	2.0
		>300-1000	3.0	2.0
		>1000	4.0	2.5
Cycle Lane	1 way	All – cyclists able to use carriageway to overtake	2.0	1.3

2.12 Improving conditions on existing highways

2.12.1 The design sections of this document set out some of the potential solutions for new build schemes and redesigning whole streets.

2.12.2 Site-specific constraints often make it difficult to achieve the ideal cycling facility on existing roads and streets. The designer will usually need to look at traffic management measures to improve conditions for cycling. Such interventions may include (but are not limited to):

- Reduce vehicle capacity by removing vehicular lanes to increase available highway width for cyclists.
- Limit use by large vehicles to achieve narrow lane running for general traffic
- Inset, remove or relocate parking and loading bays

- Inset bus stops (e.g. for continuity of a cycle lane) or build-out bus stops into carriageway to create space for a cycle bypass.
- Make links one-way (but retain 2-way cycling)
- Alter or narrow footway configurations as appropriate
- Introduce shuttle working
- Reduce vehicle speed limits or install traffic calming such that links require less segregated cycling infrastructure
- Reduce vehicle volumes through point closures and 'filtered permeability' such that links require reduced specific cycling infrastructure
- Mixed provision along a given link such that it transitions between different cycle link types as appropriate.

2.12.3 Table 4 below and in Appendix A sets out the options for allocating carriageway space over the range of highway widths and conditions typically encountered within the West Midlands.

		Below 5.5m	5.5-6.0m	6.0-6.5m	6.5-7.0m	7.0-7.5m	7.5-8.0m	8.0-8.5m	8.5-9.0m	9.0-9.5m	9.5-10.0m	10.0-10.5m	10.5-11.0m	11.0-11.5m	11.5-12.0m	12.0m and above
GENERAL (INC LOCAL CENTRES)	BUSY	Unlikely scenario	Centre marking only		Centre marking only, consider narrow hatching at widths approaching 7.0m	Centre hatching and 3.0m lanes	Centre hatching and 3.0m lanes OR 2.0m ghost island and 2.75m lanes if heavy right turns	2.0-2.5m ghost island and 3.0-3.25m lanes		2.5m ghost island and 3.25m lanes	Consider other options to avoid overly-wide traffic lanes - e.g. parking lay-bys, cycle lanes, central medians, wider footways					
	QUIET	Omit centre marking	Centre marking only	Centre marking only, consider narrow hatching at widths approaching 6.5m	Centre hatching and 2.75m lanes	Centre hatching and 2.75m or 3.0m lanes	Centre hatching and 3.0m lanes OR 2.0m ghost island and 2.75m lanes	2.0-2.5m ghost island and 3.0-3.25m lanes		Consider other options to avoid overly-wide traffic lanes - e.g. parking lay-bys, cycle lanes, central medians, wider footways						
CYCLE LANES	BUSY	No cycle lanes	No cycle lanes	No cycle lanes	Consider centrehatching options to create 'virtual' cycle lanes	Consider centrehatching options to create 'virtual' cycle lanes, possible narrow cycle lead-in to ASL in one direction only	Consider centrehatching options to create 'virtual' cycle lanes, or 1.5m cycle lane in one direction	Consider centrehatching options to create 'virtual' cycle lanes, or 1.8m cycle lane in one direction	1.3m advisory lanes in both directions or wide lane in one direction only	1.5m cycle lane and 3.0m traffic lane both ways	1.8m cycle lane and 3.0m traffic lane both ways	1.8m cycle lane and 3.25m traffic lane both ways	1.8m cycle lane and 3.0m traffic lane both ways with centre hatching	1.8m cycle lane and 3.0m traffic lane both ways, with centre hatching, or narrower lanes with 2.0m ghost island	1.8-2.0m cycle lane and 3.0-3.25m traffic lane both ways, with 2.0-2.5m ghost island	
	QUIET	No cycle lanes	No cycle lanes	Consider centrehatching options to create 'virtual' cycle lanes	Consider centrehatching options to create 'virtual' cycle lanes, possible narrow cycle lead-in to ASL in one direction only	Consider centrehatching options to create 'virtual' cycle lanes, or 1.5m cycle lane in one direction	Consider centrehatching options to create 'virtual' cycle lanes, or 1.8m cycle lane in one direction	1.3m advisory lanes in both directions or wide lane in one direction only	1.5m cycle lane and 2.75m traffic lane both ways	1.8m cycle lane and 2.75m traffic lane both ways	1.8m cycle lane and 3.0m traffic lane both ways	1.8m cycle lane and 2.75m traffic lane both ways with centre hatching	1.8m cycle lane and 2.75 3.0m traffic lane both ways with centre hatching, or narrower lanes with 2.0m ghost island	1.8-2.0m cycle lane and 2.75-3.0m traffic lane both ways with 2.0-2.5m ghost island		
BUS LANES	BUSY	No bus lanes	No bus lanes	No bus lanes	No bus lanes	No bus lanes	No bus lanes	No bus lanes	No bus lanes	3.0m bus lane if cyclists in opposite direction can be accommodated off-c/way**	3.0m bus lane, ideally cyclists in opposite direction should be accommodated off-c/way**	3.0m bus lane, cyclists in opposite direction accommodated off-c/way OR with wide lane containing cycle symbols**	3.0m bus lane with 1.5m cycle lane in opposite direction**	3.25m bus lane with 1.5-1.8m cycle lane in opposite direction**	3.5m bus lane, 3.0-3.25m traffic lanes, 1.8m cycle lane**	Wide bus lane in one direction OR 3.0m bus lane in one direction with centre hatching OR 3.0m bus lanes both ways**
	QUIET	Bus lanes unlikely to be justified on quieter roads														
										** Note - Traffic lane adjacent to a bus lane can be reduced to 2.75m if there is not a significant proportion of HGVs.						
DUAL C/WAY	BUSY (above 1200-1400veh/hr)	Unlikely scenario	Unlikely scenario	Two lanes with centre line marking only	Wide inside lane with cycle symbols along channel	Wide inside lane with cycle symbols along channel, consider narrow cycle lanes esp. at lead-in to ASLs	1.5m cycle lane with two 3.0m traffic lanes	1.5-1.8m cycle lane with two 3.0-3.25m traffic lanes, consider buffer or light segregation	1.8-2.0m cycle lane with two 3.0-3.25m traffic lanes, with buffer or light segregation		Consider other options to avoid overly-wide traffic lanes - e.g. parking lay-bys, bus lanes, or wider footways / central reserves					
	BUSY (below 1200-1400veh/hr)	Unlikely scenario	Unlikely scenario	Convert inside lane to bus lane (3.25m preferred if off-peak parking), with one 3.0-3.25m traffic lane	Convert inside lane to bus lane 3.25-3.5m, with one 3.0-3.25m traffic lane	Convert inside lane to bus lane up to 4.5m wide with traffic lane up to 3.5m wide, consider advisory cycle lane within bus lane		Convert inside lane to bus lane 3.0-3.5m, with 3.0-3.25m traffic lane and separate cycle track on inside, consider buffer or light segregation		Bus lane 3.0-3.5m, with two 3.0-3.25m lanes, OR 3.5m bus lane and one traffic lane and separate cycle track on inside with buffer or light segregation		Unlikely scenario	Unlikely scenario	Unlikely scenario	Unlikely scenario	Unlikely scenario
	QUIET	Unlikely scenario	Convert inside lane to cycle lane with buffer OR 2.0m parking bay with wide single lane inc cycle symbols		Convert inside lane to 2.0m parking bay and 1.5-1.8m cycle lane, with one 3.0m traffic lane	Convert inside lane to 2.0m parking bay and 1.5-1.8m cycle lane with buffer or light segregation, and one 3.0m traffic lane	Unlikely scenario	Unlikely scenario	Unlikely scenario	Unlikely scenario	Unlikely scenario	Unlikely scenario	Unlikely scenario	Unlikely scenario	Unlikely scenario	Unlikely scenario

Table 4: Cycle Facilities within Carriageways (see also Appendix A for larger version)

Notes: 'Busy' refers to A Roads, or to B (and occasionally Unclassified) Roads with significant number of buses or HGVs. 'Quiet' refers to most Unclassified Roads, or to 'B' Roads with few buses or HGVs. If parking is retained then deduct 2.0m from overall c/way width (or 4.0m for parking both sides), plus width of buffer zone 0.5-1.0m if desired. Information shown is for guidance only and designers should still consider local conditions and carry out stakeholder and public consultations on any proposals. Any lane widths less than those shown in the table would require agreement with the Traffic Manager.

2.13 Facility selection in relation to traffic speeds and volumes

2.13.1 Design options on any connection depend on physical constraints, budget and operational requirements of the wider network. The designer may choose to integrate cyclists with motor traffic on the carriageway or look to separate them from other users by providing cycle tracks within the highway or by creating a separate route away from the highway.

Table 5: Motor Traffic Flow / Speed Relationship to Cycle Provision

Source: LTN 1/19 (Adapted from London Cycle Design Standards and IAN 195/16, Highways England)

2.13.2 Where there is a high volume of traffic, fast-moving traffic or high proportion of HGVs, it is advantageous to separate cyclists from motor traffic or undertake traffic management measures to reduce the volume and speed of traffic (see Table 5).

2.14 Facility selection in relation to location

2.14.1 Many local authorities have developed a framework for prioritising road space allocation that takes account of both the movement around strategic transport network and the needs of local people. The approach provides a context for adressing user requirements, especially along key corridors where there are competing demands between local access and strategic transport. Within the TfWM area a regional Key Route Network has been identified, but this also includes sections that have other functional significance as local centres or public transport corridors.

2.14.2 This section considers prioritization of cyclists' needs within such a functional context.

Cycle lane to nearside of loading bays, Manchester city centre

2.14.3 There are many relatively high-flow roads that also have a lot of pedestrian activity. These are mainly in district centres, but similar issues also arise around schools and colleges, public transport interchanges and some major employment sites. The aim in these areas is to reduce traffic speeds and provide protected space as far as possible to enhance safety for pedestrians and cyclists. The sites typically include frequent pedestrian crossings, side roads, on-street loading areas, busy bus stops and kerbside car parking, all of which can make it difficult to provide any form of continuous cycle track or lane that gives any advantage to cyclists. They are sometimes called 'mixed priority' roads and streets.

2.14.4 Manchester has pioneered a light-segregation approach within a 'high street' type environment in Wilmslow Road, Rusholme, a busy district centre on a radial road south of the University. The cycle tracks are also protected by parking bays, and the scheme was mainly achieved by reducing the width of traffic lanes and removing right-turn pockets with the intention (in response to business and residents feedback) to retain as many on-street car parking and loading bays as possible. Traffic management measures elsewhere on the route have also helped to remove some of the through-traffic between Rusholme and the city centre by creating a section of road that is only available for bus, cycle and local access.

Rusholme, Manchester. Use of light segregation and build-outs to preserve parking spaces near businesses while still offering protected cycle facility.

2.14.5 Separate cycle facilities do not always work particularly well in locations where the intention is to emphasise the ‘place’ function, and one criticism of the Wilmslow Road scheme is that pedestrians sometimes walk in the track and use it as a refuge when crossing the road, and some cyclists take advantage of the dedicated space to cycle more quickly than they would normally do in a high street. Cycle lanes and tracks in such an environment may be interrupted by bus stops, loading bays and parking, adding to potential conflict points. Kerbed facilities installed to deter unlawful parking on a cycle track can be a barrier or trip hazard for pedestrians. These risks however need to be considered against the risks posed to cyclists using a shared carriageway alongside buses, HGVs and other traffic.

2.14.6 An alternative way to accommodate pedestrians and cyclists in district centres is through a combination of ‘de-cluttering’ to remove obstacles such as signs and other street furniture from footways, removing on street parking to widen the footway or formalising on- street parking into bays, reducing the carriageway width to single lane for through traffic and reducing speeds to 20mph. Local Transport Note 3-08, ‘Mixed Priority: Practitioners Guide’ gives further advice on designs.

2.14.7 A ‘shared space’ approach using traffic calming measures and urban design helps to change the appearance and user behaviour, as in this example from Poynton, Cheshire where there are over 27,000 vehicles per day including 6% HGVs. The ultra-low-speed environment has helped to smooth the flow of traffic through the town so that the overall vehicle journey times have not increased. Because of the low speeds, motorists are more willing to stop to permit pedestrian crossing movements, even away from designated crossing points.

2.14.8 However, blind and partially sighted users require clearly marked priority crossings and points of reference for navigation, even within a shared space scheme. Mobility experts and local stakeholders should be fully engaged in the design process to ensure that their needs are understood and met. Other issues may be identified through an Equality Audit.

Poynton: Removal of street clutter, use of textured central margin and side bars to visually narrow carriageway while still providing adequate width for HGVs. Cyclists use the all-purpose carriageway but can enter the footway at-grade to stop at shops etc. However, disability groups and some cyclists do not consider this to offer adequate separation.

2.14.9 Across the West Midlands, many areas with 20mph speed limits help provide safer on-carriageway cycling on residential roads, district centres and town/city centres. This is an important element of the cycling strategy because 20mph roads may offer greater opportunities for quiet cycle routes, and so-called ‘invisible infrastructure’ such as increased permeability due to exemptions from turning bans, mode filters, unsegregated contraflow cycling and a reduced requirement for segregated cycling infrastructure.

The Chamberlain Clock at the centre of the Jewellery Quarter, Birmingham is dominated by motor traffic in contrast to Seven Dials in London where traffic management and lower speed limits have helped to increase the number of pedestrians and cyclists using the area and a revival of local businesses.

2.14.10 Residential streets are also places where fully segregated facilities are usually not appropriate. In new developments, there is some advantage in having separate cycle facilities that connect up culs de sac, making walking and cycling more attractive through the principle of 'filtered permeability'. This may also be desirable in older streets where through-traffic is a problem, by closing off an existing road but retaining a 'gap' for cyclists. Making residential areas less accessible to motorised through traffic is an important part of encouraging more journeys on foot and by cycle because this helps to ensure that there is a time advantage for cycling, as well as improving the safety and ambience of streets.

Filtered permeability, route closed to general traffic but remains open to cyclists and pedestrians

2.14.11 The initial approach should always be to look at what measures can be introduced to reduce traffic speeds and flows on roads where this as part of overall strategic traffic management, and then at whether further infrastructure is still required for cycling. Failure to address strategic traffic management issues can result in expensive over-engineered cycle infrastructure that is unused because it is impossible to develop continuous safe facilities within existing traffic conditions.

2.14.12 If the number of cyclists using a street is at least double the number of motor vehicles (e.g. Cheddar Rd on the Rea Valley route in Birmingham), it may be possible to introduce a 'cycle street' (similar in concept to a Home Zone), where the design of the street implies priority to pedestrians and cyclists. This is usually in the form of narrow (circa 2.5m) opposing carriageways separated by a slightly raised (but low enough to drive over) margin, all constructed in block paving or textured asphalt. The physical design is important to discourage cars from overtaking the cyclist within the street. This concept is only suitable for streets with fewer than 2000 motor vehicles per day, and only over short distances of up to 500m.

2.14.13 Transport for London has also been developing a 'Healthy Streets' framework[1] that considers ten indicators that make up a pedestrian and cycle-friendly street that will help to enable and encourage active travel (see illustration).

[1] Healthy Streets for Londoners, TfL, 2017

Healthy Streets framework (Lucy Saunders/TfL)

Textured paving, mode filter, narrow carriageway, greenery and limited forward visibility used to create low speed areas with priority for non-motorised users while retaining capacity of on-street residential parking.

2.14.14 At the other extreme, roads and streets with few 'active frontages' (i.e. blank building walls or wide verges) tend to have higher speeds (regardless of the speed limit), relatively low pedestrian flows and few side roads and crossings. These areas are typically local distributor roads, parts of the ring road or sections of arterial roads running between local centres where ‘movement’ is the primary function. It is along these roads that segregation in the form of wide cycle lanes or cycle tracks is the most desirable form of provision for cyclists, including adequate separation at the busiest and most complex junctions.

2.14.15 Alongside main roads, with high speeds and flows, cyclists need to be separated from fast- moving traffic. In suburban and inter-urban situations with few pedestrians, a shared surface may be adequate. Elsewhere, separate paths for cyclists and pedestrians offer a better solution.

Separate cycle and pedestrian facilities alongside Birmingham New Rd (Sandwell Council)

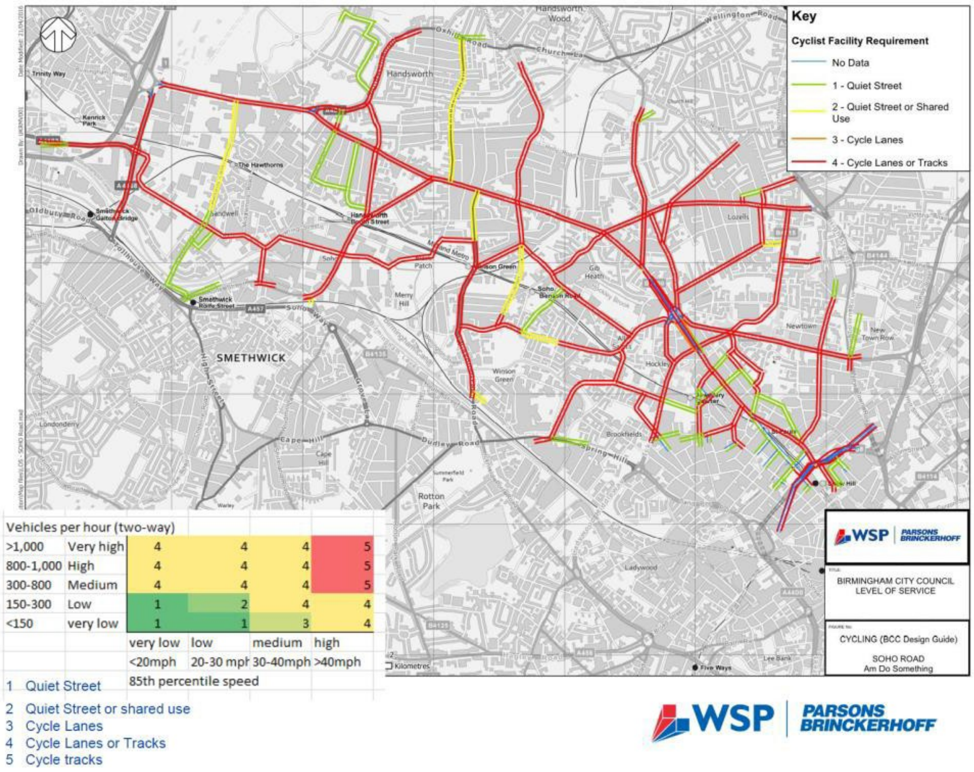
2.15 Facility Selection Based on Cycling Level of Service (CloS)

2.15.1 The Local Cycling and Walking Infrastructure Plan guidance (LCWIP) and Active Travel Act Wales Design Guidance offer simple audit tools to help assess cycling Level of Service. Cycling Level of Service (CLoS) combines techniques used in ‘User Audits’ and ‘Streetscape Appraisals’ to investigate the various metrics (widths, street function, degree and type of kerbside activity, traffic speeds and flows etc.) and come up with a subjective score for each factor to help determine the optimum solution. This type of analysis can also be helpful during consultation when explaining or comparing the merits of different design proposals.

2.15.2 CLoS is based on the six design outcomes of safety, directness, coherence, comfort, attractiveness and adaptability. It then breaks down each into specific factors. At the next level of detail are indicators that can be used to measure performance against each factor. For example, the ‘safety’ element contains three factors: collision risk, feeling of safety and social safety. CLoS focuses on environments that would entice new cyclists to switch journeys from other modes and maintain this modal shift for the long term.

2.15.3 LTN 1/19 also includes a simple junction assessment tool that can be applied to identify all the relative risks and ease of movement for cyclists at junctions, to work out what facilities will enable all movements by cyclists, and what facilities will help cyclists in opposed turns.

2.15.4 An example of the Birmingham Transport Space Allocation (Birmingham Connected, November 2014) and Level of Service Toolkit (Birmingham Connected, April 2016) methodology when considering cycle provision in different types of roads, streets and places is shown below.



Example of level of service and facility choice applied to Soho Road corridor (WSP/Birmingham City Council)

3 Traffic-Free Green Routes and Canal Towpaths (Non-Highway)

3.1 Description

3.1.1 The West Midlands has many paths that are available for cycling that do not lie within highways. This includes routes through public open space, links and alleyways running between buildings (which may or may not be designated highway land), canal towpaths (usually owned and managed by the Canal and River Trust), and Green Routes and other paths and tracks within land owned and managed by the Council. Cyclists are also entitled to use bridleways and restricted byways that form a part of the public rights of way network, and may have permissive access to privately owned land such as educational campuses. There are various legal mechanisms that relate to access for pedal cycles including the Highways Act, Cycle Tracks Act and local Byelaws, and designers should always check on the local circumstances to determine the correct procedures.

3.2 Design Objectives

- Where possible create a 2.5 - 3.0m space for unsegregated two-way use shared with pedestrians or 5.0m where segregated (3.8m minimum). In general, to minimise visual intrusion in parks and green spaces, an unsegregated shared route will be the preferred option, rather than separate or segregated pedestrian and cycle paths which will take up more width. There are also issues of compliance with segregation, particularly where user flows (mainly cyclists) do not 'saturate' their appropriate side, so resulting in transgression by other users.
- Minimise stopping and starting (at crossings and junctions with carriageways) to smooth the flow of cyclists along the route.
- Provide sufficient width to overtake other cyclists and pedestrians without slowing down or leaving the surfaced facility.
- Provide a sealed all-weather surface.
- Provide centre line markings on cycle only routes to divide heavy opposing flows (on 'tidal' routes it may be better to omit the centre line away from junctions to encourage use of whole width during peak hours).
- Provide adequate maintenance to periodically clear routes of fallen leaves and overhanging branches where they are bordered by trees and shrubs.
- Consider how surfaces will be maintained during winter and if routes are not cleared of snow or salted/ gritted, what alternative routes are available nearby
- Provide (vandal-proof) lighting for routes intended for year-round commuter use (or provide a signed lit alternative route). Solar stud lighting is acceptable where street lighting is undesirable for environmental reasons.
- Minimum kerb radius of 6.0m at corners.

- Crossfall of up to 3% to facilitate drainage.
- Gradients of 5% or less preferred for ramps connecting to subways, canals etc. (see also DfT 'Inclusive Mobility' guidance on this issue).
- For leisure routes, create a 'memorable' experience using sculpture, providing benches at viewpoints, and providing information about the locality (history, nature, nearby attractions).
- Ensure that the off-road route is signed from adjacent destinations and access points (and vice versa).

Re-graded ramped access to Birmingham Canal Old Line towpath, sealed aggregate surface (but requires widening and removal of overhanging branches to bring up to cycle route standard)

Eroded gravel path on slope in Selly Oak Park. Sealed surface is more expensive but may have reduced overall costs when maintenance is considered

3.3 Design Principles

- **Convenient**. Direct, step and barrier free connections to the highway network.
- **Useable in all seasons.** Always use a sealed surface in urban areas to facilitate all-weather cycling and minimise maintenance costs. Provide lighting (or a lit alternative route) at commuting times.
- **Safe design.** Smooth even surface, clear of sign poles and overhanging vegetation, adequate width and no blind corners.
- **Safe from crime.** Avoid (where possible) lengthy stretches that are not overlooked by adjacent properties or have no access points to help minimise personal security concerns. Keep a clear margin alongside the path free of vegetation to improve visibility and ensure that full surface width is available for users. Provide adequate lighting where use after dark is anticipated.

3.4 Riding surface

3.4.1 Highways standard machine laid bitmac offers the most durable and comfortable surface. A bitumen bonded aggregate finish (tar-spray and chip) is likely to be required on canal towpaths and open spaces. This is for reasons of aesthetics and /or conforming with established maintenance regimes. Some 'luminous' products are now available that may be helpful in areas where street lighting is unacceptable due to environmental concerns.

3.4.2 Concrete is used extensively for road and path surfacing in some parts of Europe and provides a durable and comfortable riding surface for cycling.

3.4.3 Unsealed gravel surfacing is not recommended on steeper gradients as it is easily washed away and the resulting gulleys can be hazardous. Unsealed surfacing is not suitable for regular commuting routes because it makes clothes and cycles dirty, adding to the difficulty of cycling.

Canal towpath with a bonded aggregate finish that gives a more natural appearance while having many of the advantages of a fully sealed surface (Sandwell Council)

3.5 Lighting

3.5.1 Highways standard lighting can be used where this is desirable, particularly where there is a known risk of crime. However, this is expensive to install and operate, and may be intrusive in residential areas. Solar LED studs have been used along sections of the Rea Valley Route in Birmingham to help mark out the edge of the path in dark conditions. Other solar street lighting products are increasingly available and may help reduce operating costs. Solar panels cannot be used in areas with dense tree canopy or other permanent shading.

3.5.2 The operating costs and maintenance liability should always be considered. Operating costs can be reduced by using lights that respond to movement or by switching lights off between midnight and 5 a.m. when there will be very few users.

3.6 Managing conflicts with other users

3.6.1 **Access Barriers.** Access barriers are sometimes installed to prevent motorcycles getting onto cycle and pedestrian routes. These barriers often exclude hand-cycles, tandems, tricycles, child trailers, some wheelchairs and mobility scooters and cause delays and inconvenience on popular routes. They should therefore be introduced only as an absolute last resort when there is a persistent problem of illegal motorbike access that cannot be resolved by enforcement. Further information on barriers is provided in Chapter 12 Construction and Maintenance.

3.6.2 **Speed Humps**. It can be helpful to add humps at junctions between shared routes and footpaths to remind users to slow down. These are preferable to staggered barrier arrangements (even ones not requiring dismounting). These can be along the lines of the double humps used on Dutch Cycle paths to control moped and scooter speeds, but with a profile suited to limiting cycle speeds. Pedestrian trip hazards need to be considered.

Speed hump at junction of footpath and shared path in a park. (Birmingham City Council)

Access barriers are not compatible with high volumes of cycle use and exclude people with child seats, trailers and mobility scooters. (Adrian Lord)

There are many areas such as parks and Green Routes where unsegregated shared-use is the 'best' design solution that can be achieved, but where high levels of pedestrian activity are anticipated. Additional signs such as those above can help to remind people to act with due consideration for others, particularly where pedestrian-only paths cross a shared path. (Adrian Lord)

3.7 Common hazards

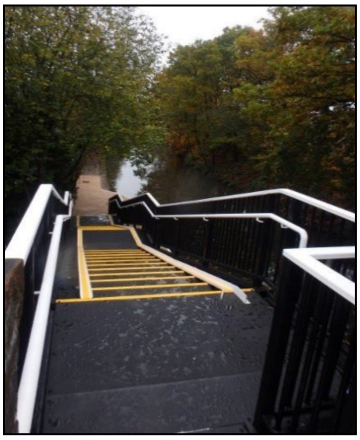
3.7.1 Design and maintenance should aim to remove or minimise common hazards which include:

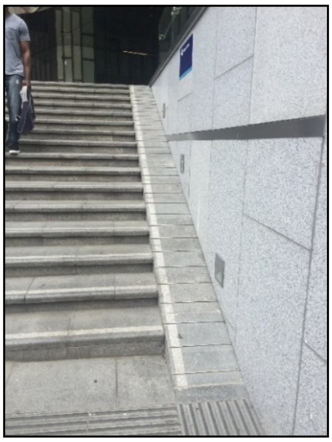
- Surface defects due to inadequate maintenance or poor-quality construction such as potholes, loose slabs, poor drainage, fallen leaves - addressed by regular inspection and maintenance.
- Insufficient space to overtake slower cyclists / pedestrians on shared paths – addressed by achieving the width requirements set out in this guidance (or localised widening where available such as intermittent spaces along canal towpaths).
- Meeting opposing cyclists/pedestrians at blind corners and other areas with poor forward visibility – addressed by achieving the kerb radii, clearances and widths set out in the guidance.
- Street furniture or vegetation within a track causing a width restriction and hazard in dark conditions – addressed by achieving the recommended lighting, clearances for fixed objects and regular maintenance.
- Surface defects arising from poor specification (e.g. coarse texture unsealed surfaces), wear and frost damage, tree root damage due to inadequate construction depth.
- Crime and fear of crime due to restricted access points, poor visibility and lack of lighting – addressed by achieving the recommended lighting, geometry and improving the quality and frequency of access points.

3.8 Wheeling Ramps

3.8.1 Wheeling ramps may be required alongside steps where cycle access is being improved at an existing footbridge or stepped access to a route where space is restricted, they should not usually form part of the design of new infrastructure other than at building entrances such as basement cycle parks or at a new access point to an existing feature such as a towpath or Green Route. The ramp can be provided as a metal channel bolted to the step or by infilling the side of the steps to create a smooth ramp. If metal is used, a textured surface such as 'chequer plate' can help improve adhesion for people wheeling a bike down the steps. Where steps are sufficiently wide (2m minimum) channels can be placed on both sides. On narrower steps the channel should be placed on the right-hand side of the steps if possible for 'upwards' movement (which enables the cycle to be carried on the right side of the body with the chain well away from clothing and other people). Wheeling ramp features should be:

- 200 - 300mm offset from a balustrade or handrail
- Continued over landings
- A splayed entry
- Adequate room must exist to line a cycle up on entry. If this does not exist, not installing the ramp should be considered.
- No obstruction or hazard to pedestrians





Dual wheeling ramps on Birmingham University station canal access – note 200mm offset from stairs stringer and splayed entry (Birmingham City Council)

Simple wheeling ramp at Birmingham New Street station (Adrian Lord)

3.9 Legal aspects of off-highway cycle route creation

Urban footpath: Procedure - Cycle Tracks Act (CTA) 1984 (as amended) to convert all [or part] to shared use

3.9.1 An existing footpath may be suitable for shared use by cyclists and pedestrians as part of development of the cycle route network. This is typically maintainable highway not adjacent to carriageway and not on the definitive map, with or without cycle prohibition order. There may be a need to allow cyclists and pedestrians to use part or the entire width.

3.9.2 The CTA states that a highway authority may designate "any footpath for which they are highway authority", or part of it, as a cycle track. There is no qualification of the footpath i.e. no mention of it being a 'definitive' footpath (appearing on the definitive footpath map) or an 'urban' footpath (surfaced highway as found in urban areas and created after the drawing up of the definitive map). This is interpreted as meaning that any footpath which forms part of the highway, whether or not surfaced or maintained by the highway authority, is a 'footpath' for the purposes of the CTA and should be converted by its application.

3.9.3 Separate planning consent is not needed since CTA 84 3(10) (as amended) states that the local authority has the power to carry out any physical works necessary and that any change of use that would have constituted development within the meaning of the Town and Country planning Act 1971 is deemed to be granted under Part III of that Act.

3.9.4 However, if the footpath is not converted but the existing surface is widened such that the cycle track is created alongside and segregated from the existing footpath then the use of the CTA does not apply:

3.9.5 Note: It is generally considered that in these circumstances segregation by some form of physical delineation is appropriate. This is because cyclists have no 'right' to cycle on the remaining section of footway and without definition of 'their' path (by a white line etc.) are likely to do so. This also casts doubt on the value of retaining a narrow strip (often too narrow to walk upon) of the definitive footpath, when converting under the CTA, if the resulting user paths cannot be defined because of the chosen surface materials (e.g. crushed stone). This practice is sometime used to overcome objections that the creation of the cycle track will result in the removal of the footpath from the 'definitive map'.

3.9.6 The Town and Country Planning Act 1990 (TCP) s.55 (b) (as amended) and the Town and Country Planning Act (General Permitted Development Order) 2015 (GPDO) (Part 13 A) give(s) a local highway authority the ability to maintain and improve a 'road' maintainable at public expense without the need to seek planning approval. The GPDO enables such an authority to 'improve' a highway by doing works immediately adjacent to the existing highway without the need to apply for planning approval. These abilities are interpreted as meaning that no statutory procedures must be completed to create a cycle track alongside a surfaced urban footpath – see cover photograph for an example. It is, however, good practice to consult with existing users, residents and adjoining landowners and give prior notification of carrying out the works to create the cycle track.

3.9.7 Any byelaw or order prohibiting cycling must be removed prior to (or in parallel with other procedures) the conversion of a footpath to a cycle track. Whilst, strictly speaking, this may not be necessary if a cycle track is to be created alongside the footpath, the presence of any form of prohibition, supported by signs to give it effect, can appear illogical and lead to confusion over user rights.

3.9.8 Naturally, it is also necessary for the highway authority to acquire the land either by purchasing it (compulsorily if required) or achieving a dedication to the highway from the owner. However, since the wording of any dedication is usually along the lines of (the landowner) 'hereby freely dedicates the land shown coloured pink on the attached plan to the highway maintainable at public expense' it is not necessary to state the purpose for which the land is to be subsequently used i.e. as carriageway, footway or cycle track etc. as this is determined by the authority. This is analogous to the highway authority purchasing land/taking a dedication to widen an existing carriageway and create a footway alongside it. Whilst the plans used for the transaction/dedication agreement could well be extracts from the scheme plans, it does not require further action to formally create the footway/additional carriageway to give the police the power to enforce offences under the Road Traffic Regulation Acts.

3.9.9 Similarly, agreements under Highways Act 1980 s38 between developers and highway authorities generally have similar wordings that confirm that the developers are owners of the land identified on the drawings and through the agreement are dedicating the land, shown on the drawings, to the highway maintainable at public expense. Such plans invariably indicate the nature of the works to be undertaken and, therefore, the future use of the land e.g. bridge, carriageway etc. but again, there is no requirement to dedicate as one form of use and then for the authority to go through other procedures to establish the status of each element of the additions to the highway network.

Definitive Footpath: Procedure - Cycle Tracks Act 1984 (to convert all or part of footpath to shared use).

3.9.10 This is a footpath that is included on the definitive map of public rights of way. There may be a requirement to widen it and/or convert it for shared use by cyclists and pedestrians.

3.9.11 The procedure is the same as for other urban footpaths. If the land is not owned by the highway authority it must ensure that the landowner has consented in writing [CTA s3] and any land lying outside the width of the existing footpath which needs to be acquired for the purposes of constructing the cycle track has been dedicated to/purchased by the highway authority to enable widening to take place.

3.9.12 Where it is proposed that the line of a public footpath is to be diverted to achieve a more appropriate alignment so that it may then be converted to a cycle track leaving no isolated pedestrian rights of way, the diversion of the footpath should be confirmed before the order is made under the CTA.

3.9.13 A landowner may give permission for cyclists to use land occupied by a definitive footpath to avoid the use of the Cycle Tracks Act or because it wishes to retain control of the land. However, it is understood that the DfT takes the view that if the landowner is also the highway authority it should abide by the spirit of the Act and make an order. If the authority does not wish the land to become highway, for example where it runs through a public park or the long-term use of the land is undecided, it is advised to publish details of its proposals and consult with all stakeholders as though it were making an order.

Public footpath which terminates at the rear of a footway and conversion of the footway crossing (to enable cyclists to reach the carriageway) Procedure - Cycle Tracks Act and Highways Act.

3.9.14 The conversion of the public footpath should be dealt with in the same way as any other i.e. the CTA. The footway should be converted by using the powers available under the Highways Act 1980. This Act does not say in s65 that such a cycle track must be of a minimum length or travel in any direction relative to the carriageway. This may be interpreted as permitting the conversion of the short length of footway necessary to achieve a crossing.

Example of adjacent cycle track and footpath that cross the footway to join the road. This type of route can also cross minor roads with priority to the cycle track, using a flat top road hump. (Adrian Lord)

A 'footway' not part of the public highway. Procedure – varies.

3.9.15 A 'footway' outside the highway boundary has, by definition, no highway status and cannot, therefore, be treated as a footway as defined by the Highways Act 1980. This situation could arise where the footway (and accompanying carriageway) was originally created by a housing authority but not subsequently adopted as public highway. Similarly, it might occur in the case of a development that allows public access but the means of access are not adopted as highway e.g. on a major business or retail park.

3.9.16 The conversion of such a feature can, therefore, only be dealt with as a permissive route or the authority will have to find a way for it to be adopted as highway by some means, with the owner's co-operation, and then converted.

3.9.17 This is a complex issue and should be dealt with locally on a case by case basis.

Footbridges and Underpasses. Procedure - Cycle Tracks Act 1984 or Highways Act 1980

3.9.18 The procedures employed will be based upon the circumstances under which these features were created. Where these are not clear, local judgement will be required as to whether the footbridge or subway acts as a footpath or a footway.

Path (Bridleway) Creation. Procedure - Highways Act 1980 s26

3.9.19 Section 30(1) of the Countryside Act 1968 gives the public the right to ride a cycle on any bridleway, but in exercising that right, cyclists must give way to pedestrians and persons on horseback. The act places no obligation on the highway authority to 'improve' the surface to better accommodate cycle use. The Highways Act provides powers to create bridleways by means of a public path creation order.

Widening the highway adjacent to a bridleway to create a surfaced cycle track. Procedure – TCPA and GPDO.

3.9.20 This is similar to widening a footpath as described above except that the highway to be widened is a bridleway and not a footpath.

Conversion of a footpath alongside a watercourse/river/canal. Procedure – varies.

3.9.21 Cycle tracks created alongside a watercourse by the conversion of a public footpath will inevitably require engineering works, if only in the form of signs. In addition to the use of the Cycle Tracks Act or planning approval (if access is based on permissive rights) it may be necessary to obtain consent under the Water Resources Act 1991 – contact the

Environment Agency for more information. In some regions and in most circumstances the agreement of the Internal Drainage Board will be required where any work impacts upon its operations.

3.9.22 In the case of footpaths alongside canals, it appears that the Canal and River Trust's powers to introduce a byelaw prohibiting cycling take precedence over any highway rights. It is, therefore, recommended that contact be made with the local office to discuss the best means of achieving cycle access.

3.9.23 Cycling is permitted on most towpaths within the West Midlands unless there are physical constraints that prevent safe cycling.

Prevention of use of cycle tracks (Cycle tracks created through use of Town & Country Planning Act) by motor vehicles. Procedure – none necessary.

3.9.24 The Cycle Tracks Act s2(1) used to make this an offence but this was superseded by s21 of the Road Traffic Act 1988. This offence does not take account of how the cycle track was created. Creation using Town and Country Planning legislation is not relevant to this issue any more than if the same legislation had been used to create a carriageway which forms part of the highway. To give an example, once a bypass has been created using a planning application and all the other statutory procedures, there is no need for further orders to ensure that, for example, the police can enforce the national speed limit or other similar offences.

3.9.25 In other words, so long as the correct creation procedures have been properly followed and the necessary signs have been erected to denote that the highway at that point is a cycle track then no further orders are necessary for the police to enforce the requirements of the Road Traffic Act.

4 Cycle provision within the Highway - cycle tracks off carriageway

4.1 Description

4.1.1 Where traffic flows and/or speeds are at the higher end of the range encountered in urban areas, most people who wish to cycle will find the conditions unpleasant and hazardous, so much so that they will choose not to cycle, avoid that route or cycle on the footway. In order that streets such as this are accessible for people wishing to cycle for daily journeys (as opposed to fast sporting cycling) a cycle track separated from the carriageway will need to be provided. This should offer the same level of surface riding comfort and priority as the main carriageway and offer segregation from pedestrians.

4.2 Design Objectives

- Create a cycle specific route parallel and fully protected from an adjacent carriageway for cyclists to travel either one-way or two-way.
- Provide adequate width for cyclists to overtake other cyclists without leaving the facility.
- The cycle track should ideally be on each side of the road.
- Two-way cycle tracks on one side of the road are acceptable where there are few side roads, there is a good set-back to enable priority at side road crossings, and where there is not much requirement to cross the road (i.e. infrequent side roads and attractors on opposite side). Two-way cycle tracks are also required where they lead to a toucan crossing, or where a cycle track crosses a main road at a staggered junction.
- Minimise stopping and starting (at side roads, crossings and transitions to and from carriageways) to smooth the flow of cyclists along the route.
- Provide separate space for cyclists and pedestrians where their movements are likely to conflict.
- Shared footways alongside the carriageway are not generally acceptable over long distances unless there are very few pedestrians, e.g. in industrial areas such as the Fort Parkway.
- Separate cyclists from pedestrians due to high speed differential.
- Manage conflicting movements around parking, loading and bus stop areas to minimise stopping.

4.3 Design Principles

- Greater separation (increased spatial separation and/or separation by level difference) of cyclists from other modes is required with greater speed and volume of motor traffic, and on gradients where cycle speeds can be unusually fast or slow.
- Cycle tracks can be provided alongside any road where there is space and where they would offer a safe and convenient facility for cyclists.
- Cycle tracks may require changes to junction geometry at side road crossings to help to slow down the turning movements of vehicles, or to provide the necessary set- back to enable the cycle track to have priority. The cycle track should normally cross at 90 degrees to the side road. This is to enable cyclists to be able to see and avoid any vehicles that are turning into the side road (even if the cyclist has legal priority).
- Cycle tracks contribute to ‘perceived’ safety by offering physical separation from motor traffic which encourages more people to cycle. Some Nordic and North American design manuals recommend returning cyclists to the carriageway about 20m before side road junctions so that they can integrate back into the traffic flow, while the Dutch advocate segregation, but with clearly marked priority of either the cycle track or carriageway at every location. The disadvantage of the Dutch method is that cyclists lose priority at any side road with more than 2,000 vehicle movements per day or frequent use by buses and HGVs, and are also obliged to give- way to cycle traffic joining the track from a side road. Where many minor roads carry high levels of traffic, this criterion could result in frequent stopping and starting at side road crossings. The disadvantage of the integration method is that it generally requires low speed at junctions (with geometry to enforce 20mph) to enable cyclists to feel comfortable and safe in mixed traffic, and this is not yet fully embedded into the UK culture and design practice.

4.4 Speed/flow criteria for provision of cycle tracks

4.4.1 Table 5 suggests cycle tracks or shared-use footways should be considered where traffic flows exceed 10,000vpd and traffic speeds are above 30mph, and should be the first choice on roads more than 40mph and with more than 3,000-8,000vpd or 300-800vph.

4.4.2 This does not of course mean that they cannot be provided alongside less busy roads. There is an increasing public expectation that segregated facilities are required to encourage more cycling, particularly among children and the elderly. It is important that cycle tracks are suitable for existing experienced riders and the least competent and slow cyclists, and that requires adequate widths, surfacing of similar standard to the carriageway, and priority at side road crossings where this can be done safely.

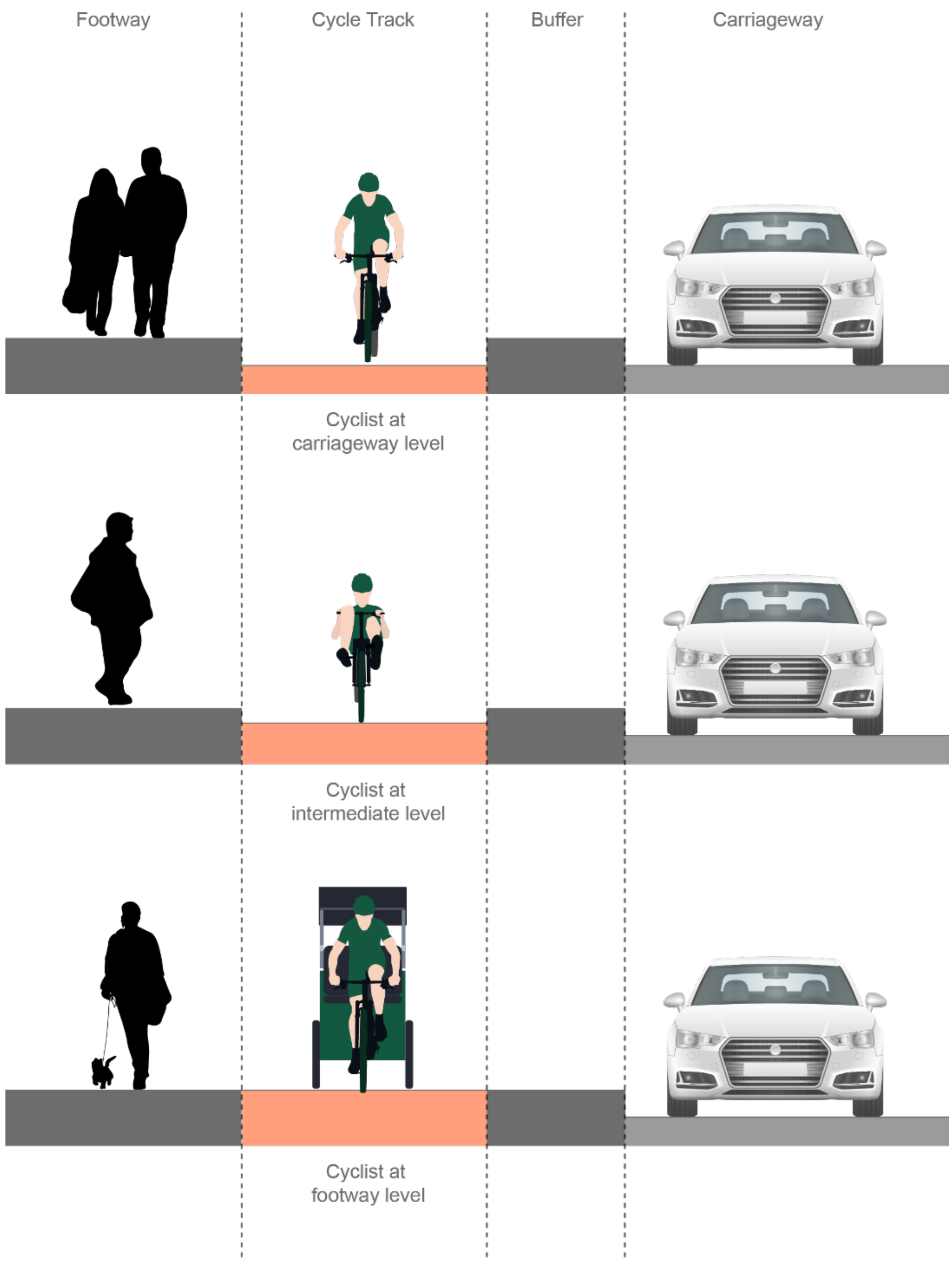
4.5 Common hazards

4.5.1 The main hazards for cyclists along link sections of a route are:

- Side road crossing collisions. A cycle track does not eliminate the common hazard of being struck by a left-turning vehicle unless the cyclist or the turning vehicle is forced to yield priority. Good visibility and bending the cycle track in or out at the side road crossing may help.
- Side road congestion. Even where the cycle track has priority, it may be blocked by cars waiting to exit a side road, which may lead to cyclists making risky manoeuvres of swerving into the main carriageway or crossing between slowly moving vehicles. Raised table top crossings and coloured surfacing may help to encourage drivers to leave a clear path.
- Surface defects due to inadequate maintenance or poor-quality construction such as potholes, loose slabs, poor drainage, and fallen leaves. Addressed by regular maintenance.
- Insufficient space to overtake slower cyclists / pedestrians. Addressed by meeting width recommendations in this guide.
- Street furniture or trees causing a width restriction. Addressed by moving items to the edge of the path.
- Vehicle crossovers (often with poor visibility) where residential property is immediately alongside a transport corridor. The cycle track should always have priority over private driveways.
- Conflicts with pedestrians or with motor traffic when passing occupied bus stops and loading bays. Addressed by clear demarcation of space and crossing points for pedestrians or short sections of shared-footway with priority to pedestrians.
- Unlawful stopping/parking of motor vehicles within cycle tracks. Addressed by enforcement.

4.6 Cycle Track Design within a highway

4.6.1 In general cycle tracks within the highway should be distinct and separate from pedestrians so that each mode has its own defined space because cyclists will typically be travelling up to seven times faster than pedestrians within a relatively confined strip along the edges of the road. On roads with a speed limit of 30mph or less a stepped cycle track immediately adjacent to the carriageway may be acceptable, but with higher speeds a margin of separation or ‘buffer’ is preferred. In all arrangements a kerb that is detectable by cane users and guide dogs should be provided at the edge between the footway and carriageway.



4.6.2 Cycle track separation from other modes–

- A **level difference between cycle track** and pedestrian and motor vehicle space is preferred. However, a large kerb upstand can be hazardous, especially where width is restricted, and is not good for people with pushchairs and wheelchairs. A full battered (splay) kerb can help cyclists to move between adjacent carriageway and footway space if necessary, reducing the chances of conflict and falling off due to catching a wheel or pedal on a right-angled kerb. In Cambridge and Oxford, a very shallow angle kerb with a low upstand is used to separate the cycle track from footway and carriageway, and at private driveway crossovers (see photo example of crossover).

Stepped cycle track at private driveway crossing, Oxford

4.6.3 This type of kerb is also used on some sections of street running tram routes in Greater Manchester, making it easier for cyclists to move off the carriageway if necessary. Depending on the circumstances, space for the cycle track may be taken from a lightly used footway, a verge, or from the carriageway. Where the kerb is being moved, there will often be a requirement to modify the drainage arrangements. Other factors that may add significantly to construction costs are services or tree roots close to the surface. These need to be identified at an early stage in preliminary design. In some circumstances building up the level of an adjacent footway may be more cost-effective than excavation to create a level difference.

Brighton's Old Shoreham Road with-flow hybrid (half-height) cycle track (Tony Russell). Manchester's Oxford Road (right) has a higher demand for parking and an adjacent bus lane, therefore more signing and lining is required.

- A **cycle track at the same level** as the carriageway can be separated by a continuous kerb. The separation usually needs to be 0.5m wide to accommodate bollards at the start and end points, and to offer adequate separation of a 'buffer zone' where there are parked cars to the offside, but can be narrower by simply laying two adjacent kerbs on link sections (e.g. Hill St contraflow). This arrangement may require additional drainage or new connections to existing services. Kerb-face gulleys can be used to avoid metal gulleys within the limited space of the cycle track. Using battered kerbs can help to avoid cycle crashes due to wheels or pedals catching the kerb edge and reduce the chance of injury in the event of a fall onto a kerb. This arrangement does cause additional trip hazards for pedestrians so formal crossing points will be required for visually impaired people and wheelchair users.

Kerb separated cycle track width should be 2.0m to allow for street cleansing and overtaking, splayed kerbs would be more forgiving than right angled kerbs.

Kerbs laid back to back to provide narrow continuous separation feature where width constrained at a bridge, Bristol

Car parking can be used as a 'buffer' between the cycle facility and the live traffic as in the examples above (in Paris, Manchester, Newcastle and Brighton).

A gap of at least 500mm should be left to protect cyclists from car doors (may be kerbed, use a 'light segregation' feature or marked with hatching). May need consideration of parking turnover relative to cycle usage and loading requirements (to assess possible risk of conflicts)

Two-way cycle track on one side of road, A34 Birmingham (Alison Kennedy)

- **Segregation from a pedestrian path using a raised white line** (Diag 1041.1) or painted line (Diag 1041) where a cycle track runs alongside a footway. This is the least desirable but may be acceptable over short distances or in low use areas. It is unlikely to be observed by users which can lead to conflict between pedestrians and cyclists in busier areas. Colour or material contrast between the cycle and pedestrian side may help. The raised line will often break up, especially if occasionally overrun by vehicles and mechanical sweepers. An alternative is a preformed concrete separator to the same profile as Diag 1041.1 (see Photo). Where the overall available width is less than 3.0m, it is usually better not to separate pedestrians and cycle parts of the path. *The DfT plans to update tactile paving guidance in 2019. Designers should refer to the latest guidance.*

Raised white line dividing footway/cycle track – only suitable where pedestrian flow is minimal (Sandwell Council)

Pre-formed concrete dividing strip. As with the painted line, this should be 60mm high and white (in contrast to surface) to help detection by partially sighted users.

- **Separation of cyclists and pedestrians within shared footways and pedestrianized areas using 'urban design'** features to indicate preferred routes (different surfacing materials, small changes in levels, placement of benches, planters and other street furniture). These techniques are useful in core areas and heritage areas to help minimise street clutter and signs.

Different colour and texture separates pedestrian and cycle sides of footway helping to minimise signing and lining, Sheffield city centre.

4.6.4 Street furniture (sign poles, lamp columns, letter boxes, telephone boxes, planters) must not be placed within the cycle track, and must be moved if an existing area is being converted into a cycle track.

4.6.5 Where a cycle track connects into a more open (and less linear) public space such as a vehicle restricted area it is usually better not to define a 'cycle path' using hard infrastructure as this will be largely ignored by pedestrians and lead to conflict. Instead the suggested path might be marked by inset paving or studs and cyclists can be reminded to give-way by upright signs.

4.7 Cycle Tracks within central reservations

4.7.1 Some cities, particularly those with 'Boulevard' type dual carriageway streets have made use of the central reservation as a space for cycling, including the A38 Bristol Road in Birmingham. The approach provides an uninterrupted track away from potential conflict areas such as footways, residential driveway cross-overs, loading bays, parking bays and minor side roads. The central cycle track is usually accessed via dedicated crossing points and at major junctions.

A 38 Central cycle track (under construction), Birmingham (Adrian Lord)

Central cycle tracks, Nantes (Adrian Lord)

4.8 Cycle Tracks at Bus Stops

4.8.1 Despite concerns about safety and conflict with pedestrians, the initial on-street trials of bus stop bypasses at six sites in London have proven successful[9] and the concept has been popular with cyclists, with typically 90% using the facility when passing a bus stop. The design appendix includes a layout developed in Cambridge in partnership with disability groups to ensure that hazards for blind people and practical dimensions for wheelchair users are addressed. Monitoring by TfL has proven that a zebra crossing is the most effective way to assist pedestrians, particularly the visually impaired. Belisha beacons and zig zags are not required on the cycle track and the striped markings may be narrower than usual (see TSRGD).

4.8.2 The pedestrian access between the bus stop island may also be placed on a 'flat top hump' across the cycle track, marked with buff tactile paving on the footway. Careful construction is required to ensure the track can drain properly. Cyclists are usually expected to give way to pedestrians (who may be visual/hearing impaired or otherwise unaware of their presence). On quieter roads where the provision is a cycle lane rather than a track, the arrangement could enable the cyclist to continue on carriageway within the bus stop clearway and only use the bypass when a bus is present (middle photo is an example).

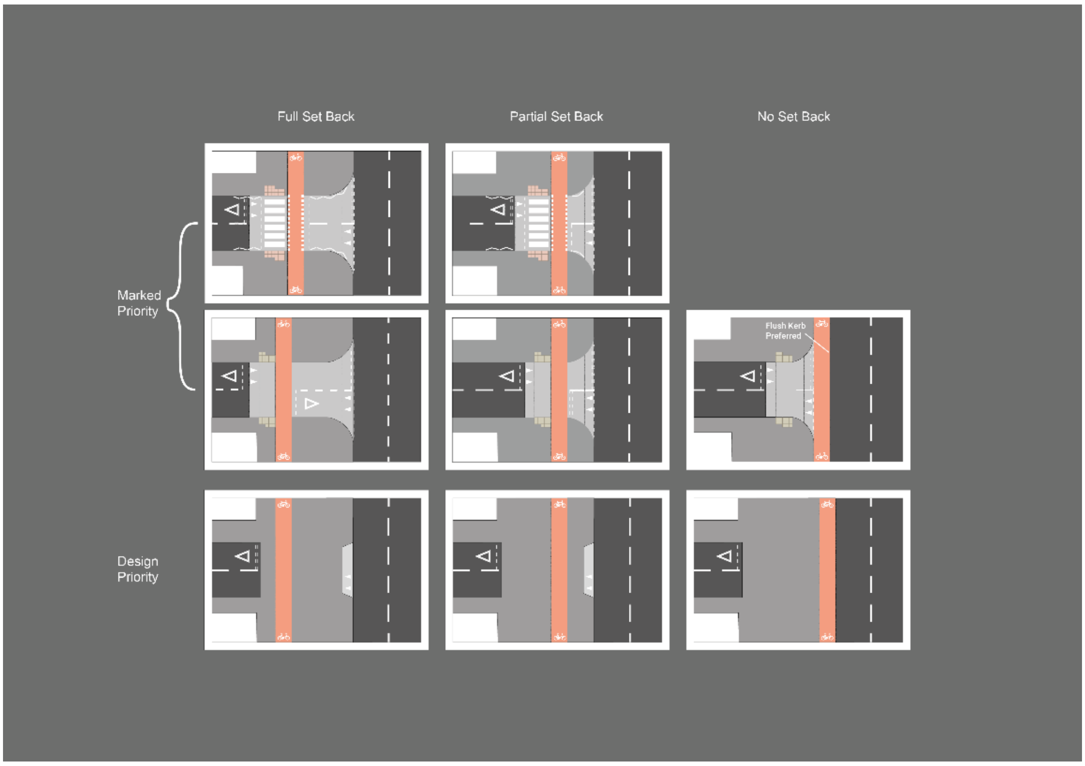
[9] Stratford Bus Stop Bypass Monitoring Report, TfL, 2014

Where a cycle lane or track passes a bus stop (or tram stop) a bypass will help to improve cyclists' safety by removing the requirement to move into the traffic lane to the offside of the bus. Potential arrangements for cycle lanes and cycle tracks are illustrated here with shelters in different places. (Adrian Lord)

4.9 Cycle Tracks at Side Road Junctions

4.9.1 Crossing side roads at priority junctions is a significant design issue. The effort of stopping and starting may cause cyclists to ignore a cycle facility in favour of the automatic priority they get when on the carriageway. For child cyclists, understanding and reacting appropriately to the various turning movements of motor traffic is very challenging. Options for crossing side roads are illustrated below.

Partial set-back crossing in Birmingham (Alison Kennedy)



Potential arrangements for cycle tracks at side roads

4.9.2 The aim should be to develop a design that gives priority to the cycle traffic along the main road, as would be the case for on-carriageway cycling. This should be the assumption for all side roads with less than 2000 vehicle movements per day, less than 10% bus/HGV traffic and speed limits on the main and side road of 30 mph or less. The exception to this is sites where visibility is restricted and cannot be improved. In such cases a give-way should be marked on the side road exit (before the cycle track crossing), and on the cycle track so that both drivers and cyclists will slow down and check before crossing. The crossing should ideally be placed on a flat top speed hump. The cycle track and footway should always have priority over private drives and vehicle cross-overs with fewer than 100 movements per day regardless of visibility, and it is not usually necessary to have any markings or signs.

Priority shared use side road crossing on raised table, Bristol (Adrian Lord)

Priority side road crossing on two-way cycle track, Lambeth (Adrian Lord)

4.9.3 On high speed or high flow roads, industrial access road crossings used by HGVs and junctions with high frequency bus routes turning across the cycle track it is safer to make the cycle track give-way. Signal control or grade separation may be needed at the busiest locations such as major road slip roads (see Section 8 Junctions). Where deceleration or merge/diverge lanes are provided the cycle track may need to deviate away from the mainline to cross at a place where traffic speeds are lower.

Set back cycle track crossing side road by Great North Road, Newcastle. The track has been bent out to rear of the grass verge and the priority prominently marked (Adrian Lord)

4.9.4 Priority crossings can be achieved by:

- Returning cyclists to the carriageway in advance of the junction (one-way cycle tracks only);
- Cycle track crosses the junction at carriageway level (route may be marked with coloured surfacing or left unmarked).;
- Cycle track crosses on a flat top hump at junction mouth (or set back from junction mouth)
- Parallel cycle/zebra crossing
- Cycle track and footway continue across junction and carriageway crosses them on a vehicle crossover (similar to residential drive arrangement).

4.9.5 It is important that the design and placement of Give Way lines and signs makes the priorities clear to all users. It is not permissible to use ‘elephant’s footprint’ markings at un-signalised crossings.

	
Cycle track crosses on a raised hump set back (at least 5.0m) from junction mouth (Phil Jones Associates). Cycle track uses 'give way' on raised flat top hump. Works for one-way or two-way cycling.	*Parallel zebra and cycle crossing at side road in Birmingham*
	
Cyclists return to carriageway ahead of left turn to a cycle lane offside of the turning lane. Only works for with-flow cycle facilities. (Phil Jones Associates)	*Cycle track crosses side road at carriageway level (Alex Sully). The cyclist here has the same status as if cycling along the carriageway (only works for one-way with-flow cycle tracks)*

Minor side road crossing arrangement on Leeds-Bradford Cycle Superhighway

Private driveway treatment on stepped track Leeds-Bradford Cycle Superhighway

4.9.6 There are some specific issues associated with designing cycle track crossings at side roads:

- Cyclists at risk from vehicles turning left into the side road. This is most unsettling hazard faced by cyclists crossing side roads. Cyclists have poor visibility over their right shoulder towards vehicles approaching to their rear on the main road. Left turning drivers are generally disinclined to give way to pedestrians or cyclists crossing side roads.
- Cyclists at risk from vehicles turning right into side road (particularly at two-way cycle tracks and/or where cyclists are in contraflow with general traffic and where vehicles are turning through ‘gaps’ in queuing traffic and their view of the cycle track is therefore obscured);

- Vehicles queuing within the line of the cycle track while waiting to leave a side road.

4.9.7 There is no universally correct solution to these issues as the preferred design will depend on the speed and volume of traffic, frequency of turning movements, visibility splays and the intensity of cycle and pedestrian use. Some examples of different layouts that help to give cyclists priority are shown above and in the design appendix. Roads may also be stopped up for motor traffic, or turning movements restricted, as part of cycle route development.

4.9.8 On busier roads, with higher speed limits, or with high proportion of HGV traffic the cyclist would normally be required to Give-Way and wait for a safe gap in the traffic flow.

4.10 Legal aspects of cycle tracks within the highway (adjacent to footways and carriageways)

Converting an existing footway (adjacent to carriageway & within maintainable highway) to permit cycling. Procedure - Highways Act 1980

4.10.1 To convert all or part of a footway to cycle track, all or the appropriate part of the footway must be removed under section 66(4) of the Highways Act 1980, and a cycle track 'constructed' under section 65(1) of the act. No physical construction is necessary but there needs to be clear evidence that the local highway authority has exercised these powers. This can be provided by a resolution of the appropriate committee.

4.10.2 Clearly there will be some 'works' if only the erection of signs to denote the change of use. It is good practice to consult with existing users and give prior notification of carrying out the necessary works. The designers should also consider any implications relating to the Equality Act for users to ensure that access for all is still possible.

Widening the footway to create a Cycle Track. Procedure – General Permitted Development Order and Highways Act.

4.10.3 The highway authority has powers under the GPDO to widen the existing highway to create or widen a footway without the need to seek planning consent. It also has powers under the Highways Act 1980 62 (4) to "alter or remove any works executed by them …".

4.10.4 The cycle track can then be created under the powers described above if all or part of the resulting footway requires conversion. Alternatively, it may be created just as a cycle track, if that is the sole purpose of the widening (Highways Act 1980 65[1] – a highway authority may create a cycle track "in or by the side of a highway")

Greenfield site, compulsory purchase. Procedure - Town and Country planning Act 1990 to create the cycle track as 3 above and Highways Act 1980.

4.10.5 Sometimes there is no suitable public space within the highway boundary but the adjacent land may be vacant (i.e. not existing highway land). There is a need to acquire land from landowner [by Compulsory Purchase Order] to enable use by pedestrians and cyclists.

4.10.6 General powers to acquire land are provided by the Highways Act 1980 s239. Where local authorities find it necessary to resolve to exercise compulsory purchase powers they can do so either to improve the highway or to promote countryside access. The former is more commonly known about and better understood but the latter does provide opportunities to create facilities that have a low utility component. For more information consult appropriate staff or see The Compulsory Purchase Manual DTLR 2001.

Greenfield site, dedication of land to the highway for the creation of a cycle track. Procedure – Highways Act 1980 and Town and Country Planning Act 1990.

4.10.7 Sections 37 and 38 of the Highways Act provide a means for land to be dedicated as public highway. Since the Act does not refer to the nature of the use, simply referring to dedicating a "way as a highway" this may be interpreted as meaning that land may be dedicated to serve any function acceptable to the highway authority e.g. footway, cycle track, carriageway etc.

4.10.8 This is analogous to agreements between developers under s38 where the status of the highway so dedicated is confirmed by the plans accompanying the agreement and the works subsequently carried out.

4.10.9 It is worth noting that dedication to the highway is often confirmed by the signing of the s38 agreement not the physical completion of the carriageway, footway, cycle track etc. This enables the highway authority to exercise its various powers to do works within the highway to complete any outstanding construction works in the event of the failure of the developer to complete their obligations under the agreement. This also indicates that the dedication to the highway is not dependant on works being carried out by the landowner prior to that dedication.

4.10.10 Where the cycle track is to be created by the highway authority, consent under the Town and Country Planning Act 1990 will be required for the change of use and engineering works to create the cycle track.

5 Cycle Provision within Highways – On-carriageway cycle lanes

5.1 Description

5.1.1 Where traffic volumes and or speeds fall somewhere between the busiest situations encountered on urban roads and quiet residential streets, perhaps at 20mph, then cycle lanes can provide people who wish to cycle with an area of carriageway space that is marked out for their use and largely be free of motor vehicles. It will be important that the lane width is appropriate to passing speeds and volumes of traffic as there is a tendency for drivers to drive to the lane line. Adequate passing clearance should be provided. Existing carriageway widths need to be sufficiently wide to accommodate a cycle lane of appropriate width and a vehicle running lane wide enough to accommodate the likely mix of traffic. Cycle lanes can often be placed in the space taken up by parked vehicles; the available width is generally suitable for a cycle lane.

5.2 Design Objectives

- Create up to a 2.0m wide on-carriageway cycle lane for cyclists to travel in one direction.
- Provide sufficient width in a cycle lane to overtake other cyclists without leaving the cycle lane.
- Minimise stopping and starting to smooth the flow of cyclists along the route.
- Enable two-way cycling on most streets by providing for contraflow on one-way traffic systems.
- Eliminate unlawful footway cycling by making the carriageway the most attractive and convenient place to cycle.

5.3 Design Principles

5.3.1 Greater separation of cyclists from other modes is required with greater speed and volume of motor traffic, and on gradients where cycle speeds can be unusually fast or slow. Cycle lanes offer a sense of route continuity and can be used (with discretion for site conditions) on roads with speed limits up to 40mph and flows up to 10,000 vpd. They help to define space for cyclists within roads. They do not however offer any sort of protection from passing vehicles and are generally preferred on roads with average speeds of 30mph or less, and without significant HGV traffic. Where space is restricted and there are fewer than 5,000 vpd, advisory cycle lanes may be provided by removing the centre lane to give a single two-way carriageway. This does not work on higher flow roads because opposing vehicles must move into the cycle lanes to pass.

5.4 Common hazards

5.4.1 Common hazards for cyclists along link sections of a route are:

- Overtaking vehicles passing too close – addressed by adequate lane width.
- Being struck from behind due to poor visibility or driver inattention (this is the only common collision on links, but usually results in serious injuries or death). This type of collision often happens on rural and unlit roads. Addressed by lighting and cycle lane width.
- Conflicts with motor traffic when passing occupied bus stops and loading bays. May be addressed through nearside by-pass arrangements (where there is sufficient width to minimise conflict with pedestrians)
- Insufficient space to overtake other cyclists within a cycle lane. Addressed through adequate lane widths.
- Unlawful stopping/parking of motor vehicles within cycle lanes. Addressed by enforcement.

5.5 Protected Cycle Lane

5.5.1 Protected Cycle Lanes (Light Segregation) use a separating feature to help provide an augmentation to the painted white line, while still enabling cyclists to leave the lane and enter the carriageway if necessary (to turn in and out of a side street to the right for example). This type of facility appeals because cyclists do not lose priority at any side roads, but still benefit from some separation from other traffic. The presence of the protective features also has the effect of 'tightening up' side road entrances to help reduce turning speeds, reducing the likelihood of a cyclist being cut-up by a left turning vehicle.

