INTERIM ADVICE NOTE 195/16

CYCLE TRAFFIC AND THE STRATEGIC ROAD NETWORK

Summary

This document gives requirements and advice regarding designing for cycle traffic for the Strategic Road Network (SRN).

Instructions for Use

This document supplements and amends the cycling specific information provided in the following documents, and should be read in conjunction with these documents:

TA 57/87	Roadside features
TD 36/93	Subways for Pedestrians and Pedal Cyclists Layout and Dimensions
TA 91/05	Provision for Non-motorised Users
TA 90/05	The Geometric Design of Pedestrian, Cycle and Equestrian Routes
HD 42/05	Non-motorised user Audits
TD 22/06	Layout of Grade Separated Junctions

Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
Rev 1.0	First draft	JD	JP/PJ/AL	JD	PW	Nov 2014
Rev 2.0	April TPB	JD	JP/PJ/AL	JD	PW	Apr 2015
Rev 3.0	July TPB	JD	JP/PJ/AL	SG	PW	Jul 2015
Rev 4.0	October TPB	SG	JP/PJ/AL	SG	PW	Oct 2015
Rev 5.0	November Update	SG	JP/PJ/AL	SG		Nov 2015
Rev 6.0	January Update	SG	JP/PJ/AL	SG		Jan 2016
Rev 7.0	February Update	SK	JP/PJ/AL	SK	PW	Feb 2016
Rev 8.0	March Update	DH	SB/Atkins	DH/SB	SB	Apr 2016
Rev 9.0	April Update	DH	SB	DS/RL/SB	DS	Apr 2016

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2.7.1.2	Transport for London
2.7.3	Adrian Lord

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1. Introduction

The Strategic Road Network (SRN) makes up a small proportion of the national highway network but has an important role to play in supporting journeys made by cycle as referenced in the Highways England Cycling Strategy.

This document provides requirements and advice relevant to the SRN for the planning and design of infrastructure for cycle traffic and is intended to be used by highway design professionals.

1.1. Purpose and required actions

The purpose of this document is to ensure SRN infrastructure facilitates the convenient and safe movement of cycle traffic crossing or travelling along the SRN, where cycling is legally permitted.

This IAN document sets out how SRN infrastructure will support Highways England's objectives for cycle traffic.

1.2. Relationship

Publication of this document supersedes the stated sections in the following parent documents:

- TA 90/05: The Geometric Design of Pedestrian, Cycle and Equestrian Routes
  - 2.3 to 2.5
  - 3.3
  - 4.4
  - 5.2 to 5.5
  - 7.5 to 7.9
  - 9.5 to 9.6
  - 9.11 to 9.12

- TA 91/05: Provision for Non-motorised Users
  - 1.1 to 4.6
  - 4.8 to 8.11
  - 8.25 to 8.41

- TD 36/93: Subways for Pedestrians and Pedal Cyclists Layout and Dimensions
  - 4.6
  - 5.8

- TA 57/87: Roadside features
  - 8.1.1 to 8.5.5

Publication of the document amends the stated sections, where they refer to matters associated with cycle infrastructure, in the following parent documents:

- TD 22/06: Layout of Grade Separated Junctions
  - 6.1 to 6.4.
  - 6.5 to 6.6.

- o 6.8.
- o 6.10.

- TA 90/05: The Geometric Design of Pedestrian, Cycle and Equestrian Routes
  - o 2.2.
  - o 3.2.
  - o 3.5.
  - o 3.7 to 3.12.
  - o 3.14 to 3.18.
  - o 4.1 to 4.2.
  - o 4.5 to 4.6.
  - o 6.1 to 6.2.
  - o 7.21 to 7.22.
  - o 8.5.

- TD 36/93: Subways for Pedestrians and Pedal Cyclists Layout and Dimensions
  - o 2.7.
  - o 4.3.
  - o 4.4.
  - o 5.4.
  - o 5.7.

- TA 57/87: Roadside features
  - o 1.2.1.
  - o 1.6.2.
  - o 1.7.1 to 1.7.2.
  - o 1.8.2.
  - o 3.1.1.
  - o 7.1.2.
  - o 9.2.2.

- HD 42/05: Non-motorised user Audits
  - o 1.14.
  - o 2.2 to 2.5.

1.3. Implementation

This document shall be implemented forthwith, except where:

a. The procurement of works, at any stage from conception through design to completion of construction, has reached a stage at which, in the opinion of Highways England, use of this document would result in significant additional expense or delay progress (in which case the decision must be recorded in accordance with Highways England's procedures).

b. A contract has terms which apply specifically to the implementation of alternative requirements.

This document permits the use of Absolute Minimum values where specifically noted. The use of Absolute Minimum values only applies where there are existing physical constraints on existing roads where a cycle facility is proposed or an existing cycle facility is to be improved. The designers shall record the reasons for using Absolute Minimum Values as part of the NMU audit process. Where the use of Absolute Minimum values is not appropriate and where mandatory requirements are not met, the designer shall apply for a Departure from Standards using the process described in GD 01/15.

1.4. Scope

This document applies to the design and development of the SRN for use by cycle traffic.

This document complements existing sources of cycle infrastructure design guidance that address the planning and design of cycle infrastructure in urban highway environments.

This document does not address the infrastructure planning and design requirements for pedestrians and equestrians using the SRN.

This document does not cover design of shared use facilities for pedestrians, equestrians and cyclists; information on this type of provision is covered in TA 91/05 Provision for Non-Motorised Users [1] and in Local Transport Note 1/12 Shared use routes for pedestrians and cyclists [2]. The default position along the SRN where cycle traffic will normally be travelling at speed is for there to be a separate footway where pedestrian demand is high enough to justify it. Where new or upgraded facilities are being provided on or adjacent to existing roads with existing physical constraints, a shared route for pedestrians and cyclists may be provided.

This document does not address detailed design features to support inclusive mobility requirements; relevant information can be found in Inclusive Mobility, Department for Transport. 2005 [25].

1.5. Definitions

The following defined terms are relevant to this document:

- Absolute Minimum values: the design parameter(s) that may be used where there is an existing physical constraint on existing roads where a cycle facility is proposed or an existing cycle facility is to be improved within the highway boundary.
- Advisory Cycle Lane: a cycle lane bounded by a broken white line which enables motor traffic to enter the lane when legal to do so.
- Cycle: as defined by the Road Traffic Act (Section 192) [3]. Types of Cycle include standard cycles, solo tricycles, hand-cranked cycles, tandem cycles, recumbent cycles, trailer cycles (tandems with a hinge, usually with the rear seat to carry a child), cycles towing trailers, cargo cycles and cargo tricycles.
- Cycle Design Vehicle: a composite of the many types of cycle defined above, used to provide design criteria.
- Cycle Lane: a lane in the carriageway for use by cyclists.
- Cycle Network: a set of connected cycle routes that can be legally used by cycles.
- Cycle Route: any infrastructure that can be legally used by cycles, including cycle tracks, stepped cycle tracks, cycle lanes, light segregated cycle lanes and carriageways.

- Cycle Track: a track separate from the main carriageway for use by cyclists. Cycle tracks may be newly constructed or created through conversion of a footway (using powers under the Highways Act 1980 [4]) or footpath (using the Cycle Tracks Act [5]).
- Cycle Traffic: a specific type of traffic on the network where the vehicles meet the definition of a cycle.
- Desirable minimum: design parameters that apply where the conditions for use of Absolute Minimum value criteria are not applicable.
- Light Segregated Cycle Lane: a mandatory cycle lane that is separated from the carriageway by intermittent physical objects.
- Mandatory Cycle Lane: a cycle lane bounded by a solid white line which excludes motor traffic.
- “Must”: is used in this document to denote a statutory obligation.
- “Shall”: is used in this document to denote a requirement.
- Shared Route: a combined facility for use by pedestrians and cyclists.
- “Should”: is used in this document to denote a recommendation.
- Stepped Cycle Track: a cycle track that is adjacent to the carriageway constructed at an intermediate height between the carriageway and the verge or footway.

2. Cycle Traffic

2.1. Cycle Traffic and the Strategic Road Network

2.1.1. Designing networks for Cycle Traffic

The development of cycle networks shall be in accordance with Highways England's Cycling Strategy. Where Non-Motorised Users (NMU) are prohibited from the Strategic Road Network, out of corridor cycle routes may be created as part of the legal process of creation of new highway, or through the adoption or conversion of rights of way, such as disused railway lines, with the potential to link to national cycle routes. Highways England and designers shall plan to acquire land to create the space to accommodate cycle traffic as part of new scheme designs (see Section 1.3) or when enhancing cycling provision for existing routes with NMU prohibitions.

Where all-purpose trunk roads are upgraded with new routes being provided, the original route corridor and adjoining local road network can provide a suitable opportunity for compensatory cycle route provision. In such instances, designers shall liaise with the appropriate local highway authority responsible for the original route once reclassified.

Where alternative cycle routes away from the SRN cannot be provided, designers shall ensure that cycle networks allow for segregated cycle trips within the corridor of all-purpose trunk roads with speed limits of 40mph or greater. Cycle networks shall also allow for trips crossing the SRN corridor. Cross-corridor schemes, such as those crossing motorways or where NMUs are prohibited, can reduce or eliminate severance which may have otherwise suppressed demand for cycle traffic.

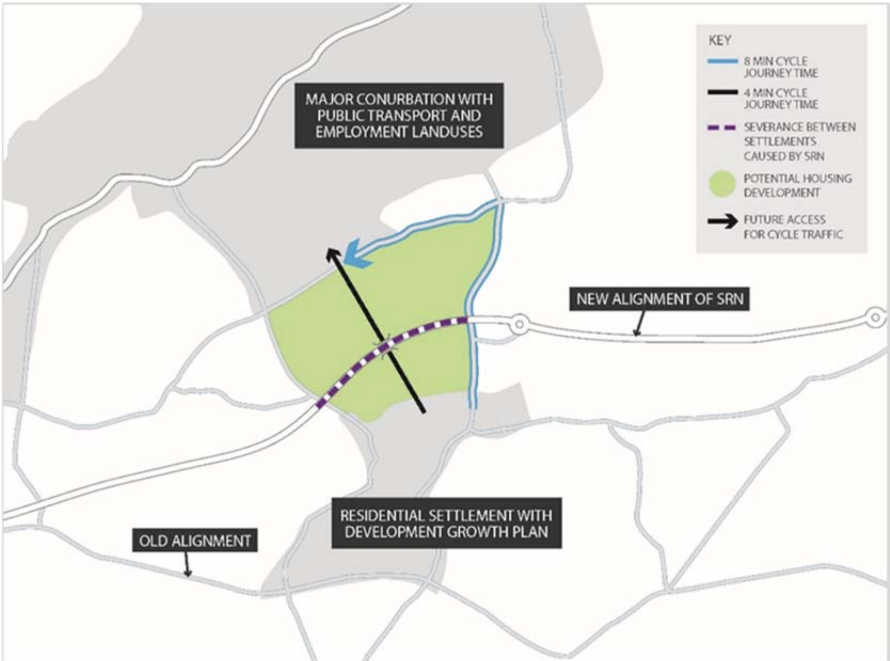
2.1.2. Demand assessment and appraisal

Infrastructure shall provide sufficient capacity to accommodate growth in volumes of cycle traffic. Current Department for Transport guidance (WebTAG unit A5-1: active mode appraisal, S2.3: Guidance on the Appraisal of Walking and Cycling Schemes) [6] on the appraisal of schemes to provide for cycle traffic shall be used in the planning and assessment stages. Further guidance may also be obtained from the Chartered Institution of Highways and Transportation (CIHT) document 'Planning for Cyclists' [7].

Current levels of demand for cycle trips are not always a good indication of potential future levels of demand. Creation of a comprehensive network of good quality cycle routes has the potential to stimulate demand beyond the incremental change that demand models predict. Designers shall not rely solely on modelled incremental increases relative to current demand for cycle trips, therefore they shall ensure they consider the potential for additional stimulated demand.

In particular, in developing network strategies, Highways England and designers shall give regard to local authority development plans and the potential for new development adjacent to the SRN. Figure 2.1.2 indicates a typical situation. If the SRN were constructed before the development, then there is a need for remedial construction of a crossing. If the SRN were constructed after the adjacent development, the crossing would then form part of the initial construction.

Figure 2.1.2 Designing for Growth in Cycle Traffic



2.1.3. Design development process

Highways England's Cycling Strategy and route strategies will be relevant in considering the overall package of measures that will comprise the comprehensive cycle network associated with the SRN.

Stakeholders shall be consulted at all appropriate stages, and early engagement will be beneficial in scheme development. Designers shall develop options before consultation takes place.

Highways England and designers shall work closely with local authorities while developing cycle networks, in order to provide route connectivity and take account of local cycle strategies, rights of way improvement plans, local transport plans, and development plans.

2.2. Design Requirements of Cycle Traffic

2.2.1. Understanding the cycle as a vehicle

Cycle traffic typically travels at speeds that are different to other users of the highway. Pedestrians and equestrians generally travel at lower speeds than cycle traffic and motor vehicles travel at speeds faster than that of cycle traffic. These speed differentials mean that the space and passing distance required by cycle traffic is different to other users of the highway. As a result, cycle traffic shall be separated where appropriate from other users of the highway. Table 2.2.2 gives requirements.

The amount of effort required to cycle depends on physical conditions and the local environment such as surface quality, surface material, gradients, undulations, prevailing winds and the ability to maintain constant speed. The most efficient use of cyclist effort shall be a key consideration in the design of any cycling provision. Designers shall take positive steps in the design to reduce the effort required to cycle.

A cycle is a vehicle capable of significant speed, and there can be considerable differences in speed between cycle traffic going uphill and cycle traffic going downhill.

In addition to the usual geometric requirements that follow from designing for all types of vehicles travelling at a design speed; for cycle traffic there are additional relevant requirements because of the nature of the cycle as a vehicle. These requirements are outlined in Local Transport Note 02/08 Cycle Infrastructure Design [8] and are originally based on Dutch design philosophy (details as given in CROW (2007) Design manual for bicycle traffic) [9]. These requirements are referred to as the "five design criteria":

- **Coherence**: Cycle networks shall link trip origins and destinations, including public transport access points and shall be continuous and easy to navigate.
- **Directness**: Cycle networks shall serve all the main destinations and shall seek to offer an advantage in terms of distance and journey time.
- **Comfort**: Infrastructure shall meet design standards for alignment and surface quality, and cater for all types of user, including children and disabled people.
- **Attractiveness**: Aesthetics, noise reduction and integration with surrounding areas are important.
- **Safety:** Cycle networks shall not only improve cyclists' and other road users' safety, but also their feeling of how safe the environment is.

Designers shall use the context reports as part of the audit process described in HD 42/05 Non-Motorised User Audits [10] to outline options for cycle traffic at start of a scheme.

2.2.2. Facility Selection

The designer shall achieve the best balance of the five design criteria set out in Section 2.2.1. Dedicated space for cycling can be provided in a variety of ways within the highway boundary as described in detail in Section 2.3 with regard to link sections, and in Section 2.4 to 2.8 for junctions and crossings.

Table 2.2.2 shows the minimum requirements which shall be used for different traffic speeds and volumes. Application of Table 2.2.2 for the SRN will often result in the provision of cycle routes that are separate from the carriageway.

Table 2.2.2 Minimum provision for cycle routes

Speed Limit (mph)	Motor Traffic Flow (AADT- Average Annual Daily Traffic)	Minimum Provision for Cycle Routes
40 and over	All flows	Cycle Tracks (excluding stepped cycle tracks)
30	0-5,000	Cycle Lanes
	>5,000	Cycle Tracks
20	<2,500	Cycle Streets or Quiet Streets: combined traffic
	2,500-5,000	Cycle Lanes
	>5,000	Cycle Tracks

Points to note from Table 2.2.2 are as follows:

- This table does not include cycle routes away from highways which are included in TA 91/05 [1].
- If actual speeds are higher than a speed limit, and are unlikely to reduce through control measures, then consider the next highest category of speed.
- "Cycle Tracks" includes stepped cycle tracks unless noted otherwise.

For all types of cycle route, cycle traffic has geometric requirements that are related to the speed that cycles are capable of, and to the dimensional characteristics of the cycle and rider. The range of cycles commonly in use and the cycle design vehicle are described in Section 2.2.4.

2.2.3. Design speed

As with any transport system, the design speed determines all of the relevant geometry. The design speeds in Table 2.2.3 shall be used.

Cycle traffic shall be separated from pedestrian and equestrian traffic in order to allow cyclists to travel at the design speed.

Table 2.2.3 Design Speed for Off-Carriageway Cycle Routes

Circumstance	Design Speed (kph)	Absolute Minimum Design Speed (kph)
On down gradients of 3% or greater	40	N/A
All other off-carriageway cycle route provision	30	20

The Absolute Minimum design speed shown in Table 2.2.3 is only permitted in the circumstances described in Section 1.3 and for distances up to 100 metres if combined with the use of 'SLOW' markings, although this is not permitted on downhill gradients of 3% or greater.

