B.02 Road Crossings – Side Roads

Key Principle

Maintaining the continuity of cycle tracks is important if they are to provide an attractive alternative to being on road. Consideration should be given to the use of cycle priority crossings where they cross minor roads where daily traffic flows are below 2000 vehicles per day. European experience suggests that where the cycle track is used solely by cyclists travelling in the same direction as vehicles on the adjacent traffic lane, returning cyclists to the carriageway before side road junctions can also be an effective solution.

Design Guidance

Background

General cycle track crossings of roads are covered in B03 Road Crossings – Mid Link. This chapter only covers the type of crossing required when a cycle track alongside a main road needs to cross a side road.

Cycle Infrastructure Design:

As a result of concerns over the safety of parallel cycle tracks crossing side roads, it is becoming common European practice to reintroduce cyclists to the main road in advance of a junction. Cyclists pass the junction on the carriageway and then rejoin the cycle track.

Many cyclists feel safer riding on a dedicated cycle track than on a busy main carriageway, but in urban areas, cyclists are likely to be safer on-carriageway than on a cycle track which is interrupted by having to give way at frequent side road junctions. A TRL study into cycle tracks crossing minor roads concluded that "[the risk of crossing the minor road] must be weighed against the risks to cyclists using the major road. The safer option will depend on a variety of site-specific factors. If satisfactory crossings of minor roads cannot be provided, the creation of a cycle track may not be a sensible option".

This is backed up by Danish research based on 8,500 accident reports that has shown that whilst the construction of cycle tracks has resulted in reduced levels of accidents between junctions there has been a significant increase in accidents at junctions (9-10%).

Types of side road crossings

When taking a cycle track across a side road, the following alternatives are available;-

- The cyclists can either give way or have priority.
- The crossing can either be at road level or placed on a road hump.
- The crossing can either be in-line or bent-out.

Full consideration should be given to building cycle tracks with priority over side roads where two-way daily traffic flow on the side road is below 2000. However, if cyclists are to be given priority over road traffic, the crossing must be placed on a

flat-topped road hump to comply with TSRGD. Cycle priority crossings at road level are not prescribed in TSRGD. This leaves six ways of effecting a side road crossing for a cycle track which runs parallel and relatively close to the main carriageway;-

1. ***Cyclist has priority - crosses on a road hump - crossing is bent out.***

   This option is considered to be the safest way of granting priority to cyclists as the bent-out crossing allows for a single vehicle to leave the main carriageway completely when stopping to give way. This arrangement also accommodates a stationary vehicle waiting to join the main road without it blocking the crossing. However, with bent-out crossings, the land-take is greater and cyclists are forced to travel a longer route thus reducing the convenience of the cycle track.

2. ***Cyclist has priority - crosses on a road hump - crossing is in line.***

   This is the most convenient for cyclists. The crossing is direct, with no ramps, and cyclists do not have to stop to give way. However, care is needed to ensure that the arrangement is suitable for the expected traffic conditions.

   The main point to consider is whether a hazard is created by vehicles turning into the side road obstructing the main road whilst giving way to cyclists crossing. Such obstruction is not necessarily a problem in many situations, particularly where sight lines are generous. However, if the main carriageway is very busy with vehicles frequently turning into the side road, and this is coupled with a large number of cyclist crossing movements and limited sight lines, then it may be best to go for the bent-out option below. Although this option is referred to as in-line, the track may need to be slightly bent out from the main line or else the major road kerb line built out either side of the side road to accommodate the necessary road hump ramp and markings in the entrance to the side road.

3. ***Cyclist gives way - crosses on a road hump - crossing is bent out.***

   This is better for cyclists than option 4 because of the reduced traffic speeds but it still has the potential to introduce delay and loss of momentum. It is also slightly less inconvenient than the previous option because of the opportunity to cross at road level.

4. ***Cyclist gives way - crosses on a road hump - crossing is in line.***

   The presence of the road hump near the mouth of the side road means that motor vehicles should be travelling slowly which reduces the risk of conflict. Although this option is referred to as in-line, the track may need to be slightly bent out from the main line or else the major road kerb line built out either side of the side road to accommodate the necessary road hump ramp and markings in the entrance to the side road.

5. ***Cyclist gives way - crosses at road level - crossing is in line.***

   This is the easiest arrangement to install but one of the most inconvenient for cyclists since it causes delay and loss of momentum. At such crossings cyclists have to make a series of rapid judgements when deciding whether it is safe to cross without stopping. Not only do they have to take into account traffic on the side road and the presence of pedestrians, they also

have to watch for vehicles turning off the main road, particularly those coming from behind. These conditions are made worse where there are no measures to bring down the speeds of other traffic. If there are several crossings to be negotiated, it may be better to keep cyclists on the main road and not provide a cycle track.

