CIHT

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Buses in Urban Developments

Principal author: Tim Pharoah, FCIHT

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Chartered Institution of Highways & Transportation

119 Britannia Walk
London N1 7JE

t: +44 (0)20 7336 1555
e: info@ciht.org.uk
www.ciht.org.uk

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Contents

Endorsements

The following organisations have endorsed these guidelines demonstrating the wide level of support from the bus industry to planning and transportation professionals.

CIHT would like to thank all of the following organisations for their support:

Foreword to Buses in Urban Developments

Buses play a vital part in providing accessibility for everyone and, through their efficient use of space, in supporting the viability of high quality urban places.

For buses to play their full role, however, urban developments must be designed specifically to encourage their use. This involves bringing together the planning of land uses, the access routes to bus stops, and the bus infrastructure. Showing how this can be done is the unique contribution of "Buses in Urban Developments".

Buses need to be an integral part of our towns and cities, but in many parts of the UK they are marginalised or fail to meet their potential. Prioritising public transport as a component of urban development is not new, but too often the policy is poorly reflected in practice on the ground. CIHT – with the publication of "Buses in Urban Developments" – addresses this issue and shows how to put bus services right at the heart of development planning and urban transport.

If urban developments are designed to promote the use of bus services, and this document for the first time provides the necessary guidance, then important challenges will be addressed. For instance, if we consider modal shift from cars, buses will play a central role in improving air quality and in meeting the longer-term objective of decarbonising the transport network. Bus travel also supports active travel, which in turn helps to demonstrate the contribution that transport can make towards improving personal and community health.

We need to have the golden thread of accessibility running through all our thinking. And in both senses of the word: firstly, in ensuring that bus networks help people connect from one area to another; and secondly, that they are readily accessible for everyone.

Some high specification bus services have already demonstrated the importance of a quality service in persuading people to take the bus, for example that the buses themselves must be comfortable, clean and attractive, and that service frequencies and reliability are crucial. Much less widely appreciated is the importance of the infrastructure used by buses, and its relationship to the areas they serve. Roads need to be maintained to ensure that those travelling by bus experience a smooth ride, and greater attention must be paid to the walking and cycling routes used to access bus stops and stations. The bus stop itself may be regarded as the calling card of the entire system. If it is missing, neglected, of poor quality or without the necessary information, people are more likely to choose an alternative mode.

The structure of this document is designed to make it easy to work through. It starts off by establishing the context and policy framework that buses operate within. Then it looks at the technical detail of the infrastructure required. Final sections consider levels of service and information provision, as well as participation and collaboration.

So wherever you sit in the transport industry there will be something in this document for you – from policy makers to practitioners, from planners to bus operators.

I am delighted to see this document published during my time as President of CIHT. My presidential theme is 'creating better places' and by supporting buses in urban areas we help to deliver this.

Better bus provision requires the integration of land use planning and transport and the support for this document rightly includes key organisations that represent both of these disciplines. We have support from the bus industry with endorsement from the Confederation of Passenger Transport (CPT) alongside support from the Royal Town Planning Institute (RTPI) and the Transport Planning Society (TPS).

CIHT firmly believes that buses have a significant role to play in providing sustainable connectivity and we hope this document will help to promote that role within the transport system and in the creation of high quality urban and rural environments.

Andreas Markides,
President, CIHT (2017-18)

Executive summary

This document is a reference for spatial and transport planners, highway and traffic engineers, developers and urban designers to ensure that buses can perform efficiently in the urban travel market. For bus and transport operators, it provides an overview of what they should expect from the local transport and planning authorities. It focuses on the configuration of new developments, residential or otherwise, to enable bus services to play a major role in connecting developments to the places people need to go. It also sets out the requirements of bus services to enable this role to be fulfilled in an efficient way, with long-term viability.

The key messages are as follows:

- New developments should be sufficiently compact or dense to generate demand that will support high-frequency bus services with long-term viability;
- The layout of streets and paths in new developments should facilitate direct and efficient bus operation, with direct and pleasant walking routes to bus stops;
- Buses should be integral to the urban fabric, aided by a set of spatial planning policies that cascade logically from the governing spatial plan to the development management regime, together with local transport policies that satisfy this aim;
- Good bus services should be available from the occupation of any new development, either through proximity to existing routes or through the provision of new or extended routes.

Introduction and purpose

Buses in Urban Developments is one of the Streets and Transport in the Urban Environment (STUE) series of guidance documents from CIHT[1], which replace the printed volume Transport in the Urban Environment published in 1997.

Despite government guidance (DCLG, 2012; DCLG, 2014; DCLG, 2015) and the widespread adoption of urban policies to improve sustainable modes of travel and to encourage their use, little has been published on what constitutes a good bus service and what is needed to achieve high levels of use.

The focus of this document is on how urban developments can be configured to bring about an increase in the level of bus use, bringing benefits to the economy, the environment, and the community. Broadly, the aims of this document are to:

- Present aspirational, but achievable, standards of bus service provision and bus-oriented development;
- Indicate what is necessary to promote high levels of bus use in new developments; and thus
- Help practitioners implement a firmly established sustainable development policy.

High-quality bus services are an essential part of an integrated approach to sustainable urban transport and spatial planning and contribute to maximising the potential of new urban developments.

The document is arranged in four sections:

Section A explains how urban development needs to be planned to enable a strong role for buses. A greater role for buses supports the complementary aims of stronger communities, greater equality of access, better economic performance, more attractive places, and a more sustainable environment.

Section B provides guidance on the design of infrastructure needed to deliver a strong role for the bus, which is relevant to existing as well as new urban development.

Section C sets out the quality of service needed for buses to cater for a high proportion of people's local travel, as well as the information that needs to be provided.

Section D emphasises the need for collaboration and coordination between various authorities to deliver effective bus-oriented development.

The organisation, planning, funding, regulation and management of bus services are not directly addressed. This document focuses on the types of services and infrastructure that should be aimed for, regardless of who owns or regulates such services.

[1]These can be accessed at: http://www.ciht.org.uk/en/knowledge/streets-and-transport-in-the-urban-environment/

Section A - Context and policy framework

A.1 Introduction

This section is relevant particularly to those involved in urban policymaking, master planning, development management and transport planning. It deals with the policies required to enable attractive and efficient bus services in new developments.

These guidelines focus on bus services as the predominant form of collective urban transport whilst acknowledging that technology is changing transport through, for example, Mobility as a Service (MaaS) (Transport Systems Catapult, 2016).

Bus services are important to urban areas for several reasons (see section A2):

- Bus use enables more people to be moved along a corridor of limited vehicle capacity;
- Buses enable people who either do not have a car or who do not wish to use one to travel farther than they can walk, with benefits to social equality;
- Bus services from peripheral developments can reduce car use from those developments and the resulting congestion on main radial roads;
- Bus users contribute substantially to retail activity in town centres;
- Towns and cities in which access to the centre is largely by bus can achieve a better city centre environment through more pedestrian space and better air quality;
- Buses contribute to active travel and healthier lifestyles because of walking (or cycling) to and from bus stops.

The challenge bus operators face when trying to provide high-quality bus services are the following:

- Competition from the car, particularly where there is ample low-cost parking;
- Delays to services by congestion;
- Street layouts that make it impossible to provide an economically efficient bus service that is attractive to passengers.

The use of buses varies considerably between different towns. It is high in London at 15% of all trips, reducing to 10% in the bigger cities, 5% in smaller towns and only 3% in rural towns and fringe areas (see Table 1).

Table 1: Mode split of all trips in England, 2014 – 2015 percentages

	England excluding London	London	Urban conurbation	Urban city and town	Rural town and fringe
Walk	21	26	23	23	20
Local bus	5	15	10	5	3
Other public transport	3	16	9	3	2
Car	68	38	56	66	72
Other private transport (including cycle)	3	4	3	3	3

Source: NTS, Table 9903, sum of 2014 and 2015 (DfT, annual (a)

Annual bus statistics compiled by the Department for Transport (DfT, annual (b); KPMG, 2016) enable estimates to be made of the bus mode share by region and by local authority area. This is done by comparing bus boardings with overall daily trip rates per person provided in the National Travel Survey (NTS). Given a broadly stable trip rate, for all modes taken together including walking and cycling, of about 2.5 trips per person per day, it is reasonable to assume that a high bus trip rate corresponds to a high modal share[2]. On this measure, some places have achieved higher levels of use than the norm, notably Brighton and Hove, Nottingham and Reading. Table 2 shows the areas in England (outside London) estimated to have the highest bus mode share in 2014–15, up to 15%, together with the change from 2009–10. At the other end of the scale, more than half of the 88 county and unitary authority areas have a bus mode share less than 5%.

In Edinburgh, a travel diary survey in 2008 indicated an 18% bus mode share of all trips by the resident population (Scottish Household Survey 2007/8, Table 15).

Table 2: Areas with highest bus use in England, excluding London, 2010 – 2015 (estimates)

Local authority areas with bus mode share >10%	Bus boardings per person 2014–15	Change from 2009–10	Approximate bus mode share of all trips in 2014–15[3] %
Brighton and Hove	158	+3%	15
Nottingham	154	-6%	14
Reading	119	+10%	11
Tyne & Wear ITA	107	-10%	10
West Midlands ITA	98	-16%	10
Bournemouth	97	+8%	9
Kingston upon Hull	91	-11%	9
Merseyside ITA	89	-10%	9

Sources: DfT, annual (b), Table Bus0110, Local bus passenger journeys England 2014/15; and NTS (DfT, annual (a)) Table 9903, sum of 2014 and 2015.

A.2 The reasons to provide high-quality bus services

This section summarises the evidence for the value of bus services and the national policies that support the provision of such services. It also examines the factors that may account for the higher-than-average use of bus services in towns such as Brighton and local policies and practices that can support the operation of quality bus services, particularly in new developments.

High-quality bus services are key to successful urban areas and enable the creation of attractive streets and places, with less traffic and congestion, even where populations are growing. To achieve this, buses have to cater for a high proportion of trips and to be viable in the long term without the need for subsidy. The great majority of bus services in Britain outside London are already operating commercially without any direct subsidy from a local authority. With high levels of use, a win-win situation can be achieved allowing a better urban environment and economy supported by high-quality bus and other public transport services[4] (Johnson, 2016; Begg and Haigh, 2017).

[2]The NTS average trip rate per person for England for 2013–14 was 2.53.
[3]It is assumed that bus journeys are 15% less than the number of boardings, to allow for multi-stage bus journeys; and that overall annual trip rates in the urban areas shown are 50 trips less than the relevant regional average.
[4]More on this can be found at the 'Greener Journeys' campaign website: http://www.greenerjourneys.com

A.2.1 Bus use enables more people to be moved along a corridor of limited vehicle capacity

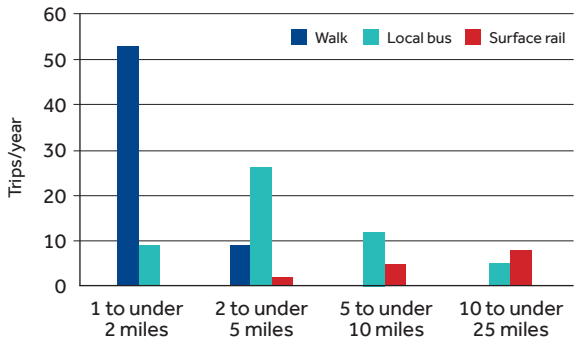
For all journey purposes taken together, the average occupancy of a car is about 1.6 persons. However, for journeys to work, car occupancy is only about 1.2. This may be particularly relevant when considering bus priorities at peak periods. Bus occupancy overall is about 9 but varies greatly between areas; the number is typically between 20 and 30 passengers on main roads into towns. A typical bus takes the space of about 2.5 cars, so buses can be expected to move about 5 to 10 times more people along a given corridor compared to cars.

A.2.2 Buses enable people who either do not have a car or who do not wish to use one to travel farther than they can walk

Figure 1 shows how the number of bus trips per person per year is greatest for lengths of 2 to 5 miles. For trips shorter than 2 miles, people make more trips on foot; for trips over 10 miles, they make more by surface rail. Because Figure A.1 only shows non-car trips, it demonstrates how buses extend the non-car range of people beyond the distance they can walk or cycle. The bus accounts for less than 1% of trips under 1 mile.

Figure 1: Non-car trips per person per year for different lengths, England 2016.
DfT National Travel Survey, Table 0308.

(Note: Trips under 1 mile and over 25 miles are omitted for graphic clarity. The figure for walk under 1 mile is 180, for bus under 1 mile is 2. Walk and bus over 25 miles are both 0.)



A study by KPMG shows that better bus services reduce social deprivation: *'This new econometric analysis shows a statistically significant association between local bus service connectivity and deprivation, with a 10% improvement in local bus services connectivity associated with a 3.6% reduction in deprivation after controlling for other local factors'* (KPMG, 2016). Greener Journeys (2016) and Johnson (2016) also show the ability of bus services to reduce social deprivation.

A.2.3 Bus services from peripheral developments can reduce car use from those developments and the ensuing congestion and other negative impacts

As residential, retail or employment developments are created, the traffic to or from those developments and the town centre will tend to exacerbate congestion and environmental impacts on the existing road network.

If users of the peripheral developments are able to use good-quality bus services instead of cars, these impacts can be reduced, especially if the improved services encourage mode shift away from the car in existing parts of the town through which they pass.

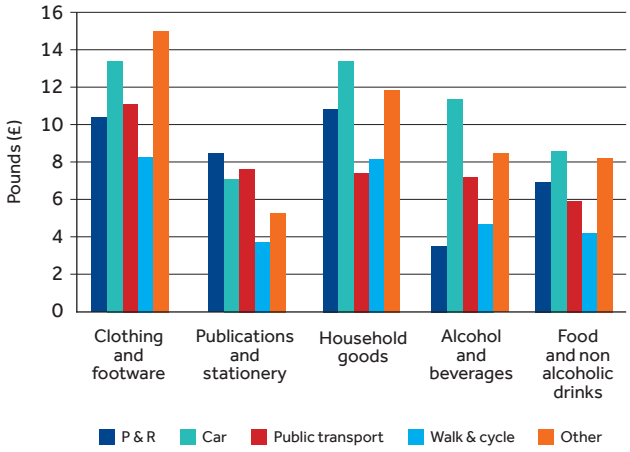
A.2.4 Bus users contribute substantially to retail activity in town centres

Numerous studies have shown that, contrary to much folklore, bus users and pedestrians are responsible for a substantial percentage of retail activity in town centres (Johnson et al., 2014; Johnson, 2016).

'The bus is a vital artery for shopping trips. In our sample survey, 70% of non-food shopping trips are to town/city centres with 30% out of town. Bus has the largest market share (one third) of retail/expenditure trips to city centres. Bus users contribute 22% of expenditures on non-food and entertainment across all locations'
(Johnson et al., 2014).

The CfIT report *Sustainable Transport Choices and the Retail Sector* (2006) shows that in many sectors the retail spend per trip is quite similar for car users, bus users and park and ride users, as illustrated in Figure 2 (Figure 1.1 in the CfIT report).

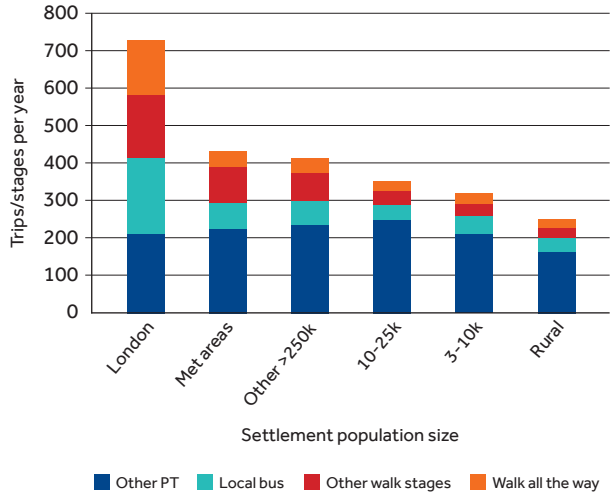
Figure 2: Average spend per visit by retail sector (CfIT, 2006)



A.2.5 Bus services contribute to active travel and healthier lifestyles because of walking (or cycling) to and from bus stops

Unlike most journeys by private car, journeys by bus (or rail) mostly involve walk stages to and from the stops. Not surprisingly, therefore, there is quite a strong correlation between the use of public transport and the number of walk stages that people undertake, as shown in Figure 3. In this way, buses can help increase the amount of physical activity undertaken by the populations they serve.

Figure 3: Walking and use of public transport (excluding taxi) by size of settlement
(NTS GB 2007–2009, special tabulations)



A.3 Policies to support bus provision

The National Planning Policy Framework (NPPF) (DCLG, 2012), promoting public transport–oriented development, says (page 6) that, as a *'core planning principle'*, planning should

> *[a]ctively manage patterns of growth to make the fullest possible use of public transport, walking and cycling, and focus significant development in locations which are or can be made sustainable.*

Section 4 of the NPPF on 'promoting sustainable transport' provides further advice in relation to new development (page 10):

> *Plans and decisions should ensure developments that generate significant movement are located where the need to travel will be minimised and the use of sustainable transport modes can be maximised. ... [D]evelopments should be located and designed where practical to ... have access to high quality public transport facilities.*

In addition, most regional strategies, local plans and transport plans include a range of economic, social and environmental objectives and acknowledge the potential role of switching more travel to sustainable modes.

