A.04 Clear Space

Key Principle

Carriageway profiles (especially those at pinch points created by build-outs and refuges) should be chosen to create adequate space for cyclists to be passed by other roads users in safety and comfort.

Design Guidance

Introduction

Cycle Infrastructure design

2.1.1 The space needed for a cyclist in which to feel safe and comfortable depends on:

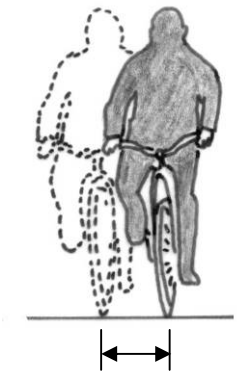
- the cyclist's dynamic envelope, i.e. the space needed in motion;
- the clearance when passing fixed objects; and
- the distance from, and speed of other traffic

The understanding of these factors, for example when determining the widths of carriageways, cycle lanes and other facilities, is critical to achieving a cycle friendly environment.

Dynamic Envelope

Since cyclists rely on forward motion for their stability they can be expected to deviate more from their path (wobble) as their speed decreases. The amount of deviation will vary with speed, gradient and the need to avoid obstacles. Dutch research shows that at speeds of 11km/h (7mph) or above this adds 200mm to the effective overall width of the cyclist. Side winds make little difference (width increases to 300mm) but at speeds below 5km/h (3 mph) this increases to 800mm.

When cyclists stop and start, for example to pull away from traffic signals, this figure will be even greater. When taking avoiding action to miss potholes or sunken gullies, cyclists may be expected to pull out by at least 500mm from their original path.



0.2m	Deviation at 7mph +
0.8m	Deviation at 3mph
0.5m	Deviation to avoid gullies etc.

Based on the above, the effective width (the dynamic envelope) of a cyclist in free-flowing traffic conditions may be taken as 1000mm wide. Whilst the carriageway profiles set out below are derived from measurements taken from the body of the cyclist and not the dynamic envelope this explanation has been included to demonstrate why it is important to create adequate space for cyclists to be overtaken in safety and comfort, for example when deciding how wide cycle lanes should be (see A11 Cycle Lanes). Designers should also be aware that at higher speeds cyclists will lean into the corner to remain stable. Dutch guidance suggests that the dynamic envelope should be increased by 0.5m in such circumstances. No advice is available to suggest at what radii this is an issue since it will depend on a range of factors: for example the high speed might result from a step approach to corner.

Critical distances (from cyclists) to fixed objects

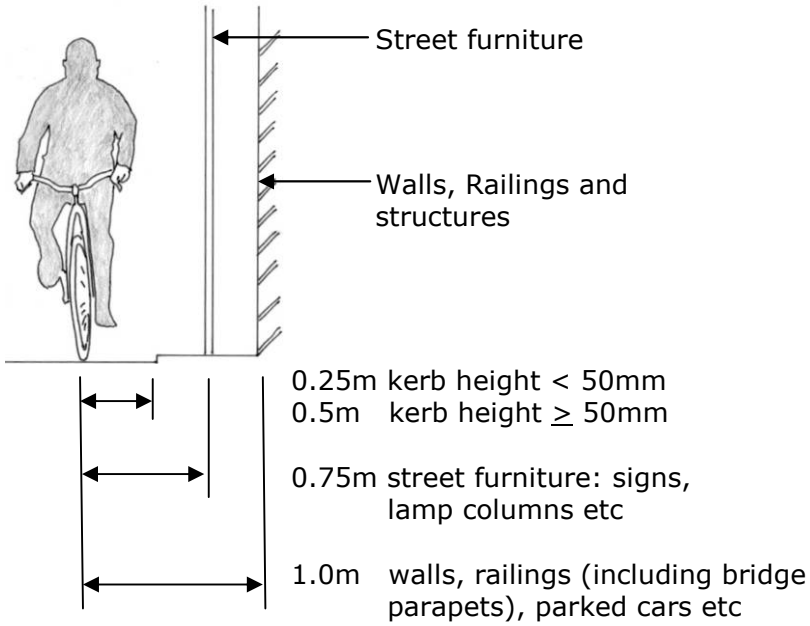
In order to determine the position of a bicycle being ridden past fixed obstacles the following distances are measured from the edge of the wheel to those obstacles and not from the dynamic envelope. These measurements should be taken as minimum distances and should be increased wherever possible.