6. ***Cyclist gives way - crosses at road level - crossing is bent out.***

   This is the least convenient of all for cyclists although it does move cyclists away from turning traffic. Apart from having to give way, the cyclist must travel further and negotiate ramps down to and up from road level. However, it may be useful if there are safety concerns due to traffic conditions or the type of cyclist expected to use the crossing, e.g. schoolchildren.

General design considerations

Priority for cyclists

Giving cyclists on a cycle track priority over road traffic at crossing points makes the whole facility more attractive but it is likely to lead to a small increase in cyclist speed at the crossings. Where this is a problem, measures can be introduced to mitigate it. Measures which introduce a degree of horizontal deflection just before the crossing can be effective, as can bending out the cycle track. The cycle track can be made more conspicuous to motorists by applying colour to its surface.

If flow on the cycle track is two-way, extra care is needed in the design of the arrangement. Cyclists travelling against the flow of main road traffic are at greater risk of conflict with motor vehicles where the track has priority over the road. Directional arrows and cycle symbol markings, together with vertical signing, can be used to help ensure that motorists approaching the crossing are aware of the fact that cyclists can come from both sides.

Danish experience shows that if the side road carries more than 2000 vehicles per day it is unlikely that the crossing will be safe for cyclists to be given priority without changing the layout of the junction, for example by using build-outs to both narrow the side road and reduce the corner radii. Even then, difficulties may be experienced because of the high levels of queuing traffic blocking the cycle track during peak periods.

Private accesses

Cyclists using a cycle track adjacent to a carriageway have priority over vehicles crossing the cycle track to gain access to or leave private property. Footways with frequent crossings are unlikely to be suitable for conversion to cycle tracks. Where it is proposed that a cycle track will be crossed by a busy service road or access, for example giving access to a filling station, then it may be appropriate to consider returning cyclists to the carriageway. Where this is not practicable it may appropriate to treat the crossing of the access as though it were a crossing of a side road and introduce special measures to ensure the safety and convenience of cyclists (see below).

Road Humps

A non-priority cycle crossing can be placed at road level or on a flat-topped road hump. If the cycle track is to be given priority over the road it crosses, the TSRGD requires that it be placed on a flat-topped road hump. This will need to be flush with the top of the kerbs which may need to be locally ramped down to bring them to the recommended hump height of 75mm. It should be noted that road humps can only be placed in roads with a speed limit of 30mph or less because the Road Hump regulations restrict the use of humps to these roads. These regulations permit a degree of flexibility when choosing the approach ramp gradient. However, the gradient should not be so steep as to discourage vehicles from waiting behind the hump on in-line crossings.

Traffic Advisory Leaflet TAL 7/96 *Highways (Road Humps) Regulations 1996* recommends that a speed reducing feature should be installed prior to the first road hump encountered (in this case there is only one). This recommendation is automatically satisfied when the hump is placed at or near the mouth of a side road. For a vehicle joining the side road from the main road, the turning manoeuvre reduces speed so the existence of the junction is the requisite feature. For a vehicle leaving the side road to join the main road, the approach to the junction serves this purpose.

Concern has been expressed that the safety of turning cyclists and motorcyclists can be compromised if they are required to negotiate the hump at an angle. However, studies have not indicated any significant problems of this nature, provided both ramp and hump surfaces have adequate skid resistance.

The use of a sinusoidal profile for the ramps can improve comfort for cyclists crossing the hump but designers should be aware that there are some pre-formed sinusoidal ramps available which do not comply with the road hump regulations.

Bent-out Crossings

Bent-out cycle track crossing with cyclist priority, Cheltenham

Picture: Alex Sully ERCDT

The cycle track should be bent out at as narrow an angle as practicable so as not to create an excessive diversion for cyclists. In general, this deflection angle should not exceed 45° especially if this leads to cyclists or pedestrians taking the most direct line and crossing each other's path.