To meet these policy objectives, bus services must in future compete effectively with the car for a wider range of trips and a wider segment of the population. For example, people who are classified as the 'main driver' in a household currently make a mere 1.4% of their trips by bus, compared to 23% by members of non-car households[5] (NTS 2015, Table 0702; DfT, annual (a)).

Policies for 'enabling' or 'providing for' bus services need to be accompanied by targets or specific aspirations for their use. Local plans, local transport plans and the transport assessments for specific development proposals will be more effective if they included statements, at least in broad terms, about the expected outcome in terms of levels of bus use. The 'desirable' route network which is sought over the plan period should be specified and mapped, with minimum services levels, to enhance accessibility. This information is necessary if funding for public transport is to be obtained from the Community Infrastructure Levy (CIL) or section 106 planning conditions.

A.4 Securing the best environment for effective bus operation

A large bus mode share is possible with the right policies to promote, and not discourage, the use of buses. This is shown by the use of buses in a number of towns such as Nottingham, Brighton and Reading. To an extent, this can be achieved by bus operators through higher standards of provision, but the full potential requires cooperation between the operator(s), local planning authority and highway authority.

In towns and cities facing population growth, mode shift from car to bus amongst the existing population can offset additional car travel undertaken by new residents. Equally, the standard of bus service offered to occupiers of new developments will depend largely on the standard already available on the existing network.

[5]Note that 'main drivers' make 58% more trips per year than members of households without access to a car or van.

A.4.1 Planning the physical environment

Spatial planning for bus-oriented development

New developments and regeneration schemes should be located where they can be served by extensions to existing bus services or where new services can provide direct and fast routes to the town centre and other major destinations. Once a development location has been decided, the outline street layout should be planned to allow direct and fast bus services that are both efficient for the operator and attractive to passengers. Tortuous routes and long loops should be avoided whenever possible. The Stagecoach document *Bus Services and New Residential Developments* (Stagecoach, 2017) provides some excellent advice on good practice as well as examples of features to avoid. The local bus operator should be involved in the initial layout of streets and positioning of bus stops in a new development.

Locations of bus stops need to be mapped onto outline street layouts. These should act as foci for footpath networks and possible locations of local activity centres such as convenience shops (see figures 5, 10 and 11). This should be undertaken in conjunction with the bus operator where possible, or a bus planning specialist who can advise on the operational implications. Higher-density housing and larger employers can also be located close to potential bus stops.

Buses gain and retain acceptable levels of use where development has sufficient overall density and mix of uses. Lower-density developments generally do not lend themselves to viable bus operation. Buses will always struggle to secure a significant share of trips in areas containing car-based developments such as supermarkets with large car parks, free-standing retail parks and business parks, and low-density residential areas.

Figure 4: Plan for the Milton Keynes Western Expansion Area, showing the main routes on which high-quality buses run and on which schools, shops and other non-residential developments are located to maximise the convenience of bus use. Most of the development will be within 400 metres of a bus stop

Figure 5: Bus stop for Fastway services conveniently located for the Broadfield district centre, Crawley (Photo: Tim Pharoah, 2017)

The central message therefore is that the vitality of existing centres and corridors must be retained and reinvigorated whilst areas of new growth can be structured to reinforce existing, or to create new, centres and corridors. Development located outside town centres and public transport corridors is inconsistent with 'sustainability' objectives, including the reduction of harmful emissions, noise and land-take. To meet policy objectives to the fullest extent, and to ensure that bus-oriented developments are not undermined, local authorities must ensure that all developments are bus-oriented. The exception is large-scale facilities that generate little personal travel, such as distribution warehouses.

A.4.2 Principles of public transport–oriented development

The transit-oriented development (TOD) concept arose mainly in North America, as the disbenefits of car-based developments became apparent after World War II. High land and infrastructure costs, noise, air pollution and casualties all gave cause for concern. For the UK, using the term 'public transport–oriented development', the basic principles are:

- build compact nodes of development along a public transport route;
- develop at higher densities close to the public transport stops; and
- provide a mix of land uses to reduce the demand for travel.

Individual developments built to these principles benefit not only their occupants but also people throughout the entire area served by the public transport network, as a result of the higher levels of service and greater accessibility prompted by the new development.

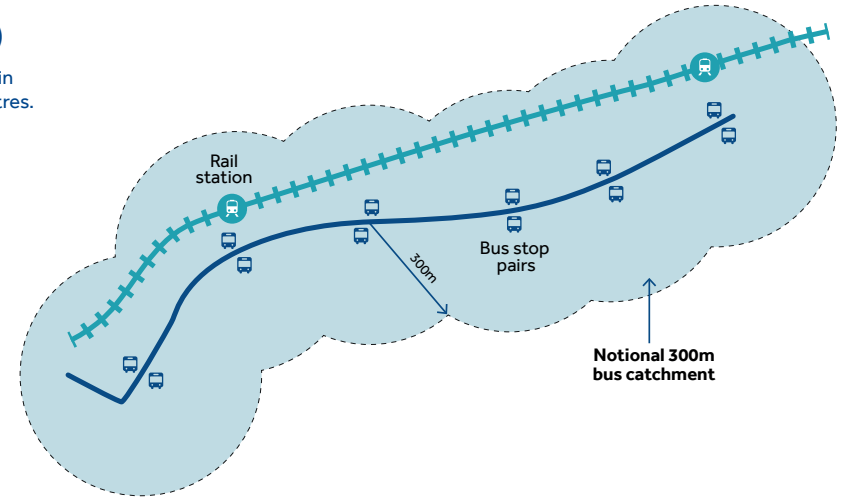
A.4.3 Bus-oriented development

The importance of relating development to routes and stops applies equally to both bus and rail services. The difference is mainly one of scale rather than principle. Bus routes have more frequent stops than heavy rail routes so that their stop catchment areas can merge to resemble a corridor, as shown in Figure 6. The spacing of stops on tram or light rail routes tends to fall in between bus and heavy rail.

Bus-oriented development requires the integration of transport and spatial planning in the following ways:

Figure 6: Spacing of bus stops and rail stations (actual example, Merseyside)

Note: A 300-metre notional catchment will result in maximum walking distances up to around 400 metres.



- Where there is an established bus stop or public transport hub, new development can be planned around it, with opportunities for higher density and greater mix of uses at key stops;
- Where there is established development, bus stops can be located and routes planned in relation to it;
- Where there is a clean sheet, the two must be planned together.

Bus stops are the means of access to bus services. They are also places where people gather and therefore need to be located where businesses and other activities can benefit from the presence of people. They are an important component of the urban area and the street scene, not simply a part of the bus system. They should easily be reached by a network of footways and footpaths serving both the stop and the local activities (considered in more detail in section B).

There are numerous examples of bus-oriented development dating from the 1960s, before the period of mass car ownership. More recent examples include inner-city regeneration projects such as Hulme in Manchester, and the Staithes South Bank development in Gateshead. Further examples of bus-oriented urban growth areas are due to appear over the next decade, including the following:

- The Western Expansion area of Milton Keynes (construction underway in 2017) is structured around a 'city street' which will become the main bus route serving the development. Densities will be higher, and the main non-residential land uses will be located on this route (see Figure 4);
- The Bridge development in Dartford is structured around the Fastrack bus rapid transit system (see case study below).

A.4.4 Spacing of bus routes and stops

For strategic and outline planning, the bus route can be presented as a corridor, up to around 600 metres wide, made up of overlapping walking catchments to stops (as shown in Figure 6).

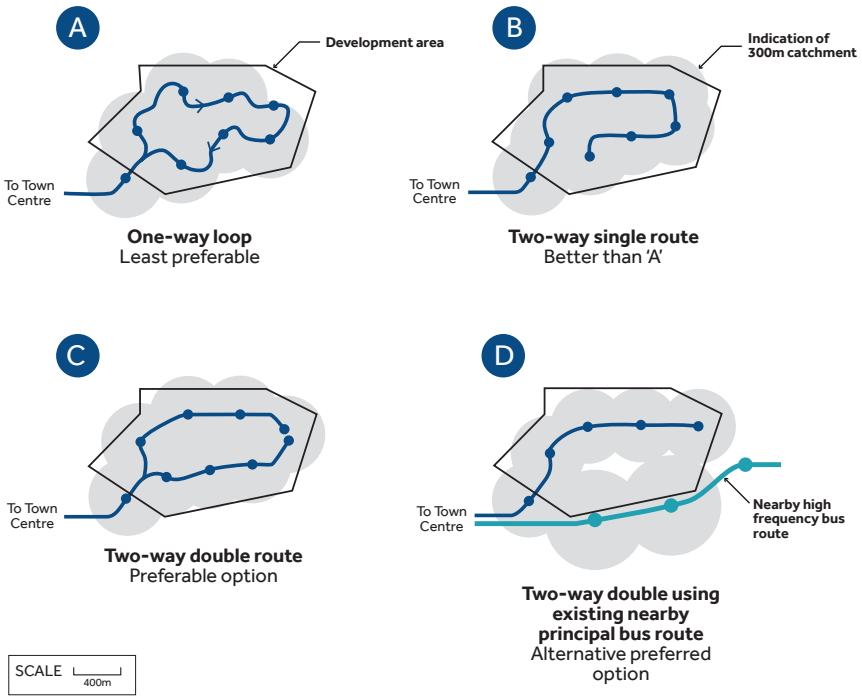
The spacing of 'parallel' or adjacent bus routes (whether existing or new) will relate to the size of catchment areas around stops. Thus, if a catchment of 300 metres is adopted, adjacent routes should be no more than 600 metres apart (Figure 7). New development should be configured to enable this to be achieved whilst also ensuring adequate density and potential demand to support each route.

Long loops are best avoided although a short loop at the terminus to facilitate the turning of the vehicle may be required. One-way operated loops especially cause inconvenience and confusion for passengers.

Figure 7: Achieving easy access to stops – theoretical example.

Direct routes (C and D) are preferable to loops. One-way loops particularly should be avoided (A).

The development should have sufficient density and/or land use mix to support high-quality services.



In planning new developments, a balance must be struck between providing very short walks to stops and providing fast, direct services. The time involved in reaching a bus stop (and hence the catchment size) is not a stand-alone consideration. For example, closer spacing of bus stops along a route will result in shorter walk times to bus stops but will lengthen the time taken by the bus to complete the route.

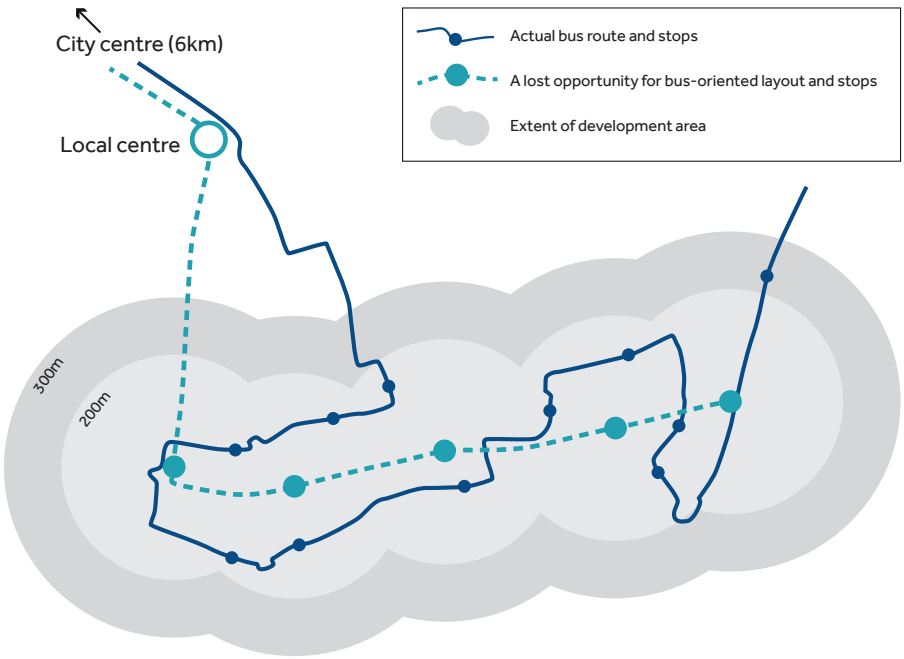
As *Bus Services and New Residential Developments* (Stagecoach, 2017) advises, there will be circumstances where achieving a 400-metre walking catchment *'results in an inefficient and contrived layout, greatly undermining the potential effectiveness of the proposed bus route. Stagecoach will always prefer an efficient bus routing strategy, serving the great majority of dwellings well, than one that serves all homes poorly with a low-frequency or indirect service. Thus we support policy approaches offering some degree of flexibility on walking distances to bus stops where this is appropriate'.*

Figure 8 compares a potential direct route with few stops, allowing a fast and efficient bus service, with the actual indirect route with many stops.

When planning the stops in larger developments, it is important to consider the time and accessibility aspects of the whole journey, not just the journey on the bus itself. Both operator and user have an interest in journey times being minimised. To achieve satisfactory bus stop locations, it is *'essential to consider the siting of public transport stops and related pedestrian desire lines at an early stage of design. Close co-operation is required between public transport operators, the local authorities and the developer'* (Manual for Streets, para 6.5.9; DfT and DCLG, 2007).

Distances between bus stops (Table 3) will generally be in the range of 200–400 metres. Wider spacing will be appropriate for BRT, express and principal corridor services. TfL (2017) recommends a spacing of 300–400 metres although a closer spacing in town centres and residential areas may be required to meet passenger requirements. Stagecoach (2017) recommends a spacing of 280–320 metres in residential areas to maximise the number of dwellings within easy walking distance of stops, whilst avoiding stops being so close together that buses cannot make efficient progress. Stagecoach also highlights that stops should be 'located to effectively serve the widest possible hinterland'.

Figure 8: An inefficient and unattractive bus route caused by poor street layout (actual example). Also shown is how the street layout could have provided for more efficient and faster bus access. The number of stops could have been halved whilst still providing for no more than a 300-metre walking distance. In addition, the ride would have been smoother, with 12 right-angle turns and 4 roundabouts avoided.



In new developments, often there will be the opportunity to design street and footpath networks to minimise walking distances to the bus stops. If stops are colocated with local facilities such as corner shops and schools, the footpath network that serves the stops will also serve those facilities. *Bus Services and New Residential Developments* (Stagecoach, 2017) comments, *'Development proposals should seek, from the very outset, to create effective stop catchments from within surrounding and/or adjoining development. The locations of new or relocated bus stops to serve development, whether on-site or adjacent, therefore need to be broadly identified at the earliest feasible stage, and typically within the Master Plan consented at Outline stage. Subsequent design development at Design Code and Reserved Matters stages can then resolve any potential conflicts with detailed design requirements'.*

In deciding applications for new developments, the mere presence of a bus stop is insufficient. The service provided is a matter for the local bus operator, but the local planning authority should liaise with the operator to ensure that the development will justify a good service and that the service will be viable in the long term. Access to the bus stop must also be convenient and pleasant. Bus stops and pedestrian routes to them should be included on plans submitted for planning permission showing, for example, the location of stops in relation to local shops and other facilities.

Table 3: Factors affecting bus stop spacing

Appropriate frequency of stops	
More frequent stops	**Less frequent stops**
Hilly routes	Fast/express bus routes
Short routes (e.g., in small towns)	Long routes (including inter-urban)
Less frequent services	Frequent services
Local routes focused on particular destinations (e.g., schools, hospitals)	Direct 'core' services (mostly on main radial roads)
Routes serving populations with a high proportion of elderly people	Routes serving populations with a younger age profile
Portions of routes with high-density housing (to distribute demand)	Medium- to low-density areas

Case study: North Kent Fastrack

The 'Fastrack' busway and bus priority network in North Kent offers a good example of integrating a high-quality bus service with new urban development, with benefits to both.

It serves an area southeast of London, along the southern shore of the Thames estuary, including both long-established urban centres (Dartford and Gravesend) and an old industrial area, previously dominated by cement manufacture, with potential for housing and retail development. Fastrack also links with Ebbsfleet International Station, offering high-speed rail services to London, and the Bluewater out-of-town shopping centre.