5.5.2 The protection may range from lightweight bollards to pre-formed concrete kerbs laid at intervals, 'armadillos or orcas' (pre-formed rounded plastic or rubber dividers) and reflective 'wands' (thin plastic bollards). Because they are permeable, there is usually no need to alter drainage unless the footway kerb is also being moved. Parking bays may be provided alongside the protected lane to create an additional buffer to the live traffic lane (but require a minimum separation space of approx. 0.5m for opening car doors).

5.5.3 Protected lanes can also offer a way to try out reallocating road space to create a cycle facility. It will take motor traffic at least 6 months to settle into a new pattern when traffic lanes are removed, so it is important that any temporary schemes are given enough time to understand how journeys are reassigned in the local network. In New York City, planters, traffic cones and temporary bollards were used to trial the impact of cycle lanes prior to installation of more permanent facilities bounded by kerbs.

5.5.4 The segregating features have no legal status. The DfT requires they should be set inside a mandatory cycle lane marking (Diag 1049). Spacing is typically at about 2.5m to 3.0m centres (there are no regulations relating to the use of these features and designers should note manufacturers' recommendations and emerging good practice from elsewhere).

5.5.5 Evolving good practice is that higher visibility 'bolt down' islands and bollards are required at the beginnings and ends of runs of the protected lane to ensure that motorised users see the segregating features in good time. These should also be repeated along the lane at 20m to 25m spacings. These more visible features will commonly be 0.5m wide so will form the buffer width inside a mandatory lane line. The light segregating features will sit centrally within this buffer. Light segregation will need to be discontinued across side road junctions where the mandatory lane will cross the junction mouth as an advisory lane. An island should form the terminating/beginning features on the approach/departure at a side road. Depending on the location the island can be sited a minimum of 5m from a line extended from the side road kerb.

5.5.6 Protected cycle lanes should be 2.0m wide to allow for overtaking within the facility and wide enough to accommodate 'Scarab' type compact street sweeping vehicles. Width is particularly valuable opposite side roads where cyclists may wait in the lane to turn right. An island/bollard should be placed directly opposite the side road to deter vehicles from veering into the lane to undertake other vehicles waiting to turn right. The segregating features should be discontinued beyond this island for approximately 10m to allow access for cyclists turning right into and out of the opposite side road.

5.5.7 The design of any new cycling infrastructure in the highway needs to consider potential impacts on all other highway users and not introduce additional hazards. Where any object is used in the carriageway it may be struck by a vehicle and can have destabilising effects. Risks to motorcycles must be considered when designing light segregation infrastructure. User groups should be consulted. The visibility of light segregation should be enhanced using islands/bollards with at least 60% retro- reflectivity at the start of the feature and at every junction, along with retro-reflective segregators. Due clearance should be given at side roads where leaning turning movements are made. Lane widths should be such as to minimise the striking of features. Road markings to highlight features can be helpful although the risk of introducing skid hazards needs to be considered.

Protected contraflow lane at puffin crossing, Birmingham

Large separating features and wands on road with 40mph speed limit, Heywood

Experimental cycle lane protected by moulded concrete blocks, Bristol. DfT advice is that the solid white line is required alongside the carriageway; the line inside the cycle lane is optional. Facility removed following damage to vehicles.

Protected two-way cycle lane on minor road, Netherlands

5.6 Mandatory Cycle Lane

5.6.1 Mandatory Cycle Lanes are generally bounded by a solid white line which has the effect of excluding other types of vehicles from entering them. Mandatory cycle lanes should ideally be 2.0m wide to allow for overtaking within the facility.

5.6.2 **Legal Issues:** TSRGD permits mandatory with flow cycle lane markings without a Traffic Regulation Order prohibiting vehicles (other than cycles) from being driven or ridden in the lane. This is a moving vehicle prohibition and does not prohibit parking or loading. Designers need to consider if frequent or widespread parking or loading is likely to occur, and whether this parking or loading will substantially impact on the function of the lane.

If so, a TRO prohibiting both or either of these activities should be made and recorded by the local authority. The prohibitions will be demonstrated using yellow or red lines and (if appropriate) kerbside loading blips.

5.6.3 A TRO maybe also be required when amending an existing mandatory cycle lane TRO.

Mandatory cycle lane, Lambeth (Adrian Lord)

5.7 Advisory Cycle Lane

5.7.1 Advisory Cycle Lanes can be entered by other vehicles and always need additional markings to indicate any loading and parking restrictions. Cycle lanes should be 2.0m wide where traffic speeds and volumes are high, although a width of 1.5m is sufficient within most 30mph areas. Where carriageway width is restricted a 1.3m advisory lane on ‘uphill’ sections and on the approach to an advance stop line may be preferable to no lane at all.

5.7.2 Removing surface gulleys and replacing them with kerb face gulleys can help to create a smoother area at the edge of carriageway when space is restricted.

5.7.3 Advisory or mandatory lanes can be provided in contraflow to the general traffic lane (see Chapter 7).

5.7.4 Cycle lanes may be installed to the nearside of parked vehicles, thereby using the vehicles as a protective barrier between cyclists and the lane of moving traffic (a buffer strip at least 0.5m wide to protect cyclists from car doors may be required if there is frequent parking activity).

5.7.5 On a 7.3m dual carriageway it may be possible to reallocate the lane markings to provide a 1.3m cycle lane and two 3.0m traffic lanes in each direction. This solution is appropriate within 30mph speed limits.

This ‘sub-standard’ 1.3m cycle lane on Iffley Road in Oxford provides a clear space that enables cyclists to file past slow moving traffic in the morning peak. However, on busy roads where traffic is usually free flowing, narrow cycle lanes can encourage drivers to overtake without adequate clearance.

5.7.6 A wider cycle lane or segregated track is required where actual speeds are nearer to 40mph or above. If cycle tracks are not being provided, cycle lanes may be separated from the traffic lane with hatching alongside the lane.

Cycle lanes (or carriageway edge markings where the width is inadequate for lanes) may be used on low-flow suburban roads (<4000 vehicles per day) to change the 'feel' of the road to help reduce speeds.

5.7.7 Coloured surfacing should generally be restricted to areas of potential conflict such as side road junctions and contraflow lanes or where lane markings are not permitted such as at zig-zag and bus stop markings.

Where a cycle track merges into an on-carriageway cycle lane the merge should be smooth and protected, as in this example in Solihull. (Solihull Council)

TSRGD permits cycle lane to be continued with a zig-zag marking offset from the kerb as above (N.B. not approved locally within Birmingham City Council area) (Adrian Lord)

Removal of the centre line can help release space for cycle lanes and reduce vehicle speeds in 20mph and 30mph areas. Dutch designers now recommend centre line removal as standard practice on straight roads treated with cycle lanes as it reduces the incidence of close overtaking by motorists. Centre lines are retained at bends and junctions (Phil Jones Associates)

5.8 Cycling in Bus Lanes

5.8.1 Bus lanes are not an ideal solution for mass cycling but (when the bus is not present) they offer the same protection as a wide painted cycle lane and are generally well-respected by motorists. In some areas bus lanes are legally reinforced by cameras to keep them free of traffic.

5.8.2 The bus lane should ideally be either 3.0m (too narrow for the bus to overtake within the lane) or 4.5m to enable safe overtaking within the lane. Additional width may be required on bends to allow for the turning path of the vehicle. Part time bus lanes with parking bays should be at least 3.9m wide (i.e. 2.5m for parking and 1.5m for cycle space).

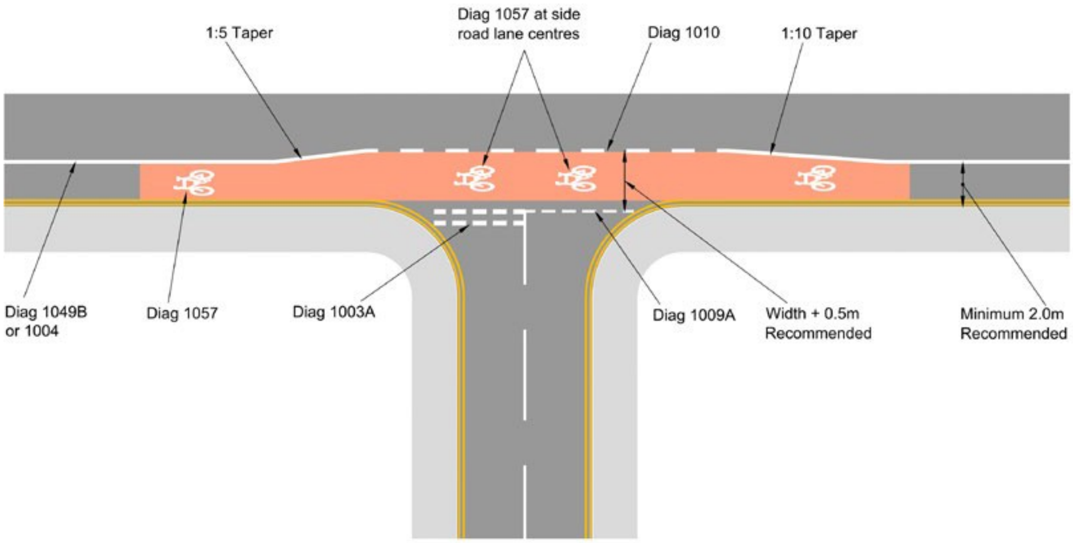
5.8.3 At bus stops without a bus layby, cyclists using bus lanes or cycle lanes should ideally be routed into a bus stop bypass to enable them to overtake a stationary vehicle without entering the adjacent live traffic lane. Some existing bus stop clearways are too short for modern buses and should be upgraded to meet the needs of the anticipated vehicle including clear space for buses pulling in and out of the stop and space for the merge/diverge of the cycle track bus stop bypass.

Articulated Sprint Bus Lanes

5.8.4 Shared bus lanes for articulated buses (such as the proposed Sprint service) should ideally follow similar arrangements to Midland Metro (see Appendix C) to ensure cyclists have dedicated space outside the dynamic kinetic envelope of the vehicle. This not only avoids hazards for cyclists but also ensures that buses are not delayed waiting to overtake slkow-moving cyclists. Where cyclists must share bus lanes with articulated buses due to a site constraint, the width should be 4.5m.

5.9 Cycle Lanes at Side Road Junctions

5.9.1 Cycle lanes should generally be continued (as advisory lanes) at side roads. Coloured surfacing can be used to highlight that this is a potentially hazardous location. It is important that the cycle lane is of adequate width on the approach to the junction. A narrow cycle lane may result in cyclists being more exposed to conflict with left turning vehicles.



The narrow cycle lane with drainage gulley and edges marked with setts was uncomfortable and hazardous, placing cyclists too close to the kerb and potentially misleading drivers turning left into the side road (lane now replaced with a cycle track). Cycle lanes can be widened as they cross side roads to encourage cyclists into a 'primary' riding position where they are less at risk from vehicles entering the side road.

It is common for bus stops to be located close to side roads, here in Oxford the cycle lane bends out as it crosses the side road to enable cyclists to start to move out ready to overtake when the bus stop is occupied, and to help reduce 'left hook' type conflicts with vehicles turning into the side road. (Adrian Lord)

5.9.2 Where a 1.3 or 1.5m cycle lane is installed on the approach to a junction, it may be feasible to widen the lane to 2.0m at the junction mouth, to emphasise to drivers that cyclists on their nearside may be going ahead, and to encourage cyclists going ahead to move out from the most vulnerable position by the nearside kerb. This would reflect the instructions about road position that are given in Bikeability training.

5.9.3 Additional Diag 1057 cycle symbol markings may be installed across the junction mouth to further highlight the cycle lane.

5.10 Contraflow cycle lanes

5.10.1 On one-way streets, contra-flow cycle lanes are one means of providing two-way cycling. This permits direct journeys to be made by bike and addresses a potential road safety issue of illegal contra-flow cycling with no facility in place. Further information is provided in Chapter 7.

Contraflow cycle lane with protective buffer area provides direct route through city centre. Mandatory lane and parking restrictions used. (Wolverhampton Council)

5.11 Edge Markings, Hard Strips and Central Hatching

5.11.1 There are many roads where it is not possible to provide a cycle lane of adequate width, and where the lane widths (usually between 3.2 to 3.9m) may create hazards for cyclists due to close overtaking. The width of these roads often varies along a given length. It may be possible in such cases to use either central hatching or edge of carriageway markings to create a more consistent carriageway width and to effectively create a 'buffer' zone which motorists can use to overtake (central hatching) or that cyclists can move into in the event of feeling threatened by an overtaking vehicle (edge of carriageway hatching). The visual narrowing of the carriageway can help in reducing vehicle speeds.

5.12 Whole Street Approach

5.12.1 The kerb lines and highway boundaries of existing roads and streets tend to have evolved over time in a piecemeal way and in some cases, are no longer suitable for the way in which they are used. In many cases a 'whole street' approach is required to reallocate space appropriately for the many functional requirements (of pedestrians, cyclists, public transport, loading, parking, and access) identified in the Birmingham Connected strategy. This strategy should be the reference to help justify major works where creating space for cycling requires significant construction.

Whole street visualisation, Birmingham Connected (WSP/Birmingham City Council)

6 Roads and Spaces Shared with motor vehicles

6.1 Cycling within all-purpose lanes

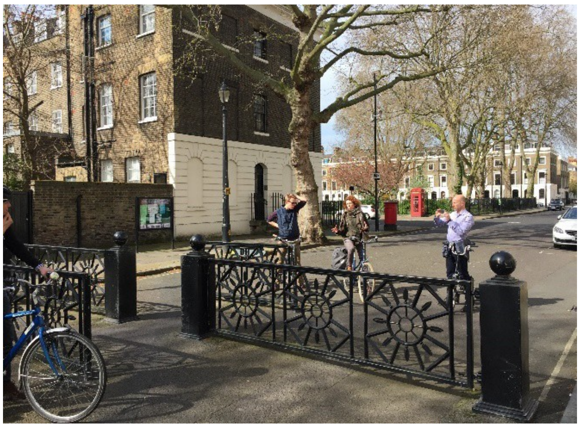
6.1.1 Many local roads and streets in the West Midlands were first built in prior to the mid-20th century at a time when the majority travelled on foot, cycle or public transport. They were not originally designed to accommodate motorised traffic and space for parked cars. Improved conditions for cyclists and pedestrians within existing streets cannot usually be achieved without reclaiming some of the physical space or priority that has been given to motor traffic. This is usually done in the context of 'placemaking' to enhance the appearance of a street and reinforce its place function for pedestrians and cyclists.

6.2 Design Objective

- To create places with no specific cycling facilities where cyclists of all types can comfortably share the carriageway with vehicles.

6.3 Design Requirements

- Removal or reduction of traffic through the removal of on-street parking, road closures to prohibit through-traffic, or one-way working to make the amount of traffic more acceptable for cyclists and pedestrians.
- Reducing the speed limit and actual speeds to 20mph or below to enable pedestrians and cyclists to mix more safely with traffic.
- Alter priority at junctions, for example where a cycle route runs through a cross roads, so that the opposing traffic is forced to give-way.



Road closure on residential street to remove through traffic within a conservation area.

Textured road surface, speed table, parking bays inset in footway, 20mph outside Broadway School, Birmingham (Adrian Lord)

6.4 Speed/flow criteria for shared all-purpose lanes

6.4.1 Cyclists can mix safely with traffic at speed limits of 20mph and 30mph but whether or not this 'feels' safe will depend on the actual speeds, volumes, proximity of overtaking vehicles (particularly buses and HGVs), and the frequency of side roads, parking and loading activities. Measures such as the removal of centre lines on narrower roads can help to encourage drivers to give more clearance when overtaking cyclists, while junction treatments and bay parking can help to address other potential conflict points.

6.4.2 Most minor roads with fewer than 3000 vpd and speeds of 30mph or less do not require cycle lanes as an aid to safety and separation from traffic. However, cycle lanes or logos can still be helpful in 'way finding' part of a marked route or to help visually narrow the carriageway to encourage lower speeds. Roads with more traffic than 3000 vpd should ideally have some form of separate provision for cycling, but it is not always possible to reallocate the necessary space. Measures to manage the volume and speed of traffic as described above should be considered.

Where turns are banned to reduce motor traffic in streets, cycle access should be retained (Adrian Lord)

6.5 Cycle Streets and Access Roads

6.5.1 'Cycle streets' are generally low-flow access streets for motor vehicles where signs indicate that pedestrians and cyclists have priority over motor traffic, and a following car would not be expected to overtake the cyclist. For them to work as intended, the cycle traffic flows should exceed the motor traffic flows to ensure that the cyclists 'feel' safe.

Dutch guidance suggests a minimum flow of 2000 cyclists per day is required. Textured surfacing and central raised central margins are often used to emphasise that such streets are low speed environments where motor vehicles should not attempt to overtake cyclists.

6.5.2 There are few streets in West Midlands where cyclists will outnumber cars, but there may be opportunities to develop routes along service roads as an alternative to the main trafficked carriageway.

Cycle Street – Cars are Guests sign (Phil Jones Associates)

A cycle lane has been marked on the quiet side of this service road, while the cycle logo provides continuity on the side used for residential parking (Adrian Lord)

A Dutch cycle street and a similar low-speed residential street in Birmingham. Only minor changes would be required to replicate the Dutch design

Cycle route marked within a ‘shared space’ access street, Deptford. The historic dockyard crane lines were incorporated into the surface design.

7 Contraflow Cycling

7.1 Permitting two-way cycling

7.1.1 The ability to make direct journeys is one of the keys to providing an attractive cycling environment. One-way streets generally introduce circuitous alternatives opposite to the one-way direction. One-way streets are often used to manage traffic in town and city centres but can make cycling inconvenient or hazardous. Ready cycle access is aided by legal contra- flow provision and non-provision can result in illegal and unsafe contra-flow riding. Cycle contra-flow should be a standard consideration for one-way traffic orders.

7.2 Design Objectives

- Contraflow cycling can be achieved using cycle tracks, mandatory or advisory lanes or with no markings whatsoever on low speed-low flow roads
- Where a lane or track is proposed a 2.0m minimum width is recommended to provide the necessary separation from opposing traffic.
- On quiet streets with low speed traffic, contraflow lanes are not usually required.

7.3 Speed/flow criteria for contraflow facilities

7.3.1 Contraflow facilities with advisory cycle lanes or no cycle lane whatsoever should generally be restricted to roads with actual speeds of below 30mph and flows of less than 2000 vehicles per day. Such facilities are compatible with low speed roads with a posted speed limit of 20mph and where actual speeds will not be significantly higher.

Simple unsegregated contraflow on minor street with 30mph limit, City of London.

This contraflow cycle lane on Hurst St offers a good width and prominent markings including a buffer zone between oncoming traffic and the lane.

7.3.2 The signs (Diag 940.2) and markings for unmarked contraflow cycling are now prescribed by TSRGD, and it is permissible to use an 'Except Cycles' plate beneath a 'No Entry' sign to indicate a contraflow facility (See Signs chapter). As stated in the Traffic Regulation Act, highway signage needs to be 'adequate'. All cycle contra flow schemes need very clear signage to indicate to drivers that cyclists are permitted to cycle in opposition to motor vehicles. All schemes will require a TRO, either an amendment to an existing order or a new TRO for new schemes. Where one-way streets feature shared-use of a foot/cycle way in the contra-flow direction, a Traffic Regulation Notice will be needed to authorise this off- carriageway contra-flow movement. It should be noted that not all roads will be suitable for contra flow cycle facilities and careful safety considerations are required prior to scheme development.

Entrance to contraflow lane at Corporation St is protected by a splitter island

Protected exit from advisory contraflow lane, Ladywood

7.3.3 On busier roads a mandatory contraflow lane or cycle track of 2.0m width is recommended. Where there is a high demand for parking (or likelihood of unlawful loading and parking), the kerb separation will reduce the likelihood of the facility being blocked.

Advisory contraflow to offside of parking and taxi rank uses coloured surfacing to increase visibility, Leeds

7.3.4 Ideally parking should be removed from the contraflow side of the carriageway but it may be retained on wider carriageways.

Contraflow protected by kerbed buffer (Adrian Lord)

8 Junctions

8.1.1 Junctions are the most difficult and important places to create good infrastructure for cycling. They are the most hazardous locations where cyclists are potentially in conflict with motor vehicles, and they are also a source of delay and inconvenience. It is important to consider both issues when trying to make junctions work better for cyclists.

8.1.2 Around 68% of reported injury accidents to cyclists occur at or near road junctions, with a further 6% at private drives and entrances. The 3 most common accident types at junctions are (in order):

- Cyclist going straight ahead struck by vehicle turning left into a side road.
- Cyclist going ahead struck by vehicle exiting a side road.
- Cyclist going ahead struck by vehicle turning right into a side road.

8.2 Design Objectives

- Minimise stopping and starting on key radial routes to smooth the flow of cyclists along the route.
- Remove or reduce conflict by separating cyclists from opposing vehicle movements using dedicated space within the highway and/or dedicated time at signals (including sufficient intergreen time to clear large junctions or junctions on steep gradients before the opposing flow is released).
- Provide clear and unambiguous information about priority to all users to avoid errors.
- On roads where there is a high proportion of HGVs, separate cyclists from vehicles with restricted visibility
- Separate cyclists from vehicles at large high capacity junctions due to high speed differential.
- Minimise disruption to pedestrians.

8.3 Design Principles

- Greater separation is required with greater speed and volume of motor traffic and on gradients where cycle speeds can be unusually fast or slow.
- Greater separation is required where there is a high proportion of HGV traffic.
- Greater separation is required where there is a high proportion of child/elderly cyclists and pedestrians.

- Greater separation is required at complex junctions with more than 4 arms and at locations designed to speed the flow of motorised traffic such as large un-signalised roundabouts.
- Junctions with acute angles such as merge/diverge slip roads or where the flare of the junction mouth enables vehicles to turn in and out quickly are most hazardous for cyclists. An approach angle perpendicular to the main junction with 'square' kerb lines offers better visibility splays and potentially lower speeds.

8.4 Types of Facility at Junctions

8.4.1 The optimum facility will depend on site specific factors. The options available include:

- Grade separated cycle subways and bridges at major road junctions
- Roundabout with separate cycle track and signalled crossings such as toucans or cycle-only crossings
- Dutch style roundabout with separate cycle tracks and cycle/pedestrian crossing priority on each arm
- Two-stage right turn at a signalised junction
- Advanced stop lines
- Early start signals
- Loop detectors / push button to trigger a separate cycle track phase at signalled junctions
- Priority crossings at side roads

8.5 Large and Multi-Lane Roundabouts

8.5.1 Large multi-lane and multi-arm roundabouts often have comparatively good safety records for motorised traffic but are particularly hazardous and unpleasant locations for cyclists. Normal Roundabouts designed in accordance with common UK practice (as in TD16 of DMRB), are hazardous for on-carriageway cycle traffic. They typically have entries and exits that are flared, with two or more lanes at the entry to maximise vehicle capacity, and wide circulatory carriageways that often do not have lane markings. This geometry enables motor traffic speeds that are likely to be significantly higher than cycle traffic speeds, particularly on large diameter roundabouts. Many large roundabouts in the West Midlands have a dedicated nearside left turn lane on the approach, an arrangement that places cyclists on the carriageway in a hazardous location.

8.5.2 Cyclists are at risk on the approach (usually shunt/merge type collisions with motor traffic entering and drivers not looking for cyclists on their nearside), on the circulating carriageway (from motor traffic entering and leaving across the path of the cyclist) and when leaving (usually from traffic continuing around the roundabout in the outside lane).

8.5.3 Signalisation of large roundabouts is helpful to faster cyclists, and advanced stop lines at the traffic signals can help were no other measures are feasible. However, roundabouts are designed to maximise the traffic flow and the wide carriageway and high-speed differential makes them a hostile environment for most cyclists. Where a roundabout is on a gradient such as on parts of the ring road, the speed of cyclists going uphill is extremely slow compared to other traffic, putting them at even greater risk and making it virtually impossible for cyclists to adopt the safest road position within mixed traffic. All cyclists (and if footways are provided, pedestrians as well) are legally entitled to use all roundabouts and it should be assumed that some will for the journeys they wish to make.

8.5.4 Appropriately safe facilities should therefore be provided.

8.5.5 The preferred arrangements for cyclists at large roundabouts (more than 3 arms, multiple approach lanes, and/or over 10,000 vpd or on gradients) are therefore:

- Grade separation using subways or bridges (in new build situations the aim should be to keep pedestrians and cyclists at ground level and raise or lower the carriageway);
- Cycle tracks with signalled toucan or parallel pedestrian/cycle at-grade crossings of each arm;
- Alternative routes that avoid the junction altogether (providing these are not lengthy diversions from any nearby destinations) It is likely that there will be alternative quieter alternatives but these may not suit all journeys.
- Signalised roundabout with advanced stop lines (least preferable) and cycle early release signals.
- Roundabout with cycle lanes and ‘hold the left’ signal (see photo below)
- Replace the roundabout (or gyratory) with an alternative design such as a ‘peninsular’ signalised junction with cycle facilities (i.e. one section of the roundabout is closed to traffic and the remaining sections converted to two-way flows).

Concept drawing for Queens Circus, London (Transport for London/Steer Davies Gleave)

8.6 Compact Roundabouts

8.6.1 Smaller roundabouts on single lane, single carriageway roads can more easily be modified to make them more cycle friendly. Roundabouts with 'tight' geometry, relatively large centre islands, single lane circulatory carriageway, single entry and exit lanes with minimal flare and maximum deflection are safer for cyclists. Textured over-run material can be used to accommodate any additional turning path required by HGVs. The diagram below is taken from Traffic Advisory Leaflet 9/97 which covers 'continental design geometry'. The dashed line shows an existing UK roundabout while the solid line shows the typical continental design which has a better safety record for cyclists.

8.6.2 Deflection at the entry is greater than with a standard design and so can be used as a speed reducing feature for motor vehicles. Motorists are unlikely to attempt to overtake cycle traffic on the circulatory carriageway, due to the limited width.

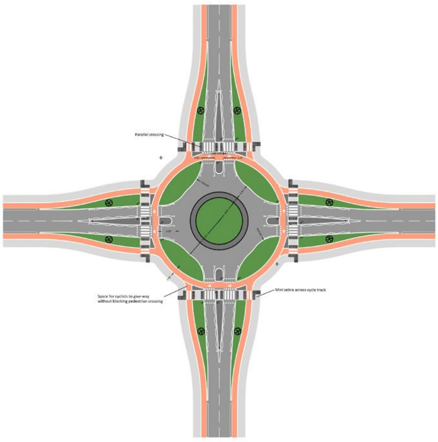
8.6.3 Compact Roundabouts should be only be considered where the highest speed limit within 100m on any approach does not exceed 40mph.

Compact roundabout with off-carriageway track for use in peak traffic, Cambridge

8.6.4 Off-carriageway cycle tracks should be provided at Compact Roundabouts when the total junction throughput is above 6,000 AADT (see Dutch style roundabout below). When cycling is on-carriageway through the junction, any cycle lanes, light segregated cycle lanes or stepped cycle tracks must end 20-30m in advance of the give way line so that cyclists can integrate with motor traffic on the junction approach.

8.6.5 The Transport Research Laboratory (TRL) has trialled several configurations of a 'Dutch style' roundabout that combines the 'continental' geometry shown above, with the addition of cycle track and pedestrian crossings on each arm. In high flow situations the cycle track will normally give-way to the carriageway, but in quieter situations or minor arms of a junction, priority can be given to the cycle track, typically using a parallel cycle track and zebra crossing (see crossings). Generally, the Dutch use a circular cycle track where the cycle track has priority, enabling the cyclists to maintain momentum.

8.6.6 At larger sites where the cycle track does not have priority, the track bends back into the side roads so that the cyclist must make more sharp turns at slow speed and is therefore more prepared to 'give way' before crossing and has better visibility with the cyclists perpendicular to traffic lanes.



Dutch style roundabout design, Cambridge

Roundabout at junction near supermarket access and residential road, Netherlands

Typical layout with priority to cycle track. Hatched area is over-run for larger vehicles.

Typical layout with priority to carriageway, also used where crossings signalised.

8.6.7 Cycle lanes around the perimeter of an all-purpose circulating carriageway do not generally work well (in the UK) as they place cyclists in the 'wrong' position at the edge of the carriageway and drivers find it difficult to anticipate the intended manoeuvre of the cyclist. In other countries where the marking is extensively used in this way (Denmark, Sweden, Netherlands) the cyclist in the cycle lane has unambiguous and well-respected legal priority over turning traffic.

8.6.8 A number of cities in the UK are introducing cycle tracks around roundabouts by using the 'parallel zebra' crossing marking such as in the Cambridge example above. The Dutch examples above show how the arrangement of the cycle track should differ to slow the cyclist and place them perpendicular to the carriageway at roundabouts where the cycle track does not have priority,

8.7 Grade Separation

8.7.1 Grade separation can be the preferred option at busy, complex and high-speed junctions where it is difficult to provide at grade facilities that are both safe and convenient to use. The cumulative delay at signalised at-grade crossings of multi-arm junctions can be unacceptably long for convenient cycling. Cyclists and pedestrians sometimes object to subways and bridges because of personal security or because they take them on a long diversion away from the shortest route. Problems with subways and bridges can sometimes be designed out, and this may be preferable to replacement with an at-grade crossing, particularly for cyclists for whom stopping and starting requires additional effort.

8.7.2 Where a subway or bridge is near to a junction but not actually on it, the cycle route should lead to the crossing point via the shortest route, often from some way in advance of the junction, so that the grade separated feature forms a 'natural' part of the route rather than a last-minute diversion away from a straight desire line along a main road.


The subway at Bristol St, Birmingham on the left offers relatively good visibility and straight, wide, gently graded approaches. The subway enables cyclists to avoid a large, busy junction on the ring road and is overlooked by nearby properties and the bus stop. By contrast the Salford Circus subways beneath Spaghetti Junction have a poor crime record and are narrow, dark, remote and threatening. Consequently, many cyclists and pedestrians cross at-grade despite the risks. (Adrian Lord)

8.7.3 Subways should ideally offer a straight approach, gentle gradients of 5% and good visibility through to the other side. Dutch guidance suggests that if a steeper ramp gradient is required, the bottom section of the ramp is steepest (where the cyclist still has momentum) and then gets shallower towards the top in a sinusoidal curve.

Cycle and pedestrian subway designed to maximise natural light and visibility, Sweden (Phil Jones Associates)

Subway visualisation showing battered sidewalls and gently graded approaches (Fiets Beraad).

8.7.4 The major central areas of Birmingham, Coventry and Wolverhampton, as well as some smaller settlements are bounded by a Ring Road with several large grade- separated junctions, so subways are likely to remain an ingredient of provision for cyclists in the West Midlands for at least the next decade. With improved links to the adjacent roads, the subways in many cases would offer the safest and most convenient routes through a major junction. Further enhancements such as lighting, CCTV and widening may be needed to improve personal security. Using battered sloping wing walls on the approaches and within the subway can help improve natural light and eliminate some of the blind spots around the subway entrance.

Underpass designed with good natural daytime visibility and highway standard lighting (Sandwell Council)

Table 6: Minimum dimensions for Under bridges

Tunnel Length	Height (m)		Width (m)		
	Cycle Track	Footway	Margin to wall	Cycle Track	Footway
<23m	2.4	2.3	0.5	3.0	2.0
>23m	2.7	2.6	0.5	3.0	2.0

Source: Design Manual for Roads and Bridges

8.7.5 New roads with grade separation can be constructed like the designs in Stevenage and the Netherlands, where the carriageway is raised up by a few metres so that there isn't such a large height difference for pedestrians and cyclists and the approaches are therefore shorter and can more easily be in line with the tunnel section for better visibility.

8.7.6 Bridges for cyclists also require a 5% ramped gradient on the approaches. The bridge deck should normally be 4.0m which gives an effective width of 3.0m (allowing 0.5m clearance to each vertical parapet), sufficient for most mobility cycles, cargo bikes and cycle trailers to pass. The standard parapet height for new structures where cyclists ride directly adjacent to the parapet is 1.4m (DMRB). On existing bridges and where there is a kerb or crash barrier achieving the 1.4m parapet height is less critical.

Cycle bridge over ring road, long ramps to minimise gradient, 4.0m deck width, Bruges

Cycle and pedestrian bridge over railway, Cambridge

8.8 Signal Controlled Junctions

8.8.1 **Advanced Stop Lines.** Advanced stop lines enable cyclists to wait and move off ahead of queuing traffic when the lights change. Where there are high levels of cycling, they can be helpful to the overall departure flow at the lights by enabling cyclists to move off quickly to reduce delay to other traffic. The reservoir area also enables cyclists waiting to turn right to take up an appropriate position towards the centre of the road. A TRL study concluded that the standard 4m depth of the ASL reservoir is only the equivalent to a single passenger carrying unit (pcu) and therefore ASLs have little impact on capacity unless a queuing lane is removed. Some adjustment to inter-green time may be required, and the traffic light sensor loops may need to be relocated. Where coloured surfacing is proposed it may make economic sense to plane off the surface, relocate the loops and install the advanced stop line using coloured asphalt for a longer life.

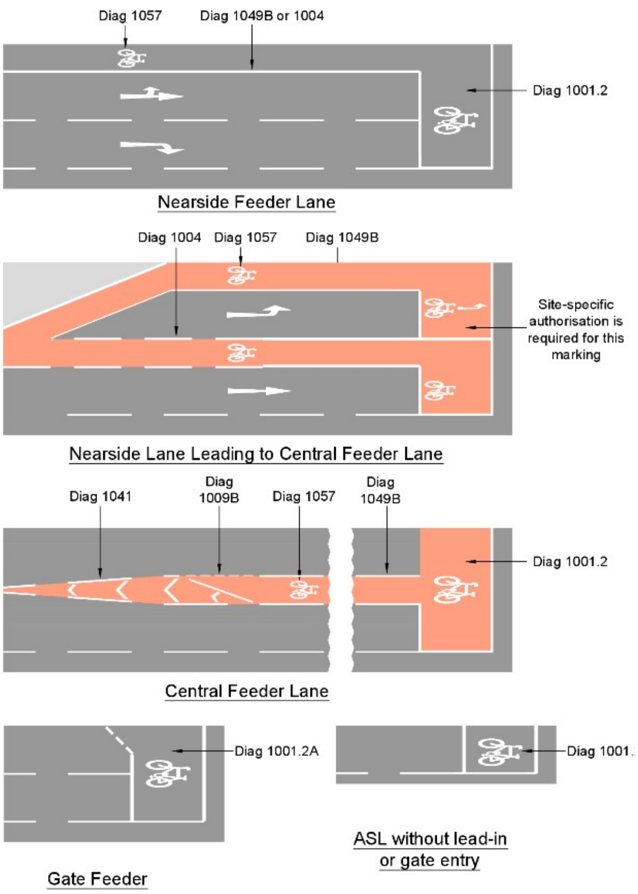
Table 7: Recommended lane widths at advanced stop lines

Carriageway (m)	Cycle Lane (m)	Lane 1 (m)	Lane 2 (m)	Opposing Lane (m)
7.3	1.3	2.8	--	3.2
7.5	1.5	2.8	--	3.2
8.0	1.5	2.8		3.7
8.5	1.5	3.0		4.0
9.0	1.5	3.0		4.5 (3.0 + 1.5)
10.0 (1 lane)	1.5	3.5		5.0 (3.5 + 1.5)
10.0 (2 lane)	1.3	2.7	2.78	3.2

Carriageway (m)	Cycle Lane (m)	Lane 1 (m)	Lane 2 (m)	Opposing Lane (m)
10.5	1.5	2.75	2.75	3.5
11.0	1.5	2.75	2.75	4.0
11.5	1.5	2.75	2.75	4.5 (3.0 + 1.5)
12.0	1.5	3.0	3.0	4.5 (3.0 + 1.5)
15.0	1.5	3.0	3.0	3.0 + 3.0 +1.5

Notes: All treatments on a site by site basis. Lanes of less than 3.0m unsuitable for regular HGV traffic and ASL lead in lanes should be advisory. Lanes below 3.0m (2.75m if few buses or HGVs) require agreement with the Traffic Manager

8.8.2 While some authorities choose to have a policy of fitting ASLs at every signalised junction, it is not always the optimum arrangement. Traffic Advisory Leaflets 8/93 and 5/96 note that right turning cyclists find it difficult to use nearside approach lanes where traffic flows per lane exceed 200-300 vehicles per hour, and that the reservoir is of limited value when the proportion of red time at signals is small. Many people, particularly those accompanying child cyclists, feel uncomfortable using ASLs, while people on three or four wheeled cycles may struggle to use the approach lane unless it is at least 1.5m wide. Typical layouts are illustrated below.



8.8.3 There are some concerns around safety, as nearside feeder lanes and the area at the rear of the reservoir are in the blind spot for HGV drivers. The attachment of convex mirrors (known as Trixi Mirrors after a cyclist who was fatally injured at a junction) onto the traffic signal pole was approved by DfT for all local authorities in 2011.

Trixi mirror fitted to traffic signal

8.8.4 The standard depth of the reservoir (i.e. distance between the cycle stop line and other vehicle stop line) is 5.0m, with 7.5m also permitted (and 10.0m with special authorisation). 7.5m and 10.0m reservoirs may assist cyclists with a greater head start at busier junctions, and to provide additional separation from HGVs, buses and vans where the volume of cycle traffic is likely to lead to cyclists queuing in the nearside lane blind spot.

8.8.5 Half width ASLs may be suitable on narrower roads where the path of larger vehicles turning into a junction occasionally crosses the centre line and are included in the TSRGD.

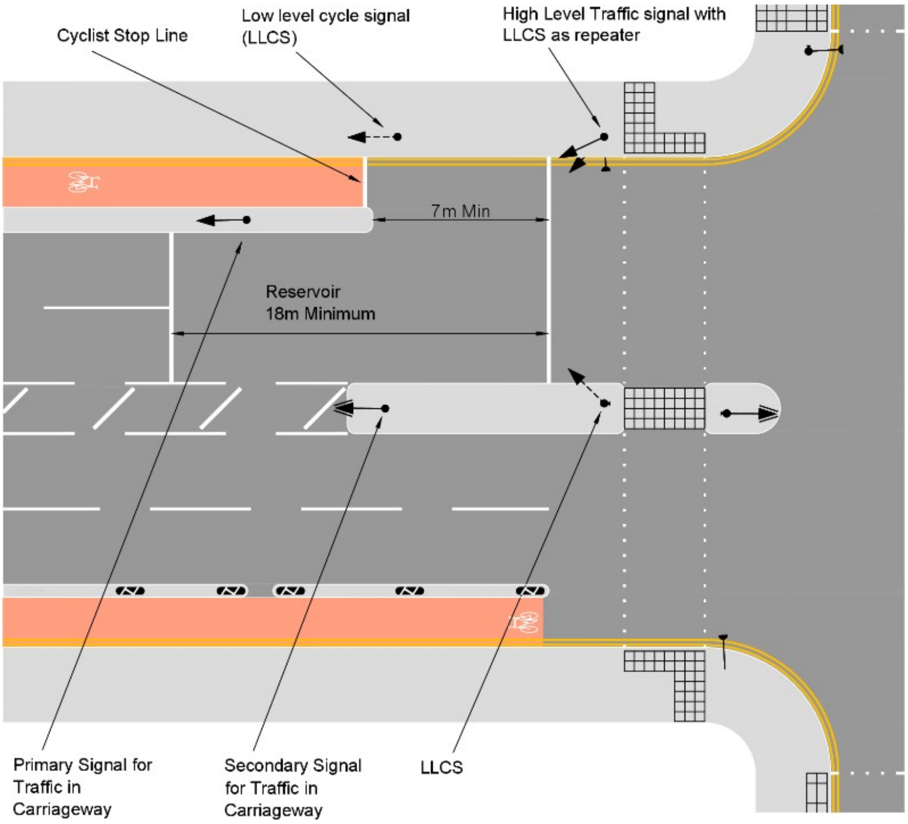
8.8.6 Nearside feeder lanes intended for cyclists going straight ahead should never be placed alongside a left-turn traffic lane. If a central feeder lane is installed to the offside of a left-turning lane, it should generally be 2.0m wide to give adequate separation from the traffic. It is permissible to install ASLs with no lead-in lane where this is considered the best option. Occasionally an offside feeder lane may be required (usually where cyclists can turn right but other vehicles must go ahead only). The offside feeder lane requires special authorisation.

8.8.7 **Separate stage.** Cyclists may need to make movements that are not available to other traffic. The arrangement of stop lines is similar to a conventional junction, with a green cycle aspect on the signals. ‘Elephants footprint’ markings can be used to indicate the route through the junction if necessary. The 'elephant's footprint' markings are not included in TSRGD and therefore require special authorisation.

A separate signal stage enables cyclists on Hill St to cross to a contraflow track in Hurst Street on the opposite side of Smallbrook Queensway, Birmingham.

Where cyclists have a separate route marked through a signalled junction, elephants' footprint markings are permitted, Westminster.

8.8.8 **Hold the Left Turn.** Cyclists can be held in a separate waiting area to avoid conflict with left-turning traffic. When the cyclists going ahead get a green light, the left turning traffic is held on red (see also 8.10).



8.8.9 **Early start for cyclists.** It is possible to include a separate signal head at traffic lights to release cyclists typically 2 to 5 seconds ahead of other traffic (using a green 'cycle' signal in a similar arrangement to a 'filter' light). This enables cyclists to clear the junction prior to turning traffic, reducing the likelihood of a conflict, and helps prevent vehicles being delayed by cyclists when the lights change. There are now many examples of such facilities including sites in Bradford, Cambridge, Manchester, Newcastle, London and York. Separate low-level signals for cyclists may be used, or a cycle signal head may be used within full size traffic lights.

Cycle early release signal offers protection where cycle track re-joins carriageway at a junction, Newcastle (Adrian Lord)

Example of low level signal in Lambeth

Cyclist early start signal, 7.5m ASL and convex safety mirror, Cambridge

Trial of 10m ASL box and low level early start signal, TRL

Cambridge signal sequence, the cycle green is called when a cyclist enters the ASL box and starts when the green for motor traffic would normally start. Essentially this delays the start of the green phase for motor traffic by about 2 seconds, sufficient for most cyclists to safely move off out of the ASL, reducing the incidence of conflict and delay to motor traffic waiting behind the cyclists when the lights change.

8.9 Cycle Lanes and Tracks through Signalled Junctions

8.9.1 Several junctions along parts of the London Cycle Superhighways include cycle lanes marked through the junction. This is a practice that is also adopted in Denmark. In Denmark left turning vehicles are obliged to give way to cycles going ahead in the cycle lane. The cycle lanes are coloured and bounded with Diagram 1010 markings. Some commentators feel that the lane could be misinterpreted as a ‘priority’ marking by some cyclists and this contributes to accidents although analysis of collision data is inconclusive.

In the Netherlands, red coloured surfacing is used at junctions where cyclists have priority, while at signalled junctions the cycle lanes or tracks through a junction are marked but not coloured.

8.9.2 Cyclists can move more quickly than pedestrians and therefore require less crossing time at signalised junctions with cycle track crossings. This offers the opportunity to give cyclists a single stage crossing or a diagonal crossing when pedestrians require a two-stage crossing.

Cycle lane continued through signalled junction, CS7, Southwark

Signalled cycle track crossing and parallel zebra crossing, Bruges

Diagonal cycle-only crossing on Leeds-Bradford cycle superhighway (Adrian Lord)

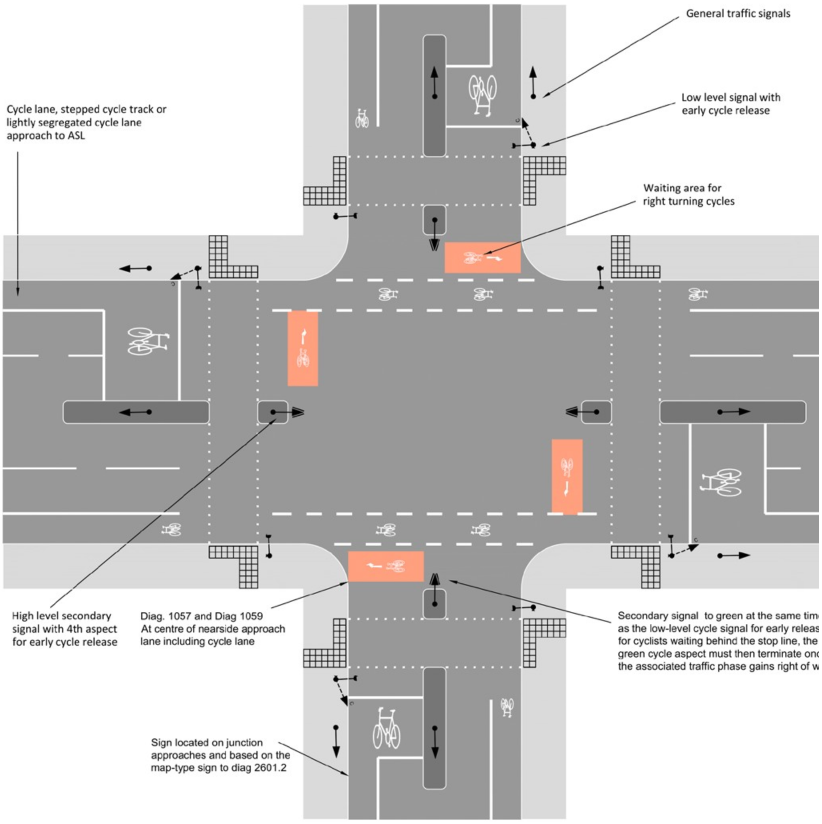
8.10 Two-stage Right Turns

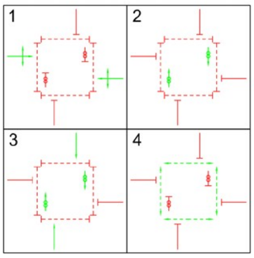
8.10.1 At large signalised cross-roads and T junctions, it can be difficult to provide adequate time between opposing flows (the inter-green) for right-turning cyclists. Cyclists also find it hazardous to safely move into a central position on the multi-lane approaches and cannot do so if there is a nearside cycle facility. A two-stage right turn enables cyclists to remain on the nearside and make the turn in two stages.

Two-stage right turn on London Quietway 1, Southwark (Adrian Lord)

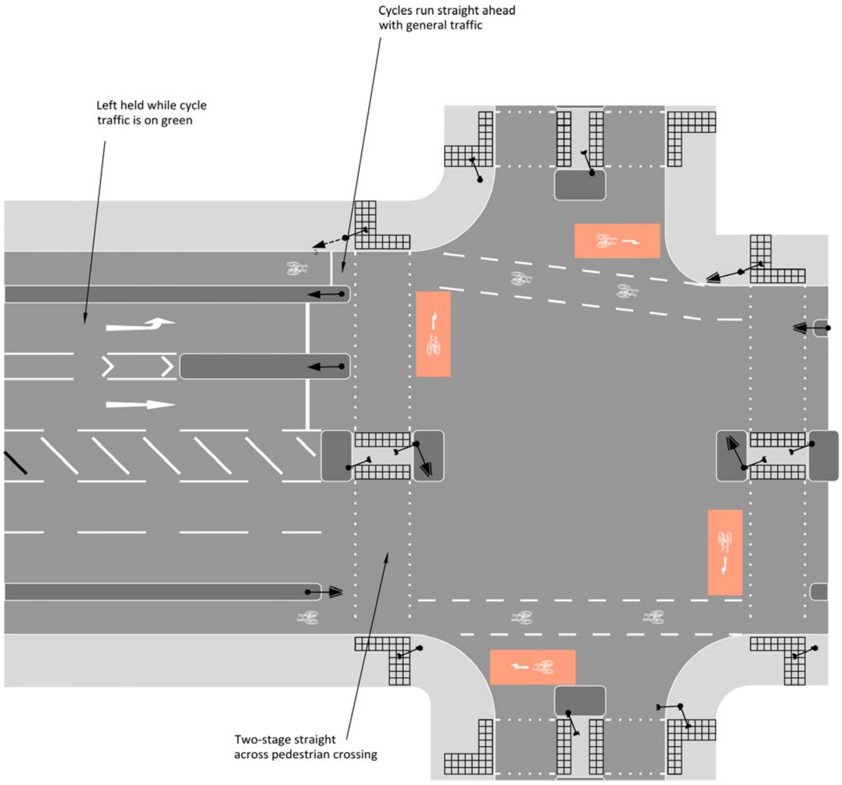
Signal hoods to shield aspects from motorists and advisory plate at two stage right turn by Blackfriars Bridge, London (Adrian Lord)

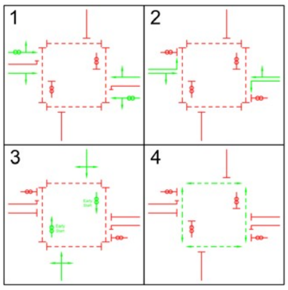
Typical two-stage right turn layout.





Two-stage right turn and hold the left turn layout and signalling arrangement





9 Crossings

9.1 Choice of Crossing

9.1.1 The cycle network can offer opportunities to avoid the most busy and hazardous locations with crossings of links away from the main junctions, or grade separated routes through the main junctions. On a ring road, these can be good locations to monitor flows of cyclists into the city/town through cordon counts.

9.1.2 The ideal choice of crossing where a cycle track crosses a side road or main road will largely depend on local circumstances. The table below is based on the recommended treatments in the Design Manual for Roads and Bridges and Dutch design guidance. As in other situations, lower the speeds and flows of motor traffic enable greater priority to be given to the cycle route. On busier roads, traffic signals are required to ensure that cyclists have sufficient time to cross a road safely without meeting opposing traffic, but where the road is also designed to allow high speeds, full grade separation is required.

9.1.3 Where the majority of cyclists approach and leave the crossing point from just one side, a parallel crossing works well, helping to minimise conflict by keeping pedestrian and cycle flows separated. Where a lot of cyclists use a crossing to turn on and off a main road as well as to cross it, a crossing shared with pedestrians may be the better option because the interactions of pedestrians and cyclists are too complex to separate.

Table 8: Crossing Selection

85^{th} percentile speed of road traffic	Road traffic flow (two way daily)	Type of cycle crossing
Side Road Crossing		
< 30 mph	< 2,000	Raised crossing - Cyclists have priority
Main Road Crossing (Standalone/mid-block)		
< 30 mph	< 4,000	Raised crossing - Cyclists have priority
< 50 mph	< 6,000	Cyclists give way to road traffic
< 35 mph	< 8,000	Zebra crossing used by cyclists
< 50 mph	< 8,000	Cyclists give way to road traffic plus central refuge
< 50 mph	> 8,000	Signal controlled, including Toucans
> 50 mph	> 8,000	Grade separated crossing

9.2 Toucan Crossings

9.2.1 Toucan crossings are always shared with pedestrians on the crossing itself, although the approaches may be segregated. Some authorities continue segregation of the crossing area by using coloured surfacing. Ideally the crossing should not be staggered as it is difficult to negotiate a narrow 'sheep pen' type arrangement on a standard bike and virtually impossible on a tricycle, tandem or when towing a child trailer (see width requirements). It is not usually possible to provide a stagger of sufficient width (at least 3.0m between kerbs/guard rail) to accommodate the space required to turn a larger cycle.

Wide toucan crossing with shared use approaches on A38 Bristol Road at Selly Oak

Separate parallel crossing, Norwich

9.2.2 In addition to the above examples it is permissible to design a 'parallel' signalled crossing similar to a Pegasus (equestrian) crossing arrangement where the cycle track is off to one side of the pedestrian crossing area. These crossings may require additional poles and signal heads depending on the location.

A simple 'jug handle' approach can be used to take cyclists from the carriageway into the waiting area of a toucan crossing.

The build-out for the crossing protects cyclists returning to the carriageway after the crossing, Dogpool Lane, Stirchley

9.3 Zebra Crossings

9.3.1 Cyclists are required to dismount when using a standard zebra crossing. Some authorities have installed cycle tracks that lead up to a zebra crossing and added 'Cyclists Dismount' signs adjacent to the crossing. This is not good practice, and cyclists are unlikely to dismount in practice.

9.3.2 A 'parallel cycle zebra crossing' includes a cycle track marked alongside the pedestrian zebra crossing avoiding the need for cyclists to dismount. Both crossing elements lie within the belisha beacons. The layout is shown in the photograph example below.

Parallel cycle track and zebra crossing on a wide flat top speed hump in Wolverhampton (Wolverhampton Council)

9.4 Priority Crossings

9.4.1 A mid-block priority crossing for cyclists can be located on a raised road hump with give-way markings. These should only ever be installed where the speed limit is 30mph or below and average speeds are at or near the speed limit.

Cycle track (priority to carriageway) on flat top hump, 2.0m central reservation, Oxford (Adrian Lord).

Cycle track (priority to cycle crossing), Thetford (Rob Marshall)

On quieter roads such as this one in Bournville, provision of dropped kerbs may be adequate, while on busier routes additional half-size give way markings and buff tactile paving can be used to indicate a mid-block crossing point.

9.4.2 On wide roads, a central reservation should be provided. The reservation should be at least 2.0m wide to prevent wheels overhanging into the carriageway.

9.4.3 Controlled crossings must be legally supported with a Traffic Regulation Notice. Changes to an existing crossing may need changes to the Notice as well.

10 Cycle Parking and Other Services

10.1 Description

10.1.1 The decision to make a journey by cycle is not only governed by the quality of the journey but also by the availability of cycle parking that users see as secure at the end of the journey. This is generally a significant issue for people using cycles; cycles are relatively expensive items and cycle-theft does occur. The importance of secure cycle parking on cycle routes and at key origins and destinations should not be underestimated.

10.1.2 Electrically Assisted Pedal Cycles (E-Bikes) are increasingly in common use, for personal transport and as low-emission delivery vehicles. Cycle parking with E-Bike charging points should be considered at key locations.

10.2 Design requirements and Standards

10.2.1 Secure cycle parking is required in homes, workplaces, schools, and other public and commercial buildings. Setting local planning standards that specify the amount and preferred style of parking for different classes of new developments can help to ensure the quality of provision. Standards vary slightly for each planning authority, and a generic example is included in Table 9 at the end of the chapter. The standard assumes that new developments will cater for the higher levels of cycling envisaged in the Cycle Charter. Stations and other public transport hubs may have constraints associated with transport security and operational safety that need to be discussed with the operator and the British Transport Police. Planning designations such as Conservation Areas and Listed Buildings may also influence the permitted location and design of cycle parking.

10.3 Identifying Demand

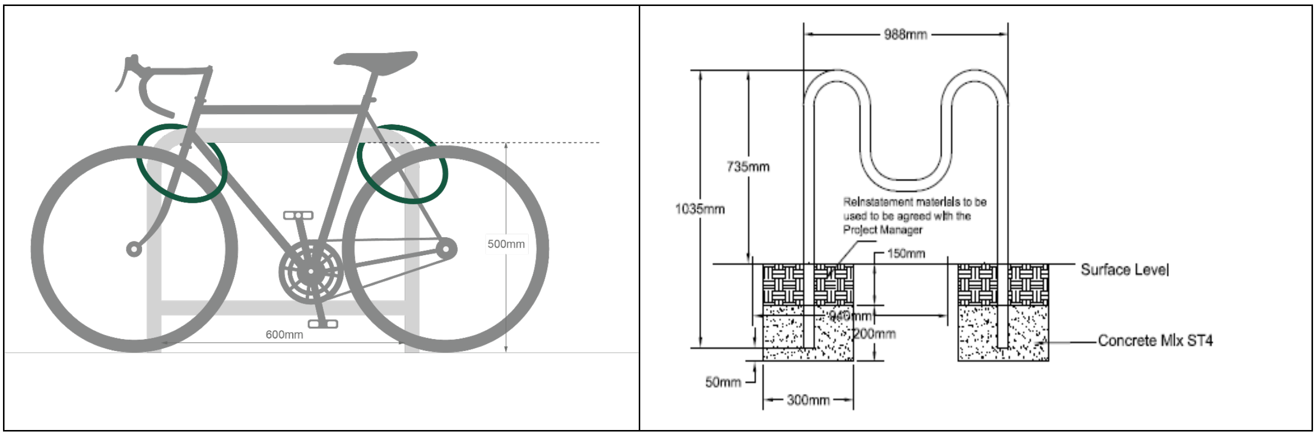
10.3.1 Improvements to cycle routes may help to stimulate new cycle journeys, leading to cycles being parked in areas where there was previously no demand, as well as breaching the capacity of existing sites. The cycle route design process should therefore identify the main attractions along a route (shops, schools, workplaces, public transport interchange) that would benefit from an increase in security or capacity of cycle parking.

10.3.2 Existing cycle parking areas should be monitored on a regular basis so that capacity can be increased in response to demand. Cycles that are abandoned in public cycle parking stands can be removed periodically by the landowner (e.g. highway authority). There is a statutory period during which a notice is fixed to the cycle to give the owner chance to retrieve it prior to removal.

In rural areas, particularly where there are no nearby rail services, bike-bus may be an option (Adrian Lord)

10.4 Design details

10.4.1 **Form of stand**. The preferred and simplest form of cycle parking is a Sheffield stand. Trials by Transport for London suggest that an 'M' shaped design offers increased security compared to a plain hoop by making more points available to lock both the frame and wheels with a single lock, and more options for securing smaller wheeled cycles. A cycle stand design should enable users to secure both wheels and the frame of a standard cycle. Stands on the end of a row within a footway can include a tapping rail and hi-viz bands to make them easier for blind and partially sighted users to detect. In any case, the stands should not be placed directly in main pedestrian desire lines.



Stand designs should enable both wheels and the frame to be secured

10.4.2 **Dimensions and spatial requirement**. M stands or regular Sheffield stands should be no more than 0.75m high (to the top of the rail) and 0.6 to 1m long. Cycle parking stands should be at least 0.6m from adjacent walls and kerbs to allow for the overhang of the wheels, and require at least 1.0m clear space in front to allow for bikes to be wheeled into the stand. Stands should be at least 0.8m apart (1.0m preferable for ease of use) to allow adequate space for both sides of the stand to be occupied. Double decker (two-tier) racks require a ceiling height of 2.7m and at least 2.5m clear space in front of the stands for loading. Stands may be placed in echelon style at 45 degrees to the kerb which may be helpful when locating them in former car parking bays or between build outs so that cyclists do not have to stop and dismount within the main carriageway.

Retrofit parking hoop at Paradise Circus, Birmingham. This design can be fitted to existing guardrail, sign poles and other street furniture to offer more secure locking points.

Cycle parking integrated into design of a Dutch railway station.

Stands arranged parallel to kerbs can enable longer cycles and trailers to be parked

10.5 Short Stay or Long Stay?

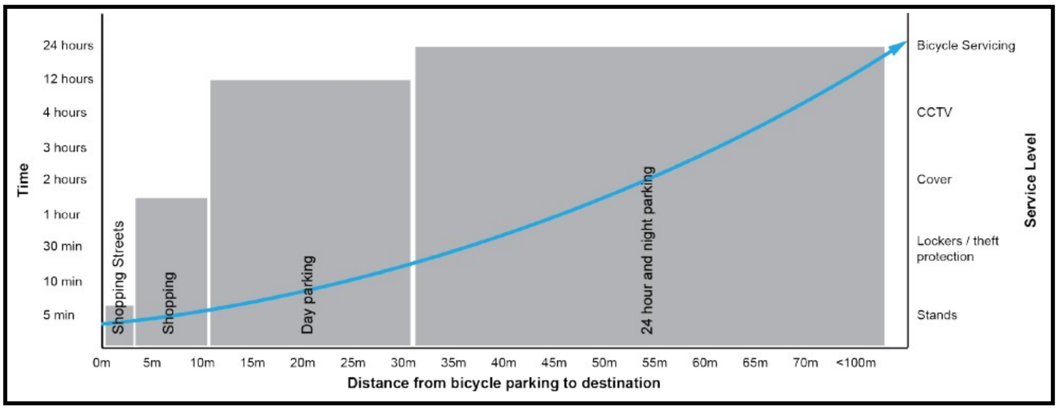
10.5.1 Users will typically be prepared to trade off convenience for security features depending on the duration of stay. Locations can be made more attractive by offering additional services or a higher level of security.

10.5.2 On street cycle parking is primarily for short-stay visits where convenience is the primary consideration. It is therefore better to have several parking areas scattered throughout a locality close to shops, offices and public buildings rather than one large central base. Stands should ideally be in areas with high footfall to help deter theft, and may also have CCTV cover where available. Stands should be close to the main entrances of buildings to enhance convenience. They should be accessible straight from the nearest cycle route.

10.5.3 Covered and off-street parking is better for longer stay. For example, the cycle stands within Birmingham's Mailbox underground car park offer relatively secure parking that is well lit and monitored by CCTV. CCTV coverage should also be of sufficient resolution to enable local Police (or British Transport Police) to secure convictions in the event of a recorded theft. Crime Prevention Officers and reputable suppliers can advise on these issues.

10.5.4 Good lighting to highways standards will help to deter thieves and is both reassuring and convenient for users when locking or retrieving cycles after dark, helping to reduce the fear of crime.

10.5.5 The location of cycle parking within buildings should be easily accessible, step free and with enough space to turn the cycle when going in and out. The space between stands should be sufficient to enable the user to get in and out to lock the bike, for bags to be attached, and children to be placed in seats.



Relationship between convenience and additional security - long and short stay

Two-tier stands enable more cycles to be stored within a given footprint but need additional aisle width for loading

A range of additional services is usually available at a cycle hub (see 10.9)

10.6 Legal Issues for cycle parking within the highway

10.6.1 Part IV of the Road Traffic Regulation Act 1984 allows for the provision of off-street parking places for vehicles and authorises the use of any part of a road as a parking place. These powers are extended by Section 63 of the Act to allow provision "in roads and elsewhere of stands and racks for bicycles". A single order under this act can be used to cover cycle parking within the highway in the whole of an administrative area. However, all the individual sites must be set out in the mandatory accompanying Schedule.

10.6.2 In pedestrianised streets, section 115B of the Highways Act 1980 (inserted in Schedule 5 of the 1982 Act), provides for a local authority to place objects or structures on a highway for the purposes of providing a service for the benefit of the public or a section of the public. Where pedestrianised highways have been introduced under section 249 of the Town & Country Planning Act 1990, this also gives local authorities the powers to place objects or structures on the highway.

10.6.3 If waiting and loading restrictions are in force, cycles (like other vehicles) may not be legally parked on the carriageway or the footway. Where such restrictions are in force, cycle parking can be permitted through an exemption within the existing waiting and loading orders, or by additional orders designating part of the road for cycle parking only.

10.7 Cycle Hubs

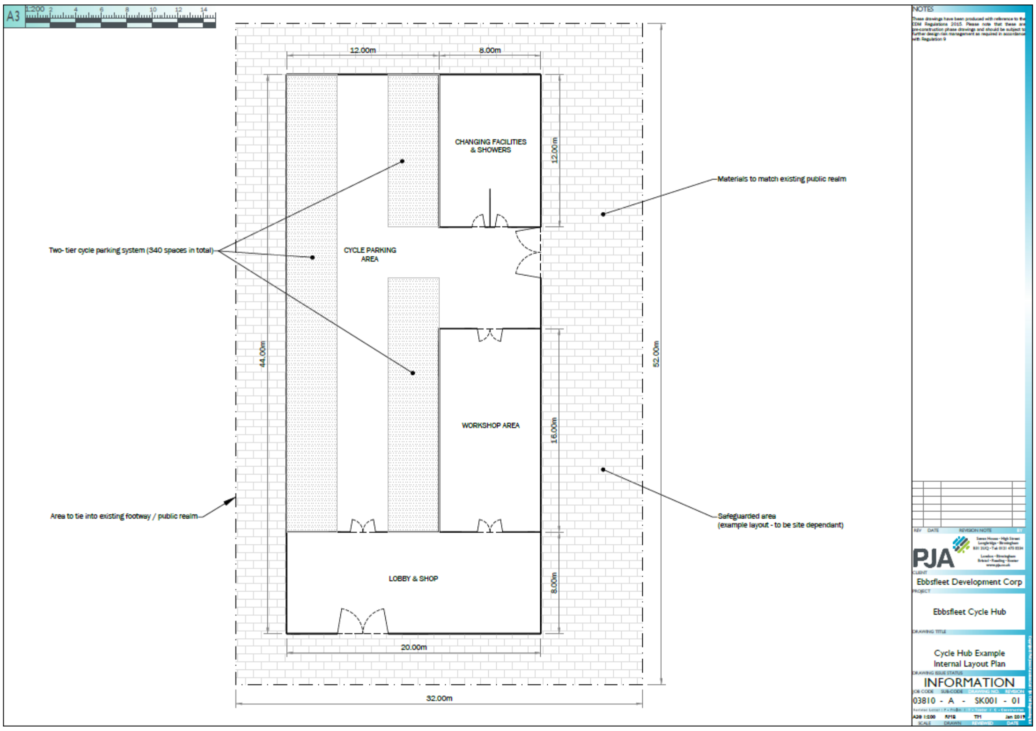
10.7.1 Cycle Hubs offer secure cycle parking that is usually staffed or accessed via a smartcard or membership scheme. Registration adds a layer of security, but it also represents an additional barrier to use, particularly for occasional users, so it should be easy to obtain whatever means of access is used. This may simply be an electronic travel card that is also registered to use the hub.

10.7.2 A hub may offer other facilities such as a repair workshop, cycle hire, café and information centre, and these can be important to make a viable business model. Some hubs at rail stations have a ticket machine, departure screens and direct access to the platform. Some hubs offer showers and changing facilities, and one chain of hubs is also linked to gym membership.

10.7.3 As with other cycle parking, at least some of the spaces in the hub should be accessible to people with larger cycles such as tandems, tricycles and quadricycles.

Parking for non-standard bikes within Malmo rail station cycle hub (Adrian Lord)

10.7.4 Staffed hubs are suitable for public transport interchanges and other city centre locations where there is likely to be good demand for repair and maintenance services that will supplement the cycle parking business. The success of Ealing Broadway's facility in west London suggests that there will be growing demand for unstaffed suburban hubs at district centres, park and ride sites and railway stations so long as they are secure locations that are convenient for the onward destination (such as a station or workplace).



