Designing for cycling

Bristol's Local Plan supports the delivery of improvements to transport infrastructure including a network of routes to enable and encourage cycling. Cycling is one of the priorities within our hierarchy of road users, and Bristol's status as the country's first Cycling City has led to a significant increase in cycling over the years.

Cycle Infrastructure Design LTN 1/20 (DfT, 2020) gives guidance on the implementation of cycle measures, and Gear Change: a bold vision for cycling and walking adds weight to the importance of designing the highest quality infrastructure, requiring all new housing and business developments to be built around making sustainable travel, including cycling and walking, the first choice for journeys.

We therefore expect all developments to maximise the opportunities to support cycling through a combination of safe and connected routes, adequate parking provision and on site facilities such as showers, changing rooms and lockers for equipment, clothing and cycle maintenance .

We would also seek to enhance and fill gaps in the existing network and provide links to serve new developments. The West of England's Local Walking and Cycling Infrastructure Plan sets out designated and proposed routes and infrastructure required to improve Bristol's local cycling networks, and developments would be expected to integrate with and link to these networks, and provide facilities within sites to allow for better access to high quality active travel facilities for all.

Fig 1: **Cycle lane**

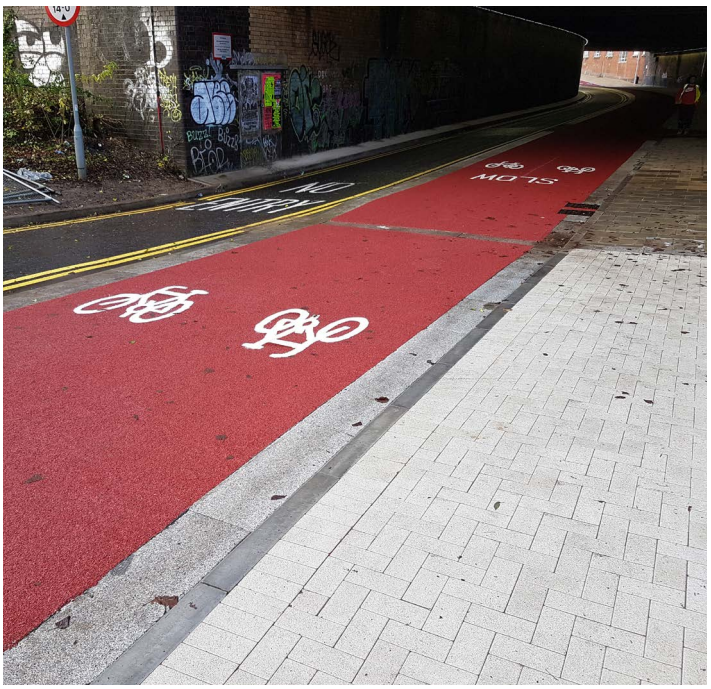


Fig 2: **Segregated cycle facility, Bristol**

Well-designed routes should cater for cyclists of all ages and abilities, the needs of cyclists should be assessed following the principles set out in our Cycling Strategy, which aims to make provision for cyclists aged 8 to 80. The layout and design of a cycle route should aim to provide safe, direct, secure, visually attractive routes that avoid the need for cyclists to dismount.

Cycling infrastructure and provision will be scheme specific, depending on factors such as the propensity to cycle, the site's location, traffic volumes, vehicle speeds, topography and scale of development.

Key principles of cycle route design

LTN 1/20 outlines five broad principles – that cycle routes and schemes are

- **Coherent**
- **Direct**
- **Safe**
- **Comfortable**
- **Attractive**

Inclusive design and accessibility should run through all five of these core design principles.