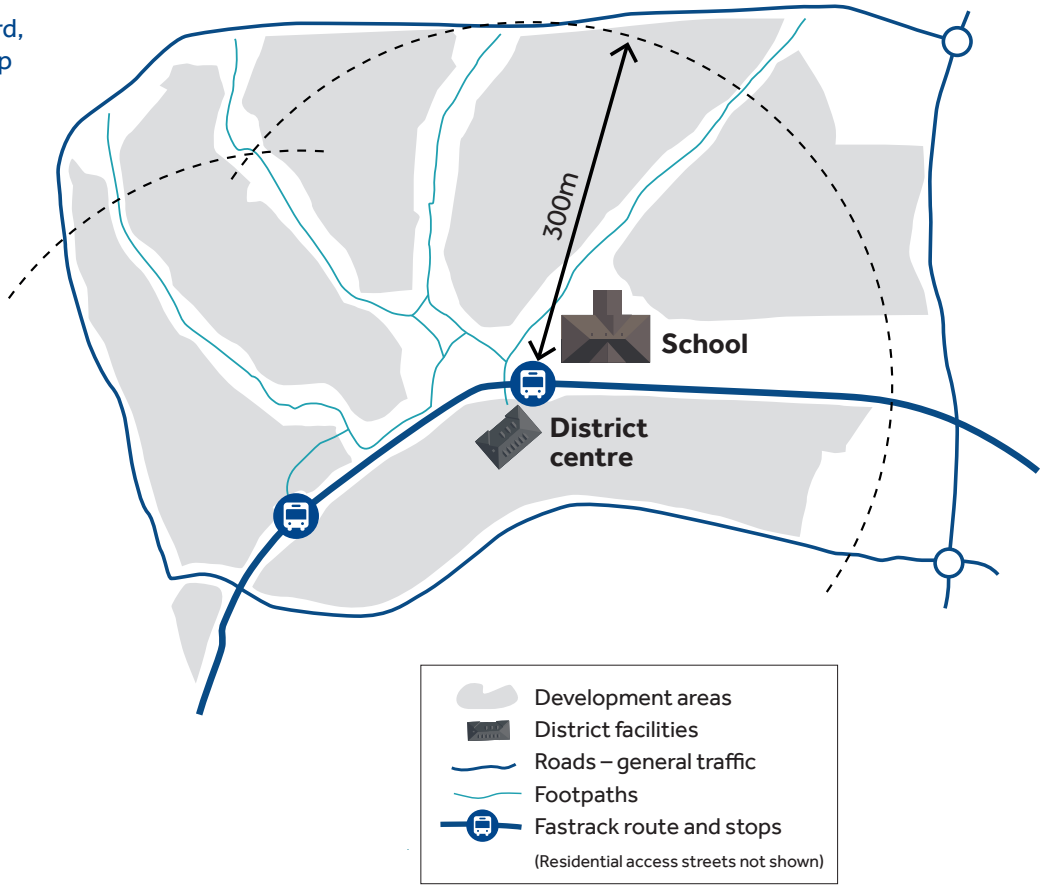
'The Bridge' development, located between the Queen Elizabeth II Bridge and an established housing area north of Dartford, is a housing area served by Fastrack from its inception in 2007. Developer contributions provided both infrastructure and support for a high frequency of service from the start, enabling new residents to become familiar with using the bus services (White, 2011). A free travel pass has been provided for new residents, valid on Fastrack service A.

The daytime frequency is 10 minutes, for both directions, dropping to 15–20 minutes during evenings and Sundays. Most of the development is within 300 metres of bus stops, which are located at focal points in the street and footpath network. A general account is provided by George (2016).

Following a period of inactivity after the recession of 2008, substantial development is now happening again, with new routes and significant investment likely. Further development east of The Bridge scheme mostly will lie within 300 metres of Fastrack stops on the existing routes, whilst extensions to the Fastrack network will serve the emerging 'Ebbsfleet Garden City' development.

Figure 9: Fastrack bus and stop (Photo courtesy of Fastrack)

Figure 10: 'The Bridge' development at Dartford, showing the relationship between development, walking routes, and Fastrack stops



A substantial transfer from car to bus was reported for the Fastrack service in its early stages. A survey in 2006 shortly after opening showed that 25% of users had the use of a car but chose to use Fastrack, and 19% would have made their journey by car before Fastrack opened (Jacobs and Kent County Council, 2008).

The busway element of Fastrack is a simple two-lane carriageway, without any guidance system, and vehicles operate on a mix of purpose-built busway and conventional roads with bus priority. From the start, operation by a single operator (Arriva) has enabled a clear brand image and common ticketing.

A feature of bus planning and operation that helps to ensure long-term viability and high passenger levels is the need to connect not just to town centres but also to other important trip attractors such as out-of-centre employment, hospitals, colleges and railway stations. This helps ensure good passenger flows in both directions throughout the day. The Fastrack system increasingly fits this description.

Figure 11: A pair of stops for Fastrack services located between school (in background) and local centre at The Bridge development, Dartford (Photo: Tim Pharoah, 2017)

A.4.5 Walking distance to bus stops and hubs

The planning of development sites should consider the walking distance to bus stops and the corresponding bus catchment areas. This affects the distance between adjacent bus routes and hence the street layout as a whole.

Custom and practice for many years[6] suggests a maximum walking distance of 400 metres from a bus stop (DOE, 1973). There are a number of factors, however, that demand a more rigorous approach to catchment area planning.

1. The 400-metre criterion dates from a time when bus use was less challenged by competition from the private car, and it may not be consistent with the goal of shifting mode share from car to bus. *Bus Services and New Residential Developments* (Stagecoach, 2017) strongly recommends that all housing development be located within 400 metres of a bus stop and preferably closer;

2. The acceptability of the walking distance is not a stand-alone consideration. People take account of the total journey travel time, including the 'in bus' time as well as the walk at either end. Consequently, people will accept longer walks to reach bus services that are fast and direct, or more frequent, and to stops serving a wider range of destinations;

3. The proportion of elderly people is increasing. A walking distance of 400 metres may be excessive when slower walking speeds are taken into account. People with children, buggies, heavy shopping, and the like will also be more sensitive to distance;

4. Acceptable walking distances are lower in town centres than in residential areas;

5. The quality of the walking route itself may affect people's judgement of an acceptable walking distance. Safe routes, well overlooked and with visual interest along the way will be perceived as less onerous than isolated, poorly lit and uninteresting routes;

Taking all these factors into account, it is recommended that new developments be planned with sufficient compactness and density to enable the maximum walking distances to bus stops shown in Table 4 to be achieved with viable services. These maxima are intended to enable the bus to compete effectively with the car and to benefit a wide range of people with differing levels of motivation and walking ability.

These standard distances should not be applied uniformly without regard to the specific characteristics of the particular location or route. For example, a shorter maximum distance may be appropriate for hilly terrain, or for access to hospitals or older people's residences, or where the walking environment is unattractive.

When planning bus routes and stops in relation to new developments, it is crucial to use actual walking distances and not notional circles whose radius is the maximum desired walking distance. Even with a regular grid layout, the actual walking catchment area will be less than two-thirds of the area described by a circle (Figure 12). The proportion can be very much smaller than this in irregular layouts. Also, the average time taken to walk the distance may be extended where the crossing of major roads is involved, and this should be taken into account.

Table 4: Recommended maximum walking distances to bus stops

Situation	Maximum walking distance
Core bus corridors with two or more high-frequency services	500 metres
Single high-frequency routes (every 12 minutes or better)	400 metres
Less frequent routes	300 metres
Town/city centres	250 metres

[6]Department of Environment Circular 82/73 (DOE, 1973) gives 400 metres as the recommended maximum walking distance along the footpath system, which represents a 5-minute walk at about 5 kph (roughly the average walking speed in the National Travel Survey).

Figure 12: Shape of catchment produced by regular grid layout

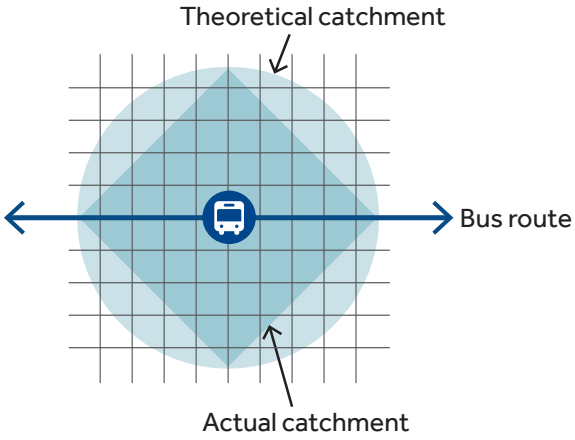


Figure 13: A more typical UK traditional layout, showing actual 300-metre catchment compared to the theoretical maximum (from a layout in Reading)

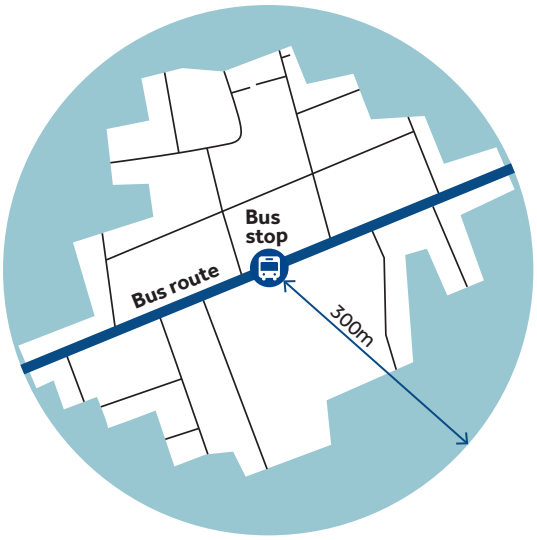
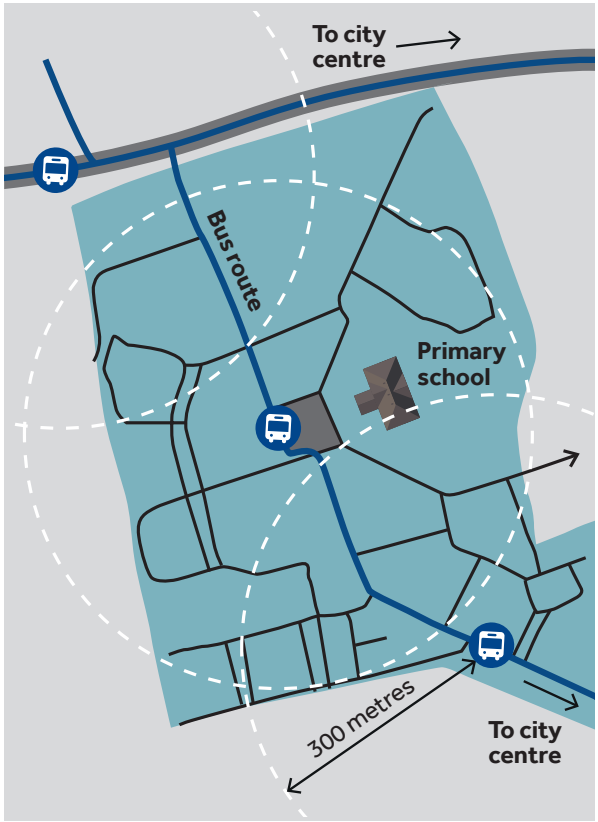


Figure 14: A disconnected layout is difficult to serve by bus and results in a small catchment (from a layout in Surrey)

Figure 15: Bus-oriented urban extension: Upton, Northampton

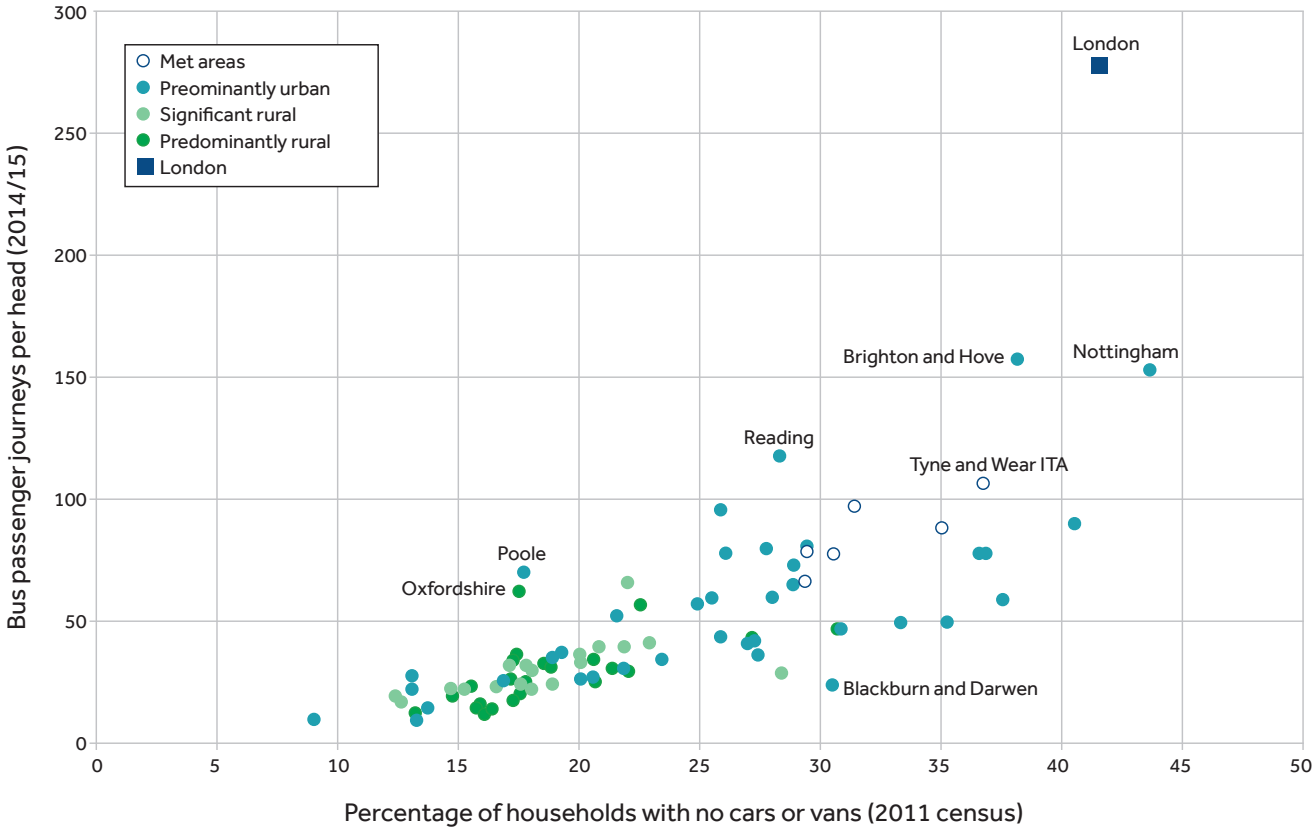


For disconnected street layouts such as shown in Figure 14, footpaths from the ends of culs-de-sac to the bus stop can greatly increase the catchment area. Figure 15 shows an example of a well-designed urban extension at Upton, Northampton, with most development within 300 metres of a stop.

Nonresidential developments that are on the edge of an urban area usually can only be accessed, if at all, by a single bus service that runs from the town centre to the edge of town location and will therefore serve directly only a small part of the total population of the town. To avoid this, urban spatial plans will need to aim for the following:

- Central location of urban employment and activities (Specialised or large-scale activities requiring access from a large population catchment must be located in central areas that are served by bus routes from throughout the urban area. Large-scale activity sites should be located where they are served by public transport from a catchment population appropriate to the scale of the development;) or
- Activities and facilities grouped within corridors, or at hubs in the public transport network, including around bus stops or stations; or
- Bus services coordinated to provide convenient interchange between routes – to achieve a 'network effect'.

Figure 16: Bus trips per head of population in England, 2014-15, in relation to household car ownership from 2011 census



(Source: Public Transport: Its Planning, Management and Operation, 6th Edition, Figure 2.1 (White, 2016) redrawn from Department for Transport data corresponding to that used for chart 10 in 'Annual Bus Statistics: England 2014–15'. See also KPMG (2016).)

A.5 Policies to avoid problems for bus operators

In addition to exploiting buses to create urban areas that are environmentally and economically successful, local authorities should develop policies to support the operation of bus services that are financially sustainable, efficient for the operator and attractive for passengers. The challenges are summarised in the subsections below. Possible solutions are considered in more detail in section B.

A.5.1 Competition from the car, particularly where there is ample low-cost parking

Car ownership is a major challenge for bus operators, but there are towns with high car ownership that also have high use of buses. Over England as a whole, people listed by the National Travel Survey as 'Main driver of a car or van' make 1.4% of their trips by bus compared to 23% by members of households without a car or van[7] (NTS 2015, Table 0702; DfT annual (a)). Figure 16 shows the number of bus trips per person per year against cars per person for local authorities. A number of cities such as London, Brighton and Hove, Reading and Poole show levels of bus use that are well above the trend line.

The towns that Table 2 shows have high bus use have relatively low car ownership compared with adjacent areas. Thus, in 2011, Nottingham had 0.76 cars per person (Derby 1.06, Leicester 0.90), Brighton and Hove 0.86 cars per person (Southampton 1.03, Portsmouth 0.95), and Reading 1.06 cars per person (Slough 1.20, Woking 1.43). Nottingham and Brighton have low levels of second-car ownership, which could be a consequence of good public transport over a long period.

Nevertheless, the towns with high bus use also demonstrate the effectiveness of long-term policies to support bus services. These cover traffic management, bus priorities, and parking provision and cost. In Reading, for example, cars are excluded from much of the city centre, central parking is limited and relatively expensive, bus lanes are provided where space allows and, where there is no space for a priority lane, the traffic management system allows buses a head start into congested areas by the use of a separate traffic signal for buses.

