Inclusive design at bus stops with cycle tracks: Appendices 2-6

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Appendix 2: Bus stop design classification

The classification of design options – for situations where a cycle track continues past a bus stop – is clearer if it is understood that the 'bus stop bypass' versus 'bus stop boarder' classification is over simple.

The biggest issue is that the term 'boarder' is confusing and is used to refer to quite different designs. A secondary issue is that current classifications tend not to describe 'hybrid' designs.

This appendix provides additional ideas about classifying the different possible designs.

NB: This appendix is provided only to support ideas about classification, and does not provide any guidance on the value (or lack of value) of the different options.

Key dimensions

This table lists some of the key dimensions which can be combined to create different bus stop designs. The options marked with an asterisk in this table are generally associated with designs known as a 'bus stop bypass'.

Table 1: Key design dimensions

	Option 1	**Option 1 + option 2 hybrid**	**Option 2**
Position of cycle track?	Cyclists pass between the bus stop and the main pavement *	Cyclists pass between different elements of the bus stop and related street furniture	Cyclists pass between the bus stop and the carriageway
Waiting area position?	Bus passengers wait on an island of pavement *	Bus passengers sometimes wait on the main pavement and sometimes on an island	Bus passengers wait on the main pavement
Boarding /alighting position?	Bus passengers alight onto an island of pavement*	Bus passengers alight onto a small area which isn't part of the cycle track but which isn't really a recognisable island of pavement area	Bus passengers alight onto the cycle track
Is island only for bus stop?	The island of pavement is distinctly defined, clearly existing to serve the bus stop*	There is a multi-use area which is neither part of the main pavement, nor a larger island of pavement, of the bus stop waiting area is a part	The island of pavement is much larger, continuing outside the area of the bus stop

How big is the island?	There is no island of any kind (even a painted area) between track and carriageway.	There is a small area between cycle track and carriageway, not large or significant enough for people to wait on it.	The island is big and significant enough several to wait on it comfortably.
Single or multiple bus stops?	The island of pavement serves one distinct bus stop *	There is an area which has a design much like the pavement, joining separate bus stop islands, but which isn't really wide enough to be walked along	The island of pavement stretches over a longer area, and it serves more than one bus stop
Does main footway continue?	Passing pedestrians stay on the main pavement area when passing the stop *	There is only a narrow area of 'main' pavement, so many passing pedestrians walk along the bus stop island area (or on the track)	It is intended that all pedestrians cross the cycle track to pass the bus stop area
One or two way cycle track?	The cycle track is one-way	The cycle track is marked as one-way, but many people use it in the wrong direction	The cycle track is two-way
Can other vehicles pass behind the stop?	The bus stop island is separated from the main pavement by a cycle track	The bus stop island is separated from the main pavement by an access used almost entirely for cycling, but which can occasionally carry a vehicle	The bus stop island is separated from the main pavement area by a vehicle access
Who crosses what?	Pedestrians cross an area, whether or not marked with a crossing, which is clearly part of a cycle track *	Cyclists and pedestrians cross an area which feels to be shared equally between pedestrian and cyclist uses	Cyclists cross or pass through an area, whether or not marked with a crossing point, which is clearly intended mostly for pedestrian use
Does the cycle track maintain its significance?	The cycle track continues through the bus stop area in an obvious way, with boundaries which are obvious*	Something reminiscent of the cycle track continues through the bus stop area, but in a diminished form, or with boundaries which are unobvious	The cycle track stops and starts for the bus stop, meaning cyclists use an area which

			feels to be ordinary pavement
Is the rest of the cycle track obvious?	There is generally an obvious cycle track, before and after the bus stop area	The cycle track, before and after the bus stop area, has indistinct separation from the pavement	Cyclists are allowed to cycle on the ordinary pavement, before and after the bus stop area

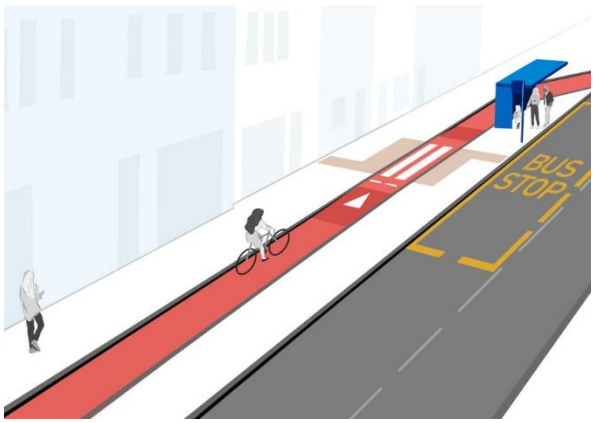
Proposed key types

As discussed in the main report, we propose that in future, there are seen to be four key design types, which are:

- Bus stop bypass (or floating bus stop / bypass bus stop)
- Shared platform boarder
- Continued kerbside track
- Broken cycle track

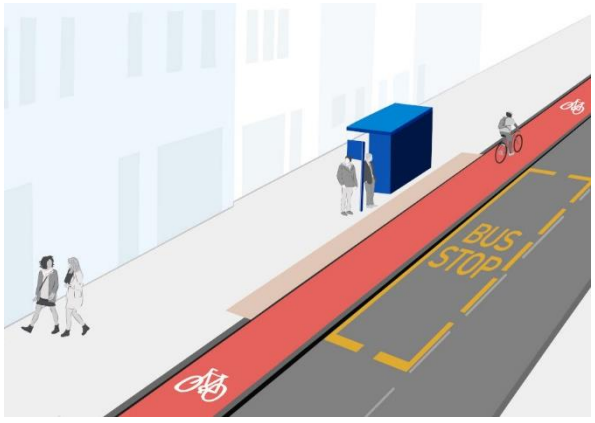
Simplified sketches of these reference types are provided in Figure 1.
NB: Inclusion of these options is only to assist in naming/classification issues.

