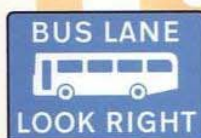


KEEPING BUSES MOVING

A guide to traffic management to assist buses in urban areas



Except
buses



End of
bus lane

LOCAL TRANSPORT NOTE 1/97

KEEPING BUSES MOVING

A GUIDE TO TRAFFIC MANAGEMENT TO ASSIST BUSES IN URBAN AREAS

Local Transport Note 1/97

London: The Stationery Office

After the General Election in June 2001 the responsibilities of the former Department of the Environment, Transport and the Regions (DETR) in this area were transferred to the new Department for Transport, Local Government and the Regions.

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CHAPTER 1

INTRODUCTION

1.1 The Government is committed to an integrated transport policy^[1] which will address the important issues of traffic congestion and environmental pollution, both of which are serious and growing problems. A key part of such an integrated policy will be measures to encourage provision of more sustainable, environmentally friendly, forms of transport, including the development of more attractive public transport services. Buses already play an essential role in the transport systems of our urban areas and, in most cases, will remain the main means by which improved public transport services will be provided.

1.2 Transport policy needs to be integrated at national, regional and local level. The Government looks to local authorities to adopt an integrated approach to transport investment in their areas. They are best placed to identify what is needed to improve local conditions and the package approach to local transport spending reinforces the need to develop transport policy across modes while allowing local authorities to determine their own priorities.

1.3 Local transport strategies will include a range of measures. Although new road construction can sometimes be justified the Government believes that the role for new major roads in urban areas is limited. Other measures are required. Improvements to public transport services, coupled with measures to discourage unnecessary use of private vehicles, are likely to be an important part of a coherent and environmentally sustainable strategy for most urban areas. When it comes to improving public transport, although the Government has recently funded significant investment in the light rail systems in Manchester and Sheffield and construction of Midland Metro and Croydon Tramlink are underway, and in London the Docklands Light Railway has been extended, light rapid transit schemes will not be the right answer in most cases. Their capital cost is high, they are usually economic only in corridors where demand is high and they do not have the flexibility of buses to serve growing and changing suburban areas.

1.4 Bus services, on the other hand, can be more easily adapted to changing demands than fixed-track systems and, with their large carrying capacity, buses can make effective use of limited road space. Buses provide transport for people who for one reason or another are prevented from driving themselves - young, elderly and disabled people, those who are not able to drive a car, and those who do not wish to, either generally or for particular journeys. Buses often provide these people with their only means of access to work, shops, education and social and leisure activities.



Buses play an essential role in the transport systems of our urban areas

1.5 However, if buses are to fulfill their potential in providing an alternative within a sustainable transport system, they must be made more attractive. To do that, it is important that buses are able to operate efficiently. Bus services are, however, particularly susceptible to traffic congestion. Buses are less manoeuvrable than private cars and their routes and schedules cannot be changed at very short notice because they are registered to run on fixed routes (and frequent re-routing would make it difficult for passengers to know when and where buses could be found). They must stop at regular intervals to pick-up and set down passengers. If land is available for segregated busways - such as those introduced in Ipswich and Leeds - buses may be able to bypass congested areas, but in most cases land is not available in intensely developed urban areas and buses are not able to avoid congestion in the way that is sometimes possible for cars and taxis. Delays to buses increase operating costs which may in turn lead to fare increases. Passengers are thus deterred because of the slower and less reliable services and higher fares; some take to their cars and so cause even more congestion.

1.6 For these reasons, it is frequently worthwhile to introduce traffic management measures to assist the movement of buses. These can take the form of measures designed to facilitate the movement of traffic generally along bus routes, and to protect access to bus stops. They may go further and permit buses to use lanes or dedicated tracks, or make movements which are denied to other traffic. Such measures can provide substantial benefits to bus passengers by allowing faster journey times and a more regular and reliable service; they can also help to attract additional passengers by eliminating unnecessary capital and operating costs by reducing the number of buses required to run the service.



Buses are used by: the young, elderly and disabled people, and those without access to cars



Buses are particularly susceptible to traffic congestion

1.7 Measures offering priority for buses are likely to be most successful where, singly or combined with other priority measures, their benefits spread to bus services over a wider area and where they are linked to other improvements such as passenger information systems, improved waiting facilities, more frequent services, and park and ride facilities. In combination, such measures can improve the image and public perception of the service in a way that encourages higher patronage and a transfer from other modes. When linked along a route, priority for buses can contribute towards an overall strategy for dealing with urban congestion, especially if supported by measures such as urban traffic control, new traffic management measures, parking control, and the provision of park and ride services. Giving priority to buses can cause other traffic some additional delay which should be assessed and taken into account in the overall appraisal. However, environmental considerations and overall transport policy objectives for the area in question may thus strengthen the case for providing priority for buses, even at the expense of delay to other vehicles. Bus priority measures can themselves be a component in a demand management strategy by reducing the road space available to cars.

1.8 The current document provides advice and guidance to local authorities wishing to implement measures to assist buses. It updates the advice first issued in Local Transport Note 1/91 issued by the Department of Transport, the Scottish Office and the Welsh Office. The revised guidance is published against the background of policy that seeks greater integration of transport with land use planning, as in Planning Policy Guidance (PPG) notes PPG6^[2] and PPG13^[3], and their Welsh and Scottish equivalents^{[4][5]} as well as emphasising integration between and across modes. The guidance also builds upon the experience gained since the release of LTN 1/91. It includes new advice on innovative techniques such as bus advance areas, bus priority in SCOOT and other signal control systems, camera enforcement of bus lanes, and the importance of decriminalised parking control in assisting the movement of buses. It also updates previous advice, especially in relation to signing and road markings, road humps and traffic calming, the responsibilities of the PTEs, and developments in London; a revised emphasis is placed on the important subject of appraisal, reflecting the changed policy context.

1.9 The Government is clear that improved bus services will continue to have an important part to play in the development of transport strategies aimed at providing attractive alternatives to the use of private cars. It believes that there is considerable scope for providing more priority for buses as a main contributor to improving services. This guidance is being issued to encourage local authorities and bus operators to consider what more can be done in their own areas. As more experience is gained, further advice will be issued to disseminate knowledge of best practice as widely as possible.



Good advertising can help compliance.

CHAPTER 2

THE AGENCIES INVOLVED

2.1 Several different agencies are involved in providing bus services and the infrastructure on which they rely, including measures which provide priority for buses;

bus operators decide what bus services to run commercially and also provide services under contract to local authorities;

traffic commissioners are responsible for the licensing of operators, the registration of bus services and the enforcement of the appropriate standards, and have powers to impose Traffic Regulation Conditions at the request of the local authority;

traffic authorities are responsible for maintaining and managing the local road network, including making Traffic Regulation Orders under the Road Traffic Regulation Act 1984, and for providing traffic control systems, both of which can be used to the benefit of bus services. The Traffic Director for London is responsible for the Priority (Red) Route network in London which aims to provide special help for the efficient movement of buses;

local authorities outside London and the English metropolitan areas are responsible for the procurement and co-ordination of bus services, the operation of concessionary fares schemes, and the provision of infrastructure to assist the smooth running and increased attractiveness of bus services; they also have powers to promote the use of public transport services in their areas. London Boroughs, and those authorities outside London which have taken up the relevant powers, are also responsible for enforcing waiting and loading restrictions on local roads;

passenger transport executives, in the English metropolitan areas outside London, are responsible for the procurement and co-ordination of bus and rail services, the operation of concessionary fares schemes, and the provision of infrastructure to assist the smooth running and increased attractiveness of bus services. They also have powers to promote the use of public transport services in their areas;

the police are responsible for enforcing all traffic control measures that affect moving traffic, and for most waiting and loading restrictions outside London.

Users' groups are also important in advising these agencies about the improvements which are needed to make services more attractive to the travelling public.

The Department of the Environment, Transport and the Regions commissions research (sometimes jointly with the Scottish and Welsh

Offices), produces guidance, and develops the legislative framework and regulations under which all these agencies operate.

Full details appear in Annex A

2.2 Bus priority involves managing the road system to make the best possible use of limited road space in terms of the overall transport objectives of the area. This requires these different agencies to carry out complex and inter-related tasks. Bus priority measures undertaken by a local authority must take account of the problems perceived by the bus operators, and are only likely to be effective if enforcement is taken into account at the planning stage. Local authorities should therefore discuss possible bus priority measures in their area at an early stage with bus operators and with others involved (including other local authorities and other interested departments and sections within the same authority), and should establish a proper framework for consultation and co-operation in their implementation. The benefits to the bus operator, and how these can be redistributed to the benefit of the travelling public (eg through improved reliability and/or service frequency) should also be established at an early stage. Such arrangements as may be agreed should be included in any TPP/Package Bid statements (see Chapter 9).

2.3 The duties, powers and responsibilities of the various agencies are discussed in more detail in Annex A. In particular the Road Traffic Regulation Act 1984 contains the provisions under which most bus priority measures may be introduced and the Road Traffic Act 1991 contains additional provisions that should assist the movement of buses in urban areas. More details appear in Chapter 3.

2.4 The London Boroughs, acting jointly and in discussion with London Transport Buses, the bus operators and other interested parties, have developed the London Bus Priority Network on those roads which carry large numbers of buses and are not part of London's Priority (Red) Route Network (see also paragraph 3.4). The new measures are seen as an important contribution to making bus services faster and more reliable as part of an overall strategy (which may also include other traffic regulation measures) to encourage more people to use bus services. Similar concepts are being pursued in some other areas.

2.5 The Government has been encouraged by the development of Quality Partnerships between bus operators and local authorities. Under such partnerships, operators provide vehicles to a specified quality, and the local authority provides assistance to the relevant bus services through traffic management schemes or other facilities. There are already a number of voluntary partnerships based on initiatives between local authorities and operators which include bus priority measures.

2.6 Good compliance, with the appropriate level of enforcement to achieve it, is essential to realising the full potential benefits from schemes providing priority for buses. If police/warden resources for enforcement are limited (see

also Annex A, paragraph A9) then self-enforcing measures or automatic enforcement might be considered in order to maintain the same level of compliance. Automatic capture of details of vehicles illegally using bus lanes has recently been successfully trialled in London. Further details appear in Annex A, paragraph A11, and in "Bus Lane Enforcement Cameras"^[6].

CHAPTER 3

PRIORITY THROUGH TRAFFIC MANAGEMENT

3.1 The movement of buses can often be assisted significantly by measures aimed at reducing congestion and improving the flow of traffic in general. For example, measures to remove through traffic from congested urban streets can greatly improve conditions for pedestrians, cyclists and local traffic, and offer the opportunity to improve bus access (see also Chapter 6). The potential impact of new traffic management measures on bus services should always be considered at an early stage in the planning of any scheme, whether its main intention is to improve bus services or not. Bus operators should always be consulted.

3.2 Indiscriminate parking can seriously reduce the capacity of the street network, and effective control of on-street parking and loading and unloading is essential to keep traffic, especially buses, moving. The Road Traffic Act 1991 provides powers under which local authorities are able to enforce on-street parking prohibitions and regulations. As required, all authorities in London had adopted the new powers by July 1994; the police and traffic wardens then ceased to be responsible for enforcement of waiting and loading restrictions except on Priority (Red) Routes (see paragraph 3.4), the Whitehall Zone and some other small areas, all of which has brought benefits to buses. Traffic authorities outside London may now apply to the Secretary of State to assume similar powers. To date (1997), few have done so, and the Department of The Environment, Transport and the Regions, would like more authorities to adopt these powers in the next few years as more experience is gained.

3.3 The number of on and off street parking places, as well as the type (eg. long or short stay, permits) and price of parking, need to be considered in the context of the overall transport strategy for an area. Adequate off-street parking, in conjunction with good on-street enforcement, can help to reduce parking on-street. Too much parking provision or inappropriate parking management policies may add to congestion on bus routes if too many cars are encouraged to use the highway or queue near to car park access roads. However, for parking spaces that do exist arrangements for directing drivers to car parks which have space free can help to reduce traffic circulating or queuing unnecessarily. Locating bus stops nearer to the main central area destinations than off-street car parking places can also help to improve the attractiveness of bus services.

3.4 The Road Traffic Act 1991 provides for the designation of a network of Priority "Red" Routes in London. These routes are subject to special parking controls and other traffic management measures designed to improve the movement of traffic so that people and goods can reach their destinations more easily, reliably and safely. On the pilot Priority "Red" Route in north and east London buses benefitted from this special attention because of the general reduction in congestion and more reliable journey times which have

followed from new priority route controls. This improved reliability has made bus services more attractive to customers. Similar benefits should be evident throughout London as the network of Priority "Red" Routes expands. Local authorities outside London can use their existing powers to establish urban clearways, and to introduce stringent waiting and loading restrictions on what they regard as priority routes. These should be indicated with the conventional yellow signs and markings.

3.5 In the implementation of traffic management measures, some matters of detailed design such as turning radii at corners used by buses, and the siting of bus stops (see Chapter 8 for details) can have an important impact on bus services. Good access to major interchanges such as rail stations can also be important. Exemptions from prohibited turns can be useful; these are dealt with in Chapter 7.

