Side Road Crossing Treatments (DRAFT)

1.0 Introduction

This document identifies and compares various side road design approaches used in similar circumstances across Europe, to justify the rationale and decisions made in the final Cycle Superhighway proposals.

One of the key design issues to how the Cycle Superhighway performs in terms of safety and convenience is the successful treatment of the cycle route as it passes side roads.

Design solutions at side roads have to consider the following key issues:

1. **Safety:** The highest concentration of accidents involving cyclists occur at side roads. These incidents happen when a cyclist travelling on the main road is in conflict with vehicles turning into and out of the side road;
2. **Safety:** A key component of the design solutions for side roads is how to afford priority to cyclists whilst addressing safety concerns associated with traffic giving way to cyclists; and
3. **Convenience:** Affording priority to cyclists at the side road whilst minimising any deviation of the cycle route as it passes the side road.

Design solutions for side roads have been developed based on design guidance and best practice from the UK and abroad.

Standard details for the Cycle Superhighway were first drafted in late 2013 at the start of the Cycle Superhighway design process. These have subsequently evolved during the consultation and design processes, to take account of feedback and lessons learnt during the design stages.

The consultation process has involved area wide public consultations as well as targeted consultations with cycle groups, walking groups, mobility/inclusive access officers, the Safety Audit team and the wider City Connect team.

2.0 Design Criteria

The characteristics of the main road and the side road influence the type of side road treatment that can be accommodated at each location.

These characteristics fall in to the following categories:

1. Traffic volumes on main road and side road;
2. Available space at the junction;
3. Speed limit on main road;

2.1 Side road treatment based on traffic flows

For the Leeds-Bradford Cycle Superhighway the traffic flows on the main road will all be in the region of 10,000-30,000 AADF.

The traffic flow on the side roads will vary from less than 10 vehicles an hour on a short cul-de-sac to over 100 vehicles an hour for local residential streets. The table below is an extract from the Leeds City Council Street Design Guide which sets out the various types of residential streets.

Summary of Residential Street Types

Type	Title	Pedestrian Provision	Max no of dwellings	Design Speed	Speed Limit
1	Connector Streets	Segregated	700	20-25mph	20 / 30 mph
2	Local Residential Streets	Segregated	200	20mph	20 mph
3	Shared Space Streets 3a)	Designated routes	Any development generating up to 100 vph in the weekday pm peak	15mph	20 mph
	3b)	Shared	Up to 10		
4	Home Zones	Variable	Any development generating up to 100 vph in the peak hour	10 mph	20 mph

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In the UK where the footway goes across a private driveway, then vehicles have to give way to pedestrians. In these instances there are no road markings installed, the kerb line acts as an 'imaginary' give way line.

One design option proposed for the Cycle Superhighway is to use the principle of a vehicle giving way to pedestrians at a driveway and apply it to both the footway and proposed cycle track, at side roads and private drives that serve a small number of dwellings.

To determine a threshold for the use of this design option the following analysis has been made:

A maximum number of 10 vehicles an hour turning in to or out of the side road has been assumed as a threshold based on the following:

The number of vehicles turning out of the side road will determine the number of occasions that a vehicle has the potential to block the cycle track. A side road generating up to 10 vehicle trips in the peak hour would provide a relatively low frequency of obstruction of the cycle track.

National design guidance assumes traffic flows for residential developments equate to 43 vehicles in the morning peak hour and 23 vehicles in the evening peak hour for every 100 dwellings. Therefore a maximum flow of 10 vehicles an hour would equate to 23 dwellings which would equate to a small cul-de-sac similar in character to a number of side roads along the Cycle Superhighway corridor.

The traffic levels on the main road will determine how easy it will be for a vehicle to turn out of a side road and therefore the period of time that a vehicle could be obstructing a cycle track. Busy main roads such as along the Cycle Superhighway route are likely to result in a vehicle waiting for a period of time to pull out of the side road. Therefore a side road generating up to 10 vehicles trips in the peak hour would provide a relatively low frequency of obstruction of the cycle track.

When a vehicle is giving way to pedestrians/cyclists whilst turning in to the side road then the vehicle could potentially cause an obstruction on the main road. Therefore the number of vehicles turning in to the side road needs to be minimised to reduce the occurrence of obstruction on the main road. A side road serving up to 23 dwellings would generate a suitably low traffic flow.

2.2 Available Space at the Junction

The amount of space available at a side road will influence what design options that can be accommodated. This is most critical when considering a set-back speed table at a side road.