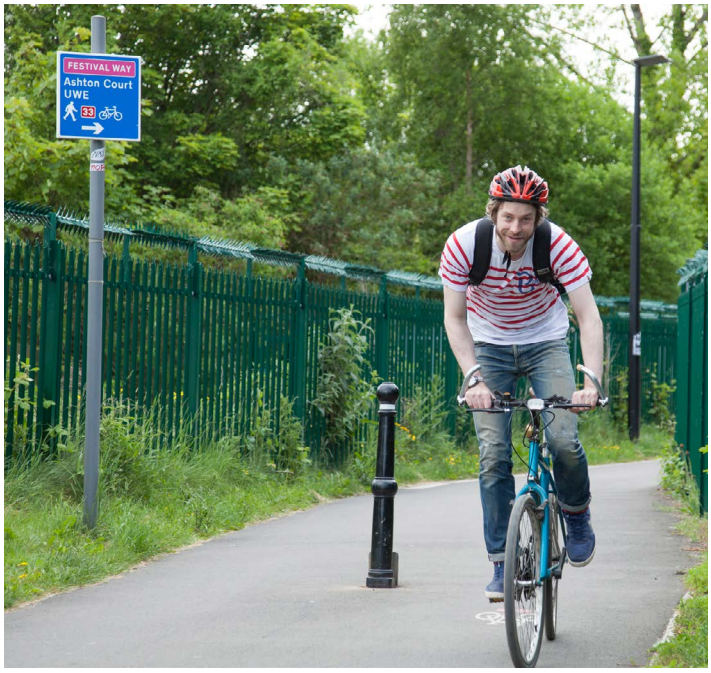


Fig 3: **Festival Way cycle route**

Developments should be designed to ensure that these key principles are followed in designing cycle provision into and around new developments:

Coherent

- Where key cycle routes are proposed, dedicated cycle facilities should be physically segregated from pedestrians and motor traffic.
- Dropped kerbs should be flush with the road surface and routes to incorporate tactile paving as per the *Guidance on the Use of Tactile Paving Surfaces*, and *LTN 1/20*. Materials will be coherent with the surrounding environment
- Signage of routes and key destinations should be clearly visible, and where on the adopted highway accord with Traffic Signs Regulations and General Directions 2016.
- In residential developments, cycle streets with low motor traffic speed and volume should also be designated within masterplans to provide a coherent route through the site and join with other networks.

Direct

- New facilities should be more direct and/or quicker than existing provision and as direct if not more direct than routes for motoring. Routes should be provided into and through areas normally inaccessible to motor vehicles, where appropriate.
- In new residential developments, residential streets will generally be low trafficked and provide for cycling on-street. These networks should create a series of direct and well connected routes for cycling.
- Delays for cyclists should be minimised and routes should be unhindered by street clutter.
- Stopping and starting and sharp bends along the route should be minimised
- Where off-highway routes are provided, access control should be avoided. Bollards could be used at a minimum 1.5m width to ensure cycles still have access.

- All control measures must ensure access for disability groups. 'K' frames should not be used. They are a barrier to disabled users.

Safe

- Routes should not only be safe, but should also feel safe. Segregation from motor traffic is preferred, but reducing motor traffic volumes and speeds can make routes feel safer.
- Along the cycle route there should be provision for crossing roads and other barriers. The potential for conflict should be minimised through design at points where cyclists interact with other road users, in particular at junctions.
- Cycle tracks should be given priority over side road junctions to reduce risk of conflict with turning vehicles. *LTN 1/20* provides detailed advice about the suitability of junctions along cycling routes.
- Sufficient visibility between cyclists and other road users will reduce conflict and improve safety for all facility users.
- Shared use paths are unpopular with most user groups, particularly elderly and visually impaired people, and can reduce the desire to cycle. Unless incorporated into a shared surface (tertiary) street, we will strongly discourage the use of shared cycle/walking space in new schemes, in line with the stance taken in *LTN 1/20*.
- Traffic volumes and speeds should be reduced to create safer conditions for both cycling and walking. We promote design speeds of 20mph maximum on most roads to enable cyclists and pedestrians to feel safer. Any new residential road would be subject to 20mph limit.
- Natural surveillance and appropriate lighting are required on all cycling routes, with frequent access points, particularly on off-highway routes. Off highway routes should feel open and have no areas which could be used for hiding.

Comfortable

- All new infrastructure should meet design standards in terms of width, gradient and surface quality, catering for all types of user, including children and disabled people.
- Surfaces must be smooth and robust in terms of maintenance. Routes must be accessible by (and appropriately constructed for the load of) maintenance and cleansing vehicles to avoid slips and damage to bicycles.
- Steep gradients (steeper than 1:20) should be avoided for lengths over 30m. Excessive crossfalls and cambers should also be avoided. Road re-profiling may be required.
- Where ramps are provided, will need to be suitably shallow in gradient and where zig-zagged, will need to ensure that cyclists can transition the bends effectively and safely. For the design of ramps at grade separated junctions, see *LTN 1/20 Chapter 10*.