Typical cycle hub layout with parking and servicing areas

Secure access cycle hub at Coventry railway station (Adrian Lord)

Secure smart card access, CCTV monitored, suburban cycle park, Selly Oak station, Birmingham

10.8 Residential Cycle Parking

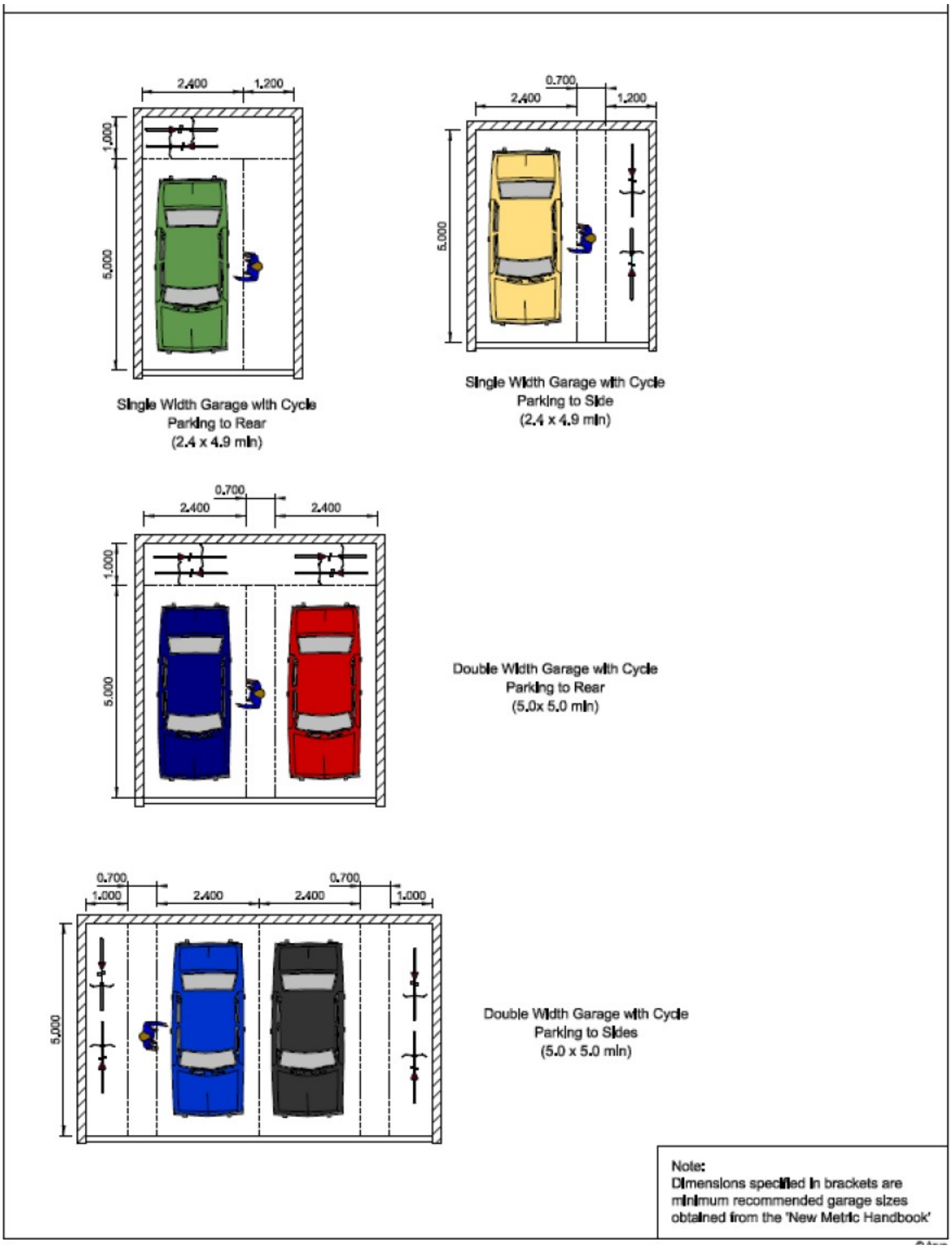
10.8.1 Lack of secure (and convenient) storage at home is a barrier to cycle use. Cycle parking should be incorporated into the design of new-build housing. It is important that residential cycle parking is secure and dry, with access restricted to legitimate users. It may be within individual dwellings or in a communal area such as a secure basement (or section of a basement car park). In established residential areas it may be possible to refurbish parts of existing buildings or to introduce new on-street cycle parking to create secure-access facilities.

On-street hangar in terraced residential area, Lambeth

Most Secure Option	Internal parking area within private residence, easily accessible from street
	Parking within private garage area of property
	Cycle parking shed/store/locker within curtlidge of individual residences e.g. garden (n.b. must not require access through house)
	Shared secured cycle parking store for up to 12 households
	Shared secured cycle parking store for more than 12 households
	Shared cycle parking store, no controlled access
Least Secure Option	Outdoor cycle shelter accessible from public street

Options for provision of residential cycle parking in new development

10.8.2 Where new housing incorporates a garage facility, providing additional space within the dimensions of the garage is one way to provide space for cycle parking. The diagram below is based on the standard dimensions for garages in the New Metric Handbook for architects, plus additional space for cycle parking.



Space for cycle parking within a residential garage (Arup for TfL)

10.9 Maintenance and Repair

10.9.1 Cycle parking may be accompanied by additional services. These can include on-street mapping, such as a totem showing the immediate local streets and onward destinations (and public transport information at interchanges). On-street maintenance facilities such as tools, air pumps and charging points for E-Bikes may be offered in some locations.

On street cycle pump, Brugge

Cycle toolkit in public cycle parking shelter

Cycle repair shop on site of former parcels office, Sheffield station

Table 9: Example Cycle Parking Standards[10]

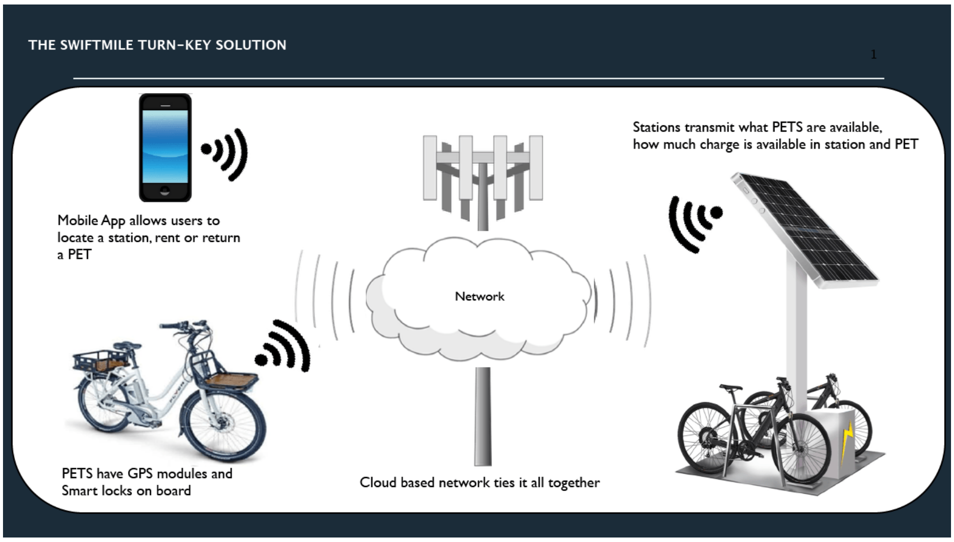
Use	Minimum Standard
Flats, apartments and houses	- 1 space per bedroom up to 3 bedroom dwellings - then 3 spaces for 4 bedroom dwellings, 4 spaces for 5 bedroom dwellings etc - some level of visitor cycle parking, in particular for large housing developments
Hotels and guesthouses	1 space for every 2 members of staff and 2 spaces for every 10 bedrooms
Student residential accommodation, residential schools, college or training centre	2 spaces per 4 bed spaces 1 visitor space per 10 bed spaces
Nursing Homes	1 visitor space for every 10 residents and 1 space for every 2 members of staff
Retirement homes	1 space for every 8 residents and 1 space for every 4 members of staff
Public houses, restaurants, wine bars and private clubs	1 space for every 20 m^2 of dining or bar area
Food retail	1 space per 25 m^2 GFA1 up to 1500m^2 thereafter 1 per 75m^2
Comparison retail	1 space per 300m^2 for developments <1000m^2 1 space per 400m^2 for developments >1000m^2
Financial and professional services.	1 space per 30m^2 GFA to include some visitor parking
Offices and flexible business use.	1 space per 250m2 for developments <1000m2 1 space per 400m2 for developments >1000m2
General industry and warehousing.	1 space per 500m2 for developments >1000m2 1 space per 400m2 for developments >1000m2
Higher and further education and schools.	Cycle spaces to be provided for 50% of children between 5 and 12 and 75% of students over 12 years. 1 space for every 4 members of staff
Museums and galleries	1 space for every 4 members of staff Visitors: on merit
Sports and recreational facilities and swimming baths	1 space for every 25 m^2 net floor area or 1 space for every 10m^2 of pool area and 1 for every 15 seats provided for spectators
Places of assembly including cinema, theatre, stadia, auditoria and concert halls	1 space for every 4 seats
Doctors, dentists and health centres.	2 spaces per consulting room and 1 space for every 4 professional members of staff
Hospitals	1 space per 10 staff
Rail stations, Metro stations, Bus stations	Space for 5% of daily passenger entrants

[10] These standards based on Cambridge. Designers should check the latest local SPD from the relevant planning authority

10.10 Public Bike Share and Cycle Hire

10.10.1 Public bikes are a form of transport for short journeys. Schemes are particularly suited to central urban areas with high density of development that ensures sufficient public demand for short journeys. Typically, an individual cycle needs to be used at least three times a day for a public bike scheme to be viable in the long term. Some schemes also offer e-bikes. The London scheme has over 350,000 subscribers and attracts up to 1.2m journeys per month. A much smaller scheme launched in Cardiff in 2018 has proven successful, with up to 5,000 hires per week in the initial fleet of 350 cycles.

10.10.2 There are various commercial models in operation but from an infrastructure perspective the two most common are docked schemes, where cycles are kept at fixed on-street locations and released and returned via an on-street locking terminal, and dockless systems where the lock mechanisms are integral to the cycle and are released and locked by a smartphone app.



Concept diagram for e-bike hire system with docking stations (Swiftmile)

10.10.3 Docked schemes require dedicated flat spaces to be provided within the highway, and with an electricity supply (although some use solar charged battery), space for the docking stations and safe access for users. Finding suitable spaces to locate docking stations can be problematic when road space is restricted or in demand for other kerbside activities. The advantage of docked systems however is that the bikes are always parked at known sites that are safe for the cycle users and not impeding other road users. The cycle hire operators also need space for their back-office and maintenance facilities, and to move cycles around between the stations in response to patterns of demand. Permissions are required from the highway authority (and other land-owners where docks are located such as Network Rail).

10.10.4 Dockless schemes enable cycles to be parked anywhere (within a geo-fenced area) but this can create problems of inconsiderate parking on footways and on private land, and the bikes themselves can be prone to theft and vandalism. Dockless systems also need some maintenance staff and relocation of cycles to work efficiently. Schemes have been withdrawn in Manchester and Sheffield due to ongoing problems.

10.10.5 Both systems provide an opportunity for commercial partnerships and advertising contracts to help subsidise or cover the costs of operation, which can be significant as the work tends to be labour intensive.

Dockless bike released by mobile app system

Bar-code used to ensure dockless bikes parked in dedicated geo-fenced areas to reduce inappropriate parking on footways (user is automatically fined if bike is not returned within a dedicated parking area)

11 Signs

11.1 Principles

11.1.1 Cycle routes and facilities will require both appropriate signage and/or surface markings reflecting, when present, Traffic Regulation Orders and Notices, along with information signs, warning signs and direction signage. Highway signage needs to comply with the 2016 edition of the Traffic Signs Regulations and General Directions (TSRGD). Routes away from the highway can be way marked with other types of sign (wooden finger post park signage or cast-iron canal signage) but these should make it clear where cycling is permitted and ideally include information about distances, destinations and of course direction.

11.1.2 Signs should generally follow the broad principles of:

- High quality
- Conspicuous
- Legible
- Coherent
- Consistent
- Frequent
- Well maintained

11.2 Design requirements

- Signing should always be kept to the minimum to reduce street clutter and maintenance costs.
- The size of a sign and x heights should be appropriate to cyclists and/or drivers needs depending on the purpose of the sign (normally at least 30mm within the highway but may be smaller on off-carriageway routes and away from the highway – see TSRGD).
- Sign poles and lighting columns should never be placed in the centre of a cycle track (other than signs mounted on bollards). Ideally posts should be 0.5m clear of the cycle track surface but if this cannot be achieved, placed at the back of the cycle track or footway.
- Mounting height should be at least 2.1m above pedestrian surfaces and 2.3m where the sign overhangs a cycle route.

11.3 Mandatory & Information Signing

11.3.1 The respective diagram numbers refer to those specified in the Traffic Signs Regulations and General Directions (TSRGD), 2002. Designers should refer to the latest edition. Careful positioning of signs associated with cycle facilities is required to comply with siting requirements, to maximise visibility and minimise street clutter. Size and illumination requirements for Diags 955, 956 and 957 were relaxed in 2013 to reduce street clutter.

Diag. No (TSRGD)	Description	Details
 955	Route for cycles only	Cycle tracks that are segregated from both motorised traffic and pedestrians

Diag. No (TSRGD)	Description	Details

   956	Shared pedestrian/cycle route	Unsegregated shared cycle/footways and variants to include use by horses
 957	Shared pedestrian/cycle route	Segregated shared cycle/footways
 886	Shared space for all highway users	
 958.1	Start of with-flow cycle lane	Mandatory cycle lane only
 959.1	With-flow cycle lane	For use with mandatory cycle lane only. Diagram 967 may be used for an advisory lane.

 960.1	Contra-flow cycle lane	On one-way street with mandatory contra-flow cycle lane.
 960.2	Contra-flow cycling (advisory lane or no lane)	On one-way street where contra-flow cycling is permitted. It is permitted to use the No Entry Sign Diagram 610 and 'Except Cycles' plate Diag 954.4 at the start of an unmarked contraflow.
 961	Time qualifying plate	Beneath Diagrams 958.1 and 959.1 as appropriate.
 962.1	Cycle lane at junction or crossing	Warns road users of potential conflict with cycle route. Generally unnecessary except for situations where contra-flow cycling is permitted.
 962.2	Contra-flow bus and cycle lane at junction	Warns road users of potential conflict with cycle route.
 963.1	Pedestrian sign for cycle route crossing	Warns pedestrians of potential conflict with cycle route. Generally unnecessary except for situations where contra-flow cycling is permitted.
 966		Permitted variants of Diag 966

 967	Route recommended for cyclists on main carriageway	Advisory cycle route or lane. Can be used in conjunction with Diag 1057 and no lane markings

11.3.2 Since January 2012 it has been permissible to use the Except Cycles plate in conjunction with No Entry, No Right/Left Turn, No Through Road, and signs to indicate mandatory turns for vehicles. A TRO is required in all cases.

11.3.3 A map type explanatory sign can be used where the cycle route leaves the carriageway on a different alignment to that of on-carriageway traffic. The sign below is a variant loosely based on Diag 2601.2. TSRGD 2016 now permits map type signs for cycle routes and facilities.

Map type sign, London

Diag. No (TSRGD)	Description	Details
1001.2a and b	Advanced Stop line for Cyclists (ASL). Variants with or without a gate or feeder lanes.	Box may be 5.0m or 7.5m long.
1003	Give Way line	When used across cycle route, 300mm (half size) long marking to be used
1004	Advisory Cycle Lane bounding line; or Centre line on 2-way cycle track	4.0m line, 2.0m gap, 150mm wide
1009	Taper at start of cycle lane; or Back of cycle lane across side road	600mm long marking to be used
1009.B	Edge of the carriageway at junction of a cycle track and another road.	300mm marking with 150mm gap
1010	Cycle lane crossing side road	Use where a mandatory cycle lane crosses a side road.
1014	Swerve arrow where vehicular traffic is deflected by cycle facilities	Use variant appropriate to traffic speed
1023	Give Way triangle	Use 1.875m (half size) variant on cycle track

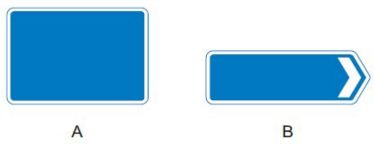
Diag. No (TSRGD)	Description	Details
1040.2	Safety buffer hatching	Used to define safety buffers, minimum width 500mm if bounded on one side only (e.g. adjacent to kerb)
1041.1	Safety buffer hatching	Used to define safety buffers, minimum width 500mm adjacent to parking or loading bays.
1048.1/1048.4	Cycle/Bus Lane	Use in contra-flow or shared cycle/bus areas only
1049	Boundary between mandatory cycle lane and traffic lane	150mm continuous white line
1049.1	Boundary between pedestrian and cycle sections of a shared segregated cycle/footway or path.	150mm continuous white line, trapezoidal in cross section, 12mm to 20mm in height
1055.3	Elephants footprint marking of cycle track alongside zebra or at signalled crossing	250mm min, 400mm max square shaped marking
1057	Cycle symbol	1.215m variant used within defined cycle facilities and shared streets (does not require associated upright signs from 2016); or 1.78m variant used at Advanced Stop Lines (forms an integral part of the ASL marking)
1059	Direction arrow	Use 2.0m variant in vicinity of junctions, 1.0m elsewhere

11.4 Direction/Destination Signs (Wayfinding signage)

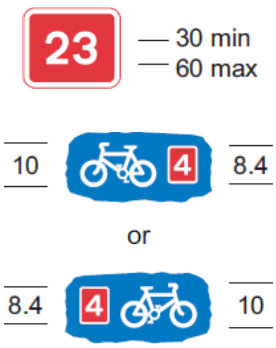
11.4.1 The following signs are the most commonly used for cycle routes. Signs should always be used sparingly to minimise maintenance costs and street clutter.

11.4.2 TSRGD permits a smaller x height of 25mm for lettering on cycle and pedestrian direction signs to enable smaller sign plates although this size is probably only suitable for quiet and low-speed off-road routes where people can read the smaller letters. TSRGD permits the use of local route branding patches on direction signs as well as National Cycle Network branding. Recent changes pertaining to direction signs which replace former Diagram numbers to enable signs to be made up of various elements are summarised below:

- New system for sign layouts (Schedule 12, parts 1-28)
- Minimum letter x height for cycle direction signs is now 25mm (was 30mm)

Sign placed on a road, other than a motorway, showing routes for cyclists (Type A and B)		1. An x-height that is not less than 25 mm and not more than 60 mm 2. The background may be varied to brown when the sign shows only tourist destinations or leisure facilities

Identification numbers of routes (Diag 2606.2) may include capital letters. If not a national or regional route, route number and patch (Diag 2602.3) may be in any contrasting colour – opening options for routebranding.

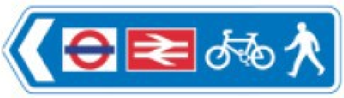


11.4.3 Designers may explore whether signs can be placed on existing street furniture to reduce the need for additional poles. Where cycling is on carriageway the signs may be incorporated (as shown in Diags 2105.1 and 2106.1 below) into general traffic signs and do not necessarily need to be separate, thereby reducing street clutter. Rectangular advance signage (to warn and allow cyclists to position themselves for a manoeuvre) along with ‘at- junction’ flag signage is good practice. ‘Reassurance’ signs after a junction are also welcomed by users.

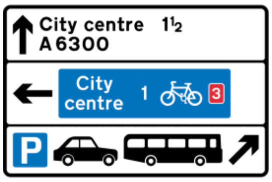
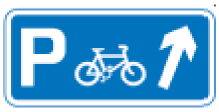
11.4.4 Wayfinding signage has a dual role. It informs users of the route but also promotes the route, making potential/target users aware of its presence as an alternative to the transport mode they are currently using. Careful sign placement can allow one set of signs to be usable by existing and potential/target users. Carefully aligned signs can serve on-route and cross-route users. Consideration of the (often crossing) highway routes that potential/target users are using and the direction in which they come from can inform sign placement.

11.4.5 Wayfinding signage indicates a recommended route, i.e. the cycling experience or Level of Service matches what one would expect for given traffic conditions. Wayfinding signage will be more appropriate to lesser known alternative back-street or traffic-free routes. It is possible to indicate that a route is a 'Quietway'. On busier roads, conventional highway wayfinding signage can play a part in directing cyclists. Links with quieter routes will require signage as will link sections of main roads where they form part of longer routes.

11.4.6 It will be likely that links to a route from surrounding origins such as residential areas and from the route to nearby destinations will need to be signed. A route provides for a range of journeys along its length and the corridor it serves. Designers need to be mindful of the quality of any recommended (signed) link given the capabilities of the design cyclist.

Diag. No (TSRGD)	Description	Details
 2602.1	Direction of cycle route at junction. Distance or journey times may be placed on sign.	
 2602.1	Permitted variant. Route branded sign with times instead of distance.	Permitted on all cycle route only signs from January 2012
 2601.1	Direction of cycle route/s ahead. Times may be shown on signs instead of distance.	Permitted on all cycle route only signs from January 2012
 2601.1	Sign to indicate direction of route ahead. Destinations omitted.	
 2606	Direction to railway station	

 2105.1	Junction of cycle route off non-primary road	

Diag. No (TSRGD)	Description	Details
 2106.1	Junction of cycle route off non-primary road	
 2603	Direction to cycle parking	
 2604	Direction and distance to cycle parking	

12 Construction and Maintenance

12.1.1 This chapter deals with the construction, maintenance and management of a pedestrian or cycle facility.

12.2 Description

12.2.1 Close attention to construction and maintenance standards will ensure that routes used by pedestrians and cyclists are comfortable for all users, including those with mobility, sensory or cognitive impairments, as well as being legal, aesthetically acceptable, easy to maintain and durable.

12.2.2 It is important to consider the full life costs and benefits of a scheme. Certain options may require increased initial capital expenditure but this investment may result in lower maintenance and management costs. It is only by considering planning, design and street management as a whole that user needs can best be met. For example, construction costs for a sealed surface path are higher than for an unsealed path, but this is often false economy once maintenance requirements are included.

12.3 On-carriageway cycle routes

12.3.1 The typical choice for the carriageway is an asphalt surface. Asphalt used for roads and paths contain bitumens and aggregates which give a durable, joint-free surface that is relatively straightforward to construct and maintain and meets the skid resistance requirements for motor traffic. Different products are available, each with their own properties. The main variables are the aggregate size, aggregate content, binder content and binder grade, which influence stiffness, resistance to cracking and other physical properties of the asphalt. The smoothness of the riding surface tends to be dictated by the texture depth of the asphalt – the higher the texture depth, the rougher the surface and vice-versa.

12.3.2 Asphalt surface treatments for carriageways generally come in one of two forms:

- HRA, hot-rolled asphalt, with or without precoated chippings, was the UK surface material of choice before the 2000s. Its use has been in decline especially in urban areas due to the positive textured nature of this material, which means it generates more noise than some other treatments. For HRA with pre-coated chippings, hard- stone (often granite) chippings are rolled into the asphalt surface course while it is still hot. They add texture to the surface and therefore increase its skid-resistance properties. The chippings are pre-coated with a binder, which can contain coloured pigment if necessary. They must be hard-wearing but with a high polished stone value (PSV), so that they are durable and do not polish over time. A typical choice for carriageway surfaces would be HRA 35/14 but other carriageway and footway grades exist.

- TSCS, a thin surface coarse system, is often applied to carriageway rather than footway surfaces. It typically uses a 10mm or 14mm aggregate. The advantage of using TSCS is that these materials come in a variety of texture depths and colours. The use of clear bitumens and coloured aggregates allows these materials to be used as decorative asphalts. Use of such decorative asphalts is not recommended in areas of load unless assurances are sought from material suppliers. Note that proprietary types of TSCS have replaced generic SMA (stone mastic asphalt).

12.3.3 The use of all these materials is described in the European Standard Specification EN13108 and thicknesses should be specified using the British Standard BS594987: 2010, Asphalts for roads and other paved areas – specification for transport, laying compaction and type testing protocols, in conjunction with the local highway authority's design and construction standards. Full guidance on using the British Standards is provided in PD 6691 Guidance on the use of BS EN 13108 Bituminous Mixtures - material specifications (BSI, 2010).

12.3.4 Wherever possible, routes for cyclists should be machine-laid rather than hand-laid, which is not so smooth. A smooth surface provides a significantly easier and more comfortable ride and is a very important component of the cycling experience.

12.3.5 Modifications to the surface may be required to incorporate cycle lanes, advanced stop lines, or traffic speed control measures (traffic calming). Dimensional tolerances should follow normal highway standards, and when a new on-road cycle route is installed a check should be carried out to confirm that this is the case.

12.3.6 Where kerb re-alignment is needed any new carriageway construction should be to normal highway standards unless there is kerb segregation of the cycle lane, when a lighter construction should be used, although surface quality should still be to highway standards. In the case of carriageway widening this can entail the relaying and/or protection of utilities plant (electricity, gas, water, foul and surface water drainage, telephone, cable TV etc.)

12.4 Coloured surfacing

12.4.1 In most situations black bituminous surfacing in conjunction with cycle logos and appropriate lane markings is satisfactory and colour should be used sparingly. Extensive use of coloured surfacing is not recommended for aesthetic and maintenance cost reasons. Poorly maintained coloured surfacing can pose an additional hazard for cyclists. Buff coloured bonded aggregate and some buff-coloured asphalt has been used on local off-highway routes such as the canal towpaths. Blue-coloured surfacing is being used on segregated cycle routes along main roads in Birmingham.

12.5 Footway construction

12.5.1 Footway construction should be of sufficient depth to withstand the loads likely to be imposed on it, which may include occasional access for maintenance vehicles in some locations.

12.5.2 Consideration should be given to the likelihood of accidental or intentional overrun of a footway by heavy vehicles and the thickness increased accordingly. The construction at vehicle crossovers may need to be thicker than the adjacent lengths of footway depending on the nature of the crossover. Cracking or rutting of surfaces due to overloading can be unsightly, create trip hazards and/or drainage problems. The construction specification for footways, footpaths and cycle tracks is contained in DMRB HD39, Tables 3.1 to 3.4.

12.6 Footpath and cycle path construction away from the highway

12.6.1 Where a footpath/cycle track is constructed away from the highway, consideration should be given at the design stage to the practicalities of constructing the path, in particular access arrangements for construction vehicles. Access points to some paths can be several hundred metres away and may require material to be moved by dumper truck. This might be satisfactory for moving sub-base materials, but keeping tarmac hot enough to lay properly may be a concern. Additional access points may need to be constructed, and the path may need to be able to carry plant associated with the works.

12.6.2 Where a footpath also serves as an access route for maintenance vehicles e.g. adjacent to waterways, the surfacing and construction of the path needs to reflect this.

12.6.3 It may also be appropriate to thicken sub-base layers, or use geotextile materials if necessary where ground conditions are poor. Where paths use land that is contaminated avoid excavating in these circumstances and lift path levels if areas are unavoidable. Grass-crete (or similar cellular products) may also offer a solution for unstable surfaces.

12.6.4 If the path is to become adopted highway it will need to be constructed to local highway standards.

12.6.5 A bitumen bonded aggregate finish (tar-spray and chip) is used locally on canal towpaths and open spaces. This is for reasons of aesthetics and /or issues of lower maintenance costs.

12.7 Cycle Track Construction

12.7.1 One of the reasons why some cyclists use the main carriageway in preference to a cycle track alongside the carriageway is that the riding quality of the main road carriageway is better. The riding quality of the cycle track should be at least as good as that of the adjacent road and should be machine laid.

12.7.2 Among the most important considerations in choosing an appropriate surface material are cost (and variation by colour), durability and skid resistance. Polished stone value (PSV) gives a measure of skid resistance. A PSV of 55 is normally acceptable for road skid resistance. Table 10 below shows a comparison of different surface materials and treatments according to these criteria.

12.7.3 Laying costs can vary considerably depending on the area (m2) and the required traffic management arrangements – difficult and restricted access are likely to increase costs. The cost per square metre will also be higher for smaller areas.

Table 10: Surface treatments for cycle routes

Surface Material[1]	Life (years)	Skid resistance (PSV)
6mm asphalt concrete	20	60+
Coloured TSCS, 30-50mm thick	20	55+
Block paving	20	55
Brick paving	20	-
Concrete paving flags	10	-
Tactile paving	10	-
York stone flags	20	-
Granite paving flags	20	-
Thermoplastic High-Friction Surfacing	4-6	70+
Resin High-Friction Surfacing	8-10	70+
Cycle Track Veneer (thermoplastic slurry)	5	55+
Cycle Lane Veneer (polymer binder)	10	55+
Slurry Seal (poor colour and life)	5	55
Surface Dressing - Granite Stone (bituminous binder)	20	60+
Surface Dressing - Granite Stone (clear binder colour enhance)	20	60+
Surface Dressing - Pea Shingle Stone	20	50

12.7.4 The preferred surfacing is machine laid bituminous material, although bound or unbound aggregate, concrete or stone flags or paving blocks are sometimes used. Unbound aggregate surfaces are generally unsuitable in an urban / urban fringe environment as they cause excessive dust in dry weather and can be susceptible to ponding and become muddy in wet weather, leading to rapid deterioration. This also makes them unsuitable for regular commuting cyclists due to repeated dirt and damage to clothing and machinery.

12.7.5 Generally paving blocks and concrete or stone flags will provide a more aesthetically attractive finish and are more suited to high quality public realm areas, but are less comfortable to cycle on and more expensive to maintain.

12.7.6 There may be local sensitivities around surfacing of paths with black bituminous material in areas of high heritage value or green spaces and these should be considered and addressed as part of the consultation; however, there is often little argument once a path is finished and open. If necessary, paths can be surface dressed with appropriate materials.

12.8 Tactile paving

12.8.1 Tactile paving is provided on walking routes to assist visually impaired people in moving around an area and on segregated shared-use routes to enable them to navigate safely, preventing them from walking into the cycle track inadvertently. Types of tactile paving used and their typical uses are listed below in Table 11. The most common form of tactile paving provided in association with walking routes is blister type tactile paving at road crossings. Ladder and tramline paving is used where cycle and pedestrian facilities are adjacent.

12.8.2 Guidance on the provision of tactile paving is set out in the Department of Transport publication 'Guidance on the Use of Tactile Paving' and 'Inclusive Mobility' on the use of tactile paving surfaces' and reference should be made to those documents when specifying tactile paving. (NB This guidance is subject to revision in 2019 – refer to the latest guidance)

12.8.3 Current national guidance covers simple layouts but does not give detail for the wide variety of layouts that are encountered in reality. For non-standard layouts engineers need to apply the principles contained in the guidance and consult with local groups representing the visually impaired during the design process.

Table 11: Common Tactile Paving Types for Pedestrian and Cycle Areas

Type of tactile paving	Typical usage	Typical example
Blister (red coloured)	Signalised pedestrian crossing facilities, including zebra and toucan crossings	
Blister (buff coloured)	Uncontrolled pedestrian crossing facilities	
Corduroy	Where a footway joins a shared use path, top and bottom of steps or other hazard	
Ladder/tramline	Start, end and repeater indication of segregated footway/cycleway (ladder on footway side and tramline on cycleway side)	

12.9 Kerbs, edgings and verges

12.9.1 Footways may require some form of edge restraint to maintain their structural integrity. Where a footway is not adjacent to a wall or building this can be provided by an edging strip. Edgings are generally formed from precast concrete units. Any edge treatment will increase the overall cost - pre-cast concrete kerbing roughly doubles the cost of a path.

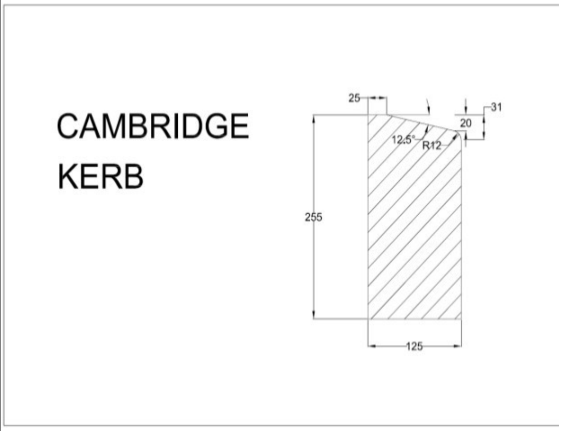
12.9.2 Where a footway is provided adjacent to a road the footway will normally be delineated from the adjacent carriageway with a kerb. This offers a degree of protection to pedestrians and can assist blind or partially-sighted pedestrians identify the edge of the footway.

12.9.3 In low vehicle speed environments where a 'shared space' is being created it may be appropriate to omit the kerb. In these cases, the impact of not providing a kerb on blind or partially-sighted users should be considered with appropriate use of tactile paving, or a low kerb upstand be retained.

12.9.4 Kerb heights should be as set out below.

Table 12: Kerb Heights

Location	Upstand	Typical example
General	75mm to 125mm Half battered profile adjacent to footway Splayed (45°) where no adjacent footway and on high speed roads	
Pedestrian or cyclist crossing	Flush with tactile paving Any upstand makes it more difficult for wheelchair users	

Location	Upstand	Typical example
Vehicle crossover	25mm To maintain continuity of edge of carriageway drainage and provide a continuation of the line for blind or partially-sighted pedestrians.	
Stepped cycle track	20mm This kerb profile has been developed in Cambridge to reduce risks of catching a wheel on the edges of stepped cycle tracks, making it easier to enter and leave the track.	

12.9.5 Edgings are generally formed from precast concrete units but in lightly used situations away from the highway timber edges can be used. An alternative to kerb edgings in locations away from the highway is to construct the sub-base and binder course 300mm wider than the path, providing a 150mm shoulder on either side to support the path.

12.9.6 Where a footway or cycle track is provided adjacent to a higher speed, or more heavily trafficked road the footway should be separated from the adjacent carriageway by a verge, typically at least 1m in width, to provide a margin between the active travel path and vehicular traffic. In most cases this margin is likely to be grassed.

12.9.7 A mown verge of 1m should be maintained each side of a cycle track, as mown edges prevent the vegetation encroaching onto the useable width of the path. The remainder of the verge may be left and can be of value to wildlife.

12.10 Drainage

12.10.1 Standing water and poorly-designed surface water run-off can cause problems for pedestrians and cyclists users and seriously damage pavement construction. Keeping water off and moving it away from a carriageway or path will increase the longevity of the pavement structure and increase its use. Any drainage system needs to be efficient and reliable and may need to extend beyond the immediate edges of a new path to be effective.

12.10.2 Where water comes from and how it is disposed of needs proper consideration. It is important to include proper drainage within a design. Poor drainage can give an impression of a forgotten route and lead to a host of other problems.

12.11 On carriageway drainage

12.11.1 When cyclists are on carriageways, attention will need to be paid to gully location and levels, which are critical for cyclists as well as ensuring good route drainage. This is particularly important where full or light segregation for cycling has been introduced, since cyclists will find it difficult to avoid gullies. Acceptable gully characteristics are as follows:

- In any location where there is a possibility that cycle wheels will cross gullies, the grate slots should be at right angles to the direction of travel. Alternatively, non- slot 'pedestrian style' gratings should be provided.
- no gaps between the frame and cover wider than 15 mm
- recessed gully frames raised to be flush (tolerance +/- 5mm) with the surface
- suitable for their location to take public highway loadings
- open in a manner suitable to be cleansed by a normal gulley cleansing or jetting machine under the relevant highway authority contract

12.11.2 Dished and other gratings unsuitable for cycling across should be replaced. Side-entry gullies or perforated kerb type gullies (e.g. Beany Blocks) may be suitable in some circumstances, particularly where there is restricted width and where cyclists will be close to the kerb.

12.11.3 Fully segregated cycle tracks and hybrid lanes will need additional gullies as well as appropriate falls to facilitate run-off. A minimum grating size of 300 x 300mm is less likely to get blocked than the smaller size gully gratings that are available.

12.11.4 A gully should be provided in the carriageway at the upper side of any pedestrian / cycle crossing to prevent surface water running across the point at which people step into the carriageway.

12.12 Off-Carriageway Routes

12.12.1 Where new routes are being provided, or widened into soft verges consideration should be given to the effects of any increase in the volume of surface water run-off contributing to the existing drainage system. Once taken off the path surface it is essential that water is returned into the system at a suitable location. This requires careful thought and understanding. Simply diverting over land run off or removal of flood water into the nearest ditch or culvert may create problems further downstream.

12.12.2 To prevent ponding of surface water, or the formation of ice, a crossfall or camber should be provided on the cycle path surface within the limits stated in Table 12 below. Excessive crossfall is uncomfortable to walk on and can cause difficulties for wheelchairs, pushchairs and tricycles.

Table 12: Crossfalls

	Crossfall (%)
Minimum	1.5
Preferred	2 – 3.3
Maximum (at crossings)	7

Source: TA90, DMRB and LTN 2-08, DfT

12.12.3 The direction of the crossfall should be set so that surface water does not run-off onto adjacent property where there is no highway drainage along the boundary. Typically, footways will fall towards the carriageway. On cycle tracks the crossfall should generally fall towards the inside of a bend.

12.12.4 Where it is not possible to provide a continuous crossfall across a path, either due to the relative levels between the kerb and the back of the path or the width of the path, it will be necessary to provide drainage channels within the path. Table 13 sets out four options.

Table 13: Drainage Channels on Paths

Measure	Advantages	Disadvantages	Typical example
Dished channel blocks	Easy to maintain	Trip hazard Requires gullies Can result in ponding water Not suitable on cycle routes	
Flat channel blocks	No trip hazard Easy to maintain	Less capacity Requires gullies Can result in ponding water	
Measure	**Advantages**	**Disadvantages**	**Typical example**
Linear channel with gratings	Can avoid having to create a low spot in a surface.	Prone to blocking and silting up Gratings can work loose and cause trip hazards (and additional maintenance cost).	
Linear slot drain	Visually un-intrusive Can have high capacity (in pipe below ground).	Prone to blocking and silting up Must be jetted or rodded to be cleaned adding to cost of maintenance.	

12.13 Access Controls

12.13.1 Access Controls are sometimes placed on off-carriageway routes to prevent access being gained by unauthorised vehicles, particularly motorcycles.

12.13.2 It is recommended that designers should start with a presumption against the use of any form of access control, as these cause difficulties to many legitimate users and are often ineffective in addressing the issues they are intended to address. In particular, restrictive access controls:

- are inconvenient, can be unsightly and can actively discriminate against some user groups who have legitimate rights to use a path.
- extend the journey time for cyclists and so reduce the utility of a cycle route
- add another level of cost, and maintenance concern, to a path.
- are frequently ineffective because fencing along a traffic free corridor is missing, broken or subsequently vandalised so that the access control can be bypassed.

12.13.3 There is also a tendency to install access barriers to stop, or slow, cyclists at the end of a path for safety reasons – whether actual, or perceived. This is often inappropriate, and designers fail to consider other solutions, such as clear signing and (if necessary) other means of slowing cyclists such as changing path geometry.

12.13.4 A single bollard and clear sight lines will be effective in many locations. Double rows of bollards, with a spacing of 1.50m can reduce cycle speeds and prevent car access, whilst retaining better permeability for users than chicane barriers. Adapted cycle for disabled people, tricycles and cycles with child trailers (all with restricted manoeuvrability) require a 'straight-on' approach and gap width of 1.5m. It is not possible for many users to dismount or lift cycles at access controls.

Access Control using bollards, Weymouth (Sus trans)

12.13.5 Sustrans' document "A guide to controlling access on paths" provides detailed information on assessing whether an access control is needed and if so the most appropriate design solutions. It covers:

- Legal issues, including the Equalities Act
- Whether an access control is required
- Alternative measures to control access
- Risk assessment
- Deciding on type of access control required
- Design parameters
- Layout and design solutions

12.14 Fencing and Hedgerows

12.14.1 Fencing may be required along off-highway paths for the safety of users, the security of neighbours and livestock control. Where needed fencing should remain visually unobtrusive.

12.14.2 The installation of fencing has an impact upon all route users, but greater impact upon cyclists as a fence immediately adjacent to the path edge reduces the effective path width by 500mm.

12.14.3 Fence lines set 1.0m away from a path edge will generate a better visual aspect, and where required on both sides of a path reduce the "tunnel effect". Verges will allow space for drainage, and if necessary ducting for lighting.

12.14.4 Security fencing can be harsh and oppressive, creating environments that are visually off putting to pedestrians and cyclists alike.

12.14.5 Under most circumstances 1.5m high fencing is, or should be, adequate in all but exceptional circumstances. To a pedestrian they still provide views over, and the visual and aesthetic impact upon a traffic free route is considerably less.

12.14.6 Hedgerows form part of the immediate environment for many paths away from or alongside the road. Developing routes that include at least one hedgerow as a boundary feature can re-invigorate them as dead wood, brambles and unwanted species are removed and new growth encouraged. Thorny species such as Hawthorn or Dog Rose should be avoided where necessary, but if used will require planting further back from the path edge to prevent hedge clippings causing punctures.

12.15 Lighting

12.15.1 Many walk and cycle journeys will be made after dark, especially during the winter months, and routes should normally be lit to provide an adequate level of safety, both real and perceived. The benefits of lighting a walking or cycling route include enabling users to:

- Orientate themselves and navigate the route ahead
- Identify other users ahead
- Detect potential hazards
- Discourage crime and increase a sense of personal security

12.15.2 It is important that the provision of lighting is considered at an early stage in the design process, so that the issues can be properly considered and the needs of users taken fully into account in the choice of equipment and the design of the scheme. While solar lighting will reduce power consumption costs, it still requires inspection and maintenance and initial equipment costs are higher.

12.15.3 Routes along urban highways will be lit by the existing highway lighting but specific lighting will be needed for off-highway routes. However, in lighting such routes consideration also needs to be given to wider factors, including:

- Limiting levels of light pollution
- Level of ambient brightness in the surrounding area
- The visual impact of the lighting equipment
- Ecological impacts on fauna and flora
- Intrusion on nearby properties
- The needs of visually impaired users for uniform illumination at surface level
- Vandalism issues
- Proximity of electricity supply
- Energy usage and cost
- Costs of installation, operation and maintenance

12.15.4 Further information is available in Sustrans Technical Information Note 12 Lighting of Cycle Paths, 2012.

12.16 Maintenance and Management - Introduction

12.16.1 Maintenance of the path or carriageway surface is of great importance to pedestrians and cyclists, including the proper reinstatement following works by statutory undertakers. For routes away from the highway it is essential to establish responsibility for maintenance of the route, and put into place a regular regime of for visits and minor works.

12.16.2 A progressive asset management policy for highway infrastructure takes a strategic approach to the design, implementation and future management and maintenance of any scheme which considers the whole life cost of the assets that it accrues.

12.16.3 Whole life costing is the systematic consideration of all relevant costs and revenues associated with the acquisition and ownership of an asset. Initial costs include elements such as design, construction and installation. Future costs include all future 'operating costs', such as inspection, maintenance, repair, replacements / renewals, energy, and management over the life of the built asset.

12.16.4 An essential cornerstone of this approach is the development and implementation of an affordable and sustainable maintenance and management regime for new schemes. This approach identifies the optimal allocation of resources for the management, operation, preservation and enhancement of the infrastructure to meet the needs of current and future users.

12.16.5 Having invested the time and money building the route, it is important that it remains attractive and functional to users for its entire lifespan. A route that is kept in good condition will be more useful, attractive and popular than one allowed to deteriorate. Identification of the future costs and sources of funding for maintenance is therefore an essential part of the design process for developing sustainable infrastructure that will be of benefit for years to come.

12.17 Designing with maintenance in mind

12.17.1 Maintenance should be considered as part of the route development process long before construction starts. The future management and maintenance burden, both operationally and financially should be considered at the outset. A thoughtful design will mean less future maintenance making the scheme more attractive and affordable across its lifespan.

12.17.2 To support this, Designers should consider Value Engineering as part of scheme development and a Future Maintenance Audit and Assessment must carried out for each proposed scheme before implementation.

12.17.3 A variety of funding sources may be used to design and develop new routes, for instance as part of large Capital Programmes. Regardless of the source of funding for the design and installation of the route, the source of funding for the future management and maintenance of the scheme must also be identified as part of the scheme proposal, along with the predicted costs for the lifespan of the scheme.

12.17.4 For example, within Birmingham City, the future maintenance and management costs are readily available as the rates per asset form part of its maintenance contract records. This means the future costs of managing and maintaining the scheme can be easily predicted and allowed for within scheme budgets, commuted sums etc. Irrespective of what the ultimate arrangement may be, it is essential that the design team have considered and identified both the design and construction costs and sources of funding, and the future maintenance costs and sources of funding so the whole life cost of the route can be established. Having invested the time and money building the route, it is important that it remains attractive and functional to users for its entire lifespan and this process ensures the development of sustainable infrastructure.

12.18 Maintenance Responsibilities

12.18.1 Most cycle routes will be within highways and subject to regular cleansing and maintenance. Some routes may well be the responsibility of another part(s) of a local authority – for example routes through school land, housing or public parks and open spaces. Some parts of the canal towpath network form an important infrastructure component and are the responsibility of the Canal and River Trust.

12.18.2 Every department with future responsibility for the maintenance of the route needs to agree responsibilities at the outset of the project and allow for them in future budgeting.

12.18.3 Some local parks and former railway greenways also have local volunteer groups supplementing the staff carrying out the bigger maintenance tasks. They provide a hugely valuable role, ensuring the local community is involved in its local path and promoting its use.

12.19 General Maintenance Tasks

12.19.1 Typically, a local highway authority has its own defect intervention criteria as part of the contract with its highway maintenance provider (which may be an external contractor or internal maintenance team), and established safety inspection regimes based on the hierarchical status and functionality of each asset.

12.19.2 The following list, though not exhaustive, gives some indication on the type of defects that affect walking and cycling network safety and serviceability.

Carriageway, Footway and Cycleway surface defects.

- Broken/uneven riding or walking surface with defects meeting or exceeding applied intervention criteria.
- Worn riding or walking surface with suspect skid resistance - where appropriate, testing of the surface should be carried out to ensure adequate skid resistance for traffic expected to use it
- Defective kerbs, edging and channels

12.19.3 On the parts of the cycle network that run within the carriageway any maintenance inspection regime of road surfaces should ensure that the area of the road which cyclists will most probably use (up to 2m from the kerb) receives a closer examination, with hazards in those locations receiving priority attention.

Drainage and utility covers maintenance

- Missing or damaged inspection or drainage covers and frames
- Surface water flooding or severe standing water
- Blocked surface water gullies and drainage systems

12.19.4 Ironworks, such as drainage gullies and utility covers, are particularly hazardous for cyclists, being both slippery in wet conditions, and often associated with potholes which form around their edges. Where cycle routes are located on roads shared with traffic, such surface defects can lead to greater conflict, with people on bikes often having to make often risky manoeuvres.

Guardrail, fencing and restraint systems

12.19.5 Missing or damaged posts, rails or barrier likely to cause a potential danger or render system ineffective. The ends of any horizontal elements should be covered or protected by a post to avoid hazards to oncoming cyclists.

Signage, Road Studs and Markings

- Missing, damaged or illegible sign faces.
- Damaged post or fixings
- Insufficient headroom from underside of sign
- Insufficient offset from trafficked areas
- Post/ sign obstruction to passage or visibility
- Loose sign brackets resulting in turned sign face
- Missing or damaged road studs
- Missing , faded, worn or incomplete markings

Street lighting, Traffic Systems, pedestrian and cycle crossings

- Daytime lamp burn
- Lamp out
- Damage, corrosion to columns or posts
- Damaged/turned heads or lanterns
- Missing/loose access doors to columns or cabinet
- Missing / damaged tactile paving at crossing
- Missing / damaged tactile rotating cone on crossing

Verge, Trees and Hedges

- Obstructed visibility or physical obstruction to free passage by vegetation, particularly at junctions and crossing points; cuttings to be kept clear of path surface.
- Root heave to surrounding walking or cycling surface
- Obvious damage, disease or poor condition of any tree within falling distance of the route
- Need for periodic cutting back of adjacent grass verges or banks to maintain full width of asset

Cleanliness and Weed Growth

- Unacceptable levels of leaf litter likely to cause drainage or safety issues for users
- Unacceptable levels of litter, detritus or dog fouling
- Sign face cleansing
- Unacceptable levels of weed growth
- Presence of Noxious weed growth
- Programmed cleansing of litter/dog fouling bins

12.19.6 A poorly cleansed surface, apart from discouraging users, can present real dangers to the user. Bypasses and gaps for cyclists do not benefit from the movement of motor traffic to push debris out of the way, so need to be regularly swept if they are to be usable.

12.19.7 Broken glass is one of the more obvious dangers. Excessive leaf litter or detritus build up can cause potential slip hazards and impact on the efficiency of surface water drainage infrastructure.

12.19.8 Failure to control weed growth can have a detrimental effect on the safety and serviceability of an asset as well as its attractiveness to users.

12.19.9 If litter bins are provided within the design, there must be a commitment to their regular cleansing.

12.20 Maintaining routes through road works

12.20.1 Road works should provide suitable provision for pedestrians, particularly disabled people and cyclists – and without cyclists needing to dismount. Equipment located on the footway must be fenced off and the accessibility of the route maintained for all types of user, with signed diversion routes where necessary. Birmingham City Council has produced comprehensive guidance for dealing with cyclists during works affecting the highway[11].

12.20.2 TROs may be used to place temporary traffic restrictions on roads during construction to enable the works to proceed safely, such as making a route one way.

Temporary contraflow cycle lane during road works, London

12.20.3 DfT Safety at Street Works and Road Works states that:

"If your work is going to obstruct a footway or part of a footway, you must provide a safe route for pedestrians that should include access to adjacent buildings, properties and public areas where necessary. This route must consider the needs of those with small children, pushchairs and those with reduced mobility, including visually impaired people and people using wheelchairs or mobility scooters. You should always try to enable pedestrians to remain safely on the footway if at all possible." (p28 DfT, 2013)

12.20.4 Chapter 8 of the Traffic Signs Manual states that:

"14.6 Where there is cycle provision, such as cycle lanes or tracks, efforts should be made to keep these open or to provide an acceptable alternative during the road works. They should not be blocked by signs, debris, plant etc."

12.20.5 Road works and any unavoidable consequential route changes must be clearly signed and promoted. Where route changes are planned the Local Authority must raise awareness in the local

[11] Accommodating Cycle Traffic at Roadworks and Around Construction Sites, BCC, 2018

community and at key facilities or destinations served by the route. This must include using local radio, talking newspapers, and informing disability groups.

12.21 Bridges and other structures

12.21.1 Bridges usually have a separate inspection and management system from the rest of the highway and traffic free networks. Bridge owners such as local councils and Network Rail have sophisticated bridge management systems but these usually focus on the structural condition. Graffiti can remain indefinitely unless reported to the council, making the whole environment feel uncared for and potentially unsafe for walkers and cyclists. Underpasses provided for pedestrians and cyclists to avoid busy roads are particularly vulnerable to this type of abuse making their use at best an off-putting and sometimes frightening experience.

12.21.2 Smaller bridges in parks and similar traffic-free environments sometimes have wooden decks which should be treated with a good antiskid surfacing material at the time of construction so they do not become very slippery when wet. Maintenance requirements should be considered during the specification of new bridges.

12.21.3 It is important to keep trees and bushes cut back close to bridges to allow inspectors a clear view of the structure and to avoid damage to by those trees and bushes which can cause masonry to crack and painted surfaces to corrode.

12.22 Winter Maintenance

12.22.1 A Winter Maintenance Plan sets out the general arrangements to ensure, so far as reasonably practicable, that safe passage along a highway is not endangered by snow or ice. The priority of walking and cycling routes should be reflected in a local authority's winter maintenance programmes.

12.22.2 It is not reasonable, due to the scale and cost to expect all sections of the highway network to remain ice or snow free, but well used walking and cycling routes should merit the same high priority as other well-used parts of the network.

12.23 Highway Enforcement and Custodianship

12.23.1 Local Highway Authorities also have a duty to assert and protect the rights of the public to the use and enjoyment of any highway, including cycle routes (within the highway).

12.23.2 The following list, though not exhaustive, shows typical enforcement or controlling actions that may need to be taken to meet the needs of users and ensure compliance with statutory duties in relation to walking and cycling. All the following have potential to cause unnecessary obstruction or potentially unsafe conditions for both cyclists and walkers, and should be addressed by the local authority or police, as appropriate.

- Placing of builders skips within the highway
- Placing of building materials within the highway
- Scaffolding within the highway
- A-boards placed within the highway
- Displaying of goods for sale within the highway
- Parking on the footway and across dropped kerbs
- Parking of trailers or caravans to cause obstruction
- Illegal signage within the highway
- Cutting back of privately owned vegetation encroaching on the highway
- Mud etc. deposited on the highway
- Control of statutory undertakers and maintenance works

13 Useful References

13.1.1 The following documents offer additional technical details including many cross sections and layouts for different situations. The Design Manual for Roads and Bridges (DMRB) contains a lot of useful geometric design information on cycling (see references below). It is intended for design of the high speed, high volume national strategic road network, primarily motorways, inter-urban and rural trunk roads with low numbers of cyclists and pedestrians and low frequency bus services. DMRB should not therefore be regarded as the 'standard' for local road layouts because the priority to movement of motorised traffic in every situation is implicit.

13.1.2 Some international references are included here as they contain useful material but obviously any designs, signing, traffic signals and markings need to be modified to comply with UK legislation.

13.2 United Kingdom

13.2.1 The following sections of the Design Manual for Roads and Bridges contain advice on cycling

(1) IAN 195-16 Cycle Traffic and the Strategic Road Network

(2) HD 42-17 Walking, Cycling and Horse-Riding Assessment and Review

(3) TA 90-05 Geometric Design of Pedestrian, Equestrian and Cycle Routes TA 91-05 Provision for Non-Motorised Users

(4) TD 36-93 Subway Layouts for Pedestrians and Pedal Cyclists BD 29-04 Design Criteria for Footbridges

(5) TD 27-05 Cross Sections and Headrooms (NB – add in cycle lane/cycle track widths when considering highway width requirements)

(6) TD 22-06 Layout of Grade Separated Junctions (NB – needs to be used in conjunction with TAL 1-88 Cyclists at Grade Separated Junctions)

- Active Travel Design Guidance, Active Travel Wales Act, Welsh Government, 2014
- A Guide to Inclusive Cycling, Wheels for Wellbeing, 2017
- Cycle Audit and Cycle Review, IHT, 2000
- Cycle Friendly Design Manual (see Sustrans website design section for latest guidance)
- Cycle Rail Toolkit 2, Cycle Rail Working Group, 2016
- Cycling and Walking Investment Strategy – LCWIP Guidance and Toolkit, DfT 2017 (network planning)
- Cycling by Design, Transport Scotland, 2011 (to be updated 2019-20)
- Healthy Streets for London, TfL, 2017 (available online)
- London Cycling Design Standards, Transport for London, 2014 (comprehensive guidance and layouts)

- LTN 1/19, Cycle Infrastructure Design, Department for Transport, 2008
- LTN 1/95, The Assessment of Pedestrian Crossings, Department for Transport, 1995 LTN 2/95, The Design of Pedestrian Crossings, Department for Transport, 1995
- LTN 1/12, Shared Use Routes for Pedestrians and Cyclists, Department for Transport, 2012 Manual for Streets, Department for Transport/Thomas Telford, 2007
- Manual for Streets 2, Chartered Institution of Highways & Transportation, 2010
- Physical Activity and the Environment (NG90), NICE, 2018 (available online)
- Traffic Signs Manual Chapters 3, 4, 5 and 7, cover signs and road markings including those on cycle routes (due for revision 2017)

13.3 International Guidance (in English)

- Abu Dhabi Walking and Cycling Masterplan, and Abu Dhabi Streetscape Manual, Abu Dhabi Department of Transport, 2010
- Collection of Cycle Concepts, Danish Cycling Embassy, 2012 (available online)
- Design Manual for Bicycle Traffic (Netherlands), CROW, 2016
- Focus on Cycling, Copenhagen Design Guide, 2013 (available online)
- Irish National Cycle Manual, National Transport Authority, 2011 (available online)
- New York Street Design Manual, New York Department of Transportation, 2009 (available online)
- Urban Bikeway Design Guidance, NACTO, 2013
- Guide to Road Design, part 6A Pedestrian and Cyclist Paths, Austroads (available online)
- New Zealand Cycle Trail Design Guide (covers off-road trail construction), 2015 (available online)

Appendix A Typical Existing Carriageway Profiles

'Busy' refers to A Roads, or to B (and occasionally Unclassified) Roads with significant number of buses or HGVs.

'Quiet' refers to most Unclassified Roads, or to 'B' Roads with few buses or HGVs.

If parking is retained then deduct 2.0m from overall c/way width (or 4.0m for parking both sides), plus width of buffer zone 0.5-1.0m if desired.

Information shown is for guidance only and designers should still consider local conditions and carry out stakeholder and public consultations on any proposals.

Any lane widths less than those shown in the table would require agreement with the Traffic Manager.

		Below 5.5m	5.5-6.0m	6.0-6.5m	6.5-7.0m	7.0-7.5m	7.5-8.0m	8.0-8.5m	8.5-9.0m	9.0-9.5m	9.5-10.0m	10.0-10.5m	10.5-11.0m	11.0-11.5m	11.5-12.0m	12.0m and above
GENERAL (INC LOCAL CENTRES)	**BUSY**	Unlikely scenario	Centre marking only		Centre marking only, consider narrow hatching at widths approaching 7.0m	Centre hatching and 3.0m lanes	Centre hatching and 3.0m lanes OR 2.0m ghost island and 2.75m lanes if heavy right turns	2.0-2.5m ghost island and 3.0-3.25m lanes		2.5m ghost island and 3.25m lanes	Consider other options to avoid overly-wide traffic lanes - eg parking lay-bys, cycle lanes, central medians, wider footways					
	QUIET	Omit centre marking	Centre marking only	Centre marking only, consider narrow hatching at widths approaching 6.5m	Centre hatching and 2.75m lanes	Centre hatching and 2.75m or 3.0m lanes	Centre hatching and 3.0m lanes OR 2.0m ghost island and 2.75m lanes	2.0-2.5m ghost island and 3.0-3.25m lanes		Consider other options to avoid overly-wide traffic lanes - eg parking lay-bys, cycle lanes, central medians, wider footways						
CYCLE LANES	**BUSY**	No cycle lanes	No cycle lanes	No cycle lanes	Consider centre hatching options to create 'virtual' cycle lanes	Consider centre hatching options to create 'virtual' cycle lanes, possible narrow cycle lead-in to ASL in one direction only	Consider centre hatching options to create 'virtual' cycle lanes, or 1.5-1.8m cycle lane in one direction		1.3m advisory lanes in both directions or wider lane in one direction only	1.5-1.8m cycle lane and 3.0-3.25m traffic lane both ways		1.8m cycle lane and 3.25m traffic lane both ways	1.8m cycle lane and 3.0m traffic lane both ways with centre hatching	1.8m cycle lane and 3.0m traffic lane both ways, with centre hatching, or narrower lanes with 2.0m ghost island	1.8-2.0m cycle lane and 3.0-3.25m traffic lane both ways, with 2.0-2.5m ghost island	
	QUIET	No cycle lanes	No cycle lanes	Consider centre hatching options to create 'virtual' cycle lanes	Consider centre hatching options to create 'virtual' cycle lanes, possible narrow cycle lead-in to ASL in one direction only	Consider centre hatching options to create 'virtual' cycle lanes, or 1.5-1.8m cycle lane in one direction		1.3m advisory lanes in both directions or wider lane in one direction only	1.5-1.8m cycle lane and 2.75-3.0m traffic lane both ways		1.8m cycle lane and 3.0m traffic lane both ways	1.8m cycle lane and 2.75m traffic lane both ways with centre hatching	1.8m cycle lane and 2.75-3.0m traffic lane both ways with centre hatching, or narrower lanes with 2.0m ghost island	1.8-2.0m cycle lane and 2.75-3.0m traffic lane both ways with 2.0-2.5m ghost island		
BUS LANES	**BUSY**	No bus lanes	No bus lanes	No bus lanes	No bus lanes	No bus lanes	No bus lanes	No bus lanes	No bus lanes	3.0m bus lane if cyclists in opposite direction can be accommodated off-c/way**	3.0m bus lane, ideally cyclists in opposite direction should be accommodated off-c/way**	3.0m bus lane, cyclists in opposite direction accommodated off-c/way OR with wide lane containing cycle symbols**	3.0m bus lane with 1.5m cycle lane in opposite direction**	3.25m bus lane with 1.5-1.8m cycle lane in opposite direction**	4.0m bus lane, 3.0-3.25m traffic lanes, 1.5m cycle lane**	Wide (4.0m+) bus lane in one direction OR 3.0m bus lane in one direction with centre hatching OR 3.0m bus lanes both ways**
	QUIET	Bus lanes unlikely to be justified on quieter roads														
										** Note - Traffic lane adjacent to a bus lane can be reduced to 2.75m if there is not a significant proportion of HGVs.						
DUAL C/WAY	**BUSY (above 1200-1400veh/hr)**	Unlikely scenario	Unlikely scenario	Two lanes with centre line marking only		Wide inside lane (4.0m min) with cycle symbols along channel, consider narrow cycle lanes at widths of 7.3m+, esp at lead-in to ASLs	1.5m cycle lane with two 3.0m traffic lanes	1.5-1.8m cycle lane with two 3.0-3.25m traffic lanes, consider buffer or light segregation	1.8-2.0m cycle lane with two 3.0-3.25m traffic lanes, with buffer or light segregation		Consider other options to avoid overly-wide traffic lanes - eg parking lay-bys, bus lanes, or wider footways / central reserves					
	BUSY (below 1200-1400veh/hr)	Unlikely scenario	Unlikely scenario	Convert inside lane to bus lane (3.25m min preferred if off-peak parking), with one 3.0-3.25m traffic lane	Convert inside lane to bus lane (3.5m min preferred if off-peak parking), with one 3.0-3.25m traffic lane	Convert inside lane to bus lane 4.0-4.5m wide with traffic lane up to 3.5m wide, consider advisory cycle lane within bus lane		Convert inside lane to bus lane 3.0-3.5m, with 3.0-3.25m traffic lane and separate cycle track on inside, consider buffer or light segregation		Bus lane 3.0-3.5m, with two 3.0-3.25m lanes, OR 3.5m bus lane and one traffic lane and separate cycle track on inside with buffer or light segregation		Unlikely scenario	Unlikely scenario	Unlikely scenario	Unlikely scenario	Unlikely scenario
	QUIET	Unlikely scenario	Convert inside lane to cycle lane with buffer OR 2.0m parking bay with wide single lane inc cycle symbols		Convert inside lane to 2.0m parking bay and 1.5m cycle lane, with one 3.0m traffic lane, or 2.75m if no buses or HGVs	Convert inside lane to 2.0m parking bay and 1.5m cycle lane with buffer, and one 3.0m traffic lane	Unlikely scenario	Unlikely scenario	Unlikely scenario	Unlikely scenario	Unlikely scenario	Unlikely scenario	Unlikely scenario	Unlikely scenario	Unlikely scenario	Unlikely scenario

Appendix B Design Drawings

Transport for West Midlands

// Appendix B

Design Elements

Version 2 | May 2019

List of Design Elements

DE001 – Footway
DE002 – Footpath
DE003 – Ramp
DE004 – Steps
DE005 – Raised Table Junction
DE006 – Sinusoidal Hump
DE007 – Cycle Bypass at Narrowing
DE008 – Cycle-Only Access with Right Turn Facility
DE009 – Segregated Contraflow Cycle Lane
DE010 – Unsegregated Contraflow Cycling
DE011 – Quiet Streets
DE012 – Cycle Streets
DE013 – Mandatory Cycle Lane
DE014 – Advisory Cycle Lane
DE015 – Cycle Lane Passing Car Parking/Loading
DE016 – Cycle Lane at Side Road
DE017 – Cycle Lanes with Removal of Centrelines
DE018 – Cycle Lane with Light Segregation
DE019 – Cycle Lane with Light Segregation at Side Road
DE020 – Car Parking/Loading with Light Segregation
DE021 – Hybrid Cycle Track
DE022 – Hybrid Cycle Track at Side Road
DE023 – Cycle Track Alongside Road, Separated from Pedestrians
DE024 – Cycle Track Alongside Road, Shared With Pedestrians
DE025 – Cycle Track at Side Road with Cycle Priority
DE026 – Cycle Track at Side Road, Cyclists Give Way
DE027 – Two-Way Cycle Track in Centre of Carriageway
DE028 – Bus Stop: Cycle Lane Bypass
DE029 – Bus Stop: Island Bus Stop
DE030 – Bus Stop: Bus Boarder
DE031 – Bus Stop: Shared Use
DE032 – Cycle Track Away From Road, Separated From Pedestrians
DE033 – Cycle Track Away From Road, Shared With Pedestrians
DE034 – Transition Between Carriageway And Cycle Track
DE035 – Bus Lane
DE036 – Simple Uncontrolled Crossings (Walking, Shared Use or Cycle Only)
DE037 – Cycle Priority Crossing
DE038 – Uncontrolled Crossing With Central Refuge
DE039 – Side Road Entry Treatment
DE040 – Blended Side Road Entry Treatment
DE041 – Central Median Strip
DE042 – Zebra Crossing
DE043 – Parallel Crossing for Pedestrians and Cyclists
DE044 – Puffin and Ped-X Crossings
DE045 – Toucan Crossing
DE046 – Pedestrian/Cycle Bridge
DE047 – Subway/Underpass
DE048 – Wheeling Ramp
DE049 – Unmarked Informal Junction
DE050 – Advanced Stop Line
DE051 – Cycle Bypass at Traffic Signals
DE052 – Cycle Lanes Through Signalised Junction
DE053 – Two Stage Right Turn at Traffic Signals
DE054 – Mini Roundabout
DE055 – Compact (“Continental”) Roundabout
DE056 - Dutch Style Roundabout

Notes:

1. These Design Elements provide concise guidance, including dimensioned drawings where appropriate, on the layout and use of particular types of design solution.

   In order to enable authorities to gain experience in the use of more innovative techniques, as well as being able to apply more well- established solutions with confidence, each Design Element has been given one of three statuses, defined as.

   Standard Details
   Details that are well understood and should generally be applied as shown unless there are particular reasons for local variation.

   Suggested Details
   Details that have not been widely applied in Wales but may be considered appropriate for use in the circumstances as advised.

   Possible Details
   Details that are largely untested in Wales but have been used successfully in other places and may be considered for use in pilot schemes to gain further experience.

   Within this document those elements denoted as Standard Details will be regarded as “standards” for the purposes of section 3(6)(a) of the Active Travel Act.

   The use of advice categorised as Suggested Details or Possible Details will require careful monitoring by the highway authorities who implement them. More details of monitoring processes can be found in Chapter 11.

2. The drawings and images provided are illustrative and will not cover all circumstances. They should be applied in the light of local context. Where appropriate references are given to other documents that will provide relevant advice, but readers should ensure that they any such documents are the current editions.

DE001 Footway

Measure and Brief Description

Footways provide routes for pedestrians within highways. A satisfactory footway of sufficient width is important to allow pedestrians to travel at their chosen speed and to pass one another safely. Footway widths may be increased by reallocating road space away from motor vehicles to pedestrians or increasing the usable width by removing street clutter. Footway provision for pedestrians is contingent on range of factors including the local context, static pedestrian activities such as seating or congregation near tourist attractions, crossing types, significant trip generators such as schools and workplaces, street clutter or pavement parking

Benefits

- Provision of direct and safe movement space for pedestrians alongside carriageways and cycle tracks

Key Design Features

- Surface materials should be even, firm and slip resistant in wet and dry conditions.
- Surface materials and layouts should be consistent in colour and tone, with good contrast between pedestrian routes, cycle tracks and carriageways.
- Manhole covers and service hatches should match surrounding material pavers and pavement treatments.
- Rest areas should be provided on a regular basis.
- Footways should normally be lit by the overall highway lighting system.

Dimensions

- Should ideally be level with a desirable maximum longitudinal gradient of 5% (1 in 20).
- Absolute maximum longitudinal gradient of 8% (1 in 12.5).
- Cambers and crossfalls should preferably be 2.5% (1 in 40) and should not exceed 3.3% (1 in 30) and an absolute maximum of 10% (1 in 10) at crossings.
- Footways will normally be separated from carriageways by a kerb. The desirable minimum kerb height is 60mm, which can be reliably detected by a blind person.
- Minimum obstacle-free footway widths (a) are shown below. Where it is expected that there will be high volumes of pedestrians, widths should be increased accordingly – see Guidance on Pedestrian Comfort in Chapter 4.

Provision	a - Footway width (m)	Width can accommodate
Desirable minimum	2.0	Two wheelchairs or double buggies passing comfortably
Accepted minimum	1.8	Two pedestrians passing, one pedestrian passing a wheelchair or double buggy
Absolute minimum	1.5	Two wheelchairs or double buggies passing
Restricted width at immovable object	1.2	Provides space for a blind or partially sighted person to walk using a long cane, or with a guide dog, or alongside a person providing guidance.

- On roads with a speed limit of 40mph or above, or with over 1,500 HGVs AADT, it is desirable to allow an additional minimum of 0.5m of footway or verge width to allow for vehicle overhang and pedestrian 'kerb shyness'. There may also be a dead area of up to 0.5 m at the back of the footway where the footway is bounded by a vertical feature such as a wall, or by the entrances to buildings.
- Minimum headroom (b):
  - Desirable minimum - 2.3m.
  - Absolute minimum to isolated obstacles (eg signs) – 2.1m.