2.2.4. Space profile and the cycle design vehicle

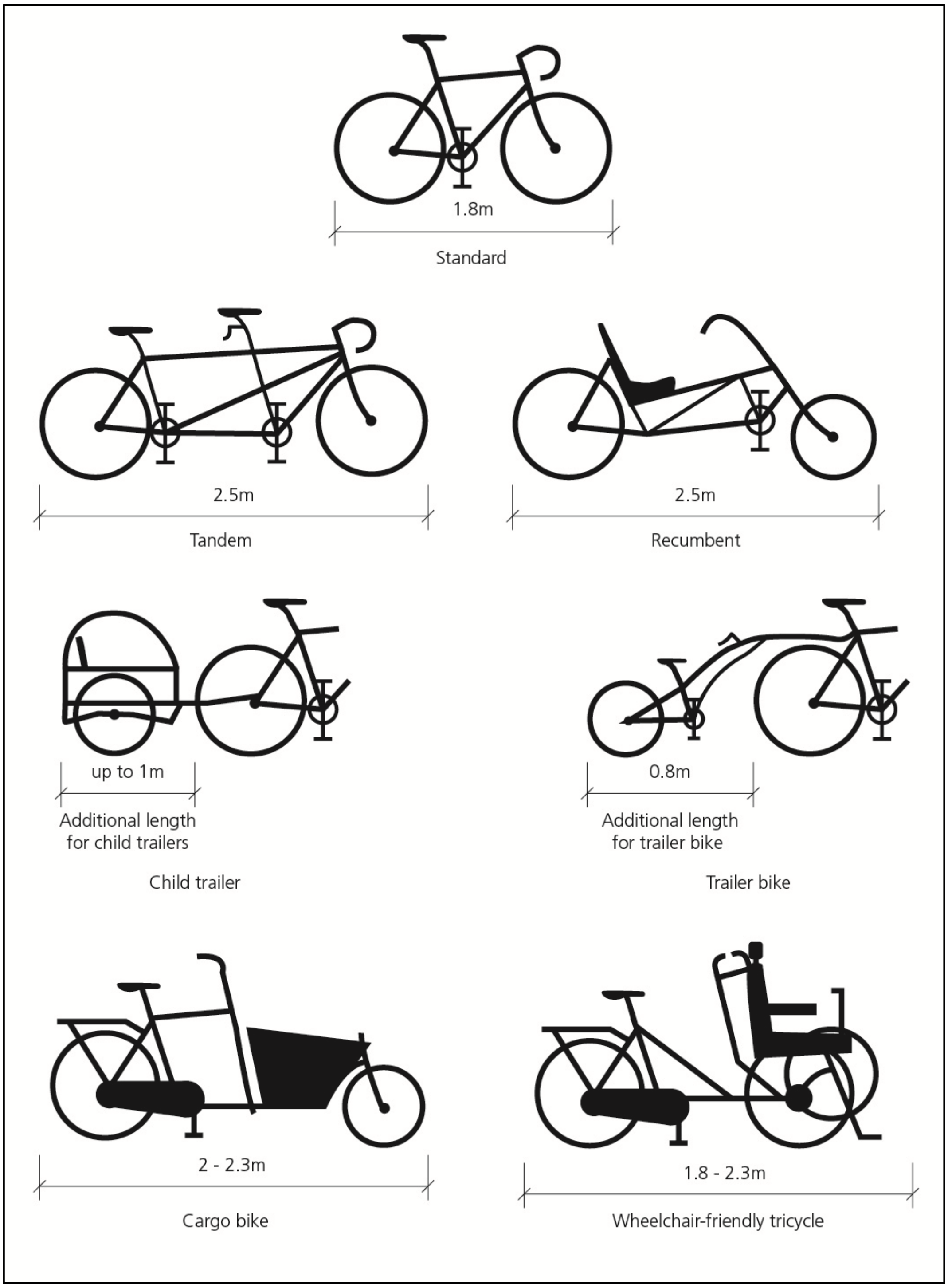
There are many categories of cycle used on cycle routes. Figure 2.2.4.1 provides information on common cycle length dimensions. The width of a standard cycle is 0.6m and the typical width of a cycle that may be used by people with certain types of disability is 1.2m.

Figure 2.2.4 Example of a Hand-cranked Cycle

The dimension of the cycle design vehicle shall be assumed as 2.8m long and 1.2m wide. Fig 2.2.4.1 shows the length of 2.8m is made up of a standard bicycle at 1.8m plus a child trailer of up to 1.0m in length.

For most cyclists, a speed of 12kph or more is required to ride comfortably in a straight line without a conscious effort to maintain balance. Above 12kph the amount of deviation is 0.2m; this deviation from a straight line means a cyclist's dynamic envelope is 0.2m wider than the cycle design vehicle width dimension.

Figure 2.2.4.1 Approximate Lengths of Different Types of Cycle



2.2.5. Stopping Sight Distance

Stopping sight distance (SSD) and visibility at junctions is as important for cycle traffic as it is for motor traffic.

SSD is the distance required for a rider to perceive, react and stop safely. It is measured in a straight line between two points at the centre line of the route, and the line of sight shall lie within the highway boundary. SSDs for cyclists shall be as given in Table 2.2.5. These distances are based on the same perception reaction times and deceleration rates for comfortable and emergency braking as assumed in TD 9/93 Highway Link Design [11].

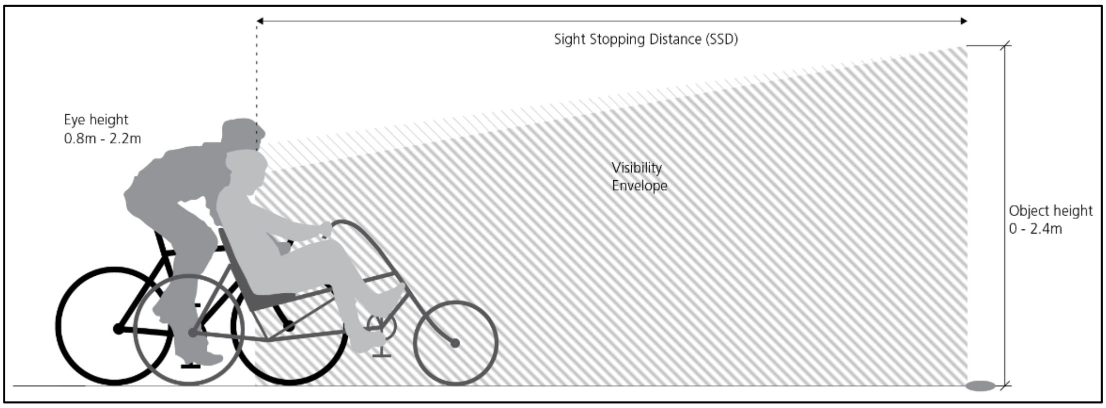
Table 2.2.5 Stopping Sight Distances

Design Speed (kph)	Minimum Stopping Sight Distance (m)
40	47
30	31
20	17

Designers shall ensure that objects between the carriageway surface and a height of 2.4 m are visible from an eye height in the range of 0.8m to 2.2m. These values accommodate a range of cyclists including recumbent users, children and adults (reference Figure 2.2.5).

Isolated objects with widths of less than 300mm may not have a significant effect on visibility, and specific case-by-case assessment of their effects on visibility shall be undertaken, taking account of likely actual speeds of cycle traffic.

Figure 2.2.5 Visibility Envelope



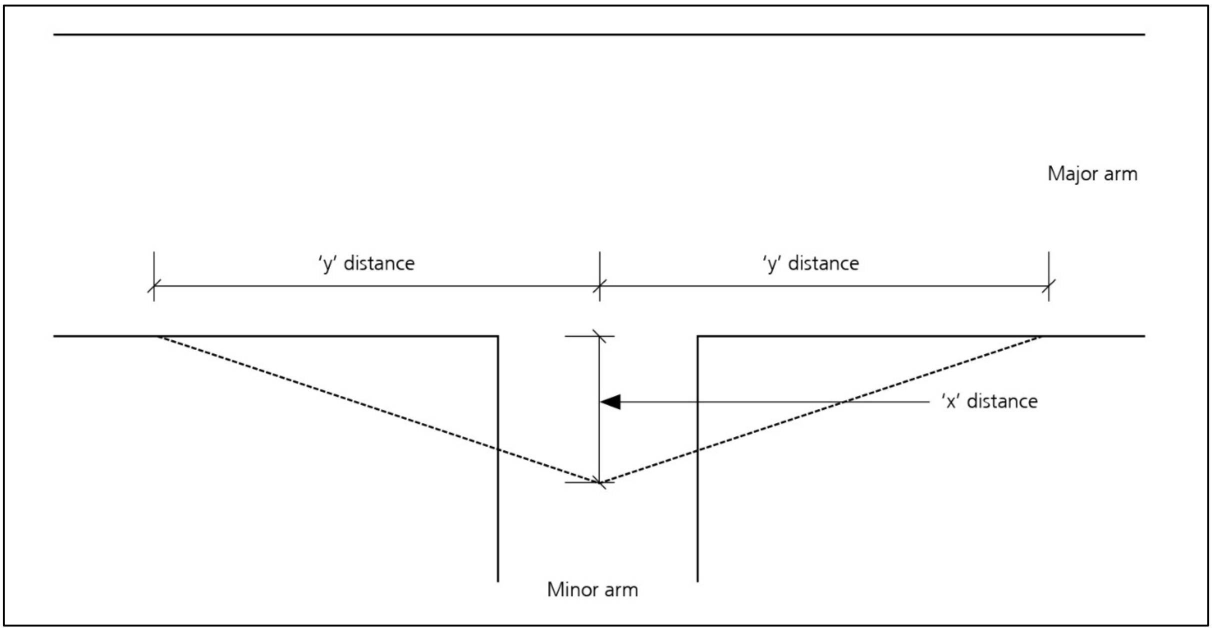
2.2.6. Visibility splays

SSD appropriate to the design speed and in accordance with TD 09/93 [11] shall be provided for motorised road users on the main route approaching a crossing used by cycle traffic.

A visibility splay shall be provided for cycle traffic approaching crossings and junctions where they have to stop or give way. “x” and “y” distances are defined, as shown in Figure 2.2.6.

Any crossing of a highway or junction between cycle routes shall be located such that all users have full visibility according to Figure 2.2.6.

Figure 2.2.6 Visibility X and Y Distance for a Cycle Track as the Minor Arm



The “x” distance is measured from a give way or stop line, back along the centre line of the minor arm. The “y” distance is measured along the edge of the highway from the centre of the minor arm.

Table 2.2.6.1 provides “x” distances. The "x” distances for cyclists equate to the eye positions for one or two cycle design vehicles. The desirable minimum "x" distance allows two users to observe the full “y” distance and both accept the gap in traffic. Designers should seek to improve visibility along the “y” distance before reducing the “x” distance. Use of the absolute minimum “x” distance is permitted at sites with existing significant constraints.

Table 2.2.6.1 “x” Distances for Cycle Traffic

Desirable Minimum (m)	**Absolute Minimum (m)**
4.5	2.4

The "y" distance shall be the same as the SSD on the major arm (reference Table 2.2.5). The major arm being joined may be a carriageway, an equestrian route, a footpath, or another cycle track. Where the major arm is a carriageway, the “y” distance shall be that identified in Table 7/1 of TD 42/95 Geometric Design of Major/Minor Priority Junctions [12]. Where the major arm is an equestrian route or a footpath, the “y” distance shall be that identified in Table 3.2 of TA 90/05 Geometric Design of Pedestrian, Cycle and Equestrian Routes [13]. Where a cycle route meets another cycle route at a junction, the “y” distance shall be the same as the major arm (reference Table 2.2.5).

“y” distances shall be measured for an eye height of 0.8m to 2.2m for cyclists. The object height shall be taken as 0.26m to 2.0m in accordance with TD 09/93 [11].

2.2.7. Horizontal alignment

A good horizontal alignment will not include diversions or fragmented facilities. Obstacles within the route shall not be permitted with the exception of bollards to prevent motor traffic access (reference Section 2.3.8).

Changes in horizontal alignment shall be via simple circular curves. Appropriate SSD for cycle traffic shall be achieved by providing appropriate radii in both horizontal and vertical planes.

Table 2.2.7 provides minimum horizontal curve radii which shall be used for cycle traffic. These radii are based on a V^2/R of 28.28 as per TD 09/93 Highway Link Design [9].

Table 2.2.7 Minimum Horizontal Radii

Design Speed (kph)	Minimum Horizontal Radius (m)
40	57
30	32
20	14

2.2.8. Vertical alignment

For comfort, there shall be a minimum sag K value of 5.0. For stopping sight distance, there shall be a minimum crest K value of 6.0. For gradients, see Section 2.2.9. This will limit vertical acceleration to less than $0.3 m/s^2$. SSD shall always be checked because it is affected by the interaction of the vertical alignment with the horizontal alignment of the cycle route, the presence of crossfall, superelevation or verge treatment and features such as signs and structures adjacent to the route.

2.2.9. Longitudinal gradient

Cycle routes on existing mainline routes and slip roads shall follow the existing gradient. Cycle routes on new roads shall be designed in such a way that the steepness and length of longitudinal gradients meets the requirements of Table 2.2.9.

The speed of travel is another important factor to consider, as well as the length of the gradient. Steep gradients can lead to high speeds for descending cyclists or low speeds for climbing cyclists, which can create hazards for all users of the route. Stopping distances also increase significantly on gradients in excess of 3%. Designers shall carefully consider the combination of horizontal and vertical geometry where gradients are greater than 3%. Unguarded hazards (e.g. fixed objects or steep drops or water hazards) shall not be permitted within 4.5m of the route where they would lie in the path of an out-of-control cycle. An example of a location where a hazard should be guarded is at a curve at the bottom of a gradient.

Table 2.2.9 Maximum Length for Gradients

Gradient	Maximum Length of Gradient (m)
2.0%	150
2.5%	100
3.0%	80
3.5%	60
4.0%	50
4.5%	40
5.0%	30

Where height differences suggest longer lengths of gradient than those given in Table 2.2.9, earthworks shall be provided or the horizontal alignment shall be adjusted to limit the length or severity of the gradient. Level sections of 5.0m minimum length can be used between gradients to achieve compliance with Table 2.2.9.

2.2.10. Crossfall and superelevation

Cycle tracks shall be designed to be free from standing water and ice. Where longitudinal gradients are insufficient to drain the surface, crossfall can be provided either to one side or cambered to both sides of the cycle facility. Superelevation is not required on safety grounds for cycle traffic and crossfall shall not exceed 5%, higher values create manoeuvring difficulties and contribute to loss of control in icy conditions. Crossfall greater than 2.5% shall not be used on cycle tracks where cycle traffic may be slower than the design speed or coming to a stop. Below a radius of 50m crossfall shall not be adverse.

2.2.11. Cycle Lane and Cycle Track Widths

Table 2.2.11 sets out the absolute minimum and desirable minimum widths of different types of cycle routes.

Cycle lanes with widths of more than 2.0m, used for high demand flows, may benefit from a green coloured surface, in addition to prescribed cycle markings to discourage general traffic from using the lane. [Normative Reference 20].

Additional width is required for higher cycle flows as set out in Table 2.2.11. Absolute Minimum Width can be used for sections up to 100m where there is a physical constraint on an existing road (see Section 1.3), including drainage gullies, as cyclists will avoid over-running them.

Table 2.2.11 Minimum Widths of Cycle Tracks and Cycle Lanes

Cycle Route Type	Peak hour cycle flow (either 1-way or 2-way depending on Cycle Route Type)	Desirable Minimum Width	Absolute Minimum Width (for sections up to 100m)
Cycle Lane	<150	2.0m	1.5m
Cycle lanes with light segregation	<150	2.5m	1.5m
1-way cycle track (including stepped cycle track)	<150	2.5m	1.5m
	150-750	3.0m	2.5m
	>750	4.0m	3.5m
2-way cycle track	<150	3.0m	2.5m
	>150	4.0m	3.5m

Note: Table 2.2.11.1 describes additional clearances to maintain effective widths for cyclists on cycle tracks and in cycle lanes with light segregation.

Minimum additional width requirements on cycle tracks to make allowance for fixed objects adjacent to or within the cycle track shall be as described in Table 2.2.11.1. These shall be added to the dimensions given in Table 2.2.11. Where an object is present on both sides of the cycle route, then allowance for both objects shall be made.

Table 2.2.11.1 Additional width to maintain effective widths for cyclists on cycle tracks

Type of edge constraint	Additional width required to maintain effective width of cycle track (mm)
Flush or near-flush surface	No additional width needed
Kerb up to 150mm high	Add 200
Vertical feature from 150 to 600 mm high	Add 250
Vertical feature above 600 mm high	Add 500
Drainage Gullies	Width of Drainage Gully

2.2.12. Personal security on cycle routes

The following design characteristics improve the personal security of users on cycle routes:

- Cycle routes within the view of passing people and passing traffic.
- Lighting (reference Section 2.3.7).
- Underbridges that provide cross-sections wider than the specified values with flared wing-walls, good lighting and good sight lines.
- Vegetation that is a low growing variety (up to 0.8m) on underbridge approaches and adjacent to entries.

2.3. Cycle Traffic on Links

2.3.1. Types of Provision

There are several ways to provide cycle route infrastructure on links depending on the degree of separation that is required between cyclists and other modes.

Table 2.2.2 provides requirements for provision choice in relation to motor traffic speeds and volumes.

The separation of cyclists, pedestrians and equestrians on new or improved highways is important because each travels at different speeds and has different design requirements that newly built infrastructure should meet. The design requirements of pedestrian and equestrian routes can be found in TA 90/05 [13] and TA 91/05 [1].

2.3.2. Cycle Tracks

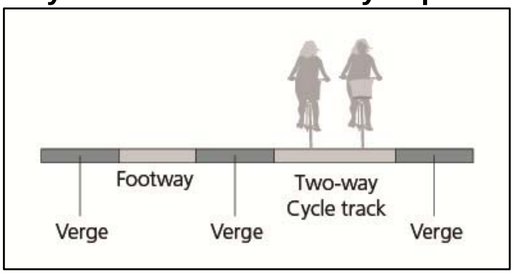
Cycle tracks are commonly located within the highway boundary and separated from the carriageway by a verge.

The designer shall ensure sufficient land is provided at the preliminary design stage to accommodate cycle tracks, footways and roadside features. This issue shall be considered carefully at junctions and crossings where, to minimise delays and hazards to cycle traffic, it may be necessary to bend the route out away from a side road junction mouth (that is, away from the main route carriageway), or to offer grade separation to cross the side road.

Sign posts and lighting columns shall not be placed within the width of a cycle track, and shall have a minimum clearance of 500mm between the edge of the cycle facility and any parts of the sign or lighting assembly that are less than 2.3m in height.

Separation of a footway and cycle track using a verge (as illustrated in Figure 2.3.2) offers a more comfortable experience because it keeps pedestrians and faster-moving cyclists separate. Drainage can run off to the unsurfaced sides or into a French drain.

Figure 2.3.2 Cycle Track and Footway Separated by Verge



Where cross-section space is limited, separation by level provides clarity for users about which section is the footway and which is the cycle track. A full height or half-height kerb may be used to provide separation (as illustrated in Figures 2.3.2.1 and 2.3.2.2). Using splayed kerbs along the edges increases the effective width of the cycle track and helps to prevent collisions by reducing the risk of pedals striking the kerb. This arrangement will require positive drainage to prevent ponding on the cycle track.

