15

chapter 15 Public Transport

15.1 Introduction

Role of Public Transport

Public Transport has a key role to play in getting the optimum people carrying capacity from the transport network. Fixed track systems such as rail and Light Rapid Transport (LRT) have a substantial role to play in this in the bigger conurbations. Although expensive, the advantage of such systems is their potential to move large numbers of people efficiently. Journey time, safety and reliability are important operating factors. It is important that they operate independently of general traffic for as much of their journey as possible. The interface with other road users such as pedestrians and cyclists needs to be designed carefully for safe and convenient access.

Encouraging the use of the bus however through initiatives such as Quality Bus Corridors (QBC) will be the key to improved movement in most sections of the urban environment. The provision of high quality, frequent and reliable bus services is essential if people are to be attracted out of their cars on a wider scale.

Buses have the ability to move large numbers of people around urban areas in a safe, economic and relatively environmentally friendly manner. To achieve their full potential, buses not only have to be able to move around the road network with a minimum of delay, but they have to be able to pick up and set down passengers quickly and conveniently. A comprehensive and high quality approach to the provision of public transport and its associated infrastructure is required if a significant modal shift is to be achieved.

The average car occupancy rate on a peak hour journey in the Greater Dublin area is 1.4 persons. The average peak hour bus carries around 54 people[1] so it is over 38 times more efficient than the car in people movement terms. On congested routes, increased use of buses can help to reduce the effects of congestion or to increase people movement capacity, by the introduction of bus lanes as well as other innovative bus priority measures.

For many people living in outlying or rural areas, the car may be the only choice for the journey into a town or city. The use of strategically positioned and well designed park and ride (see 15.4) facilities may give these people a real alternative for the part of their journey where the effects of congestion are most acute – into and out of the town/ city centre.

Promoting Public Transport

As the sustainability of travel is becoming the focus of future transport policy, public transport must receive high priority when planning road infrastructure. It is important that public transport is given priority at locations where it would otherwise be delayed by other traffic eg in/out of public transport interchanges, approaching junctions, on main exits from residential developments onto main roads.

If people are to be tempted out of their cars then public transport and the advantages it offers should be promoted on a wider scale. A holistic approach to the provision and promotion of public transport is needed.

15.2 Quality Bus Corridors

Quality Bus Corridors (QBCs) are a partnership between bus operators and road authorities. The bus operator agrees to provide a high quality, frequent bus service along specified routes whilst the road authority provides infrastructure such as bus lanes, bus priority measures and improved bus stops. The Dublin Transportation Office has set out a Specification for Quality Bus Corridors[3] that has the following objective: "To provide a clearly defined, high performance bus transportation system segregated from other road traffic"

The development of a strategy of improving facilities for public transport along an entire route or corridor can achieve substantial improvements in bus operating times and passenger usage. These improvements together with targeted publicity about the benefits of QBCs by both the bus operator and the road authority can help to achieve a substantial increase in bus patronage and remove car trips from a congested route.

Stillorgan QBC

The introduction of the N11 Stillorgan QBC in Dublin resulted in an increase in peak period bus trips from 3,000 to 5,000 people. Corridor travelling capacity (people) has increased by 700 people per hour and journey times reduced by 15%.

The infrastructure requirements of each QBC, in order of priority, are that it:

- starts on a Regional or higher classification road
- provides access priority for bus services entering the QBC
- delivers bus journey speeds on the QBC of at least 20 km/h average over the whole corridor
- increases by a minimum of 20% the capacity of the corridor to carry people when all modes are taken together
- operates on segregated lanes on the complete length of the corridor wherever the road width allows
- operates on non-segregated lengths to the highest possible performance levels by the use of traffic management techniques
- links through an intelligent interface to the Urban Traffic Control system (SCATS or SCOOT or similar)
- operates wherever possible on a 12-hour basis with a specified period for loading if required
- maintains wherever possible priority through roadworks the occurrence of which should be cleared with the bus operator
- discourages intrusion by general traffic by being clearly defined and using coloured surfacing where necessary
- provides bus stops positioned to minimise walking times for existing and potential passengers taking into account issues such as security, traffic conditions, etc
- encourages use by having high quality waiting areas at all principal bus stops, including shelters, seating, telephones, ticket vending machines, cycle parking and boarding platforms
- informs passengers at high usage bus stops with real time passenger information