Other Considerations

- Footways should be free of obstructions, with street furniture restricted to items which benefit pedestrians. These should be located in a street furniture zone out of the pedestrian flow, with adequate tactile and visual warning.
- Hazard protection (a detectable object, eg tapping rail or similar, with a minimum height 150 mm to underside)
  - Isolated objects, eg advertising boards, that cause an occasional narrowing of a footway, but which project no more than 100 mm from their base do not need hazard protection.
  - Where the base of the projection is less than 300 mm above ground level, no hazard protection is required.
  - Where an object projects more than 100 mm within a zone between 300 mm and 2.1 metres above ground level hazard protection should be provided. – See BS8300 for further details
- At dropped kerbs and at side-road junctions the appropriate tactile paving should be provided.

Further References

- National Federation for the Blind (2013) - Access for Blind People in Towns. SS1401 (Circulated by DfT).
- Department for Transport (2005) – Inclusive Mobility.
- Department for Transport (2007) – Manual for Streets.
- British Standards Institution (2009/2010) - BS 8300:2009+A1:2010 Design of buildings and their approaches to meet the needs of disabled people. Code of practice.

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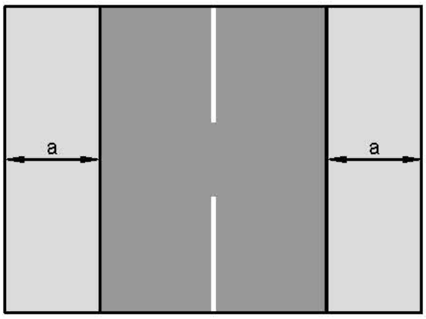
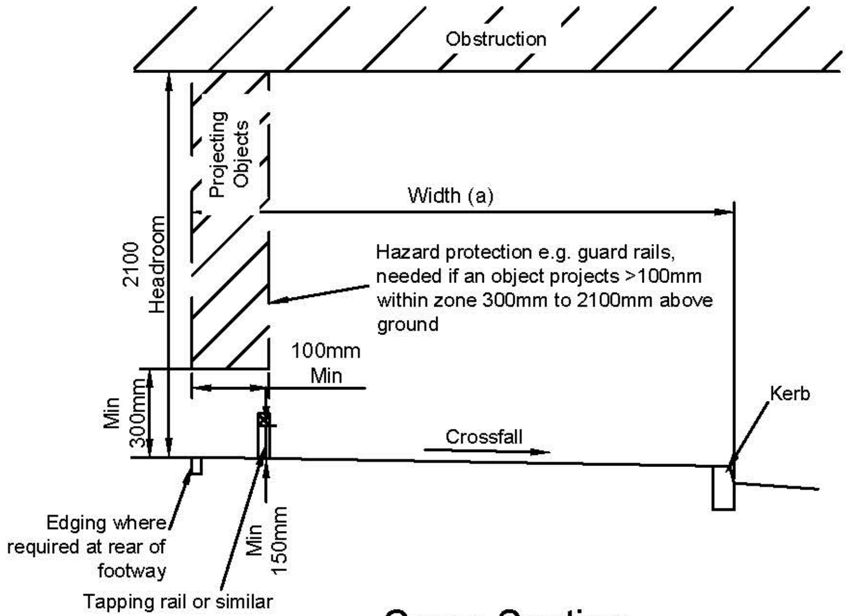
DE001	Footway



Plan



Cross Section

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DE002 Footpath

Measure and Brief Description

Footpaths provide separate direct routes for pedestrians for journeys in a range of locations such as through housing developments or across open space and countryside. A satisfactory footpath of sufficient width is important to allow pedestrians to travel at their chosen speed and to pass one another safely.

Benefits

- Provision of direct and safe movement of pedestrians typically linking footways

Key Design Features

- Surface materials should be even, firm and slip resistant in wet and dry conditions
- Surface materials and layouts should be consistent in colour and tone, with good contrast between the footpath and any cycle track
- Manhole covers and service hatches should match surrounding material pavers and pavement treatments.
- Rest areas should be provided on a regular basis
- Footpaths should be lit where users might otherwise be discouraged from using the route outside daylight hours.

Dimensions

- Should ideally be level with a desirable maximum longitudinal gradient of 5% (1 in 20)
- Absolute maximum longitudinal gradient of 8% (1 in 12.5)
- Cambers and crossfalls should preferably be 2.5% (1 in 40) and should not exceed 3.3% (1 in 30) and an absolute maximum of 10% (1 in 10) at crossings.
- Minimum obstacle-free footpath widths (a) are shown below. Where it is expected that there will be high volumes of pedestrians, widths should be increased accordingly – see Guidance on Pedestrian Comfort in Chapter 4.

Provision	a - Footway width (m)	Width can accommodate
Desirable minimum	2.0	Two wheelchairs or double buggies passing comfortably
Accepted minimum	1.8	Two pedestrians passing, one pedestrian passing a wheelchair or double buggy
Absolute minimum	1.5	Two wheelchairs or double buggies passing
Restricted width at immovable object	1.2	Provides space for a blind or partially sighted person to walk using a long cane, or with a guide dog, or alongside a person providing guidance

Other Considerations

- Footpaths should be free of obstructions, with street furniture restricted to items which benefit pedestrians. These should be located in a street furniture zone out of the pedestrian flow, with adequate tactile and visual warning.
- Hazard protection (a detectable object, e.g. tapping rail or similar, with a minimum height 150 mm to underside)
  - » Isolated objects, e.g. advertising boards, that cause an occasional narrowing of a footway, but which project no more than 100 mm from their base do not need hazard protection.
  - » Where the base of the projection is less than 300 mm above ground level, no hazard protection is required.
  - » Where an object projects more than 100 mm within a zone between 300 mm and 2.1 metres above ground level hazard protection should be provided. – See BS8300 for further details.

Further References

- British Standards Institution (2009/2010) - BS 8300:2009+A1:2010 Design of buildings and their approaches to meet the needs of disabled people. Code of practice.

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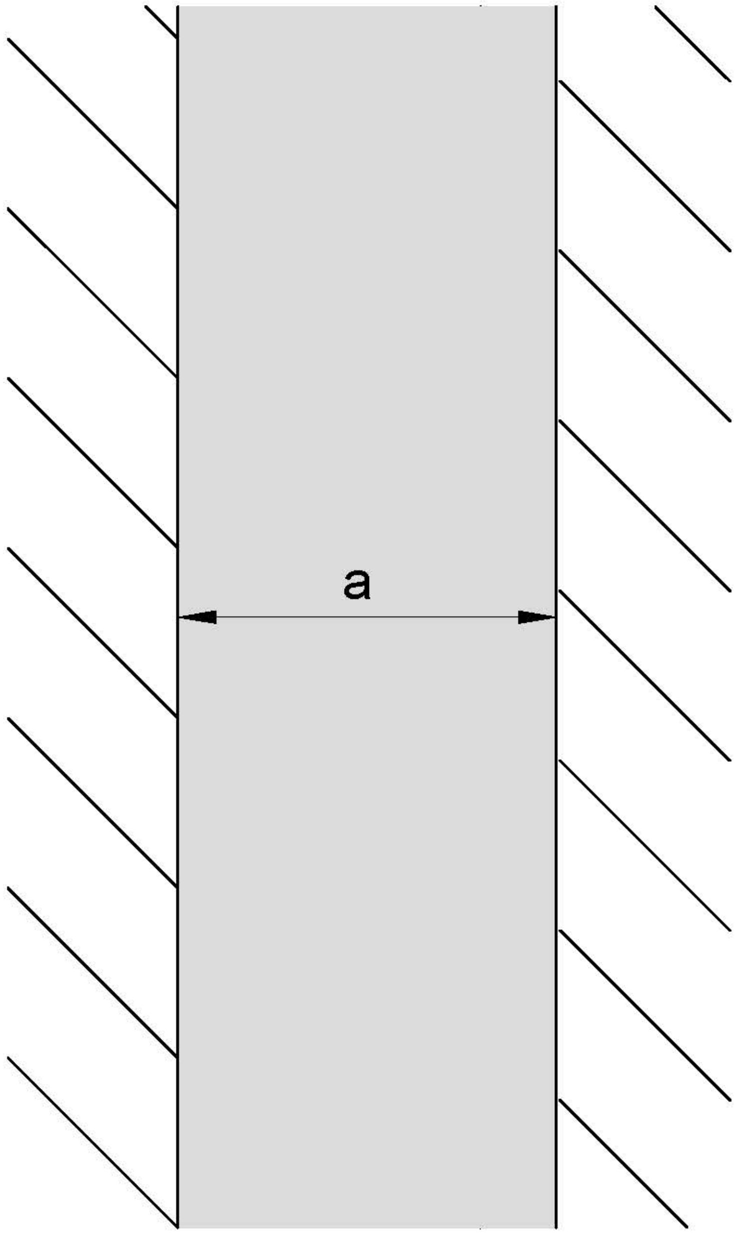
DE002

Footpath



Footpath

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DE003 Ramp

Measure and Brief Description

Ramps (defined as a gradient of more than 5 % (1 in 20)) are provided to facilitate a change in level or grade on a walking route. They should only be used where a change in level or grade cannot be avoided. In many places ramps will provide the alternative access to stairs for wheelchair users.

Benefits

- Ramps provide an accessible alternative to steps for disabled people, older people and parents and carers with pushchairs.

Key Design Features

- Where the change in level is no more than 200mm a ramp may be used without alternative steps.
- Desirable Maximum Gradient – 5% (1 in 20).
- Absolute Maximum Gradient – 8% (1 in 12). Steeper ramps will cause difficulties for manual wheelchair users.
- Absolute Maximum Gradient over short distances (max 1m) - 10% (1 in 10) - eg on a ramp between a bus entrance and the pavement.

Dimensions

- Ramp surface width
  - Preferred Minimum– 2m
  - Desirable Minimum – 1.8m
  - Absolute Minimum – 1.2m
- Sides of a ramp should be protected by a raised solid kerb at least 100mm in height.
- If kerb height exceeds 75mm there must be no slot or gap greater than 20mm in the range of 75mm to 150mm. This is done to avoid the possibility of the footplate of a wheelchair riding over the kerb or becoming trapped.
- Ramp-side face of the kerb to be flush with, or no more than 100mm away from, the ramp-side face of the handrail.
- Handrails should be provided on each side, with a minimum clear width rail to rail of 1,000mm. Where this unobstructed width exceeds 2000mm, a central, continuous handrail may be used as an alternative to a handrail on each side.
- Handrails should be provided on both sides of stairways and ramps and down the centre of stairs when their unobstructed width (ie between handrails) exceeds 1,800mm.
- Recommended height to the top of the principal handrail is between 900mm and 1000mm above the pitchline of the steps or above the surface of the ramp. On landings the top of the handrail should be between 900mm and 1100mm from the surface.
- Handrails should continue beyond the end of the ramp slope or end of the stairs by a (minimum) distance of 300mm and should either return to the wall or down to the floor or have a minimum rounded downturn of 100mm.
- Second, lower handrails for children and people of restricted growth are helpful and should be at heights of between 550mm and 650mm.
- The handrail itself should be smooth and comfortable to use by people with arthritic hands that is they should not be too small in diameter. Circular handrails should have a diameter between 40mm and 50mm; if not circular the handrail should be a maximum of 50mm wide by 38mm deep with rounded edges (radius of at least 15mm).
- There should be a clear space between the handrail and any adjacent wall of at least 50mm, preferably 60mm. Handrails should be supported centrally on the underside so there is no obstruction to the passage of the hand along the rail. There should also be a minimum of 600mm clear space above the handrail.

Other Considerations

- There is a relationship between the length of a ramp and the gradient that people can manage; the longer the ramp the less severe the gradient that is feasible. One possible approach to this is, where a lengthy ramp is necessary, to design more frequent landings and lesser slopes for each successive segment.
- Ramps should never be longer than 132 metres in total and preferably no longer than 50 metres.
- Means should be provided to limit the risk of people colliding with the underside of freestanding ramps at any point where the clear height is less than 2.1m.
- The transition between the level and inclined parts of the ramp should be sufficiently rounded to ensure that a wheelchair user does not get caught by the foot supports.

Further References

- Department for Transport (2005) – Inclusive Mobility.

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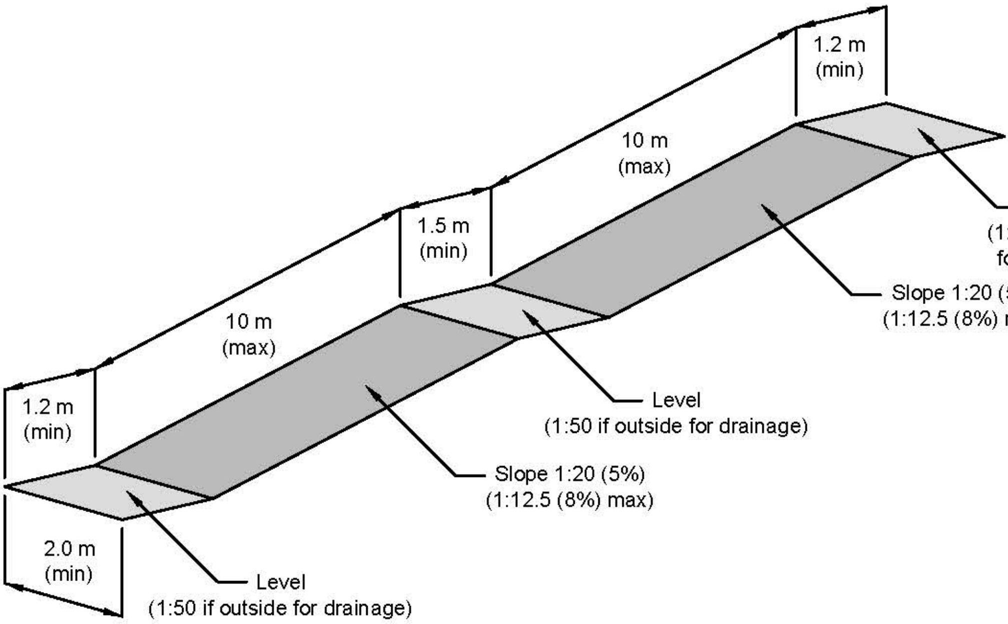
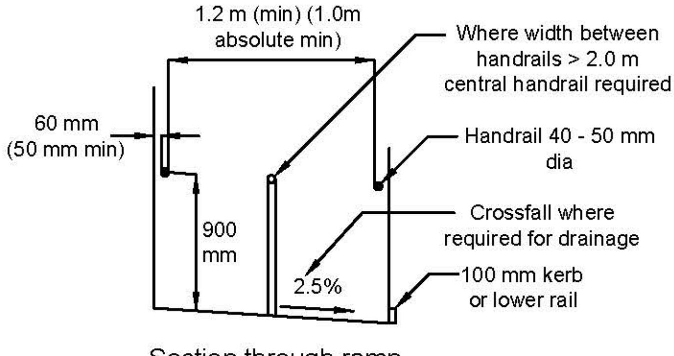
DE003

Ramps



Ramp key dimensions



Section through ramp

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DE004 Steps

Measure and Brief Description

Steps allow direct movement for pedestrians from one level to another where there would otherwise be a significant gradient.

Benefits

- Direct routes for pedestrians.
- Steps can provide a useful shortcut to maintain desire lines where it is necessary to also provide a ramp to accommodate a change in level or grade.
- Steps built within public spaces are particularly popular because they can also serve as a good lookout point.

Key Design Features

- Steps should usually only be provided in conjunction with a ramp (or lift) in order to retain accessibility for disabled people, older people and parents and carers with pushchairs.

Dimensions

- A riser height of 150mm can be managed by most people; a little more than this is possible if there are well designed handrails but 170mm should be regarded as the absolute maximum in most circumstances. Steps with very shallow risers can cause problems and should be avoided; 100mm is the absolute minimum. All steps in a flight must have the same dimensions.
- Tread depth or going should be 300mm deep (approximately the length of a size 9 shoe), with an absolute minimum of 250mm.
- The nose of the step should be rounded (6mm radius) without any overhang.
- Steps should be well lit (minimum 200 lux, see Section 11) and surfaced with a slip resistant material.
- Colour/tonal contrast on the step noses is beneficial for visually impaired people and should extend across the full width of each tread, 55mm deep on both tread and riser.
- The maximum number of risers in a flight should be 12, with resting places between successive flights. Resting places should have a Desirable Minimum length of 1.8m and an Absolute Minimum length of 1.2m, and be across the full width of the steps. The minimum number of steps in a flight should be three; fewer than this is less safe.
- The Desirable Minimum clear width between handrails is 1.2m which is sufficient for a disabled person and companion, with an Absolute Minimum width of 1m.
- Handrails should be provided on both sides and, where steps have a clear width of more than 1.8m, a centre handrail should also be provided.

Other Considerations

- Means should be provided to limit the risk of people colliding with the underside of freestanding steps at any point where the clear height is less than 2.1m.
- Incorporation of corduroy warning paving to the top and bottom, and visual contrast between elements should be used to highlight features such as steps edges and handrails.
- Open tread steps are to be avoided, as are curved or spiral steps.
- There should be unobstructed landing space at the top and bottom of each flight of steps of a length at least equal to the unobstructed width of the steps.

Further References

- Department for Transport (2005) – Inclusive Mobility.

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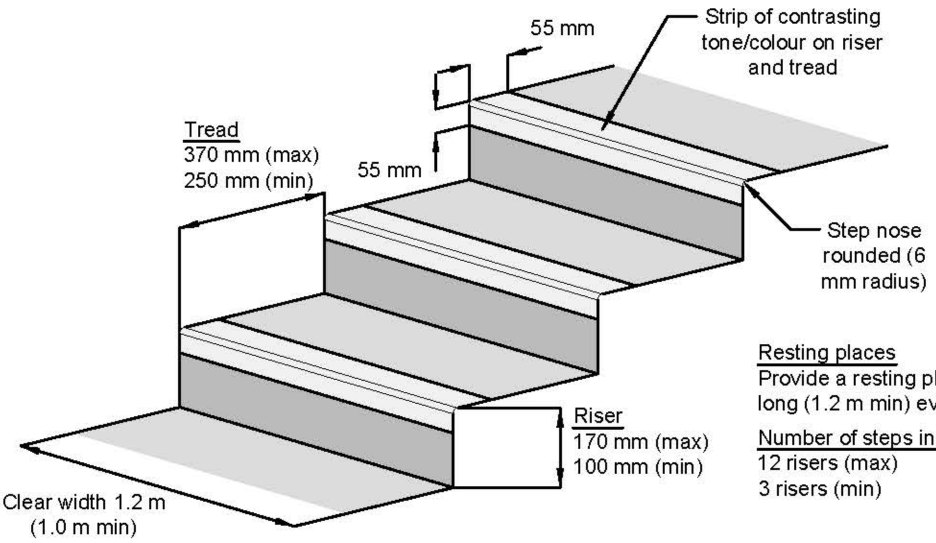
DE004

Steps



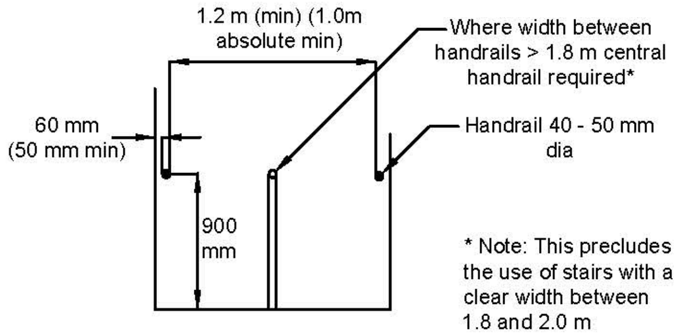
Resting places
Provide a resting place (landing) 1.8 m long (1.2 m min) every 12 risers.

Number of steps in a flight
12 risers (max)
3 risers (min)

Pitch (angle) of steps
25° (min)
35° (max for high usage)
45° (absolute max)

Rule of thumb:
tread length + 2 x riser height = 600 mm

Steps key dimensions



* Note: This precludes the use of stairs with a clear width between 1.8 and 2.0 m

Section through steps

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DE005 Raised Table Junction

Measure and Brief Description

Raised table junctions create safer environments for all users by reducing the speed of vehicles negotiating the junction. They are typically used at priority junctions but can also be applied to roundabouts (including mini roundabouts and implied roundabouts) and traffic signals.

Raised table junctions can be used on roads with a speed limit of 30mph or less, with adequate street lighting provision, in the following situations:

- urban/suburban residential and mixed use areas; and
- in town centres as part of public realm improvements, where raised tables at key junctions provide informal crossing points for pedestrians.

Raised table junctions are road humps and must comply with the Highways Act 1980, Sections 90A to 90F.

Benefits

- Raised tables emphasise the presence of a junction, encourage driver attention and lead to drivers giving informal priority to pedestrians.
- By reducing speeds, raised table junctions will commonly not require separate cycle facilities.
- The speed reduction effect of raised tables can be used to mitigate reduced visibility at some low volume/low speed junctions.
- Raised table junctions included as part of wider traffic calming measures can discourage through traffic.

Key Design Features

- The raised table must comply with the Highways (Road Humps) Regulations 1999.
- The raised table should extend from kerb to kerb to benefit pedestrians crossing. This will require attention to drainage requirements to avoid standing water at the ramps.
- Appropriate tactile paving should be provided at pedestrian crossing points.
- Approach ramps should be located sufficiently far from the junction mouth so that the changing level of the carriageway does not become problematic for cyclists when turning.
- It may be necessary to install build outs, bollards or introduce parking restrictions as appropriate in order to prevent parking around the junction.
- Drainage covers/gully gratings set flush with the footway to avoid becoming a hazard for pedestrians and cyclists.

Dimensions

- Approach ramps with a sinusoidal profile will reduce discomfort for cyclists compared to a 1 in 10 ramp.
- Table height should normally be 75mm, maximum 100mm.
- Kerb radii to be reduced to 2-3m, subject to vehicle tracking (and allowing for vehicles to cross centrelines unless flows are high).

Other Considerations

- Bollards may be provided to prevent over-run on corners.
- Strengthened corners may be necessary if over-run is to be expected.
- Raised tables can usefully be provided between junctions, using similar design criteria.

Further References

- Department for Transport (2007) – Local Transport Note 01/07. Traffic Calming.

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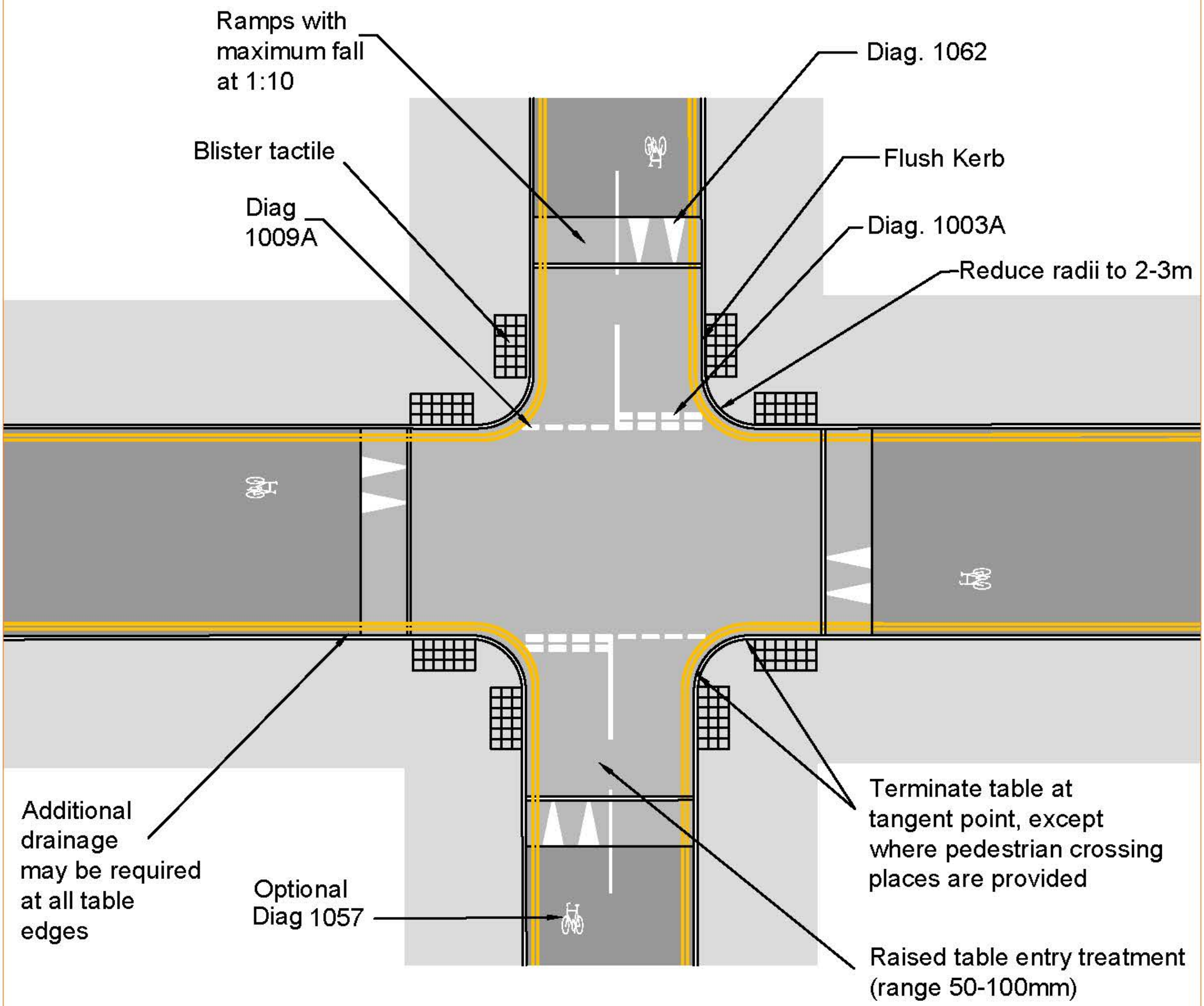
DE005 Raised Table Junction



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DE006 Sinusoidal Hump

Measure and Brief Description

Traffic calming measures are used to reduce motor vehicle speeds thereby improving safety for pedestrians and cyclists as well as improving living conditions for residents living along traffic calmed routes. The provision of sinusoidal profile humps reduces the discomfort for cyclists when riding over humps, whilst still being effective in reducing traffic speed.

Sinusoidal humps are road humps and must comply with the Highways Act 1980, Sections 90A to 90F.

Benefits

- Sinusoidal road humps minimise discomfort for passing cyclists and are effective at reducing motor-vehicle speeds.
- Improve perceived and actual safety for pedestrians and cyclists.
- Reduction in traffic speeds helps improve cyclist comfort and help create suitable cycle routes.
- Helps reduce the necessity for speed limit enforcement by Police.
- Can improve living conditions for residents living along traffic calmed roads.

Key Design Features

- The sinusoidal road hump must comply with the Highways (Road Humps) Regulations 1999.
- As an exact profile may be difficult to construct an approximate sinusoidal profile is acceptable, with a tapered entry and exit profile.
- The impacts on car parking should be considered.

Dimensions

- Hump height should normally be 75mm, maximum 100mm, see also Local Transport Note 1/07.

Other Considerations

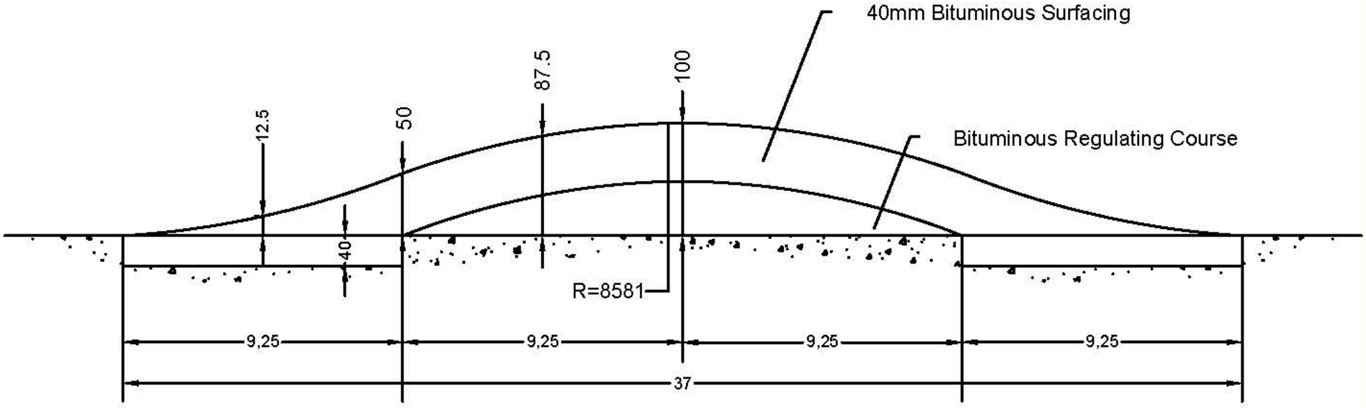
- Where a drainage gap is provided at the edge of a sinusoidal hump it should not be wide enough that drivers use it.
- Councils are required to advertise and consult on sinusoidal humps, flat-top humps and speed cushions under the Highways (Road Hump) Regulations 1999.

Further References

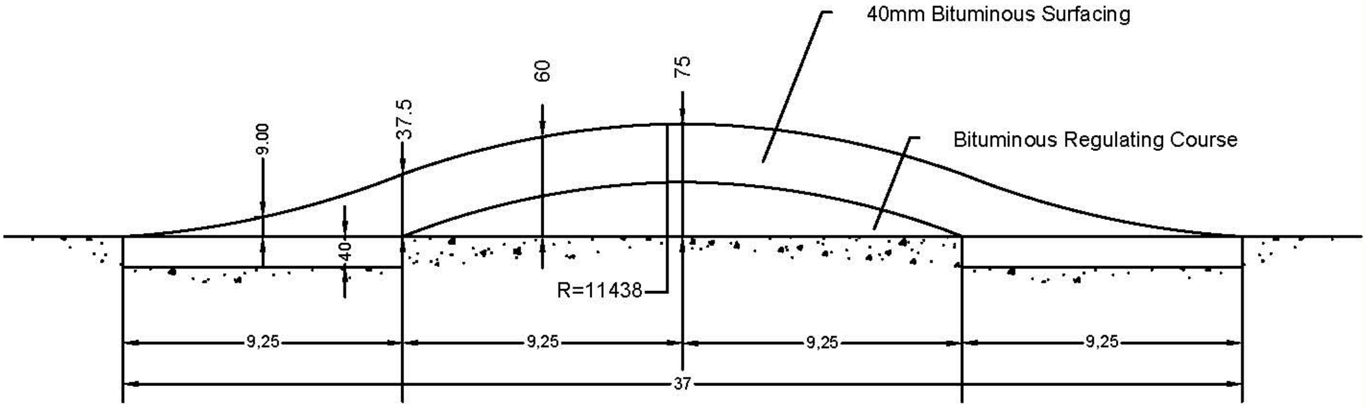
- Department for Transport (2007) – Local Transport Note 01/07. Traffic Calming.

A4

DE006 Sinusoidal Hump



A. 100mm High Hump



B. 75mm High Hump

Notes:
Flexible construction is shown but other materials could be used, for example pre-cast concrete

R = Radius of sinusoidal hump
All dimensions are in mm

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DE007 Cycle Bypass at Narrowing

Measure and Brief Description

Traffic calming measures are used to reduce motor vehicle speed thereby improving safety for pedestrians and cyclists as well as improving living conditions for residents living along traffic calmed routes. Traffic calming can improve cycling conditions, but where poorly designed it can also be uncomfortable and in some cases be intimidating and dangerous. Where horizontal traffic calming features are provided consideration should be given to providing bypasses for cyclists.

Benefits

- Cyclists are not intimidated or squeezed by motor traffic.
- Improve perceived and actual safety for pedestrians and cyclists.
- Reduction in traffic speed helps improve cyclist comfort and create suitable cycle routes.
- Helps reduce the necessity for speed limit enforcement.
- Can improve living conditions for residents living along traffic calmed roads.

Key Design Features

- Cycle bypass exits should not require cyclists to merge abruptly with motor vehicles.
- Parking and loading/waiting restrictions should be provided to avoid cycle bypasses becoming blocked by vehicles.
- Careful consideration should also be given to drainage at cycle by-passes to minimise gully grate conflict and flooding in the area.
- Bypasses should be wide enough to facilitate maintenance, e.g. street sweeper vehicles.

Dimensions

- a - cycle bypass to traffic calming features to be 2m desirable min (1.5m absolute minimum).
- b - gap for traffic between traffic calming features to be 3m max.
- c - avoid pinch point distances of between 3.1 - 3.9m – see Table 4.6.

Other Considerations

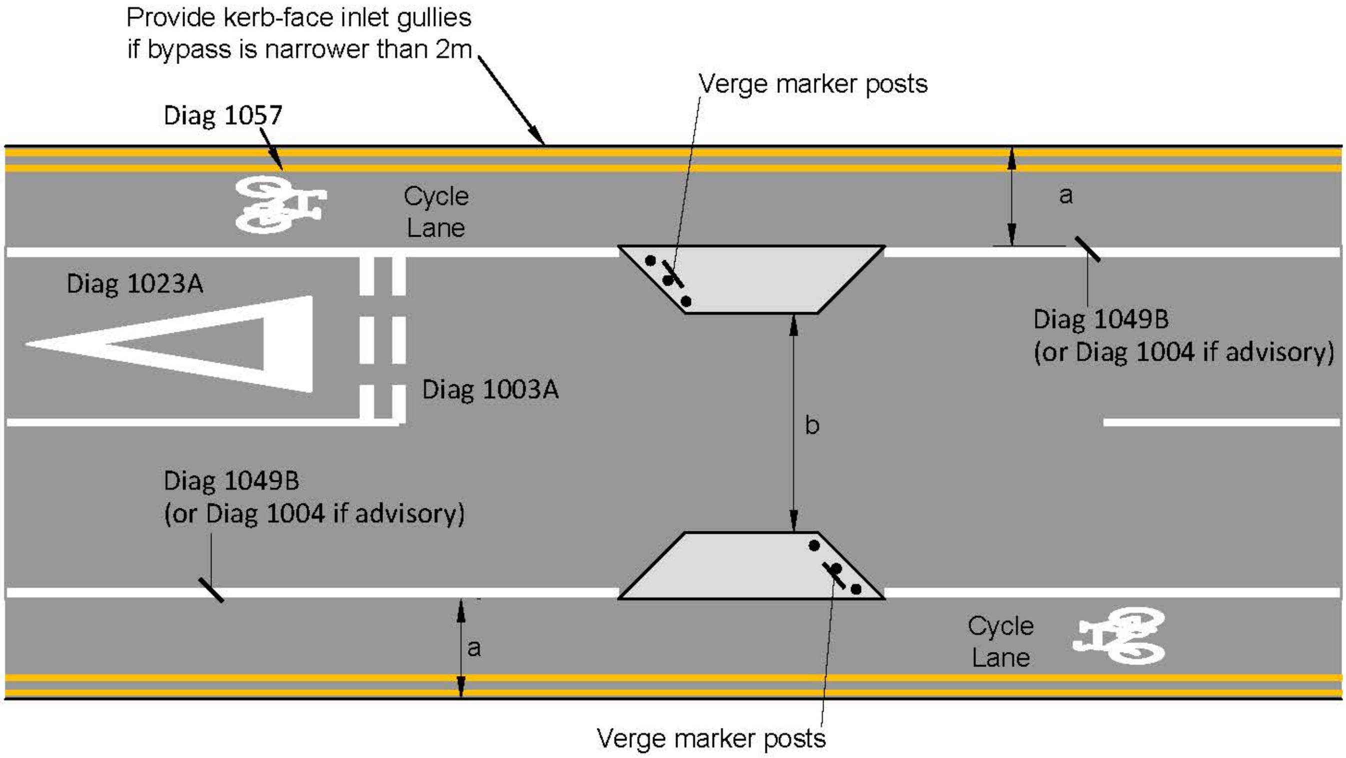
- Bypasses should desirably be at carriageway level, in which case regular sweeping will be necessary.
- Footway level bypasses should consider impact on pedestrians, and additional drainage will be required.

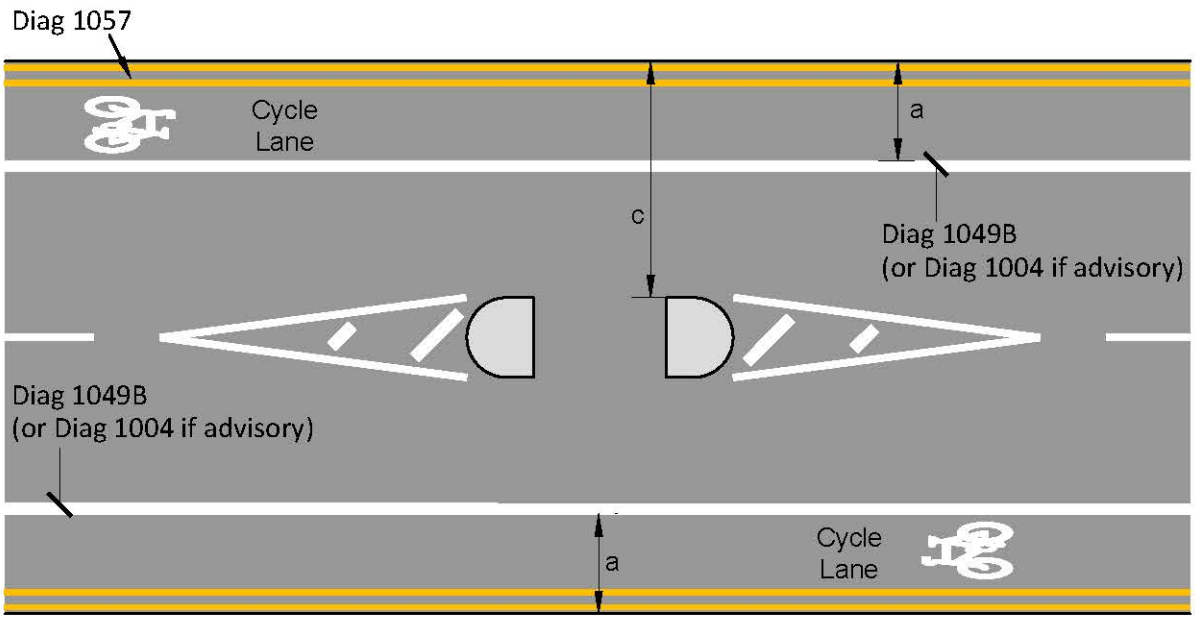
Further References

- Department for Transport (2007) – Local Transport Note 01/07. Traffic Calming.

A4

DE007 Cycle bypass at Narrowing





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DE008 Cycle-Only Access with Right Turn Facility

Measure and Brief Description

Cyclists should be exempted from restrictions applied to motor traffic on links or at junctions where safe to do so, or through the creation of short connections which are only available to cyclists and pedestrians, to give them time and distance advantages. This example shows how a cycle-only access can be provided which includes a central lane to assist right-turning cyclists.

Benefits

- Reduces cycle journey times.
- Increase permeability of area for cyclists.
- Provide convenient and attractive routes.
- Helps to limit motor vehicle through traffic, and particularly effective in neighbourhoods where extraneous traffic is a problem, helping to deter unnecessary car trips.
- Relatively low cost.
- Can be retro-fitted to existing streets.

Key Design Features

- Traffic movements are often banned to help ease congestion by deterring traffic from certain streets. It is possible to exempt cycles from turning bans without having to significantly change the physical nature of the road.
- Where a closure is planned the preferred method is by the use of bollards with cycle signing mounted on them.
- Demountable bollards can be used to retain access for emergency vehicles. Dedicated right turn pockets for cyclists provide protection whilst waiting to make a turn.

Dimensions

- a - dedicated right turn pockets for cyclists to be 2m desirable min (1.5m absolute minimum).
- Width for cyclists at road closure to be 1.5m absolute minimum.

Other Considerations

- Consideration should be given to:
  - The potential for nuisance caused by powered two wheelers.
  - Need to restrict car parking in the vicinity of the cycle gap, eg through double yellow lines.
  - Providing good natural surveillance to deter crime.
  - Potential need to maintain access for emergency vehicles.
  - Pedestrian and cyclist interaction.
- Build outs or other features may be needed to keep the cycle gap clear of parked vehicles.
- The impact of road closures can be assessed by undertaking a trial closure on a temporary basis. The closure can then be made permanent if it is found to be successful.

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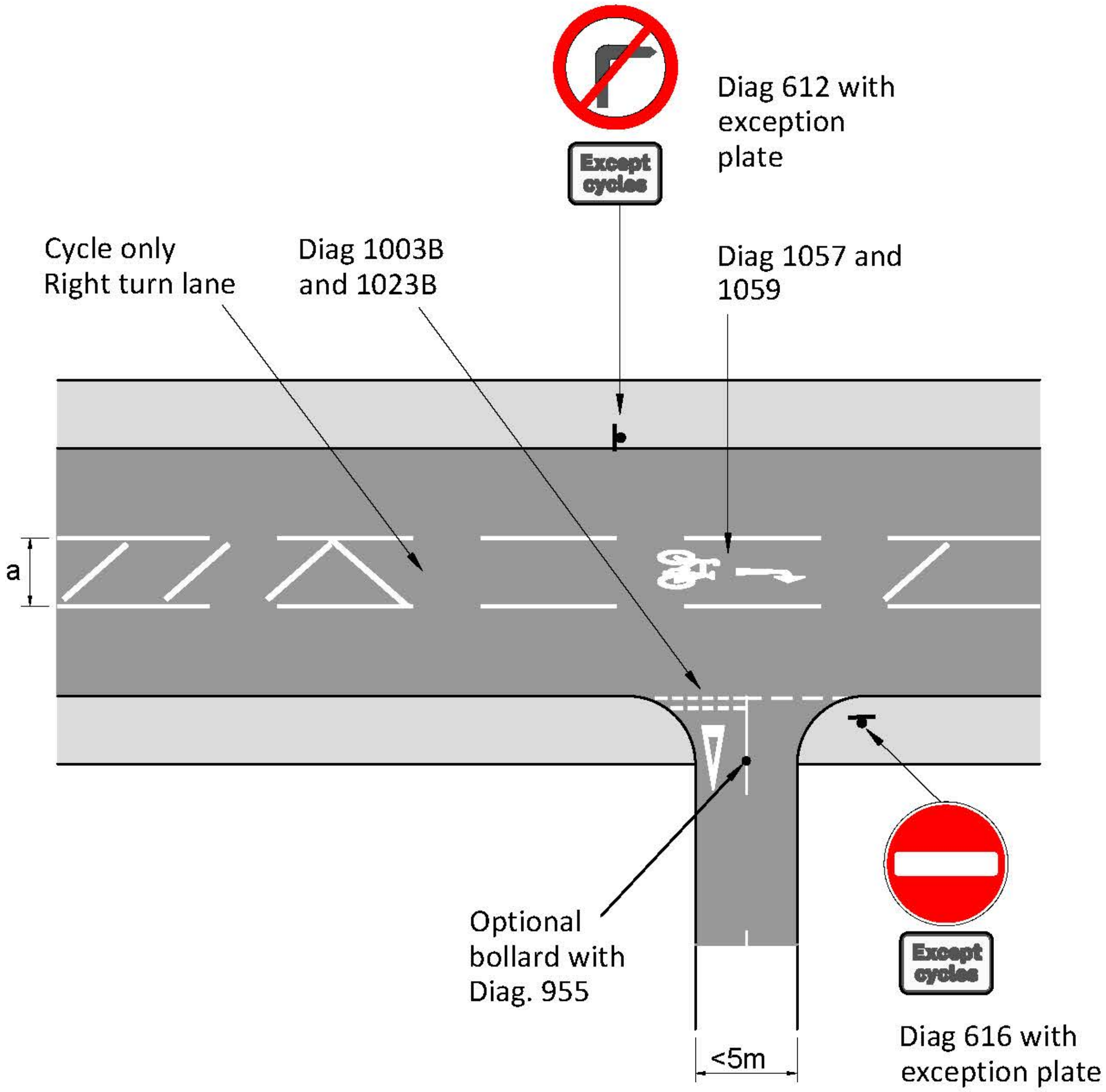
DE008 Cycle - Only Access with Right Turn Facility



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DE009 Segregated Contraflow Cycle Lane

Measure and Brief Description

The permeability of the road network for cyclists can be greatly enhanced by exempting them from one-way restrictions. This provides connections that are only available to cyclists and reduces their travel times and distances. Segregated contraflow cycling can be provided by using a cycle lane - either mandatory or advisory - or with physical separation.

Benefits

- Improves cycle journey directness.
- Enables cyclists to avoid longer routes on busy roads.
- Gives cycling an advantage over motor traffic.
- Likely to reduce the number of cyclists riding on the footway.
- In one-way streets contraflow cyclists have better vision of people exiting parked vehicles facing towards them.
- Affordable and relatively straightforward to introduce.

Key Design Features

- Mandatory cycle lane should be used in preference to advisory cycle lanes where space permits.
- Advisory lanes may be a suitable option where oncoming vehicles need to encroach into the cycle lane, eg to pass obstructions.
- An advisory lane can be considered the 85th percentile speed is less than 25 mph or traffic flows are below 1,000 veh AADT.
- Physical segregation may be appropriate where motor vehicle speeds and/or volumes are high, in the form of kerb separation or light segregation.
- Where kerb separation is provided, gaps should be used to allow cyclists access to the carriageway and junctions.
- Where contraflow lanes pass parked cars a 0.5m wide buffer zone should be provided.
- Entry points for general traffic should preferably be provided with an island with sufficient cycle gap that will not be blocked by parked vehicles, as it gives added protection to cyclists against turning vehicles.
- 1057 cycle symbols should be used at entrances/exits and across side roads to alert drivers of likely cycle movements.
- ‘Except cycles’ signs with ‘No Entry’ signs should be used rather than the ‘No Motor Vehicle’ sign (Diagram 619).

Dimensions

- Cycle lane width (a):
  - with mandatory or advisory lane or light segregation: 2m desirable minimum, 1.5m absolute minimum.
  - with physical segregation: 2m minimum.

Other Consideration

- Contraflow cycle lanes should be designed to general guidance and standards for cycle lanes, including where they pass side road junctions.
- Traffic calming features that require contraflow cyclists to change their alignment should be avoided, for example speed cushions and build-outs.
- Waiting and loading restrictions should be included in TROs for contraflow lanes to prevent parked vehicles obstructing the lane and pushing cyclists into oncoming traffic.
- Echelon parking bays should be angled so that drivers reverse into them, so that they exit facing forwards and towards contraflow cyclists, therefore improving visual contact.
- Authorities may choose to omit vertical signs to diagram 960.1 and 960.2 when the speed limit is 20mph and the contraflow cycle lane is clearly visible.

Further References

- Department for Transport (2003) – Traffic Signs Manual Volume 3. Road Markings.

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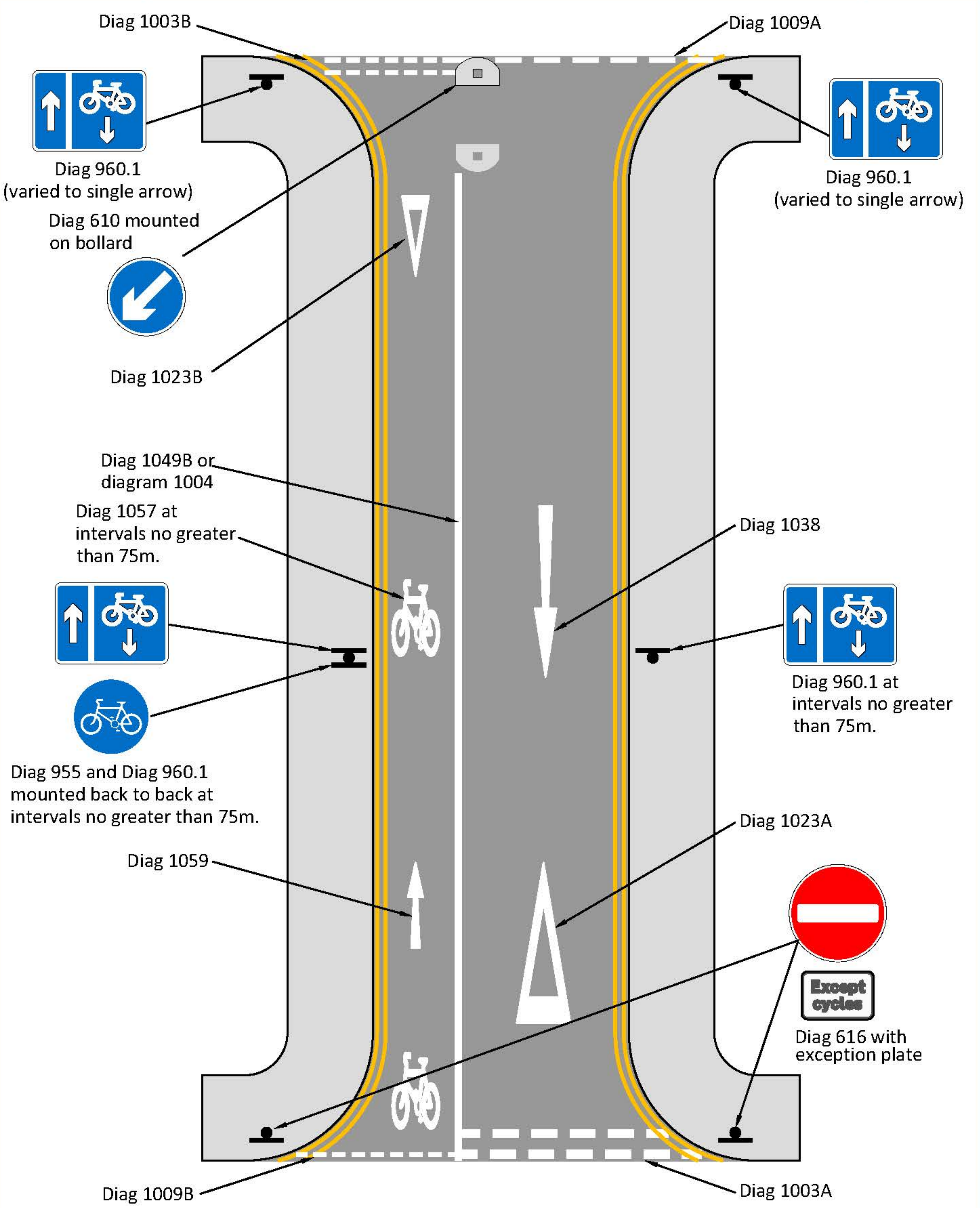
DE009 Segregated Contraflow Cycle Lane



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DE010 Unsegregated Contraflow Cycling

Measure and Brief Description

The permeability of the road network for cyclists can be greatly enhanced by exempting them from one-way restrictions. This provides connections that are only available to cyclists and reduces their travel times and distances. On less busy one-way roads with a narrow width two-way cycling may be permitted without a cycle lane.

Benefits

- Improves cycle journey directness.
- Enables cyclists to avoid longer routes on busy roads.
- Gives cycling an advantage over motor traffic.
- Likely to reduce the number of cyclists riding on the footway.
- In one-way streets contraflow cyclists have better vision of people exiting parked vehicles facing towards them.
- Affordable and relatively straightforward to introduce.
- Can be introduced without a cycle lane where traffic volumes and speeds are low.

Key Design Features

- Mandatory cycle lane should be used in preference to advisory cycle lanes where space permits.
- Where the 85th percentile speed is less than 25 mph and traffic flows are below 1,000 veh AADT, or where the street forms part of a 20 mph zone.
- At entries and exits, consideration should be given to alert drivers and pedestrians of contraflow cycle movements using a short section of cycle lane.
- Cycle logos and directional arrows should be used especially at entrances/exits and across side roads to alert drivers of likely cycle movements.
- ‘Except cycles’ signs with ‘No Entry’ signs should be used rather than the ‘No Motor Vehicle’ sign (Diagram 619).

Dimensions

- Sufficient carriageway space is required to ensure cyclists have enough space to pass oncoming vehicles, however it is possible to facilitate contraflow cycling in lightly trafficked narrow streets, including where there is car parking on one or both sides and a narrow running lane.
- a - carriageway width:
  - Absolute minimum 2.6m (no car parking).
  - Desirable minimum 3.85m based on car passing cycle (no car parking).
  - Absolute minimum 4.6m (with car parking on one side).

Other Considerations

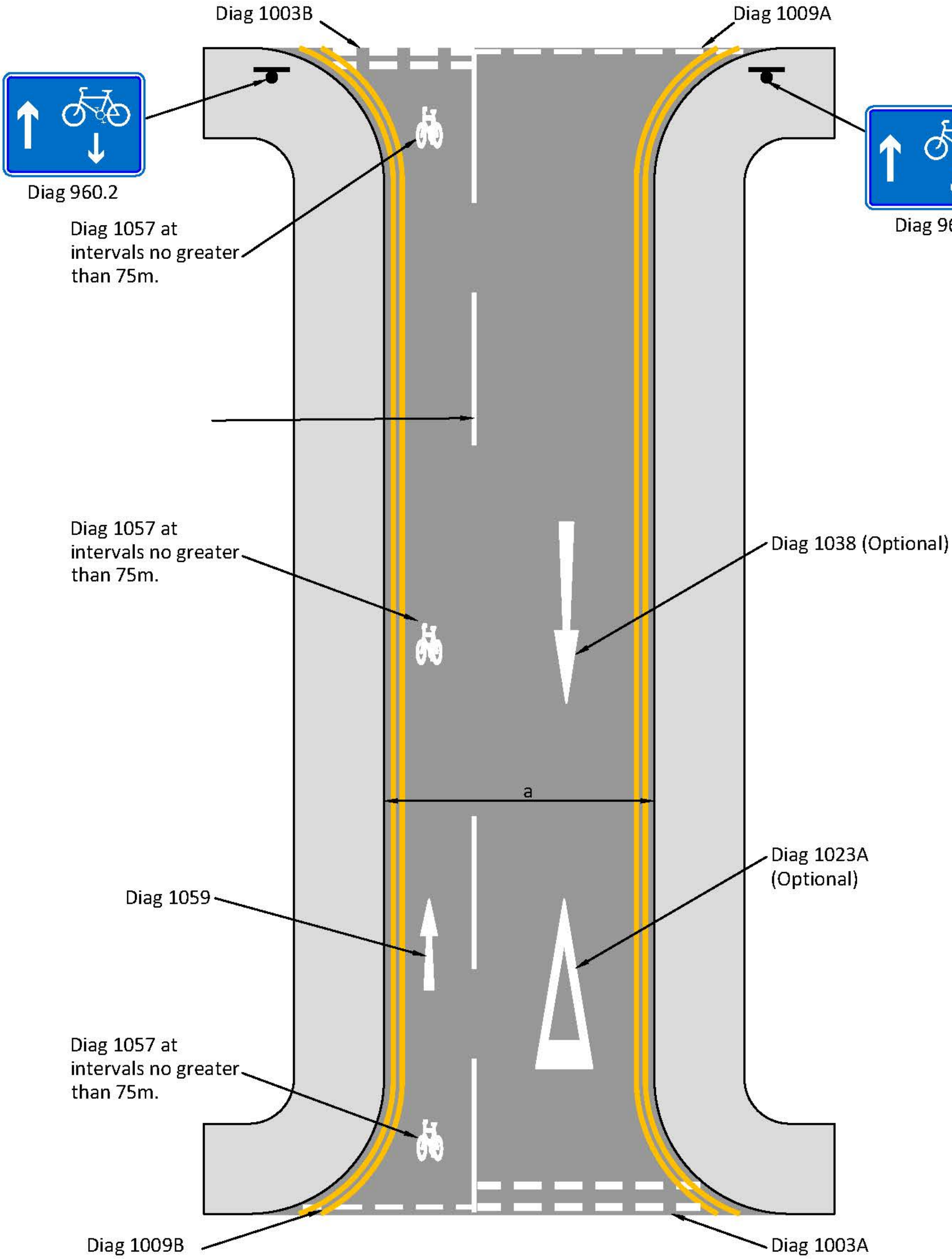
- 20mph zone with traffic calming or 20mph limit is desirable.
- Traffic calming features that require contraflow cyclists to change their alignment should be avoided, for example speed cushions and build-outs.
- Echelon parking bays should be angled so that drivers reverse into them, so that they exit facing forwards and towards contraflow cyclists, therefore improving visual contact.
- Any car parking should preferably be on the opposite side of the carriageway to contraflow cyclists.
- However, where widths are very restricted, car parking on the cyclists’ side will enable cyclists to wait in gaps between parked cars to avoid larger oncoming vehicles.

Further References

- Department for Transport (2003) – Traffic Signs Manual Volume 3. Road Markings.

A4

DE010 Unsegregated Contraflow Cycling



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DE011 Quiet Streets

Measure and Brief Description

Quiet Streets is a term given to urban cycling routes on low traffic speed and volume back streets, which are particularly suitable for new and less confident cyclists. Routes should maintain continuity for cycling and tackle physical barriers such as busy junctions, narrow paths, and should minimise diversions away from desire lines.
Cycle symbols to Diagram 1057, without necessarily the use of vertical signs to diagram 967, can be used to sign the continuity of cycle routes and indicate the correct positioning for cycling within the carriageway; in doing so they also help to raise motorist’s awareness of cyclists, encouraging them to give cyclists space.

Benefits

- Continuous direct routes for cycling following desire lines.
- Relatively low cost solution.
- Largely un-segregated from motor traffic but segregation can be used when required.
- Secure and perceived as secure (socially safe).

Key Design Features

- Routed generally via lightly-trafficked roads (less than 2,500 vehicles AADT on primary cycle routes and 5000 vehicles AADT on secondary cycle routes) and very limited HGV traffic.
- Where traffic volume levels exceed these values, traffic reduction or a filtered permeability approach should be used to reduce motor vehicle volume.
- Traffic speeds to be low – average below 20mph.
- Diag 1057 can be useful to improve legibility of the route where needed.
- Points of conflict with oncoming and crossing traffic, parked vehicles and loading bays (kerbside activity) should be minimised.
- Minimise overall delays and provide route continuity and safety by prioritising cycle movements at junctions.

Dimensions

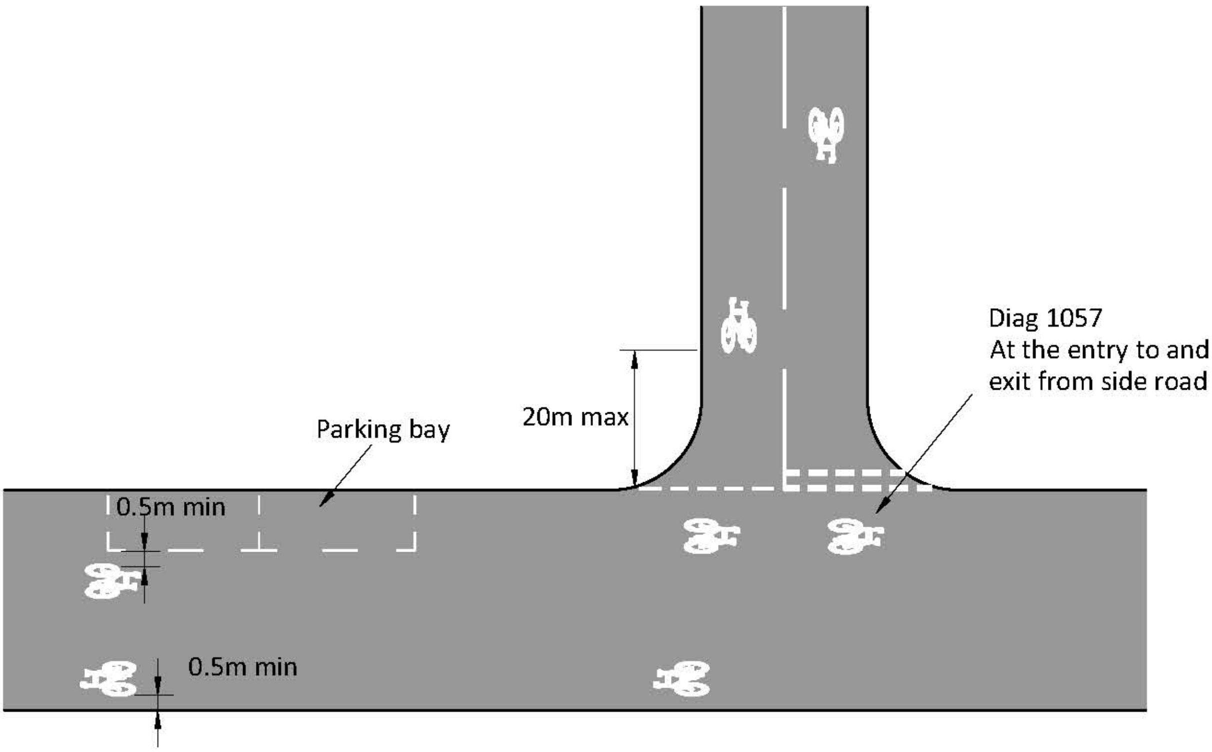
- Where 1057 markings are provided to highlight the route they should be spaced at regular intervals.

Other Considerations

- TSRGD no longer requires the use of vertical signs to diagram 967 with diagram 1057 markings, and authorities may choose to only place signs where there is a clear need to alter other road users to the presence of a cycle route.

A4

DE011	Quiet Streets



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DE012 Cycle Streets

Measure and Brief Description

A Cycle Street is a Quiet Street which also serves as a Primary Cycle Route. It should carry low levels of low speed motor traffic, high levels of cycling, and provide cyclists with a level of service comparable to that provided by a high quality traffic free route the objectives of a Cycle Street are to:

- Present a legible design recognisable to all types of user as a main cycle route.
- Influence behaviour so that cyclists assume priority over motor vehicles.
- Maintain priority for cyclists.
- Attract experienced cyclists as well as less confident cyclists.

In the consultation documents issued with the Draft TSRGD 2015, the Department for Transport proposed that traffic signs and orders could be applied to Cycle Streets which would:

- Ban the overtaking of cyclists by motor vehicles.
- Indicate an advisory 15mph limit.

Highway authorities that wish to apply these measures should seek authorisation from Welsh Government.

Benefits

- Improved cyclist safety and subjective safety.
- Improved route legibility.

Key Design Features

- Street design should encourage cyclists to assume priority, with motor vehicles travelling slowly and not overtaking them.
- There is no standard design; design approaches should be creative, easily maintainable and adaptable – the design detail provided is one indicative solution; the street must be physically recognisable, including from side roads.
- Cyclists should have priority along links and at junctions to increase convenience.
- The length over which a car has to follow a cyclist should be limited to between 200m and 400m.
- Street should carry no more than 2,500 motor vehicles AADT.
- Where traffic volume levels exceed these values, traffic reduction or a filtered permeability approach should be used to reduce motor vehicle flows.
- Traffic speeds to be low – average below 20mph.

Dimensions (Illustrative design)

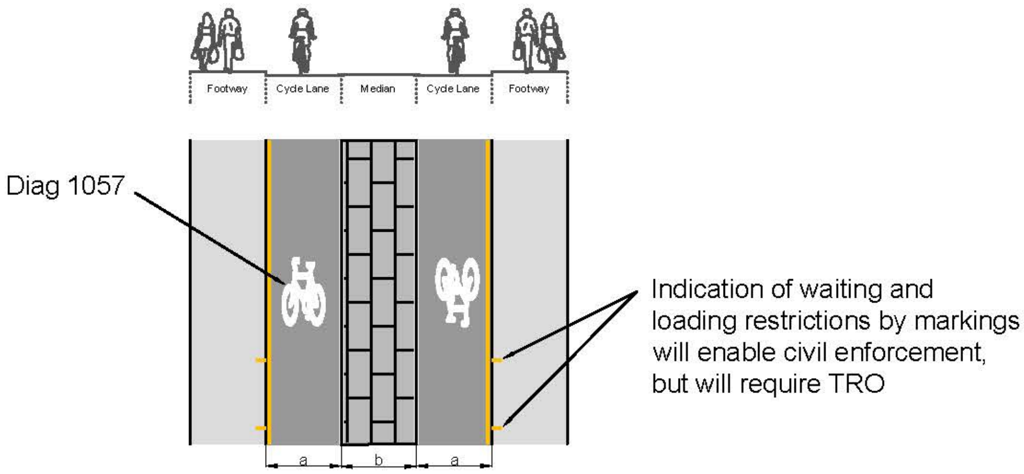
- a – traffic lane width 1.5m absolute minimum, 3m absolute maximum.
- b - central median, 1m desirable minimum.
- Where diagram 1057 markings are provided to highlight the route they should be spaced at regular intervals.

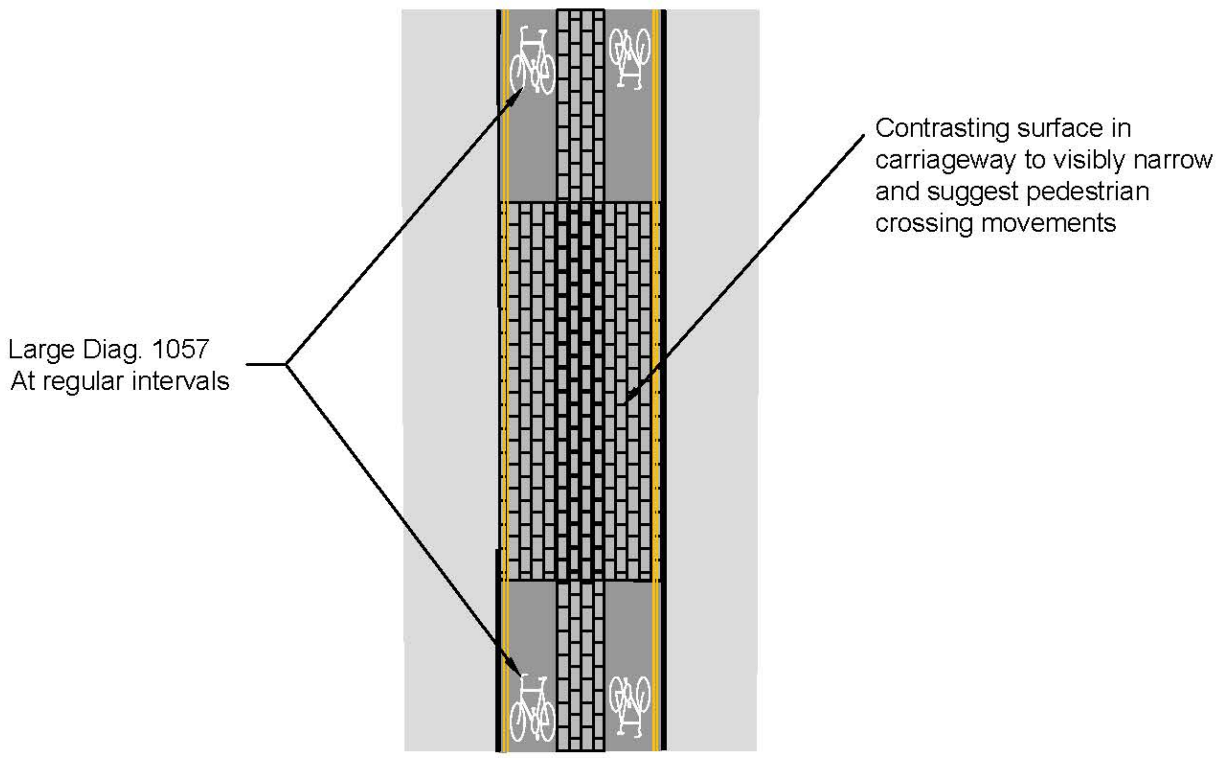
Other Considerations

- TSRGD no longer requires the use of vertical signs to diagram 967 with diagram 1057 markings. Authorities may choose to only place signs where there is a clear need to alter other road users to the presence of a cycle route.

