Foreword

For at least two generations, planning for transport in the UK has primarily focused on the car. The unintended consequence of this has been to suppress walking and cycling, and often public transport use, across all sectors of society.

This imbalance has resulted in a transport sector that accounts for a quarter of UK carbon emissions and that relies extensively on ever more expensive oil.

By shifting from motorised transport to cleaner, healthier travel, particularly for shorter journeys, we can make a significant contribution towards tackling these issues. This would be good for both public health and the liveability of our communities, and save billions of pounds in health and environmental costs.

Evidence from the Sustainable Travel Demonstration Towns shows that there is enormous potential for changing people’s travel behaviour. Nine out of ten short journeys could be made by foot, bike and public transport.

The key to success is to ensure that our streets and public spaces are suitable for people of all ages and all abilities to get around without a car. We need to focus on those not yet walking and cycling as well as those that already are.

Achieving this requires the integration of high quality infrastructure with complementary behaviour change measures. Unfortunately much of the transport infrastructure in the UK was designed and built on the assumption that almost everyone had access to a car, so people do not consider walking or getting on their bike or a bus.

The design and development of high quality infrastructure to support healthy cleaner travel requires engineers and planners to have a good understanding of, and access to, current design guidance and examples of best practice, including the latest innovative and experimental schemes.

There is a wealth of material already available from various sources. This guidance from Sustrans aims to offer broad advice on key issues around highway design, with a particular emphasis on cycling. It also provides a single point of access to this further guidance.

The guidance will be further developed in the coming months and years to include more on walking and will be regularly updated with new examples. It will be underpinned by better training for transport professionals.

We fully support Sustrans in their ambition to ensure that all of us involved in the development and design of transport infrastructure and public space do all that we can to enable travel to be both healthier and better for the environment.
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About Sustrans

Sustrans makes smarter travel choices possible, desirable and inevitable. We’re a leading UK charity enabling people to travel by foot, bike or public transport for more of the journeys we make every day. We work with families, communities, policy-makers and partner organisations so that people are able to choose healthier, cleaner and cheaper journeys, with better places and spaces to move through and live in.

It’s time we all began making smarter travel choices. Make your move and support Sustrans today.

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Introduction

This document is part of a suite of technical design guidance on active travel being developed by Sustrans. There is much useful material already available from a range of organisations, and this guidance from Sustrans aims to provide detailed technical advice on key issues around on and off highway cycle infrastructure whilst signposting users to this developing library of further resources.

The Sustrans guidance library will be largely web based and will be regularly updated with new examples including the latest innovative and experimental schemes.

The full guidance will be structured to comprise:

- handbook for cycle friendly design
- main technical guidance document on designing for cycling, divided into chapters
- more detailed guidance on selected topics, both technical and relating to strategies, monitoring etc
- technical case studies
- media resources, including a photo library and training materials
- frequently asked questions

This handbook contains a concise illustrated compendium of technical guidance relating to cycling: it can stand alone as a ‘tool box’ of ideas but also links to a library of relevant on line resources. It is very visual but contains the essential technical details, and was inspired by earlier guidance produced by the City of Edinburgh Council.

This element of the guidance is available in printed format as it is intended for widespread use as a readily available digest of the key elements of design guidance, which can be used on-site by planners and engineers.

Detailed content relating to walking design and infrastructure will be added in the coming months.

It is intended that this document be reviewed following publication of the revised Traffic Signs, Regulations and General Directions in 2015, so feedback on the content is invited, and should be made to designandconstruction@sustrans.org.uk

The structure of this guidance is illustrated in the contents page, and broadly follows the following sequence:

- a summary of the key principles and processes for a user-focused design
- wider considerations of urban design and other measures to improve the general highway design for cyclists and pedestrians
- on-carriageway provision for cyclists on links and junctions
- cycle provision off the carriageway, whether cycle tracks alongside the road or traffic free routes away from the road, including crossings
- routes in rural areas
- associated design issues including cycle parking, signing, integration with public transport and the design of new developments
- the maintenance and management of routes
Top 10 tips for user-focused design for cycling

1. Cyclists are important: designs should send the message that cyclists are at least as important users of the highway network as motor traffic, with cyclists being given an advantage in terms of directness and priority where possible;

2. User experience: cycle the route yourself, at various times of the day / week, and make sure you consult with potential cycle users and existing users throughout the design process;

3. Target user: design should be attractive and comfortable for the less confident cyclist – a sensible 12 year old or novice adult who is trained to National Standards / Bikeability Level 2 – but should aim to provide for the more confident cyclist as well. Where more confident cyclists choose not to use any facilities provided their needs should also be addressed with separate provision where appropriate; they should not be compromised by the design;

4. Design in line with cycle training: on-highway design should reinforce how people are taught to cycle in National Standards / Bikeability Level 2, in particular primary and secondary road positioning;

5. Cycles are vehicles: take account of their space requirements, manoeuvrability and speed in all infrastructure, not just specific cycle facilities;

6. Cycles are muscle powered: aim to minimise energy loss through stopping, hills and sharp corners; cyclists should never be required to dismount on cycle routes;

7. Make space for cyclists: where segregation of traffic is appropriate this should be achieved through reallocation of road space – taking space from the footway should be the last resort;

8. Tame traffic: the speed and volume of motor traffic, the proportion of large vehicles, and opportunities to reduce these, will influence the type of provision appropriate and whether specific cycle facilities may be necessary;

9. Continuity and quality of standards: consistent high quality provision (including signage) along a route and at both ends of the trip is essential, with route design following the 5 Core Principles of Coherence, Directness, Safety, Comfort and Attractiveness. Difficult engineering solutions should be addressed early on to avoid gaps being left. The design should aim to minimise maintenance requirements and costs, and take account of who is responsible for that. Ensure the design of the route enables it to be used effectively in the dark and in poor weather;

10. Behaviour of other users: take account of the real world behaviour of all users – including how pedestrians and drivers may interact with cyclists and vice versa.

Understanding user needs 1

The primary road position is that of the general flow of traffic (i.e. in the centre of the lane). The secondary road position is roughly 1 metre to the left of the traffic flow and not less than 0.5 metres to the edge of the road.
Understanding user needs 2

Provision on links

This figure illustrates how traffic volume and speed may influence the decision on the need to segregate cyclists from other traffic, and demonstrates how restraint of traffic speeds and volumes may be used to create satisfactory conditions to encourage new and novice cyclists to use the carriageway. The threshold values are intended to reflect the needs of the key target user as described above.