Figure 1: Key reference design types

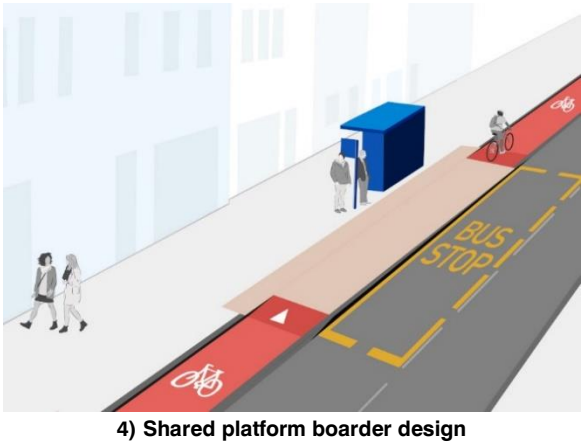


1) Bus stop bypass

2) Broken cycle track (shared pavement)



3) Continued kerbside track design



4) Shared platform boarder design

Examples from Google Streetview

Table 2 provides links to a variety of real-world designs, demonstrating how much these can vary – and the inadequacy of a simple 'bypass'/'boarder'/'shared' classification scheme.

The titles in the 'type' and 'sub-type' columns are intended informally (i.e. not to imply a formal classification scheme).

Bold entries in the 'type' column indicate examples of the key reference design types (as in Figure 1). Other options can be seen as variations or hybrids of these.

Table 2: Google Streetview image links

Type	Sub-type	Distinguishing detail	Ref	Streetview link
Bypass	Simple bypass	• Uni-directional • Kerbed • Straight track	BS-129	https://goo.gl/maps/ELiHQC2RmxFajCUM7
Bypass	Simple bypass	• Uni-directional • Kerbed • Bendy track	BS-44	https://goo.gl/maps/oJT6QfvD8FjZHHNB8
Bypass	Simple bypass	• Bi-directional • Kerbed • Straight track	BS-86	https://goo.gl/maps/1X5Jhd5FHv7CeCjd9
Bypass	Extended bypass	• Bi-directional • Straight track • Multiple uses of island	BS-139	https://goo.gl/maps/TjMZnuKgbZoevFPDA
Bypass	Double-stop	• Uni-directional • Straight track • Multiple stops	BS-182	https://goo.gl/maps/BhPB6j7GMKjEj2n16
Bypass	Pedestrians all use island	• Uni-directional • All pedestrians use island • Island bypassed by vehicle access	BS-245	https://goo.gl/maps/7y2MB7VYddHNCtKZ6
Bypass-shared hybrid		• Track loses significance but continues through stop	BS-225	https://goo.gl/maps/fvhKQubx54cjJ77y8
Bypass	Separate pavement	• Pavement and cycle track not adjacent	BS-15	https://goo.gl/maps/wQUqaQJZh58R4xo96
Bypass-shared hybrid		• Shared track/pavement area between pavement and island		https://goo.gl/maps/wQUqaQJZh58R4xo96
Vehicle-bypass	Cycle /vehicle bypass	• Space behind bypass provided for cycling but also vehicles	BS-404	https://goo.gl/maps/MYV3J6xdQNz5uVmf8
Vehicle-bypass	Vehicle bypass	• Vehicle access behind stop	BS-509	https://goo.gl/maps/81gVGPBB6kU1SCb18
Boarder-bypass hybrid	Bus infra off island	• Uni-directional • Island too tiny to be an island	BS-198	https://goo.gl/maps/c45hqGZLdEuahiD18

Boarder-bypass hybrid	Bus infra off island	• Uni-directional • Very narrow island	BS-111	https://goo.gl/maps/fxcy6vhzCjYaqTMf7
Boarder-bypass hybrid	Bus infra off island	• Bi-directional • Narrow island	BS-143	https://goo.gl/maps/P2hPEAnxSqiMN2C66
Boarder-bypass hybrid	Bus infra off island	• Uni-directional • Wider island	BS-530	https://goo.gl/maps/bR5GavYdMkYfRPKcA
Boarder-bypass hybrid	Bus infra split	• Uni-directional • Wider island • Some bus infrastructure off the island	BS-112	https://goo.gl/maps/7mtQCDV5vSrRqXcNA
Boarder-bypass-shared hybrid		• Island insignificant • Bus stop infrastructure insignificant • Track insignificant through stop	BS-150	https://goo.gl/maps/nByHn7vKuxG8t6dw5
Continued kerbside track	Simple	• Simple continuation of cycle track • Uni-directional	BS-460	https://goo.gl/maps/reE1rPAJktnRtoWP9
Continued kerbside track	Simple	• Simple continuation of cycle track • Bi-directional • Pavement insignificant • No kerbs	BS-490	https://goo.gl/maps/yX9BVvN3Pnt8PQDa7
Continued kerbside track-broken cycle track hybrid		• Cycle track continues but is marked as shared area	BS-448	https://goo.gl/maps/jhYMG2vJFm4Aqcik8
Continued kerbside track-broken cycle track hybrid		• Cycle track -pavement distinction insignificant throughout	BS-476	https://goo.gl/maps/ozzcRw6i38DNVn3T6
Shared platform boarder	Simple	• Cyclists cross a pedestrian-focused platform • Platform area distinct from pavement	BS-386	https://goo.gl/maps/rF99TgLEmszEcwuW9
Shared platform-continuation of cycle track hybrid		• Cyclists travel along a longer shared platform	BS-25	https://goo.gl/maps/vrFYB9Q8vS9EodWG8
Shared platform - shared area hybrid		• Cyclists cross raised platform which appears as if ordinary pavement	BS-309	https://goo.gl/maps/peSN9n6vWmm825s58
Shared platform boarder	Simple	• Cycle track crosses an obvious raised platform • Pedestrians cross track on raised platform	BS-622	https://goo.gl/maps/13ce8TKkC25EfoQr9
Broken cycle track	Simple	• Cycle track does not continue in any form • Cyclists allowed to use ordinary pavement	BS-313	https://goo.gl/maps/KbuEfqgwmXebP9Ct7
Other	Bus mounts track	• Bus mounts cycle track (physically almost a cycle lane)	BS-287	https://goo.gl/maps/9srHRDp511mbU7ad9

