Public transport by bus

Introduction

This topic focuses on bus-based public transport. It is intended to provide information for those planning and developing bus-based public transport systems. The Public Transport section examines the broader and high-level considerations for public transport.

Objective

Public transport should be designed to provide a public form of transport that complements walking, cycling and private car use. In some areas, public transport will have the objective of bringing about mode shift by offering a more convenient, cheaper, faster or more attractive alternative to the private car. This will have a positive impact upon the road network, enabling cost savings to be made due to reduced congestion and journey times.
## Benefits of bus public transport

| **Accessibility** | Buses enable individuals who do not have access to a car to reach basic community activities and services such as work, education, health care, welfare and shopping. It is important that the public transport network provides accessibility to all, and this means taking into account the needs of mobility-impaired people. |
| **Efficient allocation of space** | Buses move high numbers of people in an efficient way. The road space required for a bus carrying fifty people is only a fraction of that needed by private vehicles carrying the same number of people. |
| **Support land-use policy** | Well-planned bus networks can support the land-use policies of a region or town. Higher densities and intensification can be supported by providing high-quality public transport to them. |
| **Environment** | Increasing bus patronage can result in fewer car journeys. This means less stress on the environment in relation to noise, air pollution and greenhouse gases. |
| **Safety** | Moving large volumes of people by bus is safer than moving individuals in private cars, in terms of both personal risk and the danger posed to other road users. |
| **Multimodal** | Public transport by bus represents an option for moving people over short, medium and longer distances. Buses will often form the main and largest link in a multimodal chain, with walking, cycling or Park & Ride at either end. |
| **Flexibility** | A flexible bus service can offer varied bus sizes, frequencies and routes. This flexibility provides the benefit of meeting new needs and being able to respond to additional capacity demands. |
| **Low-cost** | Bus based public transport is cheaper than a rail based system as there is a lower initial capital cost since buses are able to use the existing road network. Additionally, buses can be easily moved to other locations if demand patterns change. |
| **Congestion reduction** | Passengers sharing a bus are reducing the number of vehicles on the road and lowering traffic congestion levels. When buses use dedicated bus lanes, traffic volumes in the general vehicle lanes are further reduced as travellers change mode of transport. |
| **Health** | Public transport by bus encourages walking and promotes community cohesion. |
Strategic interventions for bus-based public transport

**Busways**

Busways are a segregated section of carriageway for bus use only.

**Advantages**

- Excellent speed and removal of traffic delays lead to service reliability.
- The level of prioritisation is similar to that of rail and gives effect to bus rapid transit. Studies have found that bus rapid transit has the potential to generate high ridership growth.
- Although similar to rail in form, a busway does not restrict buses to that corridor, (i.e. they can still penetrate into the community).

**Disadvantages**

- Busways require a large area of land.
- They have high costs compared with other bus initiatives due to the infrastructure required.
- If single track, a vehicle breakdown can cause long delays.
Strategic interventions for bus-based public transport contd

**Bus priority lanes**

Bus priority lanes operate where either an additional traffic lane is provided and allocated for the use of buses only or existing carriageway space is reallocated from general traffic use to that of buses only.

**Advantages**

- Speed and reliability are improved along the route.
- Road capacity is used efficiently.
- Operation is flexible, including peak hour operation only, contra-flow, tidal flow, working hours only, bus only, buses and freight only or various combinations.

**Disadvantages**

- Enforcement is required.
- Parked cars or non-priority traffic in the lanes reduce efficiency.
- There is a perceived loss of trade by frontage retailers.
Strategic interventions for bus-based public transport contd

Queue management systems

A number of queue management options can be applied. All of these options provide advantage to buses over other traffic, improving reliability and speed.

Queue relocation moves traffic queues to an upstream section with sufficient capacity to contain the queues and thus prevent downstream blocking.
Strategic interventions for bus-based public transport contd

Bus stop infrastructure

The NZ Transport Agency has developed best practice Guidelines for public transport infrastructure including bus stop infrastructure.

Bus stop build-out and half build-out

Bus build-outs are areas of footway built out into the carriageway. They are designed to avoid the need for the bus to pull off the carriageway. Half build-outs have many of the benefits of a full border but still allow other vehicles to pass while the bus is stopped.

Advantages

- Bus build-outs save time for the bus (by reducing difficulty in re-entering a busy carriageway).
- They improve passenger access to the bus as the bus can position itself parallel to kerb.
- They increase the waiting area.
- They reduce the impact of surrounding parking on bus manoeuvres.
- They reduce the loss of parking associated with quality bus stop design.
- They act as a traffic calming feature.

Disadvantages

- They can hold up traffic on the carriageway.
Strategic interventions for bus-based public transport contd

Bus stop clearway and bus box

Bus stop clearways and bus boxes are carriageway markings and traffic restrictions that operate to ensure the bus stop remains free of parking so the bus service is not disrupted by inconsiderate parking.

Advantages
- Bus boxes and clearways keep the bus stop clear for bus use.
- They improve the reliability of the bus service.