Attractive

- Cycle routes should be attractive and interesting to encourage their use.
- Suitable cycle storage is required for all developments, which should be easy to access, secure and cater to all users. Showers, lockers and changing facilities will be required at places of work to allow for cycling commuters to travel longer distances or in inclement weather. See *3.5.2 Cycle parking – supporting facilities*.

Fig 4: **Cyclists on off-road cycle route**

Type of cycle provision

When providing for cyclists, the specific context of each site/street must be considered independently to determine an appropriate provision for cyclists. The higher volume and speeds of traffic, the more protection cyclists need. The following table taken from LTN 1/20 outlines the type of cycling facility which may be suitable for each scenario.

*Table 1:***Type of cycle provision required for level of use** *(from LTN 1/20, Image credit DfT/PJA)*

Speed limit	Total traffic flow to be crossed (pcu)	Maximum number of lanes to be crossed in one movement	Uncon-trolled	Cycle Priority	Parallel	Signal	Grade Sep-arated
≥60mph	Any	Any	**A**	**A**	**A**	**A**	**C**
40mph and 50mph	>10000	Any	**A**	**A**	**A**	**C**	**C**
	6000 – 10000	2 or more	**A**	**A**	**A**	**C**	**C**
	0 – 6000	2	**A**	**A**	**A**	**C**	**C**
	0 – 10000	1	**B**	**A**	**A**	**C**	**C**
≤30mph	>8000	>2	**A**	**A**	**A**	**C**	**C**
	>8000	2	**A**	**A**	**B**	**C**	**C**
	4000 – 8000	2	**A/B**	**B**	**C**	**C**	**C**
	0 – 4000	2	**B**	**C**	**C**	**C**	**C**
	0 – 4000	1	**C**	**C**	**C**	**C**	**C**

Key:

A – Provision suitable for most people
B – Provision not suitable for all people and will exclude some potential users and/or have safety concerns
C – Provision suitable for a few people and will exclude most potential users and / or have safety concerns

Notes:

1. If the actual 85th percentile speed is more than 10% above the speed limit the next highest speed limit should be applied
2. The recommended provision assumes that the peak hour motor traffic flow is no more than 10% of the 24 hour flow.

Whilst fully segregated routes are by far the most preferable as these afford the greatest protection for cyclists, schemes must also recognise the place function of the street and be designed to minimise clutter. Each site would be assessed on its own merits and in context with the surrounding network.

For design of transitions between segregated and unsegregated cycle routes and carriageways, see *Chapter 9 LTN 1/20*.

Segregated facilities

Segregation is the preferred provision, where conditions permit, as they afford a greater level of safety and comfort for cyclists, reducing conflict with motorised traffic.

Where such facilities are proposed, the required width and level of segregation between pedestrians and cycles will be determined by the likely level of pedestrian and cycle movements on the route and should cater for future demand. Future demand can be assessed using the Propensity to Cycle tool.

Light segregation (on carriageway)

On road facilities are contained within the carriageway. They can be either integrated with traffic or delineated through the use of advisory or statutory cycle lanes or light segregation such as wands or rubber kerbs, allowing cyclists to leave or join the facility easily and safely.

On-road facilities should be supported by waiting restrictions to deter parking.

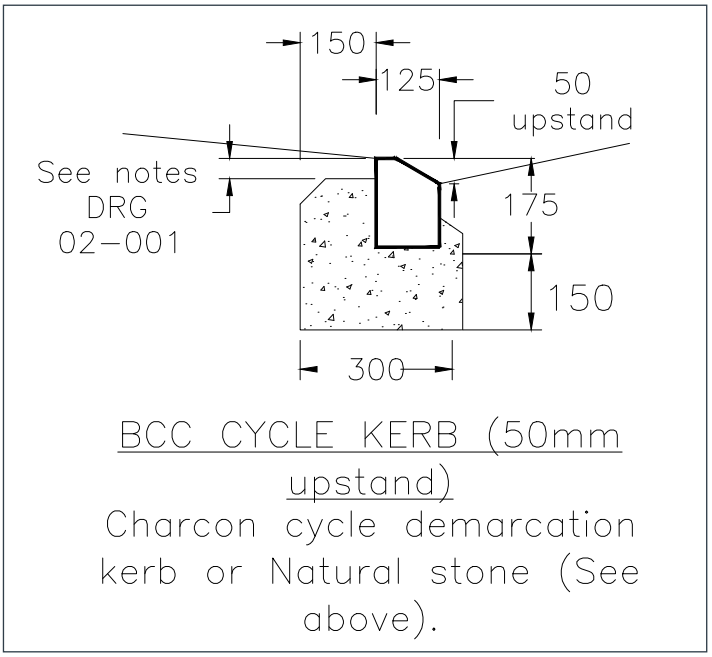
Contraflow cycle facilities should be provided where one way or no entry systems are present. This can be through a formal cycle lane provision or through signing and lining, on very low trafficked streets (fewer than 1000pcu per day) with speeds below 20mph.