Other	Two-way cycling within bus layby	• Track runs into bus layby • Includes cycling against traffic flow	BS-338	https://goo.gl/maps/JXSJmjhY2yVbHHK59

Appendix 3: Suggested design principles

For the convenience of designers, the following list summarises some of the key suggestions made in the main report. The interpretation of these points should be on the basis of the text in the main report (which makes clear which points are more speculative and which are more firmly evidenced).

Overall context

- Alternatives to continuing a cycle track past a bus stop should be chosen if possible.
- There should be an acknowledgement that blind and partially sighted people may be disadvantaged by the need to cross a cycle track to access a bus.
- A key means to reduce any excluding effects is to *significantly* increase the overall accessibility of streets in the wider area.
- Problems for pedestrians increase according to the level of cycling on the cycle track.
- Problems for *pedestrians* increase as the environment *cyclists* are encountering becomes more complex, with the level of pedestrian use affecting this.
- As a rule of thumb, it is helpful to consider three situations as different from one another, which are those with quiet-simple, moderately-busy-complex, and busy-complex environments.

Features adding to complexity

The following add to the complexity of a situation:

- Higher numbers of cyclists, a level of cycling when strangers find themselves in groups, larger flows of cyclists
- Two-way cycling
- The presence of groups of pedestrians, flows of pedestrians
- Limits to space so that pedestrians are close to the cycle track, or so they are likely to stand or walk on the cycle track
- A larger number of buses, stopping more frequently, more than one bus stopping at a time
- Buses sitting at a stop for a prolonged period
- Larger numbers of people alighting from buses, groups alighting from buses

- Pedestrians queuing (e.g. for a cash machine, shop, taxis, or for the bus), crossing the carriageway, entering and exiting shops, standing chatting in groups
- Breaks in a cycle track in which cyclists are at risk from vehicles
- Obstructions and imperfections in surface – including drain covers, slippery metal features, kerbs at pedal height, kerbs with a vertical upstand, steep ramps
- Sharp bends in the cycle track (particularly if the track is narrow and if kerbs are high)
- Handlebar height (or higher) obstructions close beside the cycle track, even if these aren't actual collision risks. Bollards in the cycle track.

Overall design principles

- Cycle tracks should be built so that it is very clear that they are separate from the footway.
- This distinction between track and footway should be made obvious for blind and partially sighted people, and more obvious for all other pedestrians, with a drop in level to the track, and the use of kerbs of sufficient height (but which are reliably below pedal height). For the same reason, cycle tracks should be of a consistent colour (and tone – i.e. "light reflectance value") and this should have a clear contrast with the footway.
- Kerbs should be of a "forgiving" design (low enough so as not to risk a pedal strike, with an angled rather than a vertical face). They should be high enough to be detectable by blind and partially sighted pedestrians using a long cane, and with their feet.
- For the reasons above it is likely to be a mistake to try to influence behaviours by introducing changes in surface colour on the cycle track (the exception being zebra crossing markings).

Basic crossing points

- Identifiable kerb-free crossing points of the cycle track should be provided, either by raising the track to footway level or by dropped kerbs (from footway to cycle track level). For cycle tracks of a decent width, with forgiving kerbs, there may be little practical difference between these arrangements (as far as the user is concerned).
- Tactile paving should be provided (in a standard arrangements) to highlight such points. It should be recognised that some pedestrians will want to avoid walking/wheeling over these.

- Zebra crossing markings might be used to highlight the overall presence of the bus stop, and any key crossing points. Crossings with very few stripes, and/or short stripes may not be recognised as formal zebra crossings by many members of the public. Zebra crossings (alone) are unlikely to lead to high levels of priority being provided for crossing pedestrians.
- Any zebra crossings should be located at places where most pedestrians are likely to cross, so that they are used rather than ignored.

Other accessibility issues

- Accessibility is improved by increasing the space available at the bus stop, particularly when there are likely to be larger groups of passengers waiting for buses, and/or alighting from them.
- Crowded environments can cause challenges for disabled pedestrians alighting from a bus. These can be reduced if it is possible for people to leave the bus stop area by more than one route (avoiding the crowd rather than being forced to pass through it).
- Excessive crossfall on a bus stop island, which can be introduced because of the combination of high kerbs at the carriageway, and lowered kerbs at the cycle track, should be avoided. It may help to align raised crossings of the cycle track, with the location that bus access ramps are deployed.

Simplicity and safety on the cycle track

The environment around a cycle track can be complex, and an overall objective is to simplify this, ensuring that cyclists are free to look ahead, anticipating the behaviours of any pedestrian likely to cross the track. In order to achieve this:

- It is important that the presence of a bus stop is obvious to cyclists.
- In a more complex environment crossing pedestrians (or pedestrians wanting to cross) should be made as obvious as possible, to distinguish them from pedestrians who are not doing so.
- Small sections of railing and the orientation of the bus shelter might be used to clearly separate waiting passengers from a cycle track, and to separate crossing pedestrians from any crowd at the stop
- There should be sufficient width on cycle tracks, so that the attention of cyclists is not on avoiding collision with other cyclists (and decreases in width at the bus stop should not introduce the risk of such collisions).
- Kerbs at the edges of the cycle track should be consistently and reliably lower than pedal height (i.e. not only at the bus stop), and of a ‘forgiving’ design (i.e. with an angled rather then vertical face).