A gap of around 5m between the main road and the crossing is probably most appropriate in urban areas. Providing a gap of more than 8m is not generally recommended as there will be a tendency for vehicles leaving the main road to

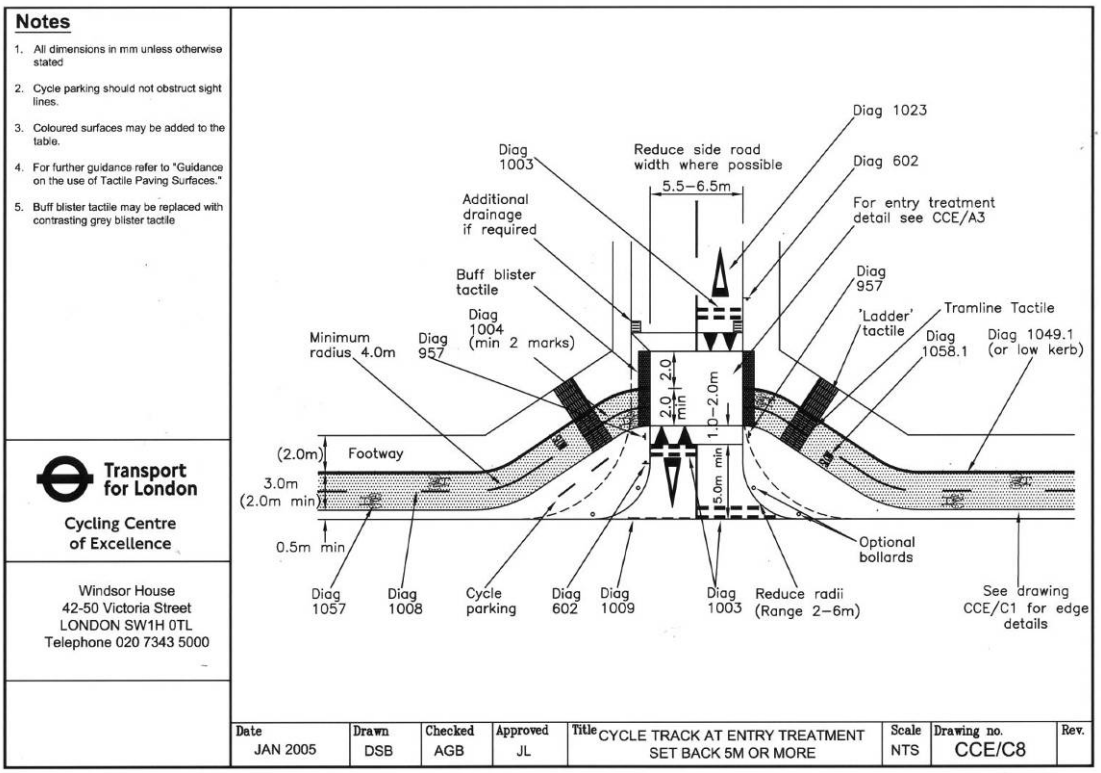
accelerate over that distance. It will also create an excessive diversion for cyclists.

If the main road is wide enough, there may be scope for constructing build-outs within the main road to reduce the amount of bending out necessary. Build-outs should not compromise the safety of cyclists on the main road by making it too narrow.

Bent out cycle tracks are most appropriate in rural and peri-urban areas, and along higher speed roads. Where used in urban areas, additional care should be taken to ensure that pedestrians are not inconvenienced. If the cycle track is segregated from an adjacent footway, the arrangement should not encourage pedestrians to cross the cycle track in order to minimise walking distance. (In general, segregated cycle tracks running alongside a road should be positioned between the road and the footway.)