Critical distances to fixed objects

Notes:

These distances are measured from the wheel and not the dynamic envelope.

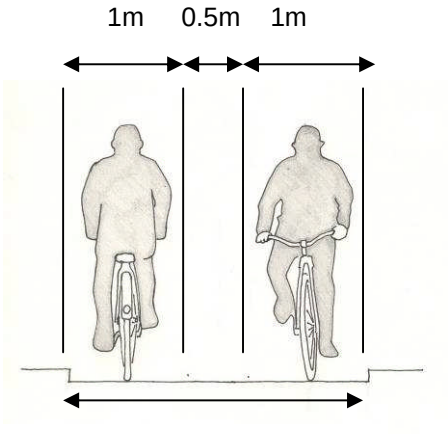
These measurements should be taken as minimum distances and should be increased wherever possible.



Minimum design distances to fixed objects	
Distance (from wheel edge)	**Object**
0.25m	Kerb < 50mm
0.5m	Kerb ≥ 50mm
0.75m	Street furniture: signs, lamp columns etc
1.0m	Walls, railings (including bridge parapets), parked cars etc

Cyclists overtaking/passing cyclists

Where cyclists need to overtake each other or pass in the opposite direction, at least 0.5m should be allowed between the dynamic envelopes of each cyclist. This gives a figure of 2.5m as being the minimum distance between kerbs of 50mm or over for a two-way cycle track.



2.5m between kerbs ≥ 50mm

Overtaking by motor vehicles

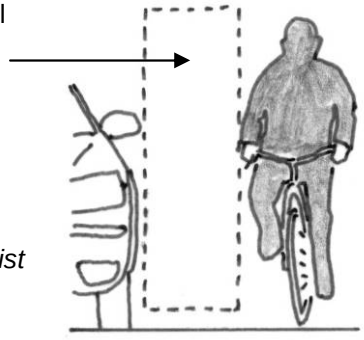
TRL research has shown that, under test conditions, nearly half the cyclists studied felt unsafe when cars travelling at 20mph passed them with a clearance of 0.95m. However, Dutch research has established that motorists driving at this speed are willing to overtake cyclists leaving a clearance of only 0.85m. This distance increases to 1.05m when passing at 30mph.

These clearances have been used to prepare the *Minimum safe passing distance* table below and although some cyclists may find these recommended clearances uncomfortable, the lane widths derived from them still exceed those given in Traffic Advisory Leaflet TAL 15/99 "Cyclists at Road Works". It is accepted that these lane widths may be harder to realise at road works, but for permanent situations, the designer should be aiming to provide as high quality an environment as possible. ***It should also be noted that these distances are measured from the cyclist and not the dynamic envelope***. These should, therefore, be considered as minima, and not desirable criteria, and improved upon whenever possible.

Minimum clearance (not regarded by all cyclists as safe – see text) between cyclist and overtaking traffic:

0.85m ≤ 20mph
1.05m = 30mph

Note: these measurements are taken between the motor vehicle and the cyclist not the dynamic envelope



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

Carriageway profiles/lane widths

The following table sets out the lane widths required for cars or HGVs and buses to overtake cyclists and achieve the minimum safe passing distances. Note that these are derived from distances measured from the cyclist and not from the dynamic envelope (see drawings 1-3 below). These distances are also based upon those at which motorists will pass cyclists (see above), and not the minimum safe passing distance. They should, therefore, be improved upon where ever possible.