Figure 2.3.2.1 Cycle Track and Footway Separated by Level

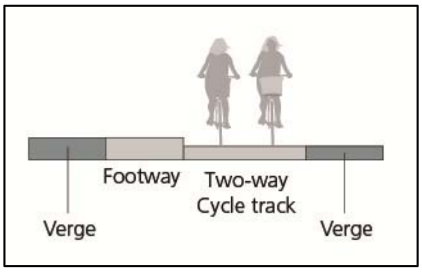


Figure 2.3.2.2 Cycle track and Footway Separated by Level with Good Quality Surface and Lighting

Cycle tracks can be one-way or two-way, each has different advantages and disadvantages as described in Table 2.3.2. Of all the considerations outlined in the table the most important consideration, and the one likely to lead to designers avoiding using two-way tracks, concerns hazards at side road crossings with priority control. Solutions include grade separation or use of one-way cycle tracks.

Table 2.3.2 Characteristics, hazards and uses of One-Way and Two-way Cycle tracks with priority control

	One-way cycle track with same direction of flow as adjacent general traffic lane in carriageway	**Two-way cycle track on one side of carriageway**
Characteristics		
Layout	Cycle tracks required along both sides of carriageway.	One cycle track required (although, in order to provide a reasonably coherent network, two way tracks may be needed on both sides of a carriageway at certain locations, for example, around and between large and/or closely spaced junctions).
Directness and coherence	Crossings of carriageway required to access and leave the cycle track and make all movements.	Crossings of carriageway required to reach destinations on the opposite side of carriageway from the cycle track; and for cyclists on that side to access the cycle track.
Hazards		
Turning movements	Cycle traffic at risk from left turning traffic entering side roads.	Cycle traffic at risk from left turning traffic entering side roads.
	Cycle traffic at risk, but lesser risk than with two way cycle tracks, from right turning traffic entering side road and from minor road traffic entering the junction.	Cycle traffic at risk from right turning traffic entering side roads.
Blocking issues	Cycle track may be blocked by traffic queuing on side road, affecting one direction of cycle traffic.	Cycle track may be blocked by traffic queuing on side road, affecting both directions of cycle traffic.
	Cyclists may use main carriageway if side road blocked. This use would be in the same direction of travel as the adjacent general traffic lane.	Cyclists may use main carriageway if side road blocked. This may encourage use of the carriageway by cycle traffic travelling in the opposite direction to traffic in the adjacent general traffic lane.
Sight lines and visibility	When crossing side roads, whatever form of priority or control is provided, cyclists need to look behind to check for left turning vehicles.	When crossing side roads, whatever form of priority or control is provided, cyclists need to look behind to check for left turning vehicles (or right turning vehicles if travelling in the opposite direction to the adjacent general traffic flow).
	n/a	Sufficient separation or barriers may be needed to reduce risk of drivers being dazzled by oncoming cycle lights and cyclists being dazzled by oncoming vehicle head lights particularly on unlit roads.
	Cyclists may incorrectly use one-way tracks in the wrong direction if it is easier than crossing a major road. If cycle users persist in using one-way tracks the wrong way, this suggests that the facility may need to be made two-way.	n/a
Implementation Locations		
Locations	Urban areas due to high frequency of side roads.	Rural and urban areas with few side roads.
	n/a	Large junctions where network for cycle traffic needs to maintain coherence.

Note: For “non-priority control” layout requirements, reference Table 2.4.2.

In situations where there are one-way cycle tracks on links approaching junctions, designers should provide two-way cycle tracks within the junction if they offer a safer more direct way to negotiate the junction.

One-way cycle tracks adjacent to the carriageway enable cyclists to proceed in the same direction as the motor traffic (as illustrated in Figure 2.3.2.3). One-way cycle tracks are generally safer than two-way tracks at side road crossings, and they avoid potential problems with glare from vehicle lights and cycle lights.

Figure 2.3.2.3 One-way Cycle Tracks Adjacent to Carriageway

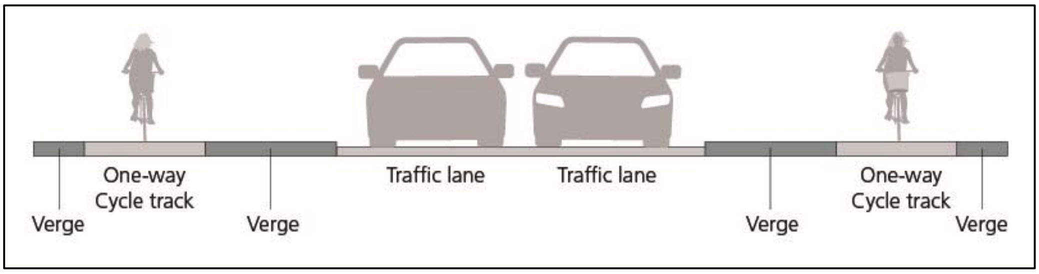
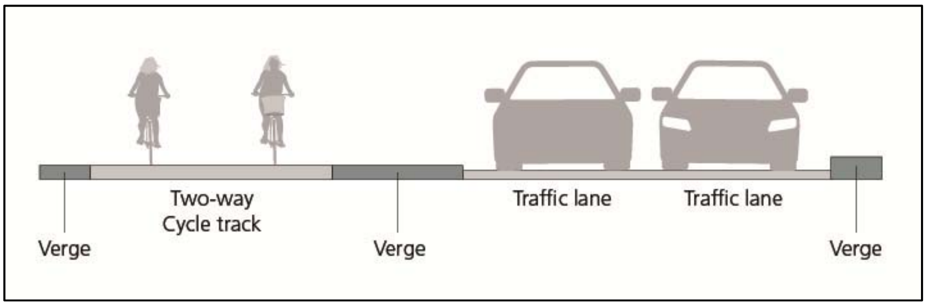


Figure 2.3.2.4 shows a two-way track arrangement. Designers shall use centre line markings on two-way cycle tracks to reinforce the Highway Code which states that users should keep to the left. The use of centre line markings also helps to differentiate one-way cycle tracks from two-way cycle tracks.

Figure 2.3.2.4 Two-way Cycle Track Adjacent to Carriageway



The requirements for separation between the cycle track and carriageway are outlined in Table 2.3.3. The cycle track may be provided at the same level as the carriageway (this arrangement may be suitable on links where provision alternates between cycle lanes and cycle tracks) or at a higher level than the carriageway.

The footway may be adjacent to the cycle track and separated from it by a kerb or a verge.

Figure 2.3.2.5 shows a separation between the carriageway and the cycle track based on these criteria.

Figure 2.3.2.5 Cycle Track with Wide Verge

2.3.3. Horizontal Separation between Cycle Track and the carriageway

Horizontal separation helps protect cyclists from the draught created by passing motor traffic and from debris thrown up from the carriageway.

The minimum width of the horizontal separation between the carriageway and the closest edge of the riding surface of a cycle track, shall be determined using the values in Table 2.3.3.

Table 2.3.3 Minimum Horizontal Separation between Carriageway and Cycle Tracks

Speed Limit (mph)	Desirable Minimum Horizontal Separation (m)	Absolute Minimum Horizontal Separation (m)
30	0.5	N/A
40	1.0	0.5
50	2.0 (including any hard strip)	1.5 (including any hard strip)
60	2.5 (including any hard strip)	2.0 (including any hard strip)
70	3.5 (including any hard strip)	3.0 (including any hard strip)

The horizontal separation shall be increased if necessary to safely accommodate street furniture. Positioning street furniture between the highway boundary and the cycle track should be considered as preferable to positions that lie between the cycle track and carriageway.

Using separation distances greater than the absolute minimum values will improve attractiveness and help reduce the effect of glare from oncoming headlights in dark conditions.

A footway may be adjacent to the cycle track and should be separated from it by a kerb or a verge.

In unlit areas a solid white line to the Traffic Signs Regulations and General Directions (TSRGD) [15][1] Diagram 1049 may be used to mark the edge of a cycle track adjacent to a kerb. If used, such a line shall be in conjunction with an edge of carriageway marking to avoid drivers from mistaking the cycle track marking for an edge of carriageway marking.

2.3.4. Stepped Cycle Tracks

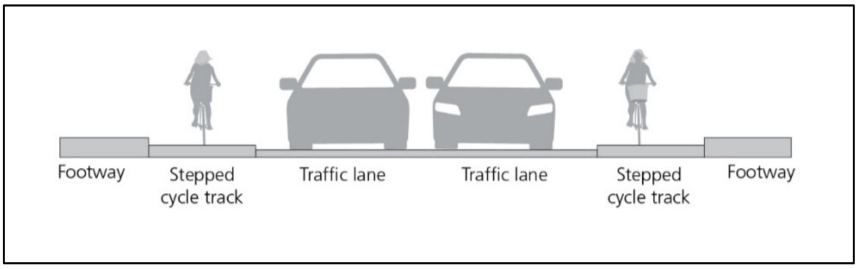
Stepped cycle tracks (as illustrated in Figures 2.3.4 and 2.3.4.1) are suitable for roads with 30 mph speed limit or less (reference Table 2.2.2).

Stepped cycle tracks are one-way in the same direction of flow as the adjacent traffic lane. Where a stepped cycle track is to be used, cycle facilities shall also be provided on the opposite side of the road to deter cyclists from using a stepped track as a two-way facility.

The height difference from the carriageway shall be a minimum of 50mm with a further 25-50mm step up to an adjacent footway (if present and not separated by a verge).

The advantage of the stepped cycle track is that it provides physical separation in a space efficient way by taking a similar amount of space to a cycle lane, and it allows cyclists to retain priority at side road junctions which have give-way priority. Stepped tracks shall return to the carriageway and become initially mandatory lanes before changing to Diagram 1010 (reference TSRGD) [15][2] markings through junctions.

Figure 2.3.4 Stepped Cycle Track



[1] This requirement anticipates the coming into force of the revised Traffic Signs Regulations and General Directions, which is planned for 2016. Until this document is published, special authorisation from the Department for Transport will be required in order to comply with the text as written.
[2] This requirement anticipates the coming into force of the revised Traffic Signs Regulations and General Directions, which is planned for 2016. Until this document is published, special authorisation from the Department for Transport will be required in order to comply with the text as written.

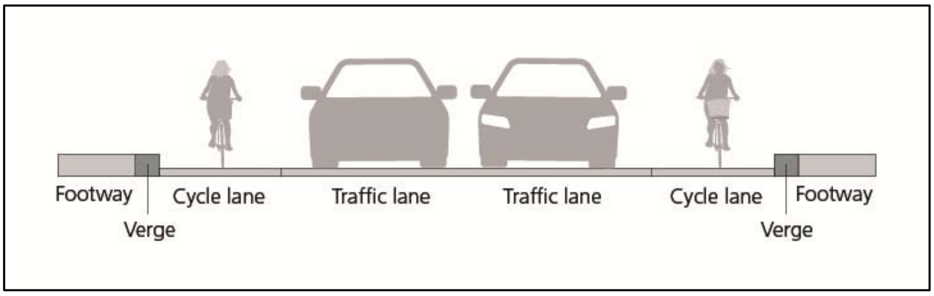
Figure 2.3.4.1 Stepped track between carriageway and footway

2.3.5. Cycle Lanes

Cycle lanes (as illustrated in Figure 2.3.5) are on-carriageway provision for cycle traffic and are suitable for roads with 30 mph speed limit or less (reference Table 2.2.2). They are delineated by either a solid white line marking (for mandatory cycle lanes which other vehicles must not enter except to pick up or set down passengers, or in case of emergency) or a broken white line marking (for advisory cycle lanes which other vehicles should not enter unless it is seen to be safe to do so). Cycle lane markings can help to improve lane discipline and keep a clear space for cyclists.

Traffic lane widths shall be designed in accordance with TD 27. Dimensions for cycle lanes are given in Table 2.2.11.

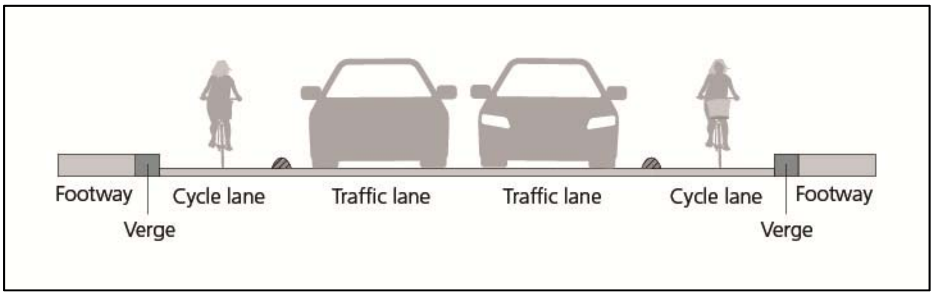
Figure 2.3.5 Cycle Lanes



Light segregated cycle lanes (as illustrated in Figures 2.3.5.1) are mandatory cycle lanes with the addition of intermittent physical objects between general traffic and cycle traffic to reduce the risks of motor vehicle incursion. A solid white line shall be marked on the motor vehicle side of the vertical feature.

A variety of options exist for the separating feature and the designer shall discuss these with Highways England. The options may include flexible bollards, low height separators (typically less than 0.3m vertical height) or an intermittent raised kerb. The offset between the nearside of the solid edge line and the features shall be selected using the advice of Traffic Signs Manual Chapter 5 for refuge islands [16].

Figure 2.3.5.1 Light Segregated Cycle Lane



2.3.6. Bus Lanes and Bus Stops on Cycle Routes

The minimum separation requirements set out for cycle traffic in Table 2.2.2 also apply where a bus lane is provided. If cycling is intended to take place on the carriageway, this should be in a separate 2.0m wide cycle lane or a shared bus lane no narrower than 4.5m wide, and with a speed limit of 30mph. A separate cycle track shall be provided if the speed limit for a bus lane is 40mph or above.

Bus stops may be a point of conflict between cyclists and buses and also between pedestrians and cyclists. The bus stop shall be placed so that users on the bus do not directly step down onto a cycle track when leaving the bus.

An example of good practice is shown in Figure 2.3.6, which shows how the designer has encouraged pedestrians to access the bus stop via the cycle track at a specific location using tactile pavers. Where there are high numbers of people boarding and alighting at the stop, consideration shall be given to the use of a zebra crossing at such crossing locations. Zebra crossings of cycle tracks do not require belisha beacons or zig-zag markings. Transitions between the cycle lane and the cycle track behind the bus stop shall be in accordance with Section 2.3.9.

Where a route with cycle lanes has bus stops, the cycle facility shall be changed to a cycle track at the back of the bus stop where space is available. Alternatively the cycle lane markings shall be omitted for the length of the bus stop, except where the bus stop is in a bus lay-by which would allow the cycle lane markings to continue outside the lay-by.

Figure 2.3.6 Cycle Lane with Bus Stop Bypass

2.3.7. Providing for cycle traffic at night

Decisions on lighting of cycle facilities should be determined using Sections 8.12 to 8.19 in TA91/05 [1] and TA49/07 [38].

2.3.8. Barriers to prevent motor traffic access to a cycle route

In most cases, a single bollard (reference Figure 2.3.8) is sufficient to prevent motor traffic from entering routes for cycle traffic. The gap between posts and other physical constraints shall be no less than 1.5m so as to prevent access by cars while retaining access by cycles. Bollards shall be aligned in such a way that enables a cycle design vehicle to approach them in a straight alignment.

A frame and K Frame type barriers, often used to prevent motorcycle access, shall not be used on cycle routes because they cannot be negotiated by the cycle design vehicle.

When designing the positioning of bollards, access for maintenance shall be agreed with the maintaining agent.

Figure 2.3.8 Lockable bollard preventing car access

2.3.9. Transitions between Cycle Tracks and Carriageway

Where a cycle track re-joins the carriageway as illustrated in Figure 2.3.9, the merge shall be designed so as to reduce the risk of cyclists being hit by traffic from behind whilst also not inconveniencing on-carriageway cyclists.

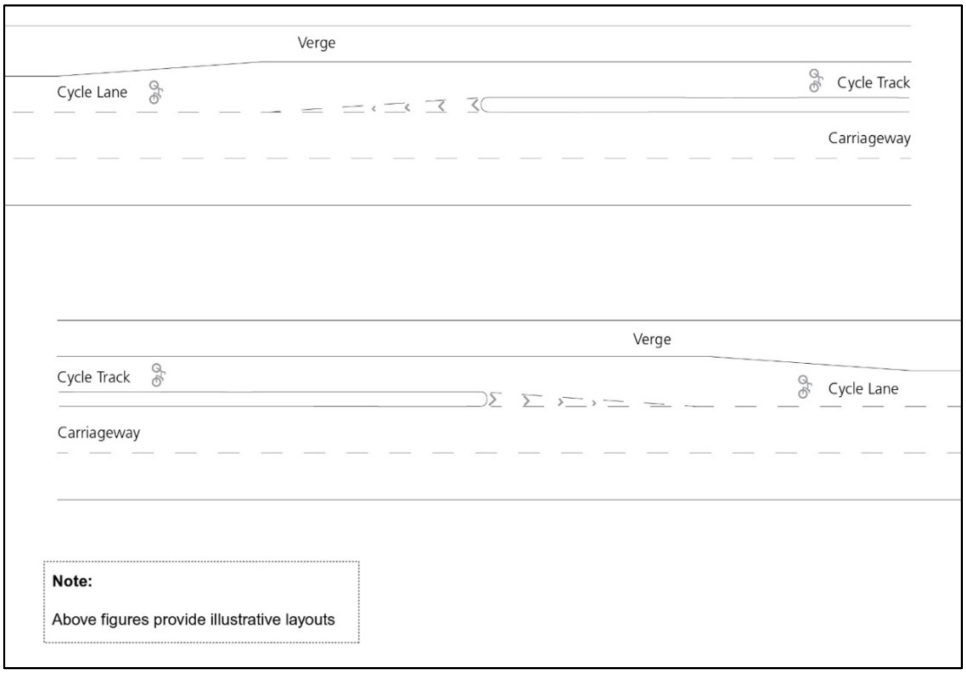
Figure 2.3.9 Cycle Track merges into Cycle Lane

Where a cycle lane leaves the carriageway and becomes a cycle track running parallel with the carriageway (as illustrated in Figure 2.3.9.1), the transition between the two shall be smooth and gradual. Transitions between the cycle track and the carriageway shall not be across a kerb; the transition shall be continuous surfacing course.