3.6 In developing a traffic management strategy for an area, it may be desirable to introduce physical measures to ensure that vehicle speeds are not excessive in relation to the characteristics of a particular road. Unfortunately no ideal measure has yet been found which does not have some effect on buses and their passengers; the more "severe" physical measures can be especially difficult for disabled people. Horizontal deflections can be effective but the recommended spacing to materially reduce speeds (10 to 15 metres between the build outs forming the deflection) would be difficult for most buses to negotiate and a compromise may be needed. Road humps are the most effective speed controlling measure. Most bus operators have declared a strong dislike of road humps, but if there is no alternative then the following recommendations should be followed. Care is needed in choosing the most appropriate design for each site. The Highways (Road Humps) Regulations 1996^[7] permit heights up to 100mm, but it is generally recommended that road humps should not be higher than 75mm in most cases. Conventional round top and flat top road humps built to the minimum height permitted by the regulations (25mm) are likely to have a minimal effect on speeds, and 50mm is normally regarded as a minimum. The maximum 100mm height might be desirable at raised junctions to assist pedestrians to cross more easily. Shallower exit ramps from road humps may be advantageous where humps can be separately related to a single direction of traffic. Whilst bus operators do not like any sort of road hump, most will reluctantly accept flat top humps with a plateau length equal to the bus wheel-base, or a minimum of 6m at restricted sites. Speed cushions can be straddled by buses with very little vertical movement, but even these do not always suit the wide variety of bus sizes (eg midibuses); the narrower they are the less effect they will have on buses, but a smaller reduction in the speed of other vehicles would have to be acceptable. Further guidance on road humps is available from the Department^{[7][8][9][10][11]}, the Scottish Office and the Welsh Office.

Busways and Tramways

3.7 Guidance for public transport systems running on segregated tracks is provided in two separate documents:

Advice about trams running on "line-of-sight" signalling, as they do when running on the highway, is given in "Railway Safety Principles and Guidance, Part 2, Section G, Tramways" ^[12]; and

for guided buses the Department's advice "Guided Buses" ^[13] is the most recent issued.

In the latter, guidance is given as to the most appropriate powers (in the Road Traffic Regulation Act or in the Transport & Works Act) under which guided busways are best introduced according to local circumstances.

3.8 Guided busways in the UK are new, and the experience from Germany and Australia where other guideways have been introduced is very limited. The Department is investigating the safety issues in the areas where guideways leave and rejoin the general purpose carriageway, and where guideways cross other roads and pedestrian ways; guidance on good practice will be issued as results from research become available.



Guided busways in the UK are new and experience from abroad is limited

CHAPTER 4

WITHFLOW BUS LANES

4.1 The "withflow" bus lane is the commonest form of bus priority measure. A traffic lane, usually on the nearside, is reserved for the use of buses and other vehicles which are to be accorded priority. Where road widths allow, double-width bus lanes can assist buses to pass slower or stopped buses, and cyclists. In some situations, for example in one-way streets or on the approach to a prohibited turn from which buses are exempt, an off-side withflow bus lane can provide considerable help for buses.

4.2 A Traffic Regulation Order under the Road Traffic Regulation Act 1984 must be made to identify the length of the bus lane and to limit its use to those types of bus and other vehicles (see paragraphs 4.10 to 4.18) which the authority wishes to allow. The restriction must be indicated using the prescribed signs and road markings which appear in the Traffic Signs Regulations and General Directions, 1994^[14] (TSRGD). Special drawings are being prepared by the Welsh Office for the bilingual signs which apply in Wales. An Order would normally specify the vehicles to which the bus symbol (with or without the word "local") on the mandatory bus lane signs to Diagrams 958 and 959 refers; these are:

- (a) motor vehicles constructed or adapted to carry more than 8 passengers (exclusive of the driver) or
- (b) local buses not so constructed or adapted.

Regulation 24 of TSRGD^[14] gives more details.

An Order prohibiting vehicles other than buses from using a bus lane would normally also exempt emergency vehicles and cleaning or maintenance vehicles. There is normally no need to sign such exceptions. Pedal cyclists are normally permitted to use withflow bus lanes (see paragraph 4.11). Parking is not permitted in bus lanes during their operating times; where required, consideration should be given to the provision of parking nearby for orange badge holders. Loading and unloading is allowed unless a prohibition is specifically written into the Order and the appropriate signs and road markings displayed on street; it is recommended that loading in bus lanes should normally be prohibited unless there are special reasons why it should be allowed.

4.3 A withflow bus lane enables buses to bypass traffic queues, usually approaching traffic signals. This will often mean a substantial time saving to buses and their passengers, possibly offset by some additional delay to the vehicles which have been overtaken. So, although there may be other important considerations such as those mentioned in Annex B (paragraph B.7), an appraisal should be carried out to determine whether the overall

benefits from the scheme are acceptable in terms of the scheme's overall costs; where appropriate the appraisal should include strategic transportation, environmental and other considerations. The appraisal may also give guidance as to whether the bus lane should operate in peak periods only, although it is recommended that withflow bus lanes which can be justified during peak periods should be provided all day unless other requirements, e.g. loading, preclude it; all-day bus lanes are easier for motorists to understand and so are less likely to be violated. The appraisal of bus priority measures is discussed in more detail in Chapter 9.

4.4 A plan of a typical layout of a single-width withflow bus lane is shown in Figure 1. Where roads are wide enough the bus lane should be 4.25 metres wide and the minimum preferred width is 4m; this allows buses to overtake cyclists safely and reduces the likelihood of interference from general traffic in the adjacent lane. The minimum recommended width is 3 metres. This will cater for up to 120 buses an hour without noticeable constraint, but there may be certain locations (e.g. at bus stops without lay-bys) where bus flow can be eased by providing a double-width lane.

4.5 If it is desired to minimise overall delay to all traffic, withflow bus lanes should normally be stopped short of the stop line at traffic signal controlled junctions. This "set back" ensures that the full width of the stop line at the junction is available to all traffic during the green period; it also facilitates, and makes safer, left turns at the junction. The aim should be to ensure that buses clear the stop line during the first available green period. As a general guide, a set back length (in metres) of twice the green time (in seconds) would normally achieve this, though it may be necessary to adjust this if there are special local site conditions or to take account of the variations in green time in active-response UTC systems. If a reduction in junction capacity is proposed as part of an area traffic management or demand management strategy, or if site conditions otherwise allow, then provided any left turning traffic can be safely accommodated and right-turning traffic does not restrict flow in the non-priority lane(s), a withflow bus lane may be continued up to the traffic signal stop line. An alternative method of allowing buses to reach the signal stop line ahead of general traffic is explained in paragraph 4.7.

4.6 At a roundabout, a set back should be provided to allow left turning traffic to take the nearside lane, and to ensure that the full width of the roundabout entry is available to all traffic at peak periods. Investigations by TRL suggest that the optimum set back distance should be at least 10metres but not more than 30m. These findings have not yet been tested in the field and the Department would like to hear from any local authority planning to introduce a bus lane on the approach to a roundabout with a view to confirming TRL's work. Where a roundabout is controlled by traffic signals, the set back distance should accord with the guidance in paragraph 4.5.



The withflow bus lane is stopped short of the signal stop line to maintain saturation flow and accommodate left turns

Bus Advance Areas

4.7 Buses can be given more priority, while still retaining full junction capacity, by stopping non priority traffic at a secondary stop line level with the end of the bus lane. This creates a Bus Advance Area and a possible layout is shown schematically in Figure 2A. During the red phase at the main signal, buses may proceed to the main stop line and take their preferred lane while non-priority traffic is held at the pre-signal. Shortly before the main signal turns green, non-priority traffic is released by the pre-signal to allow full use to be made of the green phase at the main signal. Such an arrangement has been trialled at sites inside and outside London. A schematic diagram of the layout at Shepherds Bush Green is shown in Figure 2B. An assessment of the trial undertaken for the Department of Transport by TRL^[15] showed that buses and general traffic flowed more freely after the new measures had been introduced. Bus journey times being improved to the extent that the benefits produced by the total scheme (including other bus priority and traffic management measures) covered the cost of installation in just over a year.

4.8 The Bus Advance Area principle has also been trialled on an approach to a roundabout in Doncaster. A schematic diagram is shown in Figure 2C. It should be noted that the presignals are sited where a side road joins the main road carrying the bus lane. Because a certain amount of the presignal cycle had to be devoted to the traffic in the side road, the system was not as efficient as that in Shepherds Bush Green. Nonetheless the trial was useful in demonstrating that roads which contain obstacles (e.g. side roads, bus stops) which can cause delay to traffic between the presignals and the main traffic control - in this case a give way at a roundabout - are not good candidates for a Bus Advance Area.

4.9 Other than the trials mentioned in the above paragraphs, the Department has limited knowledge of Bus Advance Areas being trialled. The Department wishes to explore further the concept of using Bus Advance Areas to give priorities at junctions where suitable opportunities to introduce them might exist. However, such trials would need monitoring before the Department could advise on their general introduction. The Department is interested to hear from any highway authority having a suitable site, with a view to monitoring additional trials.

Use by vehicles other than buses

4.10 It may be appropriate to permit other classes of vehicle to use a bus lane. Issues which should be considered in this context include:

- road safety;
- the operation of the bus lane, including potential delays to buses;
- delays to other traffic;
- the legality of the definition of the vehicle class;
- enforcement;
- any impact on modal split.

Vehicle classes which may be permitted to use bus lanes include pedal cycles, motor cycles, taxis, goods vehicles, and dial-a-ride services for disabled people, although it is not usual for all these classes to be included.



Cyclists are normally allowed to use withflow bus lanes...



...and where the carriageway is wide enough a 4m-wide lane should be provided for buses and cyclists

4.11 **Pedal cyclists** are allowed to use withflow bus lanes because they are more likely to be involved in an accident if required to ride in the main traffic lane with buses passing on their nearside. The Government are encouraging authorities to make special provision for cyclists and if there are no cycle lanes or tracks on a suitable alignment the presumption is that cyclists will be allowed in the bus lane unless there is a very good reason for excluding them, and the signing should accommodate this. Where bus lanes are only 3 metres wide, buses are unable to pass cyclists safely unless they pull out into the "non-priority" lane; in some cases it may not be possible to do this. With this in mind, bus lanes should be the preferred width of 4m or more wherever possible.

4.12 **Motorcycles** were officially allowed into bus lanes in Bristol starting in the summer of 1995. The safety record of these schemes is being monitored, but at the time of writing it was too early to say how the accident rate had changed, or whether bus journey times had been affected. Motorcycles have more power than pedal cycles and can maintain their position in the traffic stream, so they are not at risk from passing traffic in the same way as pedal cycles. Because there is, as yet, insufficient evidence from the Bristol experiment, and because there is likely to be a greater risk to pedestrians if motorcycles were able to use bus lanes, the Department recommends that motorcycles should not normally be permitted to use bus lanes.

4.13 **Taxis** are an important part of the public transport system. Where their average occupancy in any particular area is higher than other vehicles during the periods the bus lane is in force, it may be appropriate to allow them to use bus lanes. However, if this is to be done, it is necessary for enforcement purposes that the taxis be easily identifiable, as in the case of London's black cabs or where vehicles are required to carry prominent "Taxi" signs. Some assessment of the interaction between taxis and buses when using the bus lane should be carried out: where taxis would cause undue delay to buses they should not be permitted to use the bus lane. In some areas where taxis are permitted to use bus lanes there has been pressure from operators of **cars available for private hire**, most of which are indistinguishable from private cars, to be provided with the same priority; use of bus lanes by these vehicles is not recommended. The points about enforcement and interaction with buses mentioned above will be especially relevant to local authorities and police forces when deciding whether hire cars should be allowed to take advantage of bus priority measures.

4.14 **Goods vehicles** carrying high valued goods, or goods which are important to the national economy could, it is agreed, benefit from using bus lanes. However, the value of time of an average goods vehicle is no higher than that of other traffic, and the benefits to goods vehicles of using a bus lane are thus likely to be offset by delays to other traffic. There are, of course, some types of time sensitive traffic where a case for priority could be made, but these would be almost impossible to identify clearly for signing and enforcement purposes. In some situations where bus flows are too low to justify a lane exclusively for buses it may be that a combined bus and heavy goods vehicle lane would be worthwhile.

4.15 As part of a strategy to afford priority access to the central area for certain classes of vehicle, the City of Newcastle-upon-Tyne introduced a bus and goods vehicle lane in the autumn of 1992. The types of qualifying goods vehicle were agreed with the local police to minimise enforcement problems. The scheme was monitored for the Department of Transport by the TRL. The results showed that only a small proportion of goods vehicles used the priority lane which was probably due to a combination of lack of certainty among lorry drivers and local characteristics of the road carrying the priority lane. There is insufficient evidence from this trial to conclude whether or not, as a general principle, goods vehicles should be allowed in bus lanes; the appropriate regional Government Office for Environment and Transport, or the Transport Policy Division of the Welsh Office, or the Roads Directorate of the Scottish Office Industry Department, would be interested to hear from any other local authority in their respective area which wishes to install a trial bus and goods vehicle lane with a view to monitoring the result.