Bent-out priority cycle track, Bracknell Forest

Picture: Patrick Lingwood



Source: *London Cycling Design Standards* TfL 2005

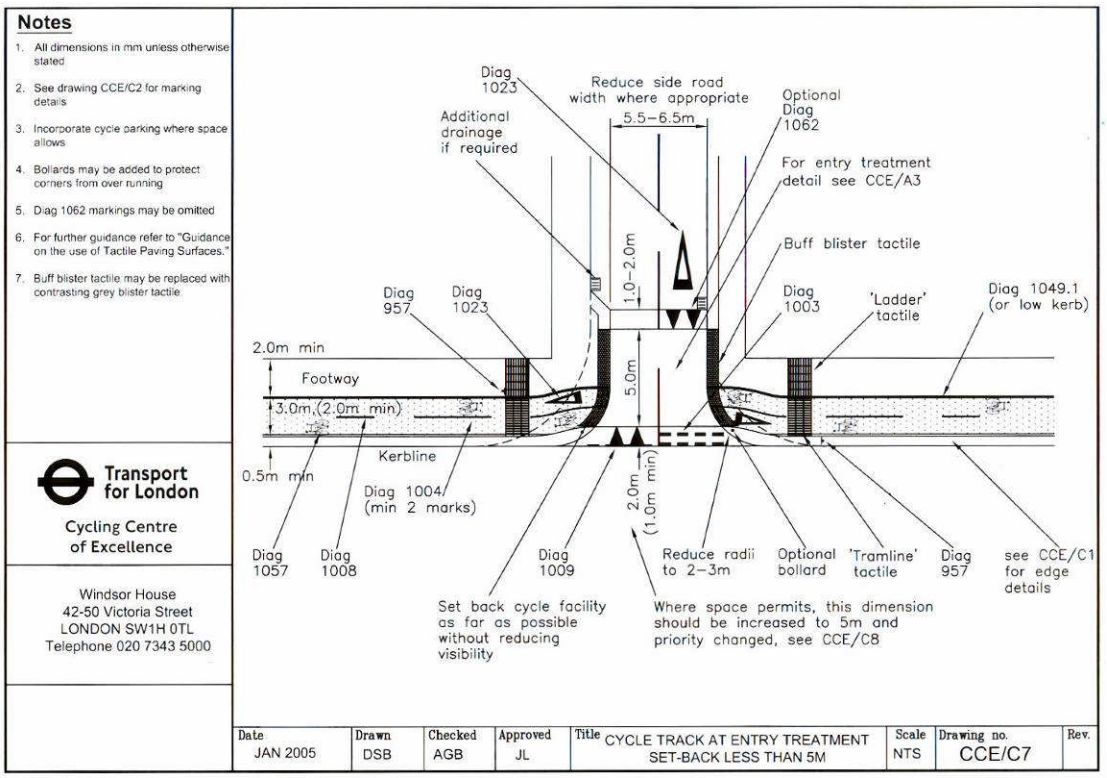
In-line Crossings

In many urban areas, there is insufficient space to allow the cycle track to be bent out from the carriageway. In such cases, an in-line crossing is required. As referred to earlier, in some cases, a small degree of deflection may be required to accommodate road markings etc. but not enough to fit a car between the crossing and the main road.

There is more potential for conflict between cyclists and vehicles turning off the main road with in-line crossings. As vehicles entering the side road have less time to interact with cyclists, in-line crossings are more appropriate where the main road speed limit is 30mph or less. Despite these limitations, a number of cycle priority in-line crossings have been implemented in UK without problem. However, care is required to ensure that they comply with TSRGD.

Good intervisibility between vehicles on the main road and cyclists on the track is important so that drivers wishing to enter the side road can judge the speed and positioning of cyclists. It becomes essential if cyclists are to be given priority on the crossing - drivers on the main road should be able to see the crossing and cyclists about to use it over a distance of at least 40m from the side road junction.

At some sites, it may be possible to close off the ends of side roads where they join the main road (cyclists should be exempt from these closures). This will enhance the safety of cyclists and pedestrians by removing the potential for conflict with motor vehicles.



Source: *London Cycling Design Standards* TfL 2005

Bent-In Crossings

Designers should be aware that the need to cross can be dispensed with altogether by allowing cyclists to join the carriageway into a cycle lane some distance (20m - 30m) before the junction with the side road, and returning them to the cycle track afterwards. Generally, cyclists would join the carriageway from a build-out ramped down to road level. A build-out gives cyclists physical protection on joining the main flow, obviates the need for cyclists to give way, and allows them to join parallel to the road centreline. Build outs should not create problems for cyclists on the main road.

The main advantage of this technique is that it avoids any uncertainty regarding priority because the cyclist simply becomes another vehicle on the main carriageway. However, it may defeat the original object of taking them off-road in the first place in order to protect them from high speed traffic.
If there is insufficient room to provide a build-out, the track can be ramped down to road level and terminated at the main road channel line. Cyclists will have to give way but if the track meets the road at a reasonable angle this will allow them to conserve some momentum while still being able to check if it is safe to join the carriageway without stopping.

Cycle track merge from a with-flow cycle track, Taunton

Picture: Alex Sully

The bent-in technique requires careful assessment, partly because it is only appropriate for with-flow cycling. Contraflow cyclists have the greatest accident risk at junctions so with-flow cycle tracks might be seen as an advantage. However, it may be difficult to maintain one-way flow unless cyclists on the opposite side of the main road are so well catered for that they are unlikely to want to use the bent-in track in contraflow.

Site specific factors

In designing a cycle track crossing, the following factors need to be considered;-

- Traffic flows and speeds on the major road,
- Gaps in the flow on the major road,
- The flow of vehicles turning into and out of the side road at the junction,
- Intervisibility between cyclists approaching the crossing (from either direction) and motorists on both the major road and the side road.