- Distracting bends in the cycle track should be avoided close to the bus stop area.
- With the exception of simple zebra markings, paint markings on cycle tracks should be minimised.
- Triangular markings highlighting the presence of ramps should only be used for ramps that are steep and high enough to cause cyclists an unexpected or unobvious hazard, not at less significant ramps.
- Pedestrians about to cross the track must not be hidden behind obstacles and must not have their visibility of oncoming cyclists obstructed. Pedestrians might be prevented from crossing at places where they are particularly difficult to see (assuming that a diversion of a few metres makes them more visible).

Regulating speeds

- If it is desired to include features to slow more extreme speeds – such as might arise on a downhill cycle track or with the use of illegally modified e-bikes – then cyclists should *finish* their negotiation of such features *before* they need to begin to pay attention to anticipating any potential crossing pedestrians.
- Such features should not exclude (or cause pain or discomfort to) users of alternative designs of cycle, wheelchairs, mobility scooters, and other wheeled mobility aids.
- Any 'SLOW' markings should be used in a manner consistent with its official meaning, and with how this marking is used on a typical carriageway. The official meaning is "Vehicular traffic should proceed with caution because of potential danger ahead". The marking typically advises of danger to the person driving where this danger is unobvious. It could be used to warn cyclists of the risks associated with negotiating a feature as described in the point above.
- Any signage to highlight the presence of a zebra crossing should be with a sign according to 'Diagram 544' in TSRGD (a warning triangle showing a crossing pedestrian).

Solutions for making it easier to cross the track

The main report recommends that a set of enhancements – for making it easy for blind and partially sighted pedestrians to cross the cycle track – are researched.

Appendix 4: A cycle track without bypasses

This appendix provides a sequence of 30 images, taken from a helmet-mounted camera, showing a two-minute journey on a cycle track which has gaps at bus stops. There is only “light segregation” from the carriageway, but the experience would be similar on a fully segregated track in which there were similar gaps.

A car is parked in the gap at the first bus stop. At the second the cyclist prepares to pass two buses, but the front one pulls away. At the third the cyclist checks to prepare to pass the front bus, finding the bus behind is pulling in close behind them

00:00 in track

00:02 bus passing

00:09 approaching gap in track

00:12 gap in track for side road

00:14 back in track

00:16 gap in track for crossing

00:17 gap in track for crossing - car parked ahead

00:21 looking behind to prepare to pass car

00:23 car parked in gap at bus stop (beginning to pull out to pass)

00:24 checking *behind* again

00:26 passing car parked in gap for bus stop (blocked access to track)

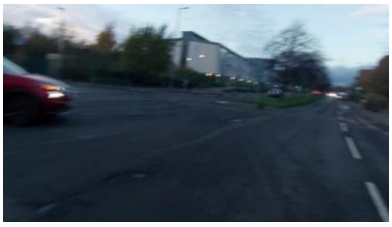
00:29 looking for a gap in protection to return to track

00:32 back in track

00:39 approaching gap for side road and bus stop, buses stopped ahead

00:42 gap in track, predicting need to pass two stopped buses

00:45 Car passing, preparing to pull out to pass buses



00:47 Checking behind and pulling into carriageway, car driving into the side road end behind

00:49 In main carriageway to overtake both buses, but front bus now moving

00:51 Overtaking rear bus, aware in bus driver's blind spot, front bus now moved away

00:53 Passing front of bus, but may not yet be visible to bus driver

01:00 Back in track

01:15 avoiding drain cover

01:32 Noting bus stopped ahead

01:35 Gap in track for bus stop, bus pulling off from stop

01:55 SUV pulling across path (at speed but with sufficient distance)

01:58 gap in track for side road

02:24 in track (22 seconds since returning to track after gap)

02:32 bus in stop ahead, gap in track, considering need to overtake

02:36 checking behind to prepare to overtake first bus, now aware second bus is following and pulling in close behind, view of carriageway behind this bus is blocked (stressful)

02:38 bus following close behind, but then stopping, view of carriagway getting better, beginning to pull out to overtake first bus (however, the front bus pulled away)

(The gaps in this track to allow for the bus stops were made larger because of there being neighbouring gaps left for the side road entrances, but even without side roads gaps for bus stops must be several times the length of a bus.)

Appendix 5: Focus group/site visit participant characteristics

One thread of project activity involved focus groups and site visits with disabled people, as members of the public. These were people involved in the project specifically as members of the public, whereas other disabled people were involved because of a professional or other relevant role. The table below summarises the demographic characteristics of those involved.

Transport for All, who were supporting this thread, sought to recruit people "pan-disability" and across other demographic groups.

These details were provided by the participants themselves and not judged or assessed in any other way.

		Impairment type(S)							Use of mobility aids								
Focus group or site visit	**Initial infrastructure focus**	**Learning disability**	**Mobility impairment**	**Mental health condition(s)**	**Long-term health condition(s) or chronic illness**	**Deaf or hearing loss**	**Blind or partially sighted**	**Other**	**Don't use mobility aid**	**Wheelchair**	**Walking stick or frame**	**Cane or guide dog**	**Mobility scooters**	**Other**	**Age Category**	**Gender**	**Ethnicity**	**Cyclist**
Both	Continuous footways	Y							Y						26-45	Male	White	?
Focus grp	Bus stops		Y	Y	Y					Y	Y			Prosthetics or Orthotics	46-65	Male	White	No
Both	Continuous footways		Y	Y					Y						26-45	Female	Black/African/Caribbean	No
Focus grp	Bus stops		Y							Y					46-65	Female	Asian or Asian British	No
Focus grp	Continuous footways		Y	Y	Y			Stroke; brain injury		Y	Y				46-65	Male	White	No
Both	Continuous footways	Y	Y						Y						26-45	Male	White	?
Focus grp	Continuous footways		Y		Y		Y			Y					46-65	Female	White	No
Both	Continuous footways						Y					Y			46-65	N/R	White	Yes