Figure 2.3.9.1 Cycle Lane merges into Cycle Track (not UK)

Example layouts for assisting cycle traffic to move between cycle lanes and cycle tracks are illustrated in Figure 2.3.9.2.

Figure 2.3.9.2 Transition between Cycle Lanes and Cycle Tracks



2.4. Cycle Traffic at At-Grade Junctions and Crossings

2.4.1. Context

The nature of the SRN requires junctions that enable large volumes of motor traffic to pass through with minimal delay. Such junctions often create significant conflict between cycle traffic and motor traffic. Separate provision can be achieved in several ways:

- Providing dedicated space for cycle traffic away from the carriageway e.g. cycle tracks, underbridges and overbridges.
- At priority junctions and roundabouts, providing signalisation to enable cycle traffic to use the carriageway at a separate time to motor traffic.
- At signalised junctions providing separate space and time for cycle traffic. Techniques include advanced green signals, cycle traffic-only phases and toucan crossings.
- Prohibiting specific turning movements for motor traffic and/or cycle traffic to eliminate conflict between these users where appropriate alternative routes are available.
- Providing clearly marked priority for cycle traffic where appropriate, particularly where it crosses side-roads.
- Slowing motor traffic to the same speed as cycle traffic at potential conflict points and on low volume roads. This may be an option on side roads and where the SRN passes through urban areas.
- Providing alternative routes to enable cycle traffic to avoid junctions, although such routes shall not add significant additional delay or distance, otherwise cyclists may not use them.

Section 2.7 provides information on crossings of signalised roundabouts; reference shall be made to the London Cycling Design Standards (LCDS) [17] for guidance relating to on-carriageway cycle facilities at other forms of signal controlled junctions. Where guidance in the LCDS is in conflict with DMRB, DMRB shall be used.

2.4.2. Cycle Crossing Design Options

Table 2.4.2 shall be used to determine the type of cycle crossing provided on links and at junctions. Designers shall use the “preferred” option in Table 2.4.2 unless there is a need to provide continuity with other existing cycle route provision and where agreed with Highways England; in these circumstances the “other possible” crossing options in Table 2.4.2 shall be permitted.

Where cycle traffic is required to stop when crossing the minor arms of junctions and roundabout entries and exits, this will reduce the overall speed of cycle traffic using the cycle track and hence its directness in terms of time (reference Section 2.2.1) compared to remaining on the carriageway. The stopping of cycle traffic flows is avoided by providing a grade separated crossing (reference Section 2.5), by using a signalised crossing with advance cycle detection, or by giving cycle traffic priority at the crossing point.

The number of lanes to be crossed in any one movement shall take account of any refuges or median islands provided to enable cycle traffic to cross the junction in stages. Keep clear markings shall be used where queueing traffic would otherwise block cycle crossing movements.

Table 2.4.2 Suitable Types of Cycle Crossing

Speed Limit	Location Type	2 way traffic flow on carriageway to be crossed, AADT	Maximum number of lanes to be crossed in one movement	Preferred cycle crossing type	Other possible cycle crossing type(s), in order of preference
≥60mph	All	Any	Any	Grade separated	No alternative
40mph and 50mph	All	> 10,000	Any	Grade separated	Signalised cycle crossing
		6,000 -10,000	2 or more	Grade separated	Signalised cycle crossing
		0-6,000	2	Priority: cycle traffic gives way	Grade separated or Signalised cycle crossing
		0-10,000	1	Priority: cycle traffic gives way	Grade separated or Signalised cycle crossing
≤30mph	Links	> 8,000	Any	Grade separated	Signalised cycle crossing
		0- 8,000	2	Parallel pedestrian/cyclist crossing, desirably on raised table.	Signalised cycle crossing or Grade separated
		0-4,000	1	Priority: cycle traffic has priority; desirably on raised table	Signalised Cycle Crossing or Grade separated
	Roundabout Entries	> 8,000	Any	Grade separated	Signalised cycle crossing
		0-8,000	2	Parallel pedestrian/cyclist crossing, desirably on raised table.	Signalised cycle crossing or Grade separated
		0-4,000	1	Priority: cycle traffic gives way	Signalised Cycle Crossing or Grade separated
	Roundabout Exits	> 8,000	Any	Grade separated	Signalised cycle crossing
		0-8,000	1	Parallel pedestrian/cyclist crossing, desirably on raised table.	Signalised Cycle Crossing or Grade separated
		0-4,000	1	Priority: cycle traffic gives way	Signalised Cycle Crossing or Grade separated
	Side Road Entries	>8,000	Any	Grade separated	Signalised cycle crossing
		0-8,000	2	Parallel pedestrian/cyclist crossing, desirably on raised table	Signalised Cycle Crossing or Grade separated
		0-2,000	1	Priority: cycle traffic has priority; desirably on raised table	Signalised Cycle Crossing or Grade separated
	Side Road Exits	>8,000	Any	Grade separated	Signalised cycle crossing
		0-8,000	1	Parallel pedestrian/cyclist crossing, desirably on raised table (see note 8)	Signalised Cycle Crossing or Grade separated
		0-2,000	1	Priority: cycle traffic has priority; desirably on raised table (see note 8)	Signalised Cycle Crossing or Grade separated

Note 1 – Where the number of traffic lanes to be crossed exceeds the upper limit for a priority or parallel crossing, a grade separated or signalised crossing shall be used.

Note 2 – Traffic Advisory Leaflet 02/03 Signal controls at junctions on high speed roads [18] advises that traffic signals are not recommended where the 85th percentile approach speed exceeds 65mph (104kph).

Note 3 – Signalised cycle crossing includes toucan crossings.

Note 4 – The same type of crossing shall be used across a junction entry and exit.

Note 5 – 'Speed Limit' parameter refers to the greatest speed limit on any arm at the junction.

Note 6 – '2 way traffic flow' refers to the traffic flow on the link to be crossed by cycle traffic

Note 7 – For crossings of minor private accesses, refer to Section 2.4.11

Note 8 – Cycle priority will not be appropriate at side road exits where there is a significant potential conflict between turning HGVs and through traffic on the main road. The degree of conflict shall be assessed based on the forecast flow of cyclists using the track, the number of HGVs entering the minor road and the volume of through traffic.

2.4.3. Priority Cycle Crossings

Priority crossings provide an opportunity for cycle traffic to cross carriageways without significant infrastructure being required.

Typically on the SRN, cycle traffic will be required to give way to motor traffic but where motor traffic flows and speeds meet the appropriate criteria in Table 2.4.2, this priority shall be reversed by providing give way markings for traffic on the carriageway as shown in Figure 10.2 of Local Transport Note 02/08 [8].

Where cycle traffic has priority, the cycle track shall be placed on a flat-topped speed hump and adequate visibility provided (reference Section 2.2). All speed humps must be constructed in accordance with the Highways (Road Humps) Regulations [19].

The use of coloured surfacing in accordance with TA 81/99 Coloured Surfacing in Road Layout (Excluding Traffic Calming) [20] across the carriageway at the crossing point should be provided to highlight an area of the road intended for cycles.

2.4.4. Parallel Pedestrian/Cyclist Crossings

This crossing type, which operates similarly to a Zebra crossing, shall be used on links and at junctions in accordance with Table 2.4.2 and where it is necessary to provide a crossing facility which caters for both cycle traffic and pedestrians.

Statutory requirements for the layout of parallel pedestrian/cyclist crossings for pedestrians and cycle traffic are given in TSRGD [15][3].

At roundabouts, parallel pedestrian and cycle crossings can be introduced between 5m and 20m from the give-way line and reduce delays to all road users. Signalised crossings can be introduced at 20m or more than 60m from the give-way line.

2.4.5. Signalised Cycle Crossings

Signalised cycle crossings on links are effectively traffic signal controlled junctions where one or more junction arms are for cycle traffic only. Cycle crossing facilities may also form part of a traffic signal controlled junction between roads carrying general traffic.

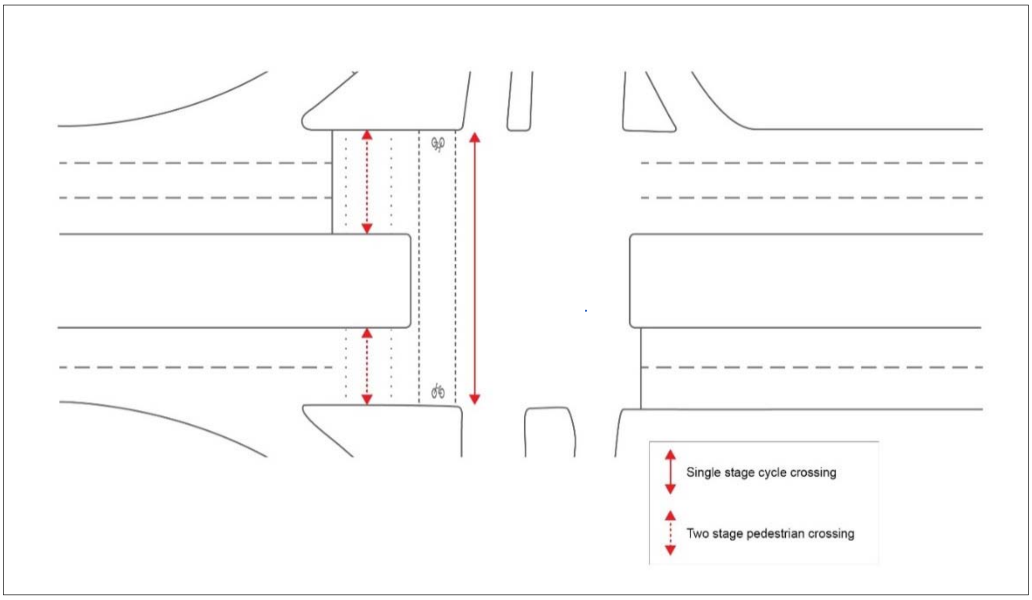
Cycle traffic may be controlled by low and high level cycle signals at the cycle stop line. Secondary high level cycle signals should be considered where there is a risk for approaching cyclists of poor visibility of low level signals, or obscuration, due to layout constraints or high levels of demand. Where practicable, detectors shall be provided on the approaches to signalised crossings so that the cycle green phase is called in advance of a cyclist arriving at the stop line. Where a cycle route passes through a series of signalised crossings, consideration shall be given to coordinating the signals to provide a green wave for cycle traffic, based on the cycle traffic design speed.

[3] This requirement anticipates the coming into force of the revised Traffic Signs Regulations and General Directions, which is planned for 2016.

Signalised cycle crossings shall be provided with road markings to Diagram 1055.3 (TSRGD) [15][3] Table 69, Item 55 (informally known as Elephant's Footprints) to indicate to all road users the presence of the crossing and the route to be taken by cycle traffic.

Cycle traffic speeds are greater than walking speeds and the default option should be to design crossings separate from pedestrians and as a single stage hence without the need for cycle traffic to wait on islands in the middle of signal controlled junctions.

Figure 2.4.5 Single Stage Cycle Crossing at Signalised Junction, Parallel to Two Stage Pedestrian Crossing Facilities



The design of the cycle crossing facility shall make it clear that it is not to be used by pedestrians. In addition to the requirement for cycle signals at the cycle traffic stop line, consideration shall be given to using kerbs to separate the footway and cycle track. The footway and cycle track shall be paved in contrasting materials. Tactile paving at the pedestrian crossing shall be provided to assist visually impaired pedestrians (reference Inclusive Mobility [25]).

Signal timings for cycle crossings shall take account of the time taken by cyclists to complete the crossing from a standing start, based on the design parameters given in Table 2.4.5.

Note that the crossing times in Table 2.4.5.1 are determined principally by the acceleration rate. Designers may consider there are circumstances where the maximum design speed of 15 km/h, as suggested for gradients of 3%, is appropriate as the design speed for flatter crossings. Note that pedestrian crossing speed is assumed to be 1.2 m/s, or 4.3 km/h, which is a much lower speed than cyclists can travel at.

Table 2.4.5 Design Parameters for Calculating Signal Timings for Cycle Traffic

Design Parameter	Flat, downhill or uphill gradient of less than 3%	Uphill gradient of 3% or more
Reaction time	1 second	
Acceleration	0.5 m/s^2	0.4 m/s^2
Maximum design speed	20 kph	15 kph
Length of cycle*	2.8m	2.8m

*Note: * allows for cycle design vehicle*

The assumed maximum design speed is based on the Absolute Minimum given in Table 2.2.3 to allow for slower-moving cyclists to clear the signals safely.

Based on the design parameters given in Table 2.4.5 the times required for cyclists to cross various distances from a standing start are given in Table 2.4.5.1.

Table 2.4.5.1 Cycle Crossing Times

Crossing Length (m)	Indicative Situation	Cycle Crossing Time from Standing Start	
		Flat, downhill or uphill gradient of less than 3% (seconds)	Uphill gradient of 3% or more (seconds)
8	Single Carriageway	8	8
10		8	9
12		9	10
14		9	10
16	Dual 2 Lane Carriageway	10	11
18		10	11
20		11	12
22		11	12
24	Dual 3 Lane Carriageway	11	13
26		12	13
28		12	14
30		12	14
32		13	15
34		13	15
36		14	16

The green aspect for cycle traffic shall run for the minimum of 7 seconds (normal minimum green time for crossings) and on-crossing detectors shall be used to extend the green aspect to the maximum green. The maximum green time shall be no less than the cycle crossing times given in Table 2.4.5.1, derived using Table 2.4.5.

Signal phases for cycle traffic may run in stages parallel with other traffic phases. Such stages shall be called if a cycle traffic demand exists, even if no demand exists on parallel traffic phases.

Inter-green timings shall be derived using Traffic Advisory Leaflet 01/06 General Principles of Traffic Control by Light Signals [21] and the data in Table 2.4.5 and Table 2.4.5.1.

2.4.6. Toucan Crossings

Toucan crossings are less comfortable for both pedestrians and cyclists than separate crossing facilities. They shall only be used where it is necessary to share the same space at the facility, for example where there is a shared path leading to the crossing or where there are complex off-carriageway pedestrian and cycle movements that are best accommodated in a shared use area.

Toucan crossings have the same form of pedestrian on-crossing detector as Puffin crossings. Minimum crossing times shall be defined by walking speeds. Pre-timed maxima shall be used so that delays to cyclists and pedestrians are minimised, unless this would give rise to unacceptable congestion for motorised traffic.

Further guidance on the design of Toucan crossings is given in Local Transport Note 02/08 [8] and Sustrans Technical Information Note Number 18 [22].

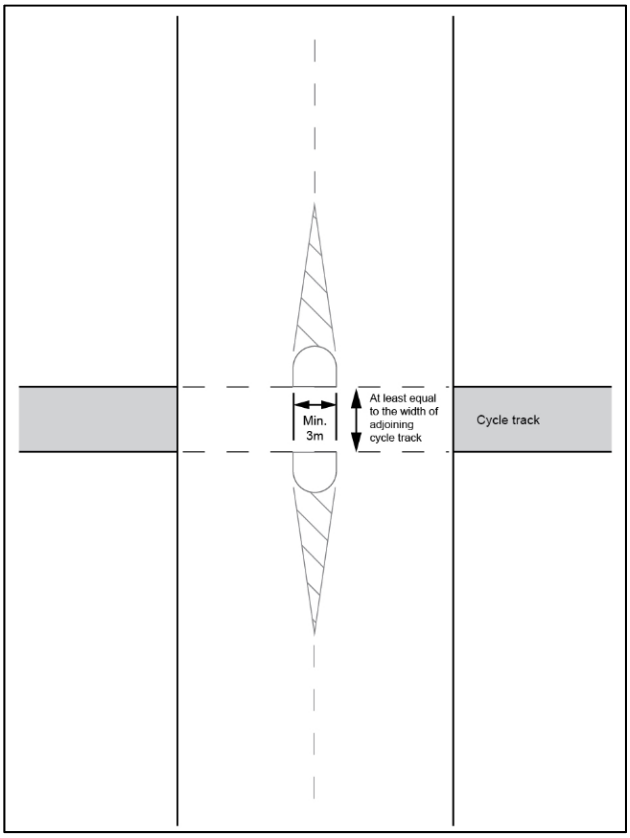
2.4.7. Refuges at Crossings

Refuges allow cycle traffic to cross carriageways in two or more separate movements. At unsignalised crossings they improve safety and comfort and reduce delay where cycle traffic does not have priority.

The width of the refuge as measured from the perspective of the crossing cyclist, i.e. its length along the carriageway being crossed, shall provide space for cycle traffic at least equal to the width of the cycle track connecting to the crossing point either side of the carriageway.

The depth of the refuge measured in the direction of cyclists’ travel shall be a minimum of 3m; this dimension accommodates a cycle design vehicle (reference Figure 2.4.7).

Figure 2.4.7 Refuge dimensions at crossing point



2.4.8. Staggered Crossings

Staggered crossings can be difficult to negotiate by cyclists, particularly people (including disabled people) using larger vehicles. Staggered crossings shall not be used unless the central refuge can accommodate the design parameters for the design cycle and a two-way cycle track (including pedestrian facilities where appropriate) in accordance with Tables 2.2.11 and 2.2.11.1.

Figure 2.4.8 Staggered crossing (only to be used where central refuge can accommodate the design cycle and cycle track parameters)

Where a staggered crossing is not used, if there are concerns that users may not understand that each half of a signalised crossing is to be treated independently, designers may introduce a shallow angle (of approximately 30 degrees) between the two halves of the crossings, and/or use nearside signal aspects.