Stepped cycle tracks

Stepped cycle tracks are set below footway level but segregated from the main carriageway level by another kerb

Segregation by kerbs of at least 50mm in height can be detected by visually impaired people. Bristol has its own bespoke cycling kerb, which provides a sufficient transition and visual contrast, whilst providing a ramped cross section which allow cyclists to cycle nearer to it without risk of catching their wheel on it and losing control.

Fig 5: **Example cross section of Bristol Cycle Kerb used to segregate cycle traffic from pedestrians**



Fully kerbed cycle track

Fully kerbed cycle tracks tend to be at carriageway level, but are segregated by a kerbed buffer zone preventing overrun by traffic.

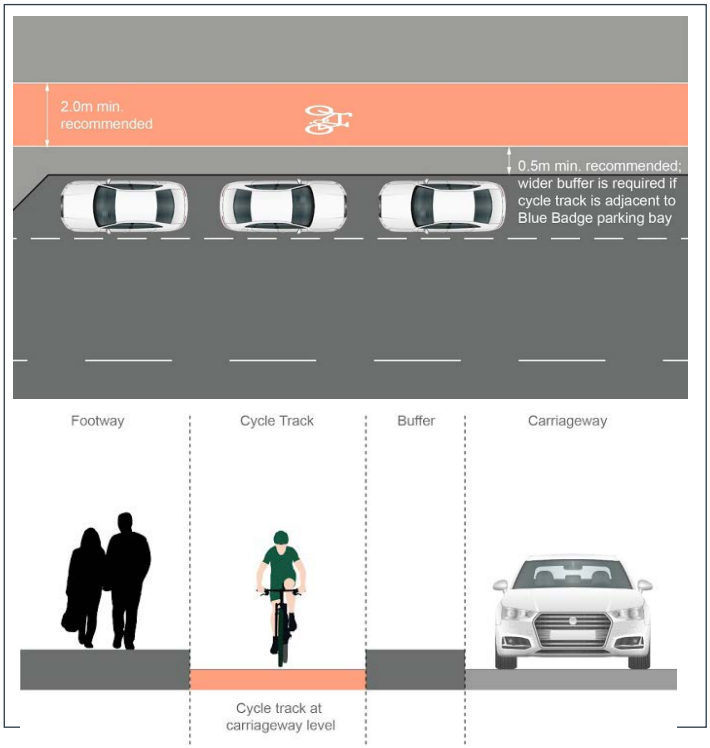
Buffer zones

Where cycle tracks are adjacent to parking and loading areas, buffers are required to prevent cyclists being knocked off by people opening car doors.

Where speeds are below 30mph, the width of the buffer should be a minimum of 0.5m. Where disabled bays are provided, this width needs to be increased to 2m to allow wheelchair users to wait and manoeuvre.

The buffer can be wider where space permits, and can incorporate planting and/or sustainable drainage. Gaps or dropped kerbs in the buffer would be required to assist crossing, allow drainage and allow cyclists access onto the cycle track, bus stop bypass or island.

Fig 6: **Cycle Track with buffer protecting from parked cars – shown in plan and section** *(from LTN 1/20, Image credit DfT / PJA)*



Unsegregated routes

Generally, non-delineated routes are only acceptable where there are low traffic volumes and speeds – as a rule of thumb fewer than 200veh/peak hour and speeds of 20mph or less, and where there are very few larger vehicle movements.

Many new residential streets would be quiet and would be appropriate for cyclists to share with motorised vehicles. When master-planning new developments, cycling streets should be provided on key routes and desire lines, and linking with other strategic routes.