A 2013 report on the Reading area Local Sustainable Transport Fund shows that for travel to work, in Reading public transport use increased between 2001 and 2011, car use decreased and walking increased (Table 5). The contrast with Wokingham, a smaller urban area with very high car ownership, is striking. The decline in the percentage of trips to work by bus by Reading residents between 2001 and 2011 was more than balanced by an increase in journeys by rail.

In May 2015, a count of journeys inside the Reading Inner Distribution Road (a ring road around the town centre) between 7 a.m. and 7 p.m. showed more than 48,000 people used public transport (20,000 rail and 29,000 bus), 30,000 used cars, 36,000 walked and 3,900 cycled. In 2003, equal numbers, about 37,000 people, came into Reading by car and by bus or train (Fort, 2015). In October 2016, another news item stated that *'Reading has seen bus usage soar by 22.8 per cent over the last five years, which is the largest increase recorded by any area of the country'* (Reading and Berkshire News, 2016).

Retailers may argue for plentiful parking at low cost in their town centre, but this encourages car use and discourages use of buses, and so increases traffic impacts, which in turn may damage the town centre economy.

Table 5: Mode share for journeys to work from census 2001 and 2011

	Year	Work at home	Rail	Bus	Car driver	Car pass.	Bicycle	Foot	Other
Reading	2001	7.4	6.4	12.2	47.8	5.0	4.1	15.4	1.7
	2011	9.1	9.3	10.7	44.6	4.3	4.1	16.3	1.5
Wokingham	2001	10.7	5.3	4.4	65.2	4.3	2.6	6.0	1.6
	2011	13.7	6.8	3.3	63.6	3.4	2.4	5.4	1.3
Southeast	2001	9.9	5.6	4.4	59.2	5.7	3.1	9.9	2.3
	2011	12.2	7.0	4.3	57.2	4.6	2.9	9.8	2.0

Reading Area LSTF Partnership Annual Outcomes Report 2013, (Reading BC & Peter Brett, 2013)

[7]Note that 'main drivers' make 58% more trips per year than members of households without access to a car or van.

A.5.2 Delays to services by congestion

Congestion is one of the biggest threats to the provision of bus services that are attractive to passengers and efficient to operate. The best way to protect buses from congestion is to use bus priority measures, particularly bus lanes. The reasons these are not used more extensively is lack of road space and the increase in congestion for cars when a lane is taken for buses, often shared with taxis and pedal cycles. In the mid-1990s, David Begg and George Hazel of Edinburgh City Council argued the case for bus lanes by saying that as half of all passengers to the city centre travelled by bus, the other half by car, half the road space should be allocated to buses (Hazel, 2017). Bus priority measures are considered in detail in section B.

A.5.3 Street layouts that make it impossible to provide an economically efficient bus service that is attractive to passengers

To provide a service that is fast and therefore both attractive to passengers and efficient to operate, buses need roads that allow them to travel directly to their destination. Unfortunately, fashion amongst developers, the DOE Design Bulletin 32 (DOE DOT 1992) and its companion guideline Places, Streets and Movement (DETR, 1998) encouraged the use of narrow winding streets and culs-de-sac in residential developments. The advice changed in 2007 when Manual for Streets (DCLG, DfT 2007) replaced both documents, and some better layouts have appeared since then. Similarly, many out-of-town business parks use a layout consisting of a ring road off which business developments are located on culs-de-sac. These tortuous street layouts make it impossible to provide an attractive and efficient bus service, even if it is physically possible for a bus to pass along. Thus, even where developments are appropriately located for bus provision, this cannot be done because of the inadequate street layout. Street layouts that are suitable for bus operations are considered in detail in section B.

A.6 Integrating buses with other modes of travel

Providing the right development with the appropriate infrastructure is only half of the equation. There are other nonphysical factors that bear directly on travel behaviour and location choices, such as the relative costs of travel by car and public transport, parking availability, and regulations for streets or areas governing access by time of day or class of vehicle. Thus, the wider policy environment is critical in determining bus use and should be aimed at supporting the use of bus services.

The main aim of an integrated approach to transport and development is to reduce congestion by limiting the call on road space and other resources from private cars. To be successful, such actions need to be promoted as positive tools for creating successful and attractive towns and cities, whereby the economic and environmental gains for the whole community outweigh any perceived loss of individual convenience. There are many possible techniques available to influence travel and traffic patterns, some of which were enabled through the Transport Act 2000.

A.6.1 Infrastructure Delivery Plans

Paragraph 162 of the National Planning Policy Framework (DCLG, 2012) requires local planning authorities to work with other authorities and providers to assess the quality and capacity of infrastructure for transport, social care and many other services, and its ability to meet forecast demands. They should also take account of the need for strategic infrastructure including nationally significant infrastructure within their areas.

An infrastructure delivery plan (IDP) provides a key opportunity for local authorities to identify their infrastructure requirements to deliver the policies and proposals set out in their local plan, whether publicly or privately funded. It should be produced as part of the local plan and subject to consultation and the Examination in Public process. It identifies all the known infrastructure requirements including social, physical and green infrastructure for the duration of the plan.

The IDP sets out what is needed, where it is needed and when. Annual updates are then provided on the delivery of schemes. Each infrastructure type is accompanied by an infrastructure delivery schedule, which provides further detail on delivery, funding sources where known, and any funding gaps. Costs should be clear for early phases but are likely to be more broad brush for the later phases of the plan and should be refined as implementation progresses as part of the annual review. The IDP also helps the authority to prioritise and determine bids for section 106 monies and Community Infrastructure Levy (CIL) income.

To enable bus services and any transport infrastructure to receive section 106 and CIL funding, it is essential that detailed network plans for these services be included in the infrastructure delivery plan. Bus operators and developers need to liaise with the local authority planners to ensure that their proposals are included in the local plan and the related IDP and to be part of the consultation and engagement process on these plans, along with the wider community.

A.6.2 Traffic limitation techniques

Traffic limitation techniques that will tend to boost public transport use and active travel, and reduce the amount of road space required for private cars, include the following:

- Reallocating space from roads and parking to public (pedestrian) space;
- Reallocating road space (or time) to favour buses (or trams), including bus priority measures;
- Limiting the supply of car parking, both on-street and off-street;
- Selective application of high parking charges (note that charges are not always under local authority control);
- Time or period restrictions on parking, properly enforced;
- Limited access zones (such as pedestrian-only areas and bus-only streets);
- Congestion charging or other forms of road pricing;
- Subsidies to public transport use;
- 'Smarter choice policies' to encourage bus travel (see Department for Transport, 2005, '*Smarter choices - Changing the way we travel')*;
- Enhanced pedestrian crossing facilities;
- Traffic calming and low speed limits for general traffic;
- Provision of easy transfer between modes (bus stops close to railway stations, park and ride on the edge of towns) and timetables that allow connected journeys;
- Company, school, residential and community travel plans, and personal travel advice services, to encourage more sustainable travel.

Guidance on travel plans and transport assessments can be found here:

https://www.gov.uk/guidance/travel-plans-transport-assessments-and-statements.

Examples of active traffic limitation policies that have benefited bus services include:

- Nottingham - Workplace Parking Levy (WPL)
- London - Congestion Charge
- Exeter High Street - Bus-only town centre access
- Reading - much of the town centre limited to buses and taxis
- Cambridge – Park and Ride, making cross-city car journeys difficult, and restricting access by car to part of the city centre.

The Bus Services Act 2017 redefines partnership arrangements between authorities and bus operators. The participating local transport authority may provide 'measures' as well as 'facilities' (traditionally, bus priorities) in fulfilling its role. For example, an advanced quality partnership (replacing the previous statutory quality partnership) might include measures such as reducing parking provision or increasing parking charges.

Section B - The infrastructure for buses

This section deals with the design of streets, roads and bus infrastructure associated with urban growth areas and major development schemes. It is relevant also to the improvement of bus routes on existing streets.

B.1 Street layout and design for bus operation

The guiding principles for the design of streets for buses include the following:

- Bus stops sited to directly serve passenger objectives;
- Buses protected from delays due to other traffic;
- Bus stops equipped for passenger comfort and convenience, including seating, shelters and information for passengers;
- Bus stop infrastructure designed for minimum 'dwell time';
- Bus infrastructure capable of handling the type and frequency of services being provided;
- Compatibility with other 'movement and place' functions expected of the street in question (see *Manual for Streets 2,* CIHT, 2010).

This section describes how these principles can be translated into street design practice. Useful references are the Stagecoach guidelines Bus Services and *New Residential Developments* (Stagecoach, 2017) and *TfL's Accessible Bus Stop Design Guidance* (TfL, 2017).

B.2 Bus route design

The layout of developments in relation to bus routes and services, and the spacing of stops are dealt with in Section A. This section focuses on the design of the bus streets themselves, and how they relate to the developments they serve.

B.2.1 Street alignments

New developments are often planned to eliminate through-use by motor vehicles, but direct routes

Figure 17: Poor urban design: gratuitous curves on a bus route bring no benefits (a town in southern England). (Image by Google)

Figure 18: A coherent street suitable for bus operation, with planted median and frontage development (Broughton, Milton Keynes) (Photo: Tim Pharoah, 2017)

Figure 19: A coherent street suitable for bus operation, with planted median and frontage development. The design also includes bus lanes and bus-friendly traffic calming (Milton Keynes eastern expansion area). (Photo: Tim Pharoah, 2017)

for buses should be provided, with bus gates where necessary to prevent their use by cars and other motor vehicles.

Streets used by buses should be direct and without severe curves or frequent turns to minimise operating distances and times. Straight alignments can also help attract demand because they afford good visibility of buses approaching and make for a more comfortable and safer passenger riding experience. Measures other than curves should be used to moderate traffic speeds on bus routes, including the discouragement of through movement (see section B.3.1) and/or traffic calming measures (see section B.4). Figure 17 shows a street layout with many unnecessary curves that would be uncomfortable for a bus passenger, and Figure 18 shows one that is more suitable for bus services. *Bus Services and New Residential Developments* (Stagecoach, 2017) provides useful examples of the features of residential street layouts that make them suitable or unsuitable for bus operations.

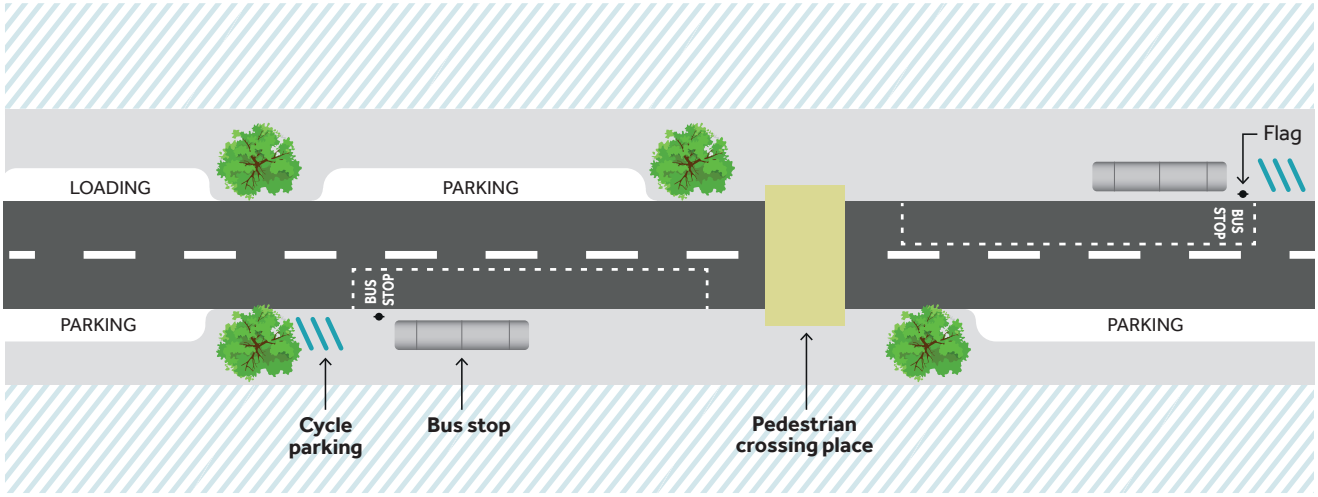
B.2.2 Street widths

Streets with bus services should provide for bus movement in both directions.

The carriageway width should be sufficient to ensure that buses are not obliged to wait to pass oncoming vehicles. To accommodate this, an unobstructed carriageway width of 6.5 metres will avoid buses having to slow to pass one another (or other large vehicles). Where a 20 mph (or lower) speed limit is applied, an unobstructed width of 6.2 metres is generally sufficient. To ensure the widths are consistently available, the carriageway must be kept clear of parked vehicles. Parking and loading activity should be provided for in parallel off-carriageway bays. These should have a width of 2.5 metres for car parking and 2.75 metres for loading, to allow for the opening of parked vehicle doors. *Bus Services and New Residential Developments* (Stagecoach, 2017) endorses the minimum carriageway width recommendations and advises that 'localised widening should be assumed on bends, in line with results of a realistic tracking exercise'.

Figure 20 shows the layout of a street suitable for bus operation, in which parking bays are intermittent, allowing space for a range of facilities including bus stops and shelters, tree planting, cycle parking and pedestrian crossings. Bus stops are located 'tail-to-tail' with a pedestrian crossing facility between them.

Figure 20: Example of bus street with bus stops (not to scale)



The maximum dimensions of buses are set by The Road Vehicles [Construction and Use] Regulations 1986, as amended (UK Government, 1986). The maximum length is 12 metres and the maximum body width 2.55 metres, though around 3 metres should be allowed when wing mirrors are included. Midi and minibuses are built to smaller dimensions for use where street widths are constrained.

Footways should have more generous dimensions on streets with buses or other heavy traffic to help mitigate the impact of noise and fumes but also to reduce intimidation when large or fast-moving vehicles pass close to pedestrians. The minimum footway width on bus routes recommended by CIHT is 2.5 metres. The addition of planted verges or swales can improve the pedestrian and driver experience. Parking bays can also act as a buffer between pedestrians and passing vehicles.

B.2.3 The walk to the bus stop

In new developments, the siting of bus stops and the walking routes to them form part of the same design exercise. Collaboration is required between the bus operator and those responsible for bus infrastructure and streets. Bus stops, and the walking routes to them, should be shown on the plan of the road layout for a new development when it is submitted for planning permission.

Walking routes on local streets and paths should be configured to minimise walking distances to bus stops (see Figures 21, 22 and 23). Routes to bus stops should be legible and, if necessary, made clear with signing. For example, a 'no through road' sign at the start of a cul-de-sac should make it clear if there is a through way for pedestrians and cyclists. The presence of bus stops can also be indicated.

The acceptability of the walk to the stop is not simply a matter of distance but also of the environment along the way and the opportunities for rest and for social interaction with others. Walking along a tree-lined street with strong visual interest and other people around, for example, is a completely different experience from walking the same distance along a street with blank frontage, or with frequent interruptions from side turns or vehicles parked on the footway. As with stops themselves, the walking routes to and from bus stops should be designed for use by people of all abilities. The CIHT guidelines Planning for Walking (CIHT, 2015a) and Designing for Walking (CIHT, 2015b) provide more information on how to make walking routes attractive.

Amongst the quality considerations are:

- Directness;
- Legibility, if necessary with pedestrian-specific signing to the nearest bus stop;
- The width of the footways or footpaths;
- Surface quality, including crossfall;
- Safe road crossings;
- Little exposure to vehicle traffic (volume, speed, composition, noise and air pollution);
- Seating (resting places);
- Safety and security, including oversight and good lighting;

- Step-free access throughout (including dropped kerbs or raised carriageways at junctions and pedestrian crossing places);
- Absence of obstructions (parked cars, bins, advertising 'A' boards, bollards, etc.);
- Light and shade, microclimate, shelter from wind and rain;
- Visual interest from buildings and landscaping (e.g., trees, grassed areas); and
- People-generating activities along the route (shops, schools, parks, etc.).

Bus Services and New Residential Developments (Stagecoach, 2017) *advises,*

- *'Attractive walking routes can usually be provided to the bus stops from all points within the development.*
- *In addition, it may well be appropriate and possible to create similar links from adjoining existing or proposed development. These pedestrian links should be logical and reasonably direct.*
- *All reasonable and deliverable opportunities to effectively combine potential demands from adjoining pre-existing development should be identified and secured. With this in mind, the careful consideration of pedestrian permeability across the site boundary during master planning can make a very substantial difference in the quality of bus service that can be provided'.*

Figure 21: Recently built street and bus route with pleasant walking environment (Poundbury, Dorset). (Photo: Tim Pharoah, 2017)

Figures 22 and 23: Streets giving access to bus stops but with poor walking environment. (Photos: Tim Pharoah, 2017)

B.3 Bus priority

Bus routes need to be protected from delays and unreliability caused by other traffic. In new developments, opportunities can be taken to provide operational advantages for bus services. Routes should be comprehensively designed, with different kinds of intervention appropriate to the circumstances at different locations. Delays anywhere on a bus route impact on the route as a whole, and so bus priority measures may be required beyond the development. *Quality Bus Corridors in Greater Manchester: Best Practice Guidelines* (GMPTE, 2008) describes the process of improving the GMPTE bus network through introducing Quality Bus Corridors, which by 2008 covered 172 miles of corridors.

