




Chapter 5

Junctions and crossings

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5.1 Introduction and general issues

5.1.1

The conflicting nature of movements at traffic junctions and crossings results in increased safety risk and interruptions to cyclists' journeys. Improvements for cyclists can be achieved by:

- reducing the number of conflicts
- managing or eliminating conflicting movements
- raising drivers' awareness of cyclists
- guiding cyclists' and drivers' manoeuvres
- lowering motor vehicle speeds

5.1.2

Junctions and crossings are considered under the following five categories in this chapter:

- priority junctions
- signal controlled junctions
- roundabouts and gyratories
- priority crossings
- signal controlled crossings

5.1.3

The whole movement of the cyclist on all routes through the junction or crossing, whether on or off the carriageway, should be considered. This can be broken down into the following elements:

- route prior to positioning manoeuvre
- transition; getting into position before any stop or give way line
- approach to the junction/stop/give-way line
- waiting at any stop or give-way line
- through the junction
- departure from the junction

5.1.4

About two thirds of cycle accidents occur at junctions, with the most severe involving Heavy Goods Vehicles (HGVs). Particular regard should be paid to this issue in junction design.

Geometry and sight-lines

5.1.5

Radii through junctions should generally allow cyclists to maintain progress without interruption when they have priority. A minimum external radius of 4m should be used on cycle facilities, with a larger radius wherever possible.



An alternative route may offer journey time as well as safety benefits

Provide a minimum external radii of 4m on routes taken by cyclists through junctions

5.1.6

Sight-lines are needed to ensure adequate visibility at junctions. These are particularly important at the junction of cycle tracks and roads. The normal motor vehicle minimum of 2.4m 'X' distance (on the side-road) should be used. In low flow situations a minimum of 2.0m may be acceptable. The 'Y' distance (measured along the main road) depends on vehicle (85 percentile) speeds on the road, 60m for 30mph or 33m for 20mph (see DB 32).

5.1.7

There may be occasions where horizontal deviations or speed humps should be introduced to improve cyclists' sight lines or reduce their speed on the approach to a potentially dangerous crossing, junction or shared-use area.



Cyclists should maintain progress without interruption

5.1.8

For cycle routes that cross other routes or footpaths, a cycle design speed of 15mph would normally be appropriate, with a minimum visibility 'Y' distance of 20m. Low sight-line distances can sometimes be useful in helping to reduce vehicle speeds, but they should not drop below the recommended distances.

5.2 Priority junctions

5.2.1

The majority of highway junctions are of the 'priority' type where vehicle priority is given to traffic on the major road. The priority is indicated by give-way or stop lines and associated signs. In a small number of cases there are no road markings at all.

5.2.2

There are a variety of types of priority junctions and crossings including T-junctions, cross-roads and uncontrolled cycle crossings that come under the category of priority junctions.

If a junction is to remain of the priority type then the choice of which movements have priority should be reviewed to optimise cycling movement, both in terms of waiting times and safety

T Junctions

5.2.3

A large variety of geometric layouts are possible for T junctions, with different approach angle, widths, number of lanes and traffic islands. A 90° approach is generally considered to be safest, with better visibility and slower vehicle speeds. Right-turning cyclists are exposed to danger when turning into or out of a minor road, both on the approach and when crossing. Turning movements both into and out of the junctions in all directions must be considered, not just on designated cycle routes. If satisfactory layouts cannot be achieved then small (cycle friendly) roundabouts or, as a last resort, signals, may be appropriate.

5.2.4

Acceptable solutions may include:

- Central islands on the main road to assist cyclists turning in and out of side roads (can include short offside cycle lane)
- Central refuges or entry treatments on side roads.
- Junction tables to slow motor vehicles
- Kerb realignment and build-outs to improve visibility, reduce motor traffic speeds and prevent parking close to the junction
- Separate cycle approach lanes where there are high vehicle flows
- Waiting restrictions

5.2.5

See drawings CCE/B8 and B10 for typical layouts at T junctions.

Crossroads

5.2.6

The principles at crossroads are similar to those for T junctions. Cyclists can use a right turning lane provided for vehicles using the main road, although high speed and/or volumes of traffic may make this difficult or not desirable. Footway build-outs at junctions can be considered on minor and main roads to improve safety for cyclist crossing movements by reducing vehicle speeds on the main road and improving visibility. However, build-outs that create pinch points for cyclists, (widths less than 4.0 - 4.5m per lane) should be avoided except on narrow quiet roads. Carriageway widths required to facilitate these are shown in figure 5.1 below.