TRL research has shown that where 2-way flows on the side road exceed around 100 vehicles per hour, the potential for conflict between cyclists and motorised vehicles is high and it may be difficult to safely give priority to cyclists using the crossing, even if it is bent out. Where side road 2-way flows are in the range 100 – 200 vehicles per hour at peak periods (roughly 1,000 – 2,000 per day) the decision to introduce priority crossings should be determined by careful examination of site conditions including traffic flows on the side and main roads (see below). If appropriate, this should include a risk assessment. If giving cyclists priority is deemed unsuitable, non-priority crossings should be considered. Where the side road flows significantly exceed this level, cycle track crossings (of any type) become less attractive and Danish research suggests cyclists are likely to be safer on the carriageway.

Major road traffic flows above 500 vehicles per hour (one way) present relatively short gaps for side road traffic waiting to join the flow. If flows are this high, or if visibility for drivers emerging from the minor road is inadequate, a queue is likely to form and vehicles may obstruct the cycle track crossing. This is more of a problem with in-line crossings where motorists waiting to exit the side road generally have no choice but to obstruct them. Bent-out crossings are better in this respect although they are not immune from being blocked by inconsiderate motorists.

Safety Considerations

The design of the crossing can have a significant impact on cyclist safety. Research suggests that the presence of a flat-topped hump, cycle symbols, coloured surfacing and good intervisibility are more important to cycle safety than whether the crossing is bent-out or not, or who has priority.

The most common conflict situation is where motor vehicles turning left from the side road collide with cyclists coming from their left, i.e. cyclists riding in contraflow along the track. In depth analysis shows that accidents occur because drivers do not generally look out for or notice contraflow cyclists. At the same time, cyclists notice the motor vehicles but misjudge the drivers' intentions, thinking that they are going to stop.

Measures to highlight the presence of the crossing to drivers will help to reduce conflict and it should be clear to all who should give way. If the track accommodates two-way cycling, this must be made clear to drivers approaching the crossing. There is a sign to diagram 963.1 which can include the phrases "CYCLE TRACK" and "LOOK BOTH WAYS", but this sign is meant for pedestrians to read. Currently, there is no equivalent sign for motorists. In view of this, it is strongly recommended that signs to diagram 963.1 be used, but positioned such that both pedestrians and motorists approaching the crossing on the side road can see them. Alternatively, the designer could apply for authorisation of a non-prescribed sign based on diagram 962.1 including the phrases "Cycle track crossing" and "Look both ways" (note that signs for motorists are generally in lower case). The crossing should be kept clear of waiting vehicles.

General Issues

The cycle track crossing should have a coloured surface which contrasts well with the surrounding surfaces. Cycle symbols accompanied by arrows should be used to reinforce the message that cyclists could come from two directions.

Where practicable, kerb radii should be as tight as possible taking into account the character of the traffic using the road. This will help reduce the speed of

motor vehicles entering and exiting from the side road. This is especially important where "in line" crossings are used. Where access is generally confined to car traffic, radii of 4m or less may be used. Where larger vehicles require access 6m radii may be more appropriate.

The width of the side road where the track crosses it can be reduced to control vehicle speed. Where regular access is required by large vehicles it will not normally be appropriate to reduce it to below 5.5m. This will allow two HGVs to pass each other. However, if the side road is lightly trafficked, the width could be further reduced. 4.8m will accommodate a truck passing a car while 4.1m will allow two cars to pass each other. If side road traffic is very light, it may be worth considering reducing the width to 3.5m. This will allow only one vehicle to pass at a time.

Intervisibility between cyclists and motorists is important. If the crossing is in line, motorists approaching the junction from the side road and from both directions in the main road should be able to clearly see cyclists on or approaching the cycle track crossing, especially where vehicles leaving the side road wait behind the road hump. If the crossing is bent out, intervisibility between cyclists and traffic on the main road is not so important.

Pedestrians

Measures to assist cyclists, such as flat-topped road humps, carriageway narrowing, and tight curb radii, also benefit pedestrians, children and the mobility impaired when crossing roads. Adequate space should be provided for these users to cross in comfort and safety as well.

A cycle priority crossing does not give pedestrians legal right of way since give-way markings only relate to vehicles (a bicycle is legally a vehicle). However, the observed effect in a well designed scheme is that motorists concede right of way to all users. Flat-topped humps at side roads can also improve the safety cyclists travelling along the side road and reduce vehicle accidents. Research has found no conflict between cyclists and pedestrians at crossings.

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