The key principle is that buses should be able to operate without delays or hindrances caused by other traffic.

There are many possible techniques ranging from fixed infrastructure such as bus gates, through bus lanes and turning privileges, to traffic control systems that can prioritise buses through the network according to lateness and the number of passengers on board. It is important that bus operators discuss priority measures with local authority planning, highway and traffic officers. This needs to happen regarding the bus network generally but also whenever significant development schemes are planned.

The benefits derived from this approach, all of which increase the attractiveness of bus use, include:

- Faster journey times, benefiting passengers directly and reducing costs and hence fares;
- More constant scheduled journey times throughout the day and thus less need for timetable variation;
- Reliable headways on frequent-interval services;
- Punctuality on timed services.

A variety of priority and other measures can be used to achieve a quality bus route or corridor:

- Bus lanes, operating permanently unless loading and parking are required at times when traffic levels do not cause delays;
- Segregated busway, guided or unguided;
- Bus-only gates to achieve preferential routing;
- Bus-only streets, and streets with restricted access for other traffic;
- Bus priority at signals (see Figure 25);
- Median islands placed just ahead of bus stops help departing buses to re-join the traffic stream without delay and also help pedestrians to cross to reach the bus stop (Figure 24);
- 'No parking' and 'no loading' regulations on carriageways used by buses;
- Permanent no parking or loading in the vicinity of bus stops.

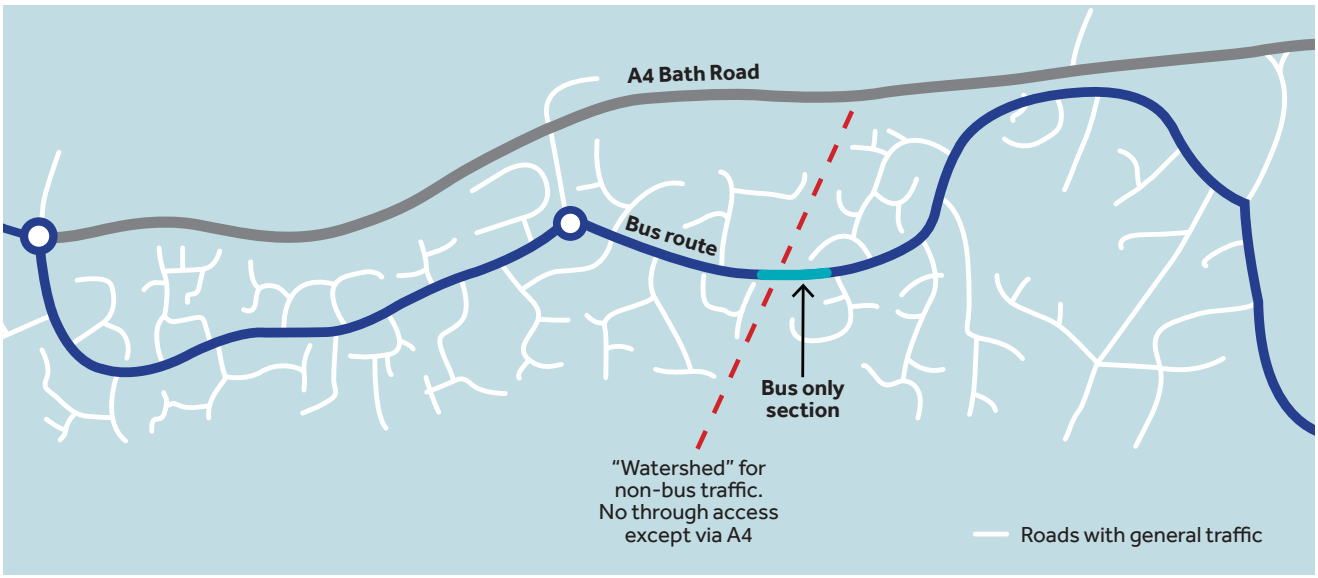
B.3.1 Preferential routing

'Preferential routing' of bus services enables the distance by bus to be shorter than the equivalent journey by car. This can increase bus journey speeds and thus the attraction of choosing the bus over the car. It can also reduce the amount of other traffic on the bus route, reducing delays. It can be achieved through the spatial arrangement of the development and street networks, the judicious location of bus-only sections of street or bus gates, and traffic management measures. Bus gates and bus-only streets must be designed to ensure compliance by other road users, for example, using enforcement cameras or rising bollards. Figure 26 shows a residential development in Reading with a central spine bus route, protected by bus gates to prevent through-car traffic.

Figure 24: Median islands placed just ahead of bus stops help departing buses rejoin the traffic stream without delay and also help pedestrians cross to reach the bus stop (King's Avenue, London). (Photo: Tim Pharoah, 2016)

Figure 25: Bus lane with separate traffic signal provides priority for buses to re-enter the traffic stream, with light control (Walworth Road, London) (Photo: Tim Pharoah, 2017)

Figure 26: Preferential routing: a housing development in Reading that parallels the A4 Bath Road. A central spine bus route with a 10-minute daytime frequency has a bus gate that prevents through use of the route by other traffic. Almost all the development lies within 300 metres of a bus stop



Other examples include the following:

- Manchester Portland Street (general motor traffic is excluded from a small section of the street, which prevents the whole street being used as a through route);
- Crawley (Fastway) bus-only link between Coachman's Drive and A23 reduces traffic using the area for through movement and is enforced with rising bollards (Figure 27);
- Kesgrave (Ipswich) guided busway and cycle link, giving direct access to the district centre; and
- Streatham Hill, London, right-turn-ban exemption for buses avoids the need to negotiate a traffic gyratory (Figure 28).

Figure 27: Bus gate enforced with rising bollards, providing preferential routing for buses (Crawley, West Sussex). (Photo: Tim Pharoah, 2017)

Figure 28: Preferential routing achieved by right-turn-ban exemption for buses (Streatham Hill, London). (Photo: Tim Pharoah, 2017)

B.4 Traffic calming on bus routes

The enforcement of speed limits, especially 20 mph or lower, may be more difficult on streets with the recommended width for efficient bus operation. Consideration must therefore be given to methods of traffic calming to encourage compliance. General advice on traffic calming is provided by the CIHT guidelines *Traffic Calming Techniques* (CIHT, 2005), which includes a section specifically on bus operators and traffic calming.

Bus Services and Residential Developments (Stagecoach, 2017) states, *'Stagecoach recognises that in certain circumstances active traffic calming measures may be needed. This is more likely to be the case where straighter streets define development blocks within higher-density schemes of more urban character. Where specific urban design conditions and opportunities warrant or permit, streets designed for bus operation could include:*

- *Speed cushions - These can be much more desirable than tables or ramps. However, a careful approach needs to be taken to their positioning and specification (see Figures 29 and 30).*
- *We support DfT guidance, advising a maximum cushion width of 1600 mm.*
- *To allow the bus to effectively straddle each feature without sudden steering movements, there should be a minimum 600mm offset between the kerb and the nearside edge of the cushion.*
- *On-street parking needs to be prohibited, for at least 25 metres either side of each.*
- *Full-width speed tables – These can cause issues if they are too frequently included. Where their use is considered essential, these should be designed to present a ramp height of no more than 75 mm, and a transition gradient no steeper than 1:15.*
- *Detailing of speed tables, especially when applied at junctions, should clearly delineate the vehicular carriageway, typically featuring kerb lines with a face of at least 25 mm, or contrasting gutter channels.*
- *Tracking of buses should ensure that there is no need for any portion of the vehicle to oversail the footway.*
- *Throttles/narrowings pose no problems if used sparingly.*
- *The most appropriate sites are likely to be found where major pedestrian and cycle routes intersect the street.*
- *Symmetrical narrowing is preferred over chicanes or offsets.*
- *We consider 3.8 metres is the minimum appropriate width for single-track sections, which should be no longer than 6 metres in length.*
- *Clear inter-visibility must be provided for on both approaches to such features, with suitable clear road length and width on both approaches to allow a bus to wait to allow an oncoming vehicle to pass.*

Bus gates, or offset contra-flow bus lanes, could offer a much better means of achieving traffic calming, and reducing inappropriate through traffic, while not disadvantaging buses'.

Sharp vertical or horizontal changes in the carriageway alignment are not favourable for bus operation because they cause passenger discomfort and possible hazard, especially if close to bus stops where passengers are more likely to be standing. They should be used sparingly on bus routes.

Raised carriageways (e.g., at pedestrian crossings and junctions) on bus routes should be gently graded and with a minimum length of 6 metres for the level section or no shorter than the wheelbase of the buses using the routes. Where articulated buses are used, longer raised sections (e.g., 12.5 metres) have been found to be more comfortable for bus passengers. The change of level should be no more than 75 millimetres, achieved with a gradient no steeper than 1 in 20, to reduce passenger discomfort (TfL, 2005; GMPTE, 2009), though Stagecoach state that a gradient of 1 in 15 is acceptable.

Figure 29: Speed cushion placement to benefit pedestrians crossing (not to scale)

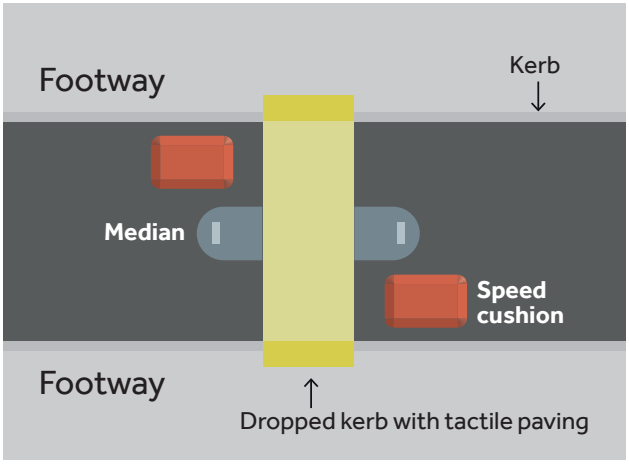


Figure 30: Correct speed cushion placement (Dover House Road, London) (Photo: Tim Pharoah, 2017)

The presence of buses themselves can limit traffic speeds, for example, if the street is arranged such that buses cannot be overtaken whilst at stops and that they can continue without loss of position in the traffic stream. This can be achieved by dividing the carriageway, especially at or near bus stops. Bus boarders can also reduce overtaking in busy traffic conditions.

Speed cushions allow buses and large emergency vehicles to straddle the cushion to avoid the severe part of the ramp although their effectiveness depends on the placement of the cushions. The presence of parked vehicles can make it difficult for the driver to position the bus relative to the cushion. Speed cushions are most effective when placed within or close to width constraints, and parked vehicles are kept 'off line' in parking bays. Recommended dimensions for speed cushions are given in Traffic Advisory Leaflet 1-98 (DfT, 1998) as follows:

- Maximum width for bus routes 1,700 millimetres (including side ramps);
- Side ramp gradients not steeper than 1:4;
- Off/on ramps not steeper than 1:8 (curved on/off ramps should have an average gradient not steeper than 1:5);
- Maximum height of 75 millimetres;
- Maximum length 3,700 millimetres.

B.5 Provision for cyclists on bus routes

Without careful planning, buses and cyclists may not mix well. Just as it is recommended that parking and loading is accommodated outside the defined carriageway to ensure unhindered bus operation, cyclists also should be provided with a separate path or lane outside this area. On existing streets, this may not be possible due to insufficient overall width, but there may be other options to mitigate safety issues, such as the application of a 20 mph speed limit or provision for cycles on alternative parallel streets.

Cyclists are permitted in bus lanes by default (there is no approved traffic sign to exclude them). However, large numbers of cyclists can negate the benefit of bus lanes for buses. If cycle traffic is expected to be significant, separate provision should be made where possible (see also section B.7.4). If cycle traffic is included, with-flow bus lanes should be at least 5 metres wide (see for example TfL (2016) and Aldred et al. (2017)) . If cycles have separate provision or if the number of cycles is expected to be insignificant, bus lanes should be at least 3.5 metres wide, enabling buses to avoid the drainage gullies adjacent to the kerb. In constrained situations, bus lanes should have an absolute minimum width of 3 metres.

The *London Cycling Design Standards* (TfL, 2016) set out requirements and advice for cycle network planning and for the design of dedicated cycle infrastructure, cycle-friendly streets and cycle parking (Chapter 4, pages 43–44, covers cycles in bus lanes). To accommodate cycles alongside buses in reasonable safety, TfL recommends that a minimum width of 5 metres allow a 2-metre cycle lane to be marked between the kerb and the bus lane. Decisions on lane widths and segregation arrangements should, however, take full account of the existing and desired cycle flows and the recent and continuing trend of increased cycle use in many locations.

B.6 Siting of bus stops

This section should be read in conjunction with sections A.4.3–A.4.4, which deal with the layout of development in relation to bus routes.

The primary factor determining the siting of bus stops should be proximity to passenger destinations, together with the need to minimise dwell times, avoid delays due to other traffic, and ensure safety. From the passenger viewpoint, bus stops are generally best located at significant nodes of pedestrian movement, such as near major intersections, within urban squares, or where green space corridors intersect the bus route although stops may also be needed to serve significant objectives midblock. Bus stops serving the two directions should be visible from each other to help visitors locate the stop for the return journey.

A bus stop should be located on the departure (downstream) side of a junction to avoid blocking sight lines. The Northern Ireland Roads Service recommends a minimum distance from the junction to the back of the bus at the stop of 15 metres (Translink, 2005), and additional distance will be required at stops with multiple services in the same direction. Away from junctions, where there are bus stops on opposite sides of a road, the stops should be positioned 'tail-to-tail' with a clear distance of at least 36 metres between the backs of the buses at the stops, ideally with a pedestrian crossing between the stops (Figure 20). Where it is intended that buses should maintain their position in the traffic stream, an alternative is to place the bus stops opposite one another, with or without a median between them (see Figures 31 - 34).

Transport for London has provided a summary of considerations for the location of bus stops (TfL, 2017, Figure 6):

- *'Driver and waiting passengers are clearly visible to each other;*
- *Located close to key local facilities;*
- *Located close to main junctions without affecting road safety or junction operation;*
- *Located to minimise walking distance between interchange stops;*
- *Where there is space for a bus shelter;*
- *'Tail to tail' on opposite sides of the road;*
- *Close to (and on exit side of) pedestrian crossings;*
- *Away from sites likely to be obstructed;*
- *Adequate footway width'.*

Figure 31: Bus stop location in relation to junction and main passenger objectives (diagrammatic)

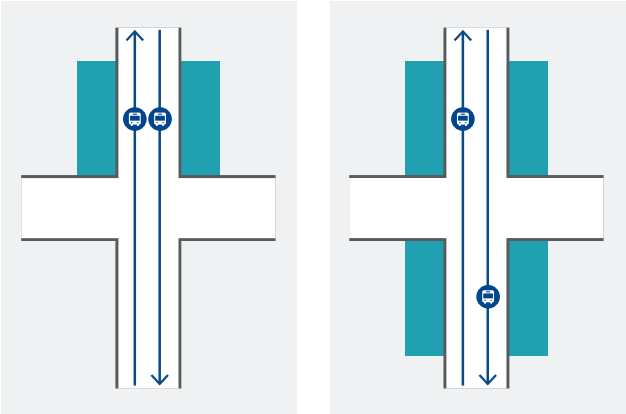


Figure 32: Pair of bus stops serving higher-density development, well overlooked, and with good intervisibility (Walworth, London). The stop on the far side is integrated with a 'pocket park'. (Photo: Tim Pharoah, 2017)

An exception to the guidance to locate a bus stop on the departure side of a junction is if the major activity centre at the junction is on one side of the junction only (Figure B.4). In that case, the bus that would normally be stopping on the side of the junction away from the activity centre could be stopped on the approach to the junction to serve the activity centre more directly.

B.7 Bus stop planning and design

Consideration should be given to three aspects:

- The walk to the bus stop (covered in section B.2.3);
- The vicinity of the bus stop; and
- The design of the bus stop itself.

B.7.1 The vicinity of the bus stop

Bus stops can become a focal point within a local community, ranging from a little extra space with seating, to a location with neighbourhood shops and community facilities. The townscape can acknowledge and highlight the presence of bus stops, for example, by widening the footway and providing distinctive planting and lighting though care is needed to avoid planting that could obstruct visibility.

'Bus stops provided within developments should be lit and appropriately overlooked and suitably prominent within the street scene without being intrusive' (Stagecoach, 2017).