Figure 5.1
Carriageway width to
accommodate kerb
build-out

Minimum carriageway remaining following introduction of kerb build-outs (m)		
	Two-way road	One-way road
Minor road	6.0	4.0
Main road	8.0 – 9.0	4.5

5.2.7

An alternative to kerb build-outs may be restricting on-street parking, if present.

5.2.8

Where appropriate and feasible, priorities at cross roads should be changed so that cyclists on a cycle route do not have to give way.

Where appropriate and feasible priorities at cross roads should be changed so that cyclists on a cycle route do not have to give way

Left turn vehicle slip lanes

5.2.9

The provision of free-flowing entry and exit slip lanes for left turning vehicles can cause particular safety problems for cyclists who are not turning. Reduction in vehicle speeds, particularly on the turning movements, and a reduction in the distance where cyclists are vulnerable should be considered.

5.2.10

To reduce the distance where cyclists are vulnerable, the slip lanes should be removed completely by re-configuring the junction or, where this is not feasible, reduced to the minimum required by reducing the taper to 1 in 3 for 30mph roads and 1 in 5 for 40mph roads.

5.2.11

Advisory cycle lanes should be continuous across the mouths of these junctions to guide cyclists and warn motorists. Use of the lane marking, frequent 1057 cycle symbols and coloured surfacing will highlight the cycle lane. Where carriageway width is insufficient to provide a cycle lane, then 'virtual' cycle lanes using coloured surfacing and cycle symbols should be used.

5.2.12

The cycle lane on the main road should be continued across the mouth of the slip lane with 1003 give-way markings on the near-side, lane markings on the outside, 1057 cycle symbols at 5m intervals and coloured surfacing.

5.2.13

For typical details of advisory cycle lanes at slip roads see drawing CCE/B11.

5.2.14

Where it is not practical to reduce the taper adequately on a slip road then a suitable crossing of that road or lane needs to be provided. This may be the

case on multi-lane and high speed roads. A dogs-leg crossing with signing to Diagram 2601.2 may be required, together with a Toucan or other signal controlled junction.

5.3 Signal-controlled junctions

5.3.1

At signal controlled junctions, vehicle and pedestrian movements are controlled at the point of conflict to manage competing demands from users. Cycle detection technology can be incorporated to optimise signal timings for cyclists and should be used wherever feasible.

5.3.2

In some cases benefits for cyclists may only be achieved by revising layouts and choosing signal timings that reduce the effective capacity of the junction.

5.3.3

Care should be taken to avoid introducing signal control where it is not justified. This can result in increased journey times for all users and is costly. It can also result in red light abuse by cyclists where the frequency of other modes does not warrant signal control.

5.3.4

All traffic signals in London are the responsibility of the TfL Signals Section (TfL SS). Works requiring changes to existing or provision of new signal controlled junctions or crossings will require liaison with TfL SS (see Chapter 2 for more details). TfL SS should be contacted as early as possible during development of a scheme that is likely to require their involvement.

Cycle detection should be incorporated in signal control systems where feasible

Signal timing optimisation should address the needs of cyclists

Options at signalised junctions

5.3.5

Trials of pre-signals, cycle advance signals and left turn filters for cyclists are being considered. Any appropriate sites for these should be discussed with CCE and TfL SS.

5.3.6

An advance pre-signal for cyclists has been used in LB Waltham Forest allowing cyclists travelling straight ahead to proceed before left turning motorists.

5.3.7

Speed control by linking signals along a length of road may be appropriate in some locations e.g. 20 mph roads. Discussion should be held with TfL SS.

5.3.8

In other locations signal layouts with cycle phases, links or cycle by-passes should be considered.



Signal layouts with cycle by-passes should be considered

Consider cycle priority systems at signal controlled junctions

Advanced Stop Lines

5.3.9

All traffic signal junctions should incorporate an advanced stop line (ASL) or similar cycle priority area. ASLs and complementary facilities give cyclists priority, and help to raise driver awareness of cyclists. Research has shown that ASLs have a negligible effect on junction capacity unless a vehicle lane has to be removed.