		Impairment type(S)							Use of mobility aids						Age			
Focus group or site visit	Initial infrastructure focus	Learning disability	Mobility impairment	Mental health condition(s)	Long-term health condition(s) or chronic illness	Deaf or hearing loss	Blind or partially sighted	Other	Don't use mobility aid	Wheelchair	Walking stick or frame	Cane or guide dog	Mobility scooters	Other	Category	Gender	Ethnicity	Cyclist
Both	Continuous footways		Y							Y					46-65	Male	White	?
Site Visit	Continuous footways				Y					Y					46-65	Male	White	?
Focus grp	Continuous footways	Y							Y						16-25	Male	Asian or Asian British	No
Both	Bus stops			Y	Y			Neurodivergent	Y						26-45	Female	Other ethnic group	Yes
Focus grp	Bus stops				Y	Y	Y					Y			26-45	Male	White	Yes
Both	Both						Y					Y			26-45	Male	Asian or Asian British	Yes
Focus grp	Continuous footways		Y	Y	Y		Y				Y		Y		46-65	Female	Mixed	No
Focus grp	Continuous footways		Y		Y	Y				Y					66+	Female	Black/African/Caribbean	No
Focus grp	Continuous footways		Y	Y	Y	Y				Y	Y		Y		66+	Male	White	No
Focus grp	Continuous footways		Y		Y					Y					46-65	Male	White	No
Both	Continuous footways						Y					Y			26-45	Male	Black/African/Caribbean	No
Focus grp	Bus stops			Y	Y	Y			Y						46-65	Female	Black/African/Caribbean	No
Both	Bus stops				Y	Y		C O P D	Y						66+	Male	White	Yes
Both	Bus stops				Y			Glaucoma & Epilepsy	Y						66+	Female	White	No
Both	Bus stops		Y							Y					16-25	N/R	Mixed	No
Focus grp	Bus stops	Y	Y	Y			Y			Y			Y	Prosthetics or Orthotics	26-45	Male	White	No
Site visit	Both		Y	Y	Y									Rolator	46-65	Female	White	No
		4	14	9	14	5	7		8	11	4	4	3					

Appendix 6: Transport for All Report

Attached after this page is a report which was provided to the project by Transport for All after their involvement in some project work.

Transport for All

Living Streets Project Written Summary

February 2023

Contents

1. Introduction

Transport for All, in partnership with Living Streets, have been researching issues of inclusion around continuous footways and bus stop bypasses. This is part of a two-year research project undertaken by Living Streets and funded by Transport Scotland and the Department for Transport.

Bus stop bypasses (also known as floating bus stops) involve a cycle track being routed between a pavement and an island with a bus stop, meaning that passengers must cross the cycle track to access the bus stop. **Continuous footways** involve a pavement continuing across the entrance to a side road, meaning that vehicles must drive over the pavement to enter or exit the side road.

Both pieces of infrastructure have been the subject of concern among disabled and older people around safety and accessibility. For instance, continuous footways may be unsafe for blind and partially sighted people due to the lack of tactile paving, which would otherwise alert them to the potential presence of cars. Those with visual impairments may also be at risk when crossing cycle tracks to reach a bus stop, as they may not be able to hear cyclists coming. People with mobility issues may struggle to navigate bus stop bypasses, as they may need more time to cross the cycle track, which may put them at risk if cyclists do not slow down or stop to allow them to pass.

The aim of this research was to understand the impact of continuous footways and bus stop bypasses on the accessibility of streetspace for disabled and older people, and to explore how existing designs can be improved to make them more inclusive.

Transport for All is a pan-impairment organization guided by the belief that all disabled and older people have the right to travel with freedom and independence. We have supported Living Streets in the delivery of the project, from recruiting disabled and older people for focus groups and site visits, to reviewing the language around disability used by Living Streets in their project outputs. Further details on how we supported each stage of the project are provided below.

2. Stages of the Project

Representative Interviews

The first stage of the project involved interviewing representatives of organizations related to disability and/or cycling on their thoughts around bus stop bypasses, continuous footways, and barriers around accessibility and inclusion. The interviews were organized and led by Living Streets, while Transport for All attended the interviews, took notes, and provided verbal feedback. The organizations involved included:

- Cycling UK
- Edinburgh Council
- Guide Dogs
- Jacobs
- Royal National Institute of Blind People (RNIB)
- Sustrans
- Wheels for Wellbeing
- Wokingham Borough Council

The representatives generally reported that bus stop bypasses exist to remove conflict between cyclists and buses, while continuous footways exist to provide pedestrians with priority over vehicles crossing their path. It was acknowledged that the designs of bus stop bypasses and continuous footways vary due to limited guidance. For instance, designers based in Scotland mentioned that Cycling by Design, Scotland's design guidance for cycling infrastructure, does not cover continuous footways so they instead refer to Edinburgh Street Design guidance. It was also reported that LTN 1/20 refers to continuous footways and bus stop bypasses in passing but does not go into a lot of detail about them.

While representatives of disability organizations were aware of issues surrounding inclusion, other representatives were less sure of how this infrastructure affects the accessibility of streetspace. Issues raised around bus stop bypasses included blind and partially sighted people having to cross cycle tracks, and wheelchair users having to navigate narrow islands to get on and off a bus. Issues raised around continuous footways included guide dogs not knowing how to navigate them, and blind and visually impaired people losing their wayfinding ability.

Mobility Trainer Interviews

The next stage involved interviewing mobility trainers involved in supporting blind or partially sighted people. They were asked questions about how blind and partially sighted people may be taught to navigate bus stop bypasses and continuous footways. The interviews were led by Living Streets, while Transport for All organized the interviews, observed them, and provided verbal feedback.