Parking at QBC bus stop

- provides a high quality running surface with a maximum camber of 2.5% together with vertical alignment transitions at junctions engineered to reduce the potential for the oscillation of buses passing through
- includes a network of pedestrian walking routes to bus stops that are landscaped, well lit, direct, with safe road crossings.

These priorities recognise that increasing service frequency, reliability and reducing journey times will help to achieve a long term modal shift. However, people want a higher level of service in terms of availability of real-time travel information and better quality buses. Bus stops should be designed to minimise passengers concerns about personal safety. Better integration of bus provision with high quality walking and cycling routes with secure cycle parking facilities will help to ensure more people travel using sustainable modes of transport.

On some of the successful QBCs, some of the principal bus stops on the corridor have become key modal change points. People will drive to these locations to use the bus and leave their cars in residential streets, church car parks etc. near to the bus stops. This has resulted in localised commuter parking and access problems in the immediate vicinity of the QBC stops.

It is therefore essential that when a QBC is being planned these possible side effects should be considered and appropriate measures taken when the QBC is introduced. In some cases it may be necessary to review existing bus stop locations to ensure that adequate and safe parking is available nearby. It may be necessary to consider the need to provide off-street car parking (as at a railway station) at some potentially heavily used sites, or to review local waiting restrictions at locations where long stay parking is inappropriate.

In addition to the road infrastructure improvements, QBCs should also be the focus of network and fleet changes by the operators. Routes could be revised and re-routed to take advantage of the timesaving that a QBC can make possible. The introduction of newer vehicles, with user-friendly features such as low floors for disabled access and facilities for push chairs can help to lift the profile of public transport in the area and give a potential boost to usage.

Low Floor bus

New high quality buses

It is intended that the bus service on a QBC shall:

- provide an agreed level of passenger waiting times at all boarding points on the corridor
- operate so that passenger boarding and alighting times at bus stops is a maximum of 12% of total bus journey time
- minimise passenger interchange by integrating services into cross-city formations
- offer an integrated ticketing system such that one passenger payment is required for any trip, irrespective of the number of modes required.

It can be seen that a successful QBC cannot be implemented by the actions of traffic engineers and planners alone. It requires the co-operation and input of the operators, An Garda Siochana and the adjacent residents and businesses to be successful. A partnership approach will ensure that good quality facilities designed to attract people out of their cars will be implemented to the overall benefit of the community.

Bus lanes at junctions

Use of Bus Lane by Emergency Vehicle

15.3 Bus lanes and bus priority

Bus lanes are provided to improve the journey time and reliability of the bus services. Bus lanes allow buses to get to the next junction more quickly. The reallocation of road space to provide dedicated lanes for buses is a very positive way of improving the people-carrying capacity along a particular route. A bus lane carrying one bus every five minutes has the same capacity as a lane carrying around 1000 people by car. Increasing the frequency of the bus service to one every two minutes could increase the people-carrying capacity of the lane by 250%.

Sometimes bus lanes are criticised by other drivers as they see the lane empty for long periods of time. In order to avoid this it is important to increase the bus service frequency to ensure that the people-movement capacity of the lane increases substantially and that the benefits are widely publicised.

Bus lane markings

The Traffic Signs Manual[2] gives details of the signs and markings that should be used for bus lanes. The bus lane markings should be continued with a dashed line across the bellmouths of minor roads. At roundabout and traffic signal junctions, bus lane markings ideally should continue up to the stop line. Where left turn facilities are permitted, the line should be dashed in advance of the junction. Downstream of the junction, the bus lane should re-commence immediately on the far side of the junction. At signalised junctions, it is the general objective that all approaching buses can negotiate the junction in one cycle of the signals.