5.3.10

In particular ASLs enable cyclists to:

- keep in drivers' line of sight
- avoid conflict with left-turning vehicles
- wait away from direct exhaust fumes
- reach a safe position for turning right.

Advanced Stop Lines (ASLs) should be provided on all arms of traffic signal controlled junctions except where acceptable alternative cycle facilities are provided

5.3.11

The recommended layout for ASLs is a single primary signal at the cyclist's stop line with a lead-in cycle lane. The lead-in cycle lane should be at least as long as the maximum queue length during peak periods.

5.3.12

The preferred length of the reservoir for cyclists is 5.0m with a minimum of 4.0m.

5.3.13

Centrally located ASL lead-in lanes can also be used instead of or in addition to kerb-side lanes to reduce the conflict between vehicle and cycle movements through the junction, particularly where there is a left-turn-only kerb-side lane. However it must be remembered that if at times traffic is expected to be fast-moving, cyclists will need a safe way of reaching the cycle lane in the middle of the road and alternative layouts may need to be considered. It may be necessary to signalise the left-turn lane in such a way that cyclists can reach the centre of the road in safety. Central ASL lead-in lanes between two running lanes must not be so long that cyclists are encouraged to join them where other traffic is fast-moving, accelerating and/or weaving.



Centrally located ASL lead-in cycle lane is useful when there is a left-turn-only traffic lane

5.3.14

A 2.0m wide cycle lane (minimum width 1.5m) should be provided where lanes are not adjacent to kerbs and this should have coloured surfacing.

Part-width and staggered ASLs

5.3.15

In some situations part width ASL reservoirs, not covering the full width of all the approach lanes and with staggered stop lines, may be appropriate. These tend to be better observed by motorists than full width ASLs.

5.3.16

They could be used at junctions where cyclists are not permitted to turn right. TfL has recently completed a trial with a number of such junctions that shows good results. At present site authorisation is needed from DfT for such layouts. See drawings CCE/B2, B3, B4 and B4.1 (but note that these are not yet DfT authorised).

Lane widths at ASLs

5.3.17

Lead-in lanes to ASLs may be either mandatory or advisory. The recommended widths are 1.5m for both mandatory (preferred) and advisory lanes. Narrower lanes may be acceptable in some cases where width is restricted, as shown on figure 5.2.

5.3.18

The remaining vehicle lanes may be reduced to 2.7m or an absolute minimum of 2.5m, which allows motor traffic not to block or encroach on the cycle lane. These widths have been shown to be effective in practice being wide enough for all but HGVs, which may encroach slightly into the cycle lane. The proportion and speed of buses and HGVs should be taken into account when considering lane widths less than 3.0m.

Figure 5.2
Recommended lane widths
at ASLs

Carriageway * (m)	Cycle Lane (m)	Motor vehicle Lane 1 (m)	Motor vehicle Lane 2 (m)	Opposing Lane (m)
7.3	1.3	2.5	-	3.5
7.5	1.5	2.5	-	3.5
8.0	1.5	2.5	-	4.0
8.5	1.5	3.0	-	4.0
9.0	1.5	3.0	-	4.5 (1.5+3.0)
10.0 (1 lane)	1.5	3.5	-	5.0 (1.5+3.5)
10.0 (2 lane)	1.0	2.5	2.5	4.0
10.5	1.5	2.5	2.5	4.0
11.0	1.5	2.5	2.5	4.5 (1.5+3.0)
11.5	1.5	2.75	2.75	4.5 (1.5+3.0)
12.0	1.5	3.0	3.0	4.5 (1.5+3.0)
15.0	1.5	3.0	3.0	3.0+3.0+1.5

* width remaining after deducting space required for central islands

Notes:

1. Treatments at all locations must be considered on their specific characteristics.
2. Where there are high proportions of HGVs in traffic flows, motor traffic lane widths less than 3.0m may not be suitable and lead-in cycle lanes should be advisory

General standards for ASLs

5.3.19

The following should be considered when designing ASLs:

- A large cycle Diagram 1057 symbol 1.7m wide by 2.75m deep should be provided in the cycle reservoir. Where the reservoir is greater than 2 lanes wide more than one Diagram 1057 symbol should be used (this presently requires DfT authorisation).
- Colour surfacing should be used in ASL reservoirs to increase awareness of the facility by motorists.
- The length of the lead-in cycle lane should be maximised and where possible extend beyond the maximum peak period vehicle queue-length, if not for the full length of the link. Diagram 1057 cycle symbol markings at 10 - 20m centres should be provided close to the junction.
- More than one lead-in lane may be required to allow for left turn and straight ahead movements.
- The ASL and cycle lane is likely to impact on existing lane widths and markings, particularly on the approach. These should be reviewed and altered as necessary.
- Consider cyclists and lane widths in the opposing direction. Lane widths may be even more critical there, and a 4.0m minimum lane is desirable.

Feeder lanes to ASLs should be provided with continuity of provision from the rest of the route

5.3.20

Where there is inadequate space for any lead-in lane it may be appropriate to provide a 'gate' or stub access to the ASL. These gates may be the only ASL access or they may be in addition to a feeder lane on a multi lane approach. At present 'gates' will require DfT site authorisation as they are not covered by TSRGD, although they may be included in a future revision.

5.3.21

See drawings CCE/B2, B3, B4 and B4.1 for typical details of layout options and recommended dimensions at Advanced Stop Lines.

Additional measures for exiting and turning right at junctions

5.3.22

Options for reducing the risks and obstruction to cyclists include:

- Cycle lanes across junctions using markings to Diagram 1004 or 1010 (for typical detail see drawing CCE/B21)
- boxed junction (clearway markings to Diagrams 1043 and 1044) – can be used to facilitate a route and its safety
- splitter islands – centrally located traffic-island to protect the cyclist from opposing vehicles
- right-turn waiting area: this should be 2.5m wide (minimum of 1.8m)
- G-turn layout – 'jug handle' allows cyclists to cross the road from the left rather than make a right turn. This method may also be used for cyclists travelling on the main road and wishing to turn right into the side road

5.3.23

Further examples for ASLs can be found in TAL 05/96 and TAL 08/93.

5.4 Roundabouts and gyratories

General considerations

5.4.1

At roundabouts and gyratories it is essential to understand cyclists' desire lines and manoeuvres in order to provide for their safety. At many existing roundabouts the geometry creates difficulties for cyclists by not sufficiently reducing motor vehicle speeds.

5.4.2

Compared with other types of junctions, roundabouts can provide all vehicles with less delay and often reduced casualties. However, the ranges of

roundabout types, their locations and usage are wide, and will have varying effects on cycling.

5.4.3

Small and mini-roundabouts generally have a moderate cycle accident record, and can give improvements to cyclists. However, larger conventional UK designs with four or more arms have a poor safety record for vulnerable road users, particularly cyclists (who are 14 times more likely to be involved in a collision than other vehicles). In general terms the larger the roundabout, the more circulating lanes, and the higher the traffic flows, then the greater the problems for cyclists. The various types of roundabout are dealt with in more detail below.

5.4.4

Most accidents involving cyclists arise from vehicles entering the roundabout and colliding with cyclists who are on the circulatory carriageway. The risks to cyclists can be reduced by:

- controlling entry, circulatory and exit speeds
- reducing unused carriageway space, including reducing the number of approach lanes where feasible
- providing an alternative route or by-pass for cyclists that does not result in additional delay
- raising driver awareness of cyclists
- giving cyclists clear, unobstructed passage up to, through, and leaving the junction
- managing traffic and conflicting manoeuvres through the use of signals

5.4.5

For smaller roundabouts, one option is to provide 'continental' type geometry. This is covered later in this section.

Consider 'continental' type geometry for roundabouts

Conventional UK roundabouts

5.4.6

Small conventional roundabouts with single lanes and low flows will normally be satisfactory for cyclists as long as the geometry is 'tight'.

5.4.7

In some cases it may be appropriate to introduce approach and circulatory cycle lanes, either advisory or mandatory. However, care must be taken not to position cyclists where they will have difficulty crossing exiting traffic, and only a few such schemes have been successful.

5.4.8

Large conventional roundabouts pose greater problems for cyclists. The most effective options for cyclists are:

- Signal control of the roundabout. Advanced stop lines can be used at signal-controlled roundabouts and they should also be considered for the circulatory carriageway for large roundabouts. Pre-signals for cyclists could be considered.
- Provide segregated cycle tracks with signal (toucan) crossings of appropriate arms if the total junction flows exceed about 25,000 vehicles per day.