Figure 2.4.8.1 Angled crossing (may be used where central refuge cannot accommodate a full stagger)

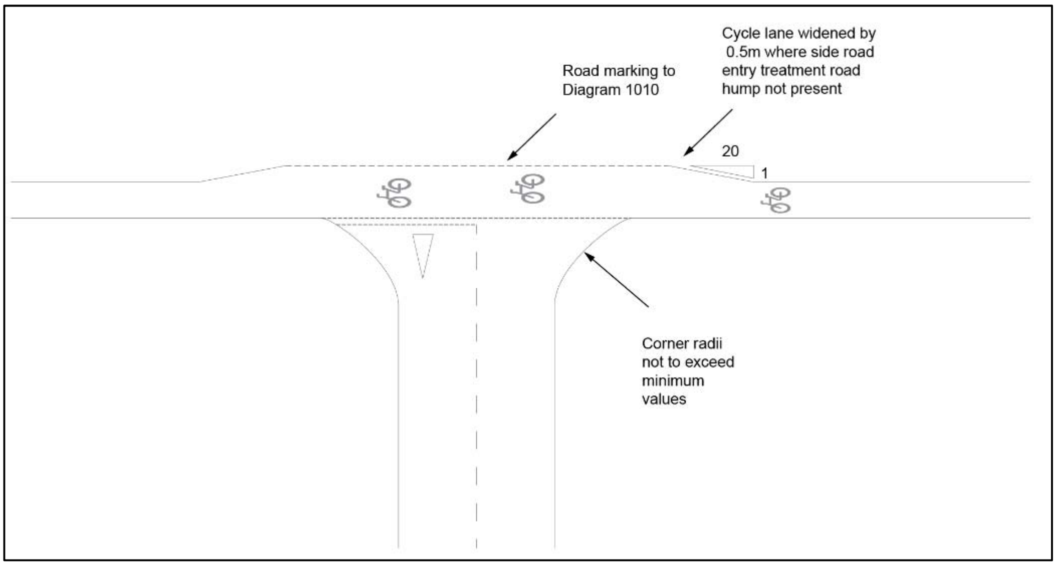
2.4.9. On-carriageway cycle provision at priority junctions

On-carriageway cycle provision shall only be considered on urban roads where motor traffic speeds and volumes permit (reference Table 2.2.2). Where on-carriageway cycle traffic interfaces with a priority junction, the following design requirements shall be used:

- Kerb radii at priority junctions shall not exceed the minimum values given in Section 7.17 of TD 42/95 [12]. The swept path of large vehicles turning into and out of the minor road can be accommodated using lane widening and overrun areas.
- Free-flowing entry and exit slip lanes at junctions create a safety risk for cycle traffic not turning at the junction. Where this layout exists cycle traffic shall be accommodated using off-carriageway facilities.
- The continuation of nearside cycle lanes using road markings to diagram 1010 (reference TSRGD) [15][4] across the minor arms at junctions, shall be provided. In addition to green coloured surfacing and/or cycle symbols. The width of the cycle lane shall be increased across the minor arm by a minimum of 0.5m, unless the junction approach from the minor arm is on a side road entry treatment road hump. The width of a cycle lane shall be an absolute minimum of 2m where the cycle lane is passing the mouth of junction that does not have a side road entry treatment.

Any physical segregation of cycle lanes on the major road approach to a priority junction shall be terminated a maximum 5m from the side road where the corner radius is up to 6m. Where a larger radius is used, the segregation shall terminate, from a line perpendicular to the edge of the minor road carriageway, a minimum of 20m from the side road. This is demonstrated in Figure 2.4.9.

Figure 2.4.9 On-carriageway cycle provision at priority junctions



[4] This requirement anticipates the coming into force of the revised Traffic Signs Regulations and General Directions, which is planned for 2016. Until this document is published, special authorisation from the Department for Transport will be required in order to comply with the text as written.

2.4.10. Off-carriageway cycle provision at priority junctions

Cycle tracks which intersect the minor arm at priority junctions are in potential conflict with motor vehicles turning into or out from the minor arm. To reduce this conflict, off-carriageway cycle tracks shall cross the minor road in one of two ways:

- ‘bent out’ away from the major road, so that cycle traffic crosses the minor arm away from the give way line (reference Figure 2.4.11.2). Where cycle tracks are already at the required distance from the main road, depending on the crossing type, there will be no change of alignment for cycle traffic.
- ‘bent in’ towards the major road so that cycle traffic crosses the mouth of the minor arm as a mandatory cycle lane (reference Figure 2.4.12). In the case of stepped tracks, where tracks are already adjacent to the major road, there will be no change of alignment for cycle traffic (reference Figure 2.4.13).

Any deviation of the cycle track on the approach to or exit from the crossing shall meet the requirements for horizontal curvature given in Table 2.2.7. To minimise any loss of directness (reference Section 2.4.2) the order of preference for off-carriageway cycle provision at priority junctions shall be:

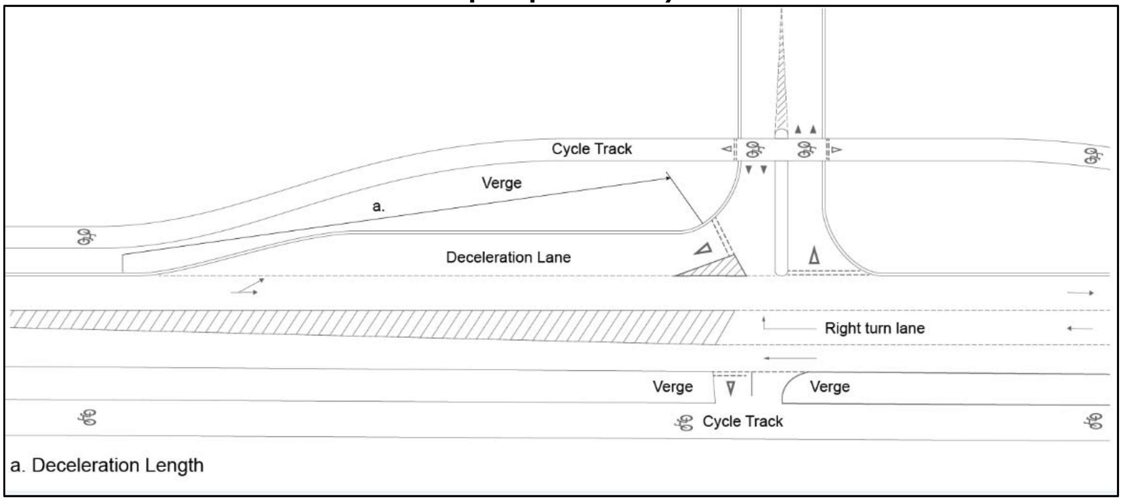
1. Bent-out crossing where cycle traffic does not need to stop by providing a grade separated crossing (reference Section 2.5) or a signalised crossing with advance cycle detection.
2. Bent-in crossing.
3. Bent out crossing where cycle traffic does not have priority

The decision to adopt at-grade priority for the cycle track will depend on the amount of traffic turning in and out of the side road (and the ability to safely accommodate the anticipated volume of traffic turning off the main road when cyclists are using the crossing).

2.4.11. Bent-out Crossings of Minor Roads

Bent-out crossings of minor roads are suitable for roads with a speed limit not greater than 30mph. They shall not be used for stepped tracks.

Figure 2.4.11.2 Bent-Out Crossings of Minor Roads (only for use with 30mph speed limit)



The type of crossing of the minor road shall be in accordance with Table 2.4.2.

The distance to the crossing shall be measured from the kerbline of the major road, or from the kerbline of the nearside diverging taper if present, to the nearest edge of the cycle track. If providing a nearside diverging taper lane, this shall be in accordance with Figure 7/11 of TD 42/95 and Clause 2.32 of TD 41/95 to reduce the speed of traffic exiting the major road and to provide additional stacking capacity, as shown in figure 2.4.11.2.
The set-back distance for the crossings of the minor arm of junctions shall be as follows:

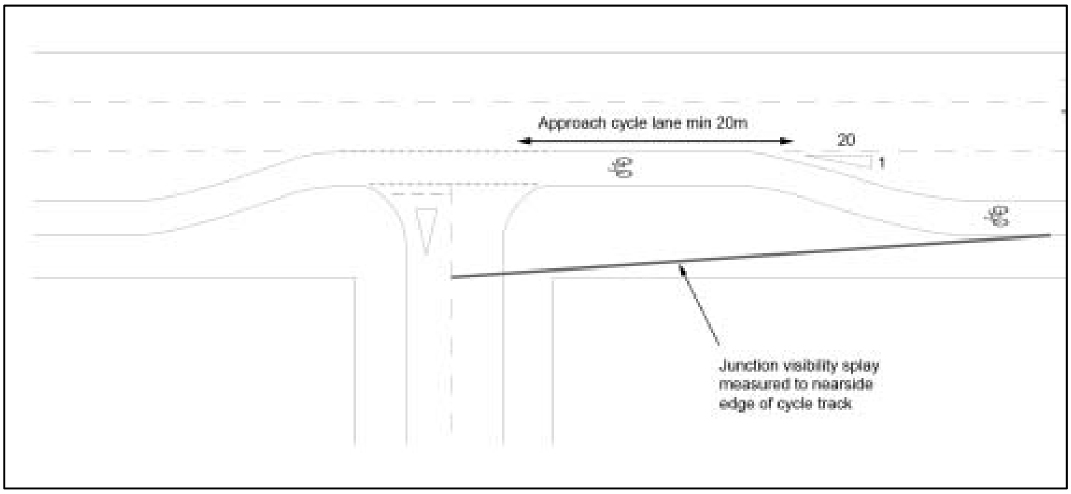
- Where cycle traffic does not have priority – 10m minimum.
- Where signal-controlled crossings of side roads are used, the crossing shall either be located sufficiently far from the major road that vehicles do not queue back into the main carriageway, or the whole junction shall be signal-controlled.

Where cycle tracks cross minor private access roads carrying less than 2000 AADT there shall be no marked priority for either cycle traffic or traffic using the minor arm; and a set-back minimum distance of 5m shall be used.

2.4.12. Bent-in Crossings of Minor Roads

Bent-in crossings of minor roads are suitable where the speed limit on any arm of the junction does not exceed 30mph. Cycle tracks at bent-in crossings shall be one-way.

Figure 2.4.12 Bent-In Crossing of Minor Road

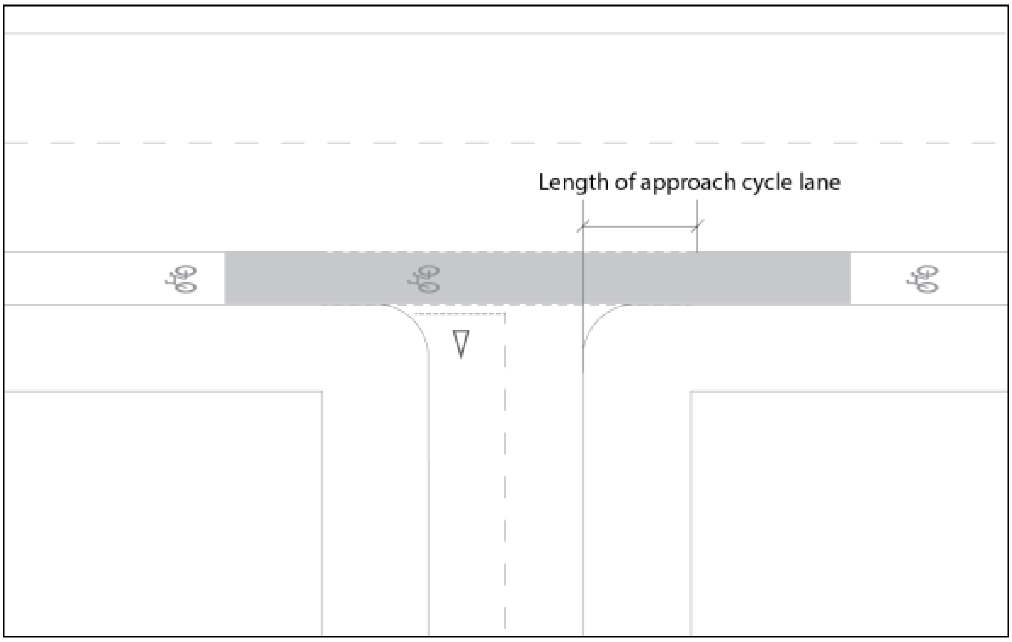


The length of the approach cycle lane shall be at least 70m and the designer shall ensure that the visibility splay as required in Table 7/1 of TD 42/95 Geometric Design of Major/Minor Priority Junctions [12] to the edge of the carriageway is expanded if required so that it extends to a point on the nearside edge of the cycle track using a ‘y’ distance as given in Table 2.2.5. The cycle lane shall return to a cycle track immediately beyond the mouth of the minor road junction. Transitions between the cycle track and cycle lane shall be in accordance with Section 2.3.9.

2.4.13. Stepped Track Crossings of Minor Roads

Stepped track crossings of minor roads are suitable where the speed limit on any arm of the junction does not exceed 30mph. Cycle tracks at stepped track crossings shall be one-way.

Figure 2.4.13 Stepped Track Crossing of Minor Road



Where a corner radius of up to 6m is used, the length of the approach cycle lane shall be a maximum of a 5m. Where a larger radius is used, the length of the approach cycle lane shall be 20m. Where the speed limit and traffic flows on the major road, downstream of the minor road, prohibit the use of a cycle lane, the cycle lane shall return to a cycle track immediately beyond the mouth of the minor road junction. Transitions between the cycle track and cycle lane shall be in accordance with Section 2.3.9.

2.5. Cycle Traffic at Grade Separated Cycle Track Crossings

Grade separation of cycle traffic from motor traffic is the preferred solution for the crossing of all high speed road links and junctions.

Grade separation can take the form of overbridges and underbridges (a term used to include underpasses and subways). If the grade separated crossing is indirect or of poor quality, users may choose to cross at-grade. The use of cycle track crossings by pedestrians and equestrians shall be considered alongside other user groups, where crossing facilities are shared.

Many existing underbridges and overbridges were designed prior to current guidance, or were not originally intended for use by cycle traffic. Where a new or modified cycle facility is to be provided at an existing bridge, existing features shall be modified to meet the requirements of this document. If it is not reasonably practicable to modify a structure, or the modification or retention does not meet the requirements of this document, designers shall assess the relative impacts of alternatives such as use of other routes or providing a new structure. If it is not practicable to modify a structure to meet the requirements of this document, this shall not automatically lead to a rejection of the structure for use by cycle traffic as this may still represent the best option available. In these situations designers shall discuss the matter with the Overseeing Organisation.

The design parameters in Section 2.2 shall be used for underbridges and overbridges, except where the Sections below provide further requirements specific to cycle routes on or under bridges

2.5.1. Underbridges

The location and alignment of underbridges and their accesses shall be arranged so that cyclists do not have long diversions from a direct line of travel.

The length of the underbridge shall be minimised in order to maximise natural light levels, and the gradient of access ramps shall also be minimised (Figures 2.5.1 and 2.5.1.1). These design characteristics can help maximise forward visibility and levels of natural light as well as the comfort (reference 2.2.1) of users travelling through the underbridge.

Figure 2.5.1.2 illustrates three options for providing underbridges – each has a different effect on the level change required by cyclists passing through the underbridge.

Figure 2.5.1 Maximising Natural Light and Visibility at an Underbridge

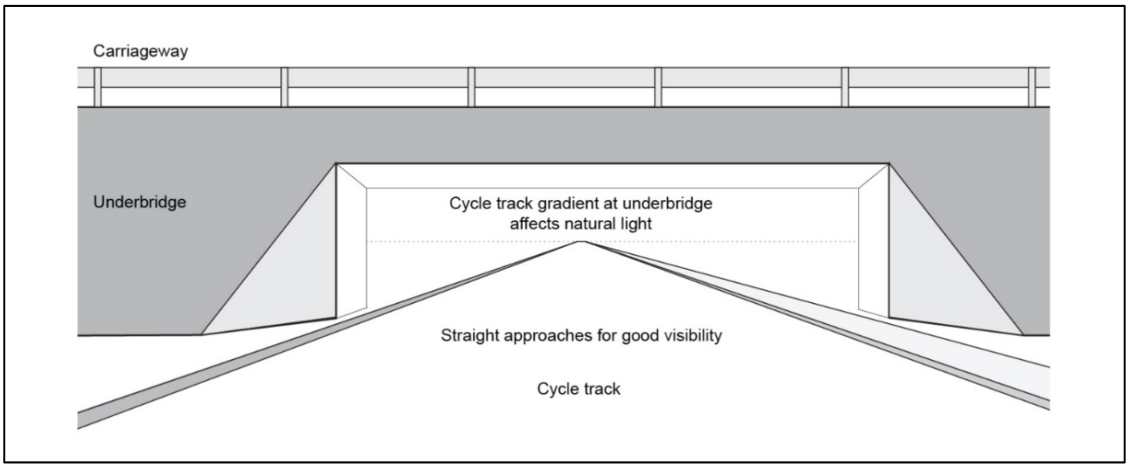
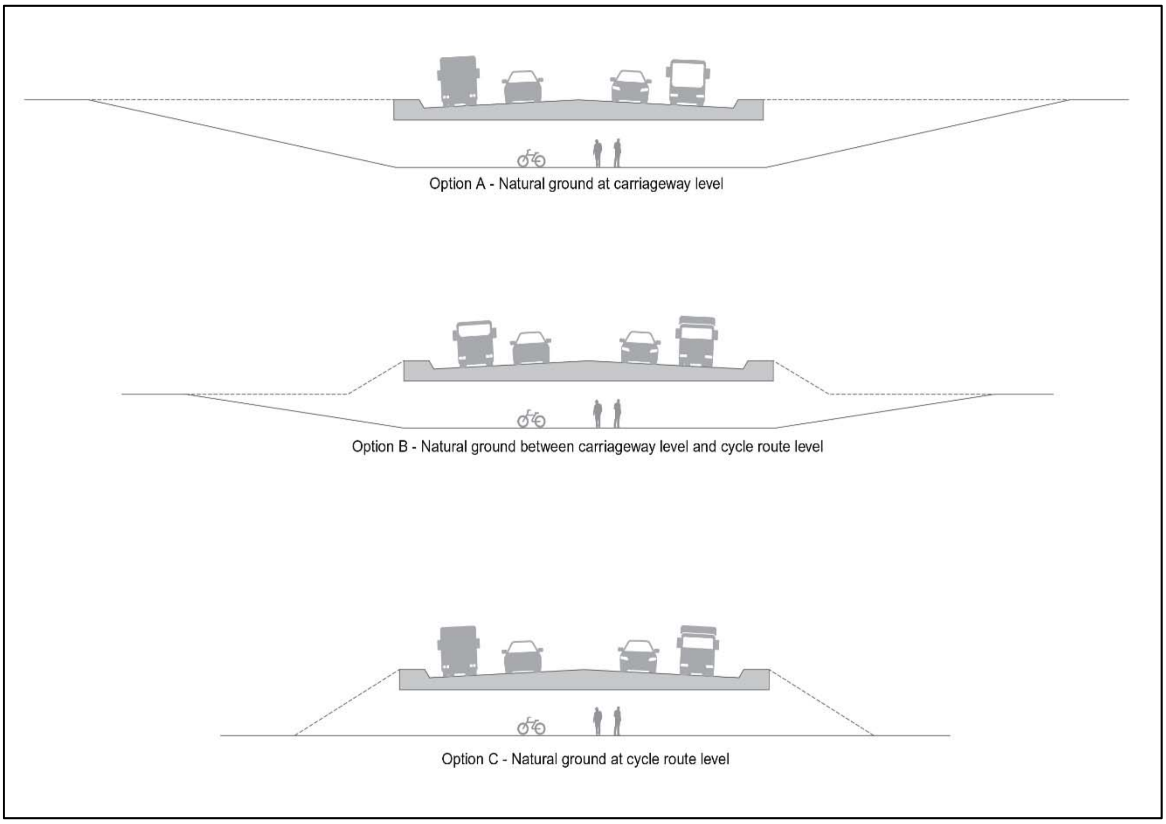


Figure 2.5.1.1 Maximising Natural Light and Minimising Gradients

Figure 2.5.1.2 Options for Underbridges to Minimise Gradient Change on Cycle Track



2.5.2. Underbridge Widths and Headroom

A minimum width of 3.0m shall be provided for two-way cycle traffic, however designers should consider increasing this dimension or other elements of the cross-section to increase the attractiveness of the facility by increasing the amount of natural light in the structure.