Vehicle type/speed	**Lane width required at minimum recommended clearances (kerbed one side only – for kerbs both side add 0.25m)**	**Key measurements***	
Car overtaking at 20mph	3.5m* (3.525m rounded down)	Cyclist distance from kerb	0.125m
Car overtaking at 30mph	3.725m	Width of cyclist	0.75m
Bus/HGV overtaking at 20mph	4.325m	Width of car or width of truck	1.8m/2.6m
Bus/HGV overtaking at 30mph	4.5m* (4.525m rounded down)	min. clearance	0.85/1.05m

* See drawings 1 and 2

Carriageway profiles may be considered as falling into 3 categories; wide, critical, and narrow. In reality, single lanes of traffic are not generally constrained between kerbs and are motorists are able to partially leave the lane to pass cyclists. This means that for a typical arrangement of a lane with a kerb on one side and a white line on the other, each section can perform as if it had a little additional width over the same section with two kerbs.

However, it is not always possible for motorists to leave the lane. They may be constrained by heavy oncoming traffic or occasional physical obstructions such as central traffic islands. When this occurs, the width of the section becomes crucial to the safety and comfort of cyclists. Ideally, motorists should be able to pass cyclists with adequate clearance without having to leave the lane. In general, the designer should assume, therefore, that vehicles cannot leave the lane when assessing the way each profile type performs. .

As the table below demonstrates, as a general rule wide profiles over 4.5m are recommended and critical sections between 2.75 and 4.5m should be avoided. In practical terms, however, where narrow sections are constrained by kerbs e.g. at pinch points or refuges the distance between kerbs is likely to be 3.0m to accommodate the swept paths of large vehicles (i.e. where their passage through the narrowing cannot be guaranteed to be in a straight line). Where such narrowings are introduced, other measures to reduce speeds should be introduced to discourage motorists from speeding up to overtake cyclists on the approach to these features (see A02 Speed Reduction and A03 Traffic Calming).

Wide, Critical and Narrow carriageway sections			
Section type		**Width in m (figs rounded)**	**Comments**
Wide		**≥ 4.5**	**Recommended**: Cars and HGVs can pass cyclists with adequate clearance at speeds up to 30mph. Ideal for bus lanes. If marked as an all-purpose lane, the width can encourage higher traffic speeds which may have to be addressed.
Critical	Wide	**3.5 to 4.5**	**To be avoided** where there is a high percentage of large vehicles. Large vehicles (HGVs/buses) are likely to pass cyclists but with inadequate clearance.
	Narrow	**2.75 to 3.5**	**To be avoided** in most cases. Cars are likely to pass cyclists at the upper end of the range but with inadequate clearance. The worst section for cyclists.
Narrow		**2.6 to 2.75**	**Generally only suitable over short lengths** e.g. at pinch points and narrowings. All vehicles unable to overtake cyclists. HGVs can just pass through gap at the upper end of range.

Emergency Vehicle Access

Designers should also be aware of the need to allow for emergency vehicle access

Manual for Streets:

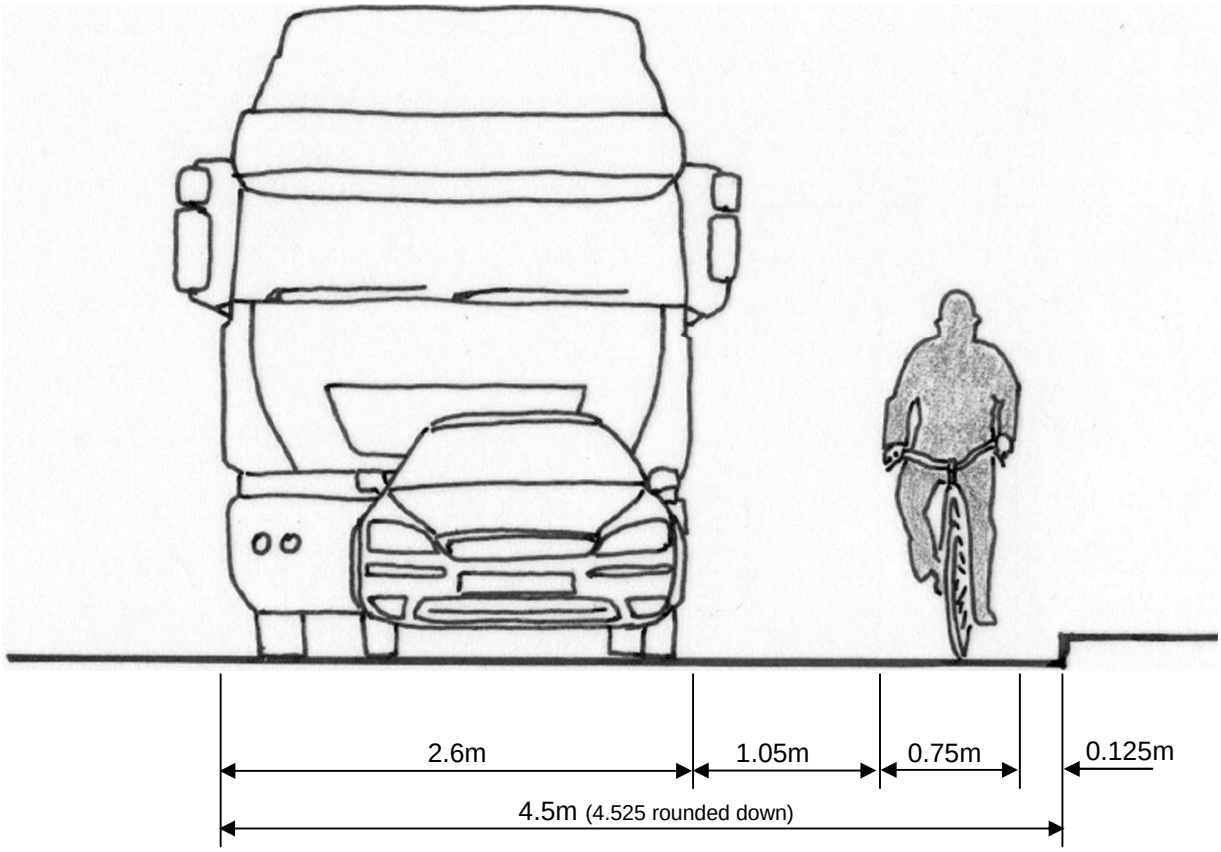
6.7.2 The Building Regulation requirement B5 (2000)**10** concerns 'Access and Facilities for the Fire Service'. Section 17, 'Vehicle Access', includes the following advice on access from the highway:

- there should be a minimum carriageway width of 3.7 m between kerbs;
- there should be vehicle access for a pump appliance within 45 m of single family uses;
- there should be vehicle access for a pump appliance within 45 m of every dwelling trance for flats/maisonettes;
- a vehicle access route may be a road or other route; and
- fire service vehicles should not have to reverse more than 20 m.

6.7.3 The Association of Chief Fire Officers has expanded upon and clarified these requirements as follows:

- a 3.7 m carriageway (kerb to kerb) is required for *operating space at the scene of a fire. Simply to reach a fire*, the access route could be reduced to 2.75 m over short distances, provided the pump appliance can get to within 45 m of dwelling entrances;
- if an authority or developer wishes to reduce the running carriageway width to below 3.7 m, they should consult the local Fire Safety Officer;

Drawing No 1



Wide Section - widths exceeding 4.5m

(Speed: 30 mph)