Bus lanes should be a minimum of 3.0m wide and ideally 4.5m wide to allow buses to safely overtake any cyclists using the lane (see Cycle manual for more specific advice). The use of coloured surfacing for the bus lane can help to discourage unauthorised usage by other vehicle drivers.

Contra-flow bus lanes

Contra-flow bus lanes

The majority of bus lanes are 'with flow' but the use of 'contra flow' bus lanes can help to provide more direct routes for access by passengers where there would otherwise be lengthy diversions around one-way systems. Contra-flow lanes can help to save on journey times and operating costs. When used in busy shopping and commercial zones they can maintain better access for bus routes while keeping the overall level of traffic down. Contra-flow bus lanes generally operate on a full time basis to avoid confusion for other drivers and so that unauthorised vehicles do not use them to take short cuts through an area. Contra-flow bus lanes should be designed with accompanying cycle facilities.

Periods of operation for bus lanes

The period of operation of bus lanes should be consistent in a town or city to avoid any potential confusion. Where there is sufficient demand, bus lanes can operate at all times but an operating period of 7am to 7pm covers the period when most traffic is using the road. Some bus lanes operate only in one or both of the peak hours (e.g. 7am to 10am and 4pm to 7pm) depending on when buses experience the most delays to their service. Bus lanes that operate over longer periods of the day

and week are likely to have fewer problems with infringements by other vehicles because the restriction is likely to be better understood. The hours of operation chosen for a bus lane should represent a balance between the benefits for the bus service in terms of reduced travelling times and the needs of local residents and businesses for parking and loading. In striking that balance, the needs of cyclists must be borne in mind.

Parking and loading

If bus lanes are to be successful, then measures should be taken to prevent their obstruction by vehicles that are parked or waiting to load/unload. A single vehicle obstructing a bus lane can cause substantial increases in journey times and delays for buses. Arrangements for local parking and loading should be considered as an integral part of a scheme, when coming to a decision over which hours the bus lane will operate. Loading and unloading should not be allowed during the hours of operation of the scheme and it may be necessary to make alternative provision for these requirements such as:

- the provision of parking/loading bays outside the bus lane
- servicing local businesses from nearby side roads
- arrangements for servicing outside the hours of operation of the bus lane
- active enforcement of restrictions

Use of bus lanes by other vehicles

Pedal cycles are allowed to use with-flow bus lanes. Unless there is a segregated cycle track, then where there are high numbers of buses and/or cyclists then a wider lane (up to 4.5m) will be needed to allow safe overtaking of the slower moving cyclists (see cycle manual).

Taxis are allowed to use with-flow bus lanes.

Emergency service vehicles responding to emergency calls are allowed to use bus lanes.

Mini-buses and coaches with a PSV licence are allowed to use bus lanes because they have the potential to transport large numbers of people.

Motor cycles/mopeds are not allowed to use bus lanes at present. Although they take up less road space than cars the case for allowing them to use bus lanes is more difficult. There are concerns that pedestrians crossing the bus lanes through a queue of stationary cars may not be expecting relatively fast moving motorcycles to be in the bus lane and that there could be accidents as a result.

High occupancy vehicle lanes have been introduced in some countries. Vehicles with two or more people in them are allowed to use the lanes, which offer priority over other traffic lanes at locations where there is congestion. These offer some incentives for higher occupancy trips but could hinder the operation of bus lanes if introduced more generally. They can also lead to enforcement difficulties.

Enforcement

For bus lanes to achieve their optimum operating potential it is essential that adequate enforcement is carried out to prevent their use by unauthorised vehicles and to ensure that illegal parking and loading does not take place to the detriment of the free flow of buses. Consultation with An Garda Siochana, residents and businesses fronting onto the scheme should take place at the design stage to ensure that as many potential enforcement problems as possible are designed out.

