6. Implementing Guided Bus
1 Introduction

The Report

1.1 This is the sixth in a series of documents relating to the proposed London Guided Busway Scheme and focuses on the legislative context for implementing kerb guided bus projects.

1.2 The full list of documents is as follows:

1. Executive Summary
2. The Scheme
3. Consultation Report
4. Guided Bus Explained
5. Guided Bus in Action
6. Implementing Guided Bus
7. Choosing Transit Mode

Structure of this report

1.3 This report continues in Chapter 2 with an explanation of the legislative context and the powers available for implementation. Chapter 3 considers good practice in implementing a kerb guided bus scheme.
2 The legislative context

Overview

2.1 In the UK guided bus schemes can be implemented in two ways – by using existing traffic regulation powers available to local highway authorities or through the process of obtaining an Order under the Transport and Works Act 1992.

2.2 Many of the existing operational guided busways in the United Kingdom have been authorised under powers derived from the Highways Act 1981 and constructed on highway land or on land obtained by means of planning agreements. Most of the existing guided busways have been built along or beside roads where there were already bus services that could be diverted on to the busway, giving the public transport authority no control over service planning or quality.

2.3 The Cambridgeshire Busway, the Luton-Dunstable Translink scheme and the Leigh Busway project are different in that the busways have been or will be built under powers conferred by a Transport and Works Act Order; physically segregated from the highway network; and owned and maintained by the highway authority. In these cases, the public transport authority can exercise control over matters including service pattern, level of service, availability of multi-operator ticketing, quality of service and age and quality of buses.

2.4 The Cambridgeshire Guided Busway was the first such scheme to be built in the UK using powers obtained through the Transport and Works Act Order-making process. Powers for the guided bus scheme in Edinburgh were provided by the City of Edinburgh (Guided Busways) Order Confirmation Act 1998 which confirmed a Provisional Order made under the Private Legislation Procedure (Scotland) Act 1936. All of the other operational guided busways in the UK were implemented under existing highways and traffic regulation powers with the guideways built as highway and access restricted to guided buses using traffic regulation powers.

2.5 The key issue is defining the circumstances in which it is necessary to make use of the lengthy and more onerous Transport and Works Act Order process. The 1992 Act specifies that railway projects, tramway schemes and trolley vehicle systems require authorisation using the Transport and Works Act process. The Act also gives the Secretary of State for Transport the power to make regulations extending the requirement for authorisation by means of a Transport and Works Act Order to ‘other guided transport systems’.

2.6 Part of the definitions of railways and tramways given in the 1992 Act describes them as systems “employing parallel rails” to “provide support and guidance for vehicles carried on flanged wheels”. This clearly excludes the GLT and Translohr rail guided bus systems as they rely on a single rail for guidance (descriptions of GLT and Translohr are provided in our ‘Guided Bus in Action’ report).

2.7 The definition of trolley vehicle systems in the 1992 Act refers to vehicles operating “under electric power transmitted to them by overhead wires”. This definition includes all trolleybus systems – although Transport and Works Act powers are not necessary for those parts or routes where dual-powered buses operate under diesel or battery power and there is no overhead line equipment present. This definition also applies to GLT and Translohr as both systems rely on overhead power supply equipment.
2.8 A definition of ‘other guided transport systems’ is provided by the Railways and Other Guided Transport Systems (Safety) Regulations 2006. It states that ‘guided transport’ means “a system of transport, used wholly or mainly for the carriage of passengers, employing vehicles which for some or all of the time when they are in operation are guided by means of (a) rails, beams, slots, guides or other apparatus, structures or devices which are fixed and not part of the vehicle; or (b) a guidance system which is automatic”.

Highway and Traffic Regulation Powers

Highway Powers

2.9 The use of existing highways and traffic regulation powers offers the speediest and most simple way of implementing kerb guided bus schemes where existing highway land is to be used to accommodate the infrastructure and no land is required from third parties. The definition of ‘highway land’ covers all of the land in the ownership of the local highway authority on both sides of the carriageway and can include land to the rear of the footway on both sides of the road.

2.10 The local highway authority can use its existing powers to construct new guided bus lanes in the central reserve of a dual carriageway; by road widening within the confines of land owned by the highway authority; by the re-allocation of carriageway space to enable the construction of a guided bus lane; or by making use of land beside an existing carriageway or footway that is in the ownership of the highway authority.