Figure 33: A pair of bus stops located at a focal point in the neighbourhood (Mattsee, Austria). (Photo: Tim Pharoah, 2017)

Figure 34: A pair of bus stops within the Ingress Park development, on the North Kent Fastrack, showing their prominent position in the street scene. Note that residents' privacy is not compromised because living rooms are located away from the bus stop vicinity. (Photo: Tim Pharoah, 2017)

The presence of people at bus stops will not in general be welcomed outside individual residential properties. Bus stops overlooking ground-floor windows of residential properties in particular should be avoided (see Figure 34) (see also *Manual for Streets*, section 6.5; DfT, DCLG, 2007). Stagecoach (2017) advises that on active frontages, *'amenity conflicts can be greatly reduced by positioning stops where:*

- *Longer garden walls flank the footway;*
- *Garage blocks/flats over garages back onto the footway;*
- *The building line of plots adjoining the stop can be significantly "stepped back" from the back edge of the footway;*
- *There is a small area of open space. It is undesirable for stops to be sited immediately next to equipped play areas;*
- *Shared private drives can offer an additional buffer between the street and dwelling frontages.*

Agreement of optimal bus stop locations, before reserved matters applications are prepared, is essential if such conflicts are to be "designed out" as far as possible.

B.7.2 Design of the bus stop itself

There is plenty of advice on the design of bus stops (TfL, 2017; GMPTE, 2007; Stagecoach, 2017). Bus stops should be designed to be suitable for low-floor buses and to be convenient for wheelchair users and passengers encumbered by small children, shopping trolleys, prams, buggies and luggage. TfL recommends that *'the bus should stop parallel to, and as close to, the kerb as possible to allow effective use of the bus's facilities. The critical dimensions to consider are the step height from the kerb to the bus floor and the horizontal gap from the kerb edge to the side of the bus. A well designed bus stop will provide features which co-ordinate with the facilities of the low-floor bus and minimise these two distances'.*

Where multiple routes are served, the bus stop must have sufficient length to accommodate the likely number of buses stopping at the same time. TfL (2017) recommends *'[a] 37m kerbside bus stop cage is normally sufficient for a frequency of 15 buses per hour (bph) but inadequate for 45 bph, where space should be provided for more than one bus to access and serve the stop at the same time. Conversely, at bus stops where the number of buses serving the stop is much lower, a shorter cage of 25 metres should be sufficient, subject to swept path analysis demonstrating that a bus can achieve a position flush with the kerb'.*

TfL (2017) advises, *'The layout of the passenger waiting area should be based around the position of the bus stop flag. The flag indicates to passengers where they should wait and serves as a marker to drivers to indicate where the bus should stop'.*

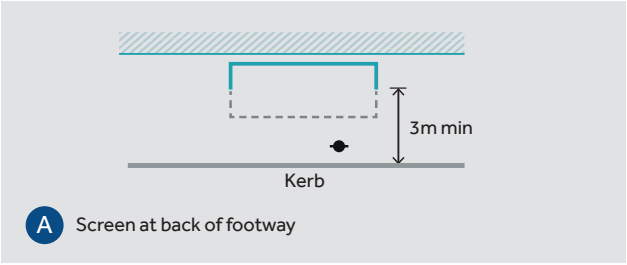
Developments should be planned such that all bus stops are equipped with a shelter and seating. This will affect the space provided at the stop. The stop should also have an electrical supply available so that lighting and a display of real-time information can be provided.

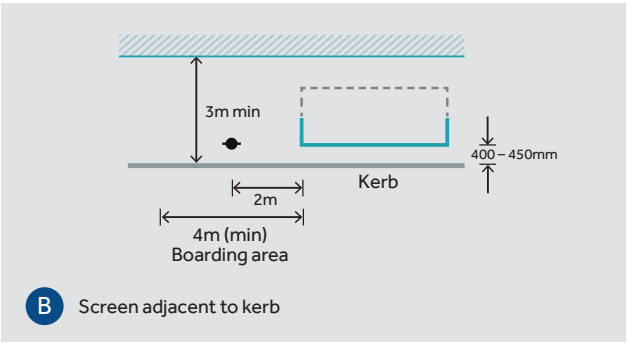
The passenger waiting area must provide sufficient unobstructed space for the wheelchair ramp at the bus entrance door to be deployed. On the footway where the stop is located, boarding/alighting areas should be kept clear of all obstructions such as litter bins, telephone boxes and sign posts.

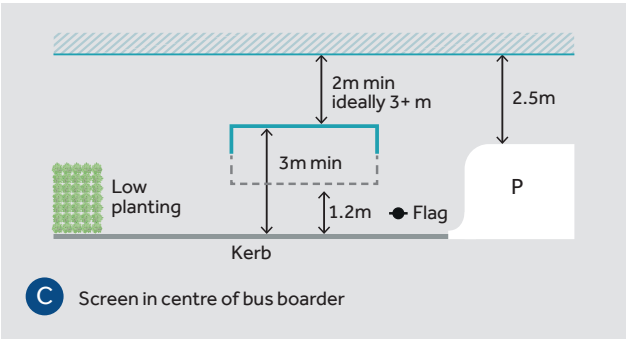
The minimum width needed at bus stops between the kerb and the back of footway is defined by the space required for a wheelchair or pushchair to manoeuvre into and out of the bus. The DfT's *Inclusive Mobility Guidelines* (2005) state that a skilled manual wheelchair user should be able to complete a 360-degree turn in a space of 1,500 mm × 1,500 mm, so this is the minimum space that must be provided in addition to the width needed for deployment of the ramp itself, usually between 1,200 and 1,500 millimetres. It may be difficult in existing situations where there are physical constraints to deliver this basic level of physical accessibility. In new developments, a minimum of 3 metres will allow for through pedestrians and people waiting. Greater widths should be considered in busier areas to segregate passengers waiting at stops from the pedestrian flow.

The length of the passenger waiting and boarding/alighting area will be influenced by the number of doors on the buses being assigned to the particular service, with longer platforms needed for two- and three-door buses.

Figure 35: Layout options for accessible bus stop and shelter with recommended and minimum dimensions







Notes for Figure 35:

- Dimensions are recommended unless specified as minimum;
- Facing the oncoming bus, the shelter should have a half screen or no screen to aid intervisibility between the bus driver and waiting passengers;
- The screen (and seating) at back of footway generally provides the best intervisibility (see Figure 36);
- The screen adjacent to the kerb provides less good intervisibility but can provide some protection from spray and noise;
- The centrally placed shelter provides separation of pedestrian flows from waiting passengers but requires greater width as afforded by a bus boarder (at least 5 metres in the example shown in Figure 35);
- Positioning of the flag will influence queuing patterns;
- Further guidance can be found in GMPTE (2007) and TfL (2017).

Figure 36: Example of screen at back of footway; prominent and distinctive bus stops for Luton busway services.
(Photo: Tim Pharoah, 2013)

Figure 37: 'Concept shelter' with screen in centre of footway arranged to provide shelter on either side. Note also the green roof.
(Photo courtesy of Transport for Greater Manchester)

Low-floor buses can stop parallel with and close to the kerb more easily if the footway is built out into the road as a 'boarder' or 'build-out'. The build-out can be the full width of a parking bay (Figure B.1). Stagecoach (2017) states, *'Stagecoach welcomes, and strongly recommends, incorporation of on-street parking in off-carriageway bays. This does require the kerbline to be built out between parking bays, at bus stops.*

- *A minimum 4m boarder length is required, inclusive of transition kerbs, while 6m is strongly recommended[9];*
- *Build-outs should extend the full width of parking bays. . . .;*
- *Build-outs should generally not project beyond the gully line into the carriageway[10];*
- *Shelters . . . should generally be located within the build-out to allow buses and waiting passengers to be inter-visible. This will also reduce conflict with building frontages'.*

The use of Kassel (or similar-type) kerbs with a height of about 160 millimetres benefits all users and reduces the time taken to board and alight, especially by people with mobility impairments. The profile of Kassel kerbs is designed to enable the driver to position adjacent to the kerb and to facilitate level boarding, which helps people with mobility problems and also reduces the risk of accidents (White, 2016). To be effective, the driver must be able to approach the stop at a shallow angle, which means that the approach to the stop must be kept clear of parked vehicles. However, if a bus does not stop close to a Kassel kerb, the resulting step down and step up can be more onerous for users than with a conventional kerb. Because of this, Kassel kerbs should not be used unless buses can be guaranteed unobstructed docking.

TfL (2017) recommends that a number of other issues should be considered including (in summary) the following:

- *Street lighting:* Inadequate street lighting can contribute to personal security issues. Good lighting should be provided at bus stops;
- *Litter:* A clean passenger waiting area improves the passengers' environment. Litterbins should be provided but located to reduce nuisance, such as smells and flies, potential for antisocial behaviour and avoid obstruction to pedestrian and passenger movement. They should also be emptied regularly by the local authority;
- *Statutory undertakers' equipment:* Positioning of bus stop flags and passenger shelters can be affected by underground utilities. Service covers can also create long-term problems at the bus stop owing to access requirements to the equipment. Consideration should be given to the boarding/alighting zone to avoid access difficulties during maintenance works;

[9]Author's note: The dimensions are suitable for stops where a single bus with single entrance door has to be accommodated. Longer boarders will be necessary on busier routes or where buses have two or more entrance doors.
[10]Author's note: This assumes that the gully line is at the edge of the carriageway rather than at the back of the parking bay.

- *Drainage:* Poor drainage, resulting in water 'ponding' on the footway around the passenger waiting area or at the carriageway kerbside, can affect the passenger environment. Ponding may also result from defective carriageway repairs, rutting or blocked drains. In freezing conditions, footway ponding can be particularly dangerous. Ponding at the kerbside can result in passengers being splashed by passing traffic (or the bus), and it is therefore important that good drainage be provided;
- *Green Infrastructure:* Green infrastructure – including street trees, woodlands and individual elements such as green walls – delivers significant environmental, economic and social benefits including improved air quality, mitigation of the urban heat island effect, floodwater management and reduced traffic speeds.

Desirable attributes of bus stops are summarised below:

- High-visibility bus stop flag and pole, suitably illuminated, displaying route numbers of all services;
- Shelters and seating at all stops, with adequate dimensions for the expected level of demand;
- Comprehensive and consistent information display, including real-time information or details of how to access real-time information on mobile devices;
- Each stop individually identified by name;
- Cycle parking for 'cycle and ride' passengers where appropriate;
- Higher-quality footway and carriageway paving materials;
- Sufficient footway width to accommodate waiting passengers and passing pedestrians;
- Good drainage to avoid splashing;
- Attractive and recognisable design.

B.7.3 Avoidance of parking at bus stops and on bus routes

At all stops, parking and loading should not be allowed in the vicinity (see Figure 38) except in 'off-line' bays (as shown in Figures 20 and 39) so that buses can approach the stop at a shallow angle to 'dock' adjacent and parallel to the kerb or the boarder, enabling level boarding for passengers with a minimum gap. Buses also should be able to leave stops without having to pull out around parked vehicles ahead. Parking enforcement is required. Bus stop 'cages' or 'clearways' do not require a Traffic Regulation Order and can be enforced through civil parking regulations using enforcement officers (UK Government, 2002). Bus stop boarders or build-outs act as self-enforcing controls on parking at stops.

Figure 38: Parking in advance of the stop limits ability to bring bus adjacent to the kerb. A bus boarder would resolve the problem. (Photo: Tim Pharoah, 2017)

Bus lay-bys are not appropriate on urban bus routes because they:

- cause delays to buses on reentering the traffic stream;
- are incompatible with the now-mandatory low-floor bus designs, which require an approach to the stop at a shallow angle;
- can be a danger to pedestrians at bus stops because of the rear-end sweep upon leaving the lay-by;
- reduce the footway width at the very place where greater width is needed.

Lay-bys should only be used where there is a bus lane or busway, enabling buses to overtake one another, or for bus layover.

With regard to parking on bus routes, Stagecoach (2017) states, *'It is clear that accommodating parking on bus routes demands an especially careful and well-informed design approach at all stages. We broadly welcome and endorse the detailed and considered guidance set out in the English Partnerships/HCA Guide: "Car Parking: what works where"* (English Partnerships, 2006) *. . . However this is general guidance and makes no specific reference to how such strategies might affect bus operation, positively or negatively.*

'On primary streets intended to be used by buses, the use of on-street parking to help control traffic speeds needs to be formally "designed in", and intentionally limited to particular marked bays. The use of defined on-street parking bays can achieve the intended purpose of speed reduction, while strictly controlling any wider proliferation of informal on-street parking'.

Figure 39: Bus boarder with shelter placed to keep footway clear. Adjacent taxi bay does not hinder bus access to the stop (Brecon, Wales).
(Photo: Tim Pharoah, 2009)

In tackling the issue of random parking that can interfere with bus operation, Stagecoach (2017) further identifies that good practice for accommodating parking along proposed bus routes:

- *'Provides sufficient parking to accommodate likely residents' demands off the carriageway;*
- *Limits the number of private vehicular accesses onto the street;*
- *Ensures that residents parking is immediately accessible to the plot, is well within the surveillance of adjoining properties, and is easily accessed from the street;*
- *Allows more than one car to be parked and used independently where two spaces are provided on a drive;*
- *Does not rely on garages being used as parking space for cars;*
- *Intentionally avoids lengths of "free" kerb-line directly backed by footway;*
- *Treats parking as an integral part of the street scene;*
- *"Designs out" opportunities for inappropriate parking;*
- *Ensures that under normal circumstances, vehicles enter the mainline carriageway in forward gear;*
- *Provides parking spaces between the building frontage and the carriageway edge by whatever means is most appropriate'.*

B.7.4 Cycle provisions at bus stops

New developments can bring significant opportunities for enabling increased cycling as well as bus use. Providing for both cycles and buses requires careful design, however.

Overtaking buses at stops is a hazard for people cycling that should be avoided if possible. It also causes delay to bus services in urban areas since the average speed of buses (including stops) is similar to that of many cyclists.

Solutions have therefore been developed to separate cycles and buses at stops. These are based on provision of a cycle bypass of the bus stop itself, otherwise known as a 'floating bus stop', as the passenger waiting and boarding area is separated from the footway (TfL, 2016; London Cycle Design Standards, Chapter 4). Guidance on the detailed design of bus stop bypasses can be found in LCDS para 4.2.8 and are therefore only summarised here.

The best arrangement for both cycle and bus users is where the cycle track is continuously segregated from the main carriageway, allowing a floating bus stop in between (see Figure 40). This is common practice in the Netherlands, where wider streets allow easier separation of the different flows. Such stops have been provided along Cycle Super Highway 6 (CS6) in London, where a two-way cycle track runs between the bus stop and the footway. These have been in operation since 2015 with no reported incidents by 2017.

The term 'bus stop bypass' generally refers to a layout in which the cycle path or track is a diversion from a nearside cycle lane (see Figures 41 and 42). This lane can be stand-alone or provided as part of a combined bus and cycle lane. Cities where bus stop bypasses have been introduced include Brighton, Cambridge, Leeds, London, Manchester, and Nottingham.

On a carriageway with no cycle lane, a bus stop by-pass is less effective since people cycling only have a reason to use it when a bus is present. This is precisely the moment when cyclists will find themselves in conflict with passengers approaching or leaving the bus. In these locations, bus drivers following a person cycling will be unsure whether the cyclist will use the bypass, an extra task when they are concentrating on stopping safely.

The design should unambiguously convey the message that the bus stop is part of the pedestrian realm and that there is a balance between people walking and cycling at these locations. In some locations, cycling will take priority with passengers expected to wait to cross safely. However, where there is heavy pedestrian use (i.e., at busier stops) or there is a high proportion of vulnerable passengers (e.g., near a hospital), there is now provision in TSRGD (2016) for a 'mini-zebra'

crossing to be provided to ensure access to the bus stop from the footway. There is also the option of a raised crossing to help to slow cyclists using the bus stop bypass though drainage issues may need to be resolved.

The location and design of shelters need to be considered carefully to ensure good intervisibility between people walking and cycling. They should be located 'downstream' of the floating bus stop to encourage people leaving the bus to look in the direction of oncoming cyclists. Where possible, the shelter should be fully transparent with no advertising panels.

It is critical when designing bus stop bypasses that the needs of people with disabilities are addressed. Hence, any proposal for a bus stop bypass should be discussed at the earliest possible stage with potential users, particularly groups representing those with a visual, mobility or cognitive impairment who may be put at a disadvantage by having to cross a cycle track to access a bus stop. Various design issues have been addressed by research conducted by TRL for Transport for London (TRL, undated).