Enforcement of bus lanes (especially heavily used ones) is an important element in their success. Longer periods of operation (such as 12 hours) tend to pose fewer enforcement problems. If conventional enforcement resources are too stretched to provide adequate coverage of the bus lane network then consideration can be given to the use of automated enforcement (eg enforcement cameras). These can be used to detect offences and to deter infringements.

Bus priority

Buses can be given priority on links by the use of either ‘with flow’ or ‘contra flow’ bus lanes. In certain areas bus-only streets can be designated to provide improved access for public transport.

However since much of the journey time delay for buses is caused by the operation of junctions, measures to give buses priority at junctions can make major improvements in their operation.

Buses can be given priority at traffic signals and allowed access in areas restricted to other vehicles to make their operation more efficient.

Buses can either be fitted with active transponders that carry information about the individual vehicle and its route, or passive devices that simply identify it as a bus and give it priority treatment at certain facilities. The passive devices are normally relatively inexpensive and can be as simple as an inductive loop in the road or a "credit card" that can be read remotely by fixed roadside equipment when placed in the window of the drivers cab.

These devices can be used to call-on a specific signal phase for buses at traffic signals, (for example where a turning movement is banned to all other traffic but is allowed to enable buses to access a specific street or residential area). They can be used to open physical features such as "Bus only entry" (usually controlled with barrier arms or rising bollards) at road closures where buses are permitted but non-essential traffic is banned. Bus only entry can provide useful public transport links in residential or town centre areas whilst keeping through traffic out.

More complex devices (using Global Positioning System (GPS) technology or roadside beacons) can also be used to locate and monitor the progress of individual vehicles along a route. This can provide data to give priority to buses at traffic signals and can be linked up with adaptive UTC systems such as SCATS. Bus priority measures such as bus advance areas and bus gates at traffic signals are dealt with in more detail in Section D, Chapter 10.

Rising bollard at bus only entry

Public Transport Permeability in Residential Areas

It is important to ensure that new developments are highly permeable in terms of the ability of buses, and also pedestrians and cyclists, to move through and between adjacent housing developments. Mechanisms such as priority routes (green routes) for buses with car restraint measures can place sustainable transport modes at an advantage over the car in terms of accessibility and travel times. In particular, examples here would include ensuring that in larger developments, distributor roads offer routes where local bus services can access the entire development without entering circuitous and time consuming cul-de-sacs. Connection of such loops between housing developments by bus only routes can offer faster ways for buses to access residential areas.

While the first priority is to ensure that adequate "green routes" are provided for buses through new housing developments it is also important to examine the possibility of retrofitting them into larger existing developments. This can be more difficult due to existing site constraints but in some cases it may be a feasible and worthwhile proposition.

Pedestrian Permeability

If public transport is to be viable, the shortest access for residential areas needs to be identified and provided. It is essential that Local Authorities review the barriers to pedestrian permeability and develop a policy and programme to open up inter-estate linkages geared towards access to public transport, schools and employment.

15.4 Park and Ride[9,10]

This section should be read in conjunction with Chapter 16 (Parking).

Many trips to town and city centres originate from outlying areas that are not well served by public transport. Park and ride offers car drivers the opportunity to use buses for part of their journey. This can help to reduce congestion and can be an attractive alternative to high cost town/city centre parking. Park and ride facilities can be attractive because they offer either low cost or free parking combined with fixed low cost fares. They can reduce the number of car trips in the most sensitive areas of a town or city. The provision of park and ride facilities should be considered as part of an integrated transport policy and strategy. In particular it should be consistent with the overall parking and public transport strategy.

Park and ride facilities are transport interchanges and the best examples integrate all modes of surface transport including rail. Such sites offer major benefits to promoting the use of public transport as a viable alternative to the car.