2.3 Speed limit on main road

Where the speed limit of the main road is 40mph or above then there is a greater need to provide a segregated design at side roads to give cyclists a sense of security from fast moving traffic.

The use of set-back speed tables on higher speed roads is therefore considered to be the preferred design option over the use of cycle lanes where space permits.

2.4 Side Road Treatment Options

The Cycle Superhighway has adopted the side road treatments as shown on Table 1 and described in more detail in Section 4 or this design note.

Table 1: Side Road Treatment Types	
Description of side road treatment	**Reference**
Cycle Track and footway taken across private access	**PA**
Cycle Track and footway taken across side road serving up to 23 dwellings	**SR1**
Speed table set back from junction	**SR2**
Speed table at junction	**SR3**
Cycle lane taken across side road	**SR4**

The ability to introduce these side road treatments is affected by the characteristics of the main road and side road as set out in Table 2.

Table 2: Choice of side road treatment based on characteristics of main road and side road						
	Side Road Traffic Flow (vehicles per hour)		**Space**		**Speed limit (mph)**	
Treatment	<= 10	>10	Restricted	Unlimited	30	40 or above
PA	Yes	No	Yes	Yes	Yes	Yes
SR1	Yes	No	Yes	Yes	Yes	Yes
SR2	Yes	Yes	No	Yes	Yes	Yes
SR3	Yes	Yes	Yes	Yes	Yes	Yes
SR4	Yes	Yes	Yes	Yes	Yes	Yes

In summary

- PA and SR1 are restricted to side roads having up to 10 vehicles trips during the peak hour.
- SR2 requires space to accommodate the set-back speed table.
- SR2 is preferred to SR4 on roads with speed limits of 40mph or above but space is the critical factor.
- SR3 is the last resort as it does not afford cyclists any priority at the side road.

2.5 Reducing corner radii

Corner radii should be reduced in order to lower traffic speeds at the side road and thereby improve safety for cyclists and pedestrians.

The London Cycling Design Standards consultation draft – June 2014 has set out in table 4.4 corner radii based on street type.

Figure 4.4 Indicative corner radii ranges by street type (movement function)

	arterial road high road city hub/boulevard	connector high street city street	local street town square city place
arterial / high road / city hub/boulevard	6-10m	6-10m	3-6m
connector / high street / city street	6-10m	2-6m	2-3m
local street / town square / city place	3-6m	2-3m	minimal

Using this table as a guide, the Leeds-Bradford Cycle Superhighway is to be constructed along arterial roads with the side roads falling under the categy of local streets. This would give a corner radii in the region of 3-6m.

Corner radii adopted for the Cycle Superhighway is set out in Table 1. This has subdivided the corner radii based on the speed limit of the main road and the type of traffic using the side road.

Table 1 – Corner radii at side road				
Speed Limit on Main Road	**30mph**		**40mph**	
Type of traffic on side road	**Cars**	**High number of HGVs or buses**	**Cars**	**High number of HGVs or buses**
Corner radii on side road	**3m**	**6m**	**6m**	**6m**

Although not relevant for the Leeds-Bradford Cycle Superhighway , on lower category main roads, corner radii can be reduced to 2m.

2.6 Width of Side Road

The width of side roads should be reduced in order to lower traffic speeds at the side road and thereby improve safety for cyclists and pedestrians. The width will be dependent on the type of traffic using the side road and the presence of any on-street parking.

3.0 Design Solutions investigated but not adopted for the Cycle Superhighway

3.1 Design Solution SR5 – Cycle track taken across a busier side road

Cycle tracks being taken across a side road have been implemented widely with one-way cycle tracks throughout the Netherlands and Denmark. The detail is primarily used for cycle tracks that run parallel to 30mph roads, where they intersect with 20mph local roads. The main road will have low traffic levels, so that there is little disruption to traffic on the main road when a car stops to give way to a cyclist. The treatment is avoided on busier main roads and on roads with speed limits above 30mph.

Why this option has not been adopted for the Cycle Superhighway;

1. Could not use this option on the 40mph section of the Cycle Superhighway;
2. The volume of traffic on the 30mph sections of the Cycle Superhighway is too high and therefore vehicles stopping to give way to cyclists would frequently cause an obstruction to the flow of traffic on the main road.
3. A high volume of vehicles turning out of the side road would increase the frequency that a vehicle would obstruct the cycle track. This is exacerbated when the volume of traffic on the main road is high, leading to longer wait times for traffic turning out of the side road and therefore longer durations when a vehicle would be obstructing the cycle track.