Disadvantages
- The bus’s position in traffic can be lost.
Strategic interventions for bus-based public transport contd

**Bus rapid transit (BRT)**

BRT is a rapid form of public transport that can combine the quality of rail transport with the flexibility of buses (Thomas, 2001).

In many ways, BRT is closer to rail-based systems than standard bus networks. The main difference between BRT and rail-type systems is the use of buses instead of rail cars, which reduces the vehicle acquisition cost.

**Features**

- Physical infrastructure – segregated or bus-only roadways, enhanced stations, level access between platform and vehicles.
- Operations – frequent and rapid service, ample capacity, pre-boarding ticket purchase.
- Structure – access to system only by pre-arranged agreements.
- Technology – low emission vehicles, low noise, ITS utilisation (real-time information).
- Marketing and customer service – distinctive marketing and branding, ease of access between services and inter-modes, with clear route maps, signage, etc.

Many BRT systems such as South-East Busway, Brisbane and Northern Busway, Auckland, are based on multiple bus routes sharing a common dedicated busway to bypass congestion, especially to/from a CBD. In this form, the BRT system passenger capacity is limited by the vehicle capacity and vehicle headway of the busway.

Bus stops (or stations) increase the headway and limit a BRT lane to about 10,000 passengers per hour, even with passing lanes in the stations. At its busiest point, Brisbane's South-East Busway currently carries in excess of 15,000 commuters per hour per direction, and is not yet considered at capacity.

For further information see *The BRT Standard 2013*
Quality considerations for bus-based public transport

<table>
<thead>
<tr>
<th>Speed and regularity</th>
<th>A mostly segregated system supported by features such as right of way and priority at crossing and signals will remove the impacts of congestion. Measures to reduce dwell time at stops (wide doors, off-vehicle ticketing, gapless boarding) increase speed and regularity.</th>
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</thead>
<tbody>
<tr>
<td>Reliability</td>
<td>Congestion-free transport is regular and hence reliable. This further allows high-frequency timetables at peak hours to be designed, obtaining better flows. Where a mixed approach is adopted (segregated and mixed with traffic), the effects of congestion must be considered in terms of speed and reliability.</td>
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<td>Comfort, accessibility and ease of use</td>
<td>Quality vehicles, good suspension and well-maintained roads can improve comfort and the ride quality. However, this is one area in which track-based systems can offer an advantage. Low floor vehicles combined with gapless boarding points offer better accessibility for all categories of passenger. Pleasant and well-designed stations and stops combined with dynamic passenger information also contribute to customer satisfaction.</td>
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<td>Safety</td>
<td>Feelings of personal insecurity for passengers can be reduced by careful design of stations and stops and other appropriate measures by operators and authorities.</td>
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<td>Environment-friendly</td>
<td>The type of vehicle chosen and energy source will determine the level of emissions at the location of operation. The emissions from a well-patronised bus are lower per person than from a single occupancy car. Diesel engines, while improving, do create emissions, especially during acceleration.</td>
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<tr>
<td>Adaptability</td>
<td>A bus-based system is particularly adaptable. Using the existing street system, buses can penetrate the local community and urban environment to a degree which a track-based-system cannot. As land-use patterns change, bus routes, frequencies and service levels can adapt to support the shifting population.</td>
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<tr>
<td>Positive image for the city</td>
<td>A well-supported quality bus system indicates that a city or region is serious about tackling its transportation issues.</td>
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<td>Impact on urban life</td>
<td>The introduction of a quality bus mass transit line or system provides transportation choice for the population. As well as increasing accessibility and equity, the increased person capacity of the transportation system will allow a city to grow while not depending on road building. A very high-quality system, such as the Northern Busway in Auckland, can encourage compact and dense development.</td>
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<td>Phase development</td>
<td>A busway or segregated bus-based system can be installed as a first stage. As demand increases and land-use patterns alter in recognition of increased accessibility, the system can be expanded or indeed 'upgraded' to a light rail system.</td>
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</tbody>
</table>
Case study – Route 36, UK

**Introduction**

Route 36 is a bus route between the affluent town of Harrogate and the major city of Leeds in northern England.

In 2004, the operator introduced 12 very high specification buses to the route with great success in relation to patronage (50 percent increases) and general appeal of public transport.

The case study shows the value of quality in relation to buses, and the importance of strong branding and supporting marketing and information.

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**Quality of service aspects**

The service offers very high quality buses, with features including high-backed leather seats on the upper deck, arm rests, good quality high-backed fabric seats on the lower deck and ample leg room.
### Quality of service aspects continued

Other features include:
- tinted windows to absorb glare
- improved interior lighting
- upper and lower deck CCTV cameras, and recording equipment, for added security
- upper and lower deck screens displaying next stop information
- buggy-friendly, with a designated area to accommodate buggies
- low entrances that kneel to kerb height for easy access
- designated area for wheelchairs.