Park and ride sites should:

- be located on the fringe of congested areas close to the main national or regional routes with good access
- be of a well-laid out open design with high quality street lighting to reduce fears for personal safety
- include secure parking for vehicles and cycles, which are monitored by either by a permanent staff presence or by CCTV. Facilities with people present throughout the period of operation give a greater sense of security. This can be achieved by providing for some local services such as a shop or bus drivers' canteen facilities in the design
- have good public transport links into the town/city centre areas offering better journey times than by car. This will require buses to provide an express service avoiding picking up further passengers along the route
- offer a frequent (every 10 minutes) low cost service using high quality modern vehicles. Passengers should have ready access to information about operation times and frequencies. Major park and ride sites work on the principle that there is always a bus waiting to take passengers

- offer a significantly lower overall cost than for town/city centre parking. Most locations offer free parking and charge for bus travel. If a park and ride is located close to residential areas then some passengers may walk to the park and ride sites to take advantage of lower fares. This needs to be taken into account in the overall strategy for public transport in the local area as this could result in a shortfall in receipts on conventional services that pass close to the site.

Bike and Ride

There are numerous successful examples of bike and ride facilities throughout Europe. The provision of good secure cycle parking at rail, tram and bus stopping places has encouraged the concept of "Bike-and-Ride" where passengers arrive by cycle and complete their journey by public transport.

Bike and Ride

15.5 Bus stop design

Appropriate location of bus stops is essential as they automatically generate pedestrian crossing demands on the roads served by the bus. It is preferable that bus stops are located in advance of crossing points from a traffic and safety viewpoint. Despite all the investment that can be made in service improvements and road infrastructure, passengers are unlikely to be attracted to buses in the long term if their experience is unpleasant or one of inconvenience. It is therefore necessary to invest in the provision of high quality bus stops and reliable up-to-date journey information.

Traffic engineers, planners and bus operators need to ensure that roadside bus stops provide a good level of service to passengers. This can include the provision of seating, telephones, cycle parking, CCTV surveillance, etc. They must be clean, well lit and offer a secure environment reasonably well sheltered from the elements. At principal stops on QBCs the passengers are likely to park their cars in close proximity. This should be taken into account at the planning stage.

Bus stops must also be user-friendly for bus drivers. They should be able to manoeuvre their vehicles to the kerb without difficulty. Drivers should have unobstructed access at all times. This may

be difficult given the many demands placed on road space. However, if a consistent approach to bus stop provision is adopted across a whole area and adequate enforcement is provided, the job of the bus driver can be made easier.

Kassel Kerb at bus stop

Parking

Indiscriminate parking in the vicinity of bus stops causes problems for passengers with mobility problems. Good design can discourage parking in areas that would restrict access for buses. A programme of upgrading existing conventional kerbside bus stops on principal bus routes will help to encourage increased use particularly by those groups that find access difficult at present. If this is not possible then consideration should be given to imposing waiting and loading restrictions to allow easy access.

Passenger access arrangements

As a general rule, all bus stops should be designed to accommodate the current generation of low-floor buses. For these user-friendly vehicles to operate as intended it is essential that traffic engineers understand the basic operating requirements at bus stopping facilities.

For ease of access, buses should be able to manoeuvre the entry/exit platforms right up to the kerbside. Gaps of 100mm or more can present access difficulties for some users such as the elderly; people with push chairs or wheelchairs and people with sight impairment or with walking difficulties.

The optimum kerb height at a bus stop to cater for these persons should be around 180mm. All new bus stops and improvements to existing ones should be designed to this height. Special kerb units such as "Kassel Kerbs" (or similar) are available which give this upstand. They should contrast in colour with the footway.

In addition to giving good access for bus users, high kerbs can discourage casual parking at bus stops. It should be noted that if high kerbs are provided and drivers cannot get clear access to pull up close to the kerb (because of parked vehicles for example) the situation for less mobile people that require better access to buses will be made worse. They will have to step-down from a high kerb into the carriageway and then have to climb up onto the bus platform.

Kerbside bus stops

Kerbside bus stops are only advised within bus lanes, or other traffic lanes where parking is not allowed. They should be supported with Kassel type kerbs.