The mobility trainers were familiar with bus stop bypasses, but perhaps less so with continuous footways as two individuals reported having to research what they were before the interview. It was generally agreed that it is risky for blind and partially sighted people to cross cycle tracks at bus stop bypasses. The main issue raised was blind and partially sighted people not being able to hear cyclists coming, especially on busy roads. One mobility trainer even mentioned that they would not teach a blind or partially sighted person to cross a cycle lane and would instead teach them a route involving a controlled crossing.

It was reported by all the mobility trainers that blind and partially sighted people are taught to indent into side roads in order to cross as it is quieter, which gives them more time to hear what is coming. Some suggested that there should be tactile paving at continuous footways to alert blind and partially sighted people that there is a change, though it was also considered that the tactile paving must be different from that used at crossings.

Participant Focus Groups

The project then focused on learning from those with lived experience of disability. Four virtual focus groups were held, each with around 5 participants, to provide the opportunity for disabled and older people based in London and Glasgow to learn about continuous footways and bus stop bypasses and to share their thoughts around issues and solutions. Participants were recruited through Transport for All's own network of disabled members based around the UK, as well as through disability organizations based in London and Glasgow. They were asked to express their interest by filling out a Google Form which collected information about their availability, demographic data, as

well as any access requirements. Researchers from Transport for All then selected participants for the focus groups to ensure a fair representation of different impairment types and sociodemographic characteristics.

The focus groups were hosted by a disabled facilitator and lasted around 2 hours, with each participant receiving an incentive of £50 for taking part. Participants were sent images of continuous footways and bus stop bypasses ahead of the focus groups, along with alt text.

Most participants who attended the bus stop bypass focus groups had heard of them before, though some were unfamiliar with the term but acknowledged they may have come across them without realising what they were. Some participants explained that bus stop bypasses have been implemented to segregate cyclists from traffic and to protect them. It was also mentioned by one participant that they exist to protect pedestrians from traffic by ensuring that cars do not mount the pavements. It was generally agreed by participants that bus stop bypasses are not safe for pedestrians, due to a lack of tactile paving, lack of controlled crossings, and the speed of passing cyclists. It was suggested that bus stop bypasses could be made safer and more accessible by implementing flashing beacons to warn cyclists of crossing pedestrians, educating pedestrians and cyclists about the infrastructure, and building larger islands to ensure wheelchair users have enough space to navigate.

Some attendees of the continuous footway focus groups had heard of continuous footways and had encountered them before, while others were not familiar with the infrastructure. Some participants reported that continuous footways have been implemented for individuals with mobility issues, while others mentioned that they exist

to slow cars down. Participants were unsure as to whether continuous footways are safe for pedestrians. It was mentioned that continuous footways may be safe for wheelchair users and people with prams to navigate, but they would not be safe for individuals who have a visual impairment. Participants were unsure whether a driver would be aware that pedestrians have the right of way, and whether they would stop for them. It was suggested that tactile paving and high colour contrast between the road and continuous footway could be helpful for people who are blind or partially sighted.

Participant Site Visits

Those who attended the participant focus groups, as well as other individuals who expressed their interest in the focus groups but were not selected, were then invited to in-person site visits to continuous footways and bus stop bypasses in London and Glasgow. Four site visits were conducted, each with around 5 people with lived experience of disability. Two site visits took place in London, and two took place in Glasgow, with each location having one site visit to a bus stop bypass and another to a continuous footway. Participants received an incentive of £50 for attending.

The sites were chosen to ensure proximity to accessible train stations, bus stops, as well as vehicle and cycle parking. Risk assessments were also carried out prior to the site visits to ensure the safety of participants from risks such as COVID-19, vehicles, cyclists, and other pedestrians.

During the site visits, the participants spent 10 minutes observing the continuous footway or bus stop bypass and were then taken on a guided walk towards a library or community centre, where a room was booked for them to sit and have further

discussions around potential solutions to make the infrastructure more accessible for them.

Participants attending the bus stop bypass site visits suggested that they could be more accessible if there were descriptive markings on two-way cycle paths to inform pedestrians that they should look both ways before crossing. It was also mentioned that the size of the bus stop island should be increased to make the space easier for users of wheelchairs and mobility scooters to navigate. Some participants suggested that the general lighting at bus stop bypasses should be improved, and that lighting should be used to indicate the presence of zebra crossings. Further solutions included adding rumble strips on cycle lanes, introducing speed bumps to slow down cyclists[1], and implementing signage to indicate the presence of a cycle path.

Participants who attended the continuous footway site visits suggested that there should be steep ramps[1] at continuous footways to ensure that cars slow down for pedestrians. It was also mentioned that there should be tactile paving at continuous footways to inform blind and partially sighted people of the potential presence of cars. Another proposed solution for those with visual impairments was using high contrast paving to alert them of a change. Further solutions included educating drivers about changes in the Highway Code, implementing road markings to alert drivers to slow down, and improving the condition of pavements.

Internal Solutions Workshop

[1] It should be noted that these proposed solutions could create barriers for disabled cyclists.

The final stage of the research involved an online workshop, organized by Transport for All, which aimed to examine the solutions proposed by the site visit participants. The workshop was attended by two Living Streets colleagues, four Transport for All colleagues (including two access consultants), as well as a representative from the Mobility and Access Committee for Scotland (MACS) who had previously been involved in the Reference Group events held by Living Streets. The workshop was facilitated by a Transport for All staff member who was not otherwise involved in the research and lasted 2 hours.

Prior to the workshop, the solutions proposed by participants were narrowed down to omit those that were not at all feasible (e.g. traffic lights at continuous footways) or had nothing to do with the infrastructure itself (e.g. improving the condition of pavements). This left 7 solutions for bus stop bypasses and 7 solutions for continuous footways.