DE012

Cycle Streets





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DE013 Mandatory Cycle Lane

Measure and Brief Description

Mandatory cycle lanes define an area of the carriageway that is reserved for cyclists and are suitable for roads where the speed limit is 30mph or less. Mandatory lanes are marked with a continuous white line (Diagram 1049) which prohibits vehicles from entering the lane during the hours of operation, which should normally be at all times. There can be exceptions, such as emergency service vehicles and access to private driveways. Parking and loading should also be prohibited through appropriate controls. Mandatory lanes are preferable to advisory lanes and should be used unless there are particular local circumstances preventing their use. Following TSRGD in 2016, mandatory lanes do not require Traffic Regulation Orders to be made.

Benefits

- For exclusive use by cyclists during hours of operation (normally at all times).
- Delineated by solid white line, which is less likely to be crossed by motor vehicles.
- Can be enforced by the Police.
- Reduces the potential for conflict between motor vehicles and cycles compared to an advisory lane.
- Highlights presence of cyclists.
- Reduced lane width for motor traffic likely to reduce traffic speeds.

Key Design Features

- Continuity of cycle lane essential.
- Solid white delineation line 150mm wide (Diagram 1049).
- Cycle symbol markings (Diagram 1057) should be placed at the start of the lane and after every break, as well as at regular intervals on long uninterrupted lengths.
- TRO not required for use of marking but may be used to enforce parking.
- Lanes should operate at all times.
- Waiting and loading restrictions should apply at all times.

Dimensions

- a - Desirable minimum 2.0m, Absolute minimum 1.5m.
- Cycle lane entry taper 1:10, exit taper 1:5.

Other Considerations

- Mandatory lanes must be discontinued at side road junctions but the use of a short length marking to diagram 1010 preserves continuity.
- Mandatory lanes can be continued across private accesses.
- Additional protection of cycle lanes can be provided using hatched road markings and traffic islands.
- A cyclist riding in the ‘secondary’ position will fill a 1.5m cycle lane, so if this width cannot be provided a cycle lane is unlikely to be appropriate.
- Inadequate cycle lane widths may increase conflict risk because drivers do not realise that cyclists need to move away from the kerb to avoid surface hazards. A narrow cycle lane may also give motorists (misplaced) confidence to provide less clearance while overtaking than they would in the absence of a cycle lane.
- Greater width should be considered on uphill cycle lanes to allow for additional lateral movement.
- A single uphill cycle lane is preferable to two sub-standard lanes.
- Cycle lanes constrain cyclists to the margin of the carriageway and so cycle-friendly gully gratings are essential.
- Authorities may choose to only place vertical signs to diagram 959.1 with each diagram 1057 marking where there is a clear need to alert other road users to the presence of the mandatory lane.

Further References

- Department for Transport (2003) – Traffic Signs Manual Volume 3. Road Markings.

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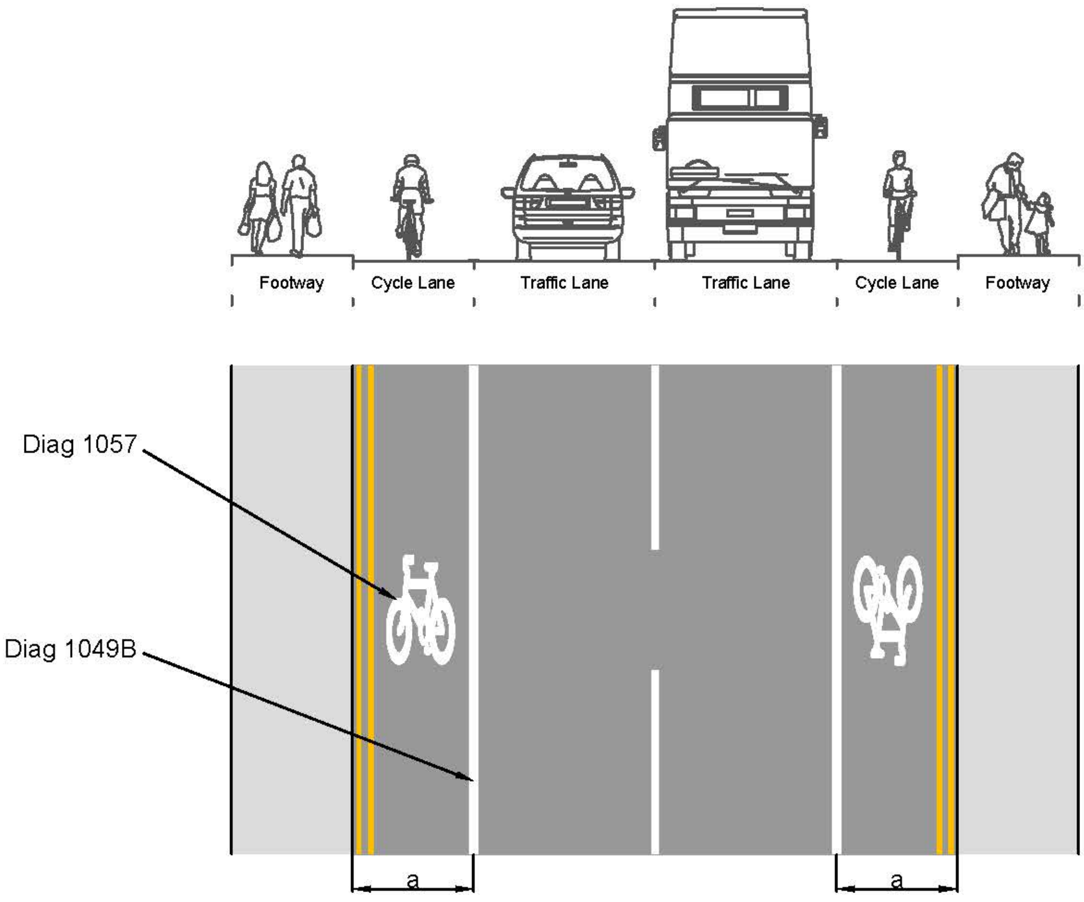
DE013 Mandatory Cycle Lane



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DE014 Advisory Cycle Lane

Measure and Brief Description

Advisory cycle lanes define an area of the carriageway that is intended for cyclists and are suitable for roads where the speed limit is 30mph or less. Advisory lanes are marked with a broken white line (Diagram 1004) which indicates that other vehicles should not enter unless it is safe to do so. Advisory lanes are less preferable than mandatory lanes, which should be used unless there are particular local circumstances.

Benefits

- Can be used in circumstances where a carriageway is not wide enough to permit full width mandatory cycle lanes, resulting in occasional motor vehicles entering the cycle lane.
- Can be useful to indicate routes through a large or complex junction.
- Reduces the potential for conflict between motor vehicle andcycles.
- Highlights presence of cyclists.
- Reduced lane width for motor traffic likely to reduce traffic speeds.

Key Design Features

- Continuity of cycle lane essential.
- Bounded by broken white line 100mm wide (diagram 1004).
- Cycle symbol markings (diagram 1057) should be placed at the start of the lane and after every break, as well as at regular intervals on long uninterrupted lengths.
- TRO not required for advisory cycle lane.
- Waiting and loading restrictions should apply at all times.

Dimensions

- a - Desirable minimum 2.0m, Absolute minimum 1.5m.
- Cycle lane entry taper 1:10, exit taper 1:5.

Other Considerations

- Where width is constrained, a wider advisory cycle lane may be preferable to a narrow mandatoryone.
- There can be benefits in continuing advisory cycle lanes through signalled junctions.
- Additional protection of cycle lanes can be provided using hatched road markings and traffic islands.
- A cyclist riding in the ‘secondary’ position will fill a 1.5m cycle lane, so if this width cannot be provided a cycle lane is unlikely to be appropriate.
- Inadequate cycle lane widths may increase conflict risk because drivers do not realise that cyclists need to move away from the kerb to avoid surface hazards. A narrow cycle lane may also give motorists (misplaced) confidence to provide less clearance while overtaking than they would in the absence of a cycle lane.
- Greater width should be considered on uphill cycle lanes to allow for additional lateral movement.
- A single uphill cycle lane is preferable to two sub-standard lanes.
- Cycle lanes constrain cyclists to the margin of the carriageway and so cycle-friendly gully gratings are essential.
- Authorities may choose to only place vertical signs to diagram 967 with each diagram 1057 marking where there is a clear need to alter other road users to the presence of the mandatory lane.

Further References

- Department for Transport (2003) – Traffic Signs Manual Volume 3. Road Markings.

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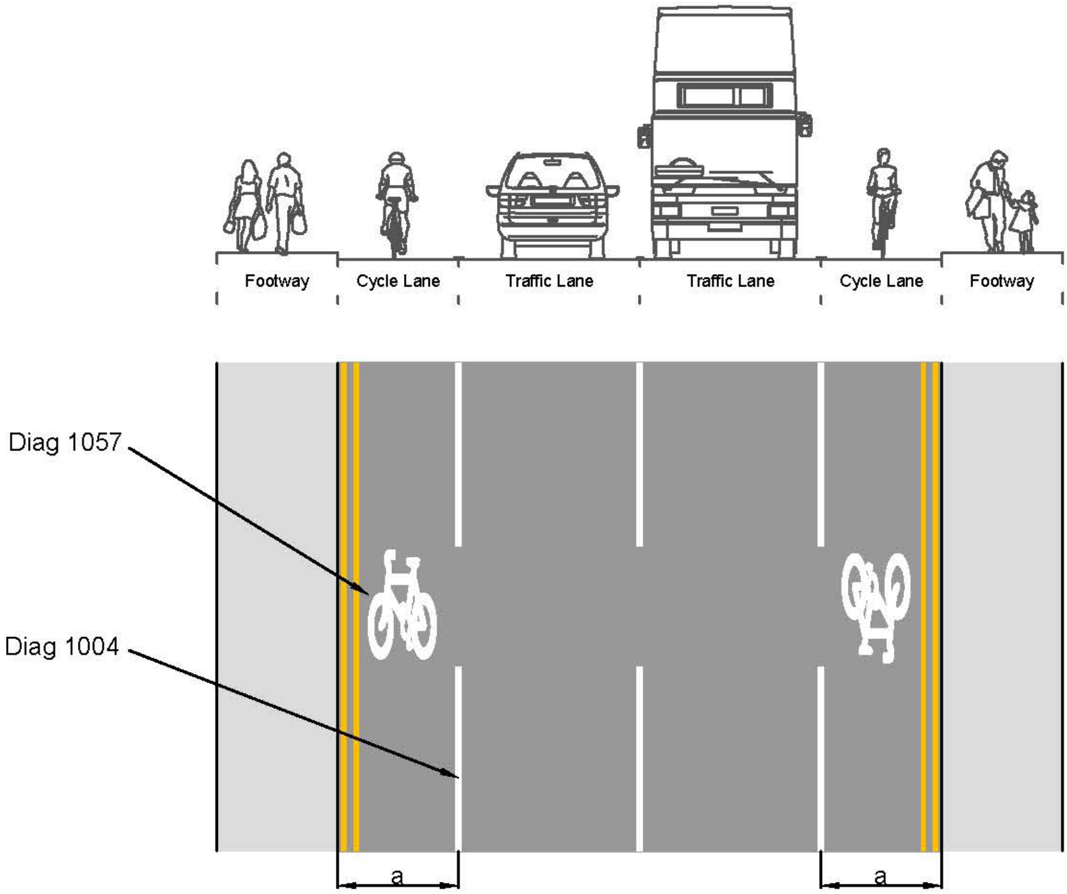
DE014

Advisory Cycle Lane



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DE015 Cycle Lane Passing Car Parking/Loading

Measure and Brief Description

Kerbside vehicle parking or loading can be dangerous for cyclists, especially parking spaces with high vehicle turnover rates, since there is a significant risk to cyclists from vehicle doors being opened. It is therefore highly desirable that cycle lanes pass vehicle parking areas with a dividing strip of sufficient width (buffer strip).

Benefits

- Prevents cyclists being hit by vehicle doors opening.
- Reduces the risk of cyclists having to swerve into traffic lane to avoid opening doors.
- Encourages good road positioning as taught in cycle training.
- Prevents cyclists getting trapped at the kerbside at the start of a parking bay.

Key Design Features

- Buffer strip between parking/loading bays and cycle lane.
- Hatched road markings may be used to define the buffer strip.
- Tapers required at approach to and at end of parking/loading bays.

Dimensions

- a - Desirable minimum 2m, Absolute minimum 1.5m.
- b - Buffer strip along parking/loading bays - desirable minimum 1m, absolute minimum 0.5m min.
- c – width of parking/loading bays:
  - for cars – min 2m wide.
  - for vans – min 2.4m wide.
  - for buses and HGVs min 2.8m wide (preferably 3.2m wide).
- d - general traffic lane should be 2.5m min width, or 3m where there are significant heavy vehicle flows.
- 1:10 approach taper to allow cyclists the opportunity to safely realign themselves before passing parked vehicles.
- 1:5 exit taper to allow cyclists the opportunity to safely realign themselves after passing parked vehicles.

Other Considerations

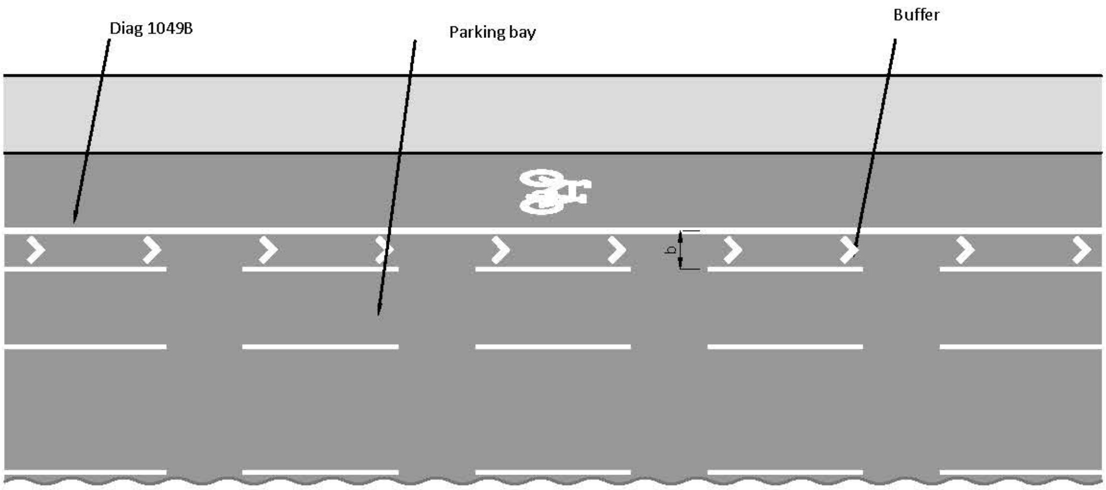
- If there is insufficient width for a cycle lane and buffer strip past car parking, consideration should be given to narrowing traffic lanes or removal of centre line, rather than substandard facilities for cyclists.
- It may be possible to remove/relocate parking and introduce mandatory cycle lanes, for example if a street has adequate off-street car parking facilities or excess provision.
- Where carriageway widths are narrow and parking cannot be relocated or removed all day, timed mandatory cycle lanes could be considered for peak times.
- A 2.0m wide cycle lane can be reduced locally to 1.5m to allow a 0.5m wide buffer strip to be provided.

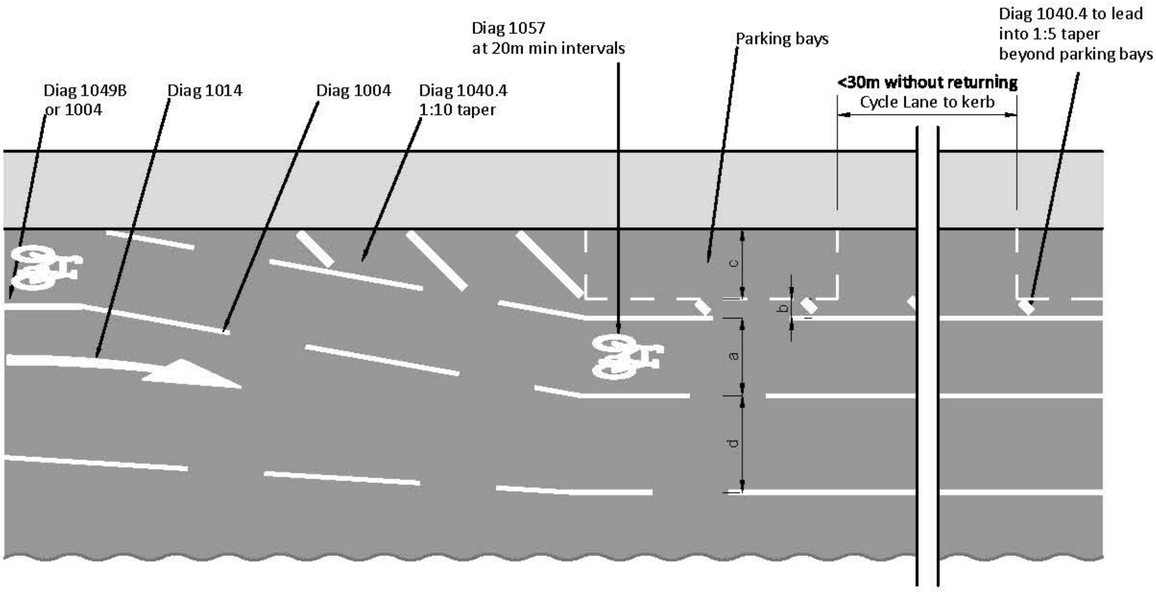
Further References

- Department for Transport (2003) – Traffic Signs Manual Volume 3. Road Markings.

A4

DE015 Cycle Lane Passing Car Parking / Loading





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DE016 Cycle Lane at Side Road

Measure and Brief Description

Cycle lanes should continue across side road junctions to ensure continuity and help improve safety. This can be achieved using a stretch of road marking 1010, where the white line is broken, since continuous mandatory lanes across side road junctions are not permitted and in preference to advisory cycle lanes to diagram 1004. It is recommended that the cycle lane width be increased at the mouth of side roads to encourage cyclists to position themselves further out from the kerb in order to increase its effectiveness and avoid conflict with vehicles nosing out of junctions.

Benefits

- improves conspicuity of cyclists at conflict point.
- provides route continuity.

Key Design Features

- The use of Diagram 1010 markings is recommended in preference to advisory cycle lanes to Diagram 1004 to increase conspicuity.
- Cycle symbols (Diagram 1057) may be placed in the cycle lane along the mouth of a junction.
- Coloured road surfacing may also be used in cycle lane to highlight the area of potential conflict.
- Wider cycle lanes across side roads help offer cyclists more space when cars encroach and encourage better road positioning by cyclists.

Dimensions

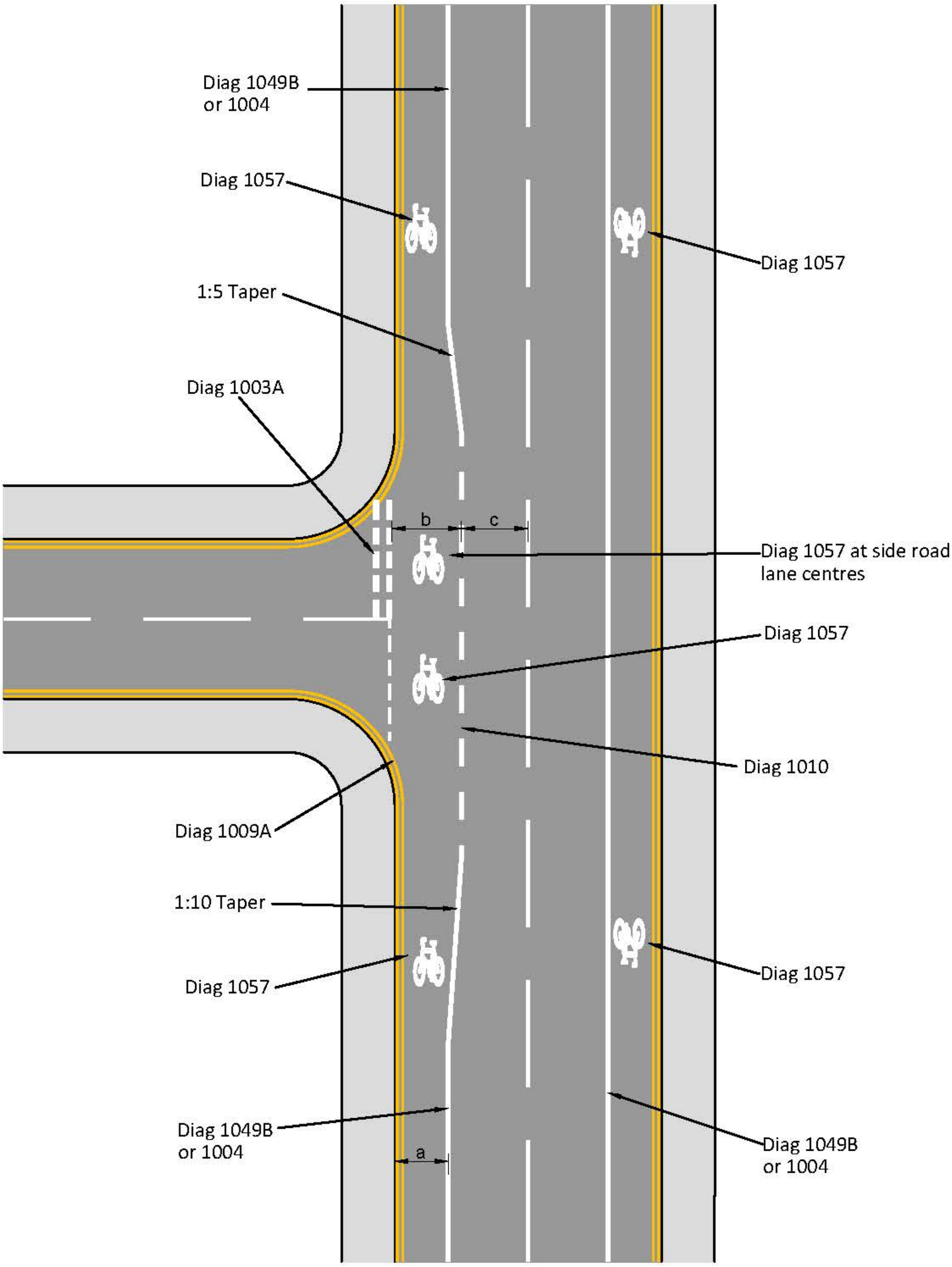
- a – Width on approach - desirable minimum 2.0m, absolute minimum 1.5m.
- b - Width at side road should be at least 0.5m greater than on approaches.
- c - general traffic lane should be 2.5m min width, or 3m where there are significant heavy vehicle flows.
- Widening at side road introduced with 1:10 entry taper and 1:5 exit taper.

Other Considerations

- Side road entry treatments (DE39) should also be considered, which provide raised carriageway tables and reduced comer radii at side road junctions. They help reduce turning vehicle speeds, making it safer and more accessible for cyclists passing through the junction and pedestrians crossing the side road.
- Entry to and from side roads should be reviewed to ensure appropriate sightlines and speeds to mitigate risks to cyclists from turning traffic.
- Side-road warning signs to Diagrams 962.1 or 963.1 to warn motorists and pedestrians of the presence of cyclists are generally unnecessary except for situations where contra-flow cycling is permitted.

A4

DE016	Cycle Lane at Side Roads	



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DE017 Cycle Lanes with Removal of Centre Lines

Measure and Brief Description

Consideration can be given to the removal of centre lines where carriageway widths do not permit the introduction of cycle lanes of adequate width whilst retaining two general traffic lanes. In addition to increasing the width available for cyclists, the technique also has a speed reducing effect as motor traffic no longer has defined lanes in each direction. Where the need arises for on-coming motor vehicles to pass each other on a narrow carriageway, this is achieved by both drivers momentarily pulling over into their respective near-side advisory cycle lanes, having first checked to see they are clear of cyclists.

Benefits

- Creates sufficient width for cycle lanes of the appropriate standard.
- Creates a safer and more comfortable environment than sub-standard cycle lanes.
- Achieves speed reduction for motor vehicles.
- Cost-effective, may be facilitated through maintenance works.
- Can be politically more acceptable than other more physical, traffic calming techniques.

Key Design Features

- Not suitable for roads with high traffic and HGV flows.
- A max of 10,000 vehicles AADT is recommended, although schemes have been introduced with traffic volumes of up to 14,000 vehicles AADT.
- Not suitable for roads with speed limits over 30mph.
- Unless only light vehicles are present, advisory cycle lanes should be used so that large vehicles can use the cycle lanes to pass one another.
- Requires adequate forward visibility.

Dimensions

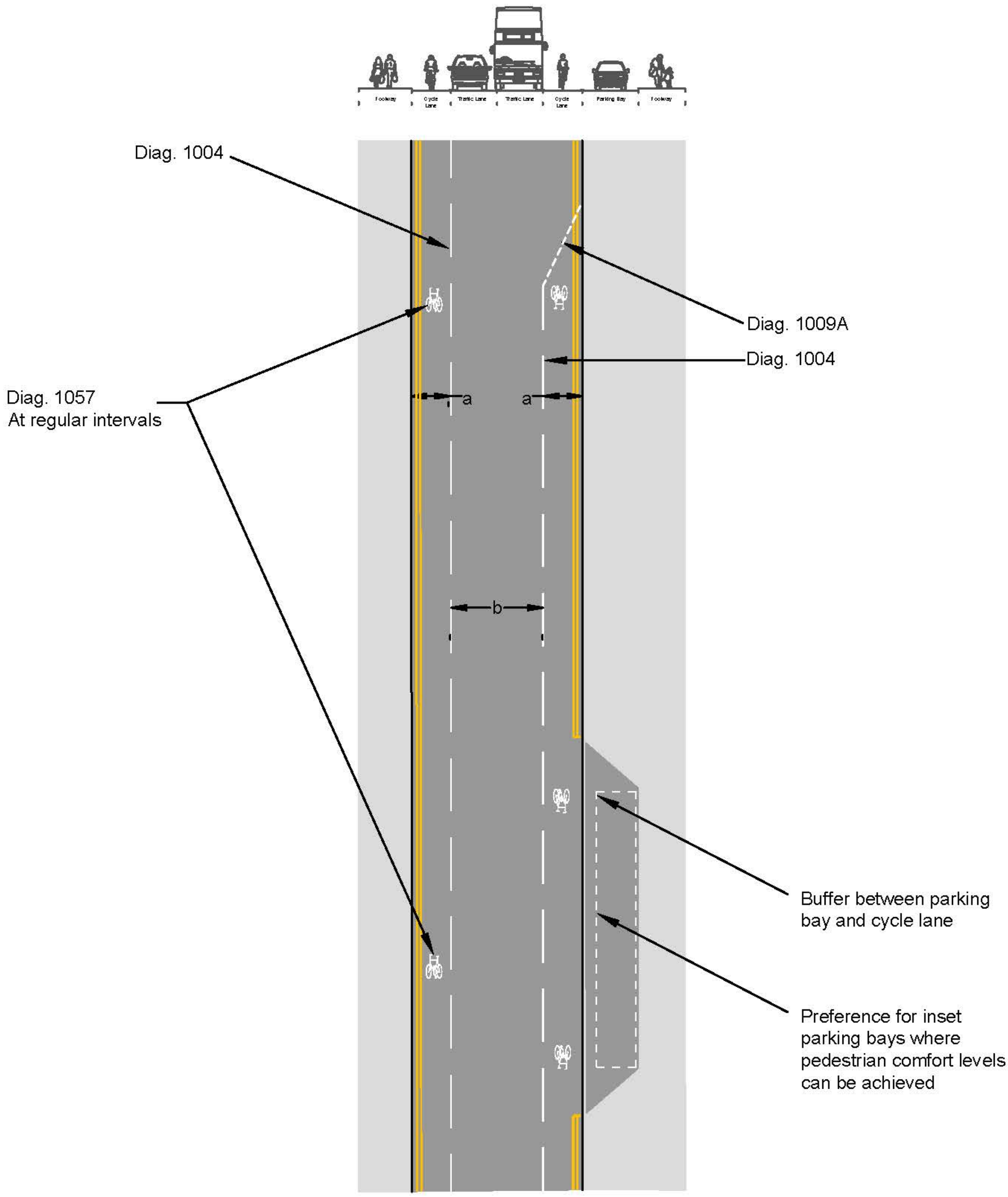
- a - Desirable minimum 2.0m, Absolute minimum 1.5m.
- b - central general traffic lane 3m to 5.5m wide, preferably 4.1m – 4.8m.
- Where kerb-side parking is present, provide a buffer strip of 0.5 - 1m, or use inset parking bays.

Other Considerations

- If the general traffic lanes are wider than 5.5m in total, the additional space should be used to increase the width of cycle lanes.

A4

DE017 Cycle Lanes With Removal of Centrelines



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DE018 Cycle Lane with Light Segregation

Measure and Brief Description

The degree of separation provided by a mandatory cycle lane may be reinforced by ‘light segregation’ from the main carriageway, i.e. intermittent low level physical features such as planters, wands (retroreflective self-righting bollards) or proprietary raised features which may be constructed from rubber, PVC or concrete. The fact that the obstacles are intermittent allows cyclists to manoeuvre between the cycle lane and the carriageway as necessary, avoids any impact on drainage and means that the design is cost effective and flexible.

Benefits

- Increase cyclist comfort and safety levels, as well as subjective safety.
- Can be used on roads with speed limits of up to 30mph.
- Physical features deter motorists from encroaching into lane.
- Cyclists can manoeuvre in and out of the lane to carry out right turns and for access
- Low installation cost.
- Easily installed to existing cycle lanes.
- Lane widths can be easily adapted to suit future conditions, such as increased usage.
- Can also be used for contra-flow lanes and for two way cycling.
- Avoids the need for drainage works.

Key Design Features

- Used in combination with a mandatory cycle lane (diagram 1049).
- Advisory cycle lane (diagram 1004) should not be used, as a key design principle is that motor vehicles should not cross light segregation.
- Physical features should be placed on the left-hand side of the cycle lane marking so that the marking can clearly be seen by drivers.
- Careful consideration is needed for the design of the physical feature – they need to be conspicuous and robust, but not mimic a road marking or sign.
- Low features should have curved or sloped faces to minimise the hazard for motor vehicles.
- Continuity should be provided at bus stops.

Dimensions

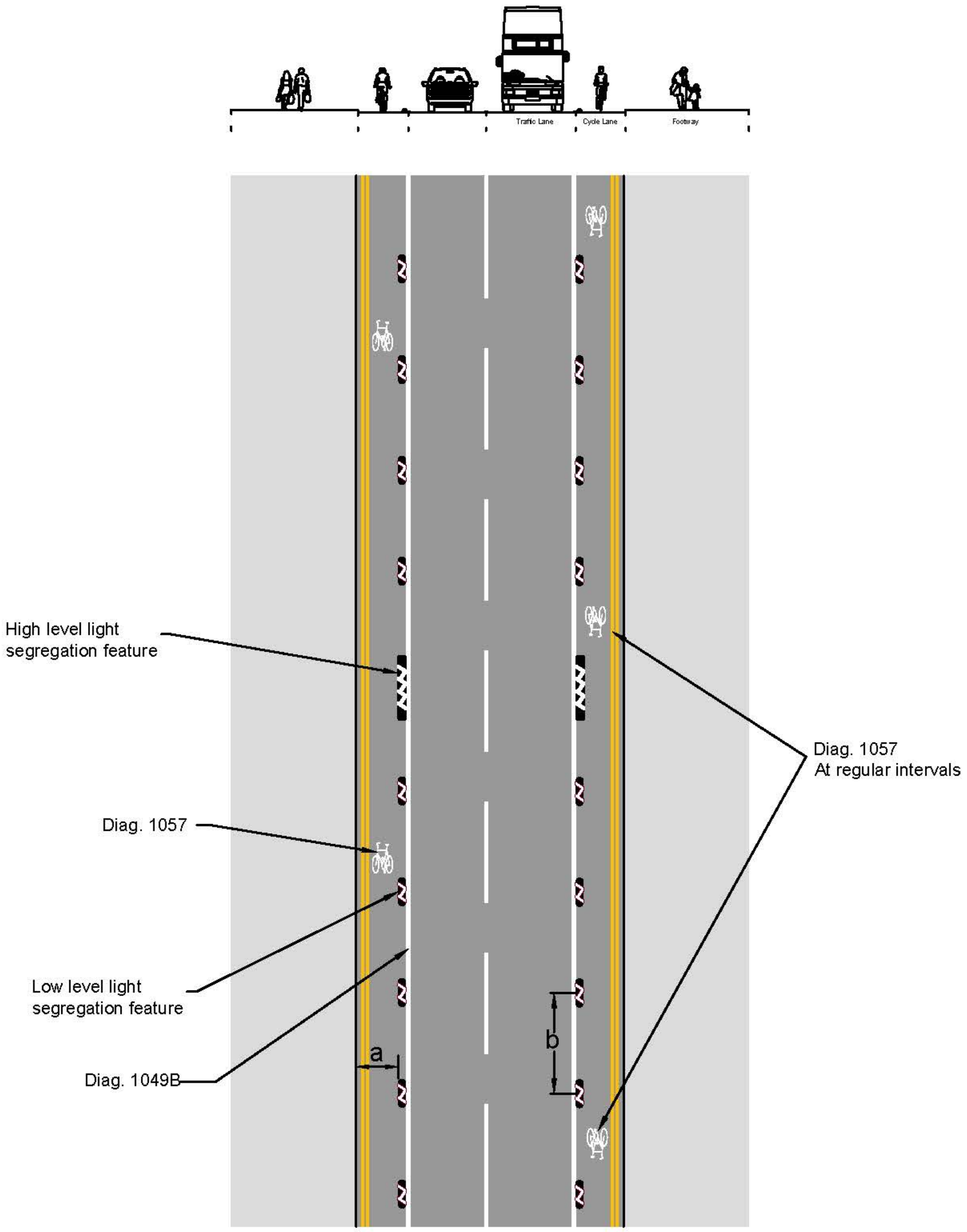
- a - Desirable minimum 2.0m, Absolute minimum 1.5m.
- Where cycle flows are heavy (over 150 cyclists in the peak hour) and frequent overtaking occurs, widths should be increased to 2.5m.
- b - Segregation features to be spaced at 2.5-10m intervals, or as recommended by the product manufacturer.

Other Considerations

- If using bollards consideration should be given for illumination or reflective strips.

A4

DE018 Cycle Lanes With Light Segregation



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DE019 Cycle Lane with Light Segregation at Side Road

Benefits

- improves conspicuity of cyclists at conflict point.
- provides route continuity.

Key Design Features

- Light segregation feature does not continue across side road.
- The use of Diagram 1010 markings is recommended in preference to advisory cycle lanes to Diagram 1004 to increase conspicuity.
- Cycle symbols (Diagram 1057 TSRGD) may be placed in the cycle lane along the mouth of a junction.
- Coloured road surfacing may also be used in cycle lane to highlight the area of potential conflict.

Dimensions

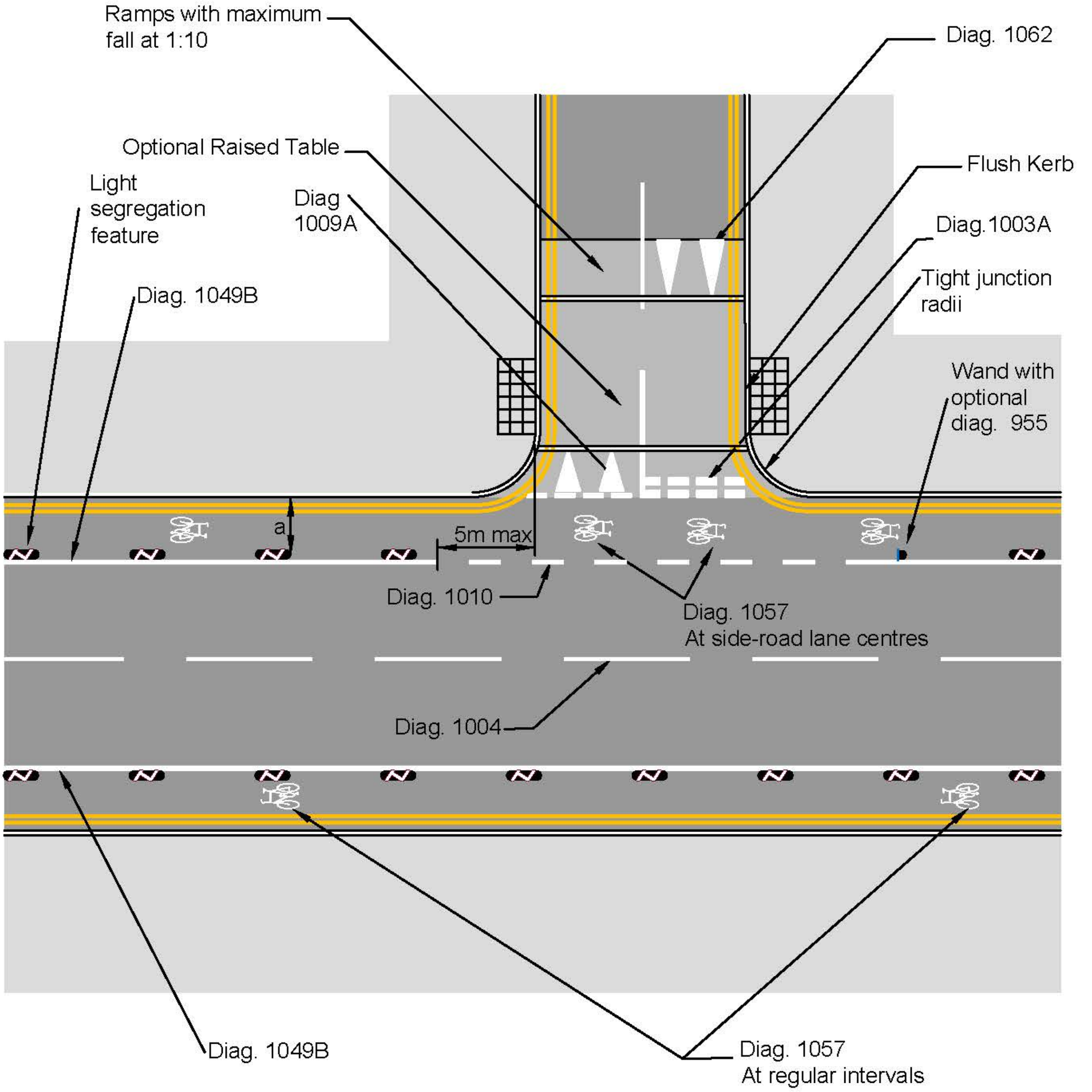
- a – Width on approach - desirable minimum 2m, absolute minimum 1.5m.
- Should be a minimum of 2m wide across side road.
- Segregation features to be spaced at 2.5-10m intervals.
- Segregation to cease no more than 5m from junction, depending on swept path requirements.

Other Considerations

- Side road entry treatments (DE39) should also be considered, which provide raised carriageway tables and reduced comer radii at side road junctions. They help reduce turning vehicle speeds, making it safer and more accessible for cyclists passing through the junction and pedestrians crossing the side road.
- Entry to and from side roads should be reviewed to ensure appropriate sightlines and speeds to mitigate risks to cyclists from turning traffic.
- Side-road warning signs to Diagrams 962.1 or 963.1 to warn motorists and pedestrians respectively are generally unnecessary except for situations where contra-flow cycling is permitted.
- Widening of the cycle lane at the junction can also be considered.

A4

DE019	Cycle Lane With Light Segregation at Side Road	



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DE020 Car Parking/Loading with Light Segregation

Measure and Brief Description

Car parking/loading may be provided on the carriageway side of cycle lanes with light segregation, preferably with a buffer strip between the edge of the lane and the car parking/loading. Parking/loading should be prohibited in the vicinity of side road junctions and accesses so as to maintain adequate intervisibility.
This detail can also be applied to hybrid cycle tracks.

Benefits

- Provides cyclists with additional protection from moving traffic.
- Prevents parked cars causing obstruction to cycle lanes/tracks.
- Reduces likelihood and severity of cyclists being hit by vehicle doors opening.
- Prevents cyclists getting trapped at the start of parking bay.

Key Design Features

- Car parking located on the carriageway side of the cycle lane/track.
- Buffer strip to be provided between the edge of the cycle track and the parking/loading spaces where possible.
- Car parking/loading to be prohibited on the approach to side roads/accesses, so approaching cyclists are clearly visible to traffic coming out of the side road/access.

Dimensions

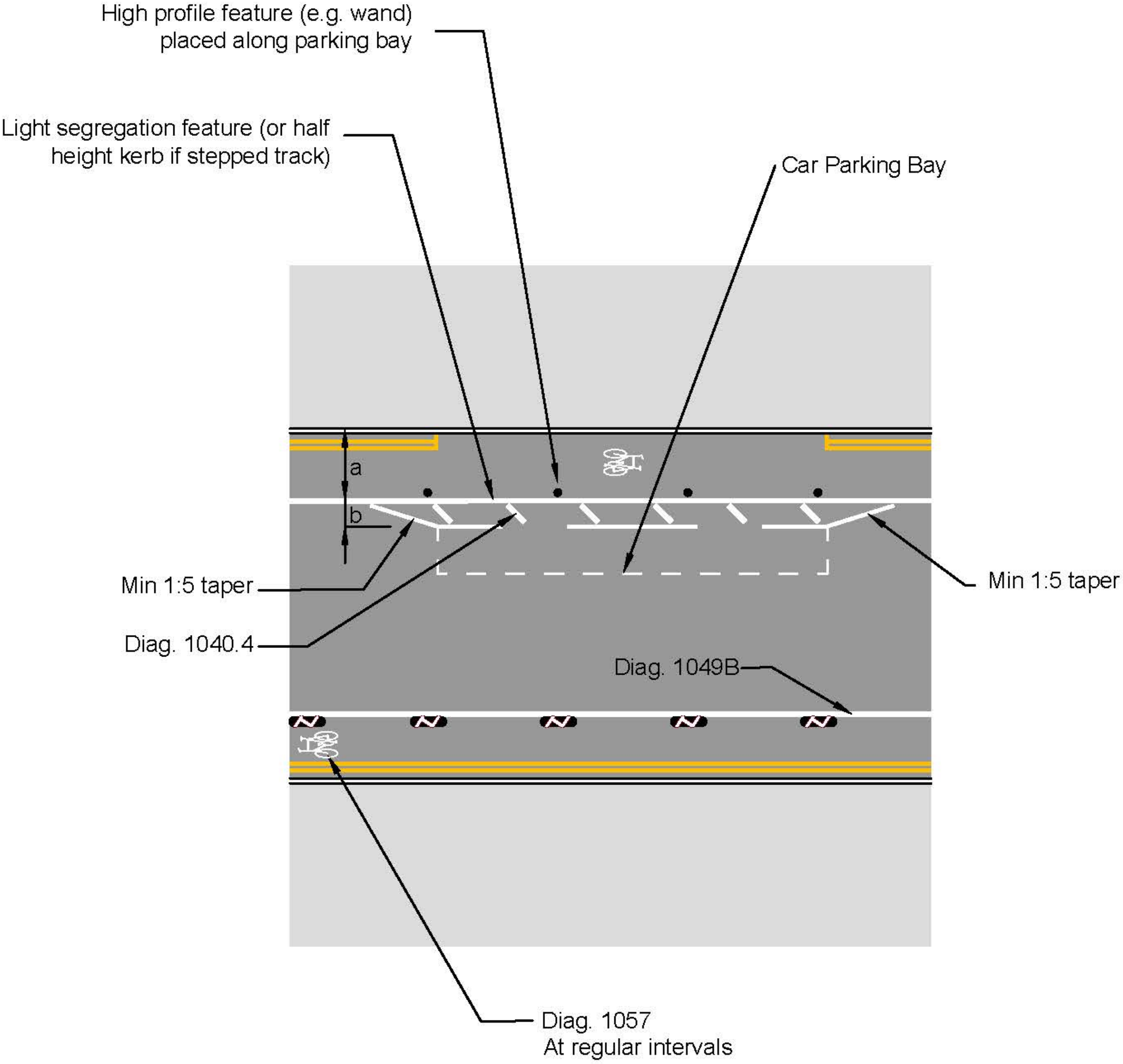
- a - Desirable minimum 2.0m, Absolute minimum 1.5m.
- b - Preferably also provide buffer strip of width 0.5m.
- Segregation features to be spaced at 2.5-10.0m intervals.

Other Considerations

- A 2.0m wide cycle track can be reduced locally to 1.5m to allow a 0.5m wide dividing strip to be provided.

A4

DE020 Car parking/Loading with Light Segregation



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DE021 Stepped Cycle Track

Measure and Brief Description

Hybrid cycle tracks have a surface raised above the carriageway but are below the level of the footway. They keep cyclists close to other traffic but provide more separation from it than a cycle lane or light segregation does. Cyclists can enter and leave the cycle track relatively easily where lowered kerbs or fillets are provided but the presence of a raised kerb edge along most of the length deters encroachment by motor vehicles.

Benefits

- Increase cyclist comfort and safety levels, as well as subjective safety.
- Can be used on roads with speed limits of up to 30mph.
- Level difference helps deter motorists from straying into cycle lane.
- Priority for cyclists over accesses to properties and side roads is maintained.
- Can reduce the amount of traffic signs and markings compared with mandatory cycle lanes.
- No TRO is required although this would be necessary for parking restrictions.
- Can reduce conflict between cyclists and pedestrians compared with shared use paths.

Key Design Features

- Hybrid cycle tracks operate one way, in the same direction as motor traffic flow.
- Space can be taken from footway or preferably carriageway to create the track.
- Lowered to merge with the carriageway at junctions or other areas where cyclists need to access the general traffic lanes.
- Continuity should be provided at bus stops.
- Hybrid tracks at side roads retain priority for cyclists.

Dimensions

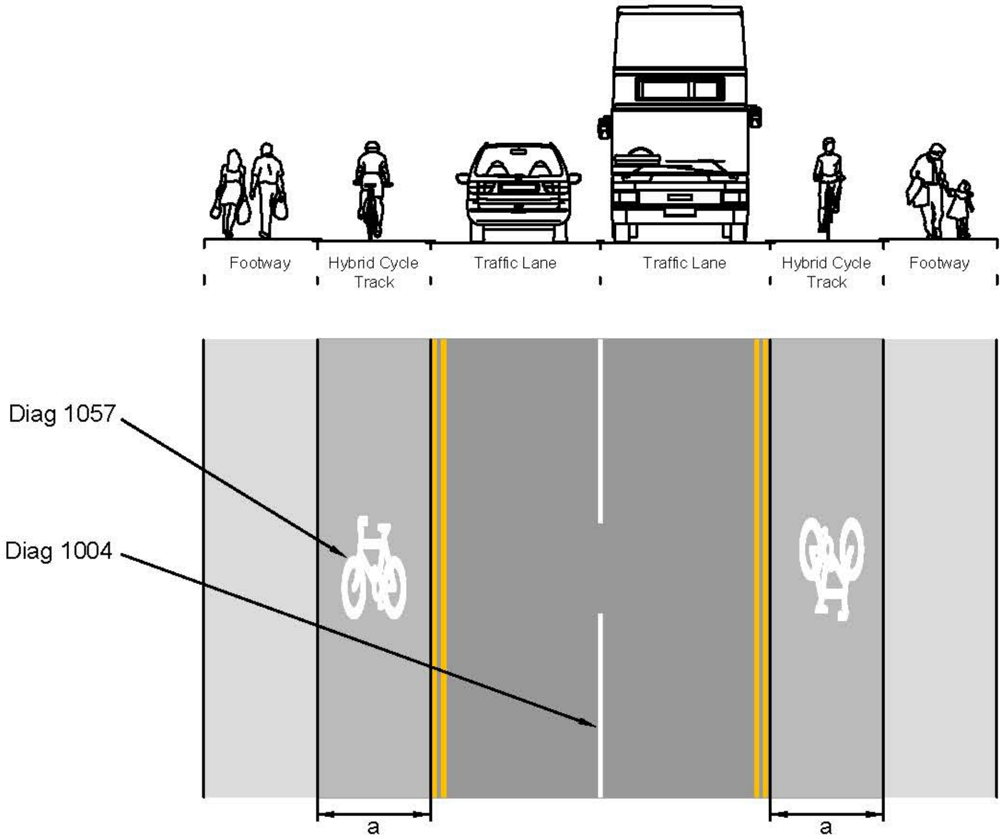
- a - Desirable minimum 2.0m, Absolute minimum 1.5m.
- Where cycle flows are heavy (over 150 cyclists in the peak hour) and frequent overtaking occurs, widths should be increased to 2.5m.
- Minimum kerb upstands should generally be 50mm on the carriageway side, and 25mm on the footway side.
- Lamp columns, sign posts, etc should be placed 0.5m from any hybrid cycle lane.

Other Considerations

- New drainage facilities will need to be introduced into the narrowed carriageway while existing grates will need to be raised to cycle track level. Cycle friendly drainage grates should be used for both.
- Can be used as part of centre line removal projects.
- There is no particular requirement to sign hybrid tracks (or use coloured surfacing). In many cases, the kerb upstand itself will suffice to deter motor vehicles from entering. However, the use of a mandatory lane placed on the carriageway side of the kerb could be considered if encroachment by motor vehicles (including parking) becomes a problem.

A4

DE021 Stepped Cycle Track



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DE022 Stepped Cycle Track at Side Road

Measure and Brief Description

As hybrid tracks are still considered part of the carriageway, and normally operate one-way in the same direction as general traffic, they should cross side roads in the same position as a cycle lane, ensuring route continuity. One-way hybrid tracks should normally retain priority over side roads; this can be achieved by:

- Continuing the hybrid track through the junction with a flush kerb;
- Stopping the hybrid track within 5.0m of the junction on either side with a raised crossing for turning traffic and tight corner radii at the side road; or
- By the hybrid track becoming a cycle lane 20m -30m in advance of the side road (in which case refer to DE016).

Benefits

- helps the conspicuity of cyclists at conflict point.
- helps with route continuity.

Key Design Features

- Side road give-way markings should be set back from the hybrid track.
- Cycle symbols (Diagram 1057) may be placed in the cycle track/lane across the mouth of a junction.
- Coloured road surfacing may also be used in cycle track/lane to highlight the area of potential conflict.
- Care needs to be taken where hybrid tracks pass private accesses, to ensure drivers emerging from the access can see cyclists. Cyclists should not normally be required to give way to vehicles using accesses.

Dimensions

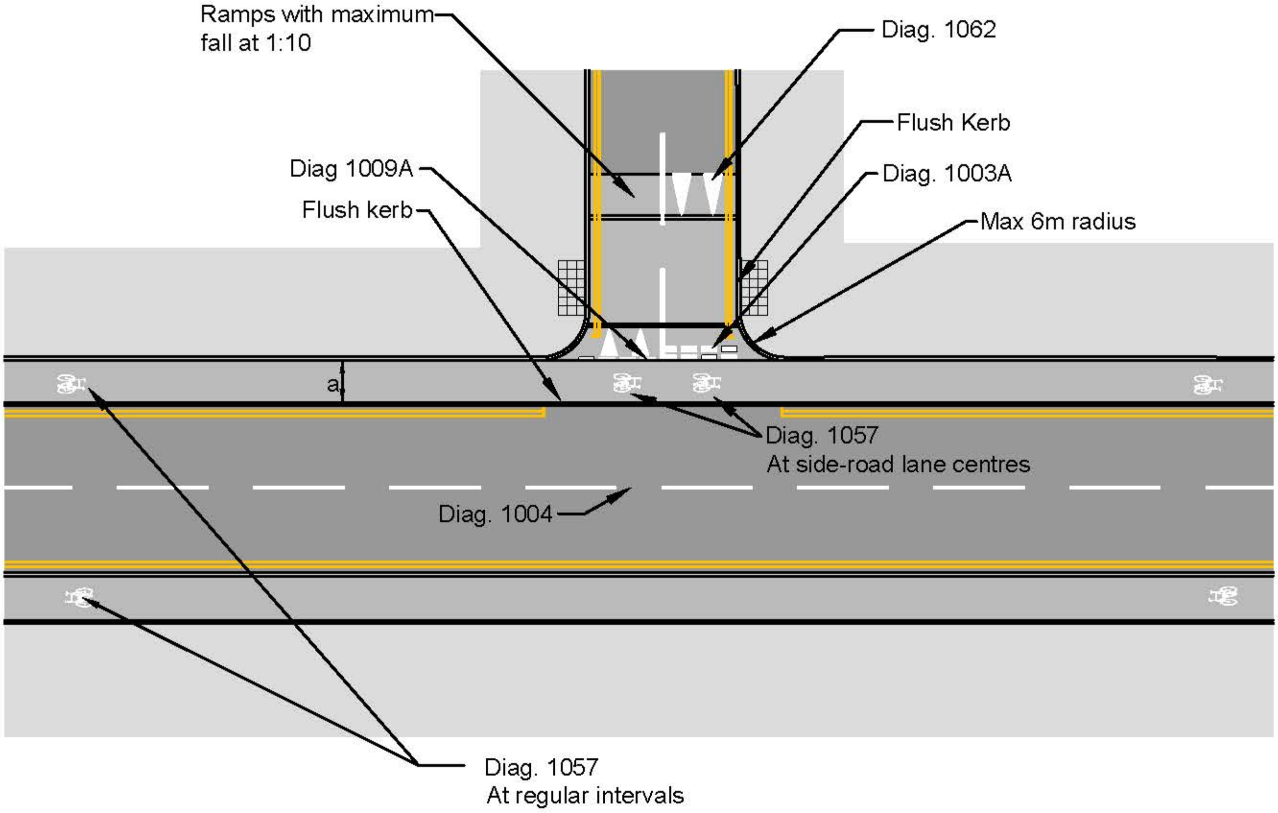
- a – Width on approach - desirable minimum 2.0m, absolute minimum 1.5m.

Other Considerations

- Side road entry treatments (DE39) should also be considered, which provide raised carriageway tables and reduced comer radii at side road junctions. They help reduce turning vehicle speeds, making it safer and more accessible for cyclists passing through the junction and pedestrians crossing the side road.
- Entry to and from side roads should be reviewed to ensure appropriate sightlines and speeds to mitigate risks to cyclists from turning traffic.
- Side-road warning signs to Diagrams 962.1 or 963.1 to warn motorists and pedestrians respectively are generally unnecessary except for situations where contra-flow cycling is permitted.
- Widening of the cycle lane at the junction can also be considered.

A4

DE022 Stepped Cycle Track at Side Road



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DE023 Cycle Track Alongside Road, Separated From Pedestrians

Measure and Brief Description

Where traffic volumes and/or speeds are too high for cycle lanes, light segregation or hybrid tracks, physical separation from motor traffic may be appropriate to provide cyclists with safe and comfortable space, through the provision of segregated cycle tracks. Segregated cycle tracks should be of adequate width, comfortable, continuous and link into surrounding cycling routes. Preferably they will be provided through reallocation of road space from the carriageway; in most urban locations the conversion of footways to segregated shared use should be the last resort.

Physical segregation from pedestrians is generally preferred provided widths are adequate and this can be achieved through a level difference or verge. Barriers between cycle tracks and footways are not desirable since they limit the effective width of the paths and are a particular hazard to cyclists. Segregation using only simple white lines (Diag 1049) (which are not detectable by blind users) or a raised white line delineator (Diag 1049.1), is an option but it is rarely respected by pedestrians (who have the legal right to use the cycle track) in practice, unless cycle flows are high or there is generous width, and should therefore be avoided.

Benefits

- Provides routes which are free from conflict with motor traffic.
- Segregated paths allow each group to move at their own desired pace and improve comfort and subjective safety.

Key Design Features

- The cycle track should normally be located between carriageway and footway.
- Footways and cycle tracks should be continuous across private accesses.
- Pedestrians require regular crossing points with a flush kerb between the cycle track and the carriageway; tactile paving should be provided.
- Cycle tracks should not deflect more than 45º and changes in height should be avoided.
- Machine-laid black bituminous surfacing should be used as it will make cycle journeys safer, more comfortable and helps distinguish cycle tracks from adjacent footways surfaced by paviours or slabs.
- Lamp columns and other street furniture should not be placed in cycle tracks.
- Centre lines should be marked on two-way cycle tracks.

Dimensions

- a - Cycle track width should be sufficient to accommodate the forecast level of use with a minimum of:
  - Absolute minimum 2.5m, where the peak hour cycle flow is less than 50/hr;
  - Desirable minimum 3m, where it is 50-250/hr, 4m for cycle flows over 250/hr.
- Cycle tracks should include additional width where they are bounded by vertical features. Additional width required is:
  - Kerb up to 150mm high: add 200mm.
  - Vertical feature 150-600mm high: add 250mm.
  - Vertical feature above 600mm high: add 500mm.
- b - In addition to the path width above, a margin strip separating the cycle track from the carriageway is recommended:
  - Desirable minimum 0.5m with speed limits of 30mph
  - Desirable minimum 1.5m with speeds limits of 40mph or above.
- c - The width of the footway should reflect the level and type of use, based on level of service, Desirable minimum 2.0m width, increasing to 3.5m width where there is frequent use by groups. 1.5m may be acceptable over short lengths – see DE001.
- Verges separating pedestrian and cycle routes should be a minimum of 1m wide.

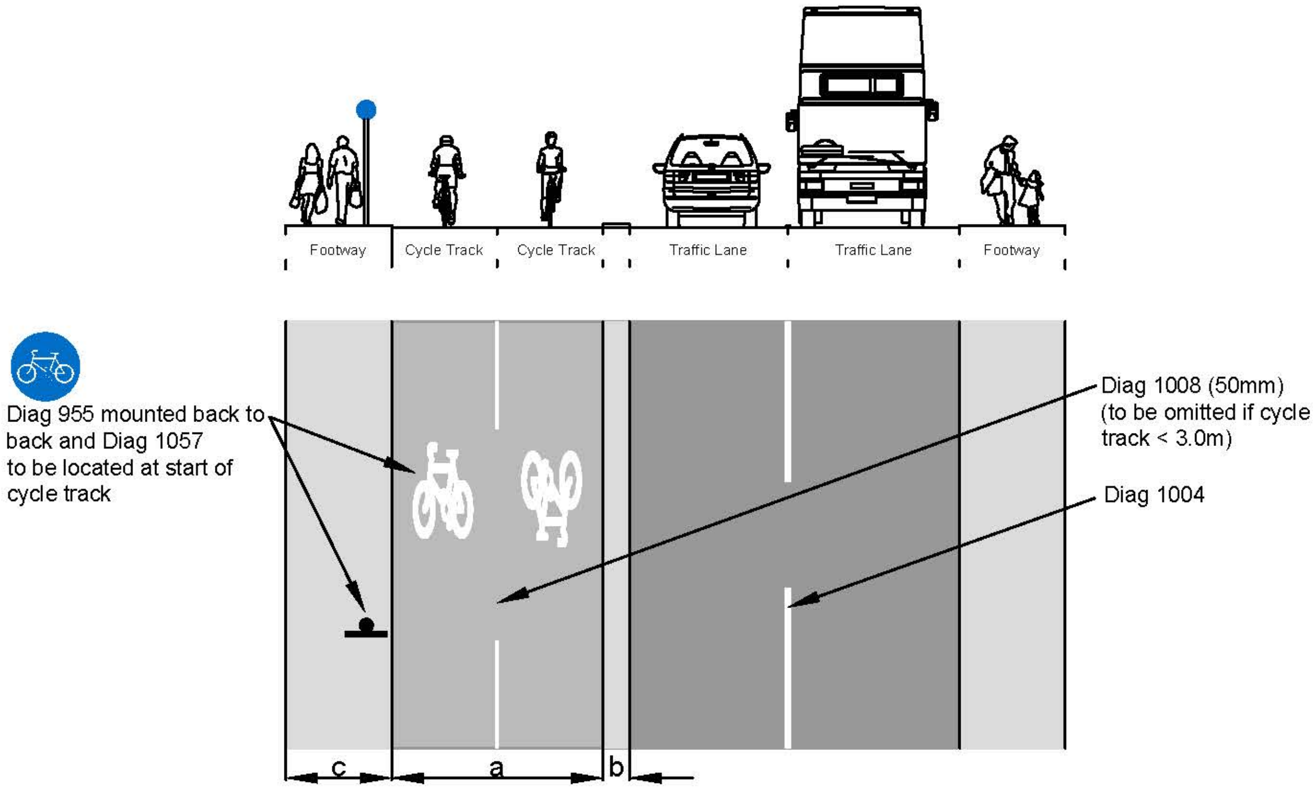
Other Considerations

- Generally cycle tracks alongside the carriageway will either be two-way, usually on one side of the road, or one-way on both sides of the road. Historically most cycle tracks in the UK have been built as two-way, but this can present safety problems at junctions.
- Care needs to be taken where a cycle track passes private accesses, to ensure drivers emerging from the access can see cyclists.
- Two-way tracks are therefore best suited to routes that have few side road junctions and accesses.
- Use of white lining to provide a buffer between the cycle track and carriageway is not recommended in unlit areas, as this could be misinterpreted as marking the edge of carriageway by passing motorists, who are then at risk of striking the kerb and losing control.
- Upright signs to indicate cycle track should preferably be located in the verge or footway.

A4

DE023

Cycle Track Alongside Road, Separated From Pedestrians



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DE024 Cycle Track Alongside Road, Shared With Pedestrians

Measure and Brief Description

Where traffic volumes and/or speeds are too high for cycle lanes, light segregation or hybrid tracks, physical separation from motor traffic may be appropriate to provide cyclists with safe and comfortable space. Where a cycle track will be shared with pedestrians, sufficient width must be provided for the two user groups to interact safely and in comfort. It is essential that developing the design of an unsegregated shared use track includes early consultation with relevant interested parties such as those representing people with disabilities, pedestrians and cyclists. Preferably they will be provided through reallocation of road space from the carriageway; in most urban locations the conversion of footways to unsegregated shared use should be the last resort.

Key Design Features

- Shared cycle tracks should be continuous across private accesses.
- Pedestrians require regular crossing points with flush kerbs; tactile paving should be provided.
- Cycle tracks should not deflect more than 45º and changes in height should be avoided.
- Machine-laid bituminous surfacing should be used as it will make cycle journeys safer, more comfortable and helps distinguish shared cycle tracks from nearby footways surfaced by paviours or slabs.
- Lamp columns and other street furniture should not be placed in cycle tracks.

Dimensions

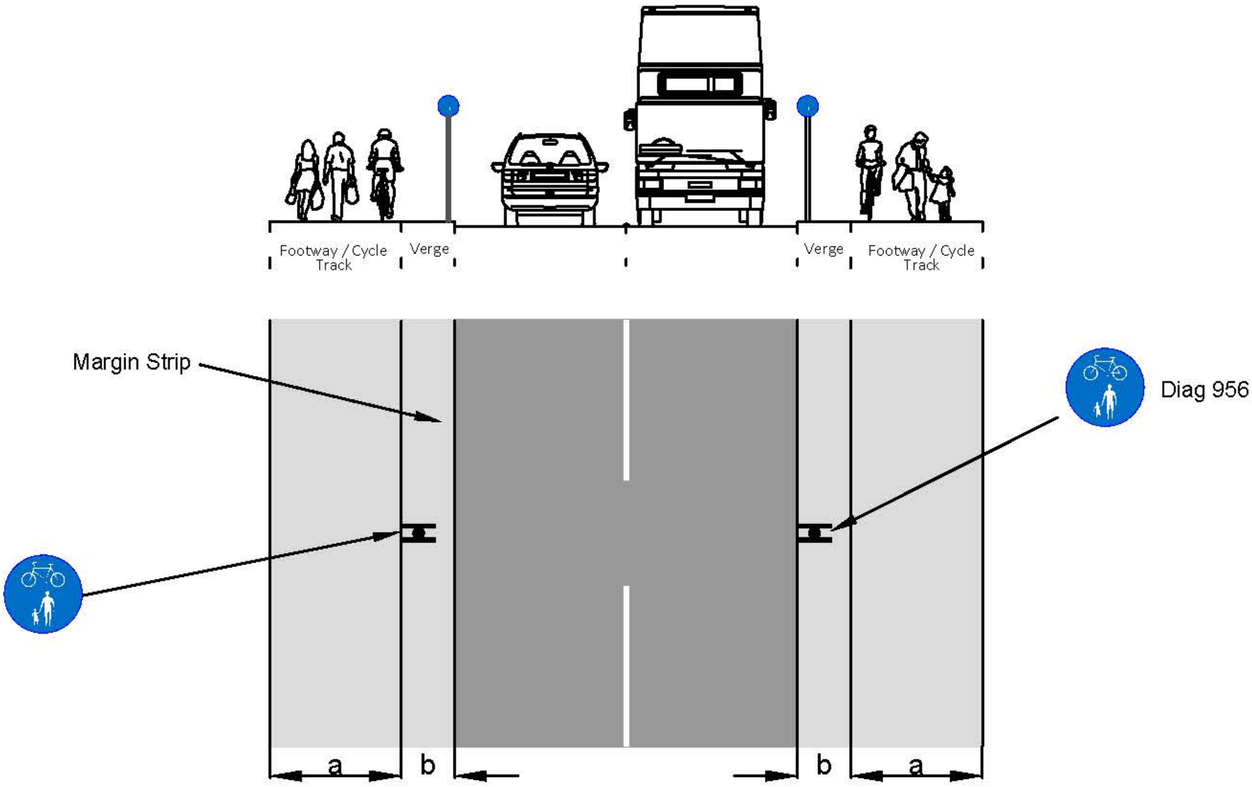
- a - width should reflect the level and type of use forecast with a minimum of 3m width on primary cycle routes, or 2.5m on less busy secondary routes. On particularly heavily trafficked routes it should be increased to 4m.
- Unsegregated cycle tracks should include additional width where they are bounded by vertical features. Additional width required is:
- Kerb up to 150mm high: add 200mm;
- Vertical feature 150-600mm high: add 250mm;
- Vertical feature above 600mm high: add 500mm.
- b - In addition to the path width above, a margin strip separating the cycle track from the carriageway is recommended:
- Desirable minimum 0.5m with speed limits of 30mph;
- Desirable minimum 1.5m with speeds limits of 40mph or above.

Other Considerations

- Generally cycle tracks alongside the carriageway will either be two-way, usually on one side of the road, or one-way on both sides of the road. Historically most cycle tracks in the UK have been built as two-way, but this can present safety problems at junctions.
- Care needs to be taken where a cycle track passes private accesses, to ensure drivers emerging from the access cansee cyclists.
- Two-way tracks are therefore best suited to routes that have few side road junctions and accesses.
- Use of white lining to provide a buffer is not recommended in unlit areas, as this could be misinterpreted as marking the edge of carriageway by passing motorists, who are then as risk of striking the kerb and losing control.
- Upright signs to indicate cycle track should preferably be located in any verge between the cycle track and the carriageway.

A4

DE024	Cycle Track Alongside Road, Shared With Pedestrians	



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DE025 Cycle Track at Side Road with Cycle Priority

Measure and Brief Description

Uncontrolled cycle track crossings at side roads should, wherever safe and practicable, give priority to cyclists crossing the side road. Such crossings will allow cyclists to continue without loss of momentum and present a strong promotional message about how non-motorised users are valued along a corridor. Factors to be considered when determining who has priority include: location, motor vehicle speed and volume, visibility, number of pedestrian and cycle movements and collision records.

Benefits

- Improved continuity and reduced effort for cyclists.
- Raised status for pedestrian and cyclists.
- Reduced vehicle speeds on side roads entering junction.

Key Design Features

- Side roads and accesses where vehicle speeds are less than 30mph and volume is less than 2,000 vpd will normally be suitable for cycle priority crossings.
- When cycle tracks are two way, drivers waiting to turn right into a side road may not anticipate cycles approaching from behind. Similarly drivers emerging from the side road may not anticipate cycles approaching from the left. One way cycle tracks which operate in the same direction as general traffic are therefore preferred.
- Cycle priority crossings should be located on a raised table.
- The corner radii and carriageway width of the side road should be minimised.
- Cycle track should not turn through more than 45 degrees on approaches.
- There needs to be good levels of inter-visibility between pedestrians, cyclists and motorists.