Bus bays (lay-byes)

Bus bays are advised principally on high frequency bus routes (eg QBCs) in order to facilitate buses overtaking other buses, and/or on distributor roads (outside schools, hospitals etc.) for safety reasons. Horizontal reverse access should be used when setting out the entry and exit kerbs for bus bays, as far as practicable.

In congested urban locations, bus bays can become parking and loading bays, forcing the bus to stop on the main carriageway, with passengers having to make their way through the parked vehicles. This is a major problem for the mobility impaired and causes access problems for people with wheelchairs, pushchairs, etc. Most existing bus bays take up a large amount of footway space (at least 2m depth by some 50m length) yet do not adequately cope with the dynamic movements of modern buses. Kerb build-outs within the bay (Diagram 15.1) or conversion to a half width bus boarder (1m deep, see Diagram 15.2) could assist in making these more user-friendly.

Bus boarders

Bus boarders are either full width (2m wide, Diagram 15.3) or half width (1m wide, Diagram 15.2) kerb build-outs and are a good solution to providing easy access for passengers and buses. In heavily parked areas, a bus boarder should extend out into the carriageway beyond the stationary vehicles giving the bus driver the opportunity to pull up in the correct position for ease of boarding and alighting. Bus boarders also provide space for improved passenger waiting and information facilities whilst allowing 180mm height kerbs to be installed. A full-length bus boarder is around 12m long (the equivalent of two parking spaces).

Bus promontories

Bus promontories (Diagram 15.4) are short (2m to 3m kerbside length) versions of bus boarders which can be useful on roads

Diagram 15.1 Conversion of bus bay

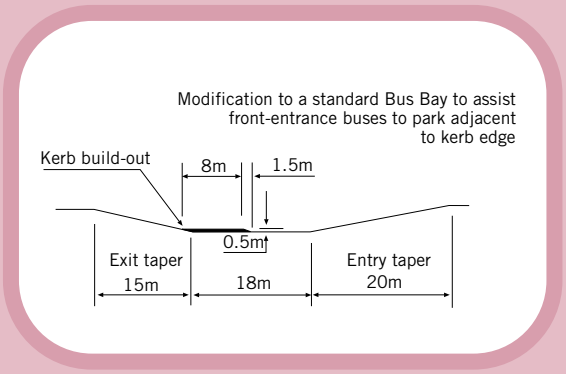


Diagram 15.2 Half-width bus boarder layout

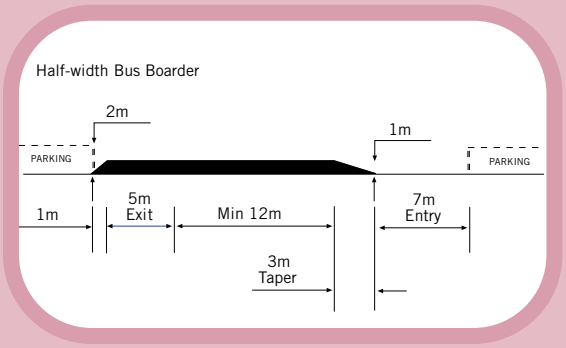
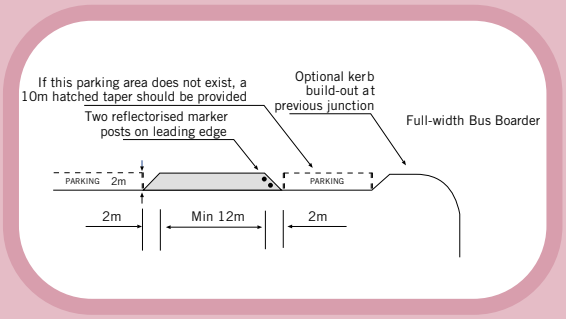
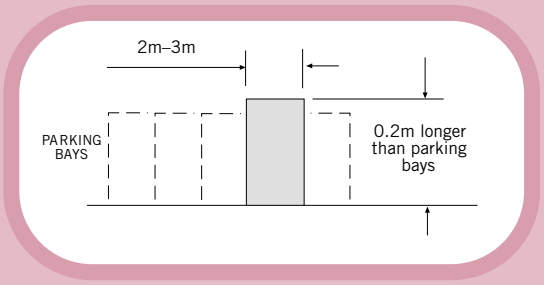