4.16 **Dial-a-Ride Services for Disabled People** are provided in some areas using mini-buses where seats have been removed (or not fitted) in order to accommodate wheelchair users. Some of these vehicles will not fall within the definition of a bus because they do not have enough seats, but they should normally be permitted to use withflow bus lanes if they can be defined adequately in the Order and recognised for enforcement purposes.

4.17 **High occupancy vehicles (HOVs)** carrying, say, three or more occupants have been provided with special lanes on freeways in the United States; in most locations there are grade separated junctions and no frontage access. The HOV lane has generally been most successful where it has been constructed as an additional traffic lane, rather than reallocating an existing lane. The main advantage obtained from HOV lanes in the USA has been that they have encouraged car sharing by people who previously travelled by car alone, thus reducing the total amount of traffic. In the UK an HOV lane could encourage the rather different result of a switch to car sharing by public transport passengers. A clear understanding of the definition of an HOV and easy recognition of such a vehicle would be essential for enforcement purposes.

4.18 During peak periods when most bus lanes operate, most car occupants are likely to be travelling in non-working time, so the value of time of a vehicle carrying three occupants would be little greater than the average for all traffic, and considerably less than the value of a well loaded bus. Enforcement of non-qualifying HOVs in a withflow bus lane would be extremely onerous. It is considered that while there can be no general case for allowing HOVs to use bus lanes, there may be special situations where an HOV lane would be justified. The appropriate Department (see paragraph 4.15) would like to hear from any authority wishing to consider an experimental scheme.

Signing for withflow bus lanes

4.19 Clear signing of bus priorities is of utmost importance. Illustrations of the signs most relevant to bus priorities also appear in Figure 8, together with their Diagram numbers (from TSRGD^[14]) which are referred to in the text below and the associated figures.

4.2 For lanes which are separated only by a white line from the remainder of the carriageway, Figure 1 shows the signing recommended for most situations arising from the introduction of a withflow bus lane. Only those signs applicable to the bus lane are shown; for example, signs relating to the one-way street in Figure 1 are not shown. Where a bus lane is in force, waiting restrictions are not required because parking is prohibited in a bus lane. However, if loading restrictions apply, the markings on the kerb (to Diagram 1019, or 1020.1) and No Loading Signs to Diagram 638 or 638.1 are necessary. The following signs should be provided:

- Advance signing of a withflow bus lane should be provided by a sign to Diagram 958 sited as described in Chapter 3 of the Traffic Signs Manual^[16]. The sign must indicate any other classes of vehicle which may be permitted to use the Bus Lane and should normally include the pedal cycle logo unless, in exceptional circumstances, pedal cyclists are prohibited from using a withflow bus lane. (In such a case, special authorisation must be sought from the appropriate Department (see paragraph 4.15) to omit the cycle symbol.) The appropriate permitted variant should be used. The sign should be upstream of the taper marking the start of the lane (Diagram 1010); the approximate recommended distances are:

85 percentile approach speed (private cars)	Distance of sign from start of taper	Minimum clear visibility distance of signs
up to 30 mph	30 metres	45 metres
over 30 mph	45 metres	60 metres

- Along the length of the withflow bus lane, signs to Diagram 959, with the appropriate time plates to Diagram 961, must be sited facing traffic at the commencement of the bus lane after the tapered road marking. Where other classes of vehicle are included, the appropriate permitted variant or specially authorised sign should be used, also with the appropriate time plates. The same signs should be erected at intervals of not more than 300 metres for the whole length of the bus lane. Generally these repeater signs should be sited on the downstream side of each side road, though local discretion may be used where side-road traffic is very light.

- Where there is a heavy left turning movement across the bus lane into a side road, two signs to Diagram 877 should be erected facing the oncoming traffic travelling in the same direction of flow as the bus lane. One such sign should be placed 30 metres in advance of the road junction between the sign and the junction to which it refers. The second sign should be erected immediately on the upstream side of the junction (see also Figure 1).

- Every side road carrying traffic proceeding towards the bus lane should be provided with a sign to Diagram 962 using the appropriate variant indicating the direction of the bus lane. Where the road carries bus lanes in both directions the arrow should be omitted and "s" added to this word "lane". The sign should be erected facing traffic; where the road is one-way with two or more lanes a sign should be erected on each side of the road.

- Where there are large numbers of crossing pedestrians, signs to Diagram 963 and its permitted variant should be erected to warn pedestrians to look in the direction of approaching buses.

- At the end of the bus lane a sign to Diagram 964 should be erected facing traffic proceeding in the same direction of flow as the bus lane. Where the bus lane forms part of a recommended cycle route, signs to Diagrams 2601 or 2602 should be erected to indicate the direction of the continuation of the cycle route.

Note that coaches operating excursions or tours are included in the new definition of vehicles to which the bus symbol applies. In some circumstances it may be desirable to exclude coaches from the priority lane. This may be achieved by the addition of the legend "local" to the bus symbol in the blue and white "bus only" sign to Diagrams 953, 958 and 959.

Where taxis are permitted to use a bus lane, this should be signed by the addition of the word "taxi" to the bus lane signs to Diagram 958 and 959.

Signs for withflow bus lanes which permit any other class of vehicle, or which exclude pedal cycles, and signs for bus lanes in the centre, or on the offside, of the road require special authorisation. Appropriate variants of the nearside withflow bus lane signs should be submitted to the appropriate Department (see paragraph 4.15).



Bus lane signs should be repeated at intervals of not more than 300 metres along the whole length of the bus lane

Road Markings for withflow bus lanes

4.21 Road markings should be provided as follows. Figure 1 illustrates the text:

- Deflection arrows to Diagram 1014 should be placed 30 metres and 15 metres upstream of the start of the bus lane taper. Traffic should be deflected to the offside where the bus lane occupies the nearside lane, or to the nearside where the bus lane occupies the offside lane.



The carriageway approaching the bus lane should be marked with deflection arrows and a tapered broken line

- A tapered broken straight white line to Diagram 1010 must be provided immediately in advance of the start of the bus lane. Its angle with the kerb (or the tangent to a curved kerb) from which it runs to connect with the solid line marking the outer edge of the bus lane (see below) should not normally exceed 1:10. Some adjustment may be required on sharp right hand bends, but it is recommended that the length of kerb over which the taper

takes place should not be less than 30 metres. In any event the tapered line indicating the start of a bus lane (rather than its continuation after a junction) should not extend across a junction; the start of the bus lane in this situation should be moved sufficiently far down stream to allow the tapered line to run from the kerb to the solid edge marking within the angle specified.

- The outer edge of the bus lane should be marked by a solid white line 250 or 300mm wide to Diagram 1049. Wherever possible the wider line should be adopted to reduce the likelihood of wing-mirror conflict. The line should terminate at the entrance to or exit from a side road on the same side of the main road as the bus lane and recommence on the other side of the side road; a curved broken line to Diagram 1010 should be provided as a lead-in to the solid line on the downstream side of every side road entry point.
- The legend "BUS LANE", to Diagram 1048, should be marked on the bus lane at its commencement so that it is legible to drivers proceeding in the same direction of flow as the bus lane. The same legend should also appear in the lane after every side road on the same side of the road as the bus lane, and in every location where repeater signs appear.
- In advance of any junction with a major left turning flow across which the bus lane continues, it is recommended that the solid white line is replaced with a broken line to Diagram 1010 accompanied by advisory direction arrows to Diagram 1050 which should be positioned as near as possible to the first of the signs to Diagram 877 (see above).



The outer edge of the bus lane should be marked by a solid white line which terminates at the entrance to or exit from a side road

4.22 The bus lane can be emphasised by the use of coloured surfacing (which is not a road marking and does not require authorisation), but care should be taken that the material used complies with normal skid-resistance criteria. Unlike prescribed road markings, coloured surfaces may be continued through the controlled area on the approaches to pedestrian crossings which are designated by zig-zag lines, and across junctions. Whilst there are no

national standards for coloured surfaces, compliance appears to have improved in London and elsewhere where red has been used extensively. Compliance can also be encouraged by:

- designing the start of the bus lane so as to encourage the "natural" movement of traffic into the general traffic lane rather than into the bus lane; one way might be to build out the kerb using a suitable curved design; or
- where the road width permits, providing short islands along the length of the bus lane.

4.23 Cars straying onto the solid white dividing line between the bus lane and the remainder of the carriageway may obstruct buses. This is more likely where bus lanes are at or near the minimum recommended width of 3 metres. It has been suggested that better demarcation by longitudinal islands or such devices as raised rib marking could help to prevent this usually unintentional violation, and so reduce the need for police patrols. Research by the Transport Research Laboratory (TRL) in 1977^[17] highlighted the danger to two-wheeled vehicles from the introduction of two styles of upstand then available (research on raised-rib markings in other locations on the highway is also reported in Traffic Advisory Leaflet 2/95). More modern methods such as raised rib marking similar to that used on the edge of motorway carriageways may be more successful, but no specification has yet been developed for its use as a bus lane demarcation and it cannot legally be used without authorisation from the appropriate Department (see paragraph 4.15). The safety of motorcyclists (who are not normally permitted to use bus lanes) and cyclists is of great importance, and there are implications for all traffic during the periods when the bus lane is not operating. In the few locations where raised rib demarcations have been installed they appear to have improved compliance. The Department would like to investigate this aspect further and would like to hear from any local authority wishing to promote a trial.

CHAPTER 5

CONTRAFLOW BUS LANES

5.1 By allowing buses to travel against the main direction of traffic flow in a oneway street, contraflow bus operation enables buses to avoid unnecessary diversions, to maintain route patterns when new one-way streets are introduced, and to gain better access to business and shopping areas. This can often be achieved on a two-way road by restricting the flow in one direction to buses and other permitted vehicles. In other situations a designated contraflow bus lane may be required; a typical plan is shown at Figure 3. Unlike withflow bus lanes, contraflow bus lanes normally operate 24 hours per day.

5.2 The introduction of a contraflow bus lane may cause delays to other traffic. As in the case of a withflow bus lane, the savings to buses and the delays to other traffic should be carefully assessed (see Chapter 9) to determine whether the benefits, including environmental and other considerations, are sufficient to justify the cost of the scheme. A contraflow bus lane will have particular road safety implications, and potential accident costs should be taken into account in the assessment; the servicing of premises fronting onto the contraflow lane may need special consideration.

5.3 Contraflow bus lanes should be at least 3 metres wide and separated from the rest of the carriageway either by a solid white line (see 5.14), or else physically separated by a continuous upstand or series of long islands. Although physical separation helps to keep the bus lane clear of other traffic, segregated lanes are costly to install, and by confining buses to a precise track can cause tracking of the road surface. Complete segregation also prevents buses from overtaking cyclists, a broken down vehicle or other obstruction, and may create a safety hazard by preventing the bus driver from steering to avoid a pedestrian. For these reasons, separation by white line supplemented by occasional traffic islands and/or solid white lines with hatching between them will usually be preferable to full physical separation. As for a withflow bus lane, the recommended width where cyclists are allowed to use the lane is 4.25 metres with a preferred minimum of 4m; the comments about coloured surfacing reinforcing the special nature of the lane (see paragraph 4.22) and about raised rib marking (see paragraph 4.23) are also relevant here.

Use by vehicles other than buses

5.4 As with a withflow bus lane it may be appropriate to permit other classes of vehicle to use a contraflow bus lane. Subject to consideration of the issues listed in paragraph 4.10, vehicle classes which may be permitted to use contraflow bus lanes include pedal cycles, taxis, and dial-a-ride services for disabled people, although it is not usual for all these classes to be included.

5.5 Research has shown that **pedal cyclists** using contraflow bus lanes can be at risk, mainly from conflicts with other traffic at the beginning and end of the lane^[18]. However, over lengths of bus lane between junctions, accident risk tends to be low. If at all possible, safe junctions should be provided at the entry and exit points so that cyclists can use the contraflow lane. This is especially relevant where alternative routes are considered to be more dangerous for cyclists, or where they involve a substantial detour.

5.6 **Taxis**, and **dial-a-ride** services for disabled people, may be allowed to use contraflow lanes at the discretion of the local authority. It is recommended that motorcycles, goods vehicles and HOVs should not be permitted to use contraflow bus lanes.

Safety issues

5.7 A contraflow bus lane can create new road safety hazards. Based on investigations carried out by TRL in 1989^[18] the following measures should be considered:

- guardrailing to channel pedestrians to points where crossing facilities can be provided, and where clear signing indicates the direction of approaching buses.
- careful design of geometry, signing and road markings on the approach to the entry of a contraflow bus lane to control possible conflict between vehicles entering the lane and those turning across their path.
- reducing the number of uncontrolled junctions along the length of the lane, possibly by closing them off altogether or by banning turning movements in order to reduce the number of likely vehicle conflicts.

The use of contraflow bus lanes by unauthorised vehicles may create a particular hazard for pedestrians.



Road geometry, signing and markings on the approach to a contraflow bus lane

Signing for contraflow bus lanes

5.8 Signing and road markings should be in accordance with the Traffic Signs Regulations and General Directions 1994^[14]. Particular note should be taken of the recommended signing at the entry to the contraflow lane which is designed to exclude all classes of vehicle except those permitted to use the lane. Illustrations of the most relevant signs and their Diagram numbers appear in Figure 8. Contraflow lanes are normally located so that buses travel along the lane with their nearside nearest the kerb. Contraflow lanes in other locations are extremely rare and are not recommended where stopping places are required or for anything other than a very short link in special circumstances. The following advice applies to the normal situation.