Dimensions

- Cycle priority crossings should normally be ‘bent out’, i.e. set back 5m from the junction channel line to enable a car to stop clear of the main carriageway. However, there are examples of schemes where the cycle track has been built closer to the junction which have operated satisfactorily.
- This option can be considered where there is only light traffic using the side road and speeds on the main road are no greater than 30mph.

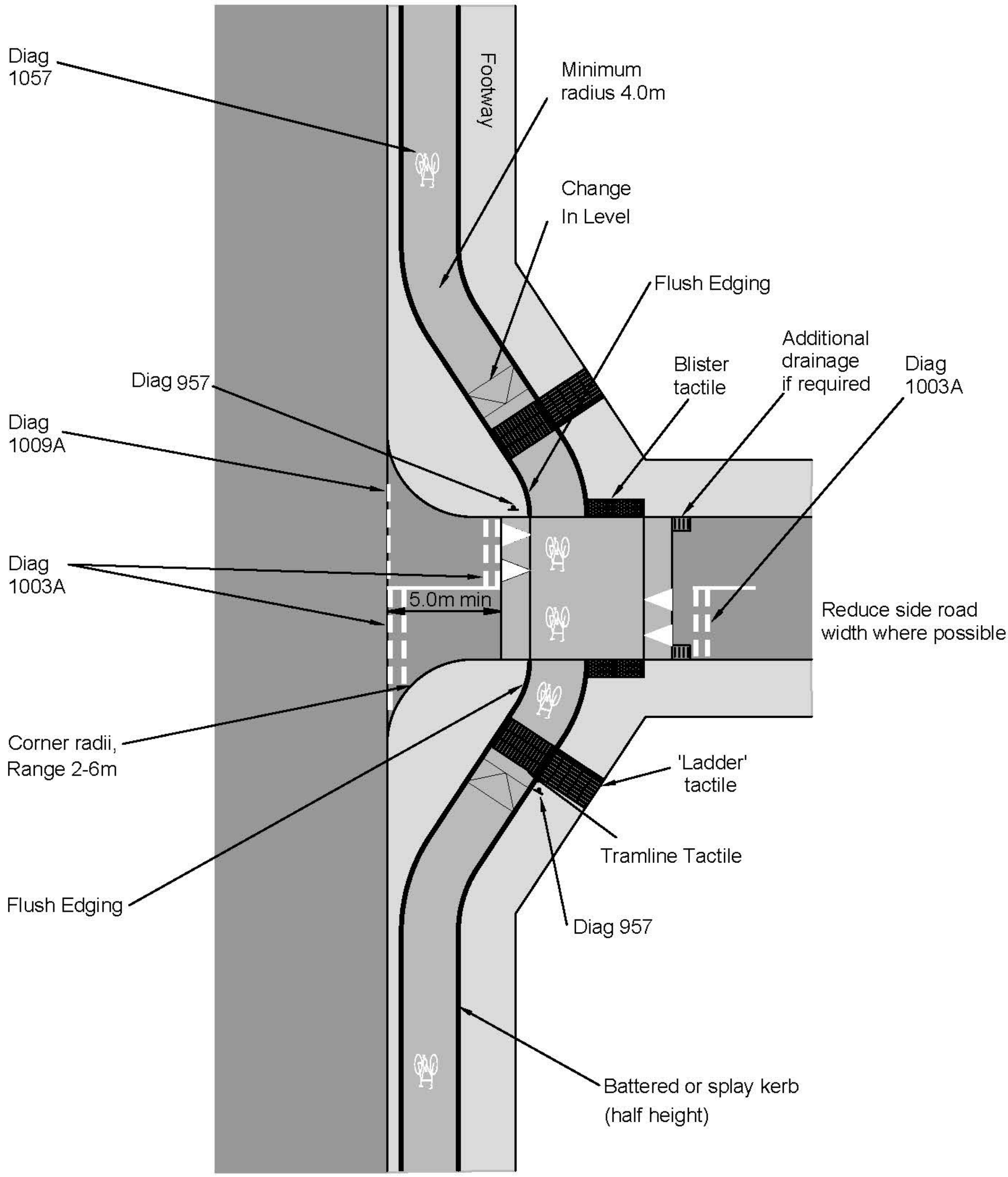
Other Considerations

- Consider highlighting the crossing with coloured surfacing.
- Cycle track crossings can be difficult places for younger or inexperienced cyclists to negotiate, as they need to ensure that they are aware of vehicles on both the main carriageway and the side roads and judge speeds and turning movements. Simple design and clear signing is therefore important.

A4

DE025

Cycle Track at Side Road with Cycle Priority



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DE026 Cycle Track at Side Road, Cyclists Give Way

Measure and Brief Description

Although they are preferred, priority crossings for cyclists (DE025) will not be appropriate in all locations, and where the cyclist is expected to give way clear road markings will be necessary, together with measures to reduce the speed of vehicles using the junction. Restricting traffic movements into the side road may enable cycle priority to be considered without a set back from the carriageway edge. Factors to be considered when determining who has priority include: location, motor vehicle speed and volume, visibility, number of pedestrian and cycle movements and collision records.

Benefits

- Less land required than ‘bent out’ priority crossings (DE025)
- Retains line of cycle track

Key Design Features

- Side roads and accesses where vehicle speeds are less than 30mph and volume is less than 2,000 vpd will normally be suitable for cycle priority crossings.
- When cycle tracks are two way, drivers waiting to turn right into a side road may not anticipate cycles approaching from behind. Similarly drivers emerging from the side road may not anticipate cycles approaching from the left. One way cycle tracks which operate in the same direction as general traffic are therefore preferred.
- Cycle priority crossings should be located on a raised table.
- The corner radii and carriageway width of the side road should be minimised.
- Cycle track should not turn through more than 45 degrees on approaches.
- There needs to be good levels of inter-visibility between pedestrians,cyclists and motorists.

Dimensions

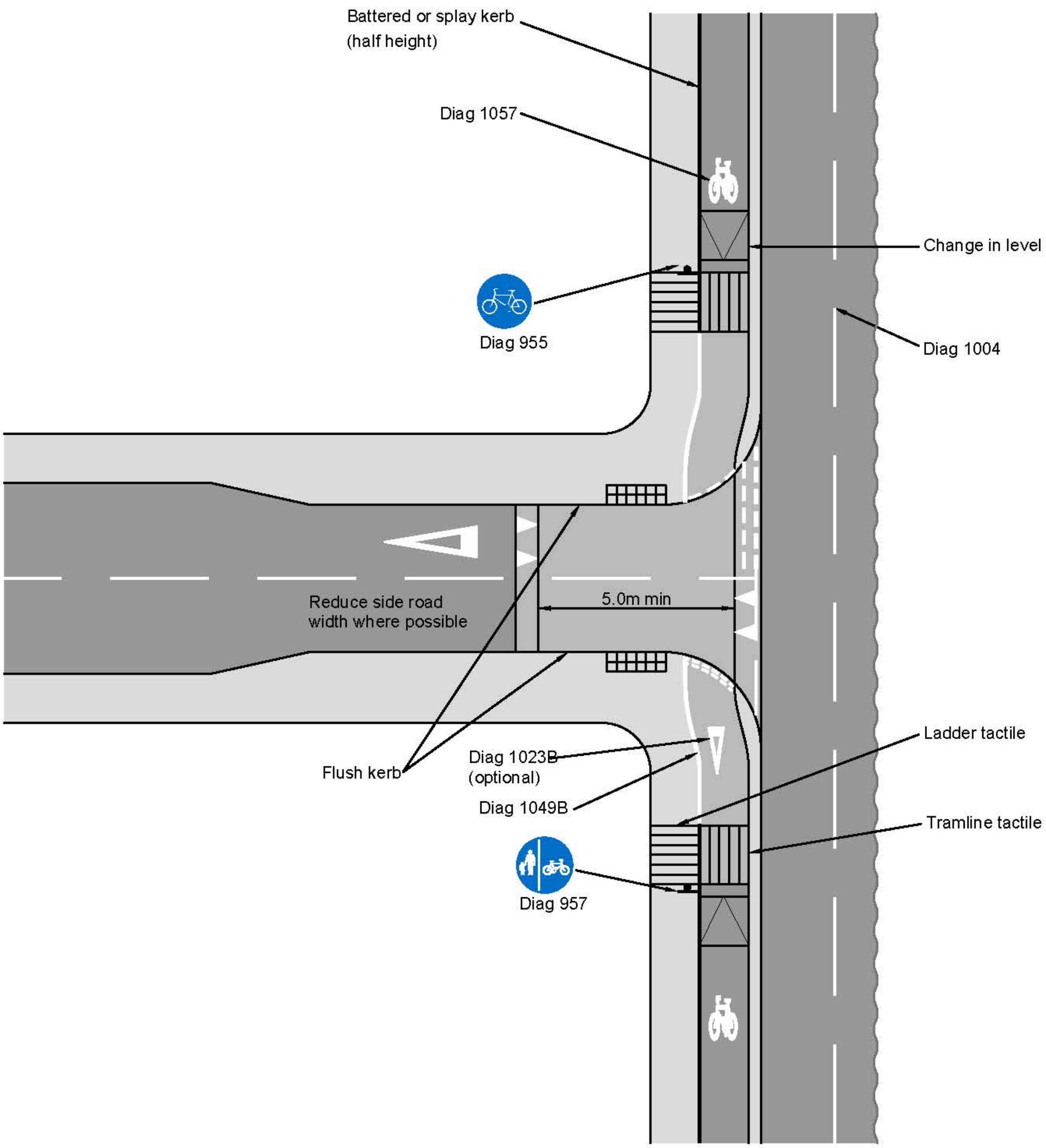
- Side road crossings where cyclists give way do not need to be set back from the main road carriageway any further than the cycle track itself.

Other Considerations

- Cyclists have to look through a wide angle to see approaching vehicles.
- Consider highlighting the crossing with coloured surfacing.
- Cycle track crossings can be difficult places for younger or inexperienced cyclists to negotiate, as they need to ensure that they are aware of vehicles on both the main carriageway and the side roads and judge speeds and turning movements. Simple design and clear signing is therefore important.

A4

DE026	Cycle Track at Side Road, Cyclists Give Way	



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DE027 Two-Way Cycle Track in Centre of Carriageway

Measure and Brief Description

Two-way tracks for cyclists in the centre of the carriageway can offer a good level of service. Cyclists are in a highly visible location which has no conflict with parked vehicles, bus stops or loading, or vehicles turning into and out of left in/left out side road junctions or accesses. The key issue to be resolved is the provision of access to the track, which can be via priority and signal controlled crossings, or signal controlled junctions with cycle stages. Where motor traffic volumes are not high mini or compact roundabouts are also an option, since cyclists will be arriving into and leaving from the junction in a dominant position.

Benefits

- No conflict with kerbside activity.
- High profile facility.

Key Design Features

- Two-way cycle track should be protected with kerb upstands or with lightsegregation.
- Tracks can be provided in wide central reservations, including on higher speed roads.
- Similarly, one-way light-segregated lanes, hybrid tracks or tracks can be provided adjacent to the central reservation on dual carriageways.
- Cycle priority to be maintained across any lightly-trafficked central reservation gaps.
- U-turns at central reservation gaps should be banned.

Dimensions

- Cycle track width should be sufficient to accommodate the forecast level of cycle use with a minimum of:
  - Absolute minimum 2.5m, where the peak hour cycle flow is less than 50/hr;
  - Desirable minimum 3.0m, where the peak hour cycle flow is 50-250/hr, 4m for peak hour cycle flows over 250/hr.

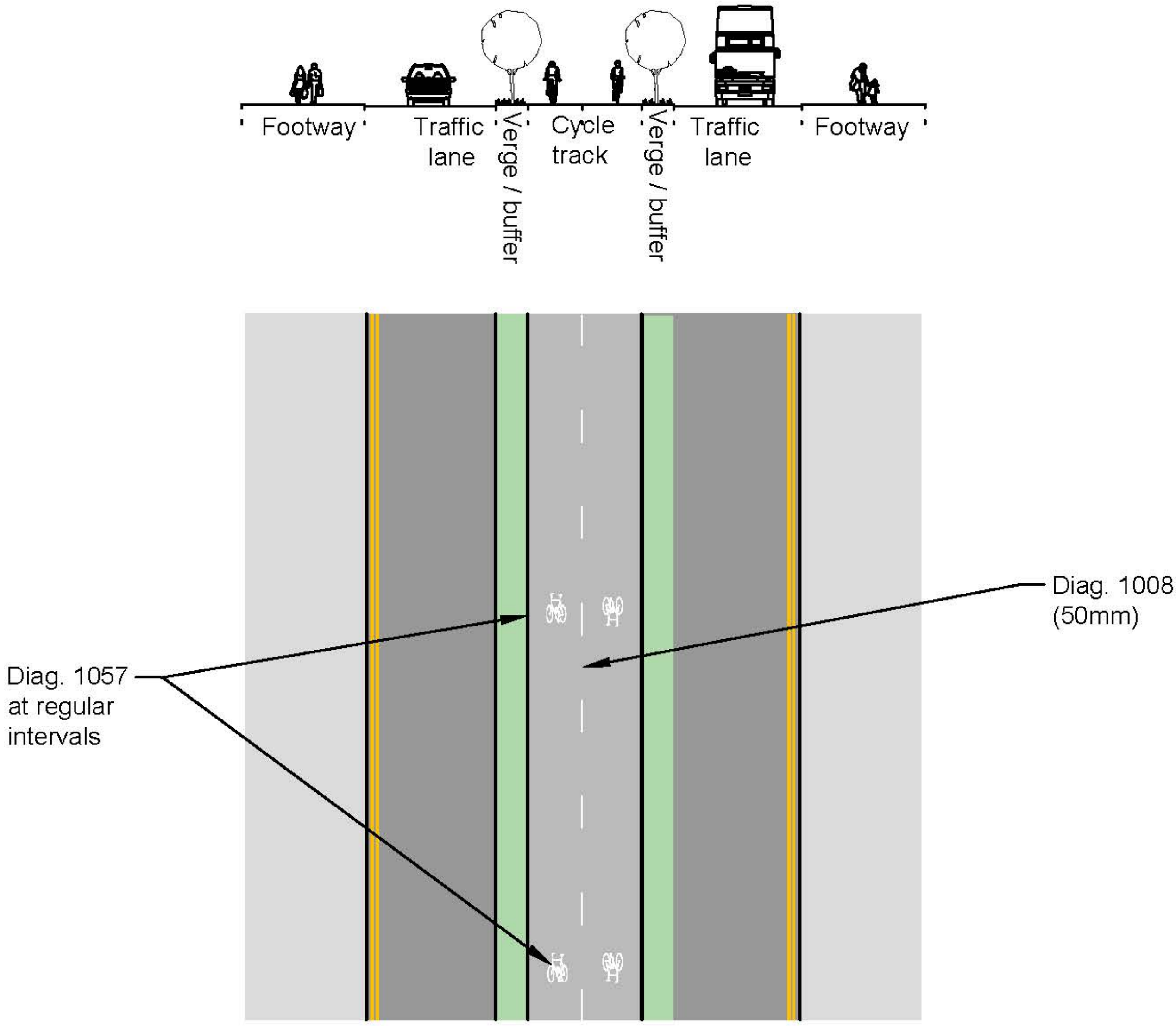
Other Considerations

- Provision should be made for pedestrians crossing movements at regular intervals.

A4

DE027

Two Way Cycle Track in Centre of Carriageway



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DE028 Bus Stop: Cycle Lane Bypass

Measure and Brief Description

Cyclists should be enabled to pass stationary buses so that they can maintain momentum and minimise delay. The Traffic Signs Manual advises that where cycle lanes in the usual position next to the kerb encounter bus stops they should be terminated and begin again after the bus cage. This requires cyclists to move out into general traffic, which does not meet their needs.

The provision of a cycle lane bypass around the bus stop provides a preferable solution. This design is best suited to urban areas where traffic speeds are below 30mph, and where bus frequency is high (more than 6 buses per hour) or bus stops are occupied for 15 min per hour or more.

Benefits

- Maintains route continuity.
- Cycle lane around the bus stop cage reduces the risk of collision with traffic when a cyclist overtakes a stationary bus.
- It provides space between an overtaking cyclist and stationary bus.
- Best suited at bus stops with high passenger numbers and high bus frequency.

Key Design Features

- Marked route for cyclists bypasses bus cage.
- Sufficient width for cycle lane and buffer strip past bus cage.
- Approach taper to be no more than 1 in 10.

Dimensions

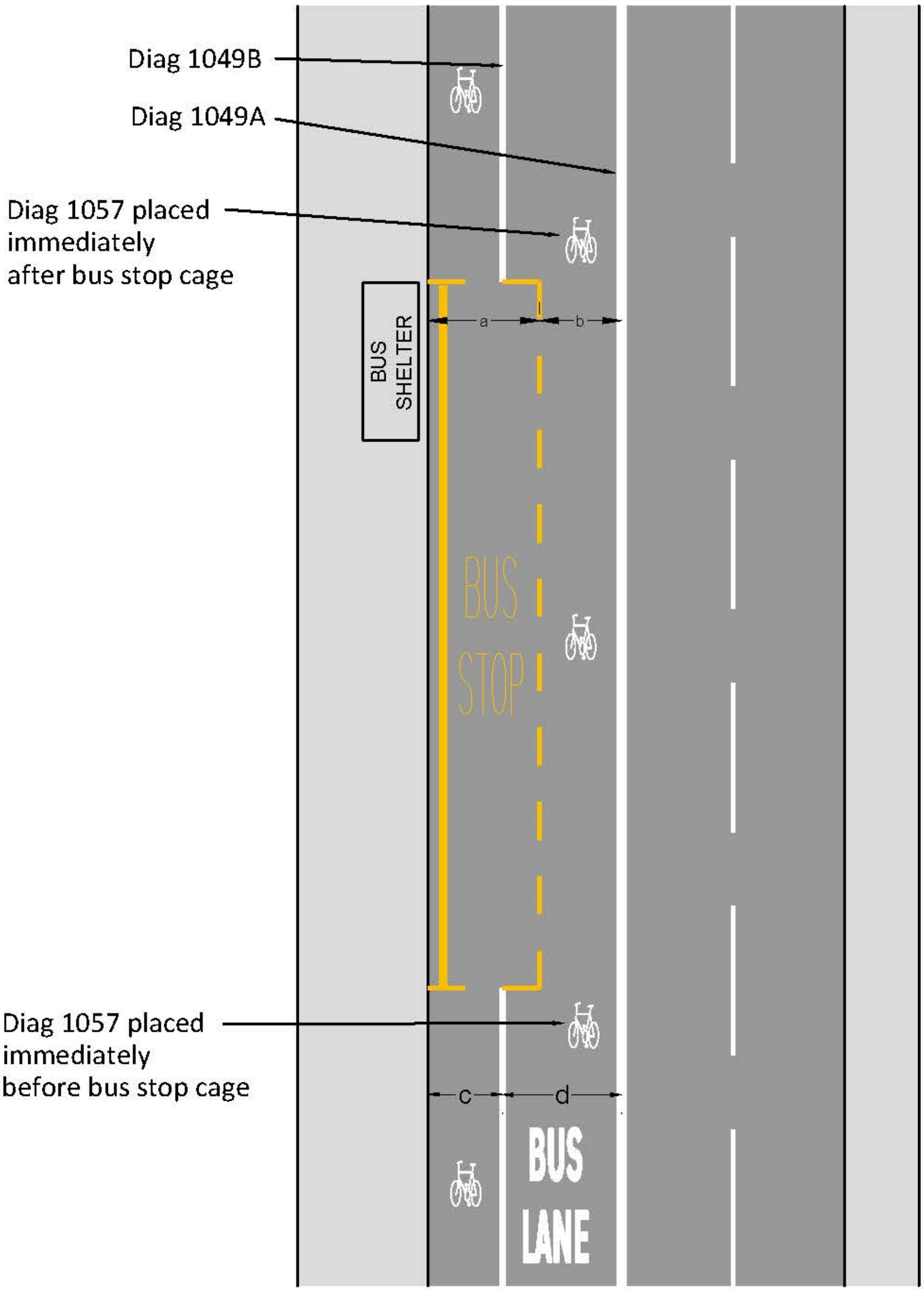
- a - Desirable minimum 2.0m, Absolute minimum 1.5m.
- b - buffer strip - Desirable minimum 1m, Absolute minimum 0.5m.
- c - bus cage width Desirable minimum 3.0m, Absolute minimum 2.7m.
- d - general traffic lane width 3.0m Desirable minimum.

Other Considerations

- Also compatible with one-way light segregated cycle lanes and hybrid tracks, which become cycle lanes past the bus stop
- Variants of this design can be considered where buses are provided with full or half width bus laybys.

A4

DE028	Bus Stop: Cycle and Bus Lane



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DE029 Bus Stop: Island Bus Stop

Measure and Brief Description

Cyclists should be enabled to pass stationary buses so that they can maintain momentum and minimise delay. The Traffic Signs Manual advises that where cycle lanes in the usual position next to the kerb encounter bus stops they should be terminated and begin again after the bus cage. This requires cyclists to move out into general traffic, which does not meet their needs.

The safest and most comfortable way to enable cyclists to pass stationary buses is to provide a cycle track past the bus stop on the footway side. Passengers will board and alight from buses from the kerbed island between the cycle track and the carriageway. The suitability of this is dependent on the available space, bus frequency and passenger volume and the number of pedestrians using the footway.

Benefits

- Maintains route continuity for cyclists.
- Eliminates the risk of conflict with buses.
- More comfortable and attractive, especially for less confident cyclists.

Key Design Features

- Sufficient widths should be provided for pedestrians walking past the stop and on the island to accommodate passengers waiting for and alighting from buses.
- It may be appropriate to raise the bypass to footway level along part or all of its length, which slows cyclists down providing more reaction time for pedestrians and increasing convenience for disabled bus users.
- Sinusoidal humps preferred on ramps.
- Minimum bypass entry / exit taper 1:10
- Tactile paving to be provided at crossing point(s) of cycle track.

Dimensions

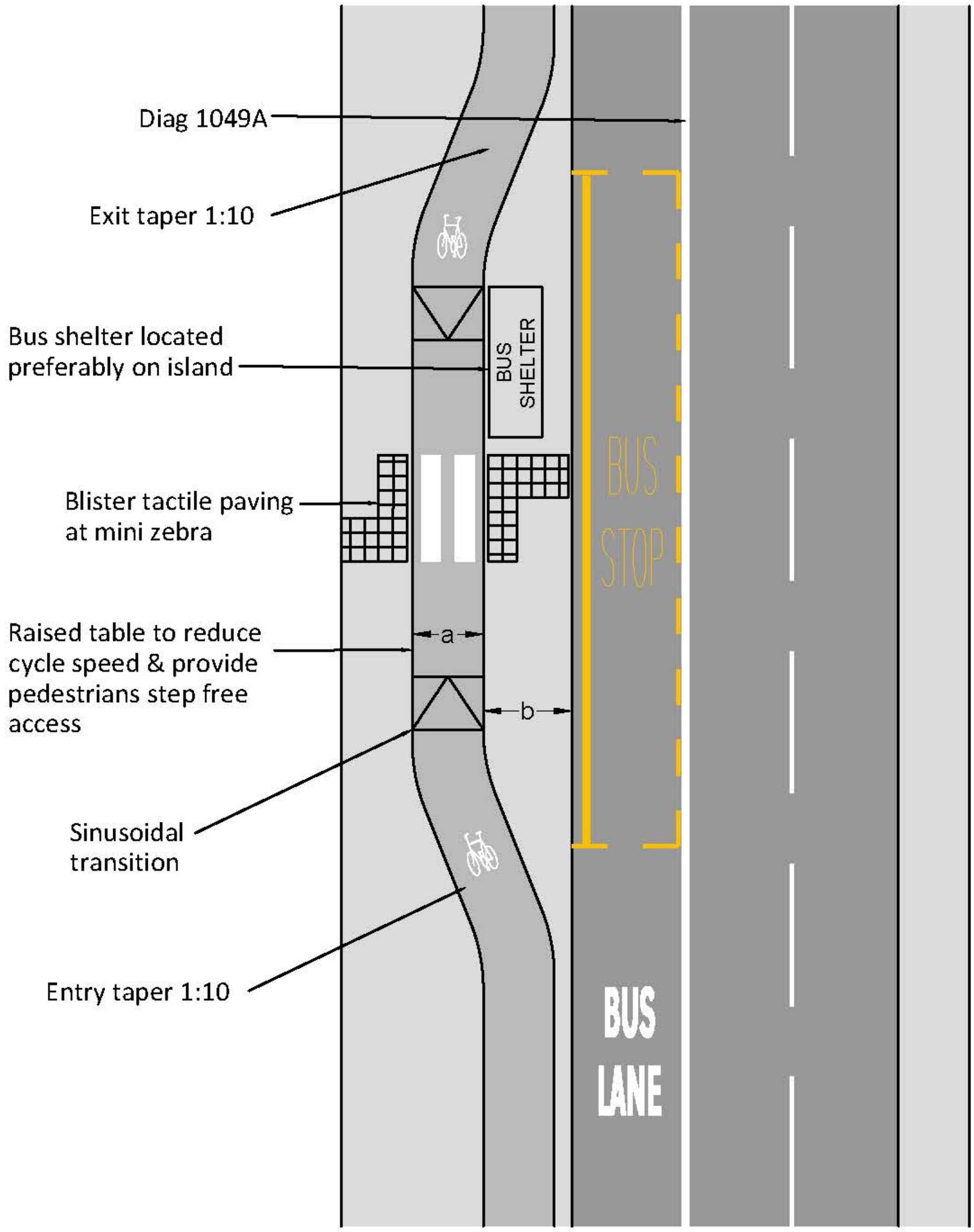
- a - Desirable minimum 2.0m, Absolute minimum 1.5m.
- b – Island width Desirable minimum 2.0m, Absolute minimum 1m.

Other Considerations

- This design can be used in conjunction with cycle lanes, cycle lanes with light segregation, hybrid cycle tracks and segregated off-carriageway tracks.
- Pedestrian crossing point(s) should be provided with dropped/flush kerbs.
- Bypasses should be kept clean and free from debris.
- Adequate drainage should be provided using cycle friendly gullies to prevent ponding and icing.

A4

DE029 Bus Stop: Island Bus Stop



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DE030 Bus Stop: Bus Boarder

Measure and Brief Description

Cyclists should be enabled to pass stationary buses so that they can maintain momentum and minimise delay. The Traffic Signs Manual advises that where cycle lanes in the usual position next to the kerb encounter bus stops they should be terminated and begin again after the bus cage. This requires cyclists to move out into general traffic, which does not meet their needs.

Provision of a bus boarder in line with the cycle lane/track will bring cyclists up to footway level onto a shared use area enabling them to continue across the bus boarder when it is clear or to cycle past pedestrians waiting at the bus stop. Careful consideration needs to given in how to minimise conflict between cyclists and pedestrians - this option is best suited to bus stops and footways with low passenger and pedestrian volumes.

Benefits

- Maintains route continuity.
- Eliminates the risk of conflict with buses.
- More comfortable and attractive, especially for less confident cyclists.
- Bus boarder provides step free access for bus users.

Key Design Features

- Ramp up to footway level to help reduce cycle speeds.
- Where the difference between levels is small a short ramp may be appropriate.
- Bus shelters and flags should be placed at the back of the bus boarder.
- Sufficient space should be provided at the back of bus stop to minimise pedestrians needing to stand in the line of cycle track.
- Good intervisibility is required between pedestrians (those waiting for a bus as well as those passing) and cyclists, to minimise potential for conflict.
- The bus stop should be apparent to cyclists, who will need to be able to adjust their behaviour and speed to reflect the additional risk of conflict.

Dimensions

- a - Bus boarder width Desirable minimum 2.0m, Absolute minimum1.5m.
- b – Retained footway width Desirable minimum 3.0m, Absolute minimum 2.0m.

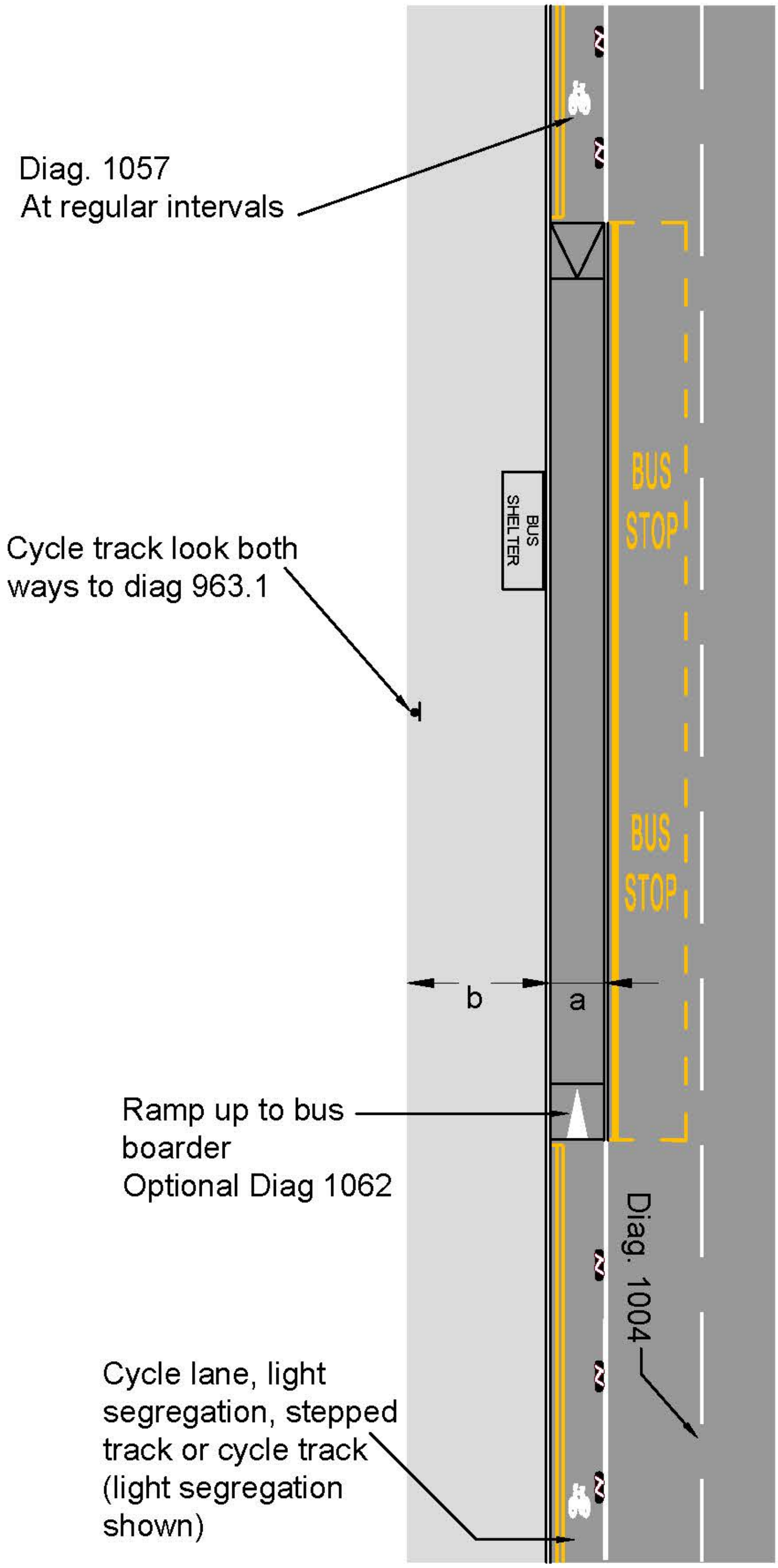
Other Considerations

- Potential for conflict with pedestrians using the bus stop.
- This design can be considered in conjunction with cycle lanes, light segregation or one-way hybrid cycle tracks.

A4

DE030

Bus Stop: Bus Boarder



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DE031 Bus Stop: Shared Use

Measure and Brief Description

Bus stops can pose a difficulty on two-way cycle tracks adjacent to the carriageway, as street furniture and waiting pedestrians associated with the bus stop can cause an obstruction and it will be difficult to maintain the width required for a fully separated track. Consequently an option is to share the entire width of the path past the bus stop.

Benefits

- Maintains route continuity.
- Eliminates the risk of conflict with buses.
- Comfortable and attractive, especially for less confident cyclists.

Key Design Features

- Cycle track segregation ends each side of bus stop becoming a shared path.
- Shared path past bus stop to be kept clear of street furniture.
- There should be a clear space for passengers to wait where will not come into conflict with cyclists.
- Good intervisibility between pedestrians (those waiting for a bus as well as those passing) and cyclists, to minimise potential for conflict.
- The bus stop should be apparent to cyclists, who will need to be able to adjust their behaviour and speed to reflect the additional risk of conflict.

Dimensions

- a – Retained shared use path width Desirable minimum 3.0m, Absolute minimum 2.0m.
- Cycle track should finish at least 15m before waiting area (in direction of general traffic) and continue 5m past.

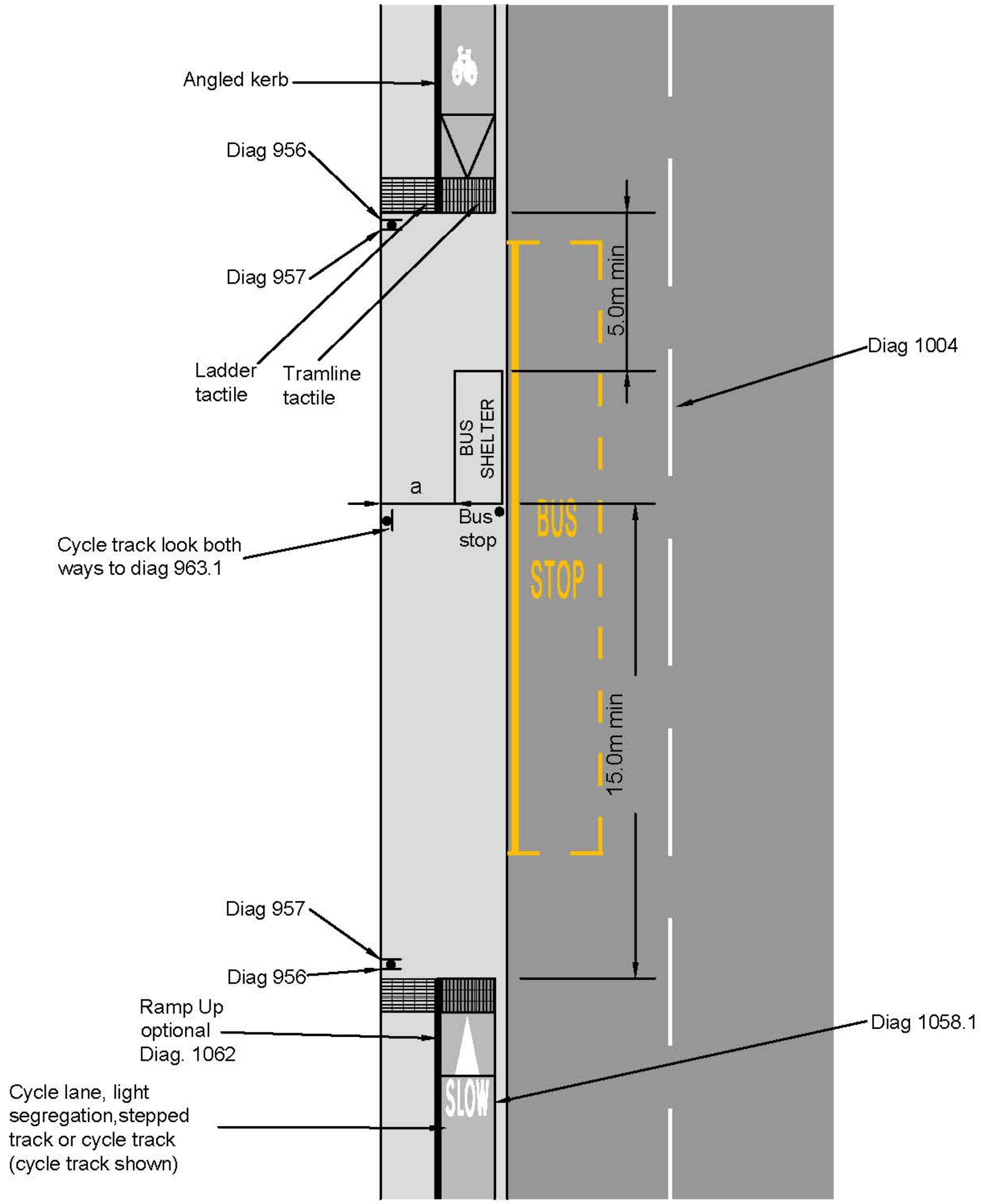
Other Considerations

- Potential for conflict with pedestrians using the bus stop or footway.

A4

DE031

Bus Stop: Shared Use



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DE032 Cycle Track Away From Road, Separated From Pedestrians

Measure and Brief Description

Routes away from the road can provide a very good quality link for both pedestrians and cyclists. A separate parallel path for pedestrians is desirable, and sufficient width should be provided for each user group so that they do not encroach on the other users' path.

Physical segregation is generally preferred provided widths are adequate and this can be through a level difference or verge. Barriers are not desirable since they limit the effective width of the paths and are a particular hazard to cyclists. Segregation using only simple white lines (Diag 1049) (which are not detectable by blind users) or a raised white line delineator (Diag 1049.1), is an option but it is rarely respected by pedestrians (who have the legal right to use the cycle track) in practice, unless cycle flows are high or there is generous width, and should be avoided.

Benefits

- Provides routes which are free from conflict with motor traffic.
- Segregated paths allow each group to move at their own desired pace and improve comfort and subjective safety.

Key Design Features

- Footpaths and cycle tracks should be continuous.
- Flush kerb with tactile paving at road crossings.
- Cycle tracks should not deflect more than 45º from cyclists' desire line and changes in height should be avoided.
- Machine-laid black bituminous surfacing should be used as it will make cycle journeys safer, more comfortable and helps distinguish cycle tracks from adjacent footways surfaced by paviours or slabs.

Dimensions

- a - The width for pedestrians should reflect the level and type of use forecast with an Absolute minimum of 2m, increasing to a Desirable minimum of 3.5m where there is frequent use by groups. 1.5m may be acceptable over short lengths, however – see DE001
- b - Cycle track width should be sufficient to accommodate the forecast level of use with a minimum of:
  - Absolute minimum 2.5m, where the peak hour flow is less than 50/hr;
  - Desirable minimum 3.0m, where it is 50-250/hr, 4m for cycle flows over 250/hr.
- Cycle tracks should include additional width where they are bounded by vertical features. Additional width required is
  - Kerb up to 150mm high: add 200mm.
  - Vertical feature 150-600mm high: add 250mm.
  - Vertical feature above 600mm high: add 500mm.
- Verges separating pedestrian and cycle routes should be a minimum of 1.0m wide.

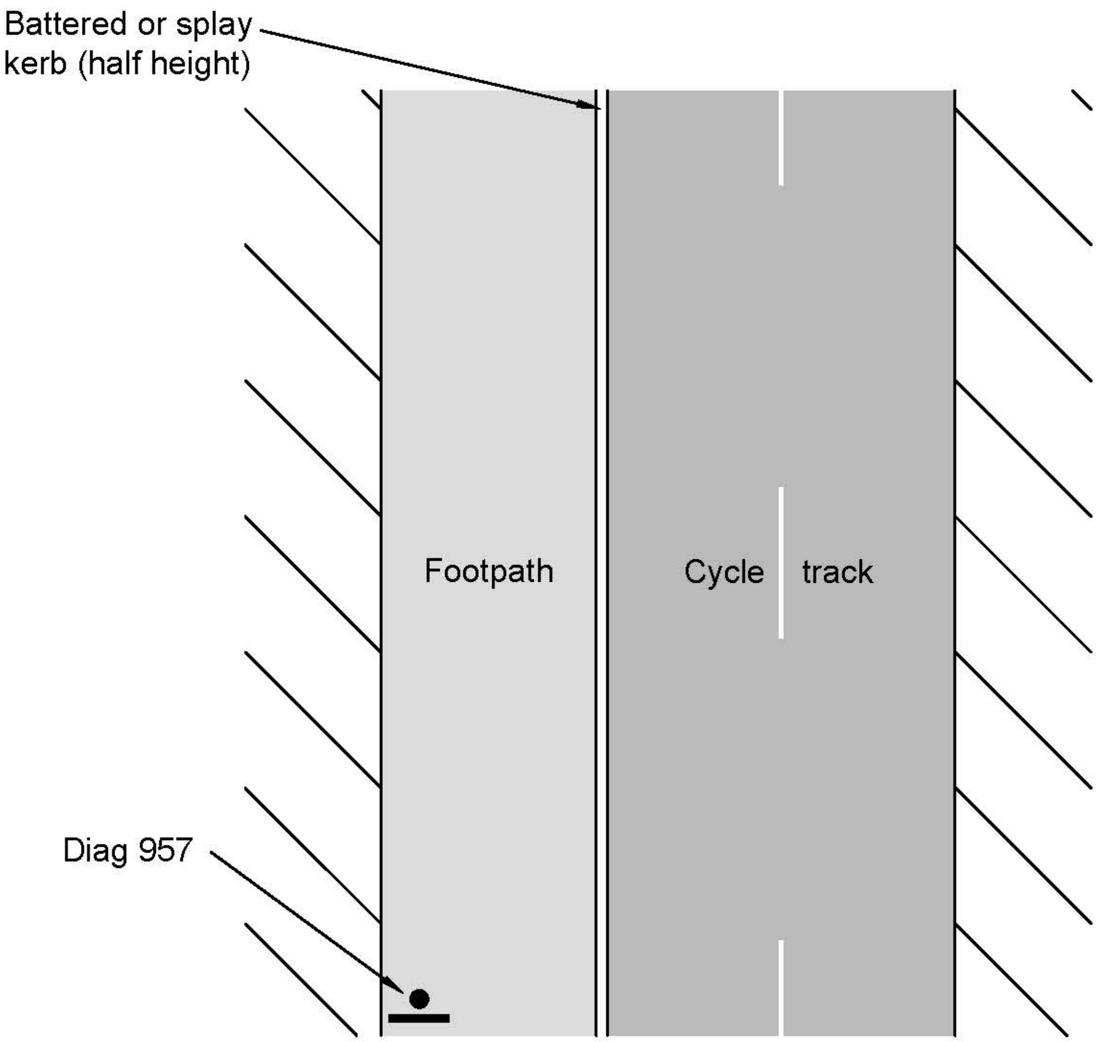
Other Considerations

- Generally, cycle tracks will be two-way.
- Centre lines should be marked on two-way cycle tracks.
- Lamp columns and other street furniture should be set back at least 0.5m from the edge of the cycle track.
- Path geometry, particularly radii, forward visibility and gradient, should reflect the user need criteria set out in Chapter 4.
- Paths used for utility journeys (all Active Travel Routes) should normally be lit.
- Access control features should not be installed unless absolutely necessary.

A4

DE032

Cycle Track Away From Road Separated From Pedestrians



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DE033 Cycle Track Away From Road, Shared With Pedestrians

Measure and Brief Description

Routes away from the road can provide a very good quality link for both pedestrians and cyclists. Where a cycle track is to be provided which will be shared with pedestrians, sufficient width must be provided for the two user groups to interact safely and in comfort. It is essential that developing the design of an unsegregated shared use track includes early consultation with relevant interested parties such as those representing people with disabilities, walkers and cyclists.

Key Design Features

- Footpaths and cycle tracks should be continuous.
- Flush kerbs with tactile paving at road crossings.
- Cycle tracks should not deflect more than 45º from cyclists' desire line and constant changes in height should be avoided
- Machine-laid bituminous surfacing should be used as it will make cycle journeys safer and more comfortable.

Dimensions

- a - width should reflect the level and type of use forecast with a minimum of 3m width on primary cycle routes, or 2.5m on less busy secondary routes. On particularly heavily trafficked routes it should be increased to 4m.
- Shared use cycle tracks should include additional width where they are bounded by vertical features. Only where there is open space on both sides is it is practical to use the whole track width to cycle. Additional width required is:
  - Kerb up to 150mm high: add 200mm;
  - Vertical feature 150-600mm high: add 250mm;
  - Vertical feature above 600mm high: add 500mm.

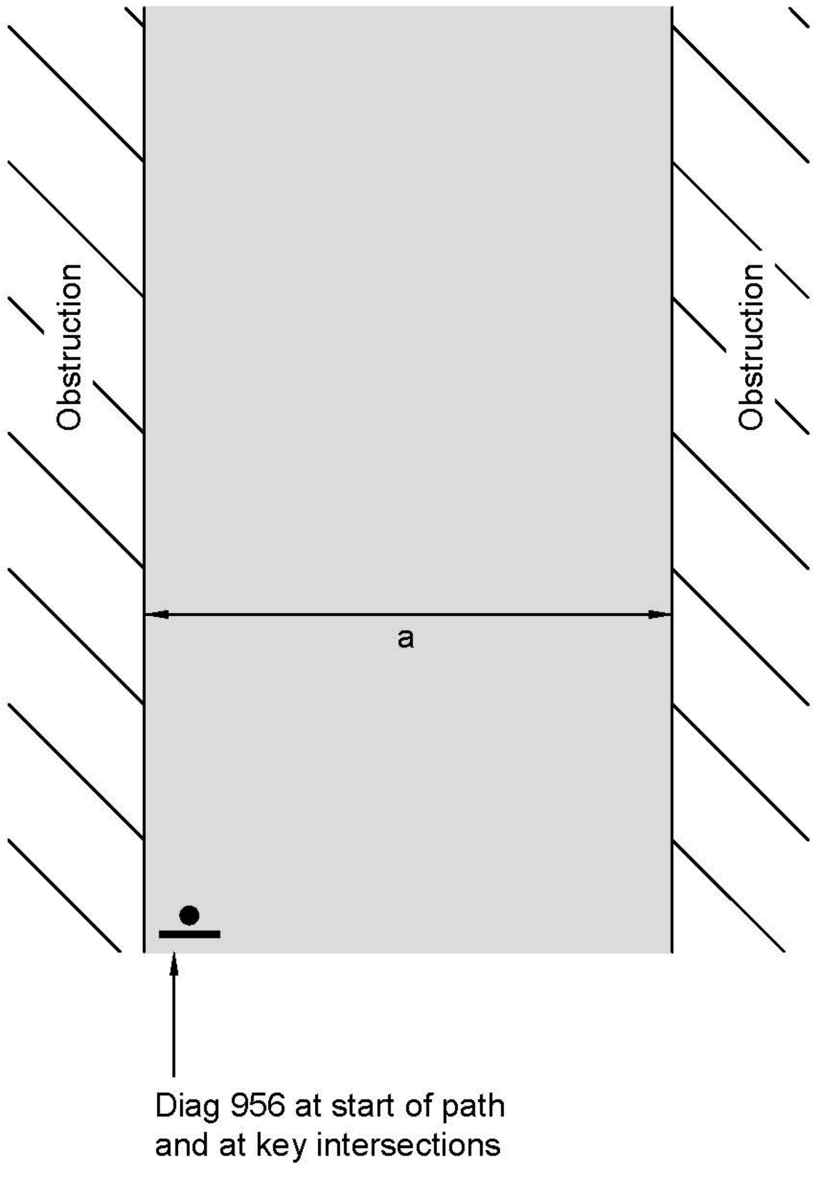
Other Considerations

- Generally, cycle tracks will be two-way.
- Centre lines should be marked on two-way cycle tracks.
- Lamp columns and other street furniture should be set back at least 0.5m from the edge of the cycle track.
- Path geometry, particularly radii, forward visibility and gradient, should reflect the user need criteria set out in Chapter 4.
- Paths used for utility journeys (all Active Travel Routes) should normally be lit.
- Access control features should not be installed unless absolutely necessary.
- The British Horse Society recommends a desirable minimum width of 5.0m for new bridleways, which would be shared with pedestrians and cyclists.

A4

DE033

Cycle Track Away From Road Shared With Pedestrians



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DE034 Transition Between Carriageway And Cycle Track

Benefits

Measure and Brief Description

'Merge' transitions involve cyclists joining the carriageway, a cycle lane, light segregated lane or hybrid track, from an off-carriageway cycle track. At 'diverge' transitions, cyclists carry out the reverse manoeuvre to join a parallel cycle track.
The design of these transitions should provide a direct route for cyclists which does not require them to deviate significantly from their direction of travel, nor cross a kerb at an angle. At merges they should not need to give way to general traffic and be given space free from motor vehicles to enter into, defined by a cycle lane, light segregation or a hybrid track. The design should ensure that cyclists are clearly visible to motorists and that motorists are aware that cyclists are likely to be re-joining the carriageway.

As well as providing transitions between on- and off-road facilities along links, these transitions can be used on the approaches to controlled crossings or junctions to enable cyclists to leave the carriageway to use a facility. The design should minimise any conflict with pedestrians and other cyclists waiting at the crossing point.

- A smooth transition when joining or leaving the carriageway, without the need to give way or stop, will make a facility more comfortable and safe.

Key Design Features

- Build-outs can be used to push vehicles away from cyclists rejoining the carriageway.
- Designs should take account of cyclists who are already using the carriageway at the merge point.
- Cyclists leaving the carriageway should not be brought into conflict with pedestrians.
- Cyclists should cross any kerbs at 90 degrees.
- Any tapers should be no sharper that 1:10.

Dimensions

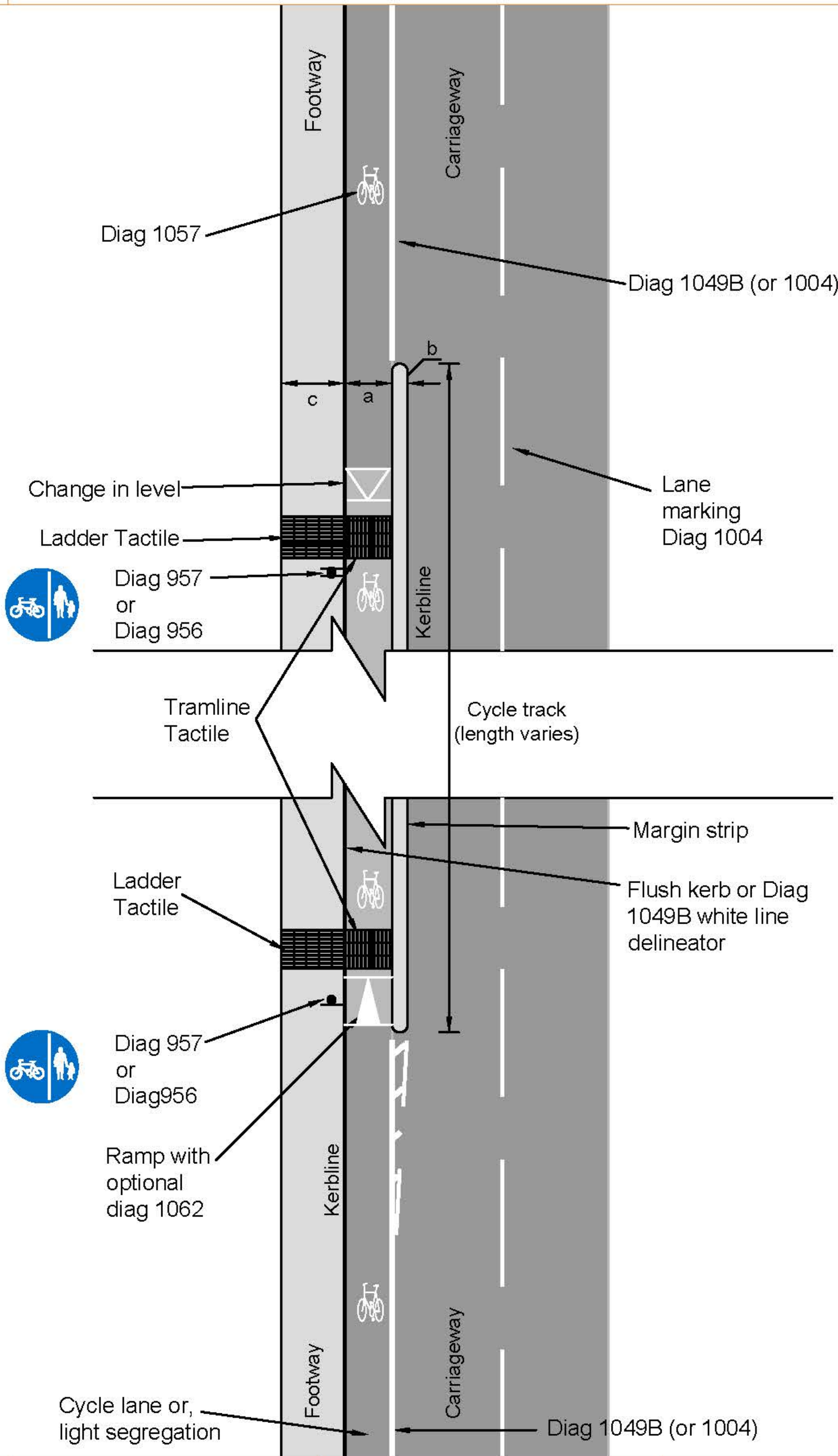
- a – Width - desirable minimum 2m, absolute minimum 1.5m.
- b – Desirable margin strip separating cycle track from carriageway 0.5-1.0m.
- c - The width of the footway should reflect the level and type of use, based on level of service, Desirable minimum 2m width, increasing to 3.5m width where there is frequent use by groups. 1.5m may be acceptable over short lengths – see DE001.

Other Considerations

- Generally cycle tracks will be two-way.
- Centre lines should be marked on two-way cycle tracks.
- Lamp columns and other street furniture should be set back at least 0.5m from the edge of the cycle track.
- Path geometry, particularly radii, forward visibility and gradient, should reflect the user need criteria set out in Chapter 4.
- Paths used for utility journeys (all Active Travel Routes) should normally be lit.
- Access control features should not be installed unless absolutely necessary.
- The British Horse Society recommends a desirable minimum width of 5.0m for new bridleways, which would be shared with pedestrians and cyclists.

A4

DE034	Transition Between Cycle Lane and Cycle Track



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DE035 Bus Lane

Measure and Brief Description

The primary purpose of bus lanes is to improve the reliability of bus services by giving priority to buses over other vehicles on congested parts of the road network. Combined bus and cycle lanes can also be a useful feature for cyclists, enabling cyclists to share in the congestion avoidance and time-saving benefits provided to buses, as well as providing safer conditions for cycling. The default position is to allow cyclists to use bus lanes.

Bus lanes should not be regarded as part of designated Active Travel Networks unless bus flows are light and/or there is a cycle lane within the bus lane, and no other vehicles (eg taxis, motorcycles) are allowed.

Benefits

- Cyclists can bypass traffic congestion and queues.
- Gives cyclists priority over general traffic at the locations and times where it is most needed.
- Cyclists using bus lanes have less traffic to interact with than if using a general traffic lane.
- There is a space buffer between the general traffic lane and the cyclist, (albeit occupied intermittently by buses).
- Cycle lanes within bus lanes are safer and more comfortable than shared bus lanes or general cycle lanes, since cyclists are passed by fewer vehicles

Key Design Features

- Where bus lanes are proposed and are expected to form the main provision for cyclists along a route, a cycle lane should be provided within the bus lane wherever possible.
- The cycle lane would preferably be a mandatory lane, although authorities could use an advisory lane. This will also simplify TRO requirements,
- The hours of operation of bus lanes where cyclists are permitted should normally be ‘at all times’ to provide the highest benefit for cyclists. Where mandatory cycle lanes operate within bus lanes, they may operate full time even if the bus lane is part time.
- Diagram 1048 (‘Bus Lane’) markings must always be used in with-flow situations. The use of Diagram 1048.1 (‘Bus and Cycle Lane’) is reserved for contra-flow facilities only unless specially authorised.

Dimensions

- a - A 4.0m bus lane with no cycle lane is the recommended minimum width where bus speeds and volumes are low. If widths of 4.0m on lower flow routes are not possible, then the bus lane should be restricted in width to 3.2m. This removes the dilemma for bus drivers of whether there is sufficient width to overtake a cyclist within the confines of the bus lane. Cycles are still allowed to use the Bus Lane, but buses will have to drive into the general traffic lane when overtaking cyclists. Bus lane widths of between 3.2m and 3.9m should not be provided as they leave insufficient room for buses to overtake cyclists or cyclists safely and comfortably. Where off-peak car parking or loading is permitted in a bus lane, the lane should be at least 4.0m and preferably 4.5m wide in order to allow cyclists to pass stationary motor vehicles without leaving the bus lane. It is also preferable to mark parking bays within bus lanes to encourage drivers to park close to the kerb.
- b - cycle lanes within bus lanes should be at least 1.5m wide and desirably 2.0m wide.
- c - the minimum width for the bus lane outside of the cycle lane should be a minimum of 2.7m.

Other Considerations

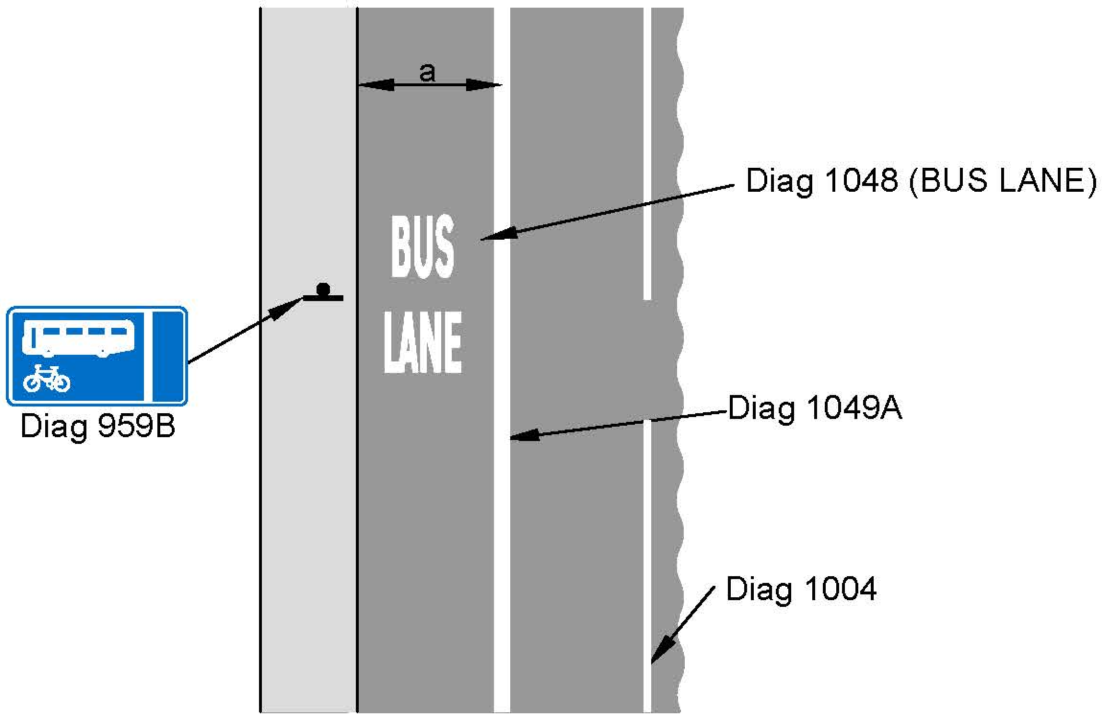
- Where bus lanes are provided, care should be taken to ensure that provision for cyclists in the opposite direction is not compromised.
- There is often pressure on highway authorities to permit a wide range of other users to use bus lanes, including taxis, private hire vehicles and motorcycles. This can reduce the benefits afforded to cyclists and should be avoided.
- There should be a presumption in favour of designing contraflow bus lanes to be of sufficient width to accommodate cyclists. Where this is the case the widths referred to above for with-flow bus lanes will apply.
- Where bus-only links are provided, for example between two residential neighbourhoods, the design should normally include provision for cyclists.
- Authorities may choose to only place vertical signs indicating the presence of cycle lanes where there is a clear need to alter other road users to the presence of a cycle route.

Further References

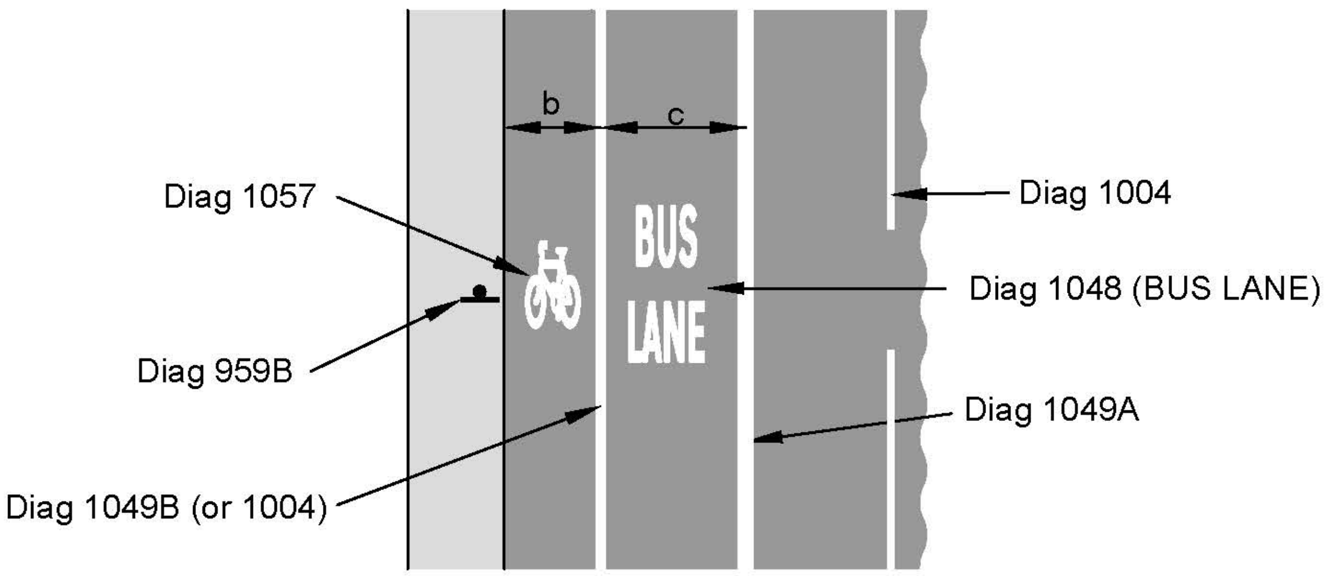
- Department for Transport (2003) – Traffic Signs Manual

DE035

Bus Lane



Bus Lane Shared with Cyclists



Cycle Lane Within Bus Lane
(preferred)

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DE036 Simple Uncontrolled Crossings (Walking, Shared Use or Cycle Only)

Measure and Brief Description

This is the simplest form of pedestrian or cycle crossing where a footway, footpath or cycle track meets the road at a dropped kerb.

Benefits

- Alerts drivers to the presence of crossing pedestrians and cyclists.
- Indicates to pedestrians a suitable crossing place.
- Relatively cheap to install.

Key Design Features

- Tactile paving to be provided at dropped kerbs.
- A coloured surface may be useful to highlight the presence of the crossing to motor traffic.
- If the road has a speed limit of 30 mph or less, the crossing may be placed on a flat-topped road hump. If so, it needs to be made clear to cyclists that they must give way when crossing.
- Road humps must comply with the Highways Act 1980, Sections 90A to 90F.
- Where it is not clear to cyclists approaching the crossing that they are about to meet a road, it may be worthwhile adding markings (and possibly signs) indicating that they should give way.
- On single carriageway roads with two lanes where the national speed limit of 60mph applies or on other rural roads where a lower speed limit is in place, consideration should be given to additional measures such as light coloured antiskid surfacing for 50m either side of the crossing, rumble strips on the approaches, localised visual narrowing in vicinity of crossing and Diagram 950 warning signs on the approaches.

Dimensions

- Width of crossing (a) to be at least as wide as the path either side. On pedestrian only routes this should be 2m min, on shared use paths, 3m min

Other Considerations

- Any coloured surface needs to maintain a good condition to remain effective.
- The effect of parked vehicles in the vicinity of an uncontrolled crossing should be considered and if necessary parking restrictions imposed to maintain adequate visibility.
- Vehicle crossovers are not suitable as pedestrian crossing points and care should be taken over the siting of crossings relative to crossovers so as not to cause confusion to users.
- Build outs can reduce the crossing distance, and in some situations will aid visibility, but can impede on-road cyclists. Designers should understand the impact that creating a better crossing point can have on a cyclist already on the road.
- Physical changes to the kerb lines can be costly but reducing the carriageway width is an effective solution.
- In rural locations detectors on the approach paths can be used to trigger vehicle activated signs to alert motor traffic of the presence of an infrequently used crossing only when there are cyclists or pedestrians present.

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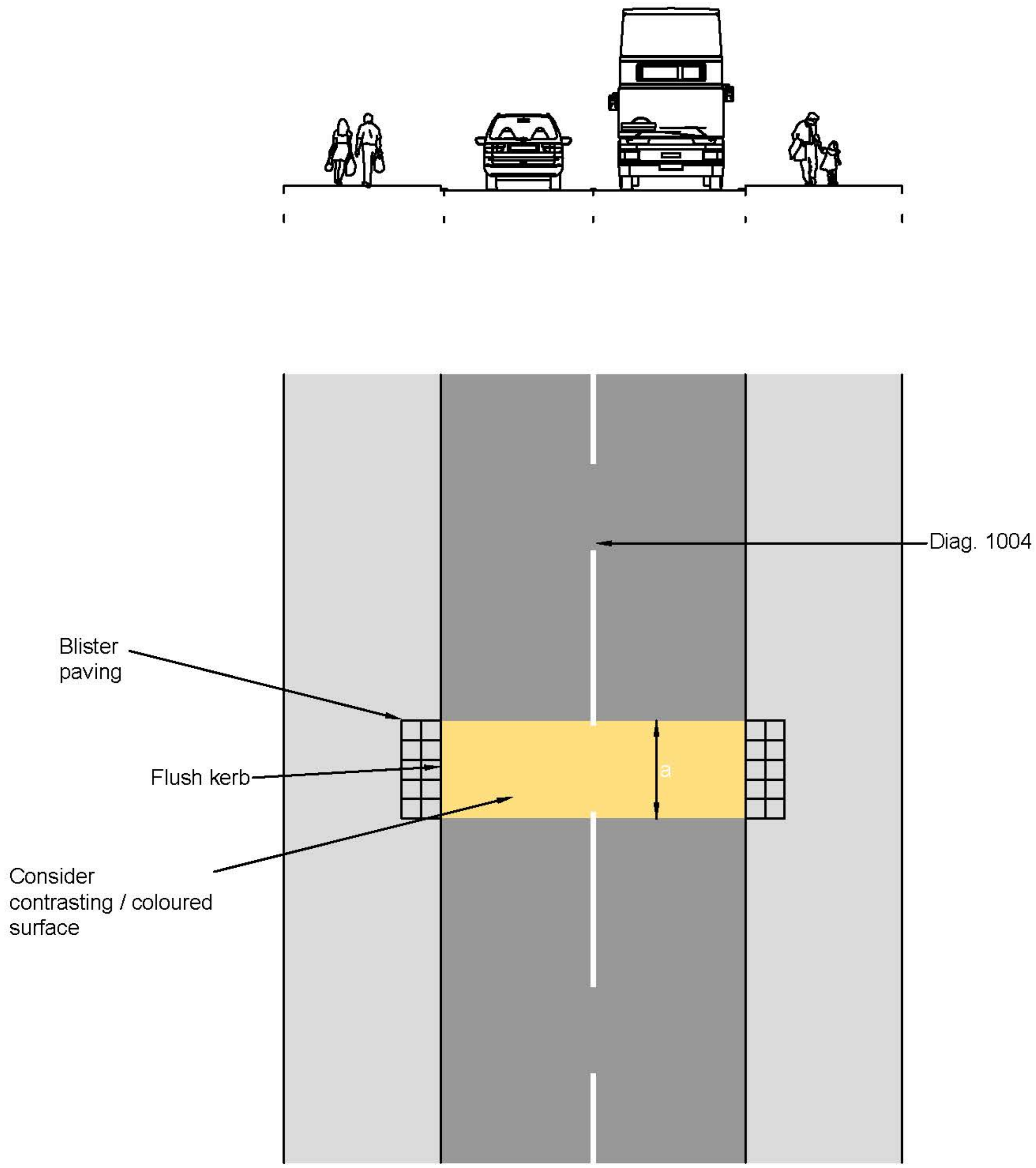
DE036

Uncontrolled Crossing



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DE037 Cycle Priority Crossing

Measure and Brief Description

Where a cycle track crosses a carriageway, the cycle track can be given priority over vehicles travelling along it. Care needs to be taken to ensure it is clear to motorists that they must give way, and that there is sufficient visibility along the cycle track. This type of crossing is best suited to relatively lightly trafficked slower speed roads.