The workshop was split in two halves, with the first half focusing on the bus stop bypass solutions, and the second half focusing on the continuous footway solutions. Attendees were prompted to think of advantages, disadvantages, and potential improvements for each proposed solution. The following tables summarize the discussions had during the workshop.

Bus Stop Bypass Solutions

Solution	Advantages	Disadvantages	Potential Improvements
Descriptive markings on cycle paths to tell pedestrians to “Look both ways before you cross” or “Look left” and “Look right”	None mentioned	Only works for individuals who are able to see and are able to understand English	Any markings would have to be as simple as possible – arrows could add confusion
		Makes it the responsibility of the pedestrian to take action rather than the cyclist	
		Would add to the problem of too many markings around bus stop areas	
Improve general lighting of the bus stop bypass area	Would benefit most people	May be issues around areas where there is light pollution	Need to think about the type of lighting and how it interacts with the type of surface
		Can be counterintuitive as cyclists may be less visible if you cannot see their lights against background lighting	Need to ensure that the colour of the lighting maintains 30 points light reflectance value
		Bright lights can be too strong for visually impaired people	Lighting would need in situ trials and specialist input
Increase the size of the bus stop island	Bigger islands may mean that dropped kerb gradients are less steep	Designers may use some of the pavement, which moves the problem somewhere else	Need to decide on technical standards, such as the minimum size of space needed to maneuver wheelchairs

Signage to indicate the presence of a cycle path	None mentioned	Contributes to visual clutter	Could instead be signage for cyclists to indicate the presence of pedestrians
		Puts the focus on the pedestrian taking action rather than the cyclist	
		Only works for individuals who are able to see and are able to understand English	
Rumble strips on cycle lanes near bus stop bypasses	Could potentially hear the cyclist coming	The sensation of rumble strips may cause discomfort for some disabled cyclists	Would want to keep the design as simple as possible
		Need regular maintenance as they can come loose and become a safety hazard	
		Add to the mental workload of cyclists	
High contrast between pavement and cycle path	None mentioned	May not be adhered to by councils who prefer to make things look the same, e.g. by using different shades of grey	Could be achieved by using dark asphalt on the cycle path and light paving stones on the pavement
		Would be difficult to pick colours that make it clear that you can still cross the area	
Remove slopes on bus stop islands	None mentioned	Bus ramps are supposed to be deployed onto a raised pavement, so if they were to be deployed further down, then the ramp would be steeper	Would be better to raise the kerb at the zebra crossing so that someone who is

	Cyclists may mount the island or the pavement, making it unsafe for pedestrians	visually impaired knows where they need to cross

Continuous Footway Solutions

Solution	Advantages	Disadvantages	Potential Improvements
Steep ramps to slow cars down	None mentioned	May cause issues for those who use mobility scooters on the road and may also need to negotiate the ramps	Would need to be high contrast to be clearly visible to pedestrians
Signage to tell pedestrians to look left and right	None mentioned	More signs for pedestrians to be on the lookout does not change driver/cyclist behaviour which tends to be the issue	Could instead be rumble strips on the road to make drivers slow down
		Could add to confusion and clutter	
		Puts onus on the pedestrians	
		Masking a problem that we should not create in the first place	
High contrast between ordinary		Some people may perceive the contrast as a change in level	Raised side road entry pavements are an alternative to continuous footways which

pavement and continuous footway	Could alert people to differences in the area	Would mean it is no longer a continuous footway	have colour contrast to indicate that they are part of the carriageway
		People might not be able to physically see the change in a busy area	
Tactile paving at crossing point	None mentioned	May hinder visually impaired people who may be disrupted by anxiety thinking they are going to cross a road	Would be good to do user engagement with visually impaired people
Road markings to alert drivers to slow down, e.g. yellow zigzag lines	Could be beneficial on the road and complement double yellow lines and no stopping markings	Could confuse pedestrians	Solutions would need to be discussed and tested with drivers
		Drivers may not notice the markings	
Increase drivers' awareness of changes in the Highway Code	Important as people generally are not aware of changes and the order of priority	None mentioned	Continuous footways are not in the Highway Code, so there needs to be a diagram so drivers are aware of them
Markings to alert pedestrians of the presence of cars	None mentioned	Would add to confusion and shifting of responsibility	None mentioned
		Has the same problems as the other marking solutions discussed	

Following the workshop, the attendees completed a Google Form where they were asked to rate each solution from 1 to 5 in terms of its feasibility, affordability, and accessibility for all disabled people. Feasibility refers to the solution being possible and likely to be achieved, affordability refers to the cost of the solution being appropriate, and accessibility for all disabled people refers to the degree of accessibility for disabled people across all impairment groups. For instance, a solution that is highly accessible to one impairment group but almost fully inaccessible to another impairment group would receive a low score on this element.

Once all attendees had completed the form, the scores were averaged for each solution, and then each solution was ranked from 1-7 in terms of its feasibility, affordability, and accessibility. The solutions which scored higher were given a lower rank, i.e. 1 being the highest rank and 7 being the lowest. These rankings were then averaged to provide an overall ranking for each solution, again the lowest rank being the better solution.

For the bus stop bypass solutions, the highest ranked solution in terms of feasibility was “high contrast between pavement and cycle path”, the highest ranked solution in terms of affordability was “descriptive markings on cycle paths for pedestrians”, and the highest ranked solution in terms of accessibility for all disabled people was “increase the size of the bus stop island”. The highest ranked solution overall was “high contrast between pavement and cycle path”.

For the continuous footway solutions, the highest ranked solution in terms of feasibility was “tactile paving at crossing point”, the highest ranked solutions in terms of affordability were “tactile paving at crossing point” and “road markings to alert drivers to

slow down”, and the highest ranked solution in terms of accessibility for all disabled people was “increase drivers’ awareness of changes in the Highway Code”. The highest ranked solution overall was “tactile paving at crossing point”.