Main cycle routes (see Network Planning) will generally justify a higher level of service than other cycle routes and so may have lower thresholds at which segregation is provided and greater widths.

Core principles for routes used by cyclists

Coherence
- link all potential origins and destinations
- be continuous and recognisable
- offer consistent standard of protection throughout
- be properly signed
- include well located cycle parking

Directness
- be based on desire lines
- result in minimal detours or delays
- provide a positive advantage in terms of directness and priority over motor traffic

Safety
- be safe and perceived as safe
- provide personal security
- limit conflict between cyclists and pedestrians and other vehicles

Comfort
- be smooth, non-slip, well maintained, drained and free of debris
- have sufficient width for the level of use
- have easy gradients
- be designed to avoid complicated manoeuvres
- enable cyclists to maintain momentum
- minimise impacts of noise, spray and headlight dazzle from other traffic

Attractiveness
- be attractive and interesting
- integrate with and complement their surroundings
- contribute to good urban design
- enhance personal security
- be well maintained

Adaptability
Where substantial increases in cycling are expected, consideration should also be given to the adaptability of infrastructure to accommodate large increases in use.
Understanding user needs

Design speeds

Key design parameters for cycle tracks will normally reflect the expected design speed of the route. A design speed of 12mph is appropriate for a local access route, or for a main route where there is likely to be significant interaction with pedestrians. For other main routes, designers should aim to provide a higher design speed of 20mph.

Widths required by cyclists

The space required by cyclists in motion needs to take account of:

- ‘dynamic width’ of the cyclist
- clearance when passing fixed objects
- distance from other traffic (both cyclists and passing motor vehicles)

![Diagram showing widths required by cyclists](image)

<table>
<thead>
<tr>
<th>Minimum passing distance</th>
<th>Minimum passing distance from other users (Table H.1)</th>
<th>Clearance for edge constraints (Table H.2)</th>
<th>Additional width for high cycle/pedestrian volumes, steep gradients, curves</th>
</tr>
</thead>
<tbody>
<tr>
<td>20mph</td>
<td>1m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30mph</td>
<td>1.5m</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table H.1 Overtaking by motor vehicles**

<table>
<thead>
<tr>
<th>Car passing at 20 mph</th>
<th>4.3m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car passing at 30 mph</td>
<td>4.8m</td>
</tr>
<tr>
<td>Bus/HGV passing at 20 mph</td>
<td>5.1m</td>
</tr>
<tr>
<td>Bus/HGV passing at 30 mph</td>
<td>5.6m</td>
</tr>
</tbody>
</table>

**Table H.2 Additional clearances to maintain effective widths for cyclists**

<table>
<thead>
<tr>
<th>Type of edge constraint</th>
<th>Additional width required (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flush or near-flush surface (including shallow angled battered kerbs - see photo below)</td>
<td>Nil</td>
</tr>
<tr>
<td>Kerb up to 150 mm high</td>
<td>Add 200</td>
</tr>
<tr>
<td>Vertical feature from 150 to 600 mm high</td>
<td>Add 250</td>
</tr>
<tr>
<td>Vertical feature above 600 mm high</td>
<td>Add 500</td>
</tr>
</tbody>
</table>

**Table H.3 Calculation of minimum width required:**

minimum width = a+b+c+d

- a: dynamic width
- b: minimum passing distance from other users
- c: clearance for edge constraints
- d: additional width for high cycle/pedestrian volumes, steep gradients, curves

Source: LTN 2/08 & LTN 1/12

Additional clearance to maintain effective width and headroom for cyclists

- Use of shallow angled battered kerb to increase effective width, London

![Diagram showing additional clearance](image)

Not to scale
Understanding user needs

Table H.4 Cycle parking and manoeuvring at low speeds: minimum dimensions

<table>
<thead>
<tr>
<th></th>
<th>Overall width (mm)</th>
<th>Overall length (mm)</th>
<th>Minimum turning circle (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Outer radius (a)</td>
</tr>
<tr>
<td>Conventional bicycle</td>
<td>700</td>
<td>1800</td>
<td>1650</td>
</tr>
<tr>
<td>Tandem</td>
<td>700</td>
<td>2400</td>
<td>3150</td>
</tr>
<tr>
<td>Bicycle and trailer</td>
<td>800</td>
<td>2700</td>
<td>2650</td>
</tr>
<tr>
<td>Cargo trike</td>
<td>1200</td>
<td>2600</td>
<td>2300</td>
</tr>
</tbody>
</table>

Note: a wide range of adapted bikes are used for disability cycling: their design requirements will generally fall within the ranges in this table.

Typical minimum widths required by pedestrians and wheelchair users

Table H.5 Link design parameters - traffic free

<table>
<thead>
<tr>
<th>Type of cycle route</th>
<th>Design speed</th>
<th>Min. stopping sight distance (1)</th>
<th>Sight distance in motion (2)</th>
<th>Min. radius of curve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commuter route</td>
<td>20 mph</td>
<td>25 m</td>
<td>80 m</td>
<td>25 m</td>
</tr>
<tr>
<td>Local access route</td>
<td>12 mph</td>
<td>15 m</td>
<td>50 m</td>
<td>15 m</td>
</tr>
</tbody>
</table>

1. Add 50% for unsealed surfaces
2. Sight distance in motion is the distance a cyclist needs to see ahead when riding in order to feel safe and comfortable

Visibility at junctions

Recommended X distances for cyclists are:
- 4m preferred
- 2m recommended
- 1m where geometry is tight

If these visibility requirements cannot be achieved the alternative is to use the full range of markings and signs available to make clear the need for cyclists to slow down and give way.