2.11 Local highway authorities can also use their existing range of powers to build new lengths of highway to be dedicated for the exclusive use of guided bus. The construction of a new road requires the grant of planning consent under Town and Country Planning legislation. This process is summarised below in general terms:

- A copy of the highway authority’s resolution to seek planning permission for a new highway or length of highway and the associated plans are placed in the register of planning applications for the prescribed period.
- If the scheme is a departure from the adopted development plan, the application must be sent to the Secretary of State for Transport.
- The application is advertised in local newspapers and notice must be served on statutory consultees and any individuals with a material interest (e.g. owners/tenants of any property affected).
- After an objection period of the specified length, the highway authority must consider any objections received before resolving to implement the proposed scheme at which point planning permission is deemed to have been granted.
- If the Secretary of State decides to ‘call in’ the application, the proposed scheme will be considered at a public inquiry before the Secretary of State decides whether to grant planning consent or to refuse permission.

2.12 There is a parallel process that must be followed in making an Order for construction of a new highway or length of highway and the compulsory purchase of land if required to enable the proposed scheme to proceed. The process will involve a Public Inquiry leading to consideration of
an Inspector’s report and a decision by the Secretary of State if objections to the making of the proposed Order are not resolved and withdrawn. Thereafter the process allows the option of a challenge in the high Court before procedures for the compulsory purchase of land can commence.

**Traffic Regulation Powers**

2.13 Traffic Regulation Orders (TROs) can be used to restrict the use of the guided busway to guided buses. TROs can also be used for the implementation of all of the associated measures to regulate the movement of other categories of road traffic including bans on turning movements and to authorise the implementation of any necessary waiting or loading restrictions or prohibitions.

2.14 The use of traffic regulation powers by local authorities is subject to a set process that includes:

- consultation with statutory consultees (i.e. the police, the Freight Transport Association and the road haulage association in the case of TROs);
- ensuring that draft Orders and the right of objection are publicised adequately through advertisement in local newspapers, roadside notices and information provided directly to owners or tenants of frontage properties;
- the right of objection within a specified period of publication of the notice in local newspapers; and
- the responsibility to give due consideration to objections and, in certain circumstances, to hold a public inquiry if objections are received.

**Using Existing Powers Available to Local Authorities**

2.15 The majority of guided bus schemes in the UK take the form of combinations of sections of guided busway or conventional bus lanes designed to speed buses past traffic queues with buses running in general traffic lanes at other locations where traffic is free-flowing at peak times. This is the approach that has been adopted in Leeds, Bradford and Crawley (see our ‘Guided Bus in Action’ report).

2.16 Highway authorities can use their powers to restrict access to bus guideways to vehicles fitted with guide wheels in addition to the normal powers to restrict access to bus lanes to specified categories of vehicles (e.g. buses, bicycles, taxis).

**Powers under the Transport and Works Act 1992**

2.17 The Cambridgeshire guided bus scheme was the first to be authorised under the Transport and Works Act Order-making process. The process is more complex and requires a longer time period than the approach of using highway and traffic regulation powers, but it does have a number of benefits where a proposed scheme includes a substantial length of fully segregated alignment.

2.18 Cambridgeshire County Council chose this approach for a number of reasons:

- It allowed powers to be obtained to construct, operate and maintain a segregated guided busway, and to authorise the acquisition of land and rights in land by agreement of through compulsory purchase. It also provided powers for the temporary possession of land for purposes related to the construction of the busway.
• It conferred powers for the construction of new streets and paths and for the stopping up or diversion of existing paths and streets. It also provided for the temporary stopping up of streets and paths with the agreement of the appropriate street authority.

• It enabled the guided busway and other roadways forming part of the scheme to be designated as ‘protected streets’ under the New Roads and Street Works Act 1991 for the purpose of restricting the placing of apparatus in, on or over them.

• It made provision for vehicles on the guided busway to cross other streets on the level.

• It enabled the temporary closure of the Great Ouse waterway within the limits of the works to enable the construction of the busway.

• It modified certain items of planning legislation (e.g. relating to the treatment of tree preservation orders).

• It enabled the County Council to operate the busway for the carriage of passengers and goods with exclusive rights relating to the operation of the busway and the establishment of a criminal offence for its unlawful use.