Desirable minimum underbridge heights and widths for cycle tracks and footways are set out in Table 2.5.2. Existing structures with lower headroom are acceptable subject to an Absolute Minimum of 2.2m. When deciding whether a headroom below desirable minimum is acceptable designers shall consider the forward visibility to the underbridge offered by the vertical and horizontal geometry. Signs to Diagrams 530 and 530.2 shall be used to warn of low headroom.

Table 2.5.2 Dimensions for Underbridges

Length (m)	Cycle Track Headroom (m)		Width (m)	
	Desirable Minimum	Absolute Minimum	Margin to Wall	Cycle Track
<23	2.4	2.2	1.0	3.0
≥23	2.7	2.2	1.0	3.0

Note: For minimum headroom for equestrians refer to TD36/93 Subways for Pedestrians and Pedal Cyclists Layout and Dimensions [23]

Natural light is also increased where wing walls are angled to maximise penetration of daylight beneath the underbridge; an example is illustrated in Figure 2.5.2.

Figure 2.5.2 Straight Approaches, Wide Profile and Flared Wing Walls Help to Maximise Visibility

Underbridges and their approaches are likely to be bounded by vertical or near vertical features such as retaining walls. Cycle tracks in underbridges shall include kerb separation from any adjacent pedestrian facility. Additional width requirements alongside vertical features are set out in Section 2.4.

2.5.3. Overbridges

The siting of an overbridge shall use the natural topography to minimise the requirement for ramps. Lowering of the carriageway can help achieve the desired ramp gradients for cycle design vehicles.

Where an overbridge is being introduced because a road severs an existing right of way, the overbridge shall be sited and aligned to minimise the diversion from the existing line of the cycle route.

Further detail regarding overbridge design is in BD 29/04 Design Criteria for Footbridges [24].

2.5.4. Overbridge Width and Covered Overbridge Headroom

Overbridges for use by cycles and pedestrians only, are generally designed for two-way use and shall conform to the design parameters for cycle traffic, set out in Section 2.2.

The width of a two-way cycle track shall be a minimum of 3.0m plus an additional 0.5m margin clearance to each parapet (Table 2.2.11.1). Where a footway is required, additional width shall be provided and the footway shall be separated with a kerb.

Where the overbridge is covered, the headroom shall be that prescribed for underbridge heights (reference Table 2.5.2). An illustration of a covered overbridge is provided in Figure 2.5.4.

Figure 2.5.4 Covered Bridge for Cycle Traffic and Pedestrians

2.5.5. Underbridges and Overbridges access gradients

Gradients on the approaches to underbridges and overbridges shall meet the criteria set out in Section 2.2.9.

The importance of helping the cycle design vehicle maintain momentum on ramps shall be considered and a ramp profile whereby the steepest gradient is at the bottom can reduce the effort needed to climb a ramp.

If the route is likely to be used by wheelchair users as well as cyclists, horizontal landings should be used, even on straight ramps, so that the total rise between landings is not greater than shown in Section 2.9. If a helical ramp is provided, it shall be of sufficient width to allow two cycles to pass comfortably while turning.

TD36/93 [23] and Inclusive Mobility [25] provide guidance for pedestrians.

2.5.6. Perpendicular Parapet Height

Table 2.5.6 gives the required perpendicular parapet height minimal values that shall be provided in various circumstances. Where an existing parapet height is less than 1.4m and it is impractical to increase its height, the Absolute Minimum as given in Table 2.5.6 may be used in the circumstances described in Section 1.3, where the risks of cyclists falling over the parapet are considered low and equestrian use is not expected. The designer shall consider the likelihood of high crosswinds and the overall proposed alignment of the cycle track relative to the parapet when determining these risks. Further guidance on the determination of appropriate parapet heights for cycle traffic is given in Reference [39].

Table 2.5.6 Minimum Parapet Height

Circumstance	Minimum Parapet Height (m)
Desirable minimum (no equestrians)	1.4
Desirable minimum (equestrians present)	1.8
Absolute minimum	1.2

2.5.7. Wheeling ramps

Where an existing stepped footbridge lies on a route used by cycle traffic, a wheeling ramp can be fitted to help cyclists push their cycle up and down the steps. Wheeling ramps shall be installed only as an interim solution until there is acceptable alternative provision that is accessible to users of all types of cycle. Signing for an alternative route shall be provided.

The ramp may be provided as a channel or by infilling a section of the steps. Examples of wheeling ramps can be seen in LTN 02/08 [8]. Wheeling ramps shall be a minimum of 100mm wide and be positioned 200mm from a vertical feature (for example a parapet or hand rail) to avoid handlebars and bags from becoming snagged. Wheeling ramps shall be compatible with existing handrails and other features of the facility.

2.5.8. Access restrictions

If there is a risk that motor vehicles will unlawfully use an underbridge or overbridge, bollards shall be installed at the access points, as set out in Section 2.3.8.

2.6. Cycle Traffic at Roundabouts

2.6.1. Context

TD 16/07 Geometric Design of Roundabouts [26] provides requirements and guidance for the design of roundabouts. References to provision for cyclists in TD 16/07 [26] shall be read in conjunction with this document.

Designers shall consider the following design options for roundabouts to accommodate cycle traffic:

- A Compact or Normal Roundabout with a separate cycle track around the outside of the junction and with cycle crossings.
- A Compact Roundabout without a cycle track around the outside of the junction. This option only applies where cycle traffic is on-carriageway at all roundabout entries and exits (reference Section 2.2).

On-carriageway cycle lanes shall not be provided on the perimeter of the circulatory carriageway, as they encourage cyclists to take up a nearside position where they are vulnerable to being hit by vehicles exiting the roundabout.

Where both options are possible, the first shall be preferred because most cyclists will prefer off-carriageway provision as they will perceive it to be safer and more comfortable. Where off-carriageway cycle tracks are used on the junction approaches, they shall link with tracks around the junction and crossings of each arm shall be provided in accordance with Section 2.6.4.

2.6.2. Compact Roundabouts

A Compact Roundabout has tighter geometry than a Normal Roundabout and hence motor traffic speeds through the junction are lower. Compact Roundabouts are also referred to as roundabouts with ‘continental design geometry’ (reference Traffic Advisory Leaflet 09/97, Cyclists at roundabouts: continental design geometry [27]).

Compact Roundabouts have arms that are aligned in a radial pattern, perpendicular to the inscribed circle, with unflared, single lane, entries and exits, and a single lane circulatory carriageway. Deflection at the entry is therefore generally greater than with Normal Roundabouts and the design 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.

Off-carriageway cycle tracks shall be provided at Compact Roundabouts when the total junction throughput is above 8,000 Annual Average Daily Traffic (AADT). When cycling is on-carriageway through the junction, any cycle lanes, light segregated cycle lanes or stepped cycle tracks shall end 20-30m in advance of the give way line so that cyclists integrate with motor traffic on the junction approach.

Median islands on the junction arms meeting the parameters given in Section 2.4.4 and Section 2.4.5 shall be provided to achieve deflection and provide refuges for cycle traffic crossing movements. The non-flared entries/exits will create shorter crossing distances for cycle traffic and give the designer more flexibility in siting pedestrian and cycle crossings.

Further guidance on the design of Compact Roundabouts is given in the Wales Active Travel Design Guidance, Design Element 055 [28]; where guidance in this reference document is in conflict with DMRB, DMRB shall be used.

2.6.3. Normal Roundabouts

The geometry of Normal Roundabouts, as defined in TD16/07 [26], enables motor traffic speeds that are likely to be significantly higher than cycle traffic speeds, particularly on large diameter roundabouts, which can lead to high severity injury collisions between motor traffic and cyclists. The flared entry and exit geometry, multiple lanes, and wide circulatory carriageways that may not have lane markings make it difficult for cyclists to adopt a safe position in the carriageway due to the number of potential conflict points. Cyclists who keep to the nearside when cycling around a roundabout are at risk of not being noticed by drivers entering or leaving the junction.

Roundabouts with a dedicated left turn lane to increase capacity for left turning vehicles provide an additional hazard for on-carriageway cycle traffic, both where the lane diverges at the entry and where the lane merges at the exit. They shall not be used unless segregated cycle facilities are provided.

At Normal Roundabouts the following design options shall be considered by the designer:

- Provide off-carriageway cycle tracks around the junction, with crossings of each arm.
- Remodel the junction as a Compact Roundabout, where permitted by TD16/07.
- Provide grade separated cycle tracks around and/or across the junction (reference Section 2.5).
- Introduce signal control to the roundabout, with appropriate cycle facilities (reference Section 2.7).
- Replace the roundabout with a signal controlled junction or another form of junction, with appropriate cycle facilities.

2.6.4. Cycle Tracks around Roundabouts

The design of off-carriageway cycle tracks at roundabouts shall be in accordance with Section 2.3.

Two-way tracks reduce the distance cycle traffic needs to travel when making right turns and shall be used at roundabouts, except where cycle traffic has priority over any or all of the roundabout entries and exits. In this situation one-way cycle tracks shall be used as drivers are more likely to anticipate cycle crossing movements from the left (reference Table 2.3.2).

One-way tracks shall be clearly signed using road markings so that cyclists understand how to use the facility.

2.6.5. Cycle Track Crossings of Roundabouts

The preferred type of cycle crossing of roundabout arms shall be in accordance with Section 2.4. General requirements for the location and design of crossings at roundabouts are given in TD 16/07 [26].

Parallel pedestrian and cycle crossings[5], as described in Section 2.4, shall be used in situations where zebra crossings are referred to in TD 16/07 [26].

Where parallel pedestrian and cycle crossings are provided, they shall be introduced between 5m and 20m from the give-way line. They can reduce delays to all road users unless pedestrian and/or cycle traffic flows are high. Signalised crossings at roundabouts shall be introduced at 20m or more than 60m from the give-way line.

2.7. Cycle Traffic at Signalised Roundabouts

TD50/04 The Geometric Layout of Signal-Controlled Junctions and Signalised Roundabouts [30] provides general guidance and requirements for the design of signalised roundabouts. References to provision for cyclists in TD50/04 [30] shall be read in conjunction with this document.

The introduction of signal control to roundabouts, particularly large Normal Roundabouts, will provide opportunities to improve conditions for cycle traffic. This includes roundabouts at motorway junctions where motor traffic flows can be particularly high.

There are three approaches to providing for cycle traffic at-grade, at signalised roundabouts; these are:

- Provide facilities on-carriageway at the signalised nodes, so that cycle traffic is separated from conflict with motor traffic.
- Provide a cycle track around the junction with signal-controlled crossings of the roundabout entries and exits, as part of the overall junction control.
- Provide a cycle track across or around the central island, with crossings of the circulatory carriageway and the roundabout entries and exits as necessary, as part of the overall junction control.

Reference shall be made to Table 2.2.2 to determine whether cycle traffic should be accommodated on- or off-carriageway. Signal timings shall be set based on the criteria for cycle traffic given in Section 2.4.5.

2.7.1. On-carriageway Provision at Signalised Roundabouts

The methods of control at the signalised nodes shall give protection and priority to cycle traffic by providing separation from motor traffic. Any requirement for dedicated time for cycle traffic will affect the operation of the signals and the effect on overall capacity of the junction shall be assessed.

[5] This requirement anticipates the coming into force of the revised Traffic Signs Regulations and General Directions, which is planned for 2016. Until this document is published, special authorisation from the Department for Transport will be required in order to comply with the text as written.

Although Advanced Stop Lines (ASLs) have been used extensively, including at signalised roundabouts, they are not adequate for major junctions and shall not be used on any junction approach carrying more than 5000 AADT, with more than two traffic lanes or where the approach is on green for more than 30% of the cycle time.

Suitable methods of providing for on-carriageway cycling at signalised roundabouts on the SRN are as follows, in order of preference.

- Separate stages: Cycle traffic shall be provided with wholly separate stages at the signalised node, enabling cyclists to complete their manoeuvres without conflict. Traffic shall approach the signalised node via a cycle lane or track, depending on the criteria given in Table 2.2.2.
- Exiting traffic held: Cycle traffic is provided with a track or lane (which shall be protected by light segregation) around the outside of the circulatory carriageway. Left turning motor traffic exiting the roundabout is held on a separate red aspect while all circulating traffic (motor vehicles and cycle traffic) are given a green aspect (Figure 2.7.1.1). Motor traffic turning left to leave the roundabout is given a green aspect at the same time as traffic entering the roundabout, so that each signal node still operates efficiently, with two stages. This arrangement requires tighter exit geometry than is common where existing large roundabouts are signalised. TD50/04 [30] provides requirements for signalised roundabouts.
- Cycle Gate with Early Release: As noted above, a significant disadvantage of ASLs is that they are of no value when general traffic is receiving a green signal. To overcome this, a Cycle Gate may be used (Figures 2.7.1.2 and 2.7.1.3), which controls how cycle traffic enters an area between two motor traffic stop lines (the reservoir area). Cycle signals show a red signal to cycle traffic while motor traffic is receiving green signals at the two stop lines. Cycles are released then into the empty reservoir while motor traffic is held at the first stop line, and are given an early release from the reservoir in advance of general traffic. However, while this solution does improve safety it introduces a time penalty for cycle traffic and will therefore be less suitable for cycle traffic movements that pass through a number of signalised nodes. Cycle Gates may also be used at signalised junctions at locations other than roundabouts.

Figure 2.7.1.1 Cycle Track in conjunction with 'Exiting Traffic Held' Staging

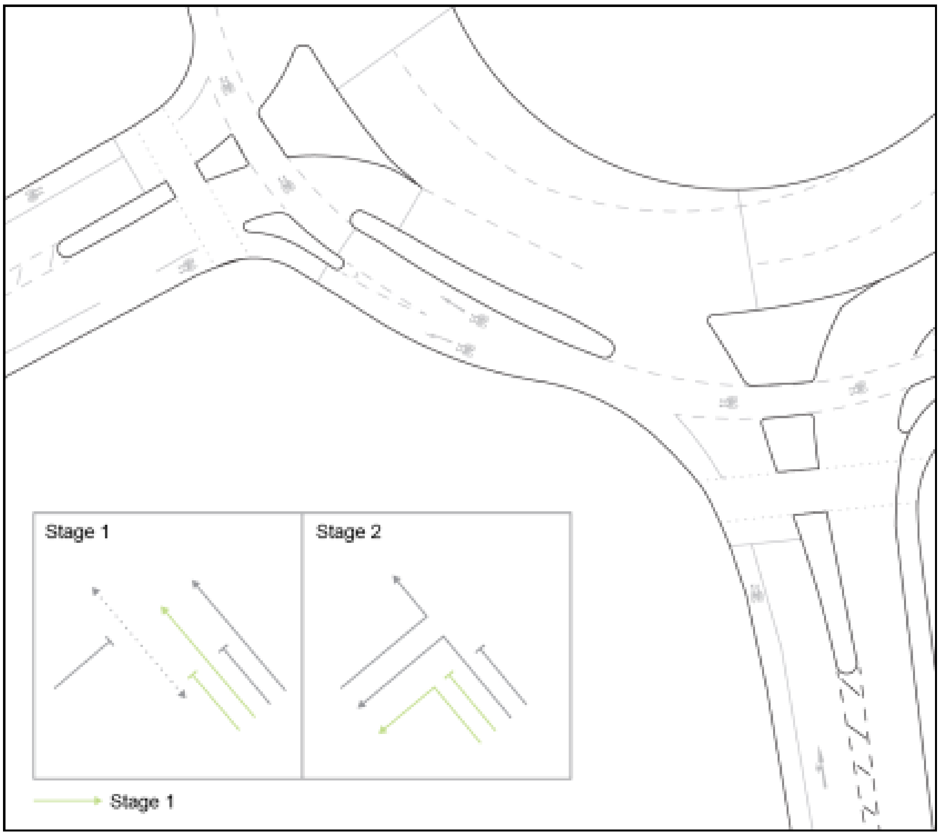
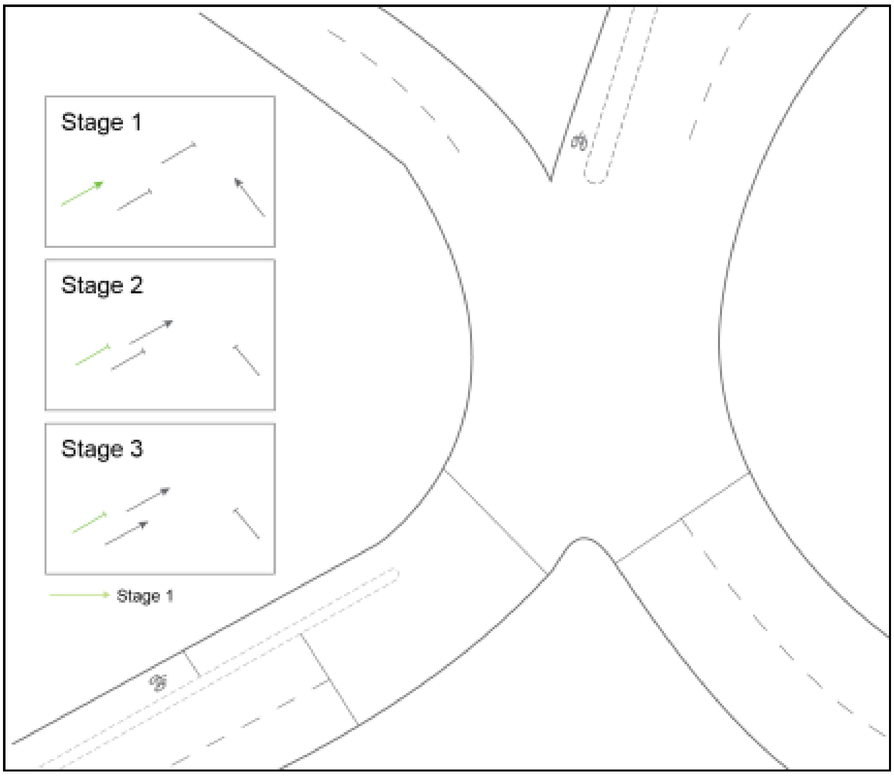