The following tables summarize the rankings for both the bus stop bypass and continuous footway solutions.

Bus Stop Bypass Solutions

Solution	Feasibility Score	Feasibility Ranking	Affordability Score	Affordability Ranking	Accessibility Score	Accessibility Ranking	Average	Overall Ranking
Descriptive Markings	3.83	3.5	4.33	1	2.67	7	3.83	3.5
Improve Lighting	4.00	2	2.83	5	4.17	3	3.33	2
Increase Size of Island	2.67	6.5	2.67	6.5	4.67	1	4.67	6
Signage	3.83	3.5	4.00	2	2.83	6	3.83	3.5
Rumble Strips	2.67	6.5	3.67	3	3.00	5	4.83	7
High Contrast	4.17	1	3.50	4	4.00	4	3.00	1
Remove Slopes	3.67	5	2.67	6.5	4.33	2	4.50	5

Continuous Footway Solutions

Solution	Feasibility Score	Feasibility Ranking	Affordability Score	Affordability Ranking	Accessibility Score	Accessibility Ranking	Average	Overall Ranking
Steep Ramps	3.67	2	3.17	6.5	3.50	3	3.83	4
Signage	3.50	3.5	3.67	3.5	2.50	7	4.67	5
High Contrast	2.67	6	3.33	5	3.17	5	5.33	6
Tactile Paving	4.33	1	3.83	1.5	4.00	2	1.50	1
Road Markings	3.33	5	3.83	1.5	3.33	4	3.50	2
Educating Drivers	3.50	3.5	3.17	6.5	4.33	1	3.67	3
Markings for Pedestrians	2.50	7	3.67	3.5	2.83	6	5.50	7

3. Strengths of the Research

The research benefitted from collecting rich qualitative data from a small group of disabled and older people with a range of different impairments and sociodemographic characteristics. The use of focus groups and site visits allowed us to collect in-depth insights from disabled and older people about their lived experiences. A gradual learning approach was followed, whereby participants learned about the infrastructure in a safe, online setting before being given the opportunity to visit a site in person. This meant that they were able to make an informed decision about participating in the site visit.

Accessibility was central to the research, as we ensured that individual access needs were met and people with a range of impairments could participate. The focus groups were held online to ensure they were inclusive for those who were unable to attend in-person focus groups. Information about access requirements was collected in advance of the focus groups to ensure that participants' needs were accommodated. The focus groups were hosted by a disabled facilitator who created a safe atmosphere for disabled people to share their experiences. Participant safety was taken into consideration for the site visits, as a risk assessment was conducted beforehand by disabled people from a pan-impairment perspective.

Participants were compensated for taking part in the research to acknowledge the time and effort taken to participate in the project. If the research took more time than expected, which was the case at some of the site visits, then participants were provided with further payment to reflect their level of contribution. Travel costs were reimbursed if participants were unable to travel by public transport, or if they needed to hire a carer or

personal assistant. This ensured that participants did not incur extra costs as a result of taking part in the research and aimed to minimize barriers to participating in the project.

4. Limitations of the Research

The small sample size may have been beneficial in some respects, though it also meant that the sample may not be representative of the disabled population[2] as not all impairment types were included. Due to the limited scope and budget for the project, we chose to focus on only two urban locations for the focus groups and site visits: London and Glasgow. However, this may have affected the findings of the research, which may have varied in other locations where the design of the infrastructure itself may have been different as well as the context in which it is found.

Although we tried to ensure that our research was inclusive, our choice to hold online focus groups may have excluded disabled and older people who do not have access to an internet-connected device. This highlights the issue of digital exclusion among the disabled population, who are less likely than the general population to be internet users. Insights from the site visits were recorded on a smartphone, which posed difficulties as street noise made it difficult to capture all data from participants. This meant that some insights may have been missed.

We must also consider the power dynamics at play between researchers and participants. While our aim was to conduct inclusive, co-produced research with disabled and older people, the inherent power imbalance between researchers and participants raises ethical implications. Transport for All attempted to establish an equal

[2] It should be noted that this is usual for qualitative research as it does not seek to be representative.

relationship with participants by appointing disabled researchers to work on the project, though it must be acknowledged that not all Living Streets researchers had lived experience of disability.

Several points were raised by the attendees of the internal solutions workshop. The access consultants who attended found it difficult to comment on solutions when they had not seen designs of them, as they struggled to envisage what the solutions might look like in practice, e.g. road markings and signage. It was also mentioned that rating the solutions was difficult as it would depend on how the solutions were implemented. The feasibility rating caused the most issues, as one attendee explained that the feasibility of some of the solutions will depend on maintenance. For example, putting markings on the ground is feasible, but they would have to be well-maintained to ensure that they are fit-for-purpose, and the additional costs required for this would reduce their feasibility. Another attendee commented that some solutions may be feasible but would not achieve the desired effects. For instance, descriptive markings are a feasible solution, but they may have little effect in the complex situations that occur around bus stop bypasses. Other solutions may be feasible but lead to adverse effects. For example, high contrast between the ordinary pavement and continuous footway may be feasible but may also lead to people driving over the footway as though they have priority, meaning that it would no longer be a continuous footway. These issues highlight the complexity of applying accessibility principles in practice.

5. Future Research

Future research could improve on the current work by gathering quantitative as well as qualitative data. For example, surveys could be utilized to collect quantitative data about

disabled people's experiences of using this infrastructure. This would provide a cost-effective way of reaching more individuals, since the methodology used in the current project only allowed for the recruitment of a small sample. If qualitative methods such as focus groups are employed for future research, they should not be solely held online to ensure they are accessible to those who do not have access to the internet. Data should also be collected from a wider range of individuals from different areas of the UK and with different impairment types, to ensure the data are representative of the disabled population in the UK.