5.9 Vehicles approaching the beginning of a contraflow bus lane should be warned in advance by a map-type direction sign (e.g. to Diagram 2108) which shows "No Entry" into the road carrying the contraflow lane and the alternative route(s) for non priority traffic.

5.10 Figure 3 shows the signing recommended for a contraflow bus lane. At the beginning of the lane, No Entry Signs to Diagram 616 (see Figure 8) should be erected on either side of the main carriageway carrying the opposing flow; a traffic island should be provided between the contraflow lane and the opposing carriageway to accommodate this sign. The sign on the nearside kerb should be a blue and white sign (Diagram 953 or permitted variants) to show which vehicles may use the lane, and an "only" plate to Diagram 953.2. Where the lane is to be restricted to local buses, the word "local" must be added to the bus symbol in the sign to Diagram 953. Alternatively a No Entry sign to Diagram 616 may be used in conjunction with one of the following exemption plates:

- an "Except buses" plate to Diagram 954, or
- an "Except local buses" plate to Diagram 954.2.

Where taxis are to be allowed to use the lane, the sign to Diagram 960 must be used and the word "taxi" must be added below the bus symbol. All traffic islands should carry, at both ends, "Keep Left" arrows to Diagram 610.

5.11 All side road approaches must carry signs to Diagram 612 or 613, and signs to Diagram 962 should be added to warn drivers of the bus lane. Signs to Diagrams 606 and 609 may be used to supplement the information.

5.12 Where provision is made to accommodate crossing pedestrians, refuges separating the bus lane from the other traffic lanes must be constructed. Signs to Diagram 963 must be erected on the refuge and on the kerb opposite the refuge on the other side of the bus lane.

5.13 At the end of the street where buses exit and general traffic enters, there will normally be no need to sign the end of the bus lane. Signs to Diagram 960 must replace the normal One Way Street Sign (Diagram 652),

and be erected to face traffic entering the street. These signs should also be repeated, facing the direction of the main traffic flow, after every side-road junction, on whichever side the side-road is located.



Contraflow bus lanes must be signed with a blue and white sign (Diagram 953 or permitted variants) and an "only" plate (Diagram 953.2) or...



...a "No Entry" sign to Diagram 616 with an "Except buses" plate to Diagram 954 or "Except local buses" to Diagram 954.2

Road markings for contraflow bus lanes

5.14 Figure 3 illustrates how road markings should be provided. The bus lane should be separated from the rest of the carriageway by a 250mm or 300mm solid white line to Diagram 1049 where there are no traffic islands or other physical separations. The line should be discontinued at nearside road junctions but, unlike withflow bus lanes, a broken line is not necessary on the approach to side roads since all non-priority traffic would be travelling in the opposing direction. "BUS LANE" road markings to Diagram 1048, together with appropriate direction arrows, should appear at both ends of the lane so as to be legible to drivers approaching the contraflow lane; these markings should be repeated each side of every side road junction. If cycles are to be allowed to use a contraflow bus lane, the road marking to Diagram 1048.1 must be used. "LOOK LEFT"/ "LOOK RIGHT" markings should accompany signs to Diagram 963 at pedestrian crossing places.



Road markings in a Contraflow bus lane

CHAPTER 6

BUS ONLY STREETS

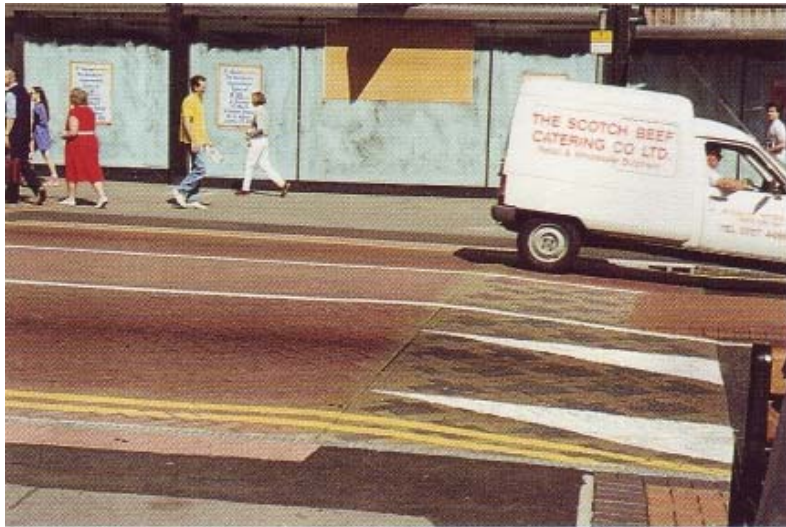
6.1 A bus only street is a section of road for the use of buses only. It may be a section of road enabling the bus to take a more direct route, for example between a main access road and a residential estate, or it may be a "pedestrianised" street in a town centre where buses are exempt from a prohibition on all, or some types of, vehicles. Such streets enable buses to:

- maintain route patterns in areas where traffic flow patterns have been changed; long detours which add to bus operating costs can be avoided whilst preventing unwanted short cuts by other traffic;
- gain close access to business and shopping areas at times when it is denied to other vehicles; such arrangements help to make bus services more attractive by providing convenient access for bus passengers, including elderly people and those with mobility handicaps.

6.2 The appraisal procedure recommended for bus lanes may be appropriate for bus only streets, but it is likely that in many situations, particularly in town centres, environmental considerations will predominate.

Pedestrianised streets

6.3 Allowing buses to use pedestrianised streets can help town centre businesses by encouraging bus use, especially where bus stops are nearer than major car parks are to the focal points in the town. A clear indication of which section of the carriageway is designated as a bus only street will encourage compliance and ease enforcement. Safety for pedestrians in a pedestrianised area into which buses are also allowed is paramount. Some successful schemes use a carriageway at a different level from the footway which is helpful to blind and partially sighted people. In others road surfaces flush with the footway are of different textures and/or colours from the footway. Excessive speeds are particularly dangerous in pedestrian streets. Bus operators should agree safe speeds with the local authority, and instruct their drivers accordingly. If extra measures are required to reduce bus speeds, road humps may be considered, although other measures which avoid the use of road humps are often preferable (see paragraph 3.6). In some bus only streets, it may be necessary to introduce defined pedestrian crossing places, especially when bus service frequencies are high. Side roads having junctions with the bus only street should be closed off wherever possible to reduce the likelihood of accidents. The environment can be enhanced with features such as planting but good visibility between pedestrians and vehicles must be maintained.



Speed reducing hump with shallow approach gradients and flat tops extending along the length of the carriageways

6.4 Some authorities have used rising bollards to reduce or prevent entry violations of bus only streets. Such bollards have been activated by electronic devices fitted to the buses or by drivers using remote control panels. The rising bollards have been installed under Sections 92 to 94 of the Road Traffic Regulation Act 1984 to reinforce a Traffic Regulation Order. A traffic authority using rising bollards should be mindful of the duty of care which they owe to the public, and especially to ensure the safety of pedestrians, cyclists and other vulnerable road users. Signing would normally be used to show the times at which access can be gained to the restricted area. Advice should be sought from the appropriate Department (see paragraph 4.15) at an early stage as to whether site authorisation for signing or approval for equipment will be required^[28].

Bus gates

6.5 Short lengths of bus only street are sometimes referred to as "bus gates". Short, standard width, sections of road protected only by signs are commonly used; violation rates are often high at such installations, especially away from central areas. Narrowing the road to the width of one vehicle in the bus gate itself (see Figure 4), using a different colour for the road surface in this section, and/or installing traffic calming features such as speed cushions or road-side furniture can often improve the compliance rate. Where more elaborate carriageway constructions designed to deter smaller vehicles from passing through the bus gate are proposed, the highway authority should ensure that suitable powers are available to introduce such measures. They should also be aware that such a construction may make it impossible for some emergency vehicles to pass. Local authorities should also be satisfied that adequate alternative routes are available before introducing such measures. Bus gates and entries to longer lengths of bus only street which are wide enough to accommodate only one vehicle at a time should not exceed 30 metres in length.



Bus only streets should be signed with a blue and white sign to Diagram 953, supplemented by an "Only" plate to Diagram 953.2...



...or a No Entry sign, to Diagram 616 supplemented by "Except buses" to Diagram 954 or permitted variants

Signing for Bus Only Streets

6.6 Figure 4 shows a typical plan and the recommended signing for a bus only street. Figure 8 shows the most relevant signs and their Diagram numbers. The blue and white Buses Only Sign to Diagram 953 (see Figure 8) or permitted variants should be used (to show which vehicles may use the lane) with an "only" plate to Diagram 953.2. Where the street is to be restricted to local buses, the word "local" must be added to the bus symbol in the sign to Diagram 953. Alternatively a No Entry Sign to Diagram 616 may be used in conjunction with one of the following exemption plates:

- an "Except buses" plate to Diagram 954, or
- an "Except local buses" plate to Diagram 954.2.

Where taxis are to be allowed to use the lane, the sign to Diagram 953 must be used and the word "taxi" added below the bus symbol. These signs should be positioned on each side of the road, and on any central islands in the road, at each end of the length of restricted road. Adequate advance direction signs showing alternative routes for non-priority vehicles approaching the restricted street should be provided as for contraflow bus lanes (see paragraph 5.9).

6.7 Where other motor vehicles are also exempt from the restriction, the appropriate variant of the Pedestrian Zone sign to Diagram 618.2 or 618.3 should be used so as to exempt only those type(s) of buses which are permitted. Advice on signing where a variety of exemptions are in force is contained in Chapter 3 of the Traffic Signs Manual^[16].



Different colour or texture of road surface can encourage compliance and ease enforcement

CHAPTER 7

BUS PRIORITY AT JUNCTIONS

7.1 Buses can be given priority at road junctions, either by permitting buses to make turning movements prohibited to other traffic, by giving preference to flows containing a high proportion of buses, or by adjusting signal controls when a bus is detected in the traffic stream.

Turning exemptions

7.2 Allowing buses to make a turn which is prohibited to other traffic is a measure which is usually cheap to install, and which can give buses a considerable advantage by allowing them to take a shorter route than other traffic. Exemptions can also be used to allow buses to enter a contraflow bus lane, or a bus only street. Research into the safety aspects of turning exemptions for buses^[18] indicates that very few accidents involved buses making the exempted turn. Nearly four times as many accidents were caused by other vehicles making the turn illegally. This emphasises the importance of clear, well-located signs and road markings, and adequate enforcement.

7.3 To avoid long detours it may be appropriate to allow cycles to make turns prohibited to traffic other than buses. The safety aspects of any such proposal should be carefully considered. Pedal cyclists are much less visible than buses, and may be at serious risk when making a turn not made by other traffic.

7.4 Taxis may also exceptionally be exempted from turning prohibitions; again, safety aspects should be considered very carefully.

7.5 Where buses are exempted from turning prohibitions, No Left/Right Turn Signs to Diagram 612 or 613^[14] (see also Figure 8) should be used immediately on the approach to the junction, supplemented with one of the following rectangular exemption plates below the sign:

- "Except buses" plate to Diagram 954, or
- "Except local buses" plate to Diagram 954.2.

Where the exemption is from a straight ahead prohibition, the Buses Only Sign or the No Entry Except Buses Sign should be used as described in paragraph 5.10. Where cyclists are also exempt, the Buses and Cycles Only sign to Diagram 953 must be used. At signalised junctions these signs should be fixed to an extended black backplate to which the signal lights are fixed, the extension being on the side away from the carriageway. Where other vehicle classes are included in the exemption, they must appear on the rectangular exemption plates. Advance warning should be given using a standard advance direction sign (see paragraph 5.9) with the appropriate

roundel as described above but excluding the "Except buses" rectangular plate.

7.6 Exemption for pedal cycles should be signed by the addition of the exemption plate to Diagram 954.3 to the No Right/Left Turn Signs to Diagrams 612/613. Where it is intended that taxis should be permitted to make turns prohibited to other traffic except buses, special authorisation (see paragraph 4.15) will be required to include taxis in the exemption plate(s) to be used with the No Right/Left Turn Signs to Diagrams 612/613.



Turning exemption for buses at traffic signals

Selective detection of buses

7.7 Buses can be given priority at traffic signals more effectively if the signal can be made to respond to the arrival of the bus. This can be achieved by fitting buses with an electronic device which can be detected either by satellite using GPS techniques or by static equipment in the highway which is linked to the traffic signal controller. The most common form of this is a bus fitted with a transponder which is detected as it passes over an inductive loop slotted into the road surface. On receipt of the signal, a suitably equipped traffic signal controller can bring forward the start of the green phase, or hold the green phase to allow the bus time to pass the signal with minimum delay. Such systems have been found to provide significant benefits to buses^[19] and have been widely installed at individual junctions (i.e. those not linked to others in a group) in London^[20]. In some bus fleets, the traditional transponder is being replaced by a newer, cheaper, device called a "tag". Traffic authorities will need to ensure that these devices are sufficiently secure to prevent their use on nonauthorised types of vehicle.