3.2 Design Solution SR6 variant – Set back cycle lane across busier side road

Cycle lane is set back from the main road to allow give way markings to be installed. There is no cycle lane leading to the approach of the side road, instead the cycle track is taken to the side road.

Why this option has not been adopted for the Cycle Superhighway;

1. Could not use this option on the 40mph section of the Cycle Superhighway;
2. There is limited space in some locations for even a 1m set back.
3. There may be poor understanding from drivers of the priority situation, particularly if it is the first time they have used the road. This may lead to non-compliance of give-ways or rapid breaking leading to rear end shunts. This would be particularly problematic when traffic is free flowing.
4. Drivers approaching a turn with a cycle lane across it will see it, understand it and adjust their speed to suit, with an adjacent cycle track they may not understand the situation and need to come to a dead stop. This could lead to an increase risk of rear shunts or loss of control under breaking.
5. A high volume of vehicles turning out of the side road would increase the frequency that a vehicle would obstruct the cycle track. This is exacerbated when the volume of traffic on the main road is high leading to longer wait times for traffic turning out of the side road and therefore longer durations when a vehicle would be obstructing the cycle track.

4.0 Design Solutions to be adopted by the Cycle Superhighway

4.1 Design Solution PA – Cycle track taken across quiet access

Design criteria: For use on one-way or two-way cycle tracks.
Low volume of traffic using the access road and low speed of vehicles within the private forecourt/access road.
Example: Private access to commercial business, access road serving a small number of dwellings.

The design allows clear continuation of the cycle track across private accesses. The design has no give way markings. The cycle track will be coloured and cycle symbols used to give further clarity as to who has right of way. Radii for vehicles turning into the private access will be kept minimal to ensure slow speeds and reduce the risk of conflict.

A key design factor is the visibility splay for vehicles turning out of the access. In some instances footway narrowing may affect the available visibility splay.

4.2 Design Solution SR1 – Cycle track taken across quiet cul-de-sac

Design criteria: For use on one-way or two-way cycle tracks.
Low volume of traffic using the access road and low speed of vehicles within the private forecourt/access road. Cul-de-sac to avoid any through traffic.
Example: Short cul-de-sac serving a small number of dwellings and/or businesses.

The design allows clear continuation of the cycle track across a side road. The design has no give way markings. The cycle track will be coloured and cycle symbols used to give further clarity as to who has right of way. Radii for vehicles turning into the side road will be kept minimal to ensure slow speeds and reduce the risk of conflict. The cycle track and footway will create a form of raised speed table to ensure entry and exist speeds are low.

4.3 Design Solution SR2 – Set-back speed table across busier side road

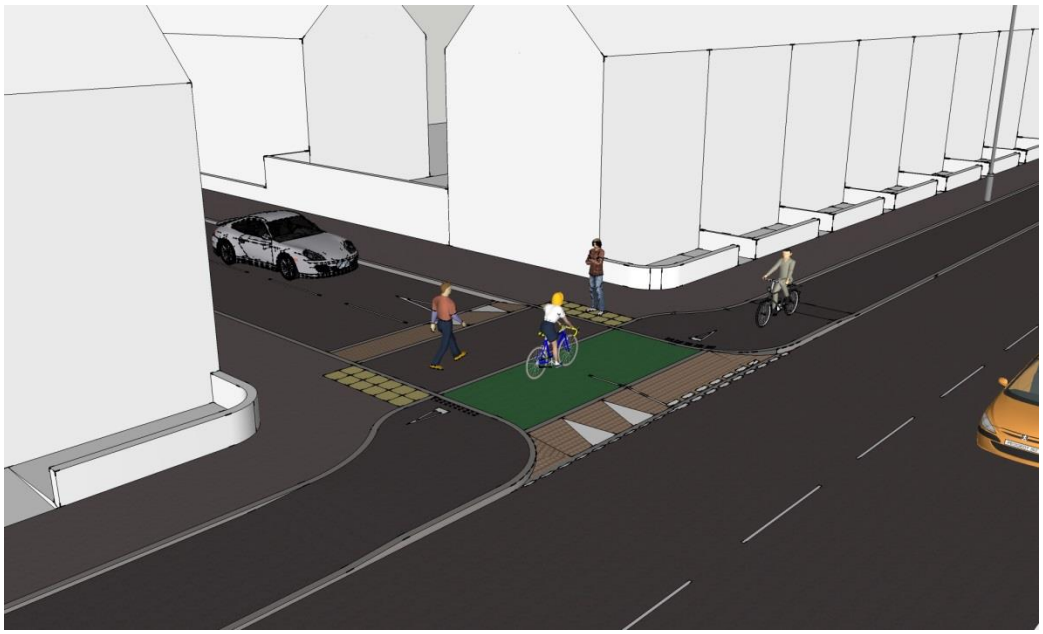
Design criteria: For use on one-way or two-way cycle tracks.
Space required to accommodate cycle track set back from the main road.
Example: Residential access road serving large housing estate located on busy main road.