B.7.5 Cycle parking at bus stops

Safe and secure cycle parking at bus stops can enlarge the effective catchment area of the public transport network and is already common at railway stations. Manual for Streets para 6.5.12 (DfT DCLG, 2007) says, *'Consideration should be given to providing cycle parking at bus stops with significant catchment areas. Cycle parking should be designed and located so as not to create a hazard, or impede access for disabled people'.*

Figure 42: Segregated cycle track at floating bus stop (Lewes Road, Brighton). (Photo: Tim Pharoah, 2017)

Figure 43: Cycle parking to the rear of the shelter at a stop on the Cambridgeshire guided busway, already well used only six months after opening (Photo: Tim Pharoah, 2012)

Figure 40: Segregated cycle track at bus stop (preferred arrangement) (not to scale)

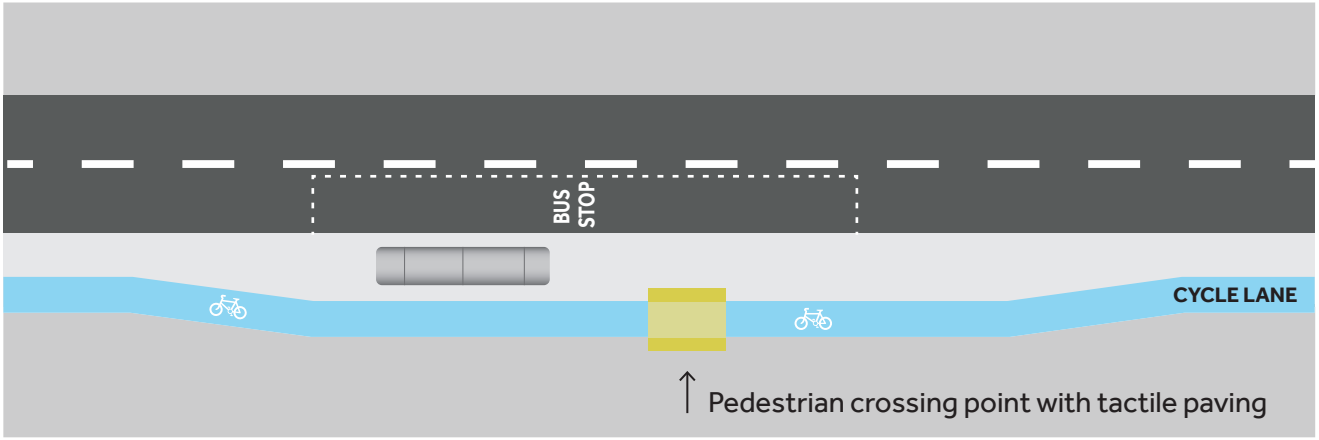
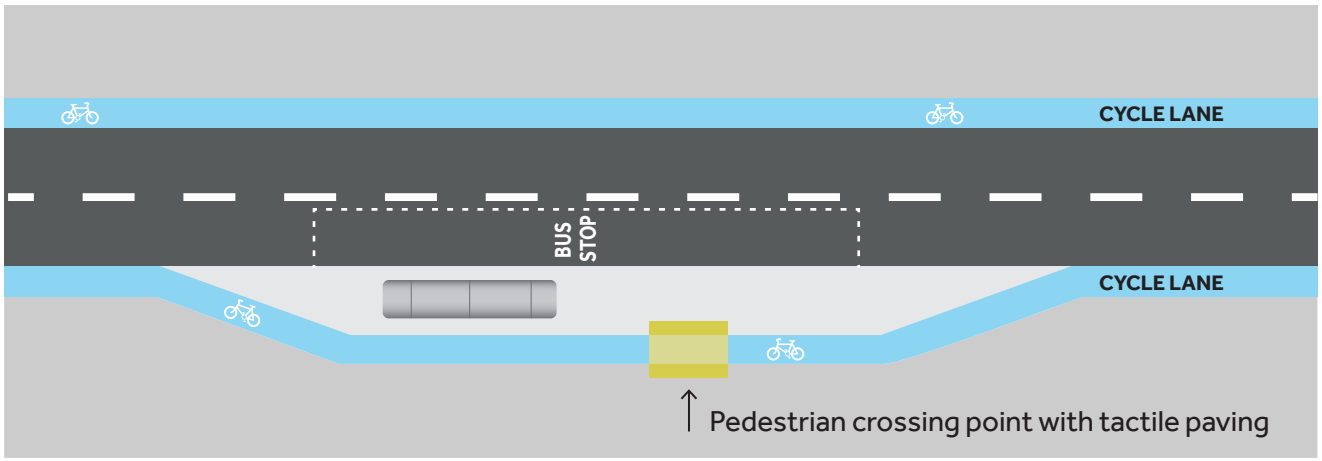


Figure 41: Cycle lane with bus stop bypass (not to scale)



Section C - Bus services and information

C.1 Bus services

This section should assist highway, transport and spatial planners, and developers, in discussions with bus operators.

The preceding sections have dealt mostly with the physical environment and permanent infrastructure within which buses operate. This section focuses on the services themselves.

A useful guiding principle is that, in larger towns and cities, **the public transport system should be sufficiently good to enable everyone with normal travel requirements to live without the need to own a car.**

In terms of bus provision, this will involve the following:

1. Land uses that generate or attract significant personal travel having high-quality bus services within easy reach (covered in section A);

2. Bus services enabling everyone regardless of income or disability to reach a wide choice of destinations within a reasonable time and distance[11].

Achieving the appropriate standards to serve new developments requires collaboration between local authorities and public transport providers (see section D). A summary of user requirements is given in Bus Users Good Practice Guide (Bus Users, undated).

C.1.1 Levels of service

To attract a high mode share of trips, and to meet the sustainability objectives set out in planning policy, the aim should be to provide a service pattern with:

- 7-days-a-week service;
- Early mornings and late evenings covered;
- All buses running between the same terminals;
- 24-hour and night city services following same routes as daytime core routes (can be extended but not shortened);
- Guaranteed last bus[12]

People also prefer timetabling and frequencies that offer:

- Regular intervals, timetables easily memorised;
- Clockface timings consistent every hour;
- Timetables varied between, but not within, the main operating periods of daytime, late evening, Saturdays, Sundays;
- Frequency minimum every 20 minutes in urban areas, with 10 minutes the target, and 5–6 minutes the target for core routes and corridors.

So far in the UK, this level of service is available only in a very few urban areas. But where buses are successful, such as the conurbations and Reading or Brighton, rising use enables services to be improved. High-quality services can only be provided if they are well used. The pattern now well established in continental cities and in London is for core bus routes to provide a 'turn up and go' reliable frequency of 10–12 minutes or better (for which people do not need to know the timetable) and for other routes to operate a 'clockface' service pattern whereby the same timings apply every hour and so can easily be memorised.

A seven-day service may be seen as an onerous requirement, but without it, there is little chance of enabling people to live without a car. Moreover, travel demand has changed over the years, and there are now far more shops and other facilities open on Sundays.

[11]'Reasonable' is suggested as about 25 minutes for bus trips, which roughly equates to the average trip time (including walking time) (NTS 2016 tables 0303 and 0311).
[12]This could be operated with free (to user) taxi back-up, perhaps with developer funding. A bus operator/local authority partnership in West Yorkshire allows passengers to claim back the cost of a taxi if the last bus fails to arrive within 20 min of the scheduled time (Bus and Coach Week 28th March 2017).

C.1.2 Punctuality and reliability

For both passengers and potential passengers, buses arriving on time and operating reliably are the main priority. Journey time variability impacts particularly on the ability to provide 'clockface' timetables. It has less impact on high-frequency services for which specific departure times do not need to be advertised: the passenger is concerned only that a bus arrives soon, not whether a particular vehicle or driver is on schedule. It is therefore important for local authorities to provide appropriate infrastructure and bus priority measures that will protect bus services from journey time variability.

C.1.3 Buses for all trip purposes

To achieve a regular and frequent service, demand must come from the full range of journey types and purposes. Achieving mode switch from car to bus only for the journey to work, for example, is likely to exaggerate peak hour demand, leading to higher costs for the provision of extra capacity for short periods of the day. Furthermore, potentially it leaves a family car available at home for other trips during the day, thus reducing off-peak bus demand and further amplifying the difference between peak and off-peak demand.

It is therefore important for bus routes to serve a variety of land uses and activities, generating trips at different times, to achieve a spread of demand through the day and between days of the week. New developments and growth areas should be configured to meet this objective, with appropriate densities and mixed land uses.

It is also vital to ensure that the demand for bus services is not undermined by provision for car access. For example, if restrictions on car access are applied only at peak hours (e.g., bus lane operation, parking restrictions), this can lead to demand for bus use at peak hours but remove demand at off-peak times, exacerbating the imbalance in demand, reducing the viability of the bus service and thus its provision in the long term. More serious risks to viability arise where plentiful free parking is provided, whether in locations served by bus or in other locations that will compete with those locations.

A particular issue for major new developments is the provision of high-quality bus services before full occupation. It is essential to enable new occupants to develop travel patterns based on public transport and active travel from the start. If good services are not available, alternative habits will develop which are hard to break, most likely involving the use of cars. Depending on the size of the new development, financial support is likely to be required in the initial period until sufficient custom has built up, which can be funded from developer contributions. Funds contributed by developers may be used to support local bus services directly or to provide the infrastructure required for bus operation.

Example: New residents of 'The Bridge' housing development in Dartford, Kent, had free use of the Fastrack bus service for three years and real-time information screens in their homes. Developer contributions provided both infrastructure and support for a high frequency of service from the start, thus enabling new residents to become familiar with the use of bus services (see case study in section A.4.4).

C.2 Service information

Bus services cannot be used without knowledge of the routes available, the timetable, and the system for acquiring tickets or other authority to travel. The more people know about bus services in their area, the more likely it is that buses will achieve a high mode share. This means that 'information' is not only about the provision of timetables and maps at stops but also about details of fares and how they are paid and ways to obtain real-time information about the operation of the services.

The information needed by intending travellers has been set out in the DfT booklet Better Information for Bus Passengers (DoT, 1996). This distinguishes between system information (which sets out all the public transport options in the area and relates bus routes to geographical areas and the locations of major activity centres and interchanges such as railway stations, together with details of fares and how they are paid) and route information (which details the services from individual stops). Both types of information should be displayed at stops, together with sources of online information and help.

Online information is increasingly available via third-party websites and mobile apps, including direct feeds to online screens in premises such as factories and schools, giving live bus arrival information at local stops (see for example the TfL website Digital Signs [13]). Technology in this area is rapidly developing, and passengers, and the population at large, increasingly can be distinguished not just by their use of different modes but also by the information they have at their disposal.

[13] https://tfl.gov.uk/info-for/business-and-commercial/travel-for-business/digital-signs

Printed timetable and route information is still important, however, especially at bus stops, because it helps everyone, not just users of mobile apps (ATCO, 2015). Responsibility for the provision of roadside information on bus services is currently divided between local authorities and operators. The principles are set out in the Transport Act 2000 (section 140), including for local authorities to provide bus service information they consider necessary (UK Government, 2000). Bus stop information also falls within the scope of the Equalities Act 2010, which has implications for the size of font used and the positioning and clarity of displays.

Summary of information requirements:

- Printed displays at all stops, including the local network map/diagram and route diagram (Figure 44), and operator contact details including social media. This should also display how to obtain real-time information on mobile devices and telephones (Figure 45);
- A single network map, showing routes of all operators, both printed and online, and on mobile apps;
- Information at stops designed and positioned to be legible, easy to understand, and read by passengers with less than perfect vision, and with low eye-height;
- Information (and other facilities) at stops well maintained and illuminated.
- Real-time displays at key stops, interchanges and destinations;
- Real-time information online and on apps for mobile devices (e.g., journey planning and service information and updates).

In London, stops have a route corridor diagram for the particular direction served. Timetables are shown that are specific to the stop (not generic). At key stops, an area map shows where tickets can be purchased. A separate panel for night buses is included at stops with night services. Major locations also have a larger 'spider map' showing the routes radiating from that location in diagrammatic form.

Figure 44: Example of TfL bus stop-specific route diagram (Photo: Tim Pharoah, 2017)

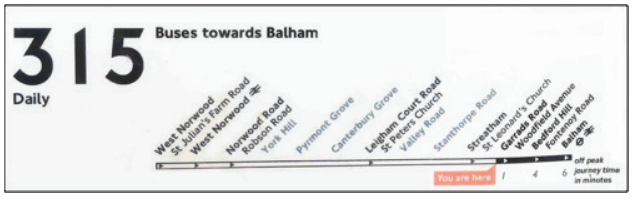
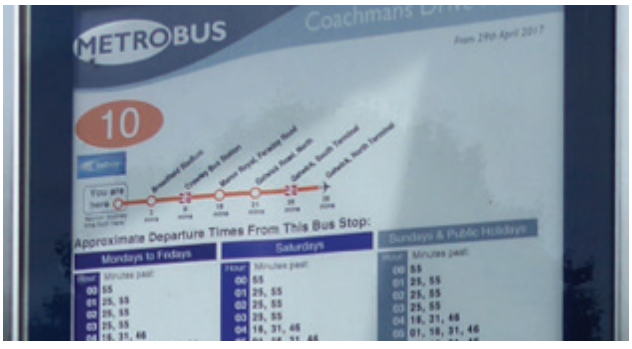


Figure 45: Example of TfL bus stop-specific information on how to obtain real-time information for the next bus (Photo: Tim Pharoah, 2017)

Figure 46: High-quality bus stop and shelter with real-time display and stop-specific timetable and route information (Fastway, Crawley) (Photo: Tim Pharoah, 2017)

Figure 47: Detail of bus stop display panel showing bus stop-specific timetable and route information. (Fastway, Crawley). Note the high-frequency daytime service and 24-hour operation seven days a week. (Photo: Tim Pharoah, 2017)



Section D - Participation and collaboration

Bus operators have to respond to opportunities arising from development as they find it but also have an interest in shaping new development to maximise passenger demand.

Local planning, highway and transport authorities influence and shape the demand for bus use through local spatial and transport plans and development management, as well as through demand and traffic management measures. There are much better prospects for high levels of sustainability, including a high bus mode share of local travel, if these agencies work together.

Spatial planners need to work with highway, traffic and transport departments as well as bus operators when preparing local development plans. Within the framework of development plans, further collaboration should occur during the masterplanning of large new developments, and the planning of other developments that may present opportunities for improving bus infrastructure, or solving an existing bus operation problem. Consultation and collaboration at an early stage can avoid problems that are difficult or impossible to fix once planning permissions are in place, in particular the layout and dimensions of new streets.

Bus operators will also need to provide advice on operational issues, such as the feasibility and viability implications of extending an existing bus route to serve a new development. On a routine basis, bus operators should be consulted on planning applications that are likely to result in changes in passenger demand. It is important also that developer contributions[14] be agreed as part of planning consents to ensure the best result for public transport. Likewise, the planning of bus services should involve partnership or collaboration between operators and relevant local authorities responsible for transport, highways, and spatial planning. Where possible, both existing and potential bus users should also be involved in the process, including representatives of people whose mobility is impaired. Such collaboration can include ad hoc arrangements to deal with particular issues, such as the planning of a major urban growth area or the creation of a quality bus route, as well as permanent arrangements for collaboration and ensuring the smooth running of the system. For example, in Greater Manchester, bus operating staff are located in the traffic signal control room.

CIHT have produced guidance on participation in another STUE document: *Involving the Public and Other Stakeholders* (CIHT, 2015c).

It may sometimes be necessary to alter service patterns and routes in existing urban areas. Where changes in services are proposed, these should be discussed first with users, or user groups. The involvement of other groups in the areas affected can also help generate and improve bus service plans. Routes and bus stops should not be changed without consultation on the implications for catchment areas and walking times to stops. Permanence is a feature of public transport routes that is important in attracting and retaining passengers. Changes to existing routes other than extensions therefore should be avoided unless of course opportunities arise for improved (more direct) routes. The diversion of existing routes to serve new developments, for example, can have a significant negative impact on the efficiency and viability of services.

Social media can be employed so that operators can receive notification of problems as they happen on the ground. This includes such events as road works, accidents or broken-down vehicles closing a street or restricting flow and causing delays, vandalism at bus stops, or incidents involving passengers on the bus. Buses and bus stops should therefore prominently display social media addresses.

[14]Including, for example, contributions for highways (Highways Act 1980, s278), public transport and other provisions under s106 of the Town and Country Planning Act 1990 (as amended), and via the Community Infrastructure Levy (CIL) under s205 of the Planning Act (2008). Note that changes in the legislation were anticipated at the time of writing.

Glossary

Access and accessibility - In transport, there are two meanings, which can lead to confusion.

1. 'Accessibility' for people with a disability or infirmity refers to the possibility or otherwise of using a transport vehicle or mode (e.g., dependent on level boarding, or visual indications of hazards)
2. 'Accessibility' for people or vehicles generally refers to the possibility or otherwise of reaching B from A.

Alternate stage traffic - (in a traffic signal cycle) traffic approaching the signals from other than the direction under discussion

Bus boarder (US: bus bulb) - a specific area of footway specially designed to facilitate boarding a bus at a bus stop, often involving 'building out' beyond the regular kerb line, especially to ensure parked vehicles are set back from the line taken by the bus.

Bus gate - a location with equipment, infrastructure or regulation designed to restrict passage to buses (and perhaps cyclists)

Bus lane - a lane within a carriageway dedicated to buses and certain other classes of vehicle (cycles, and other classes as specified in the order), either permanently or at certain times of day and/or certain days of the week

Bus priority - equipment, infrastructure or regulation designed to enable buses to proceed without hindrance by other traffic or by traffic signals

Bus stop - a place specified for buses to stop for the purpose of passengers boarding and alighting, usually with associated infrastructure. The carriageway broken-line markings denoting where buses stop is referred to as the bus stop 'cage'.