Table H.6 Visibility at junctions

<table>
<thead>
<tr>
<th>85%ile speed (kph)</th>
<th>'y' distance (m) on road</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>14</td>
</tr>
</tbody>
</table>

Source: Manual for Streets TD 42/95

In hilly areas, many roads have steeper gradients but can still make acceptable cycle routes
**Network planning**

**Characteristics of an urban network**

In urban areas the cycle network will comprise the highway network, modified where necessary, together with traffic free routes which offer more direct journeys, overcome barriers or offer attractive routes. The aim should be to develop a basic cycle network around a ‘mesh width’ of no more than 250m, so that an alternative route is never more than 250m away. Within this network more strategic main routes would be identified for prioritisation of investment and promotion. The network should be:

- safe, convenient, continuous and attractive to encourage new cyclists
- useful for all manner of routine journeys for local people and existing cyclists
- memorable such that occasional users are persuaded to cycle more

**Developing a network**

The degree of sophistication of the process will depend on the size of the urban area under consideration. All or some of the following stages may be required:

- identify main trip attractors (residential, employment, retail, education, transport, health, visitor attractions, proposed developments etc)
- assess demand (existing and potential cyclists)
- identify desire lines
- review existing routes, cycle parking, constraints and options for improvements and other proposed transport schemes
- engage with stakeholders (throughout process)
- develop a prioritised costed network development plan
- marketing / public engagement strategy
- monitor and review

Development of a network should generally begin from the urban centre, working outwards. The network may be organised around a hierarchy of routes:

- main routes
- secondary routes
- access routes

Examples of elements of a network

- providing **good access** to and through town centres and other local centres - this commonly requires mixed priority streets
- **direct connections** to public transport hubs and other trip generators
- **filtered permeability** - traffic cells, access for cyclists through road closures and vehicle restricted areas, contraflow facilities, exemption from restricted turns, cycle bridges across rivers and railways, short-cuts through parks
- area-wide **20mph limits** and zones and other means to reduce traffic speed and volume
- giving a high priority to **cycle friendly junctions** at the design stage
- **cycle lanes and advanced stop lines** to enable cyclists to avoid queuing traffic
- cycle tracks alongside rivers and canals and on disused railways
- maximising route opportunities to and through new developments
- secure and convenient cycle parking at both trip ends
Many urban streets are not wide enough to provide separate cycle facilities or have frontage activity that makes such provision impractical. Design for such environments needs to think beyond standard highway design, defining a slow speed highway environment where cycles, pedestrians and motorised traffic can safely integrate. A good street design can help create a bespoke solution that suits the local surrounding buildings and activities. This page illustrates a set of ideas from which the designer may choose to suit the context. Involving the community in local street design is strongly recommended as it enables the scheme to reflect the needs and aspirations of people living or working in the area.
Streets and roads 2
Speed reduction: street design

Designers should aim to create streets that control vehicle speeds by their physical geometry, visual appearance and provision for pedestrians, cyclists and frontage activity rather than relying on signs and vertical or horizontal traffic calming measures. Such an approach can facilitate the introduction of 20mph speed limits.

This page illustrates a number of examples of how street design can reduce speeds.

Guidance on achieving appropriate traffic speeds is contained in Manual for Streets. Examples of particular approaches include:

- shared space
- home zones
- community led street design
- mixed priority streets
- Cycle Streets

Some local authorities have developed design palettes for the design of streets with 20mph speed limits.

The range of traffic calming measures available includes:
- physical features
- changes in priority
- street dimensions
- reduced visibility
- psychology and perception

Visual narrowing

0.5m contrasting over-run strip (flush)

Low median strip

Visual narrowing, Poynton

Entry treatment, London

Layout of car parking

Staggered parking, Wokingham

Changed priority, London
Streets and roads

Speed reduction: physical traffic calming

This page illustrates the most common forms of conventional vertical and horizontal traffic calming measures, and how they can be designed to take account of cyclists.

Vertical features

Road humps

- Raised junction, Haringey
- Sinusoidal road hump, Edinburgh
- Speed cushions, Nottingham
- Pinch point, Shrewsbury

Horizontal features

- Advisory cycle lane
- Priority system - pinch point
- Central island

Recommended width depends on speed, but avoid gaps of 3.1 - 3.9m. Where pinch point cannot be removed consider marking large cycle symbol centrally. Where a cycle lane is provided it should be continued through the pinch point with a width of at least 1.5m.

Not to scale
Streets and roads

Reallocation of road space

A fundamental aspect of the provision of cycling facilities is the reallocation of carriageway from motor vehicles to cycling. This can be seen in the majority of figures within this document. The provision of cycle tracks in urban areas at the expense of the footway is not encouraged (it tends to be unpopular with pedestrians and cyclists), particularly where there are high pedestrian flows, although there are some limited situations where this may be necessary. Reallocation of road space makes an important statement about the relative priority of different transport users, as it not only promotes cycling but can act as a restraint on motor traffic, which is an important aspect of transport and planning policy in congested urban areas. Typically this will involve one or more of the following:

- filtered permeability
- removal of a traffic lane
- conversion of traffic lanes to bus lanes
- reduced width of traffic lanes
- removal of centre line
- reduction in traffic speeds
- introduction of weight limits
- removal of car parking
- reallocation of time at signals
- shared space

The drawings on this page illustrate a number of options where traffic lanes have been removed or narrowed to accommodate provision for cyclists.
Streets and roads 5

Quiet streets and Cycle Streets

Where a designated cycle route uses a low speed quiet street (e.g. residential road, town centre back street or road through a park) it should typically:

- provide a convenient and direct route between key destinations
- give cyclists priority on the road itself and also right of way at junctions
- carry no more than 3,000 motor vehicles per day

Design elements may include:
- 20mph speed limits
- changed priorities
- one-way with contraflow cycling
- psychological and physical traffic calming
- point closures with cycle gaps
- banned turns with exemption for cyclists
- cycle priority at road crossings
- surface markings

In certain situations sections of the route may be designated a Cycle Street (see Sustrans Technical Information Note 32). This is a street designed to be a main cycle route which is open to motor traffic, in which case:

- the street design should encourage cyclists to assume priority with drivers of motor vehicles behaving as ‘guests’
- it should carry at least 1,000 cyclists per day, including forecast cycle growth
- cyclists should potentially outnumber motor vehicles
- the design should provide cyclists with a level of service comparable to that provided by a high quality traffic free route
- the length over which a car has to follow a cyclist should be limited to 400m
Streets and roads 6

Innovative cycle facilities: details

This page provides basic details of a number of innovative measures to assist cyclists on links and at junctions that have recently been implemented in the UK, most of which are featured elsewhere in this handbook. More information on these and other future innovative schemes, including links to design details, is available from the Inspiring Infrastructure section of Sustrans’ website.