• It allowed the establishment of a quality partnership scheme to include specification of the pattern, frequency and timing of services using the busway enabling the County Council to operate an open access system under which operators must comply with quality thresholds covering matters including low emissions, low floors and passenger comfort (e.g. air conditioning, double glazing).

• It made trespass on the guided busway and associated land of the applicant a criminal offence. This includes the operation of an unauthorised vehicle on the busway.

• It repealed a number of local enactments relating to the railways that formerly occupied the alignment used by the busway.

• It contained a number of Traffic Regulation Orders covering matters such as prohibition of waiting and loading on station and park and ride car park access roads; prohibition of driving except buses, taxis and cyclists; provision of driving except for authorised vehicles; prohibition of turning movements; and provisions relating to off-street parking places covering park and ride car parks.

2.19 The Cambridge example demonstrates that there is a real need to follow the Transport and Works Act order-making procedure where a former railway alignment is to be used for a guided busway and where there is a wish to secure control over access to the busway and of the quality and frequency of service to be provided. It is also important to point out that, on the sections of route where the services using the busway run on-street, Cambridgeshire County Council relied on its powers as highway authority to implement highway improvements and bus priority and other traffic management measures.

The role of the Office of Rail Regulation

2.20 HM Railway Inspectorate (HMRI), now the Safety Directorate of the Office of Rail Regulation (ORR), had powers relating to the safety and operation of guided bus systems under legislation relating to Railways and Other Guided Transport Systems – also known as ROGS. When HMRI was transferred from the Health and Safety Inspectorate (HSE) to ORR in 2006, guided bus and
trolleybus systems were removed from the scope of HMRI enforcement. This is made clear in a guide to ROGS published by the Office of Rail Regulation in December 2013.

2.21 Responsibility for health and safety on guided bus and trolleybus systems remained with HSE relying on powers under the Health and Safety at Work etc Act 1974 and supporting Regulations. These impose general duties to manage safety, assess risks, co-operate with other duty holders, make sure staff are trained and have the necessary skills, knowledge and experience.

2.22 As part of their preparations for applying for Transport and Works Act Order, Cambridgeshire County Council prepared a safety procedures case and an operating regime covering a variety of matters including access control; speed of operation on the guideway, across junctions and at public right of way crossings; traffic signal maintenance plans; safety and emergency procedures and access; safety at stopping places; recovery of vehicles after breakdowns; driving standards; and production of an operating manual.

**Can Guided Bus and Heavy Rail Share a Common Track?**

2.23 The idea of track sharing by guided bus and heavy rail is not a part of the proposed London Guided Busway scheme. However, although of academic interest, it is a question that has been asked in the past.

2.24 If the gauge of a standard gauge railway (1435mm) is compared with the width of a kerb guided busway (2600mm), it does seem feasible that they could be fitted into a common single track. Figure 2.11 illustrates how the two technologies could be combined.

**Figure 2.1 Railway Track and Kerb Guided Busway**

![Diagram](source: Author)
In considering physical feasibility, there are several issues that need to be considered:

- The railway track would have to be inset in a flush concrete surface in order to provide the running track required by buses and coaches.
- Modern standard gauge heavy rail multiple unit rolling stock typically has bodies that are around 23 metres in length and a little wider than bus and coach bodies.
- Modern rail rolling stock typically has under-floor engines and a substantial amount of equipment suspended from the chassis. Each class of rolling stock is different.
- Busway guide kerbs are 180mm in height and guideway width does not vary from 2.6 metres on the type of broad, sweeping curves that are associated with railways.

The key issue is whether the equipment that is slung under a train chassis would maintain clearance from the 180mm guided busway kerb. Visual inspection of different types of rail rolling stock suggests that some but not all would have sufficient clearance on straight track. On curved track the swept path of overhanging under-slung equipment on rail rolling stock could be incompatible with the existence of a guide kerb on the inside of the kerb.