Diagram 15.3 Full width bus boarder layout



where kerbside parking space is at a premium or where it occurs with vehicles either parked at an angle or at right angles to the kerb. Bus promontories give passengers a protected route through the parked vehicles to the raised kerb. However, the disadvantage is that passenger waiting facilities cannot be provided immediately adjacent to the bus stop. They can generally be used only with single-door, front entrance buses.

Diagram 15.4 Bus promontory



Articulated Buses & Coaches

These vehicles have very specific stop requirements. Accordingly, bus service providers should be consulted on the proposed fleet in advance of any bus stop facilities being finalised.

Poor bus stop layout

Lighting

Each bus stop should be immediately adjacent to high quality street lighting such as high-pressure sodium lamps. This gives a better feeling of security to waiting passengers during the hours of darkness. It can also assist safe boarding and alighting for passengers. Where bus boarders or promontories are provided, reflective bollards and lighting will be required to highlight the kerb extension into the carriageway.

Passenger shelters

High quality shelters are essential, as the majority of journeys will start with passengers having to wait at the roadside for a period. Shelters do not have to be fully enclosed (in fact certain designs can be perceived as a potential security risk) but, where possible, should be sited so as to provide protection from the prevailing wind and rain. The side of the shelter on the bus approach side should provide good visibility of buses. Seats or a form of "resting rail" should be provided for passengers to lean on. They should be constructed from materials that are vandal resistant and can be cleaned easily. For security reasons shelters should be illuminated and should be located in highly visible areas well away from dense planting. The structure should stand clear of the ground to avoid drainage problems and to ease cleaning. High capacity litterbins should be provided as people often eat, drink and smoke, while waiting for their bus.

Street furniture

The street furniture around bus stops must be carefully considered. Where footway widths are restricted it is easy for them to become cluttered. This can cause problems for wheelchair and pushchair users and people with visual impairment. For example it is not unusual for the central entry/exit on a bus to be rendered unusable due to the poor siting of a passenger shelter or adjacent pedestrian guardrailing. Careful design could lead to the integration of the many essential elements that should be at each stop. For example lighting, service information, sitting/resting facilities, litterbins, even public telephones could be incorporated into one passenger shelter structure.

Good bus stop layout

15.6 Passenger information

Basic requirements

One of the main barriers to new customers using a bus service is the absence of information concerning bus routes and times. Providing information on these matters in a clear and easy to understand manner will help to overcome this problem. The minimum amount of passenger information that is required at all bus stops is the availability of a clear, easily understood, current timetable for all the routes serving the location. This should be produced and displayed in such a way that it is as damage and weather resistant as possible and is readable during the hours of darkness. Each bus stop should have its location (and a name) clearly displayed to enable passengers to reference it to the timetable information provided. This will assist tourists and visitors in identifying their return destination.

As well as service information, there should be details of the bus operators with contact telephone numbers for emergencies and a timetable information line for general enquiries. A simplified fare table is also useful, especially at a location where tourists/visitors are expected, or an "Exact Fare Only" operating regime exists. The greater the provision of such information the shorter the vehicle waiting time will be at each stop helping to speed-up the service as well as reducing delay to other traffic in the vicinity of the stop.

Real time information at a bus stop

Real time passenger information

With recent advances in technology it is now possible and more affordable to provide 'live' or 'real time' information on the current position of buses on individual routes. This helps to eliminate passengers concerns about whether they have missed a bus and when the next one will arrive. The costs of installation of this equipment means that it is likely to be used only at principal bus stops on main bus routes such as QBCs.

At present this technology is still developing (see Section H, Chapter 19) and a variety of systems are in use often as part of demonstration schemes. In future years, the costs will reduce and the on-street hardware will become more robust and vandal resistant.

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