**Hybrid cycle track detail (e.g. Brighton)**

- Footway
- One-way cycle track
- Carriageway
- 50mm upstand
- 50mm upstand
- 50mm upstand FLUSH at access points
- 2-2.5m

**Light segregation detail (e.g. Camden)**

- Footway
- One-way cycle track
- Carriageway
- 2-2.5m

**Benefits**: low cost; easily widened

**Early start for cycles**

- Hybrid cycle track, Brighton
- Green cycle pre-signal gives 5 seconds head start for cyclists. Examples in Brighton, York and Cambridge (requires authorisation)
- Planters and armadillos, Camden
- Small aspect, low level signal heads for cyclists, London (requires authorisation)
- Armadillo

**Two stage right turn at traffic signals (e.g. Southampton)**

- Waiting area for right turning cyclists
- Cycle lanes continue through junction
- Not to scale

**Bus stop bypass typical detail (e.g. Brighton)**

- Bus stop bypass, Brighton
- Photo: TRL
- 2.5m
- 40m
- Cycle bypass 2-2.5m
- Bus boarder
- Cycle lane 2m

**Photo**: TRL Ltd

**Benefits**: low cost; easily widened
Streets and roads 7

Carriageway and lane widths

Illustration of the sizes of vehicle various lane widths can accommodate at low speeds (HGV, coach and car illustrated)
(Cardiff Cycle Design Guide)

- Illustration of what various effective carriageway widths can accommodate at low speeds and low flow. They are not necessarily recommendations and are narrower than the widths required for overtaking in Table H.1 (note: emergency vehicle access generally requires width of 3.5m)
(adapted from Manual for Streets)

Minimum widths for one-way cycle lanes

1.5m on nearside approach to Advanced Stop Line (ASL) (1.2m absolute minimum)

1.5m where speed limit is 30mph

2.0m where speed limit is 30mph and cycle flow high

2.0m (or 1.5m + 0.5m margin) on busy roads or speed limit 40mph

2.0m ASL approach lane between traffic lanes

2.0-2.5m for hybrid cycle tracks and light segregation, dependent on level of use

Hybrid cycle track, Brighton

Waiting restrictions may be appropriate

Example of advisory cycle lane layout with centre line removed (Cardiff Cycle Design Guide)
Streets and roads

Traffic calming and contra-flow cycling

Note: for traffic calming details see streets and roads 3

- Use of cycle symbols and arrows at intervals, Brighton
- Cycle gate or “No Entry Except Cycles” sign, Bristol
- Contraflow cycling in one-way street with no cycle lane
- Speed cushions can be advantageous to cyclists and bus operators if carefully designed
- Point narrowing: avoid widths between 3.1 and 3.9m, Hounslow
- Removal of centre line to provide cycle lanes, Islington
- Flat topped humps should be constructed along pedestrian desire lines
- Transition must be flush
- Humps to be of sinusoidal profile
- Provide cycle bypass at narrowing to single lane, min 1.5m width, Bristol
- Contraflow cycle lane 2m preferred 1.5m minimum, Leighton Linslade
- Provision of cycle bypass ramped up to footway level reduces maintenance but requires additional drainage, Lambeth

Not to scale
Streets and roads 9

Cycle lanes and traffic signals

- Parking/loading bay. Avoid echelon (nose in) parking
- Dividing strip 0.5m min (1m preferred)
- Cycle lane width retained where right turn lane provided. Reduce traffic lane width as necessary
- Cycle lane width min 1.5m (30mph limit) or 2m (40mph limit)
- Central feeder lane to be min 2m width, with coloured surfacing, Shrewsbury
- Cycle lane continued across junction with 0.5m increased width, London
- Preferred length of feeder lane to be as long as normal peak period traffic queues
- Hybrid cycle track to join carriageway as mandatory cycle lane on approach to signals
- Hybrid cycle track (one way) with kerb segregation from both carriageway and footway, or ‘light segregation’. Preferred min 2m. For details see Streets and Roads 6, Brighton

- Cycle lane should normally be mandatory (solid line). Advisory cycle lanes (broken lines) are required where vehicles may need to enter them
- Reduced radius on corner, subject to tracking path for large vehicles, and possible side road entry treatment
- Advisory cycle lane with 0.5m increased width and coloured surfacing across side road, London
- Nearside ASL feeder lane min 1.5m width (absolute min. 1.2m)
- Coloured surface in ASL box and up to 30m on approach to signals recommended
- Advanced stop line (ASL) to assist cyclists. ASL box normally 5m deep, up to 7.5m with authorisation
- Cycle track with separate stage at traffic signals
- Radius at cycle track junction 2m minimum (4m preferred)
- Hybrid cycle track returns cyclists to carriageway at side road, with tight corner radii and raised crossing, Brighton, or crosses side road as advisory cycle lane, York

Photo: Jon Toy

Not to scale
Streets and roads 10

Shared roads, buses and traffic signals

**Bus lane widths**
- 4.5m recommended
- 4m preferred minimum
- 3m absolute minimum
- 3.2m to 3.9m to be avoided

**Provision for cyclists in direction not served by bus lane**

**Presumption in favour of provision of feeder lane. However where width is limited feeder lane may be omitted**

**Advisory cycle lane provides continuity at break in bus lane, Brighton**

**Cycle bypass at bus stop, Brighton**

**Photo: Brighton and Hove Council**

**Cycle bypass at traffic signals, Brighton**

**Photo: Brighton and Hove Council**

**Bus lane past car parking, Glasgow**

**Right turn pocket for cyclists, 1.5m min width (refuge optional where width allows), Shrewsbury**

**Parkin/loading Dividing strip 0.5m (1m preferred)**

**Exit taper 1:5 min**

**Entry taper 1:10 min**

**Central margin strip and informal crossing point to assist pedestrians, Poynton**

**Paved edge strip to narrow carriageway (see Streets and roads 2)**

**Widened footway**

**Car parking bay inset into widened footway, Stonehouse**

**Not to scale**
Sustrans Design Manual • Handbook for cycle-friendly design

Streets and roads 11

Roundabouts

Large conventional roundabouts pose problems for cyclists. Options to consider are:

1. Re-design to Compact/Continental design
2. Replace roundabout with traffic signals
3. Provide segregated cycle tracks with Toucan or Zebra crossings of busy arms, or cycle priority crossings/raised tables
4. Signal control of the roundabout
5. Shared space solution.