These involve the bending of the cycle track away from the main road and crossing the side road on a speed table. It relies on give-way markings and the slowing effect of the speed table to give cyclists priority over vehicles. It is particularly useful when two way cycle crossings are desired.

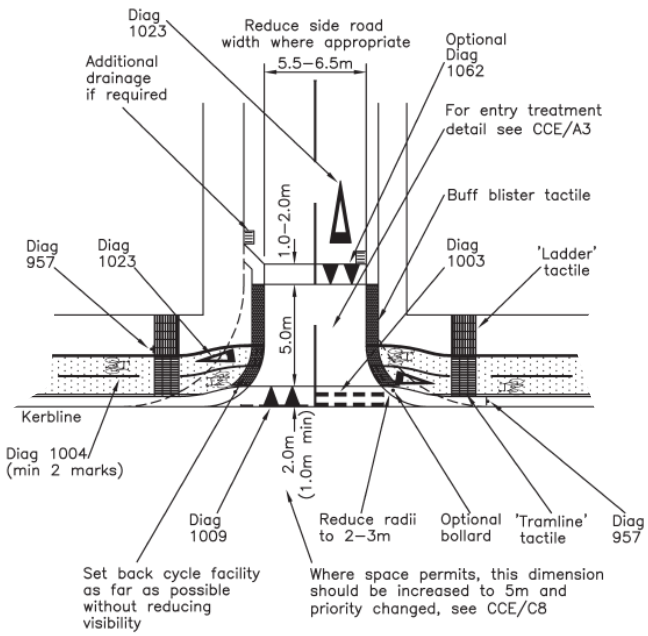
This design has been used across the UK and the continent and there are two examples in Leeds. Standard details are published by TfL and Sustrans. Vital to the success of the feature and the compliance of drivers with the give-way priority is the reduction in speed and the existence of good sight lines.

4.4 Design Solution SR3 –speed table at junction across busier side road

Design criteria: For use on one-way or two-way cycle tracks.
Where neither a set back speed table nor cycle lane can be accommodated.
Example: tow way cycle track crossing a residential access road serving large housing estate located on busy main road.



Unlike the set-back speed table, cyclists are not given priority at the side road and have to give way to traffic. This design has been used across the UK with standard details are published by TfL and Sustrans.



4.5 Design Solution SR4 – Cycle Lane across busier side road

Design criteria: For use on one-way cycle tracks
Where a segregated cycle track solution cannot be accommodated.
Example: Residential access road serving large housing estate located on busy main road.

This design involves suspending the segregated cycle track as it passes the side road. The cycle lane is introduced 20m from the side road in order to establish the right of way of the cyclists over traffic turning in to the side road.

The radii on the side road are reduced to lower vehicle speeds. The use of armadillos to deter encroachment of vehicles in to the cycle lane is being considered in addition to having the white line increased in width to 200mm.

A variation to the treatment is to introduce a speed table adjacent to the cycle lane in order to reduce vehicle speeds. This design approach has been used in Holland and London on main roads with a 30mph.

5.0 Conclusions

- The key aim of the Cycle Superhighway is to achieve a design that maximises the length of the cycle route that is segregated from the carriageway. With regard to side roads this means using treatments PA, SR1 and SR2 wherever possible.
- The flow of traffic on the main road and side road is a critical factor in determining the type of side road treatment that can be adopted in each instance.
- Where the main road has a speed limit of 40mph and there is scope to accommodate a set-back speed table then treatment SR2 should be adopted.
- Where side road treatment SR4 is to be introduced where the main road has a 30mph speed limit then introducing a speed table set behind the cycle lane should be considered. Where the side road provides a gateway in to a 20mph zone then the adoption of a speed table would act to emphasis the gateway effect of the 20mph zone.
- Where side road treatment SR4 is to be introduced then it is proposed to monitor any encroachment by vehicles in to the cycle lane to determine if additional protection of the cycle lane through the use of armadillos would be warranted.