Benefits

- Continuity of cycle route.
- Minimises delay and effort for cyclists.
- Affords visible priority to cyclists.
- Whilst this crossing design does not afford legal priority to pedestrians, traffic speeds are reduced and drivers will often informally cede priority to pedestrians.

Key Design Features

- Priority cycle crossings are generally suitable where main road flows are up to 4,000 vehicles per day, and speeds are up to 30mph.
- A road hump is not a legal requirement, but is desirable to reduce traffic speeds locally and encourage drivers to give way.
- Road humps must comply with the Highways (Road Humps) Regulations 1999
- Tactile paving to be provided to alert visually-impaired pedestrians.
- A coloured surface may be useful to highlight the presence of the crossing to motor traffic.
- Care should be taken to provide sufficient visibility. The crossing itself and its immediate approaches should be visibleand readily apparent to approaching motorists at their stopping sight distance. The crossing should be in a lit area.
- Although not mandatory, give way signs to diagram 602 will usually be required as the cycle track crossing and 1003 road markings may not be sufficiently obvious to approaching drivers on their own. The give way sign should be supplemented with a variant of diagram 962.1, varied to read ‘Cycle track’, with DfT authorisation.

Dimensions

- Width of crossing to be at least as wide as the cycle track either side, 3m min.

Other Considerations

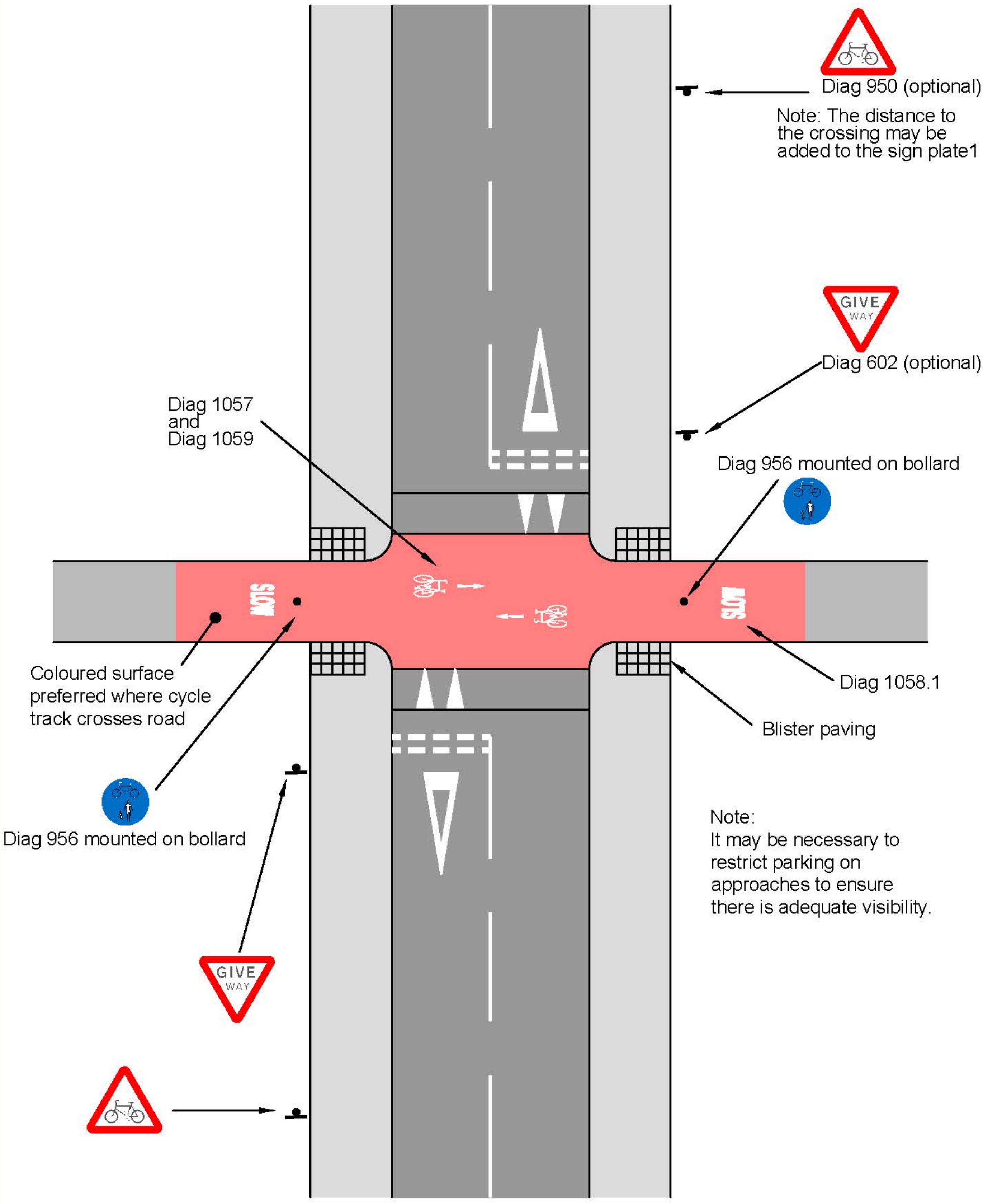
- Where cycle approach speeds are high or visibility restricted it is preferable to use path approach geometry or humps to slow cyclists. Barriers should not be used.
- Cycle priority crossings may also have central refuges (DE038)

Further References

- Department for Transport (2018) – Traffic Signs Manual

A4

DE037 Cycle Priority Crossing



Note:
It may be necessary to restrict parking on approaches to ensure there is adequate visibility.

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DE038 Uncontrolled Crossing With Central Refuge

Measure and Brief Description

Where the crossing of a road cannot easily be carried out in one stage due to the speed and volume of traffic or the width of the carriageway it will be necessary to provide a refuge for pedestrians and possibly cyclists to wait safely and make the crossing in two sections.

Benefits

- A high quality refuge crossing can considerably reduce the time needed to cross a busy road.
- Drivers are more likely to informally cede priority to pedestrians and/or cyclists where there is a refuge, as they know that they are inviting people to cross to a safe place.

Key Design Features

- Central refuges should be at least as wide as the approach paths.
- Crossings should be in a straight line.
- Refuges should normally be kerbed in order to provide a degree of protection and subjective safety to users.
- Flush kerbs and tactile paving should be provided in line with the dropped kerbs at the edge of the road, in the refuge and on the footways on either side.
- The refuge will often (but not always) need to be marked with bollards facing approaching traffic. These bollards may need to be illuminated in some circumstances - see Traffic Advisory Leaflet 3/13 and TSRGD.
- On single carriageway roads with two lanes where the national speed limit of 60mph applies or on other rural roads where a lower speed limit is in place, consideration should be given to additional measures such as light coloured antiskid surfacing for 50m either side of the crossing, rumble strips on the approaches, and beacons and Diag 950 warning signs on the approaches.

Dimensions

- a - Width of crossing to be at least as wide as the path either side. On pedestrian only routes this should be 2.0m min, on cycle tracks or shared use paths 3.0m min.
- b - Depth of pedestrian refuge should be a minimum of 2.0m to accommodate a wheelchair and pusher, or 4m where pedestrian flow > 600/hour; absolute minimum 1.2m.
- b - Depth of refuge for use by cyclists should be a minimum of 2.0m, or 2.4m on roads subject to national speed limit. A depth of 3.0m will accommodate a cycle towing a trailer, or a tandem.
- c - Refuges should not be designed to retain a running lane width of between 3.2m – 3.9m.This will encourage motorists to think that they can squeeze through ahead of cyclists.

Other Considerations

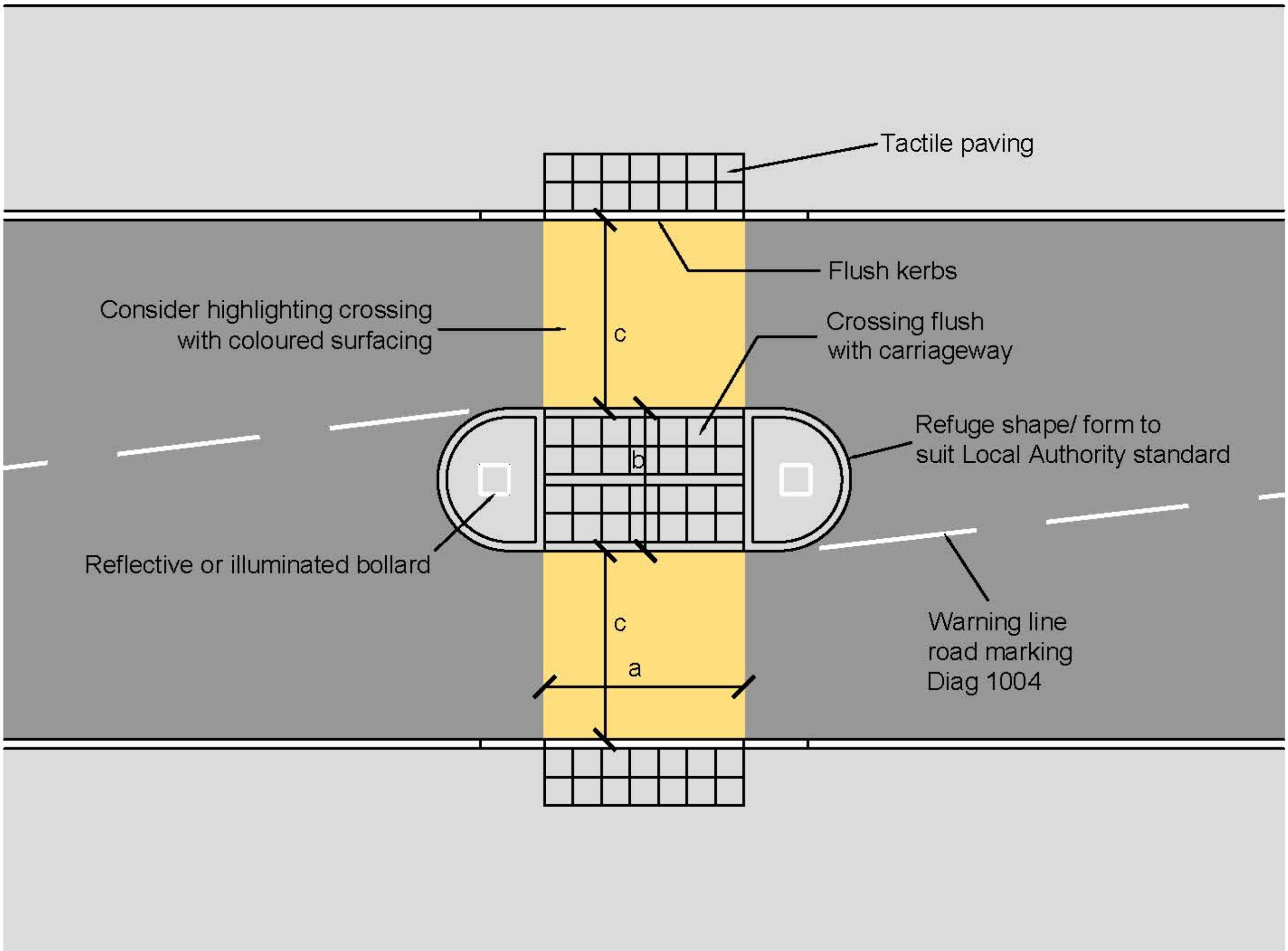
- The size of refuge should cater for peak flows in excess of current usage and allow for groups of pedestrians or cyclists (especially families) to wait together.
- The effect of parked vehicles in the vicinity of a refuge should be considered and if necessary parking restrictions imposed to maintain adequate visibility.
- Clutter-free (eg guardrailing) median islands will act as refuges for pedestrian and cyclist crossing movements and improve visibility and the streetscene.
- In rural locations detectors on the approach paths can be used to trigger vehicle activated signs to alert motor traffic of the presence of an infrequently used crossing only when there are cyclists or pedestrians present.

Further References

- Department for Transport (2013) - Traffic Advisory Leaflet 3/13. Traffic Bollards and Low Level Traffic Signs.

A4

DE038 Uncontrolled Crossing With Central Refuge



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DE039 Side Road Entry Treatment

Measure and Brief Description

Pedestrian crossings will be usually be provided across minor roads at side road junctions, if only in the form of dropped kerbs. Side road entry treatments involve raising and narrowing the mouth of the junction to make it easier and safer for pedestrians to cross the minor arm by reducing the speeds of turning vehicles, shortening the length of the crossing and providing a level route. The side road entry treatment also encourages drivers to give way to pedestrians who have started to cross.

Benefits

- Side road entry treatments make it easier and more convenient for pedestrians to cross the side road
- They also provide safety benefits to cyclists, helping to prevent collisions with motor vehicles turning into and out of the side road

Key Design Features

- Raising the carriageway to footway level across the mouth of the side road.
- Narrowing the side road to shorten the crossing distance and reduce traffic speeds.
- Tightening the corner radii of side road junctions which will slow down turning vehicles and enable the crossing point to be closer to the desire line.
- The top of the raised table should be constructed in material which contrasts with the carriageway to indicate to drivers that they should treat it differently. It may be paved in a similar material to the footway on either side.
- Tactile paving to be provided at the pedestrian crossing points.

Dimensions

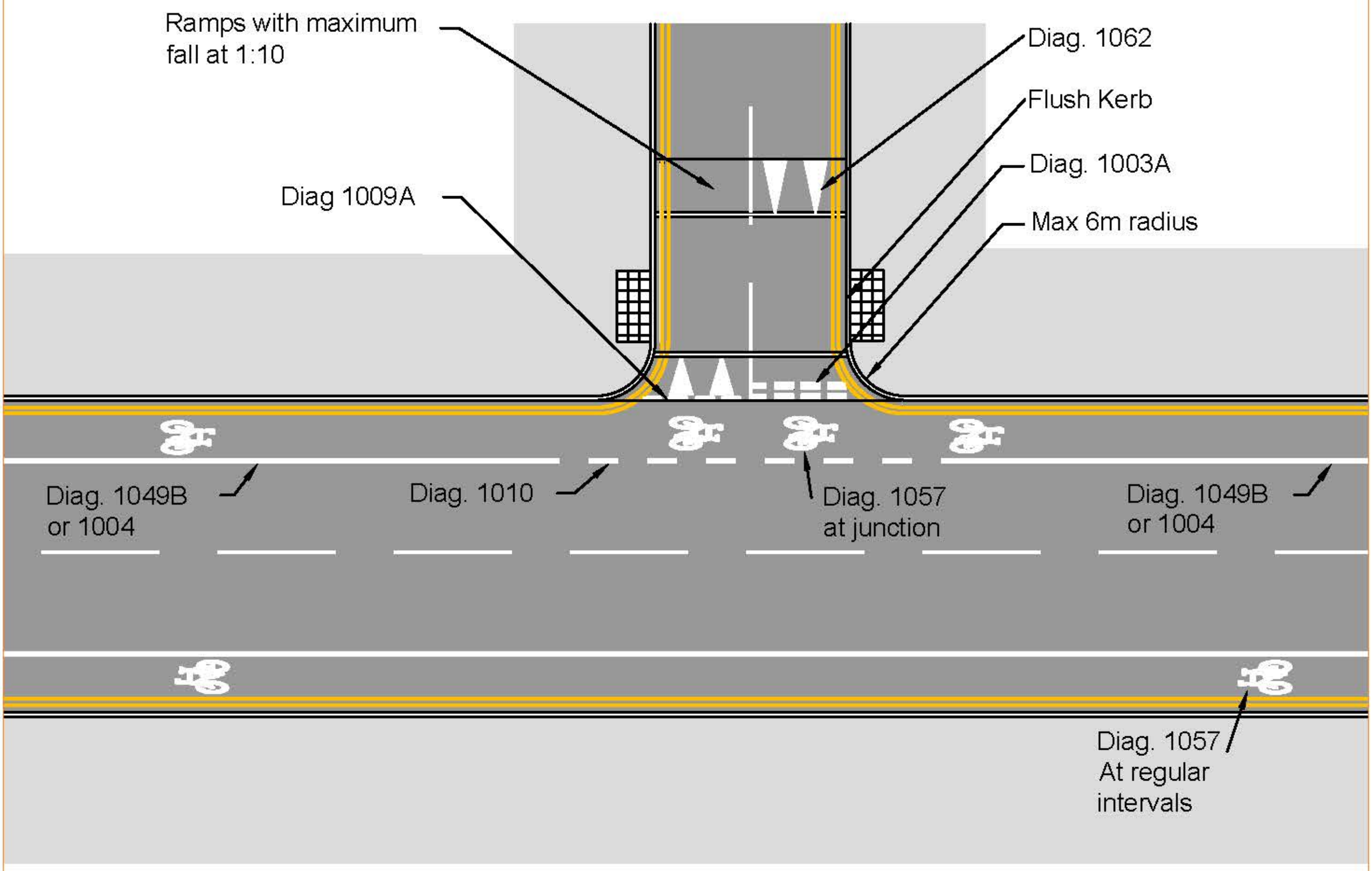
- a - Corner radii – Desirable maximum 3.0m, Absolute maximum 6.0m.

Other Considerations

- Raised tables are a form of traffic calming and as such cannot be used on roads with a speed limit greater than 40 mph.
- Consideration should be gradient of the ramp so as not to create a hazard for motorcycles and cyclists turning into the side road.
- Corner radii will depend the swept path requirements of vehicles turning into or out of the side road (allowing for vehicles to cross centre lines unless flows are high).
- Tight corner radii will enable pedestrian crossing points to be provided on the desire line.
- Bollards may be provided to prevent over-run on corners.
- Strengthened corners may be necessary if over-run is to be expected.
- Care should be taken to ensure adequate drainage provision to prevent ponding of water at the bottom of the ramps with a raised table, or in the corners of build outs.

A4

DE039	# Side Road Entry Treatment	



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DE040 Blended Side Road Entry Treatment

Measure and Brief Description

Pedestrian crossings will be usually be provided at side road junctions, if only in the form of dropped kerbs. Blended side road entry treatments involve continuing the footway across the mouth of the junction without any change to make it easier and safer for pedestrians to cross by reducing the speeds of turning vehicles, shortening the length of the crossing and providing a level route. The continuous footway strongly indicates to drivers that they should to give way to pedestrians using the footway.

Benefits

- Blended side road entry treatments make it easier and more convenient for pedestrians to cross the side road
- They also provide safety benefits to cyclists, helping to prevent collisions with motor vehicles turning into and out of the side road

Key Design Features

- Raising the carriageway to footway level across the mouth of the side road.
- Narrowing the side road to shorten the crossing distance and reduce traffic speeds.
- Tightening the corner radii of side road junctions which will slow down turning vehicles and enable the crossing point to be closer to the desire line.
- The top of the raised table should be constructed in material which contrasts with the carriageway to indicate to drivers that they should treat it differently. It may be paved in a similar material to the footway on either side.
- Tactile paving is not provided as it suggests that pedestrians should give way to turning vehicles. The design relies on the fact that vehicles are crossing over a continuous footway.

Dimensions

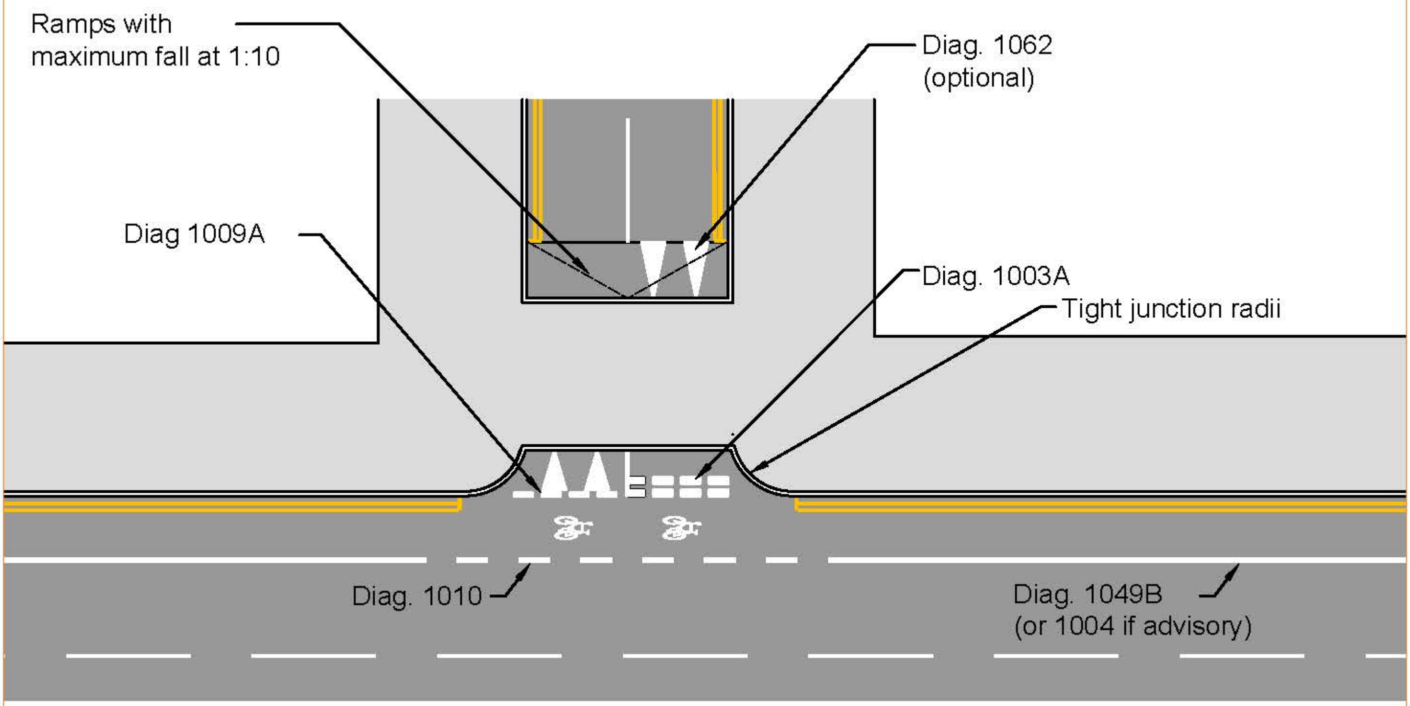
- a - Corner radii – Desirable maximum 3m, Absolute maximum 6m.

Other Considerations

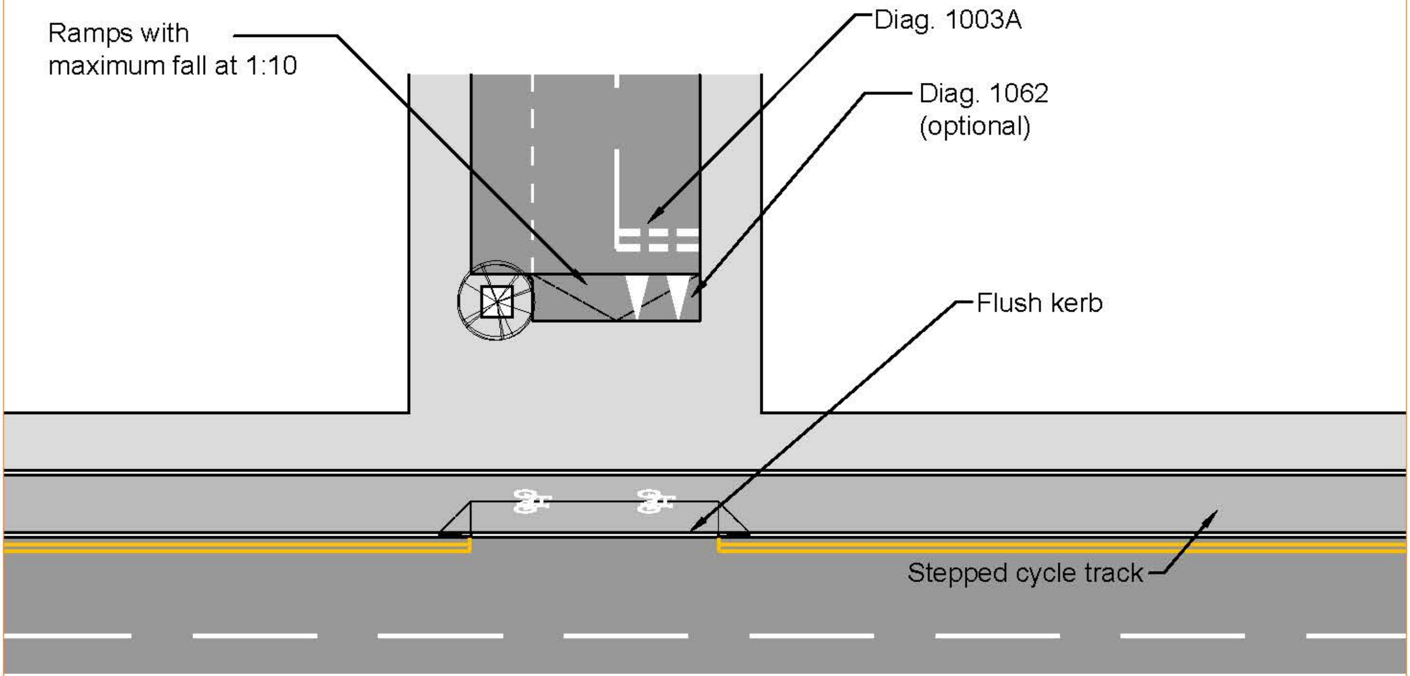
- Raised tables are a form of traffic calming and as such cannot be used on roads with a speed limit greater than 40 mph.
- Consideration should be gradient of the ramp so as not to create a hazard for motorcycles and cyclists turning into the side road.
- Corner radii will depend the swept path requirements of vehicles turning into or out of the side road (allowing for vehicles to cross centre lines unless flows are high).
- Tight corner radii will enable pedestrian crossing points to be provided on the desire line.
- Bollards may be provided to prevent over-run on corners.
- Strengthened corners may be necessary if over-run is to be expected.
- Care should be taken to ensure adequate drainage provision to prevent ponding of water at the bottom of the ramps with a raised table, or in the corners of build outs.

A4

DE040 Continuous Footway Layouts



Layout 1



Layout 2

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DE041 Central Median Strip

Measure and Brief Description

A central median strip is a paved area of different coloured or textured surfacing running along the centre of a carriageway. It provides space for pedestrians to wait in while crossing a road in two stages at any point along its length. It can also help to define a ‘narrower’ running lane to help reduce speeds, where cyclists share a carriageway.

Benefits

- Central median strips enable pedestrians to cross carriageways in two stages away from formal crossing points.
- This is particularly useful where crossing movements are distributed along a significant length, for example along a shopping street.
- These strips can also enhance the character of a highway and help to lower vehicle speeds. They also provide safety benefits to cyclists, helping to prevent collisions with motor vehicles turning into and out of the side road

Key Design Features

- The width of the central median needs to be sufficient for a pedestrian to wait safely in the median for a gap in the traffic.
- The median may be constructed to enable vehicular overrun, or kerbed to prevent vehicular overrun.
- Kerbed medians will give the most confidence to pedestrians crossing. Central medians can be designed to be overrun so that the carriageways can be kept narrow but still allow for vehicles to pass stationary buses etc.
- Strips that are designed to be overrun can be flush or domed and/or constructed in rough surfacing so that vehicles travel slowly when travelling across the median.
- Designated crossing points may still be provided at intervals, with flush kerbs on the median and at the kerbs on the opposite side of the carriageways. Tactile paving should be provided at these flush kerbs. Raising the carriageway to footway level across the mouth of the side road.

Dimensions

- a - Lane width either side to be below 3.2m or above 3.9m, avoiding the critical lane width range for cyclists.
- b – Width of median strip should be a desirable minimum of 2.0m to accommodate a wheelchair and the person pushing and an absolute minimum of 1.2m.
- Minimum kerb height of 60mm is recommended, with an absolute minimum of 50mm.

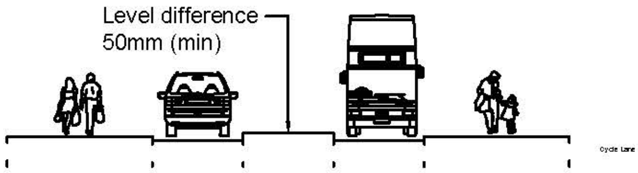
Other Considerations

- Unless kerbed, the form of construction of the median strip will need to accommodate vehicular overrun.
- Subject to vehicle tracking requirements, trees and planting can be placed in the central median.

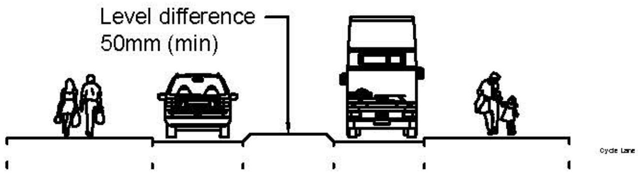
A4

DE041 Central Median Strip

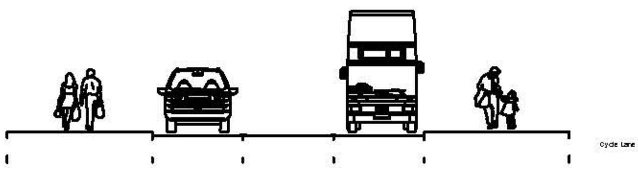
Kerbed Median

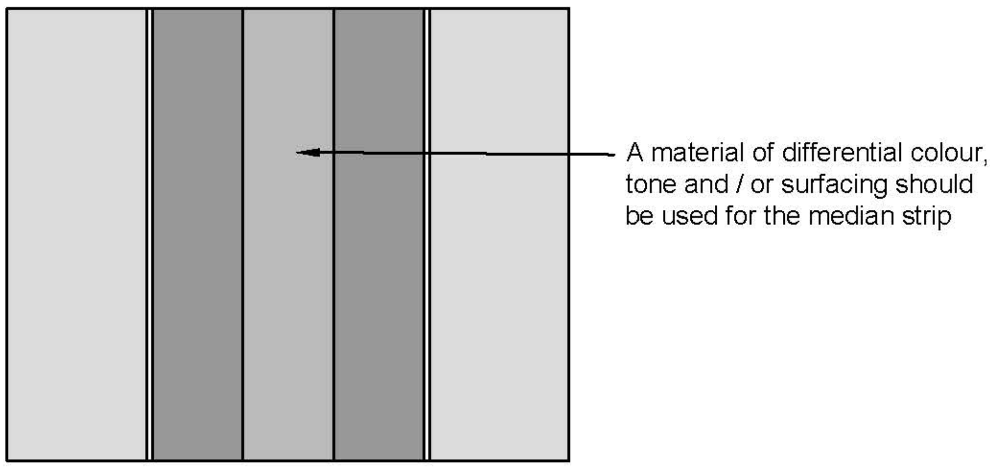


Humped Median



Flush Median





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DE042 Zebra Crossing

Measure and Brief Description

A Zebra is un-signalised crossing marked on the carriageway with transverse black and white stripes and yellow flashing globes (belisha beacons) on black and white striped poles at each side of the crossing. A driver must stop at a zebra crossing when a pedestrian starts to cross;

Zebra crossings are not designed to accommodate cyclists. Parallel crossings for pedestrians and cyclists are shown on DE043 and cycle-only priority crossings on DE037.

Benefits

- Zebra crossings provide relatively low-cost pedestrian priority crossing facilities which give an immediate response to pedestrians' need to cross.
- They can be placed closer to junctions than signalised crossings, reducing the need to deviate from desire lines.
- Unless pedestrian flows are very high they result in lower delays to vehicles. Central median strips enable pedestrians to cross carriageways in two stages away from formal crossing points.

Key Design Features

- There should be adequate visibility to a zebra crossing to ensure that approaching motorists can see a pedestrian about to cross the road.
- Zebra crossings may be sited on a flat-topped road hump (raised table) to slow traffic and highlight the presence of the crossing.
- Zebra crossings may either cross a full width carriageway in a single stage or comprise two crossings with a central refuge.
- Zebra crossings can be used across minor junctions close to the give way line.
- Zebra crossings should be at least five metres from a side road junction, measured from the driver's position in the adjacent road.
- When provided on the approach or exit from a roundabout, Zebra crossings should be located between 5m and 20m from the give way line.
- 8 zig zag markings are normally provided on either side of the crossing, which prevent parking, loading or overtaking. The maximum number is 18 and the minimum number is 2.
- Zig zag markings can be placed up to 2.0m from the kerbline so that space for cycling can be maintained up to the crossing.
- Tactile paving to be provided.

Dimensions

- a – Crossing width 4m min, 10m max.
- b – Distance of give way line to crossing 1.1m min, 3m max.

Other Considerations

- A blind person would not start to cross until sure that vehicles have stopped and would therefore seek a pedestrian controlled signal crossing. Other groups of pedestrians, including people with learning impairments and older people may feel safer and more comfortable using signalised crossings.
- Zebra crossings are unsuitable in locations where the 85th percentile vehicle speed Is greater than 35mph or where there would be regular congestion resulting from high vehicle or pedestrian flows.
- Where a zebra crossing is used on a road of two lanes or more consideration should be given to whether a vehicle stopped in the nearside lane will obstruct visibility to a crossing pedestrian from a vehicle in the off-side lane.
- Crossings may be divided by a refuge – see DE038. a – Crossing width 4.0m min, 10m max.

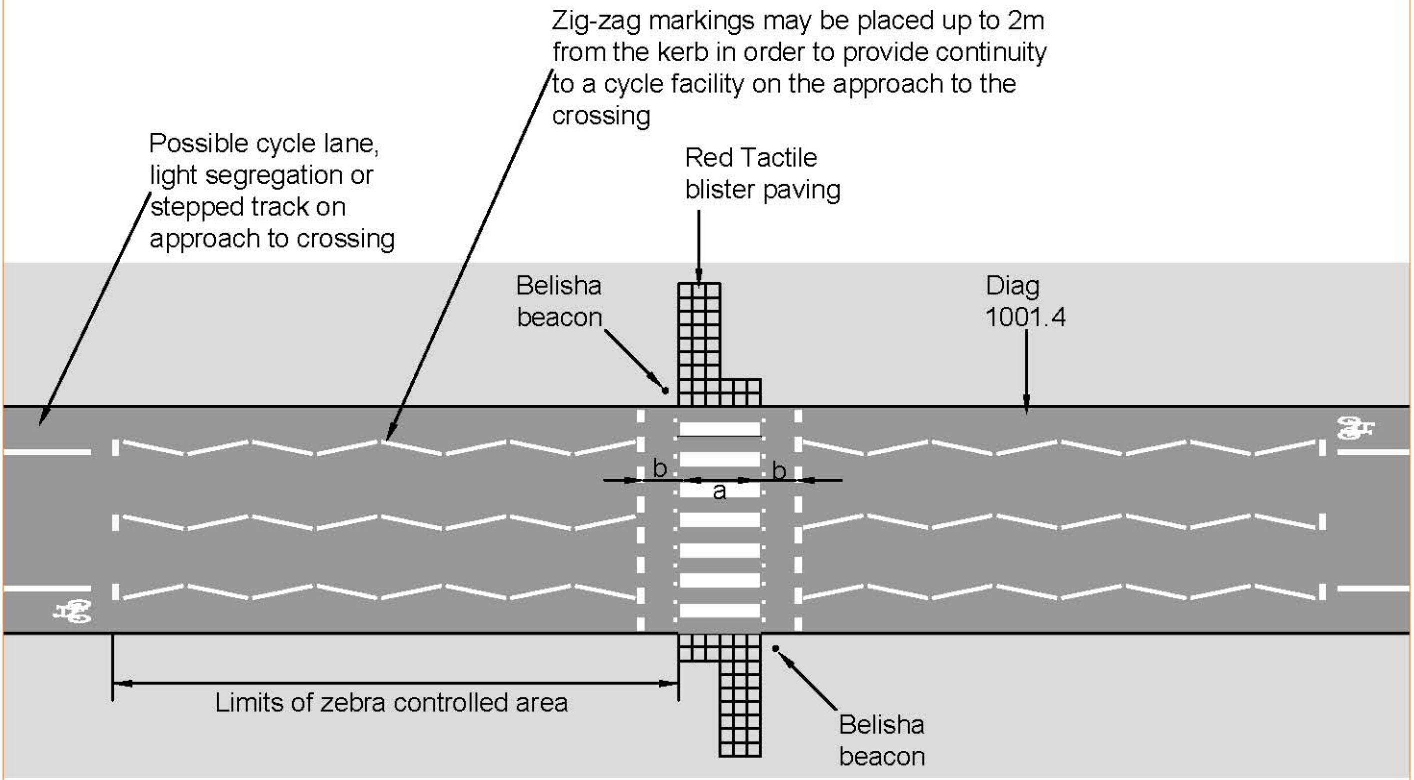
Further References

- Department for Transport (2018) – Traffic Signs Manual
- Department for Transport (1995) Local Transport Note 1/95: The Assessment of Pedestrian Crossings
- Department for Transport (1995) – Local Transport Note 2/95: The Design of Pedestrian Crossings.

A4

DE042

Zebra Crossing



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DE043 Parallel Crossing for Pedestrians and Cyclists

Measure and Brief Description

A parallel crossing for pedestrians and cyclists is included in TSRGD 2016. It is un- signalised crossing marked on the carriageway with transverse black and white stripes to indicate the pedestrian crossing and Elephants Footprint/Diagram 1057 markings to indicate the cycle crossing, together with yellow flashing globes (belisha beacons) on black and white striped poles at each side of the overall crossing. A driver must stop on the approach to the crossing when a pedestrian or cyclist starts to cross.

Benefits

- Parallel pedestrian/cycle crossings provide relatively low-cost facilities which give an immediate response to pedestrians' and cyclists' need to cross.
- They can be placed closer to junctions than signalised crossings, reducing the need to deviate from desire lines.
- Unless pedestrian or cycle flows are very high they result in lower delays to vehicles.

Key Design Features

- There should be adequate visibility to a crossing to ensure that approaching motorists can see a pedestrian or cyclist about to cross the road.
- Crossings may either cross a full width carriageway in a single stage or comprise two crossings with a central refuge.
- Crossings can be used across minor junctions close to the give way line.
- Crossings should be at least five metres from a side road junction, measured from the driver's position in the adjacent road.
- When provided on the approach or exit from a roundabout crossings should be located between 5.0m and 20m from the give way line.
- 8 zig zag markings are normally provided on either side of the crossing, which prevent parking, loading or overtaking. The maximum number is 18 and the minimum number is 2.
- Zig zag markings can be placed up to 2.0m from the kerbline so that space for cycling can be maintained up to the crossing.
- Tactile paving to be provided.

Dimensions

- a – Pedestrian crossing width 4m min, 10m max.
- b – Distance of give way line to pedestrian crossing 1.1m min, 3m max.
- c – Distance between pedestrian and cycle crossing 0.4m.
- d – Cycle crossing width 1.5m min, 3.8m max.
- e – Distance of give way line to cycle crossing 0.8m.

Other considerations

- A blind person would not start to cross until sure that vehicles have stopped and would therefore seek a pedestrian controlled signal crossing. Other groups of pedestrians, including people with learning impairments and older people may feel safer and more comfortable using signalised crossings.
- Parallel crossings for pedestrians and cyclists are unsuitable in locations where the 85th percentile vehicle speed Is greater than 35mph or where there would be regular congestion resulting from high vehicle or pedestrian flows.
- Where a crossing is used on a road of two lanes or more consideration should be given to whether a vehicle stopped in the nearside lane will obstruct visibility to a crossing pedestrian or cyclist from a vehicle in the off-side lane.
- Crossings may be divided by a refuge – see DE038.

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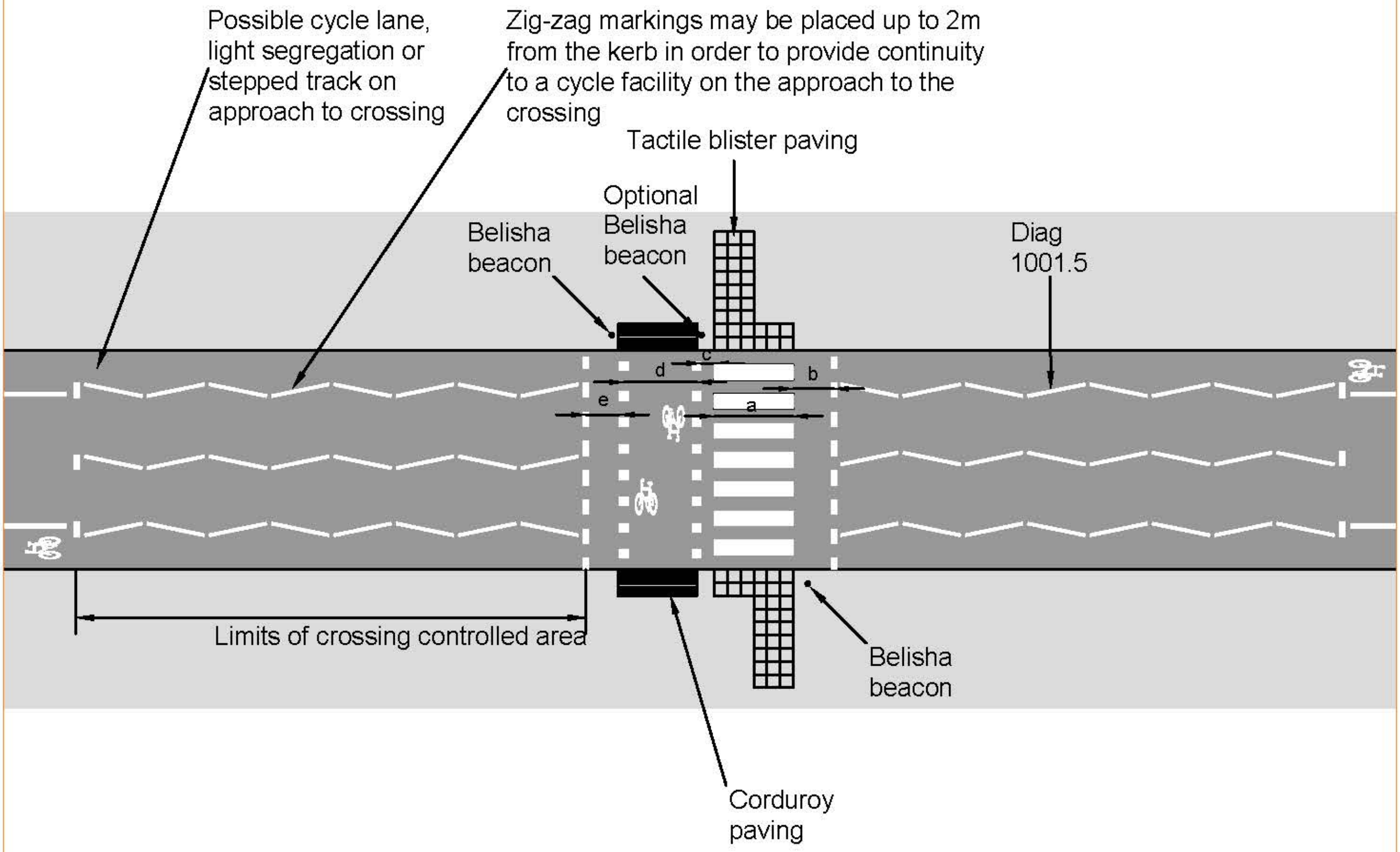
DE043 Parallel Crossing for Pedestrians & Cyclists



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DE044 Puffin and Ped-X Crossings

Measure and Brief Description

Puffin and Ped-X crossings are stand-alone signal-controlled pedestrian crossings. The traffic signal sequence is similar to a crossing facility at a signalised junction. Both types of crossing incorporate detection technology (usually infra-red which allows cancellation of the pedestrian demand if a pedestrian crosses after pressing the button but before the green man has activated. Additionally, the detectors are used to measure the speed at which pedestrians are crossing and automatically adjust the time allowed to cross the road. Puffin crossings have nearside pedestrian red and green aspects located as part of or above the push button unit, and located so that they can be seen at the same time as approaching traffic. A Ped-X crossing is a newer type, similar to a Puffin crossing in terms of signal sequence and detection, but with far side pedestrian signal aspects. 'Countdown' displays which show the time in seconds to the end of the crossing period, can be used with Ped-X crossings, but in this case, on-crossing detection cannot be used as the clearance period is fixed. Pelican crossings are an obsolescent type of crossing with a flashing amber for drivers and flashing green man crossing period, which must not be used for new installations.

Benefits

- Signalled crossings are preferred by visually impaired people, people with learning impairments and other groups of pedestrians including older people.
- Puffin and Ped-X crossings include detector technology to extend the pedestrian crossing time so that people walking more slowly are not disadvantaged. Parallel pedestrian/cycle crossings provide relatively low-cost facilities which give an immediate response to pedestrians' and cyclists' need to cross.

Key Design Features

- Ped-X crossings with farside pedestrian signals are preferred by some users and are more suited to busy locations where pedestrians may have difficulty seeing the nearside indicators due to crowding.
- Signal-controlled pedestrian crossings may either cross a full width carriageway in a single stage or comprise two crossings with a central refuge.
- Crossings of single carriageways should preferably be single stage crossings with rapid push button response and recall timings.
- Two stage crossings are often staggered to ensure that pedestrians treat each stage as a separate crossing, but straight-ahead divided crossings are much more convenient for pedestrians and should be used wherever possible. However, it will be important to avoid 'see-through' where pedestrians could mistake a green man on the far crossing for a green man on the near crossing.
- Two-stage straight ahead crossings can be achieved by using nearside pedestrian aspects, a wide central median or angling the crossings in preference to introducing a stagger.
- Where central waiting areas are created they should give maximum space and comfort to waiting users at peak times.
- The aim should be to minimise the time that pedestrians have to wait at a crossing. Where a crossing has two stages consideration should be given to including an advance call on the second crossing to minimise the time that a pedestrian has to wait for the second crossing.
- It is important that sufficient time is allocated to allow all pedestrians (particularly older people) to cross the road in an efficient unhurried manner.
- Crossings should reflect desire lines, using angled crossings if they are appropriate.
- Tactile paving and rotating cones for visually impaired users to be provided.
- Audible signals should be considered but can be intrusive in residential areas.
- 8 zig zag markings are normally provided on either side of the crossing, which prevent parking, loading or overtaking. The maximum number is 18 and the minimum number is 2.
- Zig zag markings can be placed up to 2m from the kerbline so that space for cycling can be maintained up to the crossing. There should be adequate visibility to a crossing to ensure that approaching motorists can see a pedestrian or cyclist about to cross the road.

Dimensions

- a - Crossing width 2.4m min, 10m max.
- b - Distance of give way line to crossing studs 1.7m min, 3m max. a – Pedestrian crossing width 4m min, 10m max.

Other considerations

- Signal controlled crossings should generally be at least 20 metres from a side road junction.
- On the approach to or exit from a roundabout a non-staggered signal-controlled crossing should be sited either at 20 metres or more than 60 metres from the give way line. If the crossing is staggered, the crossing of the entry arm may be located between 20 metres and 60 metres from the give way line.
- The topography of the site needs to be such that the pedestrian detectors will operate satisfactorily.
- Care should be taken when locating signalled pedestrian crossings in close proximity to give-way junctions, particularly roundabouts, where the presence of the vehicle signals could be misinterpreted as giving priority at the give-way junction.
- Crossing points should remain free from street furniture and other clutter.
- Signalised crossings should not be used where 85th percentile speeds exceed 50mph.

Further References

- Department for Transport (2001) – Traffic Advisory Leaflet 1/01, Puffin Pedestrian Crossing.
- Department for Transport (2001) – Traffic Advisory Leaflet 1/02,The Installation of Puffin Pedestrian Crossings.
- Department for Transport (2005) – Traffic Advisory Leaflet 5/05, Pedestrian Facilities at Signal-Controlled Junctions.
- Department for Transport (1995) – LTN 2/95, The Design of Pedestrian Crossings.

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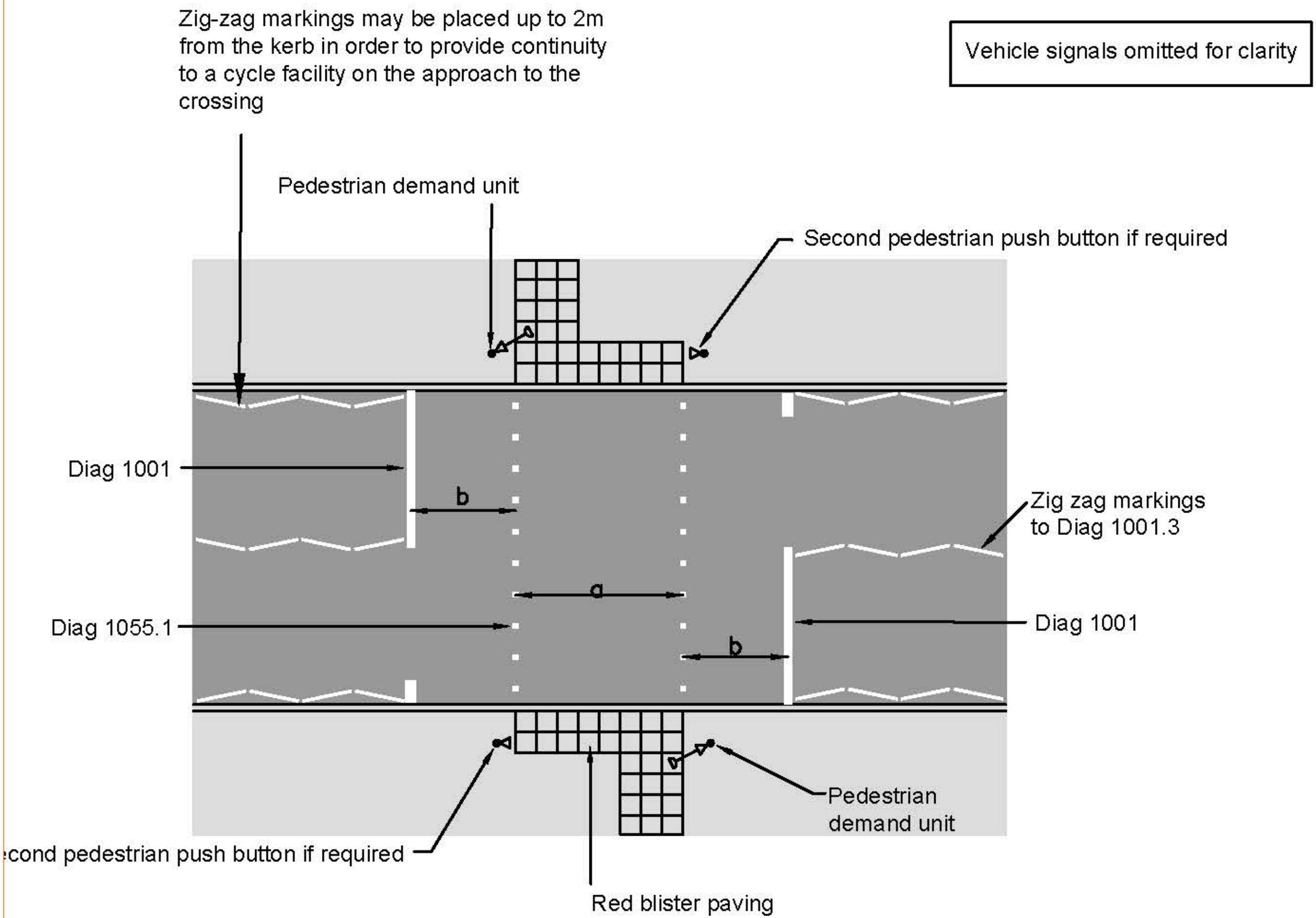
DE044 Puffin and Ped-X Crossings



Notes

1. Ped-X crossing has farside pedestrian aspects instead of nearside.

2. Ped-X with 'Countdown' crossing is as Ped-X, with countdown display next to nearside pedestrian aspects.

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DE045 Toucan Crossing

Measure and Brief Description

A Toucan crossing is a stand-alone signal-controlled pedestrian and cycle crossing. The traffic signal sequence is similar to a crossing facility at a signalised junction. Toucan crossings incorporate detection technology (usually infra-red) which allows cancellation of the pedestrian/cycle demand if a person crosses after pressing the button but before the green man has activated. Additionally, the detectors are used to measure the speed at which people are crossing and automatically adjust the time allowed to cross the road. Toucan crossings have nearside pedestrian/cycle red and green aspects located as part of or above the push button unit and located so that they can be seen at the same time as approaching traffic; farside aspects can also be used if preferred. Toucan crossings are used where there is a significant demand for cycle crossing movements over busy and faster roads, and a priority crossing (DE037) or parallel crossing for pedestrians and cyclists (DE043) is not suitable.

Benefits

- Toucans provide a compact crossing facility catering for both pedestrians and cyclists in one location
- Signalled crossings are preferred by visually impaired people, people with learning impairments and other groups of pedestrians including older people.
- Toucan crossings include detector technology to extend the pedestrian/cycle crossing time so that people travelling more slowly are not disadvantaged.

Key Design Features

- Crossings with farside pedestrian/cycle signals are preferred by some users and are more suited to busy locations where people may have difficulty seeing the nearside indicators due to crowding.
- Toucan crossings may either cross a full width carriageway in a single stage or comprise two crossings with a central refuge.
- Crossings of single carriageways should preferably be single stage crossings with rapid push button response and recall timings.
- Where a Toucan crossing is required on a wide road, a single-stage crossing should generally be provided for widths below 15m. For widths over 15m, the option of a single-stage crossing should be fully considered in the light of existing examples.
- Staggered divided Toucan crossings very difficult for cyclists to use and should not normally be provided. Straight-ahead divided crossings are much more convenient for cyclists and should be used in preference. However, it will be important to avoid ‘see-through’ where users could mistake a green signal on the far crossing for a green signal on the near crossing.
- Two-stage straight ahead crossings can be achieved by using nearside pedestrian/cycle aspects, a wide central median or angling the crossings in preference to introducing a stagger.
- Where central waiting areas are created they should give maximum space and comfort to waiting users at peak times.
- The aim should be to minimise the time that pedestrians and cyclists have to wait at a crossing. Where a crossing has two stages consideration should be given to including an advance call on the second crossing to minimise the time that a pedestrian or cyclist has to wait for the second crossing.
- It is important that sufficient is time allocated to allow all pedestrians (particularly older people) to cross the road in an efficient unhurried manner.
- Designs should also take account of the demand for cyclists wishing to join or leave the carriageway at the crossing.
- Crossings should reflect desire lines, using angled crossings if they are appropriate.
- Tactile paving and rotating cones for visually impaired users to be provided.
- Audible signals should be considered but can be intrusive in residential areas.
- 8 zig zag markings are normally provided on either side of the crossing, which prevent parking, loading or overtaking. The maximum number is 18 and the minimum number is 2.
- Zig zag markings can be placed up to 2.0m from the kerbline so that space for cycling can be maintained up to the crossing.

Dimensions

- a - Minimum recommended width of crossing is 4m, although where usage is low a 3m width is allowed. Maximum permitted width is 10m.
- b - Distance of stop line to crossing studs 1.7m min, 3m max. a - Crossing width 2.4m min, 10m max.

Other considerations

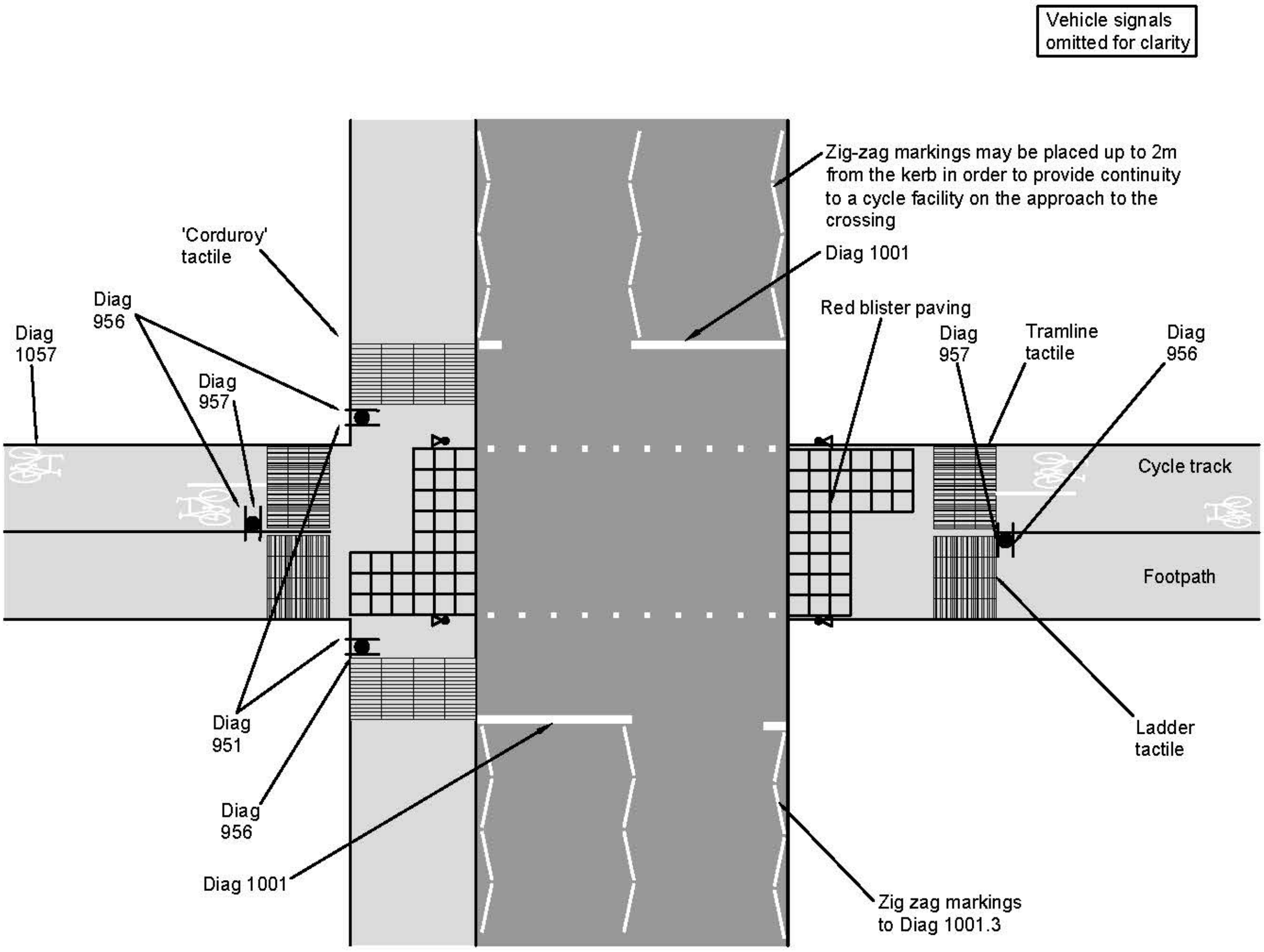
- Signal controlled crossings should generally be at least 20 metres from a side road junction.
- On the approach to or exit from a roundabout a non-staggered signal-controlled crossing should be sited either at 20 metres or more than 60 metres from the give way line.
- When crossings are located close to a signal controlled junction, consideration should be given to linking the signals to the junction signals. The distance at which this should be considered will depend on traffic conditions but 100 metres is likely to be the minimum distance at which linking is required.
- The topography of the site needs to be such that the pedestrian detectors will operate satisfactorily.
- Toucans that have a long delay time before giving a green to cyclists cause frustration and can lead to frequent attempts to cross before the green light appears. Detection systems that identify approaching pedestrians and cyclists can speed up the countdown timer and reduce waiting times on the side of a busy or fast moving road.
- Crossing points should remain free from street furniture and other clutter.
- Signalised crossings should not be used where 85th percentile speeds exceed 50mph.

Further References

- Department for Transport (2005) – Traffic Advisory Leaflet 5/05, Pedestrian Facilities at Signal-Controlled Junctions.
- Department for Transport (1995) – LTN 2/95, The Design of Pedestrian Crossings.

A4

DE045 Toucan Crossing



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DE046 Pedestrian/Cycle Bridge

Measure and Brief Description

Bridges provide very useful connections for footpaths and cycle tracks, taking routes across barriers such as major roads without conflict, railways and waterways. Where the topography is favourable the need for approach ramps can be minimised. Achieving good natural surveillance is necessary to provide personal security. New bridges can be designed as features along a route and may become attractors in their own right. New bridges are generally considerably cheaper than new subways/underpasses.

Benefits

- Provides a conflict-free crossing of a major barrier.
- A new bridge may provide an opportunity for a landmark feature.
- A bridge will often be cheaper than a subway/underpass.
- Better personal security than a subway/underpass.

Key Design Features

- Bridges require considerable investment and should normally cater for both pedestrians and cyclists.
- Bridges can attract high numbers of pedestrians and cyclists and the aim should be to provide effective segregation between them so that each group can travel at their preferred speed.
- Bridge approaches and decks should be straight or nearly straight. Right angled turns are difficult for cyclists to negotiate.
- Gradients should be in accord with the maximum values given in Figure 4.4, depending on slope length. Steeper gradients than 7% are not recommended, except over very short distances.
- Where the topography is favourable the need for approach ramps can be minimised.
- See DE003 for Ramps, DE004 for Steps.

Dimensions

a – Overall deck width:

- Pedestrian only: A minimum width of 2m , with additional width for busy routes – refer to Pedestrian Comfort Guidelines
- Unsegregated pedestrian/cycle bridge: the width should reflect the level and type of use forecast with a minimum of 4m width on primary cycle routes, or 3.5m on less busy secondary routes. On particularly heavily trafficked routes it should be increased to 5m.

b – Segregated pedestrian/cycle bridge, footway width:

- the width should reflect the level and type of use forecast with a minimum of 2m width, increasing to 3.5m width where there is frequent use by groups.

c – Segregated pedestrian/cycle bridge, cycle track width:

- Cycle track width should be sufficient to accommodate the forecast level of use with a minimum of:
  - 3m where the peak hour flow is less than 50/hr;
  - 4m on a primary cycle route (3.5m on a secondary cycle route) where it is 50-150/hr;
  - 4.5m over 150/hr.

h - Parapet height

- Parapet height for new bridges is normally 1.15m for pedestrians, 1.4m for cyclists, 1.8m for equestrians.
- On existing structures being converted to cycle use this parapet height cannot always be achieved, but it should not necessarily preclude their use as crossings for cyclists. Further advice is given in Sustrans Technical Information Note 30 Parapet Heights on Cycle Routes.

Other considerations

- Similar criteria apply to the conversion of footways over road bridges to shared use facilities Design widths should acknowledge suppressed demand and allow for growth in user numbers.
- Exposure of users to the weather should be considered – covered bridges will be beneficial.

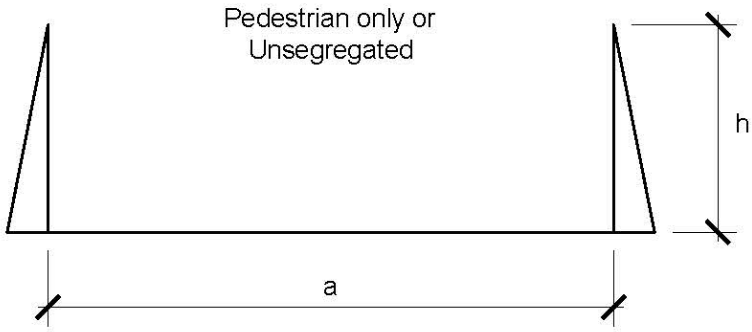
Further References

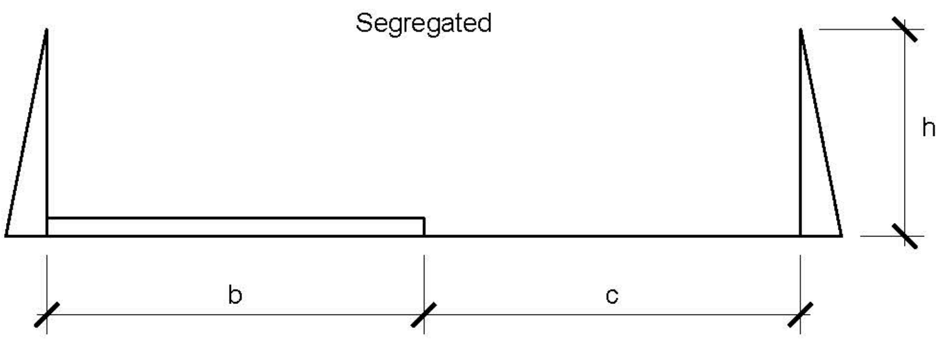
- Welsh Government (2004) - DMRB BD29/04, Design Criteria for Footbridges.

A4

DE046

Pedestrian/Cycle Bridge





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DE047 Subway/Underpass

Measure and Brief Description

Subways/underpasses can provide very useful connections for footpaths and cycle tracks, taking routes across barriers such as at major roads without conflict, railways and waterways. Where the topography is favourable the need for approach ramps can be minimised. Achieving good natural surveillance is necessary to provide personal security. This option may involve the conversion of an existing pedestrian subway or an underpass provided for private access.

Benefits

- Provides a conflict free crossing of a major barrier.
- Avoids exposure to the weather.
- The longitudinal profile of an underpass (down then up) is more comfortable for cyclists than bridges with approach ramps.

Key Design Features

- Subways/underpasses require considerable investment and should normally cater for both pedestrians and cyclists.
- Subways/underpasses can attract high numbers of pedestrians and cyclists and the aim should be to provide effective segregation between them so that each group can travel at their preferred speed.
- Approaches and the structures themselves should be straight or nearly straight. Right angled turns are difficult for cyclists to negotiate.
- Gradients should be in accord with the maximum values given in Figure 4.4, depending on slope length. Steeper gradients than 7% are not recommended, except over very short distances.
- Where the topography is favourable the need for approach ramps can be minimised.
- Lighting should be provided and be vandal proof.
- Corners and recesses should be avoided, with the exits being visible to users on entry.
- Natural lighting should be maximised by the use of generous widths, angled sides to the structure and light wells on longer crossings.
- See DE003 for Ramps, DE004 for Steps.

Dimensions

- Subways for pedestrians require headroom (h1) of at least 2.3m (2.6m for lengths over 23m) and a width (w1) of 3m (2.3m for light use).
- Subways for use by cyclists require headroom (h1) of 2.4m (2.7m for lengths over 23m) and width (w1) of at least 4m (3m for light use) if unsegregated.
- Segregated: the width for pedestrians (w2) should be at least 2m, the cycle track (w3) 2.5m and the margin strip (w4) 0.5m. Headroom for cyclists (h2) and pedestrians (h3) as above.
- A headroom of 3.7m is required if the routes is to be used by mounted equestrians.