Note: cycle lanes on the circulatory carriageway should be avoided.

Informal roundabout, London

Compact/Continental Roundabout

- perpendicular approach and exit arms
- single lane approaches, 4m
- single lane exits, 4-5m
- external diameter (ICD) 25-35m
- island diameter (including overrun area) 16-25m
- circulatory carriageway 5-7m
- Single circulatory lane
- Roundabout capacity approx 25,000 vpd, but consideration should be given to other options for cyclists where flows exceed 10,000 vpd

Weymouth

On gradients where space is limited consider provision of a wider cycle lane in the uphill direction only, Bristol

Leicester

Not to scale

Re-design of roundabout to improve safety, Brighton

Before

After

Cycle lane stops 20-30m before roundabout so cyclists mix with traffic on approach, Leighton Linslade

Informal roundabout, London

Design to accommodate main pedestrian movements

Low profile overrun area

Photos: Brighton and Hove Council

Mini Roundabout:
Design for low speeds and single file traffic:
- single lane approaches
- domed central roundel
- deflection of traffic
- consider speed table
- consider deflector islands

Leicester
Cycle tracks alongside carriageway

Key design requirements:
- Minimise number of side road crossings
- Provide for all movements at all junctions
- Cycle track continuity to avoid crossing and recrossing road
- Aim to provide cycle tracks on both sides of the road

Lamp columns and other street furniture to be removed from cycle track

Crossing of side roads or busy private access set back 4m to 8m, cycle track has priority, on raised table

Cycle track should not deflect through more than 45°

Min 0.5m margin separation from carriageway increasing to a min 1.5m where speed limit exceeds 40mph

Additional width for cycle track to be provided by reallocating carriageway space where practicable

Single stage Toucan 20m from give-way line at roundabout normally recommended (5m for a zebra)

Final approach of cycle track to crossing at right angles to carriageway to maximise visibility for cyclists

Uncontrolled crossing set back 5m (one car length) from give way line; consider use of raised table or zebra

Cycle tracks on both sides of road improve accessibility

Side road or busy private access crossing not set back. On raised table, reduced entry radii. Priority to be determined from site conditions, visibility, speeds, flow

Additional width may be required at bus stops, and visibility maintained

Reduced radii

Surface should be machine laid

Radius 2m min

Not to scale

Bristol

Glasgow

London

Cycle Tracks
Unsegregated shared use maximises the usable width. However local conditions may warrant segregation provided adequate width is available for each user group (see Traffic free routes 3)
Traffic free routes 1

Design

Traffic free routes are key features of cycle networks, providing short cuts away from the road. However their design needs to take account of the needs of all users.
Table H.8 Path construction requirements, unsegregated shared use

<table>
<thead>
<tr>
<th>Nature of route</th>
<th>Min. effective path width (see Note 1)</th>
<th>Type of surface</th>
</tr>
</thead>
</table>
| Urban traffic free                    | 3.0m on all main cycle routes, secondary cycle routes, major access paths and school links; wider on curves and steep gradients. Where high usage is expected, or significant demand to ride two abreast, a width of 4m is preferred and segregation between cyclists and pedestrians considered. 2.5m possible on access routes and links with low use | Sealed surface imperative  
Surface dressed top to bitumen base course may be appropriate |
| Urban fringe / semi rural traffic free | 3.0m on all main cycle routes, major access paths and school links  
2.5m possible on lesser secondary cycle routes and access links | Sealed surface imperative  
Surface dressed top to bitumen base course may be appropriate |
| Rural traffic free                    | 2.5m on all main routes, major access paths and school links  
2.0m possible on lesser routes and links | Sealed surface required on any route within 5km of urban area or 2km of village environment  
Sealed surface required on routes linking villages where school traffic or other utility trips will benefit.  
Surface dressed top to bitumen base course may be appropriate  
Use of unsealed surface requires a rigid maintenance plan  
Use of unsealed surface not recommended on paths:  
• with gradient steeper than 1 in 20  
• shared with equestrians  
• where significant run off expected |

1. Refer to Table H.2 for additional width required for various edge constraints
2. Minimum acceptable verge width is 0.5m, 1.0m preferred
3. Greater width required where route is used by horses
4. For widths on segregated routes see Table H.9
Traffic free routes 3

Segregation of cyclists and pedestrians

In Sustrans’ experience there are significant advantages with unsegregated paths where the width is shared by all users, particularly on traffic free routes away from the road. Unsegregated routes maximise usable width and minimise maintenance requirements and sign/line clutter. Effective segregation will benefit all users but requires significant additional width to provide the same level of service. Each situation must be considered on a case by case basis, and careful consideration must be given to the factors listed below.

DfT advice in LTN 1/12 encourages designers to think through their decisions rather than start from a default position of implementing any particular feature.

Widths

Width requirements for unsegregated paths are given in Table H.8.

Where segregation is provided, the requirements for users indicate the following two-way widths:

<table>
<thead>
<tr>
<th>Prefered width</th>
<th>Cyclists</th>
<th>Pedestrians</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5m</td>
<td>3.5m</td>
<td>7m</td>
<td></td>
</tr>
<tr>
<td>Acceptable minimum</td>
<td>2.5m</td>
<td>2m</td>
<td>4.5m</td>
</tr>
<tr>
<td>Absolute minimum for short lengths</td>
<td>2m</td>
<td>1.5m</td>
<td>3.5m</td>
</tr>
</tbody>
</table>

The effect of edge constraints is given in Table H.2. Segregated cycle tracks of 2.5m or more in width should normally include centre lines.

Management

Following the introduction of a shared use path it is advisable to monitor its performance; this will enable any concerns to be identified early on and suitable mitigating measures implemented if required.

On unsegregated paths consideration should be given to the erection of courtesy signs such as “cyclists give way to pedestrians” or “share with care”.