7.8 A traffic control system called MOVA (Microprocessor Optimised Vehicle Actuation) has been developed by TRL for controlling individual junctions. MOVA aims to minimise both stops and delays to traffic, and uses microprocessor technology to apply logic beyond the capabilities of standard equipment. It has been found in trials to reduce delays by 13% compared to

the vehicle activated system which is the present standard in the UK. The latest version of MOVA offers active bus priority via selective vehicle detection using loops in the road and transponders on the buses. Further guidance is available from the Department^[21].

Urban traffic control (UTC)

7.9 In most large urban areas, traffic signals are controlled by some form of computer-based urban traffic control system. Approximately half of these are on "fixed time" plans based upon surveys of traffic flows and their variation by time of day and day of the week. Signal timings for these fixed time plans are usually calculated by the "TRANSYT" method developed by TRL^[22]. A variation of this method, "BUS TRANSYT"^[23], can be used where bus flows are significant. BUS TRANSYT tends to favour signal approaches carrying significant bus flows, and thus takes more account of the high passenger carrying capacity of the bus.

7.10 UTC systems based on fixed time plans rely upon historical traffic patterns being repeated in a predictable way. Since traffic patterns tend to change over time, it is important that they are regularly monitored, and the timing plans recalculated. This is very labour intensive, and as a result many fixed time systems tend to operate inefficiently with out of date plans. Fixed time plans are also unable to deal with random variations in flows which cannot be predicted.

SCOOT

7.11 In order to deal with these problems TRL have developed an on-line UTC system called "SCOOT" (Split Cycle Offset Optimisation Technique). SCOOT responds continuously to actual traffic demands being detected on the network, and makes repeated small adjustments to signal timings to reduce traffic delays. The SCOOT system typically achieves 10-15% reductions in delays compared to fixed time systems, and has now been installed in over 130 cities in the UK and overseas. Facilities for active bus priority using selective detection by loops in the road or by automatic vehicle location (AVL) systems have been introduced as a result of recent research (see paragraph 7.13). These facilities are being further refined as part of on-going research commissioned by the Department of the Environment, Transport and the Regions.

7.12 The version of SCOOT used by many local authorities (version 2.3) offers a facility for weighting selected routes. This facility can be used to provide priority for buses by weighting routes with heavy bus flows; this is often called "passive priority" because the level of priority is programmed into the system rather than taking account of the real number of buses arriving at any particular time. A later version of SCOOT (version 2.4) offers additional facilities including a "gating" technique whereby the inflow of traffic to a sensitive area is controlled to ensure that any traffic queues build up outside that area. "Congestion offsets" can also be used to ensure that a specified main route is kept flowing and that any queues build up on the side roads.

These "queue relocation" techniques can be used to give priority to buses by making sure that traffic queues do not affect buses, or else occur where they can be bypassed by bus lanes. Queue relocation techniques have been used to help buses successfully in the Bitterne Road scheme in Southampton, and more recently on London's Uxbridge Road on the westbound approach to a major junction in Southall. During Southampton's morning peak period when the bus priority scheme is in operation, a special fixed time plan is introduced which reduces the inflow of side road traffic in order to help traffic flow more freely on the main road which is a major route for buses approaching the city centre. This scheme has undergone a number of modifications since it was introduced in the early 70's, including the introduction of SCOOT control at certain periods of the day. It is a good example of a traffic management scheme which includes a number of bus priority features; a plan of the scheme is shown in Figure 5.

7.13 In 1995, TRL produced a version of SCOOT (3.1) in which the software kernel processes priority calls from buses identified by selective detection. The bus priority optimiser implements green-time extensions and priority recalls where the green phase is recalled earlier than it otherwise would be). The decision to make an extension or recall makes full use of SCOOT capabilities and account is taken of queues which may delay buses. This new version, developed as part of a European research programme, showed savings in bus passenger delay of between 20% and 30% in tests at TRL. Subsequent field trials in Camden Town, London, where traffic volumes are high and bus frequencies reach 150 per hour, produced average savings in bus delay of 22% per junction. Maximum saving to buses was achieved with local extensions and central recalls; other traffic suffered small delays with local extensions at all traffic levels but recalls caused the worst conditions for non-priority traffic at higher traffic levels. Nine junctions in Southampton have also been fitted with this new version of SCOOT. Further guidance is available from the Department^[24], and more detailed information is given in the paper "Latest Developments in SCOOT"^[25].

7.14 SCOOT is being further developed with a view to providing still more advantages to buses. Other methods with potential for offering new ways of giving priority to buses within traffic signal control systems are also being tried; for example a UTC system called SPOT was trialled in Leeds as part of the DRIVE Primavera project.

CHAPTER 8

BUS STOPS

8.1 The passenger's access to the bus network is normally at a bus stop. A formally agreed bus stopping place, normally designated by a bus stop pole and/or shelter, offers the opportunity to consider the road safety implications for stopping buses. There are therefore advantages to be gained for operators, the highway authority and the Police in agreeing sites for bus stops. Where agreement cannot be reached, the Traffic Commissioner is often asked to arbitrate.

8.2 In town centres it is important that bus stops are located conveniently for the main shopping and business areas, and preferably nearer to those areas than major car parks. This makes services more convenient for passengers, particularly elderly and disabled people. The safety of passengers is most important, both while waiting at stops and whilst walking to and from them. For these reasons it is preferable that passengers do not have to cross major traffic flows to reach their destination. If this is unavoidable, bus stops should be located close to pedestrian crossing facilities. Where space is extremely limited a bus stop may be located in the controlled area of a pedestrian crossing (indicated by zig-zag lines) on the leaving side of the crossing, but not in the approach. Where one way traffic systems are involved, bus stops must be located on the nearside of the carriageway unless special provision is made for boarding and alighting. It is usually most convenient for pedestrians/passengers if bus stops are located close to junctions, especially where interchange between bus services is common, and the effect on vehicular capacity on the approaches to and exits from junctions may have to be balanced against the level of convenience offered to bus passengers. Where selective detection is in use (see Chapter 7) bus stops should not be located between the detector and the stop line. In any case, bus stops and shelters should be sited so that bus drivers can see waiting passengers and vice versa; any locations which are obstructed by large objects such as hoardings or trees also carry personal security risks and should therefore be avoided. Street clutter can be avoided by locating bus stops at existing lamp columns. Safety can be improved by the use of CCTV cameras. All these items should be considered during the consultations about the siting of bus stops which should take place between bus operators, traffic authorities, and the police, together with (where appropriate) frontagers and bus users groups.

8.3 When development takes place bus access should be considered. Bus stops should be located close to major generators of potential passengers, or to focal points in the footway network. Where new roads are involved, special arrangements may be required to give buses access to the development before the roads are adopted. In large developments it may help to construct special sections of road to provide buses with direct access to and through the development. Temporary stops and turning arrangements may be required as development proceeds. Some local authorities give guidance on

these matters in design guides for developers, to ensure that appropriate provision is made for bus services from the outset. In some situations, developers may be prepared to contribute to the cost of passenger facilities at bus stops. Whatever arrangements are sought, early consultation between authorities, operators and interested private sector parties will be necessary to ensure the facilities are used.



The passenger's access to the bus system is normally at a bus stop



When development takes place, bus access should be considered..



...and bus stops located close to focal points in the footway network

8.4 Bus stops should be well lit for road safety and personal security reasons, and should provide passengers with clear information about the services using the stop, either by static displays or by the use of real time information panels, or both. Shelters, seating, paved areas for waiting, and convenient access all help to make a bus service safe and more attractive to passengers. Guidelines for the design of public transport infrastructure, including bus stops, which address the needs of disabled and elderly people are contained in "Accessible Public Transport Infrastructure"^[26]

8.5 One of the simplest ways of giving buses priority is to protect the road space by the bus stop so that it is kept clear for buses to use. This is vital in busy areas where there is often strong competition for access to the kerb from vehicles wishing to park or to load or unload. Keeping the bus stop clear allows the bus to pull in close to the kerb which is particularly important for low-floor buses if the benefits of stepfree access are to be realised. It enables all passengers, especially those who are elderly or disabled, to board and alight without walking into the road; it also minimises the obstruction to the flow of other traffic. Special types of kerb such as the "Kassel" design can assist buses to approach as near as possible to the footway, but it should be noted that kerbs higher than 125mm may damage the underside of the bus if there is any overhang when the bus approaches at an angle; the potential conflict between street furniture and wing mirrors should also be taken into account. Sufficient road space should be kept free, by strong enforcement if necessary, to accommodate front and/or rear loading buses as appropriate. Where front loading buses are involved, kerbs should be located so as not to obstruct the swept path of buses with lowered front steps. Where more than one stop is required, sufficient road space should be kept clear for all the bus services involved.

8.6 Yellow lines (to Diagrams 1017, or 1018.1) to prevent parking, supplemented by No Loading markings (to Diagrams 1019, or 1020.1), are the commonest way of keeping the road free for buses at bus stops. A bus stop clearway may also be used; the Traffic Signs Regulations and General Directions^[14] allows total flexibility for the highway authority to choose the times of operation. All such measures will, of course, require a supporting Traffic Regulation Order.



Bus stops should provide passengers with clear information about the services using the stop



Bus stop boarder

8.7 Waiting restrictions and bus stop clearways both depend for their effectiveness upon adequate enforcement. In some locations where there is heavy parking a "bus stop boarder" may be more effective, and be largely self-enforcing because it deters kerbside parking. The "boarder" is constructed by projecting the footway into the carriageway by a distance which will vary according to the location. The optimal distance for bus passenger access will be the width of any adjacent bays designated for parking or loading, but shorter projections may be appropriate where general traffic flow may be unduly disrupted (eg. on the approach to signals or at heavily used bus stops). The projection of the footway into the carriageway provides passengers with easier access to the bus, and inhibits parking at the bus stop, while still allowing traffic to pass the stationary bus. The bus boarder may be provided with a raised area of footway and kerb to make access easier for elderly and disabled people. In some locations bus boarders can be used as traffic calming measures, but care should be taken if building out a considerable distance from the kerb to ensure that the gradient of the surface of the boarder is not so steep that it is awkward or dangerous (eg for wheelchair users) when approaching the bus.

8.8 Lay-bys can offer protection of road space at bus stops, but can create difficulties for buses seeking to rejoin a traffic queue on the main carriageway. Nonetheless, provision of a lay-by may help to improve traffic flow by removing the bus from the main traffic stream, so assisting buses further upstream in the traffic queue. Lay-bys should be provided where a stopped bus on the carriageway would present a safety hazard, or for any other safety reason, but they are not generally welcomed by bus operators. If lay-bys are provided they should preferably be constructed in material different from that used for the main carriageway so as to discourage other vehicles from parking and loading, and the crossfall should be arranged to avoid waiting passengers being splashed. Lay-bys should be clearly marked "BUS STOP" (see paragraph 8.10 for Diagram Numbers). Figure 7 shows both full-width

and narrow bus lay-bys. Where a narrow bus bay is proposed to help buses rejoin the traffic stream, care should be taken that there is sufficient width for other vehicles to pass a stationary bus safely.

8.9 Lay-bys provided for other traffic to enable easier parking and loading away from the bus stop can help to discourage bus stops being blocked by cars and lorries. Traffic authorities may like to consult guidance on bus stops, boarders and lay-bys published by London Bus Priority Network Steering Group^[27].

Signing for protection of bus stops

8.10 "BUS STOP" markings on the main part of the carriageway should be provided to Diagram 1025 (see Figure 8). In a lay-by at a bus stop, road markings to Diagram 1025.2 should be used. These are advisory, and can be supplemented with No Waiting and No Loading restrictions where necessary. A Bus Stop Clearway will, with full compliance, prevent all vehicles except buses stopping in the area of the bus stop. Road markings to Diagram 1025.1 (main carriageway) or to Diagram 1025.3 (lay-by), in conjunction with a sign to Diagram 974, must be provided.

8.11 Where waiting restrictions are in force, buses are allowed to stop only for the time needed to set down and pick up passengers. Where longer stops are required, buses should be specifically exempted from the restrictions in the Order. A bus layover place may be provided on the carriageway, signed with the "BUS STAND" permitted variant of the "BUS STOP" carriageway markings to Diagrams 1025, 1025.1, 1025.2, and 1025.3. Bus operators should ask the appropriate traffic authority to modify the necessary Traffic Regulation Order(s) so that such arrangements can be introduced.



Lay-bys improve traffic flow and access to bus stops. They are best constructed in materials different from the main carriageway...



... and narrow lay-bys help buses rejoin the traffic stream

CHAPTER 9

APPRAISAL AND FUNDING

Appraisal

9.1 The decision to implement a traffic management scheme on a local authority road, whether or not it includes any bus priority measures, rests with the local authority. Normally an authority would use its powers as highway authority under the Road Traffic Regulation Act 1984. On a trunk road outside London, decisions lie with the appropriate Department (see paragraph 4.15). On priority "red" routes, in London the Traffic Director for London's approval would have to be required, on designated roads he would also need to be notified.

9.2 A local authority considering whether to implement a scheme which provides priority for buses will require a sound basis for appraising the impact of the scheme. This should cover the operational, economic, environmental and planning aspects. Although it should not be the only criteria, and may not necessarily be the main one, an economic appraisal should always be carried out so that local authorities are able to satisfy themselves of the value for money of the priority measures before the decision is made to implement a bus priority scheme. Even where the estimated capital cost of the scheme is small, the impact on non-priority traffic (whether regarded as a benefit or disbenefit) may be significant or may affect a much wider area, and should be separately identified so that it can be properly considered as part of the appraisal.