Figure 2.7.1.2 Cycle Gate Preventing Conflict between Cycle Traffic and Other Vehicles

Figure 2.7.1.3 Detailed arrangement of Cycle Gate



2.7.2. Off-carriageway Provision at Signalised Roundabouts

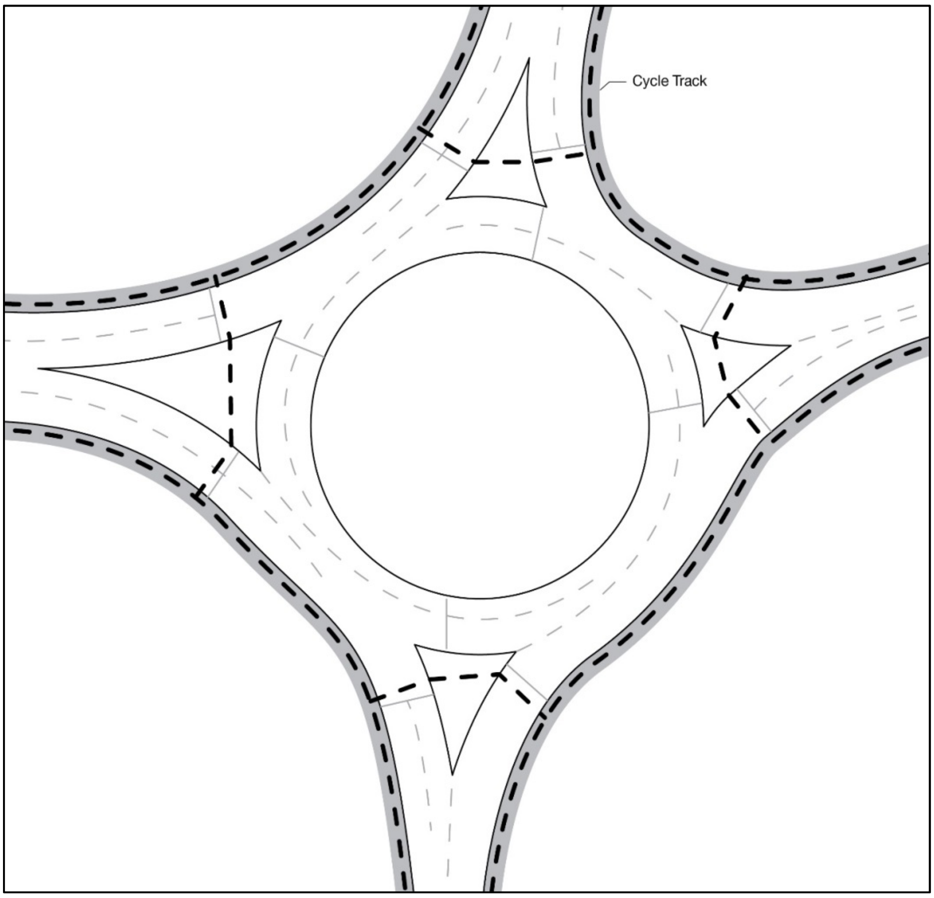
Off-carriageway cycle tracks at signal-controlled roundabouts shall be two-way, so that right turning cycle traffic can take the shortest route through the junction.

Cycle crossings of the roundabout entries shall be integrated with the junction control so that cycle traffic can cross while circulatory traffic is receiving a green aspect. Detection equipment shall be provided to enable cycle traffic to call a green signal when required. Where the red period for motor traffic entering the roundabout is of insufficient duration to enable a minimum green to be provided for cycle crossing movements (reference Table 2.4.5 and 2.4.5.1) an alternative stage, with appropriate cycle crossing duration, shall be provided on demand. Figure 2.7.2 shows a typical arrangement of an external cycle track around a signalised roundabout.

Access to and from these two-way facilities may be from one-way cycle tracks, cycle lanes or general traffic lanes on the roundabout entries and exits (see Section 2.3.9 for requirements for transitions between cycle tracks and carriageway).

Designers shall consider the need to balance motor traffic capacity requirements with the objective of providing direct routes for cycle traffic. In order to minimise any deviation in the path of cycle traffic, cycle crossings of the roundabout exits shall be placed as near as possible to the inscribed circle. Short-term motor traffic queuing back from the crossing onto the circulatory carriageway may be acceptable at the end of the motor traffic red period, depending on the progression of traffic platoons around the junction.

Figure 2.7.2 Two-way Off-Carriageway Cycle Track around Signalised Roundabout



2.7.3. Cycle track around or across a central island of a roundabout

Separated cycle tracks across or around the central island can improve directness, particularly for large roundabouts where cyclists' movements around the roundabout would involve them crossing a multiple number of arms.

Cycle traffic can travel to and from central islands without any effect on motor vehicle delay by crossing the roundabout entry while circulating traffic is on green and crossing the circulatory carriageway while entry traffic is on green; this will involve delay for cyclists as they wait a whole signal cycle to reach and then leave the central island. A preferable solution which reduces delay for cycle traffic, is to introduce a third stage on demand at the signalised node where both the entry and exit are held on red, while cyclists are able to cross to and from the central island in one movement.

Taking into account the layout and direction (one way or two way) of any cycle tracks on the approaches to the signalised roundabouts, the designer shall establish where it is necessary to provide crossings of roundabout exits, meeting the criteria given in Table 2.4.2, so that cyclists are able to make all movements through the junction.

Routes through or around central islands shall be designed to provide the best balance between directness and connectivity between crossing points. Within a central island, options that bifurcate to provide increased directness to connecting arms should be considered. At grade-separated junctions cycle tracks will normally pass around the central island but at large junctions, consideration shall be given to cycle overbridges or underbridges to provide a more direct route.

Figure 2.7.3 Cycle Track across the Central Island of a Signalised Roundabout

2.8. Grade Separated Junction Layouts for Cycle Traffic

This Section gives requirements and advice on layouts for grade separated junctions. Cycle traffic may be travelling either along or across the SRN or be moving between the SRN and the local road network. The layout of cycle facilities shall minimise delays and risk for cycle traffic.

Decisions about providing connections between the SRN and the local road network will be based on network planning (reference Section 2.1). Section 2.5 provides detail on the form of overbridges and underbridges.

The smaller horizontal curve radii that can safely be traversed by cycle traffic compared to motor traffic means that the cost and land-take of grade separation for cycle traffic will be less than the elements of the junction provided for motor traffic. For new and existing junctions the incremental costs and land-take for providing grade separation for cycle traffic will be highly dependent on the number of new or modified bridge structures required. The choice of provision of either overbridges or underbridges for cycle traffic will depend on the circumstances of the site. For new junctions there is increased potential for the design to preclude steep gradients and excessive diversions for cycle traffic.

There are a large number of forms of grade separation and Figures 2.8.1 to 2.8.1.3 show typical examples that can be adapted for cycle traffic to suit the form of junction. Designers shall ensure that the resultant cycle route alignment meets the requirements given in this document.

2.8.1. Grade separated junction layouts for cycle traffic at junctions that are grade separated for motor traffic

Cycle traffic shall be separated from motor traffic at all grade separated junctions. Grade separation will require overbridges and/or underbridges to cross the side road and slip roads to maintain directness and separation for cycle traffic. All movements for cycle traffic shall be catered for.

Figure 2.8.1 shows a layout with the minor road on an overbridge where the mainline cycle route runs broadly parallel to the mainline route with bridges constructed to allow the crossing of the off-slip and on-slip. Figure 2.8.1.1 and Figure 2.8.1.2 show layouts with two bridges where the minor road is above and below the mainline.

Where the minor road is on an existing overbridge, and where space allows, the mainline cycle route shall be accommodated by an existing span on the mainline bridge, as shown in Figure 2.8.1.1. Where the space at an existing span is insufficient or modification is impracticable, the creation of separate grade separation under the minor road shall be provided, reference Figure 2.8.1.3.

Figure 2.8.1.2 shows a layout with the minor road on an overbridge where the mainline cycle route runs broadly parallel to the mainline route with bridges constructed to allow the crossing of the off-slip and on-slip.

For major roads on bridges over minor roads, the cycle route might be accommodated if the verge is wide enough (reference Figure 2.8.1.2), otherwise new parallel structures shall be added.

Where the minor road does not have a separated cycle route, the design standard for connection to the carriageway shall be agreed with the relevant Overseeing Organisation.

At-grade crossings of unsignalised slip roads in the vicinity of the merge or diverge shall not be provided as the speed of motor traffic is similar to that of the mainline flow and cyclists are exposed.

The form of junction control where the slip roads and associated cycle tracks meet the side road will depend on the volumes of motor traffic and cycle traffic. Options include priority junctions with or without signalised crossings for cycle traffic (reference Section 2.4), roundabouts (reference Section 2.6) and signal control (reference Section 2.7).

Grade separation may exist between two roads, with no junction connecting them. It may be appropriate, depending on the desired nature of the network for cycle traffic, that a junction is created for cycle traffic, as illustrated in Figure 2.8.1.3.

Figure 2.8.1 One Bridge Grade Separation with Minor Road on Overbridge

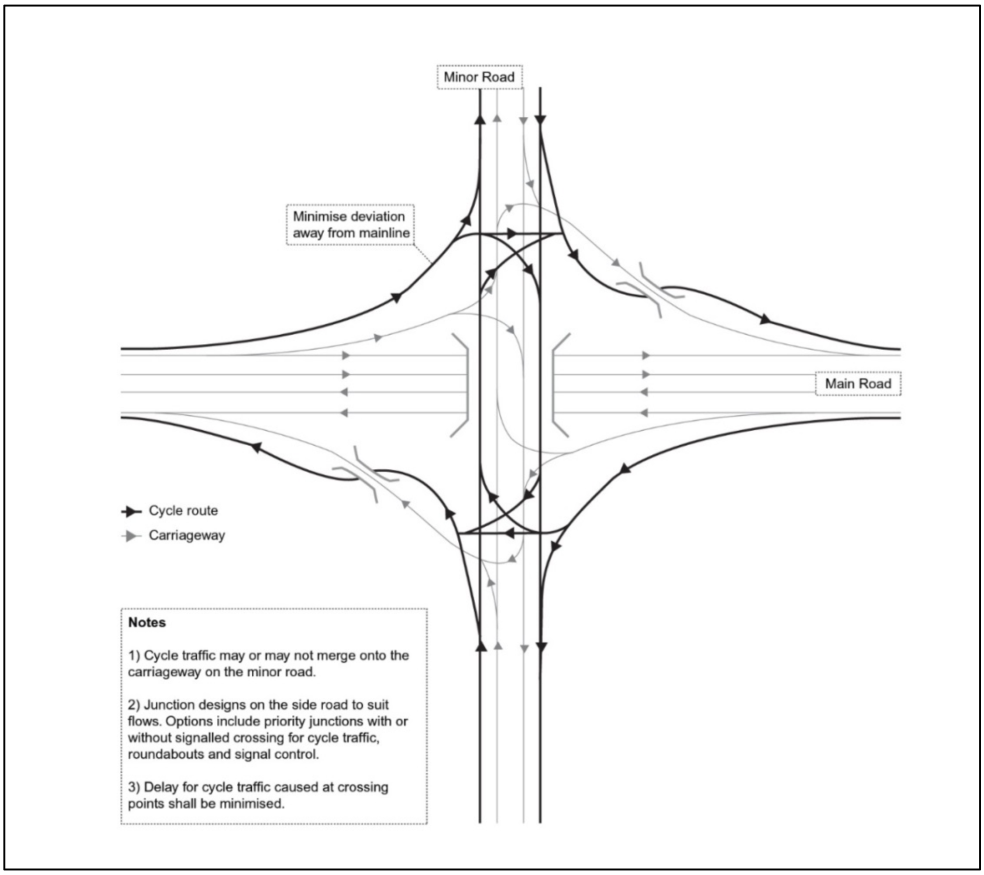
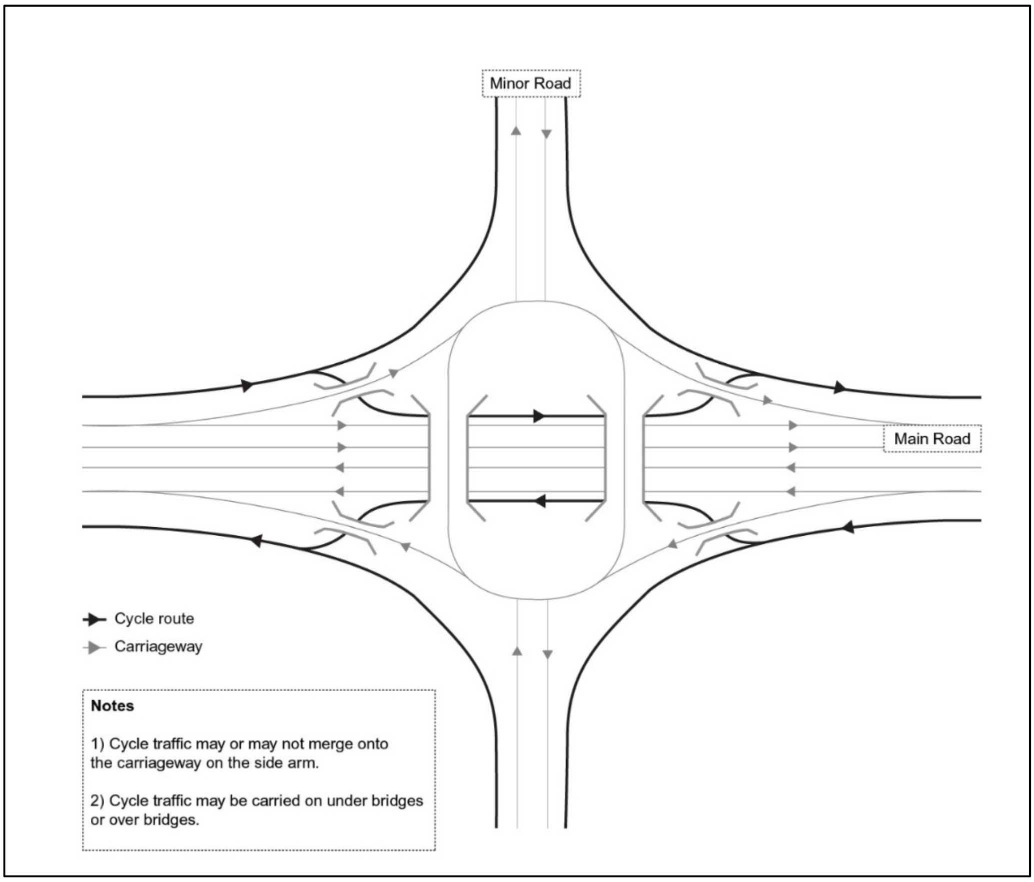
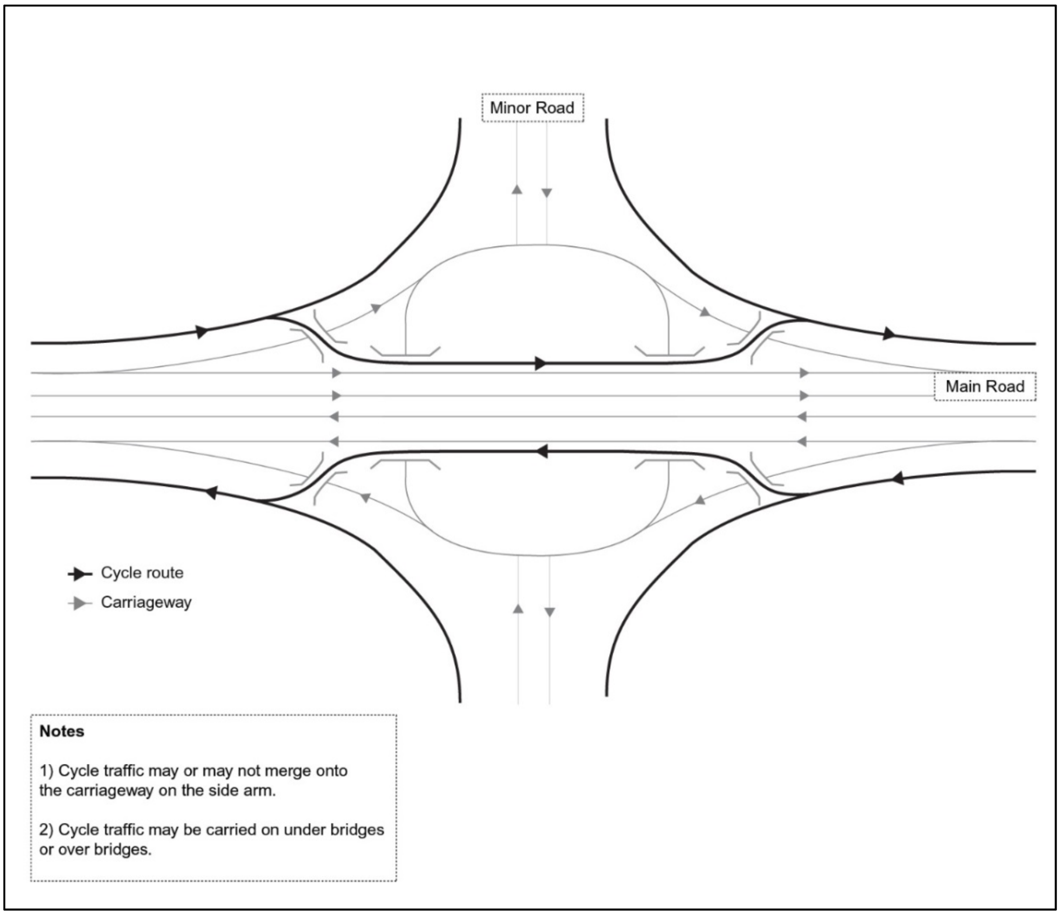