Signal controlled crossing over busy roundabout circulatory carriageway (Chiswick Roundabout)

5.4.9

Other ways to reduce the risks to cyclists include:

- Every additional entry, exit and circulatory lane increases the risks to cyclists. The number and width of entry and circulatory lanes should be minimised. Single lane approach and exit widths of between 4.0m and 5.0m, and single lane circulatory carriageways of between 5.0m and 7.0m are desirable.
- Reduced circulatory speeds can be achieved by introducing over-run strips around the central island of the roundabout, thereby reducing the width of the circulating carriageway.
- The provision of minimal entry and exit flares (between 20° and 60°). Generally, aim to provide arms that are perpendicular, rather than tangential to the roundabout.
- Provide entry deflection to the left on entering the roundabout.
- Provide islands to segregate cyclists at entry/exit and to provide greater deflection for motor vehicles.
- Reduce spare carriageway space and increase size of deflector islands.
- Provide spiral lane markings for general traffic to improve lane discipline.



Over-run strip at roundabout central island can reduce circulatory speeds

Gyratories

5.4.10

Gyratories are normally one-way flow routes around existing streets, effectively turning them into large roundabouts. They should be assessed and improved using broadly the same principles as large conventional roundabouts (see above).

5.4.11

Additional options that specifically apply to gyratories are:

- remove the gyratory and return to two-way working
- provide contra-flow cycle (or bus and cycle) lanes on one or more arms

5.4.12

High speed is likely to be problematic with gyratories, even more so than with many large conventional roundabouts. In view of this, the need to reduce motor vehicle speed requires particular attention.

‘Continental’ type roundabouts**5.4.13**

Continental type roundabouts are considered to cause cyclists fewer difficulties, see TAL 9/97. These designs are particularly appropriate for flows of 5-20,000 vehicles per day because of their tighter geometry. It may be possible to convert a conventional roundabout to one of the continental type. Comparisons between traditional UK and continental roundabout design are compared in figure 5.3 below.

Figure 5.3
Comparison of roundabout
types

Design feature	Roundabout type		
	Conventional	Continental (TAL 9/97)	Mini
Approach arms	Ideally perpendicular but can be skewed	Perpendicular	Preferably perpendicular but can be skewed
Entry width	Add one lane to entries	One lane, usually 4m	Variable
Entry radius	20m, 6m minimum	Not specified but about 10m	Not specified
Entry angle	Preferably 20° to 60°	Approx 30° to 45°	Deflection desirable
Entry path curvature	Not to exceed 100m	Not to exceed 100m	
Exit arms	Easy exits	Tight perpendicular exits	Not specified
Exit radius	40m desirable, 20m minimum	Approx 10m	Not specified/max 5m
Exit width	Add extra lane	Single lane 4-5m	Not specified
External diameter ICD	28-100m	25-35m	Dependent on movements
Island diameter	Min 4m	16-25m	2-4m
Circulatory carriageway	1-1.2 times entry width	Single lane 5-7m	5-7m

5.4.14

Orbital cycle lanes around the periphery of roundabouts have been used, but are not recommended. They may generate more problems for cyclists unless

they are wide and the main problems of vehicle speed and flow are tackled, as listed earlier.

At roundabouts, treatments in order of preference are reduce speeds and traffic lanes OR signalise (both with appropriate on-carriageway cycle facilities) OR segregate

Mini-Roundabouts

5.4.15

In general, small mini-roundabouts with low traffic flows are not problematic for cyclists. They should be designed with consideration of the following:

- minimise entry and circulatory widths, and deflection angles
- make it impossible for motor vehicles to overtake other vehicles and cyclists within the roundabout circulatory area
- a single lane entry and exit (maximum width 5m)
- a raised central island of 4m diameter should be adopted if possible to slow general traffic
- incorporate a speed table in the roundabout design
- incorporate additional deflector islands for motor traffic



This contraflow cycle lane entry to a small roundabout works well

5.4.16

Larger mini-roundabouts with more than one-lane entry widths can cause problems similar to or worse than with conventional roundabouts, so particular care is required to address cyclists' needs. Where there are particular safety and/or comfort concerns for cyclists at such junctions, signalisation should be considered.