9.3 The overall objectives of such an economic appraisal should be to evaluate the benefits of the scheme to buses and their passengers, including any additional patronage attracted to the services in question, and to compare these benefits with the effects on other road users. The net benefit should then be assessed in relation to the capital cost of the scheme. The final decision to implement bus priority measures should take into account wider considerations, particularly when it is judged that, with the development of the overall transport strategy for the area, there may be a transfer of passengers from car to bus. These wider considerations should include the benefits of bus priority as part of a package of measures to improve bus services, the overall transport objectives of the area (which may include traffic restraint), wider environmental issues such as air quality and noise, and planning concerns. Priority measures may therefore be justifiable even if, within the economic appraisal, net benefits would not cover the cost of the scheme for many years, or indeed if benefits to bus users fail to exceed costs to other road users.

9.4 Appraisals should not be confined to new schemes. Reappraisals should also be made of existing schemes when significant changes take place in either the bus service network or in the patterns of other traffic.

9.5 Annex B provides a detailed discussion of the principles, and presentation, of the appraisal of priority measures.

Funding

9.6 In England, under the package approach, spending on roads and public transport will be funded from the same allocation; this allows authorities to determine, within given resources, the optimal blend of transport measures for their areas. Capital expenditure by local authorities on bus priority measures will normally be eligible for support by way of annual capital guidelines or supplementary credit approvals. Except to the extent that a scheme whose cost is under £2m is expected to bring direct financial benefits to the local authority (e.g. rental for a trolleybus line or guided bus lane) such support will be reflected in the local authority's standard spending assessment for capital financing costs. Other sources of funding may sometimes be available; these may include funding from European funds and from private developer contributions.

9.7 Schemes estimated to cost under £2m will normally be funded by local authorities from the allocations of Supplementary Credit Approvals (SCAs) which they receive for transport minor works, including allocations made under the package approach. In exceptional circumstances, a specific allocation may be made for a particular scheme costing under £2m. Schemes costing £2m or more on roads of more than local importance may be eligible for Transport Supplementary Grant (TSG) towards 50% of the costs, with the balance funded through annual capital guidelines; other schemes costing £2m or more are eligible for support through SCAs. Major public transport infrastructure schemes such as busways are also eligible for support through SCAB; where the estimated cost of the scheme exceeds £5m and there are exceptional reasons for spreading the costs beyond users and local council tax payers, such schemes may also be eligible for partial support by grant under section 56 of the Transport Act 1968. Further details are provided in the annual TPP circulars.

9.8 In cases where users of a bus priority scheme - for instance a trolleybus scheme - are expected to pay through the fare box, a full cost-benefit appraisal must be submitted as well as an appraisal under the criteria appropriate to public transport schemes (such as those eligible for section 56 grant) in which the benefits to users are calculated by reference to the fare revenue.

9.9 In Scotland, the grant structure is different and Transport Supplementary Grant and credit approvals are not used. Local authorities must include all capital expenditure on bus priorities, whether it is grant aided (section 56) or not, in their TPP's for the Scottish Office to consider when determining capital allocations for individual authorities.

9.10 In Wales, local authorities are provided with basic credit approvals which are allocated annually by formula to cover a wide variety of services including transportation and highways. Projects are funded at local authorities'

own discretion. In addition the Welsh Office administers funding for integrated transport packages through the arrangements for Transport Grant, including support for bus priority measures. Major public transport schemes may also be eligible for grant support under section 56 of the Transport Act 1968.

CHAPTER 10

IMPLEMENTATION, MAINTENANCE AND MONITORING

Implementation

10.1 This document gives guidance on various aspects of the layout and signing of bus priority schemes. Further information on the design of highways and traffic management schemes, including designing for buses, is included in "Transport in the Urban Environment" ^[29]. Measures to assist buses appear in Chapter 26.

10.2 All organisations, groups, and individuals likely to be affected by the scheme should be consulted about the proposals in good time. This "non-statutory" consultation at an early stage in the development of the scheme will allow time for the scheme to be properly understood by those who are not familiar with the techniques involved, and for them to comment. It also allows time for representations to be taken into account as the scheme is progressed. There is also a better chance of success where organisations are involved throughout the development of the scheme.

10.3 The Statutory consultation, required at the time the Traffic Orders are made, will be facilitated if the scheme has already been the subject of discussion. Standardised orders may also help to speed up this process. Adequate time should be allowed for processing orders, including preparing and publishing the Order, consulting police about enforcement, allowing time for objections and any public enquiry which may be either necessary or desirable, dealing with objections including amending the Order as necessary, and confirming the Order.

10.4 The Road Traffic Regulation Act 1984 permits an Order to be made on an experimental basis for a period of up to 18 months, during which the impact or extent of the Order may be reduced or suspended without the need to go through a fresh Order-making procedure. Authorities may like to consider using this approach where they are uncertain about the possible effects of introducing bus priority measures. When making an experimental Order, authorities must be able to explain what aspects of the proposed scheme are experimental, and what steps they will be taking to monitor the effects of the experiment.

Maintenance

10.5 Bus priority measures should be maintained to a high standard to ensure that all road users are aware of the priority arrangements. Broken, damaged, vandalised, faded or worn signs and carriageway markings do not encourage compliance; high levels of violation will mean that the benefits are reduced. Regular inspection is recommended so that any repairs required are carried out quickly. Full reinstatement of carriageway surfaces, coloured as

appropriate, and of road markings is particularly important after road works of any kind have been carried out.

10.6 Work carried out anywhere on the highway will almost certainly cause a degree of disruption to traffic, and the effect on bus services is often disproportionate because of their fixed routes and greater vulnerability to delay. Chapter 8 of the Traffic Signs Manual^[30] and the Code of Practice "Safety at Street Works and Road Works" published under the New Roads and Street Works Act 1991 advise how such works can be arranged safely and cause minimum disruption.

Where a road carries a bus route, minimum disruption to bus services should be the aim of the authority or agency undertaking the work. That might include giving priority to buses, for example by queue management and signal settings. As far as possible the removal or suspension of bus priority measures should be avoided in any traffic management associated with the road works. Where significant disruption from planned work is a possibility operators should be consulted in time to make and publicise amendments to their services. This may be more difficult for emergencies than for planned work, but the highway authority or street works undertaker can assist by complying with their respective duties to co-ordinate and co-operate on street works activities under the New Roads and Street Works Act 1991 and by:

- * keeping as much of the plant and equipment as possible off the carriageway;
- * phasing work to minimise carriageway obstruction, particularly at the busiest time of day;
- * avoiding work in different places at the same time which affect the same bus route;
- * giving bus routes priority in winter salting programmes.



Broken, damaged, vandalised, or worn signs and carriageway markings do not encourage compliance

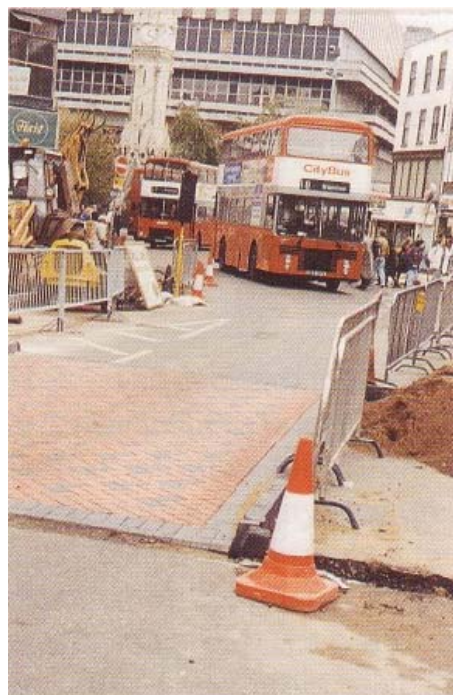
Monitoring

10.7 Bus priority schemes should be monitored after implementation to ensure that the benefits to buses which were originally estimated, and upon which the decision to undertake the scheme was based actually accrue and that the scheme performs as intended.

10.8 Bus priority schemes often depend critically upon the number of buses and passengers. Changes in the bus network, or in traffic patterns as a result of changes in the road network elsewhere, can render a bus priority scheme obsolete. The scheme should be monitored and reviewed, and on occasion may need to be removed altogether.

10.9 Items which should be monitored periodically include:

- (a) numbers of buses and bus passengers using the scheme;
- (b) number and occupancies of vehicles on the roads affected by the schemes;
- (c) any switch from car to bus;
- (d) delays to buses and to other traffic;
- (e) accidents on the roads affected;
- (f) enforcement costs and levels of compliance.



Roadworks often disrupt bus services

CHAPTER 11

THE WAY AHEAD

11.1 The Government wishes to encourage greater use of buses in urban areas because they can cater efficiently for large numbers of people and it considers that the increased use of bus priority measures can make a significant contribution to making bus services more attractive. Co-operation between all those involved in the provision, maintenance, use and enforcement of priority measures is vital if their full potential is to be realised. New initiatives developed jointly by local authorities and bus companies are being encouraged, and new technology for enforcing bus lanes which reduces the need for human resources appears to have the potential for wide application. The Government is always keen to see new types of measure developed and tested, and good practice in bus priority disseminated as widely as possible.

11.2 The guidance in this document is based upon present knowledge and experience of bus priority measures. Research commissioned by the Department has been investigating the reasons that may be deterring local authorities from implementing priority measures more extensively. Other projects are currently in hand. One is investigating how much relief from traffic congestion could be delivered by bus priority measures, and what effect such benefit may contribute to greater usage of buses compared with other ways of making bus services more attractive. Other projects are looking at innovative bus priority techniques, including automatic enforcement methods and the value of introducing long lengths of continuous bus priority. As results from these projects, and other being conducted elsewhere, become available, further advice will be issued.

11.3 From time to time, local authorities or operators may bring forward proposals for new types of bus priority measures. The appropriate Department (see paragraph 4.15) would like to be consulted about such measures with a view to setting up and monitoring trial schemes. It is important that innovations in the field of bus priority are properly monitored so that good practice can be established and disseminated widely.

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ANNEX A

DUTIES, POWERS, AND RESPONSIBILITIES

A.1 This annex reviews the duties, powers and responsibilities of the various agencies involved in providing and regulating bus services and associated infrastructure. It should be noted that it is intended only as a guide, not as an authoritative interpretation of the law. The agencies are bus operators, Local Authorities, Passenger Transport Executives (including London Transport Buses), the Traffic Commissioner, the Police and, in London, the Traffic Director, and their activities are controlled largely by:

- the Road Traffic Regulation Act 1984;
- the Transport Act 1985;
- the Public Passenger Vehicles Act 1981.

Also relevant are the Local Government Act 1985 (in particular Section 51), the Road Traffic Regulation (Parking) Act 1986, the Parking Act 1989, the Town and Country Planning Act 1990 (Section 249), and the Road Traffic Act 1991. The main effect of these provisions on the agencies concerned are discussed below.

Operators

A.2 All bus and coach operators must have a valid Public Service Vehicle (PSV) Operator's Licence which is granted by the Traffic Commissioners. An operator may without further formality run a private hire service, long distance coach service or long distance excursion or tour. Outside London, if an operator wishes to run a local bus service under the Transport Act 1985 the service must be registered with the Traffic Commissioner 42 days in advance of the start date. If the operator wishes to vary or cancel the service 42 days notice must also be given to the Traffic Commissioner. This applies to all services whether run commercially or by the operator supported by a local authority. About 83% of the total bus network mileage is run commercially. No notice is required of fare changes.

A.3 When local services are introduced or changed, the bus operator must notify the relevant County Council, County Borough Council, Regional Council, or Passenger Transport Executive (PTE) in the Metropolitan areas outside London (London Transport Buses in London), by sending them a copy of the registration document so that they can consider appropriate changes to the supported network. Changes to services may also affect matters which are the responsibility of the highway authority*, such as traffic management measures to assist buses. Informal discussions about service changes between the operators, local authorities and, where appropriate, the police prior to the formal notification is important in establishing a way forward which is workable and acceptable to all. It is also important that formal notification of service changes is given promptly to the local authority so that their effect on bus priority measures can be assessed. Changes may also affect road

maintenance and salting programmes, and arrangements where operators are notified directly by the highway authority about emergency diversions. Many local authorities and PTEs provide the public with comprehensive information about public transport services in their area. Prompt notification of service changes is essential to keep this up to date.

** In Scotland "highway authority" responsibilities are discharged by the "roads authority"*

A.4 In London most bus services operate under contract to London Transport Buses [LTB], the main licensing authority, following competitive tender. Commercial services which provide a significant benefit to the network also operate under agreement with LTB. A system of local service licensing, from which London Transport Buses are exempt, also operates under the auspices of the Traffic Commissioner.

A.5 Operators are responsible for all aspects of vehicle operation, including vehicle safety, maintenance and cleanliness. All vehicles which are in service must display a disc issued by the Traffic Commissioner to the operator, and their drivers must have a Passenger Carrying Vehicle drivers licence. Operators are also responsible for their passengers' well-being, driver behaviour and courtesy, and information about their services and the fares to be charged. Staff and passengers are subject to the Public Service Vehicles (Conduct of Drivers, Conductors, Inspectors and Passengers) Regulations 1990 (S.I.1990 No. 1020).