There is also the issue that guided bus and rail traffic would certainly have to be allocated separate time slots for operation in order to ensure adequate safety provision. The approach is therefore not likely to be suitable for sharing of track by bus/coach services and a rail passenger service. The application is more likely to be track sharing by night operation of occasional rail freight and daytime/evening operation of bus/coach services.
3 Delivering successful Bus Rapid Transit

The requirements

3.1 A successful BRT route needs to emulate all of the characteristics of rail-based rapid transit in order to be competitive with the private car – particularly speed, comfort and image. The key characteristics that must be delivered to ensure success, provided that the route is in the right place and there is a sufficient market for the service, are as follows:

- A fast overall journey time that is competitive with the car.
- A frequent service that minimises wait time at bus stops.
- A convenient route that minimises walk distances at both trip ends.
- A comfortable journey – both waiting for the bus and on the bus.
- A fare that compares favourably with the marginal costs of making the journey by car (i.e. fuel plus parking).
- An image that is as close to rail-based rapid transit as is reasonably possible.

3.2 Every trip made by public transport can be split into four stages (or more if interchange between routes or modes is involved) - walk, cycle or drive from trip origin to boarding station/stop; wait time at the station/stop; travel time on the public transport vehicle; and walk time to the final destination. For a BRT solution to be truly attractive, each of these four stages to a journey need to be addressed:

- Trip origin to point of boarding: The boarding point should be as close to the home trip end as possible and easily accessible by safe and fully accessible walking routes. Stops/stations at selected locations should offer park and ride opportunities to widen catchment areas complemented by secure cycle parking.
- Wait time at stop/station: The boarding point should have good weather protection, seating and real time information to give confidence about the arrival of the next bus. It should also be clean, well lit, highly visible and safe
- In vehicle travel time: Bus dwell time at stops/stations should be minimised by the use of pre-paid smartcards and off-bus cash ticket sales. Bus journey time should be minimised by the provision of a highly segregated route with priority over other traffic and by careful consideration of stop/station spacing and the use of express services on longer distance routes.
- Walking to final destination: As at the start of the journey, the alighting stop/station should be as close to the final destination as possible and be connected to it by a safe and fully accessible walking route.

3.3 In order to maximise convenience to public transport users at both ends of their trips, walk distance to boarding and alighting stops/stations must be minimised. This implies a need for a public transport system that directly serves many trip origins and many trip destinations. A transit system that relies on expensive fixed infrastructure for its full route length lacks the flexibility needed to provide this level of penetration of residential areas, employment zones and central business and retail districts. The ideal solution is a transit system that provides a ‘many-to-many’ type of service as shown conceptually on one side of Figure 3.1.
3.4 Figure 6.1 shows two different basic transit concepts and a number of variants. The diagram on the left side shows how an area might be served by a transit system with fixed route infrastructure (e.g. suburban rail, rail-based mass transit, light rail, rail-guided bus). The core transit system provides the ‘line haul’ function on a radial route, but relies on interchange to deliver services to catchment areas at both trip ends – passengers using feeder services from suburban areas interchange with the trunk service at outer and intermediate stations/stops and then rely on ‘distributor’ services to gain access to their destinations in the central area if they are beyond walk distance.

3.5 The diagram on the right side shows the benefits of the extra flexibility conferred by bus-based transit systems. The need to interchange mostly disappears together with the associated time and fare penalties. Bus routes can serve a wide outer suburban catchment area before converging on the outer end of the core radial priority route to the city’s central area. The multiplicity of services combine to provide a high frequency on the trunk section of route before dispersing to different parts of the city centre at the inner end of the priority route. The need for feeder services is dispensed with.
as bus routes can join and leave the priority route at any point where there is an interface with the local highway network. No more than one interchange would be necessary for anyone who does not have a direct service from the home area to a particular part of the city centre.

**When to choose guided bus**

3.6 A BRT system is dependent upon a high level of priority over other categories of traffic on the trunk or line haul section of route in order to deliver a fast journey time and a reliable and punctual service. The priority on the line haul section of route can be delivered in one of three ways – by the application of conventional bus priority measures on a whole route basis; by the use of a segregated busway; or by the use of a guided busway. Each of these potential solutions may be appropriate in different circumstances.

3.7 The whole route bus priority approach relies on the provision of bus lanes, bus detection at traffic signals and traffic management techniques to deliver free-flowing traffic on sections of route where there is no scope for the reallocation of road space to buses. The weaknesses of this approach are that delays at traffic signals are minimised and not necessarily eliminated; the speed and journey times of buses are governed by the street speed limit; capacity is limited; bus/bus overtaking is difficult; and footways may not have enough space to provide high quality passenger facilities at stops.