Provide geometry and other measures that will encourage appropriately low speeds on roundabouts

5.5 Priority crossings without signal control

5.5.1

At priority crossings, the signing will define which movements have priority over others. Road safety and driver awareness at priority crossings can be improved to provide safe crossings with reasonable waiting time. This can be helped by:

- road narrowings (with 90° approaches for cyclists)
- central islands
- traffic calming measures to reduce vehicle speeds, including width restrictions and humps
- use of coloured surfacing and Diagram 1057 cycle symbols
- improved alignment of the cycle track
- where vehicle speeds and flows are low, the introduction of give-way signs and markings for motorists and a raised table, giving priority to cyclists (See drawing CCE/C8)

5.5.2

Note, the use of 'elephants' footprints' road markings WBM294 require DfT site authorisation, that will generally not be given unless they are used at signals. See drawing CCE/B20.

Crossings must be acceptable in terms of safety and waiting times

5.5.3

Examples of priority crossing types are given on drawings CCE/C5, C14 and C15.

Zebra Crossings

5.5.4

It is not legal for cyclists to ride over zebra crossings or cycle on the adjacent footway.

5.5.5

Two options to provide for cyclists exist at present, either conversion to a toucan crossing or a priority cycle crossing adjacent to a zebra but with no markings on the carriageway (see drawing CCE/C19). A raised table with the appropriate Diagram 1062 markings is recommended.

5.5.6

Cycle and pedestrian 'zebras' are under consideration by the DfT, but are not yet authorised. Locations for trialling a crossing of this type of crossing are invited by CCE. Various layouts have been tried outside London, one requiring cyclists to dismount about 2m from the zebra.



Zebra crossings can offer cyclists minimal delay even though they must dismount

5.5.7

See section 4.2 for cycle lanes at zig-zag markings and zebra, pelican and toucan crossings.

5.6 Signal-controlled crossings

5.6.1

Where safety considerations, traffic flow, speed and demand provide justification, signal controlled cycle, Toucan, or parallel cycle/pedestrian crossings can be used to enable cyclists to cross roads. The options of non-signal controlled crossings should be considered first, see section 5.5 above.

5.6.2

A key aspect of crossing design is to consider the movements of pedestrians and cyclists and reduce conflict between these modes.

5.6.3

Ramps to enable cyclists to leave the main carriageway and use the crossing should be provided.



Exit ramp enables cyclists to use crossing to turn right across a busy road into Syon Park

Signal controlled cycle crossings

5.6.4

Signal controlled cycle crossings can be used where cyclists but not pedestrians need assistance to cross busy roads. The layout of these crossings is similar to normal signal controlled junctions. Wait times for cyclists should be minimised, including by the use of cycle detection where feasible.

5.6.5

Where a crossing is used by equestrians, these should also be catered for but horses should be segregated from cyclists by using a Pegasus crossing.

Wait times for cyclists at signal controlled crossings should be minimised, by the use of cycle detection or activation where feasible

Parallel cycle and pedestrian crossings

5.6.6

These crossings should normally be used where there is high demand by cyclists and/or pedestrians, thus reducing potential conflicts between the two modes on the crossing. They are also useful where the cyclists are approaching from a different direction from the pedestrians. As a result they are often preferable to Toucans, however they are non-standard and may be more expensive than Toucans e.g. if they need more poles.



Parallel crossing provides for direct routes for pedestrians and cyclists

Toucan crossings

5.6.7

Toucans are the most common type of shared cycle and pedestrian crossing. The surface of the crossing and to either side is shared, unsegregated, although the latter may be a small defined area, say 4m wide minimum by about 4m deep, depending on footway width. They are relatively simple and have a standard layout. However, there are many layout variations that can be used to facilitate their inclusion at side-road junctions. Variations may enable more direct crossings at side-roads, removing dog-leg deviations and lengths of shared path.

5.6.8

If some degree of segregation from pedestrians is required, this can be achieved by providing segregated paths up to the Toucan, and if required, across them, by use of coloured surface for the cycle side of the crossing. Non-standard blister tactile paving tails may be required.

5.6.9

For typical details relating to Toucan Crossings see drawings CCE/C4.1, C12, C13 and C16.

Links for cyclists to crossings should be direct without unnecessary bends or deviation