Where cyclists are required to share the carriageway with motorists, lane widths must not be between 3.2m and 3.9m, such as at traffic islands or other pinch-points. Narrower widths are not advised on routes where heavy vehicles are present, as narrow lanes create rutting in the carriageway, which in itself can create problems for cyclists.

Where cyclists share bus lanes, these should be a minimum of 4.5m width. Additional cycling lanes can be provided adjacent to bus lanes. Further detail for quiet mixed traffic streets can be found in Chapter 7 *LTN 1/20*.

Cyclists at junctions

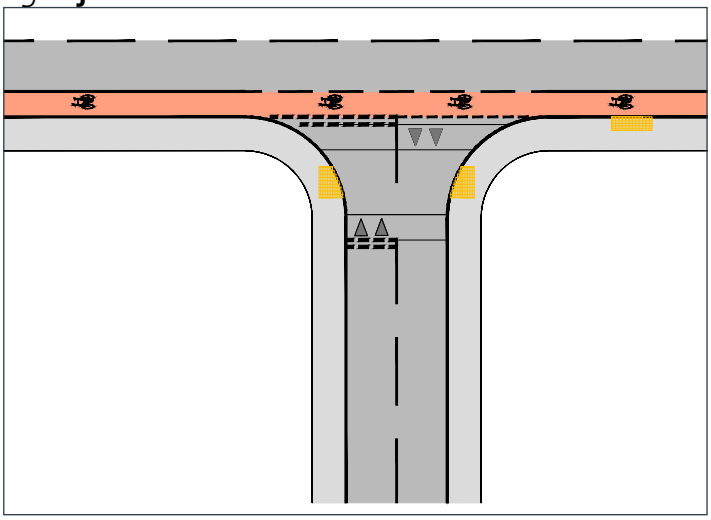
Cyclists are particularly vulnerable at junctions. Therefore, the need for specific cycle facilities at junctions should be carefully considered. The junction design would be dependent on many factors, including speeds, volumes, the type of cycling route, geometry, and the number and type of movements.

Junction design for cyclists is outlined in detail in Chapter 10 of LTN 1/20. The Junction Assessment Tool (JAT) in Appendix B of LTN 1/20 should be used to examine all potential movements at a junction, assess the areas needing improvement and help to identify the type of treatment required to raise this to an appropriate standard.

The type of treatment at the junction would also depend on the available road space, if being installed on existing roads. Where space is limited, other measures such as prohibiting turns, reducing speeds may be required.

Raised entry treatments, where a flat-topped table is placed at the junction of a side road, can benefit cyclists as well as pedestrians, as vehicular speeds will be reduced. Give way lines should be used to give priority to pedestrians and cyclists before the raised treatment.

Fig 7: **junction treatment with raised table**



Crossings

Crossings for cyclists can be:

- Uncontrolled crossings
  - With or without refuge; or
- Controlled crossings –
  - Cycle priority crossing using give-way markings
  - Parallel crossing
  - Signal controlled – Toucan and Cycle Signal Crossings

The type of crossing required on cycling desire lines depends on the level of traffic, speed of the road, and the number of lanes needed to be crossed in one movement. Table 10-2 in *LTN 1/20* indicates what type of crossing may be most suitable in each scenario, although each site will be assessed on its own merits.