Unsegregated shared use, London

Segregation by tactile setts, Bristol

Segregation by grass verge, Loughborough

One way hybrid cycle tracks on both sides of carriageway, Brighton
Rural areas

Roads and villages

Rural cycle networks serve local utility and leisure cycling trips and commonly use the existing highway where, although traffic flows may be low, the national speed limit applies. Villages provide a focus of attractions in rural networks and must be served, although they are also where motor traffic movements are concentrated.

Villages

Important elements to consider to reduce the impact of traffic and improve the conditions in the village for cyclists and pedestrians are to:

• identify and strengthen entry points to village
• emphasise location of village centre to traffic
• create visual features at junctions and key locations
• encourage slower speeds: reduce visual width of carriageway, remove centre lines, reduce signing, lower speed limits, emphasise pedestrian desire lines and crossing locations.

Outside villages

Fewer options are available to make roads outside of villages more friendly for cyclists and pedestrians, where speeds are higher and traffic movement is the main function. In many cases cyclists may need to use parallel routes on quieter roads or traffic free paths. Where changes are made to the road, these must be sensitive to the nature of the rural environment. Measures to consider include:

• Quiet Lane designation, or similar
• 20mph limits
• area wide 40mph limits
• access restrictions/closures
• road narrowings
• changed priorities
• surface treatments
• removal of centre lines and other signs and lines
• selective warning signs (including vehicle activated)

Removal of centre lines (see Streets and roads 7)

Conversion of two-way road to single track road with passing places (low flow, 20mph limit)

Typical gated road closure

Road reduced to single track, Devon

Changed priorities
Crossings 1 : General

Table H.10 Choice of crossing type

<table>
<thead>
<tr>
<th>85th percentile speed</th>
<th>Traffic flow (two way daily)</th>
<th>Type of crossing</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 30 mph</td>
<td>&lt; 2,000</td>
<td>Cyclists have priority at side road - raised crossing</td>
</tr>
<tr>
<td>&lt; 30 mph</td>
<td>&lt; 4,000</td>
<td>Cyclists have priority mid-link - raised crossing</td>
</tr>
<tr>
<td>&lt; 50 mph</td>
<td>&lt; 6,000</td>
<td>Cyclists give way to road traffic (no refuge)</td>
</tr>
<tr>
<td>&lt;50mph</td>
<td>&lt; 8,000</td>
<td>Zebra crossing shared with cyclists</td>
</tr>
<tr>
<td>&lt; 50 mph</td>
<td>&lt; 8,000</td>
<td>Cyclists give way to road traffic plus central refuge - urban</td>
</tr>
<tr>
<td>&lt; 60mph</td>
<td>&lt; 10,000</td>
<td>Cyclists give way to road traffic plus central stage refuge - rural</td>
</tr>
<tr>
<td>&lt; 50 mph</td>
<td>&gt; 8,000</td>
<td>Signal controlled including Toucans</td>
</tr>
<tr>
<td>&gt; 50 mph</td>
<td>&gt; 8,000</td>
<td>Grade separated crossing - urban</td>
</tr>
<tr>
<td>&gt; 60 mph</td>
<td>&gt; 10,000</td>
<td>Grade separated crossing - rural</td>
</tr>
</tbody>
</table>

Notes: 1. Table provides guidance on appropriate crossing type, but individual locations should be assessed on a case-by-case basis.
2. Main cycle routes justify a higher level of service than other routes and so are likely to have greater priority at crossings and junctions.
Crossings 2: Rural

On single two lane carriageways where the national speed limit of 60mph applies, the designs below should be considered. If necessary additional measures to reduce vehicle speeds should be implemented including one or more of contrasting colour, high skid resistant surfacing, rumble strips, visual narrowing. Consider use of detector loops in cycle track to activate additional warning signs for drivers.

**Rural major road crossing**
(flows < 6,000 vpd)

- **SLOW markings or deflection (preferred)**
- or staggered bollards on approach to reduce speeds

Diag 1012.1 (150mm line width)
Rumble strips
Light coloured high friction surfacing laid over full width of carriageway for a distance of 50m in advance of and through the crossing

Detail of alternative layout with central refuge
(flows < 10,000 vpd)

*Note: additional signing, lining and surfacing details as above*

Diag No 610. Mounted on reflective backing board where improved visibility is desirable

Not to scale
Interface with carriageway

Leaving carriageway

Option 1

Footway
Cycle lane
Raised white line

Option 2

Footway
1:10 taper
Ramp
Verge separation
Raised white line

Option 3

Cycle track (normally at 90° to kerb)
Min effective path radius 4m preferred 2m absolute
Right turn cycle lane 1.5m min width (consider refuge islands where width allows)

Not to scale

Joining carriageway

Option 1

Footway
Cycle lane
Raised white line

Option 2

Footway
Carriageway kerb line
Build out
Cycle lane
Ramp

Crossing carriageway

Option 1 (shared use with pedestrians)

Shared path
Optional additional markings
White lining positioned to encourage cyclists to approach at 90° to carriageway
Tactile corduroy

Option 2 (segregation from pedestrians)

Footway
Centre line on two-way cycle track
Jug handle to improve angle of approach

Flush kerb detail

Footway / cycle track
max gradient 1:12 preferred
gradient 1:20

Channel used as kerb (BS. 7263 : type CS2)

Tactile paving as necessary

Notes

1. All kerb transitions must be flush (±6mm)
2. Where cycle access may be obstructed by parking, consider use of a build-out, waiting restrictions, white line or ‘keep clear’ markings
3. Where a cycle route leaves a shared path to join/cross the carriageway, signing should initially be kept to a minimum. If necessary, direction signing can subsequently be reinforced by:
   - white lining
   - arrow (1059) and cycle symbol (1057)
   - Cyclists Rejoin Carriageway (966)
4. End of Route (965) and Cyclists Dismount (966 variant) NOT recommended
5. Additional drainage likely to be required at transitions
Bridges and other structures

Bridges

Parapet height (h)
- 1.4m preferred for cyclists, but many existing bridges operate well with lower heights
- 1.8m for equestrian use (mounted)
- effective width of bridge reduced by 500mm at each parapet
- for advice on substandard parapet heights, refer to Sustrans Technical Information Note 30