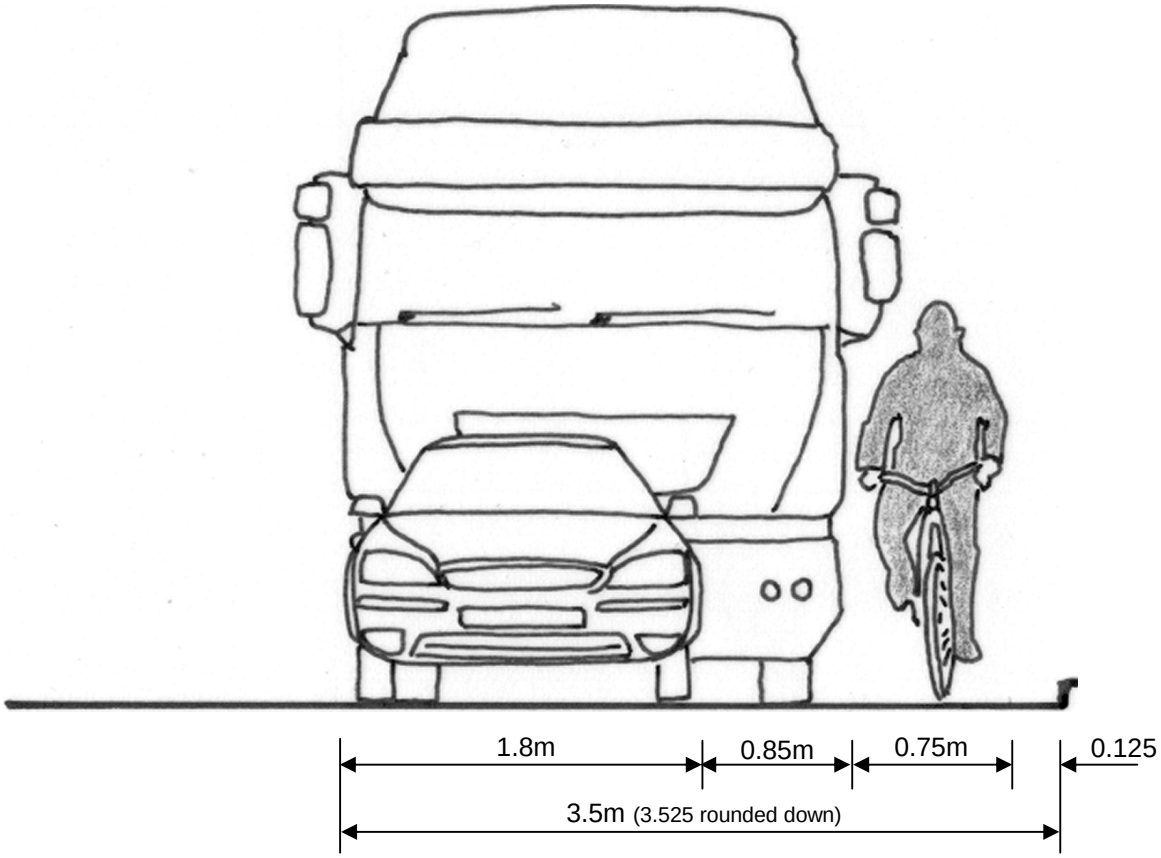
A width of over 4.5 m will allow heavy goods vehicles and buses to pass cyclists with 1.05 m clearance (undesirable but reflects observed practice).

Notes:

Measurements are taken from the cyclist and not the dynamic envelope – uphill gradients will necessitate additional space.

No allowance has been made for door mirrors (typically adds 200mm to the overall width of a car), the clearance required between motor vehicles passing in opposite directions (0.8m at 30 mph) or additional width required between kerbs (0.25m).

Drawing No 2



Critical Section - width range 2.75m to 4.5m
(Speed 20 mph)

Drawing shows a critical-wide section at its narrowest

Critical Wide Section 3.5 m - 4.5 m

Over most of this width range, HGVs cannot overtake cyclists with adequate clearance but cars can.