Other considerations

- The headroom in existing pedestrian subways is typically 2.3m; the slightly sub-standard height for cyclists should not lead to automatic rejection of a proposal to permit cycling. There are many examples of structures on public roads and on traffic free routes with headroom well below 2.4m, which operate without incident for cyclists. Any restricted headroom should be clearly signed. The ‘cyclists dismount’ sign should not be used.
- Exit must be visible on entering the subway. CCTV/convex mirrors may be retrofitted to existing subways to improve visibility at corners,
- Generous headroom and width will be highly beneficial in terms of subjective safety, natural surveillance and personal security.
- Barriers to slow cyclists should not normally be used as these can restrict access for non-standard cycles.

Further References

- Welsh Government (1993) - DMRB TD36/93, Subways for Pedestrians and Pedal Cyclists Layout and Dimensions.

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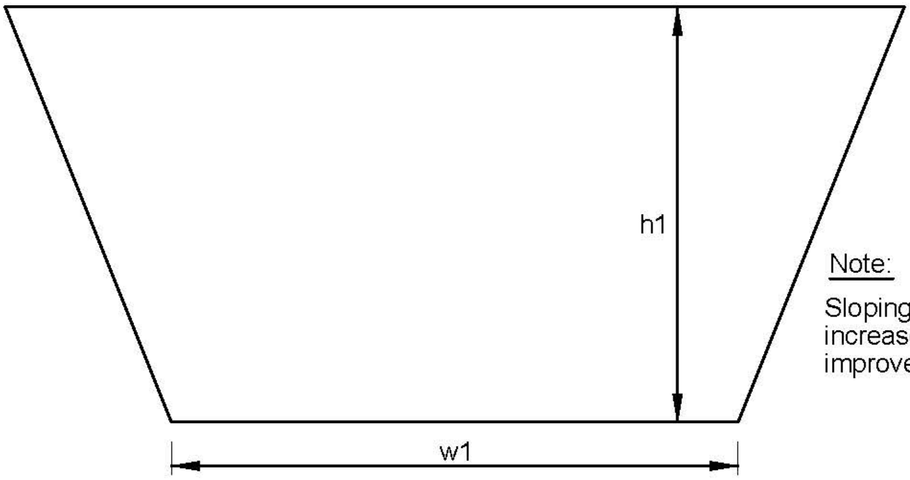
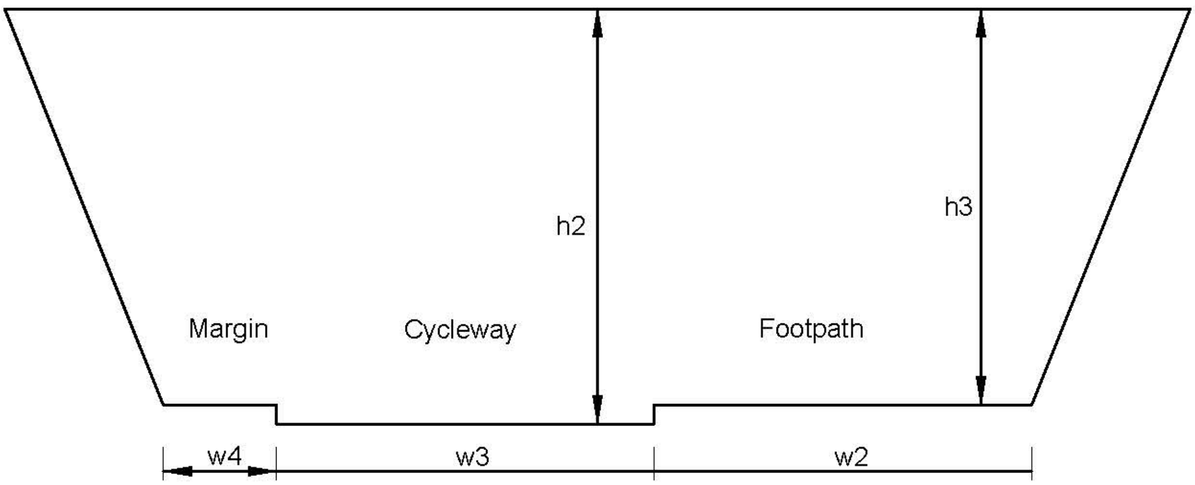
DE047	Subway/Underpass



Note:

Sloping sides preferred to increase natural light and improve personal security

Pedestrian only or Unsegregated



Segregated

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DE048 Wheeling Ramp

Measure and Brief Description

Where cycle routes are introduced onto routes originally designed for pedestrian use only, such as canal towpaths or railway footbridges, flights of steps are sometimes unavoidable, at least in the short term. To assist cyclists, wheeling ramps should be added to the flights using steel sections or by forming them in concrete.

Benefits

- Enables cyclists to negotiate an existing footbridge or underpass at minimal cost where a ramp is not possible.

Key Design Features

- Locating the wheeling ramp close to the wall minimises the trip hazard for pedestrians.
- The distance between the ramp and the wall should be enough to ensure that the pedals and handlebars do not clash with the wall or handrail while the bicycle is being held reasonably vertically.
- The wheeling channel needs to extend beyond the top and bottom steps to provide a smooth transition.
- Steel sections should have a nonslip surface so that the tyre grips the ramp on descent.
- In most cases the ramp is fitted to one side, usually on the right for people climbing, but on well used routes a ramp on each side may be considered.

Dimensions

- A channel 100 mm wide and 50 mm deep is generally suitable.
- The centre of the channel should be 200mm from the side wall.

Other considerations

- Wheeling ramps should not obstruct convenient access to the handrail nor be located in the centre of the steps where they might form a trip hazard.
- Where a ramp is constructed in metal, a continuous piece is preferred.
- In some instances timber and stone surfaces blend better with the original construction.
- Requires considerable effort from cyclists, especially with luggage.
- Are of no benefit to many non-standard cycles such as tricycles, cargo bikes and cycles with trailers. An alternative accessible route should also be signed if possible.

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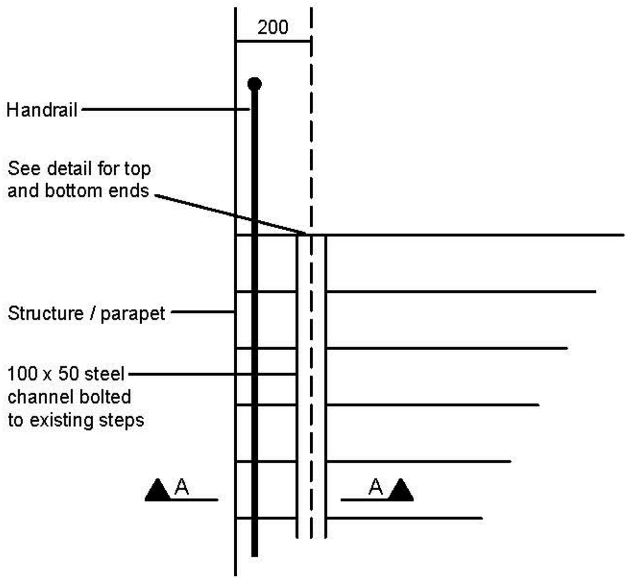
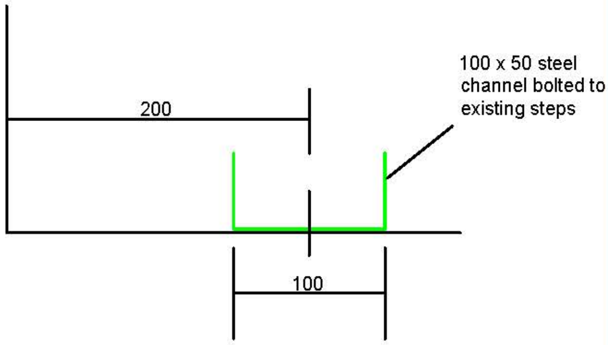
DE048

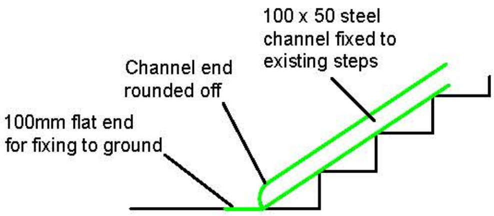
Wheeling Ramp



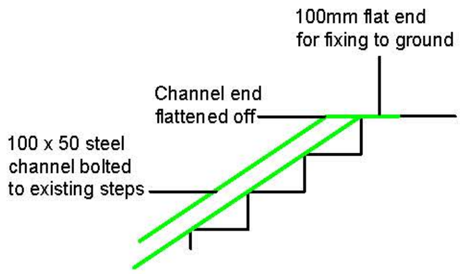
Elevation



Section A - A



Bottom end detail



Top end detail

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DE049 Unmarked Informal Junction

Measure and Brief Description

Junctions in urban areas, even on relatively busy routes, can be designed without defined priority, requiring all road users to slow down and engage/negotiate with other road users. The application of these ‘shared space’ principles is becoming increasingly common and has been demonstrated to be effective in terms of traffic capacity and safety on four-arm junctions with peak period flows in excess of 2,500 vehicles per hour. Examples include junctions in the centre of Coventry, in Poynton in Cheshire and in Hackney (see photos). This type of junction can work well for pedestrians and cyclists.

Benefits

- Reduced delays to all users, particularly during off-peak periods
- Good safety record
- Improved public realm, enhancing the attractiveness of urban centres

Key Design Features

- Junctions of this type should be designed to suit local circumstances – standardised solutions are not appropriate.
- Motor vehicle paths should be limited to a single lane on entries and exits.
- General lane widths should be kept as narrow as possible but separate provision may be made for cyclists so that they are able to pass queuing vehicles on the junction approaches.
- Speeds on the approaches should be around 20mph.
- Traffic signal crossings should not be used on the approaches to the junction since green signals can reinforce drivers’ sense of priority over pedestrians.
- Informal (or zebra/parallel pedestrian and cycle crossings) should be provided on desire lines.
- Crossings can also be made available to cyclists so that they can travel around the junction via cycle tracks or shared paths outside the carriageway.
- Crossings should be paved in a material which contrasts with the general carriageway, with tactile paving.
- Central islands or median strips at crossings help pedestrians and cyclists to cross and make it more likely that drivers will cede priority (see DE038 and DE041).
- Paving materials that are visibly different from standard bituminous surfacing will help to reinforce the distinctiveness of the place.
- A range of kerb heights can be used between crossing points. Flush or very low kerbs will require tactile paving.

Dimensions

- Overall dimensions vary but are typically around 25m to 40m across.

Other considerations

- This type of junction works best in urban areas with high numbers of pedestrians and general activity, particularly town and city centres.
- They can form part of a wider public realm/shared space scheme, but can also be provided in isolation.
- Visually impaired people have safety concerns and will prefer signalised crossings to zebra and informal crossings.

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DE049	Unmarked Informal Junction

Poynton, Cheshire - Double Junction, each designed to encourage circulatory priority, with courtesy crossings, carrying circa 26,000 vehicles per day overall

Leonard Circus, London - Uncontrolled junction with no designated crossings

Coventry - Plain uncontrolled junction with crossings

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DE050 Advanced Stop Line

Measure and Brief Description

An Advanced Stop Line (ASL) enables cyclists to take up an appropriate position in the 'reservoir', or waiting area between the two stop lines, for their intended manoeuvre ahead of general traffic, before the signals change to green. A cycle feeder lane should normally be provided, which will enable cyclists to pass queuing motor traffic on the approach to the stop line. They are established practice in most highway authorities and some now have a presumption to install ASLs at all signalled junctions. ASLs may not resolve all problems for cyclists at traffic signals however; they are of no value when signals are on green, and so may be less suitable on junction approaches which run during most of a signal cycle. A large, complex, high speed motor vehicle-dominated junction will not be made cycle-friendly by the provision of ASLs.

Benefits

- Feeder lanes allow cyclists to bypass waiting traffic, and get to the ASL reservoir at the head of the queue. Cyclists can position themselves where they are visible and in the correct turning lane. This is particularly helpful for cyclists making right turns and where there is a separately signalled left turn and cyclists wait to go ahead.
- ASLs can be used to a safe area for a cyclist to merge back into the carriageway from a cycle track.
- The ASL reservoir provides cyclists with an area free from exhaust fumes in which to wait.
- ASLs improve the comfort of pedestrians, by setting waiting motor traffic back from the pedestrian crossing.

Key Design Features

- The design of ASLs must be site-specific. Consideration should be given to factors such as the turning traffic volumes and dominant cycle movements, signal staging, location and number of approach lanes, and vehicle swept paths.
- Feeder lanes should be provided wherever possible and should preferably be mandatory, although a wide advisory cycle lane, accepting that some vehicles may encroach, may be better than a narrow mandatory lane.
- ASLs can also operate without feeder lanes, with 'gate' markings to diagram 1001.2A, but the benefit of an ASL is much reduced if no lead in lane is provided, since less confident cyclists will not try to reach the reservoir.
- Feeder lanes are normally located on the nearside. Centre and offside feeder lanes can also be provided to help cyclists make specific movements. For example where there is a heavy left-turning traffic movement which conflicts with a dominant ahead or right cycle movement, the feeder lane should be positioned between the left and ahead traffic lanes.
- Feeder lanes between traffic lanes need to be wider and this is generally achievable by narrowing the traffic lanes. Continuity of cycle lanes feeding ASLs should be maintained, with traffic having to cross the cycle lane to access the left turn lane.
- On approaches to ASLs, it is important that detection loops are positioned so that they cover the approach cycle lanes as well as the general traffic lanes. Often this is not the case, resulting in approaching cyclists not being detected. Similar considerations apply to above ground detection.
- Advanced stop lines can be partial width or have staggered stop lines. This is useful where right turns are not permitted (for cyclists or all vehicles), there are multiple right-turning lanes or tracking of vehicle movements into the arm of the junction shows that they would encroach on the ASL reservoir if it were full-width. There is some evidence that drivers less likely to encroach into partial ASLs.
- Coloured surfacing can also be used to emphasise the reservoir, which can be full or part width.

Dimensions

- The recommended minimum length of the reservoir for cyclists is 5.0m - TSRGD permits a minimum of 4.0m. Longer reservoirs may be considered to satisfy demand, up to a maximum of 7.5m (or 10.0m with special authorization).
- Nearside feeder lanes should normally be a minimum of 1.5m wide, and wider where possible. The absolute minimum width is 1.2m.
- Central and offside feeder lanes should be a minimum of 2m wide – absolute minimum 1.5m.
- General traffic lanes may be reduced to a minimum of 2.5m, which allows motor traffic not to block or encroach on the cycle lane.

Other considerations

- An 'early start' signal phase for cyclists can be used, using a low-level cycle signal (primary) and/or a 4th aspect 'cycle filter' (primary or secondary). It enables cyclists waiting in the reservoir to start (typically up to 7 seconds) ahead of other traffic and to clear locations of potential conflict with traffic on the same arm (e.g. overtaking and turning left) or opposing traffic streams.
- ASLs have little or no effect on capacity if the number of all-purpose traffic lanes remains unaltered.
- Care should also be taken at signals where there are large numbers of HGVs turning left because of the potential for cyclists to move into the driver's blind spot.

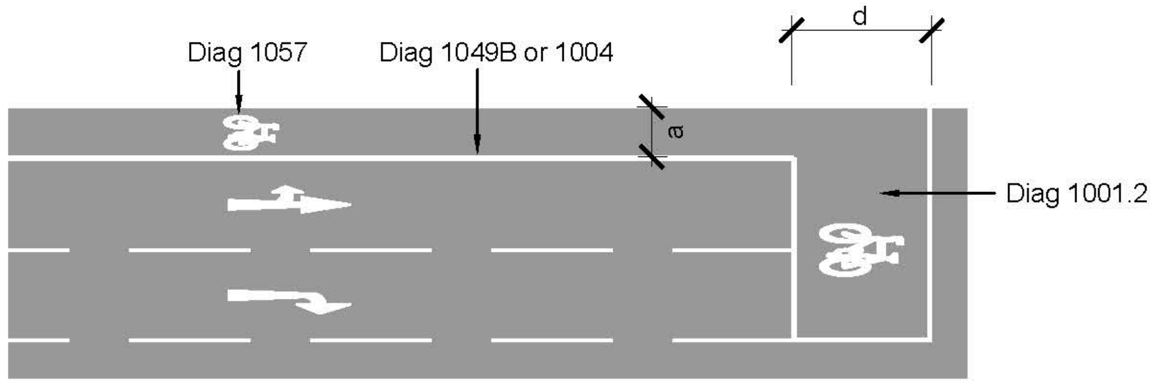
Further References

- Department for Transport (2003) – Traffic Signs Manual

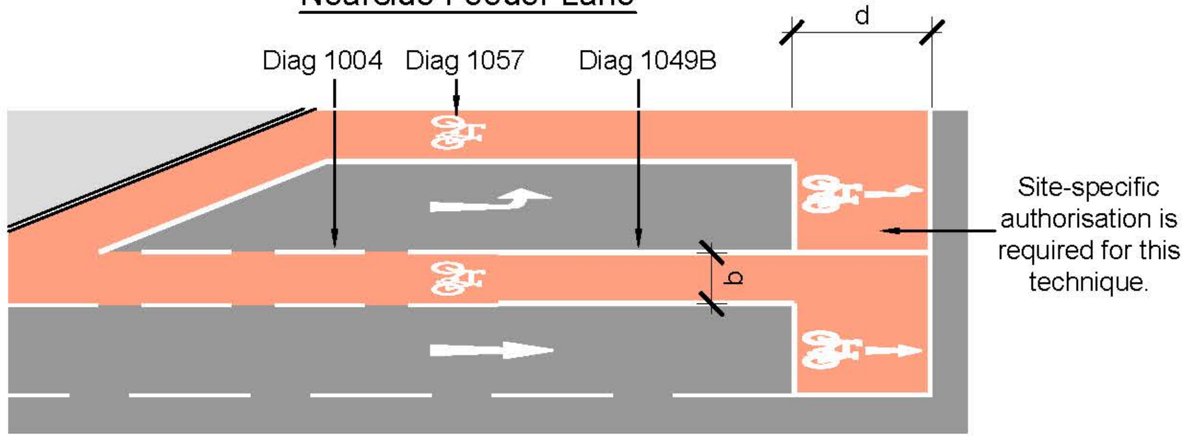
A4

DE050

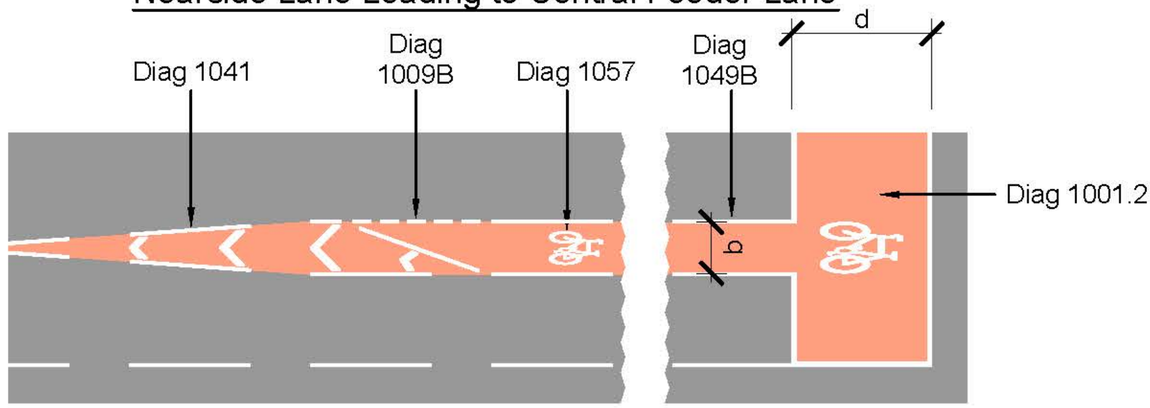
Advanced Stop Lines



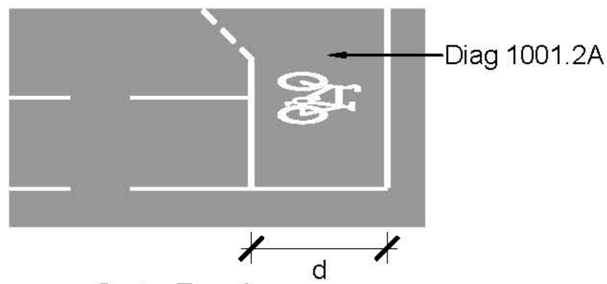
Nearside Feeder Lane



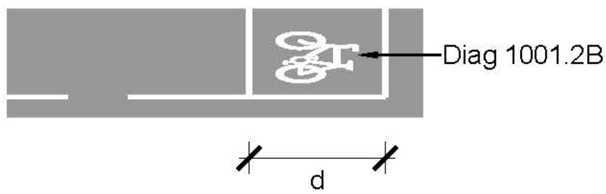
Nearside Lane Leading to Central Feeder Lane



Central Feeder Lane



Gate Feeder



ASL without lead-in or gate entry

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DE051 Cycle Bypass at Traffic Signals

Measure and Brief Description

Where space and level of pedestrian use allow, it will be beneficial to cyclists to provide a slip off in advance of a signalised junction, leading to a short section of cycle track that enables the cyclist to bypass the red signal. This may be used to assist cyclists either to turn left or to continue straight ahead at the top of a T junction. Cycle bypasses can also be used as approach routes to cycle and pedestrian crossings in order to facilitate difficult manoeuvres (e.g. right turns) or to make manoeuvres which are prohibited to other traffic.

Benefits

- reduce delays to cyclists and offer time advantages compared to other traffic.
- formalise (and legalise) common cyclist behaviour.
- enable cyclists to maintain momentum, improving comfort.
- increases permeability where it enables cyclists to make manoeuvres that are prohibited for other modes.

Key Design Features

- Bypasses should be built within the carriageway so as not to impede pedestrian flows, but where this is impractical the bypass can be merged into a cycle track at or close to footway level.
- The design should make it clear if the facility is to be used in one or both directions.
- Cycle bypasses may, or may not, have their own set of signals phased to give early starts, or separate cycle phases. They may simply end at a Give Way line, discharge into a lane or track, or merge into general traffic.
- Loop detection on the approaches, and infra-red technology to detect waiting cyclists will help to speed up sequencing of traffic signals ahead.
- Careful design is required at pedestrian crossing locations.

Dimensions

- Minimum 2.0m wide track (a), 1.5m for short lengths.
- Margin strip (b) min 0.5m.

Other considerations

- Bypasses need to be designed to accommodate a variety of cycle types, and also be accessible to mini road sweepers. Poorly-accessible facilities will collect litter/broken glass and become unusable.
- A protected entry to the carriageway is preferred.

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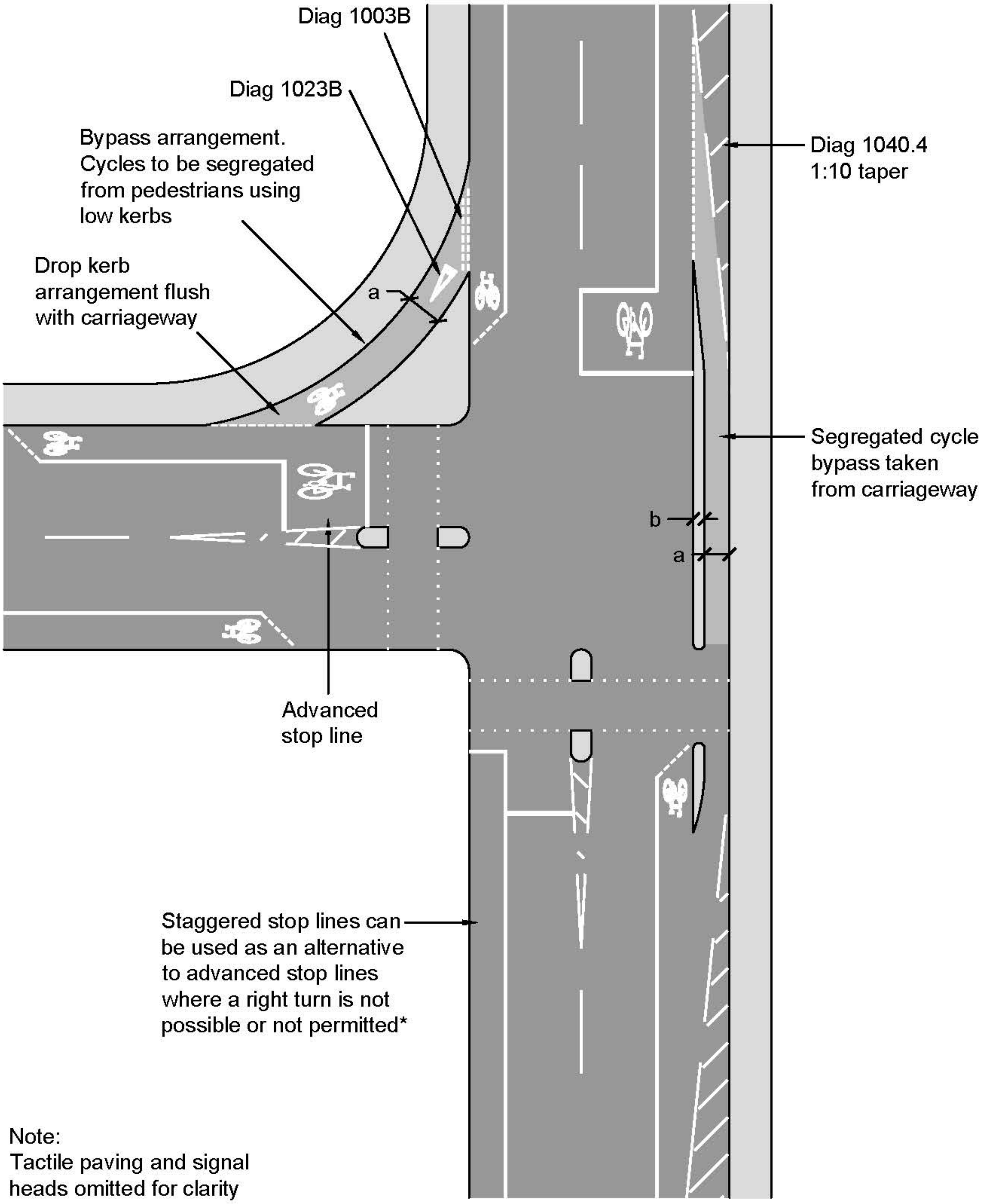
DE051 Cycle Bypass at Traffic Signals



Note:
Tactile paving and signal heads omitted for clarity

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DE052 Cycle Lanes Through Signalised Junction

Measure and Brief Description

A cycle lane marked through a signalised junction provides a visible indication of route continuity and increases drivers' awareness of key cycle movements. They are used to indicate route continuity and protect space for cyclist desire lines through major junctions on cycle routes.

Benefits

- Help to guide cyclists.
- Raise the awareness of motorists that a junction forms part of a recognised cycle route.
- They are particularly beneficial for large and complex junctions.

Key Design Features

- Route markings should comprise Diag 1010 markings or alternatively advisory cycle lane markings (diag 1004).
- Consider highlighting with coloured surfacing.

Dimensions

- a - Width of cycle lane on approaches refer to DE013 and DE014.
- b - Width of cycle lane through junction to be at least 0.5m wider than the approach cycle lane, min 2m is recommended where movements are generally straight ahead, and traffic passes cyclists on the riders' right.
- Minimum width lanes of 2.5m are recommended where traffic can be moving on both sides of the cyclist.

Other considerations

- Where cyclists have several cross cutting desire lines through a junction, attempting to mark these may be confusing and counter-productive.
- Route markings through junctions will be subject to high levels of wear and will require maintenance.

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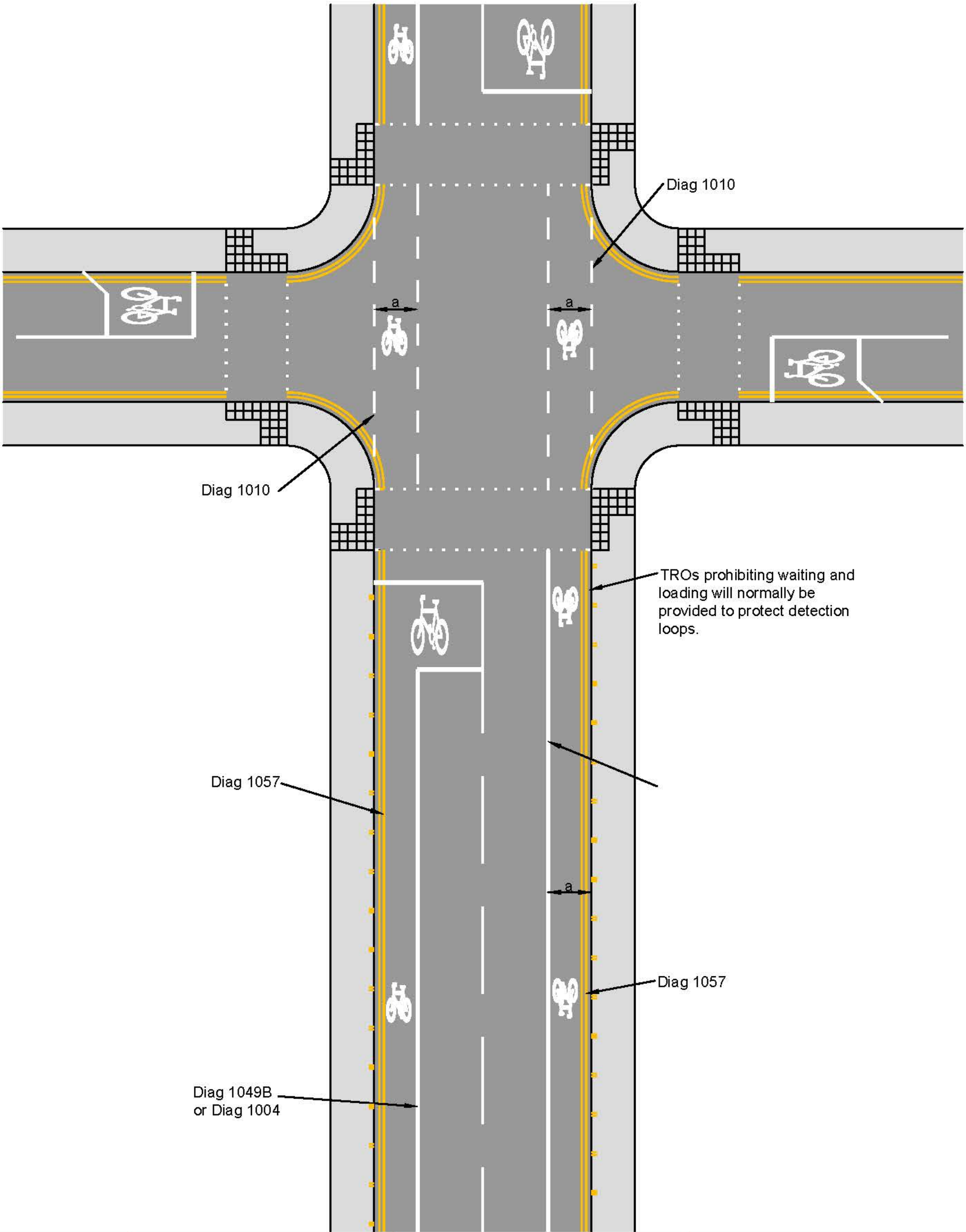
DE052

Cycle Lanes through Signalised Junction



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DE053 Two Stage Right Turn at Traffic Signals

Measure and Brief Description

Based on a standard feature at junctions in Denmark and other countries, this design provides for cyclists turning right at a a multi-lane approach to a signalised junction, where the speed and volume of motor traffic makes the execution of a conventional right turn hazardous and unpleasant, even when an ASL is provided. Provision is made for cyclists to pull in to the side road on their left and wait there until the side road has a green light, at which point cyclists can make a straight across movement to complete their right turn.

Benefits

- Cyclists able to make a safe right turn off a busy road, without having to weave across traffic lanes.

Key Design Features

- The waiting area can be marked with a cycle symbol (Diag 1057) and right turn arrow (Diag 1059), backed with coloured surfacing if needed.
- The waiting area must be clear of any pedestrian crossing on the side road and sufficiently far back from ahead traffic on the main road for cyclists waiting there to feel safe. It should be clear of any cycle lane across the junction.
- Waiting area should to be of sufficient size for the number of cyclists waiting to turn.
- Cyclists rely on the secondary signal on the side road to know when they can make the second stage of the turn, so this must be located where cyclists can see it.

Dimensions

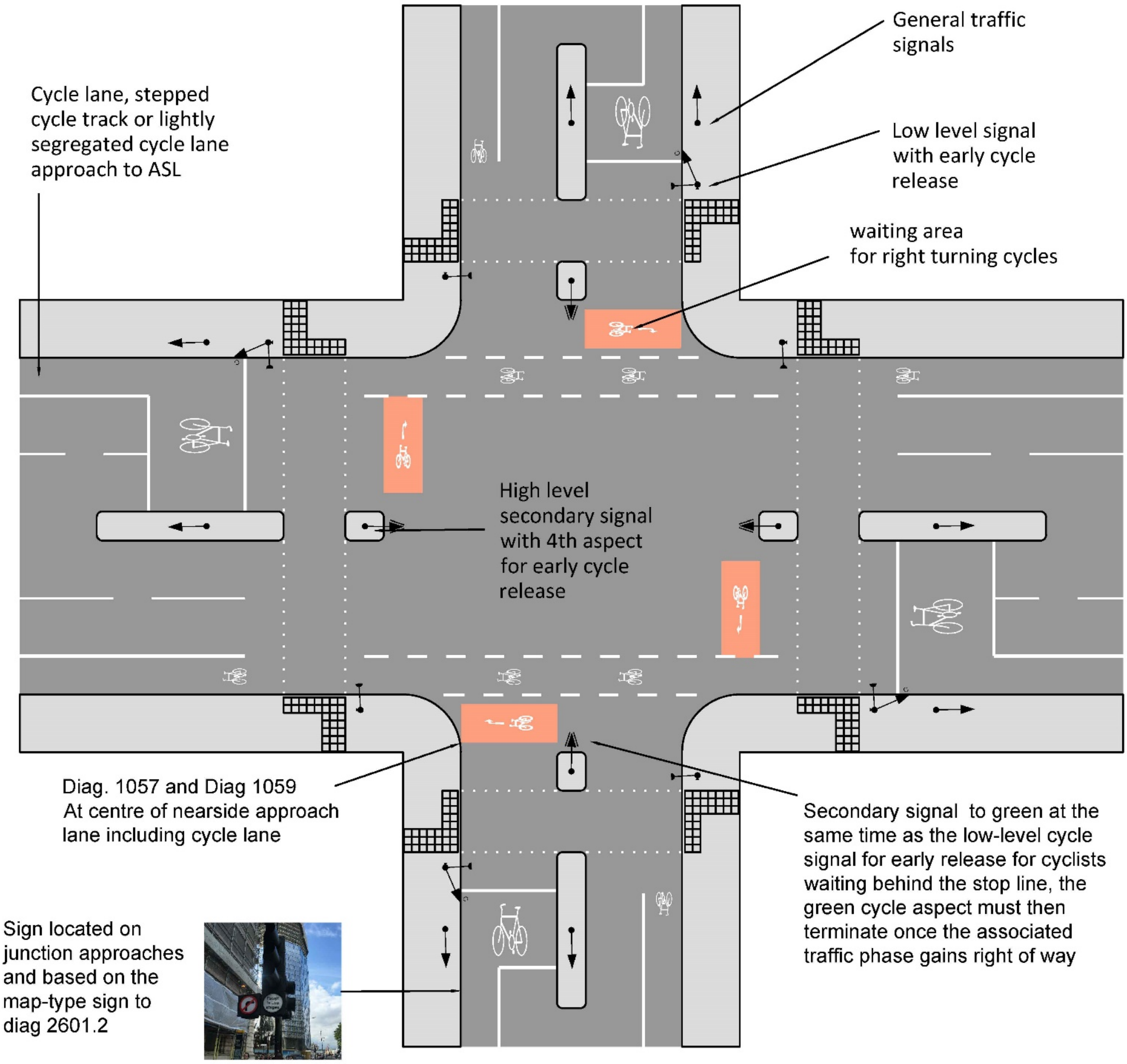
- Waiting area to be marked at centre of nearside approach lane.

Other considerations

- Detection of waiting cycles will be necessary if the side road flow is insufficient to call the stage.
- Cyclists can choose to make a two stage right turn at junctions where such provision is not marked.
- An ‘early start’ signal phase for cyclists using low level signals/4th aspect cycle filter can be used to reduce conflict with left turning traffic – see DE050.
- This is an unfamiliar manoeuvre to most UK cyclists and a public information programme should be considered.
- Surface markings at junctions will be subject to high levels of wear and will require maintenance.

A4

DE053 Two Stage Right Turn at Traffic Signals



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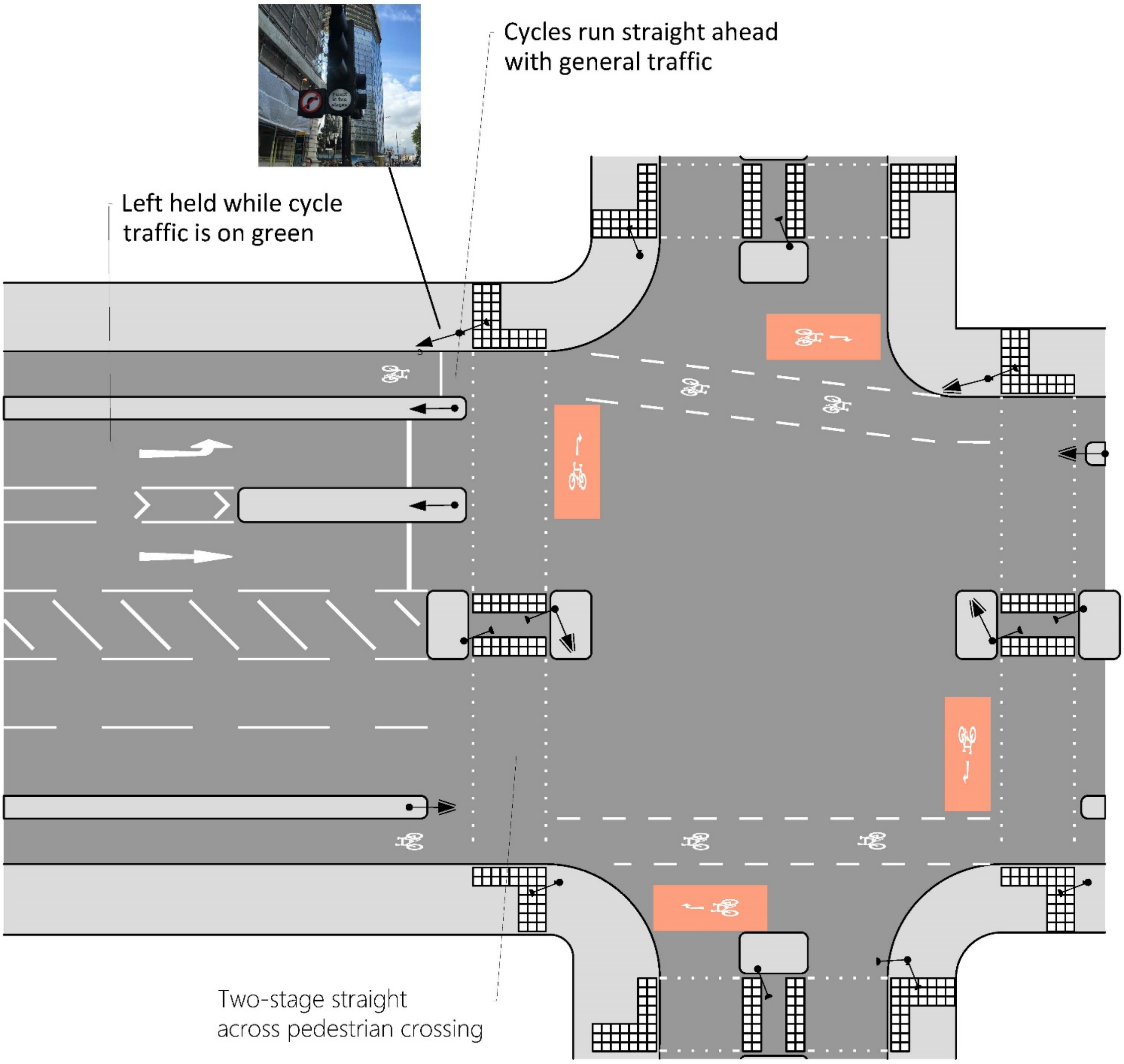
DE54	Hold the Left



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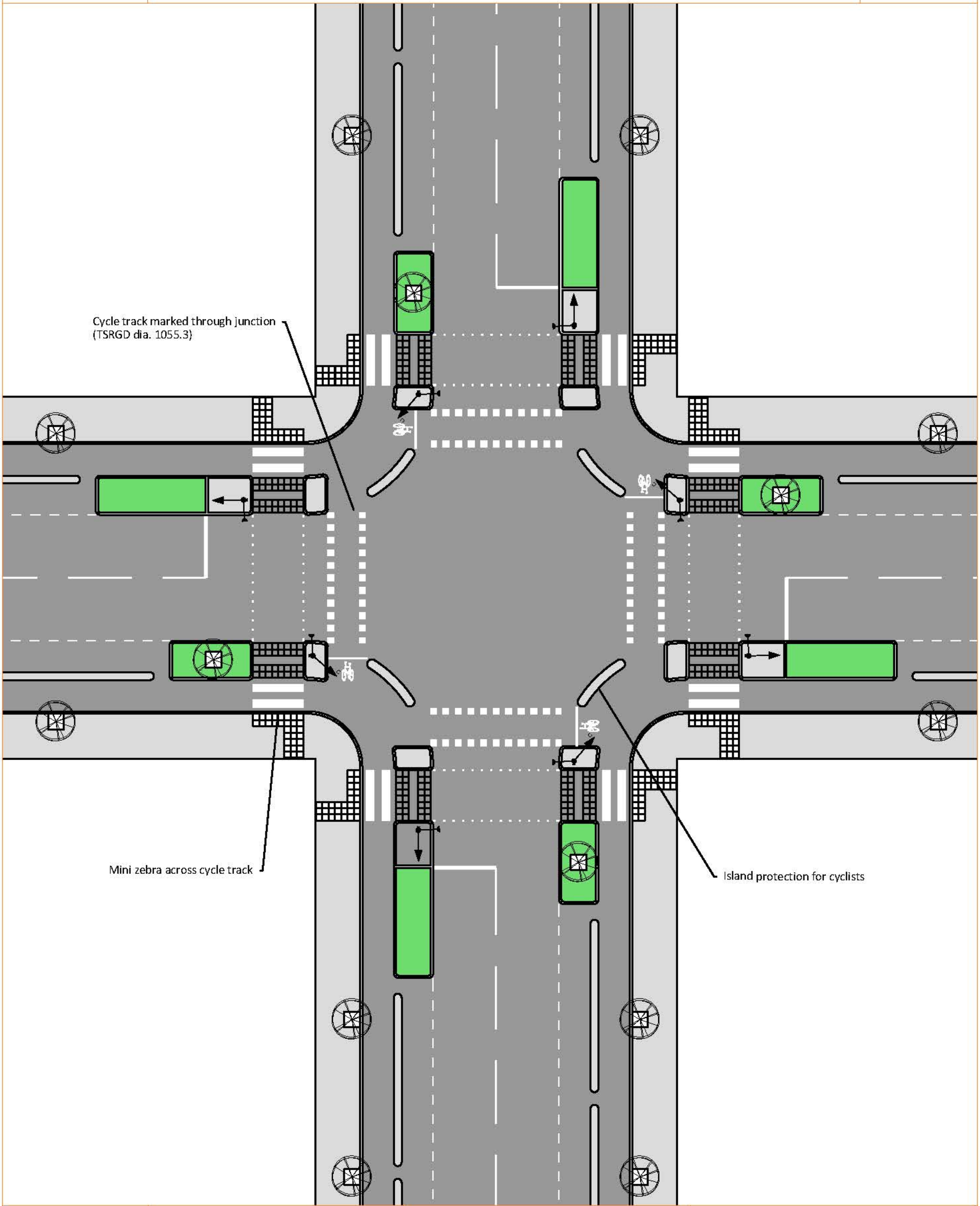
DE55	Protected Junction	



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DE056 Mini Roundabout

Measure and Brief Description

Mini roundabouts with an inscribed circle diameter not greater than 15m, can be good alternatives to retaining priority junctions when traffic volumes are relatively low and speeds are slow. By providing tighter radii they contribute to achieving slower vehicle speeds, and can be included in traffic calming schemes. Single lane approaches mean that cyclists and motor vehicles pass through the roundabout in a single stream. They can be a compact and low cost solution to improving junction capacity where traffic signals are not preferred.

Benefits

- Single circulatory carriageway puts cyclists in drivers' line of sight.
- Traffic calming effect, especially where they are installed on raised tables.
- Slower speeds which aids cyclists' comfort and safety, especially those wanting to turn right.
- Potential reduction in traffic delay compared to priority junctions.

Key Design Features

- Single lane entries and exits.
- Domed central roundel.
- Deflection of traffic.
- Any cycle lanes on approaches should end 20-30m in advance of the give way line so that cyclists mix with traffic on the junction approach.

Dimensions

- Outer radius (R1) 5m-7.5m.
- Radius of central roundel (R2) 0.5m -2m.

Other considerations

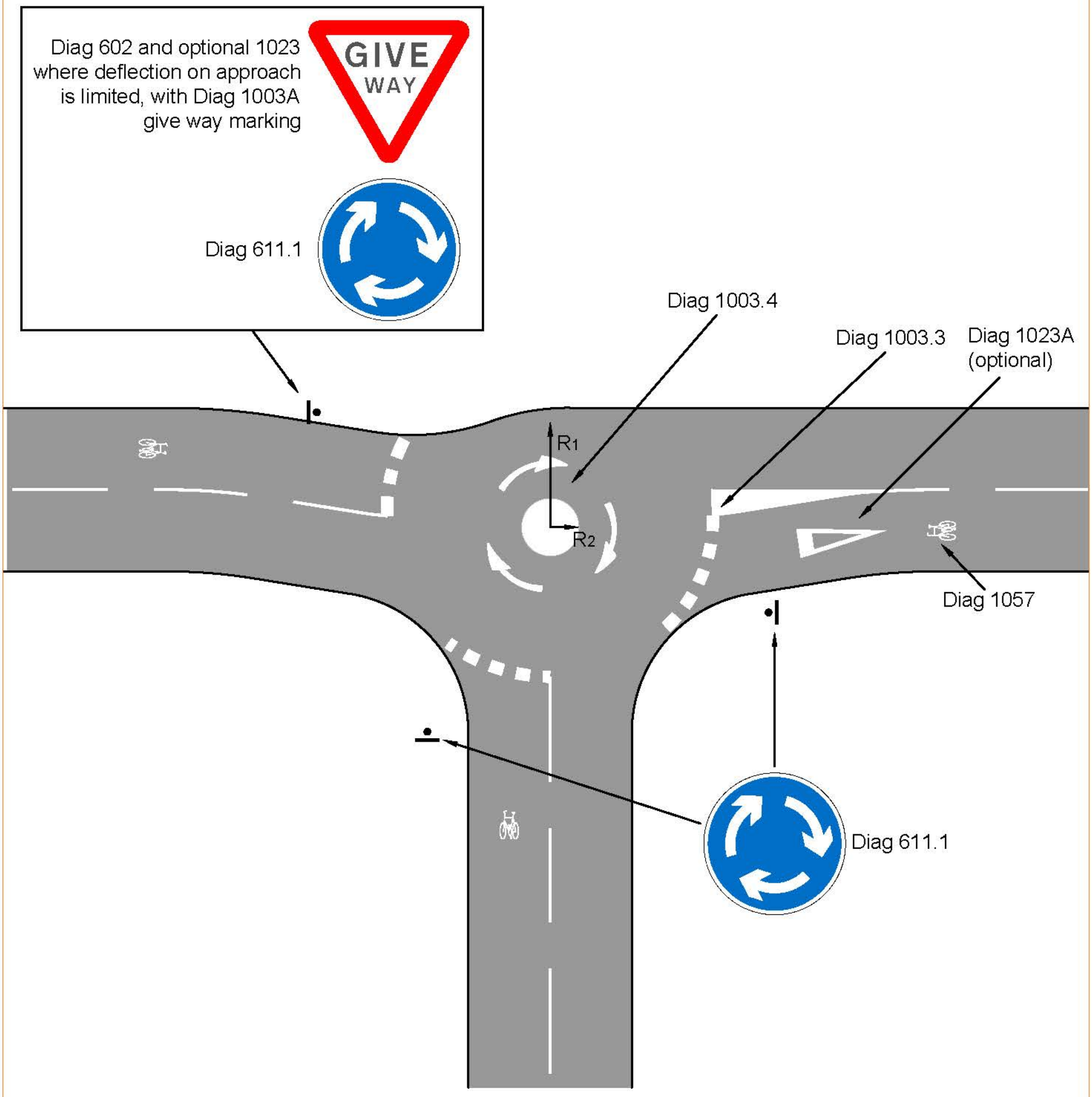
- Consider incorporating a raised table.
- Consider incorporating deflector islands.
- Busier four arm and combinations of double roundabouts can be uncomfortable and less safe from a cyclist's perspective.
- The impact upon and the ability of pedestrians to cross the carriageway.
- Impact on long vehicles and buses may be an issue.

Further References

- Welsh Government (1993) - DMRB TD 54/07, Design of Mini-Roundabouts

A4

DE056	Mini Roundabout



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DE057 Compact (“Continental”) Roundabout

Measure and Brief Description

Compact roundabouts (also known as “continental” roundabouts) have tighter geometry that is more cycle friendly than typical UK roundabouts, which often have wide entries and exits. As the geometry encourages lower speeds, cyclists can pass through the roundabout in the same stream as other traffic. Drivers are unlikely to attempt to overtake cyclists on the circulatory carriageway because of its limited width. These roundabouts have arms that are aligned in a radial pattern, with unflared, single lane entries and exits, and a single lane circulatory carriageway. Deflection is therefore greater than normal UK practice, and the layout operates as a speed reducing feature. This design of roundabout is more common in mainland Europe, but the design principles can also be applied in the UK.

Benefits

- Single circulatory carriageway puts cyclists in drivers’ line of sight.
- Tighter geometry at entry, circulatory carriageway and exit results in slower vehicle speeds.
- Slower speeds which aids cyclists’ comfort and safety, especially those wanting to turn right.

Key Design Features

- Perpendicular entry and exit arms.
- Single lane entries, circulatory carriageway and exit.
- Any cycle lanes on approaches should end 20-30m in advance of the give way line so that cyclists mix with other traffic on the junction approach.

Dimensions

- R1 - Outer radius of Inscribed Circle 10m-20m.
- R2 - Radius of over-run area 6.5m-15m.
- B1 - Width of over-run area 1m-1.5m.
- B2 - Width of circulatory carriageway 4.5m-6m.
- E1 - Entry radius 12m max.
- E2 - Exit radius 15m max.

Other considerations

- Suitable for speed limits up to 40mph
- Roundabout capacity is typically approx. 25,000 AADT, but Dutch guidance is that above 6,000 AADT a separate cycle track should be provided. This guidance recommends that where the roundabout carries over 8,000 AADT consideration should be given to providing off-carriageway tracks for cyclists.
- Depending on layout, overall junction size and swept path requirements, it may be necessary for the roundabout to have ‘re-entrant’ kerblines on the outside edge of the circulatory carriageway to maintain tight entries and exits.
- Where a peripheral cycle track is appropriate, the aim should be to include cycle priority on each arm.
- Clutter-free (eg guardrailing) median islands on the junction arms will act as refuges for pedestrian and cyclist crossing movements and improve visibility and the streetscene.
- Zebra, parallel pedestrian/cycle or informal crossings can be placed close to the give way lines on direct desire lines.
- Street lighting must be provided.

Further References

- Department for Transport (1997) – Traffic Advisory Leaflet 9/97, Cyclists at Roundabouts – Continental Design Geometry.
- Welsh Government (2007) - DMRB TD16/07, Geometric Design of Roundabouts.

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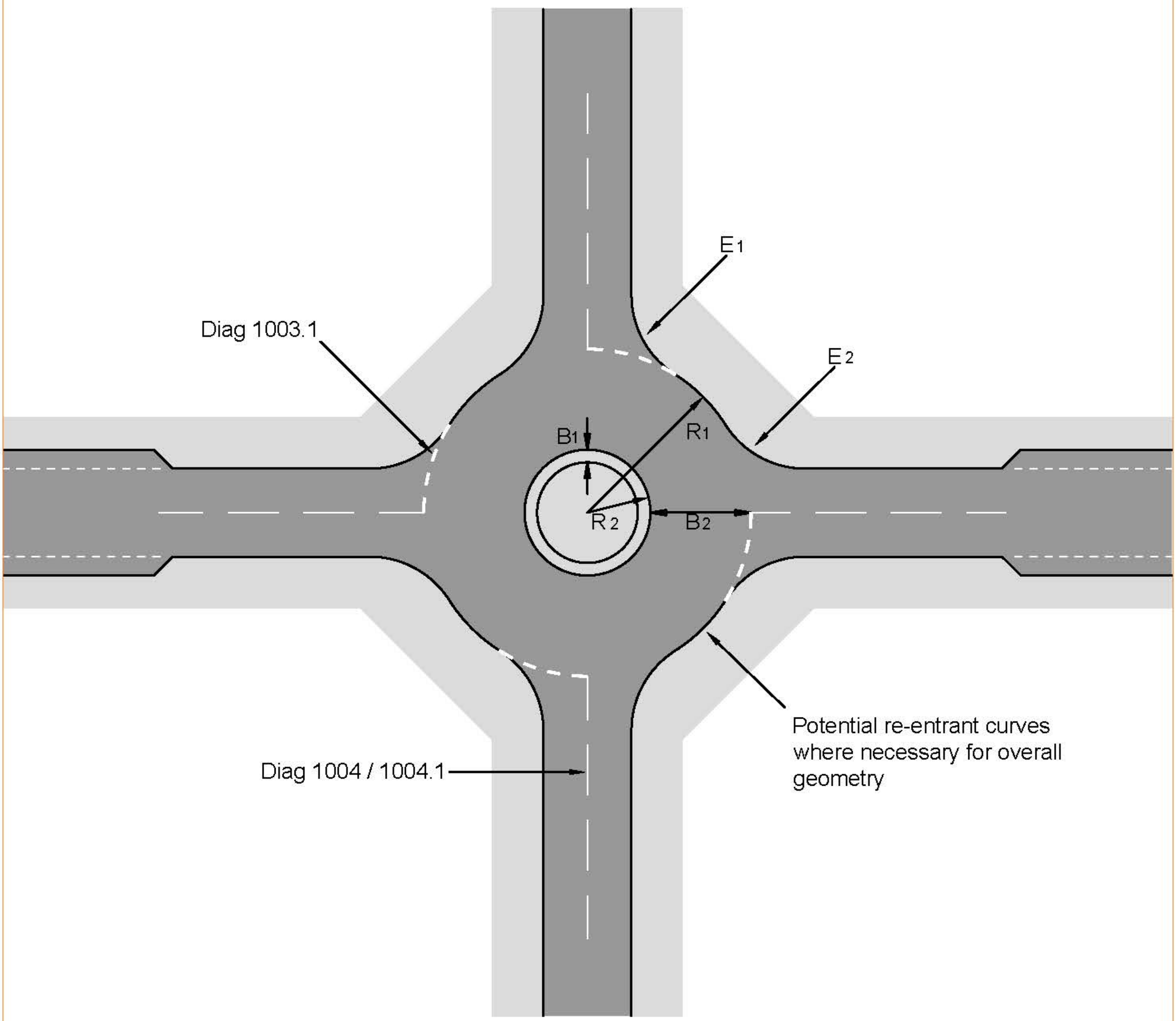

Last Revised	February 2019

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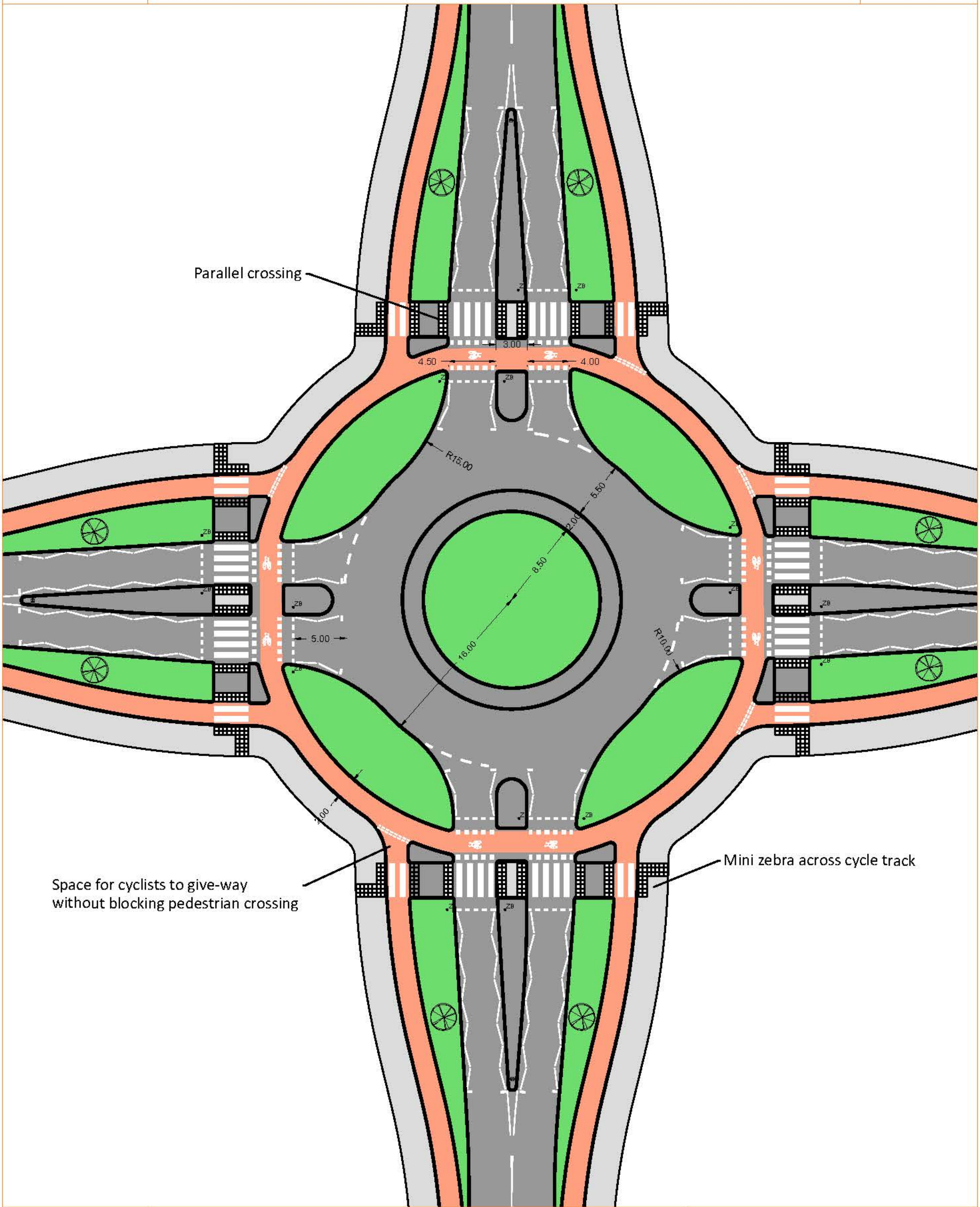
DE58

'Dutch' Style Roundabout



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Appendix C Cycling and Midland Metro

Transport for West Midlands

West Midlands Cycle Design Guidance

Cycling and the Midland Metro

March 2019

Project Code: 02821

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1 Cycling and Midland Metro

1.1 Why provide for cycling

1.1.1 Tram corridors are often attractive as potential cycle routes, offering direct links that serve several communities along their length, and built to accommodate a known demand for travel. There is potential for bike and ride interchange for longer trips. Cycling can increase the catchment of Metro stops because a 10-minute cycling isochrone covers approximately four times the area of the equivalent walking isochrone. Because Metro stops are often directly accessible from quieter residential streets they can attract people that are unwilling or unable to cycle on busier roads.

1.1.2 When introducing a new tram route, permeability of existing pedestrian and cycle routes should be preserved where possible. Tram corridors can potentially 'sever' links between adjacent quiet streets when it proves necessary to restrict and formalise crossing points. Good quality infrastructure at the intended crossing points and routes leading to them can help instil the desired behaviour and avoid conflicts with the tram system.

In West Bromwich a cycle track has been provided alongside the Metro line with access to stops (Sandwell Council)

1.2 How to provide for cycling

1.2.1 Installing a Metro line requires long term planning and major works, with opportunities therefore to add cycle facilities for marginal additional cost. There is general guidance from the Office of Rail Regulation which includes some advice on catering for pedestrians and cyclists. What type of facilities can be achieved will depend on local circumstance and are typically:

- Fully separate greenway cycle track alongside a dedicated tram line corridor (e.g. parts of West Bromwich).
- Off-carriageway cycle track alongside on-carriageway tram lines.
- Dedicated cycle lane within the carriageway but outside the Dynamic Kinematic Envelope (DKE) of the tram.
- Fully shared all-purpose carriageway.
- Safe crossing facilities where cycle routes cross a tram line.
- Secure and sheltered long-stay cycle parking stands at stops.

1.2.2 Incidents involving pedestrians and cyclists being struck by a tramcar happen very rarely. The more common hazards are slips, trips and falls associated with crossing the line. Cyclists are at risk in two ways:

- Cycle wheels may drop into the groove of the rail and cause a fall (the wheel rarely gets fully 'stuck' but the groove causes the rider to lose their balance);
- Tyres slip on the metal surface of the rail, especially in wet conditions.

1.3 Crossing the Line

The general arrangement should be that on-street crossings between the cycle route and tram tracks are at 90 degrees to the line (or as close as possible, and not less than 60 degrees). This includes arrangements for turning in and out of any side streets along the line. There is a risk at places where the cycle track/carriageway and the tram tracks merge/diverge as this is where it may be most difficult for cyclists to cross the line at right angles, especially if other traffic is present.

Cycle track guides cyclists to cross perpendicular to lines where road and tramline diverge, Nottingham (Adrian Lord)

Cycle track crossing, Manchester city centre (Adrian Lord)

1.3.1 Signalised pedestrian/cycle crossings can be used on tram lines as set out in TSRGD 2016. Where crossing points are not signalised (usually where there are low flows of people crossing and good visibility), a sign can be placed along the tram line to remind drivers to give an audible warning.

Parallel signalled cycle/pedestrian crossing with 'early release' for cyclists at road junction, Nantes (N.B. In France cars are obliged to give-way to peds/cyclists when turning at signalised junctions)

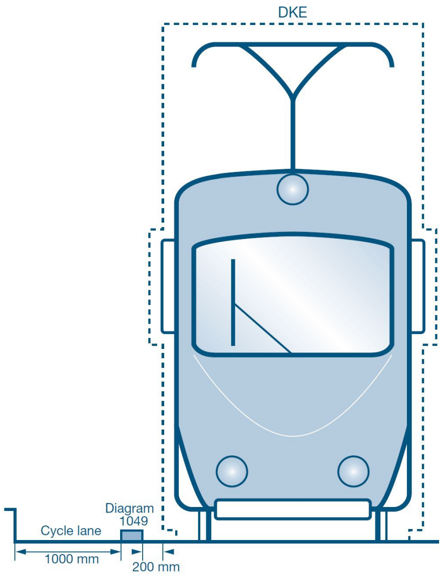
1.3.2 Where a cycle track joins or crosses the alignment of the tram line, the cycle-track arm of the junction may be treated in the same way that an all-purpose carriageway junction would be treated (either signalised or unsignalised). The stop or give-way line must be at least 500mm from the edge of the DKE and a supplementary 'Tram' plate may be used in conjunction with the stop or give way sign. At more complex signalled junctions where the cycle route might be partially on and off-carriageway, elephant's footprint markings and/or coloured surfacing can be used to indicate the intended route.

1.3.3 The 'Velostrail' type rail groove filling products may have a role to play in some circumstances such as level crossings where the tram line is off-highway. These are only for a standard 'railway line' profile and not for the flange groove used for street running tram lines. Other infill products designed for use along the length of the line in a street prevent the required regular visual inspections for rail wear and cracking, and are not therefore practicable within a UK operating environment.

Concept visualisation of crossing arrangements of road/cycle track/footway/tram track at a busy junction, TfGM

1.4 Cycling along the tram corridor

Streets where cyclists share the same direction of travel as the trams should offer a separate cycle track or sufficient carriageway width between the track and the nearside kerb. The ORR guidance suggests a minimum of 1.0m mandatory cycle lane between the kerb and the DKE of the tram, but this is inadequate for comfortable cycling and does not offer safe clearance for cycles with more than two wheels. The ORR guidance is very clear that the 1.0m minimum clear strip does not provide space for a tram to pass cyclists, and is just meant to provide a clear area to enable cyclists on a standard two-wheel bike to pass along a narrow street in the absence of trams without having to cross the tracks.



Extract from ORR guidance showing 1000mm clearance to cycle lane/track

1.4.1 Designers should normally aim for 1.5m cycle lane width as in other circumstances so that a tram can pass with a comfortable clearance between the cyclist and the vehicle. The cycle lane must be mandatory with parking restrictions and not wide enough to permit unlawful parking by vehicles. Parking/waiting by vehicles partially on the adjacent footway may be deterred by bollards along the kerb edge if necessary. The outer edge of the mandatory cycle lane marking should be at least 0.2m from the DKE.

Cycle track alongside tram tracks, Nantes

1.4.2 Roadside parking, delivery bays and bus stops should be arranged in laybys so that cyclists do not need to cross the tramline when passing. Kerb-face drainage can help cyclists to avoid having to bump over gulley grates where width is restricted.

1.4.3 If the road is not wide enough for a cycle lane but there are long sections of road where it is reasonable to assume that a tram would need to overtake a cyclist during normal operations (for example long uphill sections) there should be some kerbside refuge provision for the cyclist to be able to pull into the side at regular intervals.

1.4.4 Where suitable conditions for cycling cannot be met, an alternative cycle route may be indicated along adjacent streets.

1.5 Tram Stops

1.5.1 Tram stops on the nearside of the carriageway do not allow for any clearance for a separate cycle track and therefore a 'bypass' arrangement of a cycle track to the rear of the stop is the preferred treatment (see also bus stops in main document and bypass arrangements in appendix C).

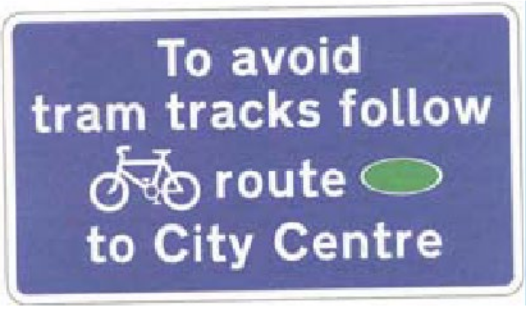
Cycle bypass at tram stop, Rotterdam. Note cycle track runs alongside tram track but outside the DKE of the vehicle

Footway adjacent to tram, cycle track to rear on approach to tram stop, Nantes (K Spence)

1.6 Signing

1.6.1 The standard blue 'Tram Only' signs can be used to mark the streets where other vehicles (including cycles) are prohibited (see TSRGD 2016). A supplementary plate describing the alternative route may be added e.g. 'Cycle access to station follow signs via XXX Street'.

1.6.2 Where a hazard associated with tram rails is identified, TSRGD 2016 permits the use of the general 'Hazard' (exclamation mark) sign. A supplementary 'Tram tracks' plate to alert users to the presence of tram rails can be used as a non-prescribed sign with appropriate DfT site approval.



Direction sign examples from Nottingham

1.7 Useful References

Design Requirements for Street Track, ORR, 2008

Guidance on Tramways, Railway Safety Publications, ORR, 2006

Nottingham Cycle City Design Guide, 2016

Pedestrian Safety, Technical Guidance Note 2, ORR, 2008

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