Bus stand - a place, on or off street, where buses can wait when not in service, particularly during 'layover' periods between journeys

Busway - a roadway dedicated to and designed for buses only

Catchment - the area around a bus stop (or station) from which passengers are or can be drawn

Clearway - a length of carriageway where kerbside parking and stopping is prohibited

Clock-face timetable - A service pattern in which buses depart at fixed intervals (i.e., every 5, 10, 15, 20, 30 minutes) and thus at the same number of minutes past each hour (based on Wiktionary definition)

Dwell time - time spent by a bus stationary at a bus stop (usually for boarding and alighting)

Floating bus stop - bus stop that is separated from the footway by a cycle bypass

Guided bus - a bus that is capable of being steered remotely from the driver, usually by means of a guideway

Headway - the time (or distance) between one bus and the following bus

Lay-by - a portion of carriageway widened to provide a separate lane or space for a bus stop or bus stand

Layover - time within a bus schedule between passenger-carrying journeys

Opposing traffic - traffic on the same alignment coming from the opposite direction

Permeable area/street layout - a street and path layout that enables direct and convenient movement through it

Preferential routing (also called 'filtered permeability', or 'modal filters') - street arrangements or designs whereby buses (or cyclists) gain more direct access than car users

Shared transport - shared use of small vehicles, including ride sharing and taxi sharing

Timing point - a defined location on a bus route where the bus actual time is compared against the scheduled time. Timing points will usually coincide with bus stops, and may have provision (in a lay-by or otherwise) for buses ahead of schedule to pause before continuing at the correct departure time. Timing points may also have facilities for late running buses to be turned short of their destination, in order to restore schedule timings on the return trip.

Tracking - a computer-based procedure for checking the area occupied or oversailed by the bus when turning or on bends

Transit - collective transport or public transport (generally land based)

Trip - A door-to-door journey with a single main purpose

Trip stage - A component of a trip involving changes of mode or vehicle, such as the walk to the bus stop

References

Aldred, R., Best, L. and Jones, P. (2017) Cyclists in Shared Bus Lanes: *Could There Be Unrecognised Impacts on Bus Journey Times?* Proceedings of the Institution of Civil Engineers - Transport http://www.icevirtuallibrary.com/doi/abs/10.1680/jtran.16.00072

ATCO (2015) *Printed Information at Bus Stops - Interim Good Practice Guidelines*, Association of Transport Coordinating Officers (only available to members), https://www.atco.org.uk/publications/

Begg, D. and Haigh, C. (2017) *Tackling Pollution and Congestion*, Greener Journeys, London. http://www.greenerjourneys.com/publication/tackling-pollution-congestion/

Bus Users (undated) *Good Practice Guide*, Bus Users, http://bususers.org/assets/Good_Practice_Guide.pdf

CfIT (2006) *Sustainable Transport Choices and the Retail Sector, Final Report*, Mott MacDonald for Commission for Integrated Transport, London, http://webarchive.nationalarchives.gov.uk/20110304132839/http:/cfit.independent.gov.uk/pubs/2006/stc/technical/pdf/stc-technical01.pdf

CIHT (2005) *Traffic Calming Techniques*, Chartered Institution of Highways and Transportation, London, http://www.ciht.org.uk/en/knowledge/publications/technical-guidelines.cfm/traffic-calming-techniques-2005

CIHT (2010) *Manual for Streets 2: Wider Application of the Principles*, Chartered Institution of Highways and Transportation, London, https://www.gov.uk/government/publications/manual-for-streets-2

CIHT (2015a) *Planning for Walking*, Chartered Institution of Highways and Transportation, London, http://www.ciht.org.uk/en/document-summary/index.cfm/docid/082BEF1B-0FD2-44F4-90A0B31EB937899A

CIHT (2015b) *Designing for Walking*, Chartered Institution of Highways and Transportation, London, http://www.ciht.org.uk/en/document-summary/index.cfm/docid/E4B48D37-9FE7-4C30-92ED822524C777CC

CIHT (2015c) *Involving the Public and Other Stakeholders*, Chartered Institution of Highways and Transportation, London, http://www.ciht.org.uk/download.cfm/docid/8BC0682B-958E-435E-BD5E44ED67E01964

DCLG (2012) *National Planning Policy Framework*, Department for Communities and Local Government, London, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf

DCLG (2014) *Overarching Principles on Travel Plans, Transport Assessments and Statements*, Guidance Note, Department for Communities and Local Government, London. https://www.gov.uk/guidance/travel-plans-transport-assessments-and-statements#travel-plans

DCLG (2015) *Transport Evidence Bases in Plan Making and Decision Taking*, Guidance Note, Department for Communities and Local Government, London, https://www.gov.uk/guidance/transport-evidence-bases-in-plan-making-and-decision-taking

DETR (1998) *Places, Streets and Movement - A Companion Guide to Design Bulletin 32 Residential Roads and Footpaths*, Department of the Environment, Transport and the Regions, London (superseded by DfT DCLG Manual for Streets, 2007), http://regulations.completepicture.co.uk/pdf/Planning/Places%20Streets%20&%20Movement.%20A%20companion%20guide%20to%20Design%20Bulletin%2032.pdf

DfT (annual (a)) *National Travel Survey*, Department for Transport, London, https://www.gov.uk/government/collections/national-travel-survey-statistics

DfT (annual (b)) *Bus Statistics (for England)*, Department for Transport, London, https://www.gov.uk/government/collections/bus-statistics

DfT (1998) *Speed Cushion Schemes*, Traffic Advisory Leaflet 1/98, Department for Transport, London, http://www.ukroads.org/webfiles/TAL%201-98%20Speed%20cushion%20schemes.pdf

DfT (2005) *Inclusive Mobility: A Guide to Best Practice on Access to Pedestrian and Transport Infrastructure*, https://www.gov.uk/government/publications/inclusive-mobility

DfT DCLG (2007) *Manual for Streets*, Department for Transport, Department for Communities and Local Government, Thomas Telford Publishing, London, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/341513/pdfmanforstreets.pdf

DOE (1973) *Bus Operation in Residential and Industrial areas*, DOE Circular 82/73, Department of the Environment, London, http://dclg.ptfs-europe.com/AWData/Library1/Circulars/Department%20of%20the%20Environment/1973/82-73%20DOE.pdf

DOE DOT (1992) *Residential Roads and Footpaths - Layout Considerations*, Design Bulletin 32, Second Edition, Department of the Environment Department of Transport, London (superseded by DfT DCLG Manual for Streets, 2007), http://regulations.completepicture.co.uk/pdf/Planning/Design%20Bulletin%2032%20-%20Residential%20Roads%20and%20Footpaths%201992.pdf

DoT (1996) *Better Information for Bus Passengers*, Department of Transport, London.

English Partnerships (2006) *Car Parking: What Works Where*, English Partnerships (now the Homes and Communities Agency), http://collections.europarchive.org/tna/20100911035042/http://englishpartnerships.co.uk/qualityandinnovationpublications.htm

Fort, L. (2015) '*Get Reading On-line*', 18 September 2015, Reading and Berkshire News.

George, D. (2016) '*Fastrack gets back on track*', BRT-UK Handbook 2016–17, Landor Publishing, London, pp. 26–27.

GMPTE (2007) *Design Guidelines for Bus Stops in Greater Manchester*, Greater Manchester PTE, available from Transport for Greater Manchester, http://www.tfgm.com/Corporate/Documents/Miscellaneous/07_0650_bus_stop_guidelines.pdf

GMPTE (2008) *Quality Bus Corridors in Greater Manchester: Best Practice Guidelines*, Greater Manchester PTE, available from Transport for Greater Manchester, http://www.tfgm.com/buses/Documents/QBC_Guidelines_270808.pdf

GMPTE (2009) *Traffic Calming for Bus Routes*, Greater Manchester PTE, available from Transport for Greater Manchester, http://www.tfgm.com/Corporate/Documents/Miscellaneous/Traffic_calming_for_bus_routes_guidance.pdf

Greener Journeys (2016) *The Value of the Bus to Society*, Greener Journeys, London, http://www.greenerjourneys.com/publication/value-bus-society/

Hazel, G. (2017) Personal communication.

Jacobs and Kent County Council (2008) *Kent Thameside: Development of the Transport Strategy*, Technical Summary Report (Final Draft), pp. 2–10.

Johnson, D., Mackie, P. and Shires, J. (2014) *Buses and the Economy II - A Survey of Expenditure of Visitors to City and Town Centres*, Institute for Transport Studies, University of Leeds, http://www.greenerjourneys.com/wp-content/uploads/2014/07/Buses_and_the_Economy_II_main_report_july.pdf

Johnson, D. (2016) *A Study of the Value of Local Bus Services to Society*, Task III Technical Report: Econometric Analysis, Institute for Transport Studies, University of Leeds, for Greener Journeys, http://www.greenerjourneys.com/publication/value-bus-society/

KPMG (2016) *Local Bus Market Study*, KPMG Report to DfT, London, https://home.kpmg.com/uk/en/home/insights/2015/12/local-bus-market-study.html#Link 2

Lyons, G. (2016) *Uncertainty Ahead: Which Way Forward for Transport?* CIHT Futures Report, Chartered Institution of Highways and Transportation, London, http://www.ciht.org.uk/en/document-summary/index.cfm/docid/54DF664C-DDB3-4AEA-B5D50039CCF24E9C

Reading and Berkshire News, 31 October 2016; http://www.getreading.co.uk/news/reading-berkshire-news/bus-usage-reading-soars-12-12087491.

Reading BC and Brett, P. (2013) *Reading Area LSTF Partnership Annual Outcomes Report 2013 - Monitoring & Evaluation Plan*, Peter Brett Associates LLP, Reading, http://www.reading.gov.uk/media/2408/Monitoring-and-Evaluation-Plan/pdf/Monitoring_and_Evaluation_Plan.pdf

Stagecoach (2017) *Bus Services and New Residential Developments*, Stagecoach UK Bus, Perth, http://www.stagecoach.com/~/media/Files/S/Stagecoach-Group/Attachments/pdf/bus-services-and-new-residential-developments.pdf

TfL (2005) *Traffic Calming Measures for Bus Routes*, Technical Advice Note BP2/05, Transport for London, London, http://content.tfl.gov.uk/trafficcalmingmeasuresleaflet-rev-final.pdf

TfL (2016) *London Cycling Design Standards*, Transport for London, London, https://tfl.gov.uk/corporate/publications-and-reports/streets-toolkit#on-this-page-2

TfL (2017) *Accessible Bus Stop Design Guidance*, Transport for London, London, https://tfl.gov.uk/cdn/static/cms/documents/bus-stop-design-guidance.pdf

Translink (2005) *Bus Stop Design Guide*, Roads Service Transportation Unit, Department for Regional Development Northern Ireland, Belfast, https://www.planningni.gov.uk/downloads/busstop-designguide.pdf

Transport Systems Catapult (2016) *Mobility as a Service: Exploring the Opportunity for Mobility as a Service in the UK*, https://ts.catapult.org.uk/intelligent-mobility/im-resources/maasreport/

TRL (undated) *Off-Street Trials of a Bus Stop Bypass*, TRL Ltd., Crowthorne, https://trl.co.uk/media/615218/summary_report_off-street_trials_of_a_bus_stop_bypass_v1.pdf

UK Government (2000) *Transport Act 2000*, HM Government, http://www.legislation.gov.uk/ukpga/2000/38/pdfs/ukpga_20000038_en.pdf

UK Government (2002) *S.I. No. 3113/2002 - Road Traffic* (The Traffic Signs Regulations and General Directions 2002), Statutory Instrument, HM Government, http://www.legislation.gov.uk/uksi/2002/3113/pdfs/uksi_20023113_en.pdf

UK Government (1986 passim), *The Road Vehicles (Construction and Use) Regulations 1986*, Statutory Instrument No. 1078/1986 as amended (amendment No. 6) by S.I. No. 3051/1995.

White, B. (2011) 'New suburbanism', *Focus* (Journal of the Chartered Institute of Transport, UK), May, pp. 22–25.

White, P. (2016) *Public Transport: Its Planning, Management and Operation*, 6th Edition, Routledge, London and New York.

Resources

A selection of other guidance documents

CIHT (1999) *Planning for Public Transport in Developments*, London.
Predecessor of the current guidelines, http://www.ciht.org.uk/en/document-summary/index.cfm/docid/8FE1EE33-A822-49A5-B43103B9AB4BE36F

CIHT (2005) *Traffic Calming Techniques*, http://www.ciht.org.uk/en/knowledge/publications/technical-guidelines.cfm/traffic-calming-techniques-2005

National Association of City Transportation Officials (NACTO) (2016) *Transit Street Design Guide*, Island Press, Washington, London.
Comprehensive and detailed discussion with numerous illustrated examples of streets designed for buses and other transit, though in the North American context. The online version is fully searchable.
http://nacto.org/publication/transit-street-design-guide/

Transport for London (2005) T*raffic Calming Measures for Bus Routes*. Bus Priority Team technical advice note BP2/05,
http://content.tfl.gov.uk/trafficcalmingmeasuresleaflet-rev-final.pdf

Transport for London, August 2012, *Guidelines for Planning Bus Services*, London.
Advocates a bus network that is frequent, reliable, simple, comprehensive, and cost-effective.
http://content.tfl.gov.uk/bus-service-planning-guidelines.pdf

UK Government, Department for Education (2014) *Home to School Travel and Transport Guidance - Statutory Guidance for Local Authorities*, https://www.gov.uk/government/publications/home-to-school-travel-and-transport-guidance

General references

BRT UK, 2015, *UK Bus Rapid Transit - A Common Standard?*
http://www.brtuk.com/wp-content/uploads/2016/06/BRTuk-Research-Paper-Final-Report.pdf

Department for Communities and Local Government (DCLG), 2012, *National Planning Policy Framework*, https://www.gov.uk/government/publications/national-planning-policy-framework--2

Department for Transport (2003) *Public Transport Information*, Traffic Advisory Leaflet ITS 7/03, http://www.ukroads.org/webfiles/its07-03.pdf

Department for Transport (2004) *Bus Priority: The Way Ahead*, Resource Pack, Edition 2.

Department for Transport (2005) *Smarter Choices - Changing the Way We Travel*, https://www.gov.uk/government/publications/smarter-choices-main-report-about-changing-the-way-we-travel

Department for Transport (2009) *The Role of Soft Measures in Influencing Patronage Growth and Modal Split in the Bus Market in England*, Final Report.

Department for Transport (2012) *Bus and Coach Security, Recommended Best Practice*, 2nd Edition, https://www.gov.uk/government/publications/bus-and-coach-security-recommended-best-practice

Greener Journeys (2015) *Bus2020: Case for the Bus Report*, Greener Journeys campaign, http://www.greenerjourneys.com/

KPMG (January 2016) *Local Bus Market Study*, Report to the Department for Transport, https://www.gov.uk/government/publications/local-bus-market-study

NTS, National Travel Survey - see UK Government below.

Mackie, P., Laird, J. and Johnson, D. (2012) *Buses and Economic Growth*, Main Report, Institute for Transport Studies, Leeds, http://www.greenerjourneys.com/news/buses-economic-growth-making-the-link-new-report/

Transport for London (undated) *Streets Toolkit*, https://tfl.gov.uk/corporate/publications-and-reports/streets-toolkit#on-this-page-1

Transport for London (2014) *London Cycling Design Standards*, https://tfl.gov.uk/corporate/publications-and-reports/streets-toolkit#on-this-page-2

Transport for London/TRL (undated) *Off-Street Trials of a Bus Stop Bypass*, http://www.trl.co.uk/media/615218/summary_report_off-street_trials_of_a_bus_stop_bypass_v1.pdf

Tyler, N. (2016) *Accessibility and the Bus System: Transforming the World*, Second Edition, ICE Publishing.

UK Government, National Travel Survey, https://www.gov.uk/government/collections/national-travel-survey-statistics

Selected historic references

Confederation of British Road Passenger Transport (CPT) (1981) *Urban Planning and Design for Road Public Transport*.

Department for Transport, Local Government and the Regions (DTLR) (1997) *Keeping Buses Moving - A Guide to Traffic Management to Assist Buses in Urban Areas*, Local Transport Note 1/97.

Devon County Council (2001) *Traffic Calming Guidelines*. Complete searchable document is at http://livingtransport.com/results.php?t=asset&search=8&content=Traffic%20Calming%20Guidelines
High resolution individual chapters are at http://www.ciht.org.uk/en/knowledge/standards-advice/traffic-calming-guidelines--devon-county-council.cfm

Runcorn Development Corporation (1967) *Runcorn New Town* (Masterplan), Especially Appendix D, 'Determination of walking distance', http://www3.halton.gov.uk/Pages/planning/policyguidance/pdf/evidencebase/Area%20Specific%20Evidence/RuncornNewTown/Runcorn_New_Town_Masterplan_(1967).pdf

Chartered Institution of Highways & Transportation

119 Britannia Walk
London N1 7JE

t: +44 (0)20 7336 1555
e: info@ciht.org.uk
www.ciht.org.uk

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