Traffic Commissioners

A.6 Traffic Commissioners are the licensing authority for public service vehicles (PSVs). They have powers to revoke or suspend a PSV Operator's Licence and may also revoke a Passenger Carrying Vehicle (PCV) driver's licence. They must take such action in respect of PSV Operator's licences if they consider that the requirements of good repute, financial standing or professional competence are no longer being met. Such action may also be taken if a condition attached to the licence has been broken or a vehicle examiner has prohibited the use of any vehicle because of its dangerous condition. They work closely with the Vehicle Inspectorate Executive Agency who are responsible for the annual testing of PSVs. All PSVs are subject to a statutory annual roadworthiness test which is to a higher standard than that for cars. In addition, vehicles and premises are subject to spot checks at any time.

A.7 Traffic Commissioners have powers to take disciplinary action against bus operators who fail to operate their local services in accordance with their registered particulars. If an operator does not run services reliably the Traffic Commissioner may place a condition on his PSV Operator's Licence; this could stop that particular service or any local service being operated. In addition, a traffic authority can ask the Traffic Commissioner to impose Traffic Regulation Conditions on the operating licences of bus operators to regulate the number and frequency of buses, their routes or stopping places (including

banning bus operators from a particular street). The Traffic Commissioner can only do this if he is satisfied that such a condition is required to prevent danger to road users or reduce severe traffic congestion. In respect of services operated in London under a London Local Service Licence the Traffic Commissioner may attach conditions to an operator's licence regulating the routes to be used and the points at which passengers may be set down or picked up.

Police

A.8 The police are responsible for enforcing the Traffic Regulation Orders made by the highway authority to control moving and stationary vehicles. Traffic wardens may enforce parking and loading restrictions, but not the Orders which relate to moving vehicles. Keeping the highway free of unlawful obstructions is crucial to maintain sufficient road space for moving vehicles, particularly where traffic is congested. Police and traffic wardens are responsible for ensuring that priorities given to certain classes of vehicle (e.g. buses) are not abused by non-priority vehicles.

A.9 In some areas sufficient police and traffic warden resources may not be available to undertake all the traffic enforcement required. In such a situation the local authority sometimes makes a financial contribution to make additional resources available. It is therefore important that full consultation takes place between the police and highway authority at all stages during the development of traffic control measures requiring enforcement.

A.10 The decriminalisation of parking enforcement under the Road Traffic Act 1991 has in London led to police and traffic warden enforcement being concentrated on priority "red" routes (which also tend to be bus routes) whilst local authority parking attendants enforce permitted and prohibited parking on other roads. This appears to have resulted in better compliance with on-street restrictions and improved flow for all traffic, including buses. Local authorities outside London who adopt on-street parking enforcement powers are also likely to want to give a high priority to enforcement on arterial routes, and this can be expected to work to the advantage of buses.

A.11 A trial of bus lane enforcement by cameras in London has successfully demonstrated that video cameras are the most promising way forward using established technology. "Static" roadside cameras and "mobile" cameras carried on buses continuously recorded events in the bus lane, thus ensuring that there are no possible general defences which cannot be disproved. The mobile camera was found to be an effective way of dealing with stationary vehicles in the bus lane, and the tests also identified that "stopped" vehicles, whether parked illegally or moving offenders held up in the bus lane, are more critical to the effectiveness of bus lanes in improving the reliability of bus services if traffic conditions are congested. The trial also showed that to be cost effective a two-camera system (which includes a close-up camera to record a registration mark) is necessary. Testing is now being carried out over a wider area.

Local authorities

A.12 Local authorities are responsible for local transport policy, set in the context of policies on the environment and sustainability. They also have certain duties in the area of public transport procurement. They also have various powers and responsibilities enabling them as traffic authorities to control the use of highway and parking space by all classes of vehicle. Their responsibilities as local planning authorities have an important influence on transport generally and public transport services in particular.

A.13 The Transport Act 1985 has encouraged operators to provide bus services on a commercial basis. However, as it was expected that their services might not meet all the public transport requirements of an area, county councils, regional councils, and passenger transport executives were given a duty under the Act to secure, under contract after competitive tendering, the provision of other services to meet any requirements not being met by commercial services. Non-metropolitan district councils also have a power to secure the provision of additional bus services in their areas. Local authorities may thus provide bus services to areas not otherwise served, or increase the frequency of services beyond what would be provided commercially. Local authorities also have the power to promote public transport services in their area, including providing information on timetables and fares. Local authorities have a duty to monitor the bus services run by operators under contract to ensure that they are run correctly and reliably. Local authority contracts generally contain penalty clauses to ensure the authority can cancel the contract if the operator is in breach of its conditions.

A.14 Traffic authorities regulate moving and stationary traffic through their responsibilities mainly under the Road Traffic Regulation Act 1984, as amended by the Road Traffic Regulation (Parking) Act 1986 and the Parking Act 1989. Highway authorities have powers to make Traffic Regulation Orders on all roads except trunk roads (for which the Secretary of State's permission is required). The purposes for which these Orders may be made include:

- preventing dangerous conditions;
- preventing damage to the road;
- facilitating the passage of any class of traffic;
- preventing unsuitable vehicles using a road;
- preserving the amenities of the area in which the road runs;
- regulating parking on the highway.
- air quality management

Specific powers contained in the 1984 Act relate to:

- the use of highways by public service vehicles [Section 19];
- the design, erection, and removal of traffic signs [Sections 64-80].

Section 122 requires, inter alia, that every local authority responsible for functions carried out under the 1984 Act should have regard to:

"the importance of facilitating the passage of public service vehicles and of securing the safety and convenience of persons using or desiring to use such vehicles".

Where highway improvements or maintenance works affect local bus services, traffic authorities should discuss their work programme with the bus operators.

A.15 The Road Traffic Act 1991 provides for the designation of a network of priority "red" routes in London and for the Traffic Director for London to be responsible for that network. These routes are subject to a distinctive signing regime, special parking controls and other traffic management measures designed to improve the movement of traffic so that people and goods can reach their destinations more easily, reliably and safely. One of their specific aims is to improve the efficient movement of buses. Buses benefit from this special attention and from the general reduction in congestion which has followed from the priority "red" route controls and from more reliable journey times. This improved reliability should make the bus services more attractive to customers. Outside London it will be for the local authorities to apply to the Secretary of State to establish priority routes using their existing statutory powers.

A.16 Provisions concerning the regulation of parking, both on and off the highway, and of loading on the highway, are contained in the Parking Act 1989, the Road Traffic Regulation (Parking) Act 1986, and those sections of the 1984 Act not superseded by either of these Acts. Provision of parking, both on and off street, and policies related to parking charges can affect bus ridership. Sections 95-111 of the 1984 Act deal with the powers available to control and enforce Traffic Regulation Orders. Provisions in the Road Traffic Act 1991 enable the local authorities to exercise greater control over enforcing parking restrictions (see paragraph 2.10). Other provisions in these Acts allow, amongst other things, restrictions to be placed on parking in the highway in order to keep all traffic, including buses, moving more freely. Bus priority measures are normally introduced under the powers conferred by Section 2(2)(a) and (b) of the 1984 Act and, in London, Section 6 of, and Schedule 1 to, the 1984 Act. Where buses are to be permitted to travel on pedestrianised streets, the authority may use its powers as local planning authority under the Town and Country Planning Act 1990. Local authorities require the permission of the Secretary of State to carry out any of these functions on a trunk road.

Co-operation between agencies

A.17 The provision, operation and enforcement of traffic management measures which assist buses involve a number of agencies, each responsible for a variety of complex tasks. Close co-operation between these agencies is essential if such measures are to operate satisfactorily.

ANNEX B

APPRAISAL OF BUS PRIORITY MEASURES:

RECOMMENDED METHODS

Good practice when appraising schemes

B.1 Appraisal methods should be:

- a) practicable
- b) affordable
- c) consistent
- d) informative
- e) capable of demonstrating value for money

B.2 The following advice is intended to be practicable from the point of those who carry out appraisals, affordable to those who commission them (and to be in proportion to the cost of the project and their potential impacts), and to encourage consistency across projects and locations and with appraisals of other transport projects. It is intended to encourage the provision of full and accurate information about schemes and their effects to policy and funding authorities. Underlying all is the need to incorporate all significant costs and benefits within sound analytical techniques.

Presentation

B.3 Many bus priority appraisals will be components of a wider presentation of a package submission within the local transport capital expenditure round. The Department issues advice on appraisal, presentation, and other aspects of packages each year in "Supplementary Guidance Notes on the Package Approach". (Contact Local Transport Policy Division, Great Minster House London SW1P 4DR.)

B.4 Other appraisals are made for individual priority measures or strategies for other sources of funding, from DOT or elsewhere. The broad Framework Tables described in the package approach guidance will generally be inappropriate for these schemes, but the same broad principles will in many cases still apply.

B.5 This Annex is intended to provide additional advice to those completing appraisals of priority measures, be they stand-alone measures, related to other schemes or projects, or part of a package bid.

Priority measures within packages

a) Objectives

B.6 All transport investments should be appraised within the context of policies, objectives and problem solving. (As background and illustration, brief descriptions of general traffic, environmental, and business conditions are valuable.) The overall strategy for achieving objectives needs to be explained, highlighting the role of priority measures. It is therefore important that these factors are presented clearly and in full at the beginning of an appraisal, and the effects assessed against them at the end. It is difficult or impossible to assess projects against very general objectives such as "To regenerate the local economy"; more quantifiable objectives, which can be shown to contribute to the wider aims, should be adopted. The nature of bus priorities should make them one of the elements of a package most suitable for this purpose.

B.7 Packages of measures (whether within a package approach bid or any other systematic grouping of projects) will generally have been designed with local policies and objectives to the fore, but relevant national ones, such as on emissions or safety targets, should also be included in appraisals. Any additional significant effects, beyond clearly defined objectives, also need to be presented.

B.8 Appraisals should also describe current conditions. Delays to buses, and effects on reliability of services and waiting times at stops, should be presented, for the route as a whole and at specific black spots. A brief description of service frequency, type of service, and patronage levels is important.

b) Methods

B.9 A brief but informative description of modelling techniques and data sources should be presented. Consistency with other local modelling exercises should be demonstrated, or the reasons for any differences justified.

B.10 All other relevant significant factors should also be included, such as details of consultation exercises. Bus operators may respond to priority measures by running extra services, or by maintaining current services with fewer buses. Details of consultations with operators should be presented, along with details of how the likely responses have been modelled.

B.11 Many priority schemes consist of a series of measures (e.g. along a corridor) introduced over a period of time. The effectiveness of such measures, and the interaction with other transport initiatives, can depend significantly upon the sequence in which they are implemented. Appraisals should demonstrate the rationale for the planned programme, in terms of incremental effectiveness through achievement of objectives and value for money.

c) Project costs and benefits

B.12 The Supplementary Guidance Notes on the Package Approach provides tabular frameworks for scheme appraisal; one for transport, environmental, and economic development impacts, and one for economic and financial consequences. Comparable frameworks have also been constructed for specific major bus priority investments. Such tables are intended to act as a checklist for local authorities to ensure that all relevant impacts are considered, and to satisfy them (and demonstrate to the Government if necessary) that all measures are consistent with local authority policies and play a part in achieving objectives.

B.13 The framework is a minimum requirement for package bids; the results of any additional analysis should also be presented. However the Department no longer requires that authorities automatically submit tables with submissions, but may call for them later for clarification.

B.14 The Department does not require full economic analysis for individual measures of less than £2m within TPP submissions. Qualitative assessments of physical/traffic and environmental consequences are required.

B.15 B.13 and B.14 should not be taken to imply a relaxed attitude to economic appraisal. Local authorities should satisfy themselves of the value for money of bus priority and other measures even though they may not be required to present them to the Department.

B.16 Table 1 is a suggested framework for the presentation of bus priority appraisals. Like the package approach tables it is meant as a guide. Alternative approaches may more clearly present the effects and economics of individual measures while retaining the same basic content.

Stand-alone priority measures

B.17 There will continue to be a place for bus priority measures which are not part of a recognised package of measures. Nevertheless the basic principles of identifying overall strategies and objectives will apply, and in many cases their contributions may be significant. Even where there is no significant impact on wider objectives a "nil response" is a useful piece of information.

Table 1

Appraisal Framework

CONTEXT

Brief description of local traffic, environmental and economic conditions, traffic growth.

Relevant local policies/strategies;

How priority measures contribute

SCHEME

Discussion of do-minimum.