### Other aspects
- Very modern branding
- Web support for information
- Bus times sent to phones
- 10-minute frequency at peak and 20 inter-peak and Saturdays
## Case study – Northern Busway Auckland

### Introduction

The segregated busway forms the ‘central spine’ of the North Shore City’s Bus Rapid Transit (BRT) system. There were many organisations involved and it took time to develop. The outcome is testament to the success of the coordinated approach.

The combination of high-quality facilities and train-like priority makes the service very attractive to users.

### Bus stations: high-quality waiting environment

- Bus stations along the route are of very high quality and designed as modern train stations with landscaping.
- Inside waiting areas have seating and other facilities.
- Two are designed as Park & Ride sites.
- Good lighting improves surveillance.
- Good information is available (maps, timetables and real-time information)
Case study – Northern Busway Auckland continued

Details

Cost: $300 million
Length: 6.2km dedicated two-way roadway for buses, plus a single 2.5km lane to the harbour bridge.

Supporting measures

The busway and its stations are being complemented by:

- upgraded suburban bus stations
- upgraded and improved shelters
- bus priority lanes on local streets
- new bus routes
- real-time information signs
- improved timetable information
- easy access by foot and bike to the stations (cycle parking provided).
Case study – bus corridor improvements, Bradford, UK

Introduction
Bradford is a city in the north of England. The Manchester Road in Bradford is the main route south from the city centre to a motorway and the towns of Brighouse and Huddersfield. Before the guided bus scheme, there was no priority for buses on the Bradford section of this corridor. Traffic congestion meant long journey times and poor reliability.

The project started as a public–private sector partnership to develop a guided bus scheme. The proposals were refined so the final scheme consisted of a mix of guided busway, with-flow bus lanes and priority at signal controlled junctions. The project was completed in February 2002.

Problem
Before the guided busway opened, congestion delayed buses in both directions during peak hours. Timetables included an additional 10 minutes to allow for delays. Congestion on Manchester Road affected the reliability of cross-city services on the Shipley and Leeds corridors.

Surveys in 1998/99 highlighted reliability and punctuality as bus users’ greatest concerns. Motorists also identified reliability and punctuality of buses as the most important factor influencing their willingness to switch to bus. The city council was concerned about the way that the dual carriageway cut South Bradford in two for pedestrians, forcing them to rely on footbridges and subways.

Scheme features
- There is 2.3km of guided busway, using reallocated central reservation from dual carriageway.
- Conventional near-side with-flow bus lanes were introduced for 1.1km of the route.
- In some places, the number of lanes available for general traffic was cut from three to two in each direction. The objective was to provide two lanes for through-traffic over the full length of the scheme. Three lanes were retained at junctions to cater for turning traffic.
- The speed limit was also lowered from 40 to 30mph.
- Signal-controlled pedestrian crossings at 11 locations serve bus stops on the central guided busway and at kerbside bus stops.
- Kerb height was raised at stops on Manchester Road and elsewhere along the corridor to give close and level boarding.
- New bus shelters were provided along the road.
- New, accessible, low sulphur emission buses were provided.
- Drivers were trained in customer care and a ‘customer promise’ was introduced to guarantee service standards.
- Day-time frequency was increased to 22 buses per hour.

Results
- Peak traffic using Manchester Road fell: inbound traffic fell by 14 percent in the morning peak and 13 percent in the evening peak.
- There were some small reductions in journey times (1 to 2 minutes per bus).
- Bus reliability improved.
- Patronage increased by 7–10 percent.
## Complementary measures

<table>
<thead>
<tr>
<th>Rail-based public transport</th>
<th>Rail based public transport is a compliment to bus based public transport. Typically rail provides a higher capacity service than buses</th>
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<tbody>
<tr>
<td>Cycling</td>
<td>Cycling includes the development of cycling and bus linkages, where a public transport user will also use a bicycle as part of a journey.</td>
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<td>Walking</td>
<td>All bus users are also pedestrians. Measures to improve bus services should also consider the pedestrian environment in the bus catchment.</td>
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<td>Accessibility</td>
<td>Bus based public transport is a key resource when improving the accessibility of an area. Buses offer more route flexibility and new routes can be established at relatively low cost to improve access.</td>
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<td>Urban design</td>
<td>The design of bus stations, bus stops and busways provides an opportunity for quality urban design to have a positive impact on urban spaces.</td>
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<td>Priority lanes</td>
<td>Priority lanes for buses significantly improve the reliability and attractiveness of bus services.</td>
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<td>Travel planning</td>
<td>A travel plan will consider public transport options and in this way compliments bus and other public transport measures.</td>
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</table>

## Other policies this may address

<table>
<thead>
<tr>
<th>Congestion reduction</th>
<th>Increasing bus patronage is a positive way to reduce congestion.</th>
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<tbody>
<tr>
<td>Multi-modal transport</td>
<td>Bus based public transport services can provide one option in a multi-modal transport network.</td>
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<tr>
<td>Economic efficiency</td>
<td>Moving large numbers of people by public transport improves economic efficiency. This occurs as congestion is reduced and productivity increases.</td>
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</table>
## Further information

### Network design and procurement


### Demand for public transport


### Bus stop design


### Personal security