3.8 The ability to construct a new busway is limited by the availability of an existing suitable alignment or the ability to reallocate sufficient road space to provide the necessary carriageway width. A conventional two-way busway has the same dimensions as a two-way single carriageway road – a carriageway of 7.3 metres plus strips on both sides of one metre or more. The space requirement can increase by up to five metres to accommodate platforms and shelters at stopping places.

3.9 A decision to adopt kerb guided bus technology can reduce the space needed to provide a priority route for buses compared with the land take needed for both a with flow bus lane and a conventional busway.

3.10 The absolute minimum width for an effective with-flow bus lane is 3.5 metres assuming that use is not shared with cyclists. Guidance suggests that the ideal width for a bus lane is around four metres. In comparison, a single lane guided busway of the type implemented in Leeds and Bradford has a minimum width of 3.1 metres (i.e. 2.6m carriageway plus 0.5 metres reserve to separate the bus from an adjacent traffic lane) if an existing kerb line can be utilised for the installation of one of the guide kerbs.

3.11 A two-way guided busway has an absolute minimum width of 6.3m (see Figure 2.3) although slightly more generous provision is desirable to give refuge strips on both sides of the carriageway of at least one metre in width – taking the overall width needed to 7.7 metres. A guided busway can be fitted easily within a disused double track railway alignment without the need to undertake any reconstruction of over-bridges if only single-deck buses are to be used. In the same circumstances, a conventional busway would require much more substantial engineering works to enable utilisation of a disused double track railway alignment.

3.12 The ability to fit a guided busway along a relatively narrow corridor is not the only positive attribute of kerb guided bus. It combines the best features of a conventional bus-based rapid transit system with
the good points of a system with fixed route infrastructure – the ‘go almost anywhere’ flexibility of a bus combined with the high level of segregation from congestion and delay that comes with a fixed priority route and the consequent high levels of punctuality and predictability of arrival time at the destination.

3.13 The advantages of a guided bus system are summarised below - some are shared with BRT on conventional busway and some are not:

- An ability to provide a large number of route permutations.
- Penetration of suburban residential areas and city centres on a variety of routes.
- Minimal need for interchange between routes.
- Fast, direct and reliable services on the trunk route.
- The ability to provide a frequent ‘turn up and go’ service.
- Potential for carrying large numbers of passengers particularly if multiple stands are provided at intermediate stations/stops.
- A capability to increase capacity in small increments in line with growth in demand.
- The ability to combine express and stopping services if overtaking facilities are provided at stations/stops.
- The capability of accommodating large numbers of services operating at short headways between buses.
- The possibility of minimal dwell time at stations/stops if pre-paid ticketing and off-bus cash ticket sales can be implemented.

**Good practice in system planning**

3.14 Major investment in any large scale rapid project, whether road or rail based, must be considered as part of an integrated approach to transport and spatial planning. The provision of a high quality transit system must be planned in parallel with demand management policies covering parking supply, parking charges and traffic management in order to create the circumstances in which motorists will consider changing mode to an attractive public transport alternative. New development needs to be oriented towards the rapid transit route and conditions attached to planning consent need to include rigorous control of on-site parking and rigorous application of travel planning techniques to encourage the use of public transport by residents or employees.

3.15 The essential requirement for the delivery of a successful BRT system or a successful guided bus system is the provision of a fast and reliable service. This necessitates consideration of the whole route and not just the segregated, high speed trunk route. The principal risk to reliability and attractiveness of service is at the inner end of the trunk priority route where buses operate on city streets. The need is for a ‘whole route’ approach that addresses the provision of priority routes along city centre streets using conventional techniques – bus lanes, priority at traffic signals, bus gates, buses-only turning movements. Priority exit from and entry to the busway is particularly necessary.
3.16 It is much less likely that traffic congestion will cause problems at the outer end of a busway or on suburban roads used by busway services. Nevertheless, there may be locations where intervention is necessary to ensure that busway services are not delayed by local congestion.

3.17 The Adelaide North East Busway and the Brisbane South East Busway are both designed for high speed running between stops and both have relatively widely separated stopping places enabling buses to run at or near maximum speed for much of the time. Both benefit from alignments through linear parks that enabled their designs to be based on gentle, sweeping curves with few speed restrictions away from stops. The Cambridgeshire Guided Busway achieves the same objective by making use of a former railway alignment that provides the gentle curves and wide spacing of stopping places and highway intersections necessary to deliver a high average speed.