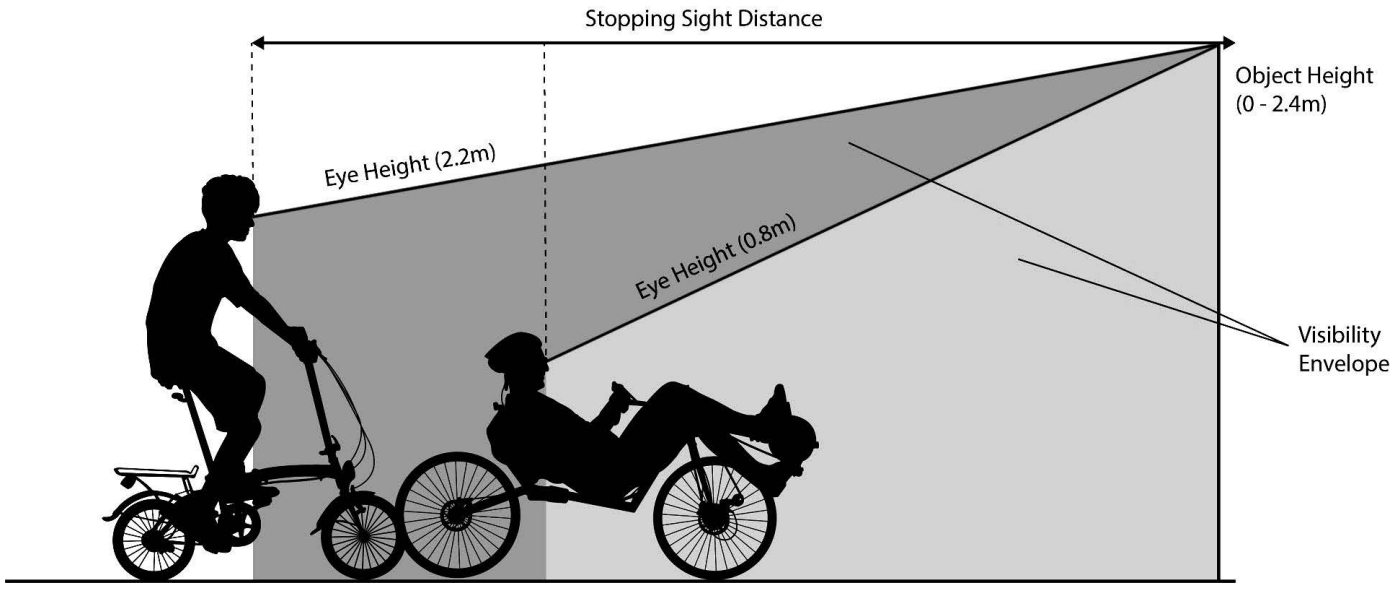
Further information about the types of crossing and their design can be found in *LTN 1/20* Chapter 10.

Visibility

Visibility is covered in detail in Chapter 5 of *LTN1/20*. General principles are summarised below:

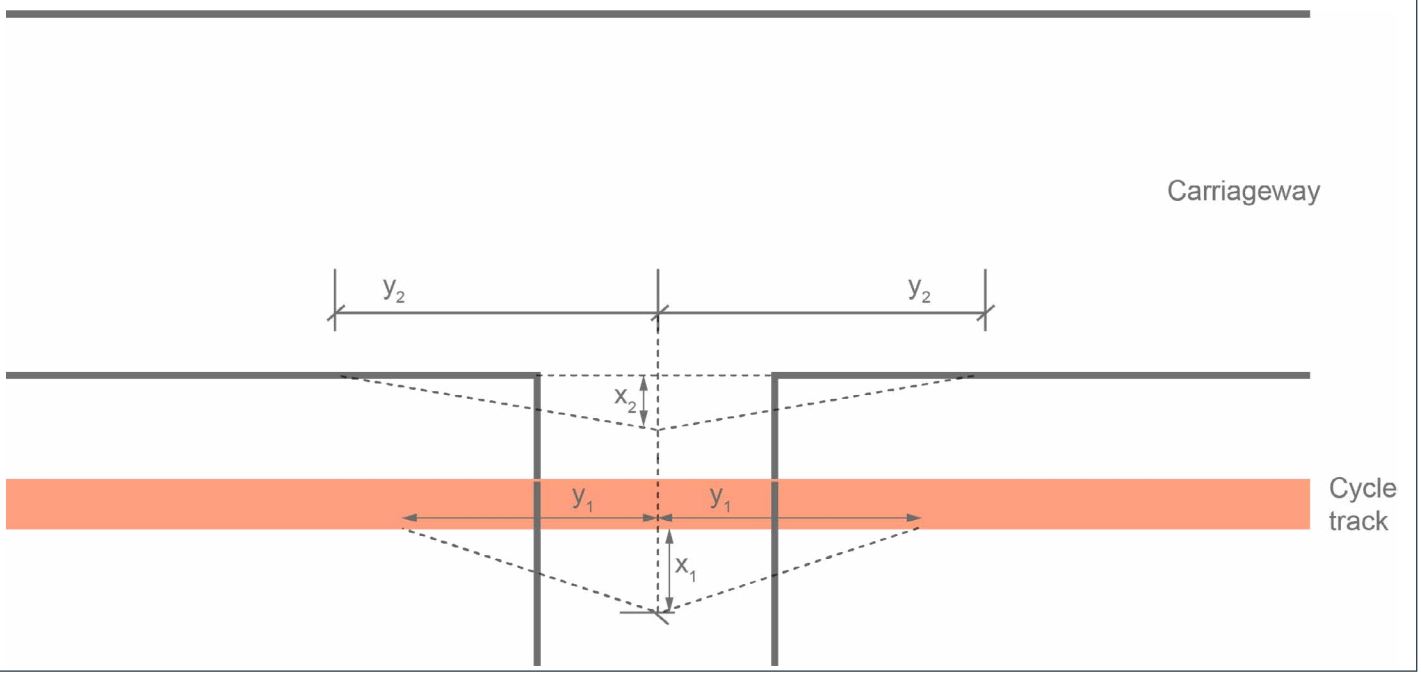
A cyclist must be able to see an object from 0 – 2.4m from an eye height from 0.8m – 2.4m along the visibility envelope as outlined below in *Fig 8*:

Fig 8: **Visibility envelope in vertical plane** *(from LTN 1/20, Image credit DfT / PJA)*



The visibility envelope in the horizontal plan is defined below:

Fig 9: **Visibility splays for segregated cycle lane** *(from LTN 1/20, Image credit DfT / PJA)*



x-distance

The x-distance is measured from the stop or give way line at the junction. The absolute minimum x-distance is 2.4m although a 4.5m distance is preferable.

The longer 'X'-distances should be considered where cycle flows or speeds are likely to be high (e.g. on a downward slope), to allow cyclists to stop, and to allow drivers greater visibility of approaching cyclists.

y-distance

Where traffic approaches the cycle track, the y-distance (y1) is determined by the stopping distances for cyclists as below:

Table 2: **y-distance (y1) along cycle track**

Cycle Track Design speed (KPH)	Minimum visibility distance (m)
20	17
30	31
40	47

Where cycle routes join the main carriageway, then it should join perpendicularly and provide y-distance visibility (y2) in accordance with the following table:

Table 3: **y-distance (y2) along carriageway**

Main Road Design / Recorded speed (mph)	Minimum visibility distance (m)
20	25
30 (MfS)	43
30 (DMRB)	90
40	120
50	160
60	215

Detailed design of cycle routes

Some key principles of cycle route design are summarised below. Detailed design is outlined in chapter 5 of *LTN 1/20*.

Widths

The following tables are recreated from *LTN 1/20*.

Table 3: **Minimum effective widths of cycle track and cycle lanes – route type: protected space for cycling** (including light segregation, stepped cycle track, kerbed cycle track)

Direction	Peak hour cycle flow *(either one way or two-way depending on cycle route type)*	Desirable minimum width (m)	Absolute minimum at constraints (m)
1 way	<200	2.0	1.5
1 way	200–800	2.2	2.0
1 way	>800	2.5	2.0
2 way	<300	3.0	2.0
2 way	>300–1000	3.0	2.5
2 way	>1000	4.0	3.0

Table 4: **Minimum effective widths of cycle track and cycle lanes – route type: cycle lane**

Direction	Peak hour cycle flow *(either one way or two-way depending on cycle route type)*	Desirable minimum width (m)	Absolute minimum at constraints (m)
1 way	All – cyclists able to use carriageway to overtake	2.0	1.5

Additional widths are required where there are vertical features adjacent to the cycle route as cyclists are wary of cycling too close to these. The additional width depends on the height of the feature:

Table 5: **Additional Width at fixed objects**

Type of edge constraint	Additional width required to maintain effective width of cycle track (mm)
Flush or near-flush surface including low and splayed kerbs up to 60mm high (e.g. Bristol Cycle Kerb)	No additional width needed
Kerbs 61mm to 150mm high (e.g standard kerb)	200
Vertical feature from 151mm to 600 mm high (e.g. light segregation measures)	250
Vertical feature above 600 mm high (e.g. bollards, railings)	500

Therefore, generally a standard on-street cycle lane without physical segregation should be a minimum of 2.2m wide. Where standard 125mm kerbs are in place on either side of the cycle route, this would need to be widened to 2.4m.

Gradients

New highways would be expected to be a maximum 1:20 (5%) gradient, and cycle routes would be in line with this.

For gradients of off-road routes the following should be applied.

Table 6: **Maximum length for gradients**

Gradient %	Desirable 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

For further details on crossfall, vertical and horizontal curvature and design speeds for off-road cycle routes, see *LTN 1/20 Chapter 5*.