Critical Narrow Section 2.75 m - 3.5 m

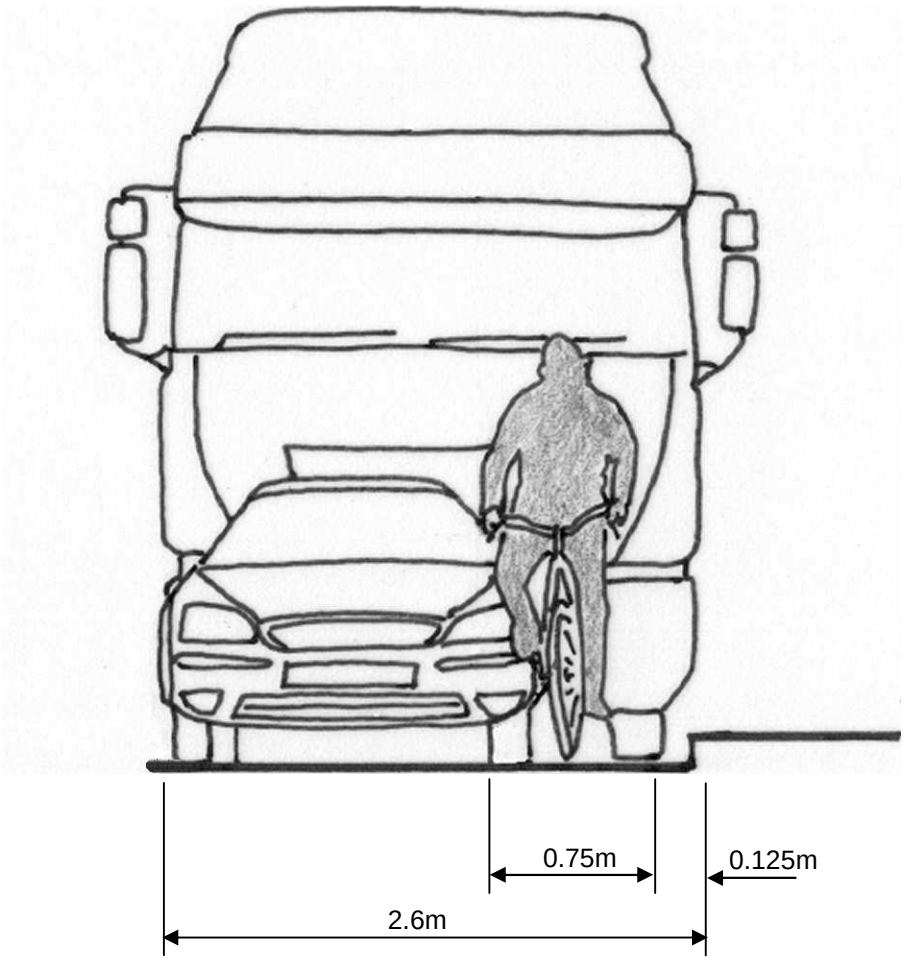
Cars are unable to overtake cyclists with adequate clearance but some motorists will still attempt it, even at the bottom of the width range. Lane widths between 2.75m and 3.25m should be avoided in most cases (see text).

Notes:

Measurements are taken from the cyclist and not the dynamic envelope – uphill gradients will necessitate additional space.

No allowance has been made for door mirrors (typically adds 200mm to the overall width of a car), the clearance required between motor vehicles passing in opposite directions (0.8m at 30 mph) or additional width required between kerbs (0.25m).

Drawing No 3



Narrow Section - width range 2.6m to 2.75m

(Speed 20 mph or less)

Drawing shows a narrow section at its minimum width

Cars and HGVs unable to overtake cyclists (theoretically possible for cars to do so when section is 2.75m wide but drivers are unlikely to attempt it).

Nearly all vehicles can pass through the gap but HGVs and buses will have to do so slowly.

This section is only appropriate for short lengths.

Note:

No allowance has been made for door mirrors (typically adds 200mm to the overall width of a car), the clearance required between motor vehicles passing in opposite directions (0.8m at 30 mph) or additional width required between kerbs (0.25m).

Publications

LTN 2/08 *Cycle Infrastructure Design* DfT 2008

Manual for Streets DfT, Communities & Local Government 2007

TAL 15/99 *Cyclists at Roadworks* DfT 1999

TAL 1/97 *Cyclists at Road Narrowings* DfT 1997

TAL 9/94 *Horizontal Deflections* DfT 1994

TAL 7/96 *Highways (Road Humps) Regulations 1996* DfT 1996

Cycling England Gallery pictorial examples

CTC Benchmarking – Best practice case studies

Design manual for bicycle traffic CROW, Netherlands 2007

Other references

Cycle Friendly Infrastructure - Guidelines for Planning and Design Bicycle Association et al 1996 - ISBN 0 902237 17 9

Sign up for the bike: design manual for a cycle-friendly infrastructure, CROW 1993

Attitudes of a sample of cyclists to using single-track roads TRL Report SR 357