Subways

Typical Section (Segregated)
- dimensions shown are minimum recommended for new subways
- dimensions in brackets apply to subway lengths > 23m
- many existing subways operate well with lower headrooms and appropriate warning signs
- headroom of 3.7m required for equestrians (mounted)
- a greater width or walls receding towards the top increases natural light

Typical Section (Unsegregated)
- dimensions in brackets apply to subway lengths > 23m
- many existing subways operate well with lower headrooms and appropriate warning signs
- headroom of 4.0m (3.0m with light usage)

A bridge with sub-standard headroom on cycle route, Nottingham

Sub-standard parapets on cycle route, Bristol

Subways

Typical Section

- dimensions shown are minimum recommended for new subways
- dimensions in brackets apply to subway lengths > 23m
- many existing subways operate well with lower headrooms and appropriate warning signs
- headroom of 3.7m required for equestrians (mounted)
- a greater width or walls receding towards the top increases natural light
Destination signage

More detailed guidance on destination signage and guidance on regulatory and warning signage is provided in Sustrans’ Technical information Note 5.

Comprehensive destination signing plays a key role in the development of safe and attractive places to cycle. Signs are an essential part of any cycle route and great care must be taken when considering their design and placement. They must provide clear, reliable information and at the same time must be appropriate and sensitive to their environment. A balance must be struck between sufficient signage and the visual clutter and maintenance liability that signing can cause. Surface markings may provide a useful alternative to post mounted signs.

Cycle specific route signing serves several purposes:
- routes for cyclists may differ from those for motor traffic
- gives cyclists good directions
- improves cyclist safety and comfort
- raises awareness of cyclists amongst other road users
- promotes cycle routes to other road users (particularly where times are used)

Direction signing should make the route legible and reflect cyclists’ behaviour, and include:
- direction
- destination(s)
- distance (or time)

Non-standard signs may be appropriate in certain situations:
- to fit in with a sensitive environment
- use of map type signs to assist legibility
- signing alternative routes, e.g. where main route is unlit or may flood
- Use of temporary signs to maintain continuity is a good short-term measure until permanent signs are put up.

All signing should be:
- high quality
- coherent
- consistent
- frequent
- well maintained
- appropriate

Tip: maximise use of lamp columns and other existing surfaces for mounting signs to avoid clutter

Avoid: Cyclists Dismount or End of Route signs
Cycle parking

Cycle parking is an essential element of a cycle network. It should cater for all destinations and be sited close to building entrances where it can be observed by passers by and the building occupier. The preferred type of public cycle parking is the Sheffield stand, in conjunction with shelters where bikes are left for long periods. Care should be taken when siting cycle parking to avoid obstructions to pedestrians including those with visual impairments.

Sheffield stands

- **Option 1:** Stand embedded into the ground (preferred)
- **Option 2:** Stand bolted to the ground

- 50mm dia (min) tubing
- Optional additional rail
- Low level ‘tapping rail’ where appropriate
- 700-1000mm radius max
- 200mm
- 750mm (650mm allows for child bike frames)
- 250mm (min)
- 50mm dia (min) tubing

‘Toast rack’ of Sheffield stands

- Stands welded to steel runners
- 1000mm min

**Layouts**

- **Perpendicular**
  - Boundary / building line
  - Kerb line
  - 900 1000
  - 1000mm*
  - Centre line
  - 2500mm spacing
  - 900mm min

- **Along kerb**
  - Boundary / building line
  - Kerb line
  - 1800mm min
  - Spacing 2500mm
  - 900mm min

Visitor parking, Cambridge

Parking alongside kerb, London

**Siting details**

- **Footway:** cycle parking on the footway should be located where it is unlikely to cause obstruction to pedestrians
- **Off-street:** cycle parking should be in prominent locations near entrances to major attractions. Appropriate standards for cycle parking should be imposed on new developments
- **On carriageway:** road space can be given over to cycle parking, for example by removal of car parking bays. The cycle stands should be protected from encroachment by motor vehicles. Care should be taken when siting on-carriageway cycle parking opposite (nose to kerb) echelon parking bays

Brighton
**Cycle/rail integration**

Urban and rural railway stations may have a commuter catchment by bike of at least 5 miles radius. Railways present linear barriers to cycle permeability so high quality cycle crossing provision is essential.

Network of well signed and direct routes feeding into station from all directions

Secure and convenient cycle parking on both sides of station

Use of surplus railway land for new access

Traffic free shortcuts into station

Wheeling ramps on bridge/subway (if ramps or lifts not possible)

Entrance with cycle map and other information for cyclists arriving. Destination signing for cyclists at all exits

Bike Hub*

*Note: Station forecourt design to prioritise pedestrian, cycle and bus passenger movements over taxis and private cars

3 miles
- 20 min
- 60 min

1.5 miles
- 10 min
- 30 min

1.5 miles
- 10 min
- 30 min

32 April 2014

*Bike Hub - may provide
- secure cycle parking
- luggage storage
- maintenance facility
- sales
- bike hire

Not to scale
Development planning

New developments present opportunities to improve the permeability of the development plot and to adjust building lines that previously constrained the cycle network around the pre-existing frontages.

Future mixed use housing and commercial development fronting onto traffic free route

Key: new links provided by development
- Cycle / pedestrian access
- Cycle / pedestrian through routes

Development part-funds hybrid cycle tracks on main road

New mixed use housing and commercial development

Houses fronting onto existing traffic free route to enhance natural surveillance

Notes:
Street design within developments to follow Manual for Streets / Designing Streets

All possible opportunities to be taken to create direct routes for cyclists and pedestrians

Adequate public and private cycle parking to be provided commensurate with usage targets and closer to the entrances than car parking

Estate road

Not to scale
Overall principles:

- a route that is kept in good condition will be more popular than one allowed to deteriorate
- having invested in the route’s construction it is important that it remains attractive to users
- design should minimise maintenance liabilities and consider whole life cost of scheme
- maintenance should be considered as part of the route development process long before work to build it starts
- a high standard of design will mean less maintenance in the future. For example a path surfaced with tarmac will have a long life and require little maintenance
- secure funding for maintenance at project development stage

On road routes:

- pre-plan cycle network enhancements as part of network management programme
- prioritise maintenance of 1.5m to 2m nearest to kerb
- repair loose drain covers and potholes
- clear drainage channels and gullies
- sweep debris
- repair worn markings / coloured surfacing
- accommodate cyclists at roadworks
- include in winter maintenance
- repair / replace damaged / lost signs