3.18 Busways created on city streets are usually restricted to the speed limit in force on the adjacent general traffic carriageways unless they are physically segregated by barriers that are not penetrable by pedestrians. They also tend to have stops at much more frequent intervals (500m rather than several kilometres apart). All of this results in lower maximum and average speeds.

3.19 A guided busway is, by its very nature, self-enforcing. The fact that the carriageway consists of two strips of concrete separated by an unsurfaced area or a drainage channel creates a ‘roadway’ that cannot be used by cars or other vehicles. There is a need for effective signage to avoid drivers of cars and other vehicles trying to enter the guided busway in error. There is no need for any other form of deterrent to traffic such as using camera surveillance or constructing of physical obstacles to prevent cars entering the busway such as the ‘car traps’ used on the Zuidtangent in the Netherlands.

3.20 One of the objectives in designing a busway or guided busway is to provide adequate capacity. Buses are driven on 'line of sight' with drivers having full control over acceleration, speed and braking. It is possible for a single lane on a busway or guided busway to be used by several buses every minute, separated only by safe braking/stopping distance. The key issue is to ensure that there is adequate capacity at stations/stops by providing several bus boarding and alighting stands and by providing overtaking facilities. A typical layout for such a busway station/stop is shown at Figure 6.2.
3.21 All three bus interchanges on the Adelaide North East Busway follow this basic design principle with buses reverting to manual steering with full driver control from the interchange entrance to the resumption of the guided busway. The same principle is used on many conventional busways around the world, notably Transmilenio in Bogota where it is one of the ways enabling the busway to cater for such a large ridership.

3.22 Quality of service is also vital and applies equally to service delivery, vehicles and infrastructure for use by passengers. In the UK service delivery and vehicle quality can be assured if a guided busway is authorised using the Transport and Works Act procedure rather than powers derived from the Highways Act 1980. This enables the busway to be designated as a private road under the control of the authority promoting the scheme which, in turn, enables access to the guided busway to be limited to operators who have reached an agreement with the promoting authority on the specification of the vehicle to be provided and the standard of service to be delivered in terms of reliability.

3.23 It is often argued that a promotional strategy based on strong branding and the use of distinctive and attractive vehicles is essential to the success of any BRT scheme. The objective is to deliver a product that has a powerful image and is easy to market because it shares many of the attributes of rail rapid transit. A number of attempts have been made to produce buses that look like trams. Examples include the ‘ftr’ introduced in York, Leeds and Swansea by FirstGroup; Civis and Cristalis in France and Phileas in the Netherlands.

3.24 In the UK, conventional buses are used on all of the existing guided bus systems, the most distinctive being the vehicles deployed on the Fastway network in Sussex – that distinctiveness comes from a combination of livery and design. The plan for Cambridgeshire is to use modern double and single deck buses on guided bus services. In Adelaide guided bus services have improved their market share despite the age of the vehicles deployed. On the Zuidtangent in the Netherlands and on Ligne
4 in Nantes, modern single deck buses are used in preference to the more costly options such as the ‘ftr’.

**Key attributes of a successful guided busway project**

To conclude this chapter, there follows a brief summary of the key characteristics that must be delivered in order to ensure the success of a guided busway scheme – many are shared with conventional (unguided) busway schemes:

- A high frequency of service that enables users to ‘turn up and go’ at their convenience.
- Wide route coverage to maximise ‘catchment’ at the inner and outer ends of the busway.
- A fully segregated route with a smooth alignment and wide spacing of stops that enables maximum advantage can be taken of the high speeds that can be achieved in a guided busway.
- An effective priority route between the inner end of the busway and the city centre destination to avoid dissipation of the journey time and reliability benefits of the segregated route.
- A strategy that minimises bus dwell time at stopping places by ensuring that no ticket transactions take place on bus and by providing enough bus doors to allow speedy boarding and alighting.
- A strategy that avoids bus congestion at intermediate stopping places on the busway by providing multiple stands and overtaking facilities – which also allows the operation of ‘stopping’ and ‘express’ services.
- A strong identity delivered through branding and the use of modern buses.