Figure 2.8.1.1 Two Bridge Grade Separation with Minor Road on Overbridges



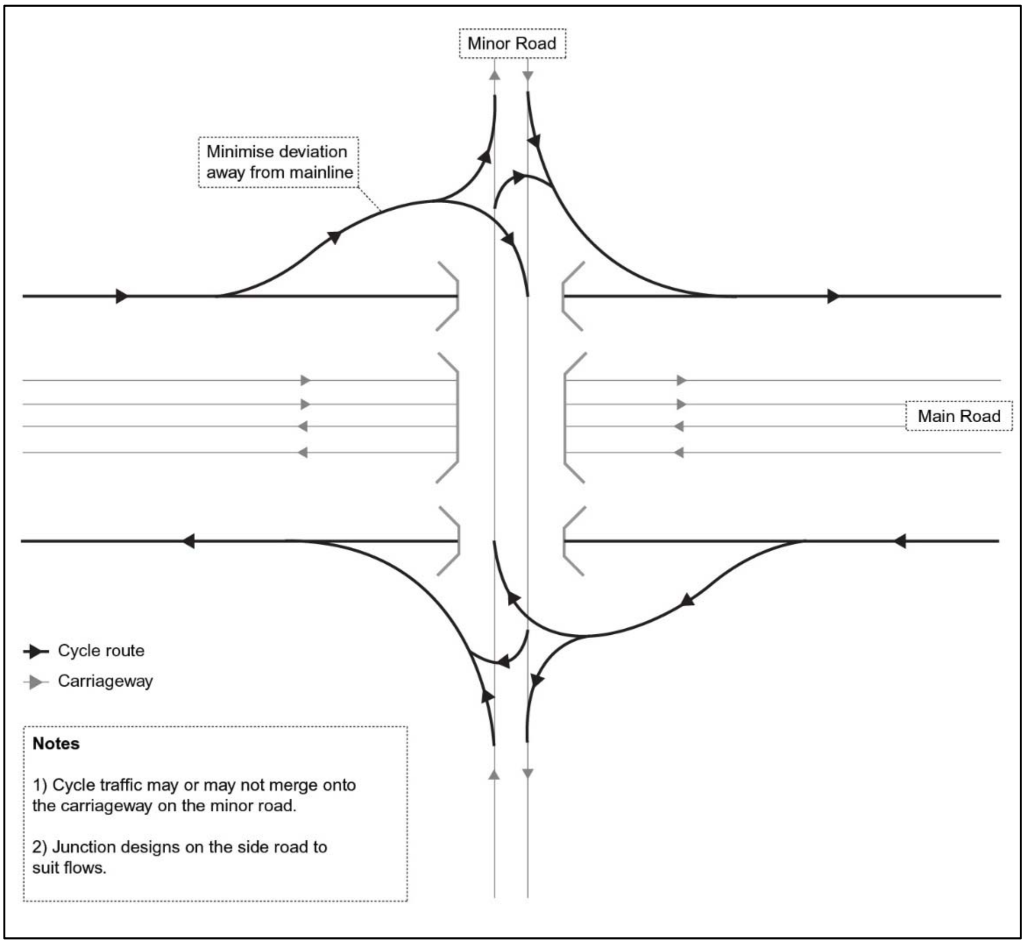
For details of movements for cycle traffic around the roundabout, see Section 2.6.

Figure 2.8.1.2 Two Bridge Grade Separation with Mainline on Underbridges



For details of movements for cycle traffic around the roundabout, see Section 2.6.

Figure 2.8.1.3 'Grade Separated Cycle Routes at a Location where there is no Connection for Motor Traffic from the Mainline to the Minor Road.



2.8.2. Grade separated junction layouts for cycle traffic at junctions that are at-grade for motor traffic

Large and complex at-grade junctions for motor traffic are not attractive or comfortable for cycle traffic. Grade separation of cycle traffic at these junctions can work very well and reduce delay and improve actual and perceived safety for cycle traffic.

Grade separation shall be provided in accordance with the relevant case as given in Table 2.4.2.

Figure 2.8.2 illustrates an example of grade separation for cycle traffic at a three-arm T-junction and Figure 2.8.2.1 illustrates an example of grade separation for cycle traffic at an at-grade signalised four-arm junction.

Figure 2.8.2 Grade Separated Cycle Routes at a Three-Arm T-Junction.

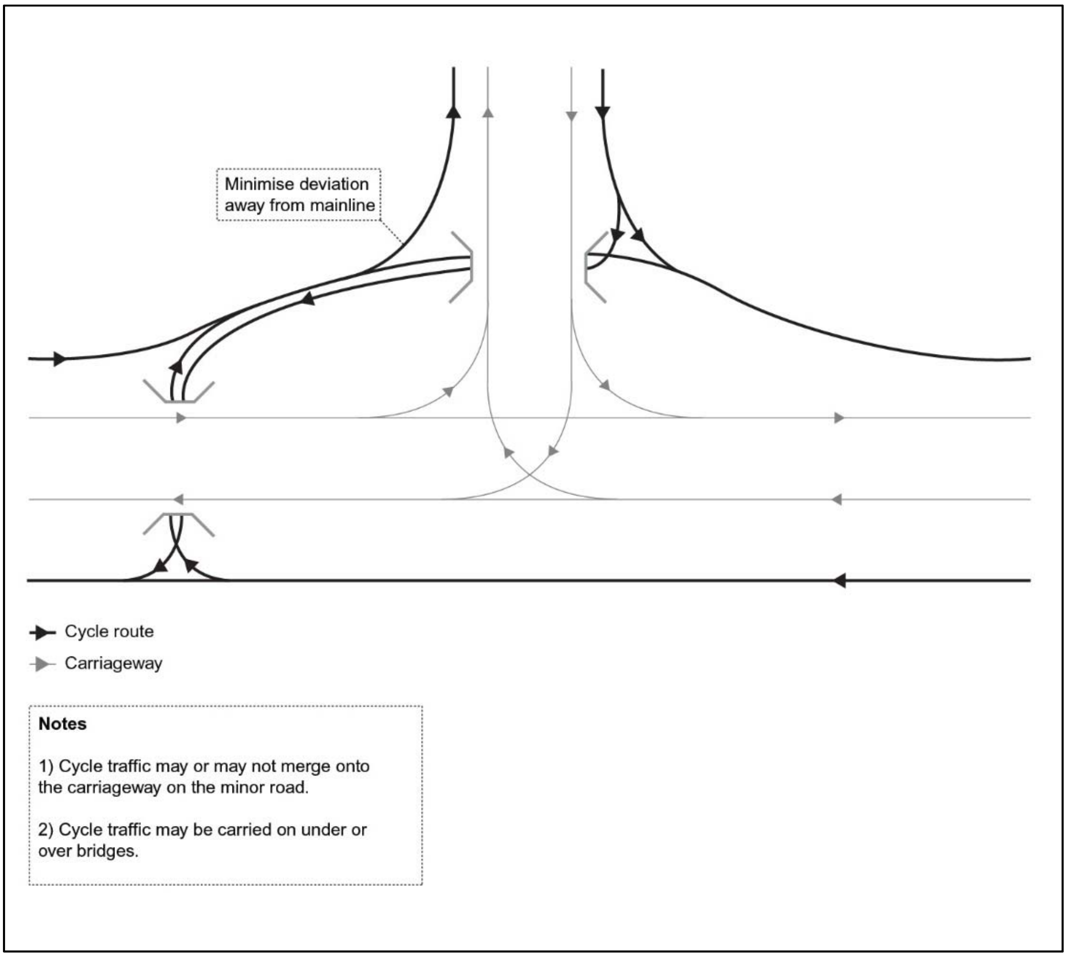
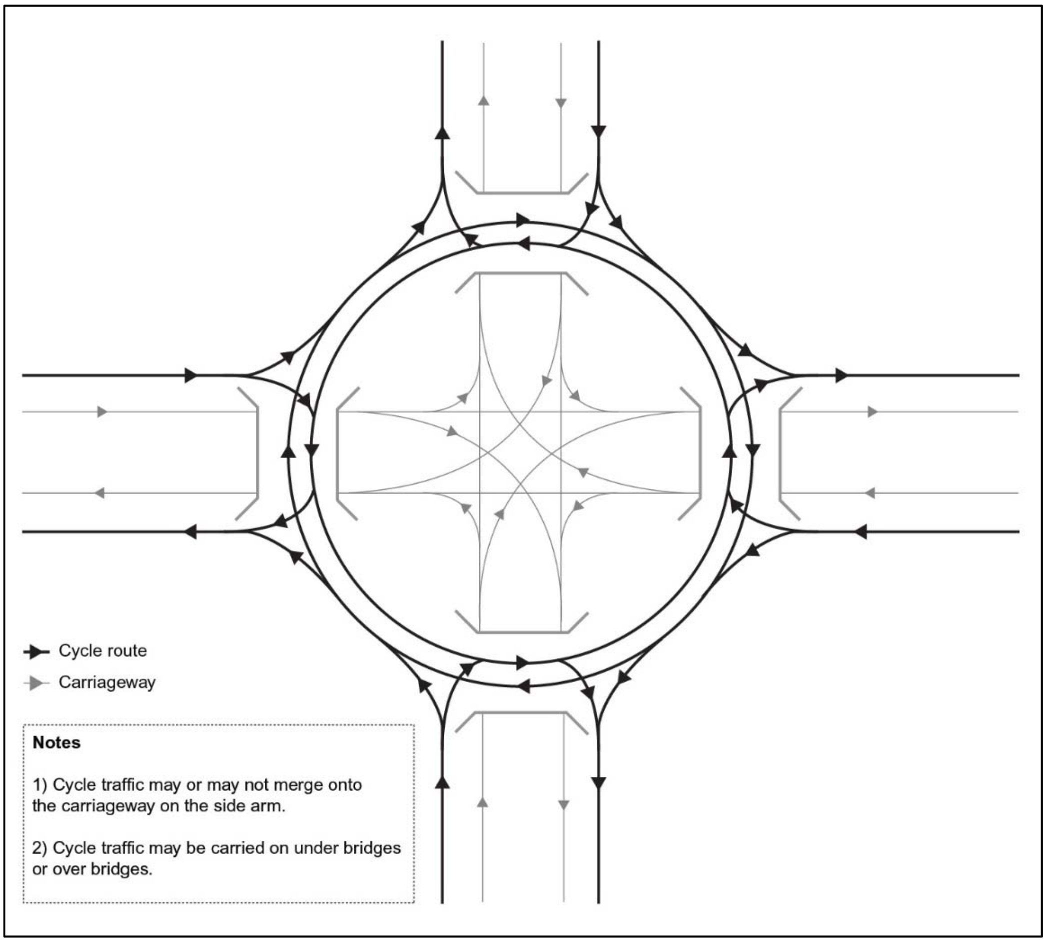


Figure 2.8.2.1 Grade Separated Cycle Routes at an At-Grade Four Arm Signalised Junction



2.9. Cycle Traffic Direction Signing

The design of traffic signs, including those for cycle traffic, must be in accordance with the TSRGD [15].

This section provides requirements for cyclist direction signs; these shall be provided for all junction layouts that interface with cycle routes, particularly off-carriageway tracks.

2.9.1. Direction Signing Strategies

Direction signing strategies define the approach used to co-ordinate signs showing routes for cycle traffic. Designers shall develop a cycle traffic signing strategy using the following principles:

- Promote connectivity to local destinations and with local cycle networks in consultation with the Local Highway Authority.
- Primary, Target, Local Place Name and Other Local Destinations shall be identified in consultation with the Local Highway Authority.
- The designer shall liaise with the Local Highway Authority regarding all signed destinations to ensure they are coherently signed on the local cycle network until the destination is reached.
- Additional cycle signs (blue face) help to promote the cycle route and provide easier wayfinding for cyclists.
- Sign clutter shall be minimised in accordance with Traffic Advisory Leaflet 01/13 Reducing Sign Clutter [32].

2.9.2. Design of direction signs for cycle traffic

Signs showing routes for cycle traffic shall use the following principles:

- Traffic signs showing routes for cycle traffic shall be provided at all decision points on a cycle route. Decision points will include all junctions with other cycle routes and where the cycle route meets the carriageway.
- Where cycle routes are two-way, signs showing routes for cycle traffic shall be provided for cyclists travelling in both directions.
- Adhering to standard horizontal and vertical clearances for the placement of verge mounted signs in relation to the edge of cycle track and / or carriageway. Further information on clearances around signs for cycle traffic can be found in London Cycling Design Standards [17].
- Signing shall not be placed where it would reduce the effective width of cycle routes below the minimum requirements in Table 2.2.11.
- The risk of sign faces being rotated (e.g. by wind or vandalism) shall be mitigated by the sign design specification and maintenance regime.
- All sign faces must be manufactured with retro-reflective sheeting. Anti-graffiti coating shall be specified where the risk of graffiti is considered high.
- Either the distance or the journey time to destinations shall be shown on direction signs. Where a destination is within a 15 minutes journey time, then the destination shall be signed using the journey time and not the distance. In all other cases distances shall be signed. Journey times shall be calculated assuming a typical cyclist speed on the route in question, taking account of factors (e.g. topography and crossing points) that may slow the cyclist. The average speed of cyclists on a level surface should

be assumed as 12mph (reference LTN2/08) [8]. The x-height of traffic signs must comply with the minimum and maximum given in TSRGD [15] and the designer shall take account of the proximity of signs to the cycle route, costs, environmental impact and consistency when selecting the x-height.

- The smallest practicable sign face size shall be used to minimise environmental impact and sign clutter whilst maintaining legibility.
- Signs at junctions may need to be read by cyclists from a distance of greater than 15m (for example from across the carriageway). Where the reading distance is greater than 15m the x-height shall be increased so that the sign remains legible. Information on calculating x-heights can be found in Appendix B of IAN 146/15 [31].
- Where route choice options are considered challenging to understand, wayfinding (non TSRGD)[6] maps shall be considered to show local destinations) or TSRGD [15] "indication of a route for cyclists through a road junction ahead", should be considered where the path of cyclists through the junction is not intuitive.
- Where there is no identified need for a pedestrian facility the cycle track shall not be marked as a shared use facility. Sign Diagram 956 shall not be used and two-way tracks shall have a centreline.

2.10. Construction and Maintenance

2.10.1. Pavement Construction for Cycle Routes

The long-term integrity, comfort, safety and aesthetic appeal of cycle routes is dependent on the chosen construction design. Unbound surfaces shall not be provided on cycle routes.

Whether the cycling infrastructure is on or off carriageway the most important consideration for the user is the ride quality of the surface course. All materials specified shall be in accordance with the Manual of Contract Documents for Highway Works Specification for Highways Works (SHW) [34].

For on carriageway cycling infrastructure the standard pavement construction of the adjacent trafficked lanes (designed in accordance with HD 26/06 Pavement Design [35]) will be appropriate for use by cyclists. In these situations the dimensional tolerances for surface course and lower layers shall be in accordance with SHW.

For the structural pavement design of off-carriageway cycling facilities, designers shall use the requirements of footway design set out in HD 39/16 Footway and Cycleway Design [36] that provide relevant guidance on factors such as likely construction plant, occasional vehicle over-run (during maintenance or by public vehicles) and ground conditions. Dimensional tolerances, for surface course and lower layers, shall be in accordance with SHW [34] for carriageways.

2.10.2. Designing for Maintenance

The designer shall apply Interim Advice Note 69/15 Designing for Maintenance [37].

[6] This requirement anticipates the coming into force of the revised Traffic Signs Regulations and General Directions, which is planned for 2016.

3. Withdrawal conditions

This IAN shall become obsolete following the publication of a new Requirements and Advice Document (RAD) which captures the information contained in this IAN as well as other relevant cycle traffic content.

4. Contacts

The Highways England contact details for this IAN are:

Standards_Feedback&Enquiries@highways.gsi.gov.uk

5. Normative References

The following documents, in whole or in part, are normative references for this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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13 TA 90/05 The Geometric Design of Pedestrian, Cycle and Equestrian Routes. Design Manual for Roads and Bridges, Volume 6, Section 3, Part 5: TA 90/05. Department for Transport and Highways Agency. 1995.

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20 TA 81/99 Coloured Surfacing in Road Layout (Excluding Traffic Calming). Design Manual for Roads and Bridges, Volume 6, Section 3, Part 4: TA 81/99. Department for Transport and Highways Agency. 1999.

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24 BD 29/04 Design Criteria for Footbridges. Design Manual for Roads and Bridges, Volume 2, Section 2, Part 8: BD 29/04. Department for Transport and Highways Agency. 2004.

25 Inclusive Mobility. Department for Transport. 2005.

26 TD 16/07 Geometric Design of Roundabouts. Design Manual for Roads and Bridges, Volume 6, Section 2, Part 3: TD 16/07. Department for Transport and Highways Agency. 2007.

27 Traffic Advisory Leaflet 09/97, Cyclists at roundabouts: continental design geometry: Department for Transport. 1997.
28 The Active Travel (Wales) Act 2013 – Design Guidance, Appendix A: Design Element 055, Welsh Government-Llywodraeth Cymru, 2014.
29 TD 51/03 Segregated Left Turn Lanes and Subsidiary Deflection Islands at Roundabouts. Design Manual for Roads and Bridges, Volume 6, Section 5, Part 3: TD 51/03. Department for Transport and Highways Agency. 2007.
30 TD 50/04 The Geometric Layout of Signal-Controlled Junctions and Signalised Roundabouts. Design Manual for Roads and Bridges, Volume 6, Section 2, Part 3: TD 54/04. Department for Transport and Highways Agency. 2004.
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35 HD 26/06 Pavement Design. Design Manual for Roads and Bridges, Volume 7, Section 2, Part 3: HD 26/06. Department for Transport and Highways Agency. 2006.
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