Traffic free routes:

- repair surface damage
- clear drainage channels and culverts
- sweep debris
- mow verges / remove edge creep
- cut encroaching trees and other vegetation
- repair / replace damaged / lost signs
- maintain lighting, furniture, structures
- use of local volunteers to assist
- develop signing and management plan to encourage considerate behaviour on shared paths
- winter maintenance, including snow cleaning
- develop a wider habitat management plan to enhance the biodiversity value of the route

Maintenance policies to include:

- prioritise cycle routes
- conduct frequent inspections
- inspect routes on a bike
- use local volunteers to assist with inspections and minor maintenance
- publicise fault reporting hotline
- quick response to problems
- regular programmed maintenance
- roadworks to accommodate safe and convenient movement of cyclists
- use temporary direction signing as short term measure where new signs are needed
References

This section includes a range of useful UK reference documents. Links to all of these are provided from Sustrans’ website.

**Key references:**

- Cycling Infrastructure Design, LTN 2/08, DfT 2008
- Manual for Streets 2, CIHT 2010
- Guidelines for Providing for Journeys on Foot, CIHT 2000
- Shared Use Routes for Pedestrians and Cyclists, LTN 1/12, DfT 2012
- Inclusive Mobility: A Guide to Best Practice on Access to Pedestrian and Transport Infrastructure, DfT 2002
- London Cycling Design Standards, TfL 2005
- Cycling England: Design Checklist, 2010
- Infrastructure Toolkit for Cycling Towns, Cycling England, 2009
- Cycling by Design, Transport Scotland, 2010
- Designing Streets, The Scottish Government, 2010

**Other DfT guidance:**

- Shared Space, LTN 1/11, DfT 2011
- Traffic Management & Streetscape, LTN 1/08, DfT 2008
- Guidance on the Use of Tactile Paving Surfaces, DfT 1998
- The Assessment of Pedestrian Crossings, LTN 1/95, DfT 1995
- The Design of Pedestrian Crossings, LTN 2/95, DfT 1995
- Traffic Signs Regulations and General Directions, HMSO 2002
- Traffic Signs (Amendment) (No2) Regulations and General Directions, HMSO 2011
- CPR1035, Traffic Management Techniques for Cyclists, TRL 2011
- Traffic Advisory Leaflets (various)

**Sustrans:**

- The Merits of Segregated and Non-Segregated Traffic-Free Paths, Phil Jones Associates, Sustrans 2011
- Sustrans’ Technical Information Notes (TINs)
  - TIN05: Cycle Network Signing, 2013
  - TIN07: Aggregates for Path Construction, 2011
  - TIN08: Cycle Path Surface Options, 2012
  - TIN11: Trees, 2012
  - TIN12: Side Road Crossings, 2011
  - TIN14: Gaining permission for works that might be affected by coastal or river flooding, 2011
  - TIN16: Cycle & Pedestrian Routes within Car Parks, 2011
  - TIN17: Cyclists’ Use of Zebra Crossings, 2011
  - TIN18: Toucan Crossings, 2011
  - TIN19: Segregation of Shared Use Routes, 2014
  - TIN23: Road Safety Audits, 2011
  - TIN28: Horses on the National Cycle Network, 2011
  - TIN29: Lighting of Cycle Paths, 2012
  - TIN30: Parapet Heights on Cycle Routes, 2012
  - TIN31: Obstacles in the Carriageway, 2012
  - TIN32: Cycle Streets, 2014

**Trunk Roads : Design Manual for Roads and Bridges:**

- Provision for Non-Motorised Users, TA91/05, Highways Agency
- Geometric Design of Pedestrian, Cycle and Equestrian Routes, TA90/05, Highways Agency
- Non-Motorised User Audits, HD42/05, Highways Agency
- Subways for Pedestrians and Cyclists Layout and Dimensions, TD36/93, Highways Agency
- Footway Design, HD39/01, Highways Agency
- Design Criteria for Footbridges, BD 29/04, Highways Agency
- Coloured Surfacing In Road Layout (Excluding Traffic Calming), TA 81/99, Highways Agency

**Other**

- Guidance for Towpath Design, Canal and River Trust 2012
- Notes on Good Practice Common in Europe, Cycling England, 2005
- Transport in the Urban Environment, CIHT 1997
- The State of our Streets, Living Streets 2012

**Sustrans’ Ecology Notes:**

- Ecology Note 01: Hedge Management, 2011
- Ecology Note 02: Grass Verge Management, 2011
- Ecology Note 03: Himalayan Balsam, 2011
- Ecology Note 04: Japanese Knotweed, 2011
- Ecology Note 05: Ragwort, 2011
Sustrans has over 30 years’ experience of designing public space to encourage more travel by sustainable modes of transport, and we know that encouraging more people to change their travel behaviour means making their journeys attractive, convenient and safe, whether they share the road with traffic or use separate paths.

We work with local authorities and councils UK-wide to deliver value for money solutions to increase travel by foot, bike and public transport by people of all ages and abilities. We also provide training to support transport and other professionals to deliver more sustainable travel choice.

**Technical Design training**

Our accredited Better by Design courses are intended for those involved in the development and design of highway schemes that will be used by cyclists.

Our one-day courses include:

- **essential skills**: principles of designing for cyclists in a highway environment; the practical issues of implementation and how to overcome these
- **design processes**: procedures involved in the development of cycle infrastructure, including audits, legislation, regulations and equalities
- **design practice**: practical issues to be tackled when applying design guidance to develop high quality infrastructure for cycling on links, junctions and crossings

Course attendees will receive a certificate of Continued Professional Development (CPD), and this course is endorsed for CPD by CIHT.

**Smarter Travel Choices training**

Our Smarter Travel Choices courses are intended for health, transport and other professionals involved in the promotion of active and sustainable travel.

Course modules include:

- benefits of sustainable travel
- how to write, monitor and update a travel plan
- how to deliver activities which effectively promote active and sustainable travel
- how to deliver personalised travel advice
- community engagement and involving residents in transport decision making

For full details of our services, visit www.sustrans.org.uk/our-services, and for training details visit www.sustrans.org.uk/training

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