Description of scheme. (Map)

Expected reactions of operators

Description of modelling techniques and data sources

Discussion of its reliability

TRANSPORT IMPACTS;

A [Table] Opening year Do-min Opening year Option

Traffic levels, vehicles⁽¹⁾⁽²⁾⁽³⁾

Car

Other private

Bus

Cycle

Pedestrians⁽⁴⁾

Bus load factors

And mode shift

Highway speeds / Time savings in minutes

Car/other private vehicles (On route, parallel)

Bus (Distinguish routes where available)

Pedestrians

Accidents

(Quantitative estimates if available, otherwise qualitative in discussion section)

B [DISCUSSION/SUMMARY]

Additional information to that provided in the Table

ECONOMIC APPRAISAL

A Discussion of occupancies, trip purposes, values of time etc

B [TABLE] Opening year (Year, £000
in 19XX prices, discounted to 19XX)

COSTS

Capital costs (in year 19XX)

Operating costs

Delays during construction

BENEFITS

TIME;

Car occupants

Bus occupants etc

FUEL COSTS;

Ditto

[RELIABILITY]

Buses

TOTAL

Benefit/cost ratio, payback period etc

Sensitivity tests

C DISCUSSION/SUMMARY

ENVIRONMENTAL APPRAISAL

Land take, noise, air quality, etc. Reference to local policies, scheme objectives.

ECONOMIC DEVELOPMENT IMPACTS

Discussion/quantification

Notes

(1) Specify units

(2) For appropriate point(s) on main corridor and any parallel routes which change significantly as a result of reassignment.

(3) Separately for different time periods if necessary

(4) Effect on total pedestrian flows and diversions

Appraisal methods

a) Depth of assessment

B.18 This requires a balance between the need for detail - to provide sufficient information for decision makers and funders - and cost and practicability. This applies to the operational assessment of priorities as well as an economic and environmental appraisal. Two useful underlying principles are;

a) models and other analytical devices should be used as an aid to decision making; they do not remove the need for qualitative or political judgement.

b) do not attempt to obtain direct measures where they are inherently unsuitable; there will be cases where indirect indicators or qualitative and objectives related approaches, are more appropriate.

B.19 One consideration will be the ease with which schemes with effects of modest proportions can be modified after opening. For example if initial modelling/simulation produces uncertainty as to which of two designs will be most effective it may be more sensible to try one, with the recognition that change may subsequently be necessary, rather than attempt a series of expensive, and perhaps uncertain, more complex simulations.

B.20 In general however, expensive schemes and schemes with larger impacts should receive more rigorous appraisals. Such schemes may require some assessment of reassignment effects of other traffic (and possibly modal split) away from the route of the priority, while this would be unnecessary where capacity and journey times for such vehicles are effectively maintained.

B.21 Congested assignment models can be expensive and time consuming to set up from scratch, and without careful handling (such as close attention to convergence) can give misleading results where small network changes are applied. More ad hoc methods of assessing reassignment effects may be attractive, especially where the local network is uncomplicated, and with realistic sensitivity analysis. In other circumstances, especially where detailed models have been built for analysing package proposals, reassignment effects of priority measures may be more practical.

B.22 Models for package bids may include mode shift and other demand effects, which may be appropriate to consider where priority measures provide major time savings for buses. Alternatively, conventional congested assignment models, or even a series of junction models, may provide a realistic estimate of major bus journey time savings which could be used to make some assessment of potential mode shift. However mode shift estimates will always be uncertain and are obvious candidates for sensitivity analysis, (and, perhaps, more detailed modelling) especially where initial estimates suggest the scheme is marginal. Priorities may also encourage existing bus users to make additional trips.

B.23 Other factors relating to the depth or complexity of appraisal methodology include;

* variability of traffic flows through the day or week. Even modest differences in levels and tidal flows, and even such factors as differences in origins and destinations, can affect the operational consequences of bus priorities. Thus in heavily congested networks it may be necessary to consider each peak, inter-peak, and Saturdays separately. For less congested or complex networks a sensible (e.g. adopting sensitivities) use of factors applied to journey times or monetised effects may be possible to compare different periods outside the peak, or even to relate them to estimated effects of the peak itself.

* variations in the regulations throughout the day or week will also affect the degree to which appraisals need to be fragmented. Some priorities along a corridor may operate at times of the day after others have ceased to apply. This may also affect the interrelationship of different sections or junctions.

b) Principles of economic appraisal

B.24 Project appraisal of transport investments should be a composite exercise which takes account of all significant consequences. Within that, economic appraisal should aim to compare the discounted costs and benefits of those factors for which money values can acceptably be derived. For larger road investments some environmental consequences are being examined as to the appropriateness of their valuation and incorporation within economic appraisal, although this is unlikely to be of major significance for most bus priority measures. But investment decisions can never become mechanistic operations and will continue to depend upon an overall judgement of economic and other factors, with particular reference to relevant policies and objectives.

B.25 The essential components of an economic appraisal of a bus priority measure are;

- capital costs and (possibly) operating costs including enforcement
- journey time savings to occupants of buses on the bus route
- benefits to new bus users, totally new trips or shifts from other modes
- changes to journey times of occupants of other vehicles on the route and on other links of the network (including other buses) and pedestrians.
- the value of changes in journey time reliability
- effects on fuel and other vehicle operating costs
- any consequences for accident levels
- any encouragement towards a transfer from car to bus

B.26 Some projects may involve significant capital expenditure, on land take, junction redesign, highway redesign to enable contra-flow bus lanes etc. though generally very much smaller than urban highway investments (e.g. inner relief roads, road dualling,). In some schemes it might therefore be thought necessary to carry out appraisals over a project's economic life, comparable to a COBA or URECA appraisal for highway investments. Long term traffic forecasting in congested, capacity constrained, networks is fraught with difficulties, introducing additional uncertainty on those priority measures which appear to require many years to achieve pay-back (or, which amounts to the same thing, have marginal npvs after even 20 to 30 years). Detailed attention to these calculations can also distract from the important question of whether priority measures do actually provide benefits to bus users and how they compare to costs imposed on other road users. In general therefore even priority measures costing in the region of £1 - 2M (greater expense would be very rare) should be expected to achieve payback within a couple of years and should not require complex forecasting exercises. If schemes do appear marginal when assessed over such periods (where an 8% real discount rate should be used) it is likely that annual net benefits are low because there are costs to other vehicles to set against the benefits of buses, rather than low benefit levels to buses. In such circumstances it is better to assess the worth of the scheme by examining such costs and benefits in terms of local policies and objectives rather than mechanistically extending the appraisal period.

B.27 An original intention was that bus priorities would permit buses to get to the front of a queue of traffic, obtaining significant time savings with minimal effect upon other vehicles. In practice many schemes inevitably take some road or junction capacity and other vehicles will suffer delays. In terms of economic efficiency the gain to bus users should be sufficient to outweigh such costs to other users, capital costs, and any other net costs (e.g. vehicle operating costs). However, the final decision on whether to implement schemes which fail to achieve a net benefit depends, as noted earlier on other factors also. These wider considerations apply only where the measures contribute to the overall transport objectives of the area, and wider environmental and planning considerations.

B.28 However it would generally not be appropriate to use priorities as a deliberate measure to restrain car use. That would be a particularly inefficient method, unable to discriminate between vehicle types or trip purposes, and tending to hit hardest those with highest values of time. The justification for npv negative schemes needs to be well argued, cogent, and consistent.

B.29 Improved public transport services can contribute to net economic regeneration, for example by improving employment supply. However, within local policies for economic regeneration or growth there are frequently specific objectives of gaining or regaining economic activity from surrounding towns. These may apply particularly to Park and Ride schemes associated with bus priority measures. While these are clearly proper local concerns it must be recognised that they do not count as national resource benefits. The exception would be where there is an accepted national policy for the regeneration of a specific area or inner city.

c) The "do minimum"

B.30 The correct appraisal of a project is not, normally, with respect to current network design and operations (the "do nothing") but against the network as it will be at the time of implementation (ie incorporating other schemes and measures which are committed and have funding agreement). Such schemes need to be explained. In addition the "do minimum" should take account of other minor changes that could, and indeed in the absence of the priority measures, should be implemented. Particular examples are to examine whether existing traffic light settings could be optimised, which might improve journey times for buses and other vehicles. Enforcement of existing parking and other restrictions should be examined. A common failing of priority measure appraisals is to assume proper enforcement of the new measures while ignoring the potentially valuable contribution which enforcement of current restrictions could bring. For both do-minimum and do-something cases the modelled effectiveness of enforcement policies should be realistic rather than idealistic.

B.31 The "do nothing" retains an important role in being the only scenario in which models can be calibrated and validated.

d) Model inputs

B.32 The Department's current advice on values of time and vehicle resource operating costs for use in economic appraisals is set out in Highways Economic Note 2 (HEN2). This is updated from time to time and is published as Appendix II of the COBA Manual. Resource values of time per person are listed in Table 1 of HEN2 for each vehicle type, and for working and non-working time. It is important that working time values apply only to journeys made in the course of work. Nonworking time values apply to all non-work journeys, including travel to work, by all modes.

B.33 Table 2 of HEN 2 gives average vehicle occupancies, and average proportions of cars in working and non-working time. While these values may be used in the absence of other local data, it is strongly recommended that where bus priority measures are involved, local surveys should be carried out to establish local values for these factors for the times when the bus priority scheme is to be operational. Bus priority measures are often used at times and places where the traffic mix and vehicle occupancies are quite atypical, and for this reason local survey data should always be used in favour of national averages. Since the essence of a bus priority measure involves trading off time savings to one type of road user against delays to others, every effort should be made to establish accurately the numbers of each type of road user affected. The proportions of car occupants in working and non-working time are important. It may be appropriate to carry out roadside interview surveys to obtain local information on this if none is already available. It may be found that in some situations, significant numbers of light goods vehicle occupants are in non-working time. Where the bus priority

scheme is to operate at both peak and off-peak times, a separate appraisal should be carried out for each time period.

B.34 Local policies and strategies may aim to favour/discourage particular categories of trip purpose by mode of travel, e.g. to discourage commuting by car. It is recommended that the impact upon different categories are distinguished in the presentation of the appraisal, but applying additional weights to the basic HEN2 values of time is not acceptable.

B.35 HEN 2 also gives a formula for calculating resource vehicle operating costs and a table (Table 5) of parameters for each vehicle type. Because vehicle operating costs depend on speed and delays, the introduction of a bus priority scheme will affect vehicle operating costs, and these should, wherever possible, be taken into account in the assessment. The vehicle operating costs in HEN2 are based upon national averages. Although they will be sufficient in many situations, there are circumstances where a more detailed estimate of the effect on bus operating costs would be appropriate. For example, if the introduction of a series of bus priority measures meant that the number of buses required to run a particular service could be reduced, the bus operating cost savings could well be greater than the formula would indicate.

B.36 Priority measures may have consequences for safety, for vehicle occupants, cyclists or pedestrians. Highways Economics Note No 1 gives the Department's estimates of the values for the prevention of road casualties and accidents for use in cost-benefit analysis.

e) Reliability and regularity

B.37 Improved reliability is often seen as a major benefit of bus priority measures, and an invaluable factor in the attempt to persuade more people to switch from their cars. The Department has therefore commissioned research towards the preparation of a methodology for estimating and presenting reliability benefits from priority measures. This will report in 1997. In the meantime, if reliability benefits are thought to be significant any estimate of their value should be presented in a way in which their impact upon the total value of the scheme can be readily identified. All methods and assumptions should be clearly expressed. The following advice is offered.

B.38 Reliability and regularity benefits can be defined as follows:

Reliability benefits result from a reduced spread of on-bus journey times.

Regularity benefits arise from a reduction in waiting times at stops due to a more even headway between buses.

In assessing the overall reliability of a service people will normally consider the two aspects together.

B.39 Passengers with a need to reach their destination at a specific time are likely to value reliability and regularity more highly than those who do not, and in many cases will allow for risk by leaving home earlier than in most cases would be necessary. For each priority measure the overall value of improved reliability will depend upon trip purpose as well as the predicted change in the distribution of journey times, and these should be examined and findings presented.

B.40 Although priority measures may significantly reduce differences in headways along their course, it cannot be guaranteed that improvements will be maintained downstream, and are less likely to be so in congested areas. Appraisals should therefore not assume regularity benefits for all passengers along a route.

B.41 Improved regularity of headways reduces average waiting times at bus stops. If it is possible to predict the distribution of arrivals after the scheme is implemented, and this is compared with estimates of the do-minimum distribution, then one element of the reliability benefit can be estimated, assuming, which is the standard assumption in transport appraisals, that waiting times are valued at twice the ordinary value of time. (This will not give the full value of regularity benefits; it does not, for example, reflect that some people may be able to spend an additional X minutes at home each morning with reasonable confidence of getting to work on time.) Average waiting times can be calculated using:

$$W = H/2 + V/(2H) = H/2 + E$$

where: W = mean waiting time H = mean headway between buses V = variance of bus headway E = excess waiting time owing to service irregularity

B.42 Detailed advice on estimating reliability benefits will be prepared on completion of the current research project.

B.43 Estimates of current unreliability and irregularity should be based upon properly compiled evidence (e.g. an appropriate number of headway counts and journey time measurements).

B.44 Although detailed modelling of the effects on journey time reliability for other road users will generally not be practical, some qualitative assessment should be made.

f) Mode shift and other demand responses

B.45 The two principal effects of priority measures on travel patterns are on bus users (direct time savings) and other road users (time savings or costs). However there are a number of other, more complex, responses. A shift from private cars to bus travel will be an expressed objective of many schemes, but other effects, such as retiming of trips and change of destination are also possible, but will almost always be too trivial to attempt to incorporate within

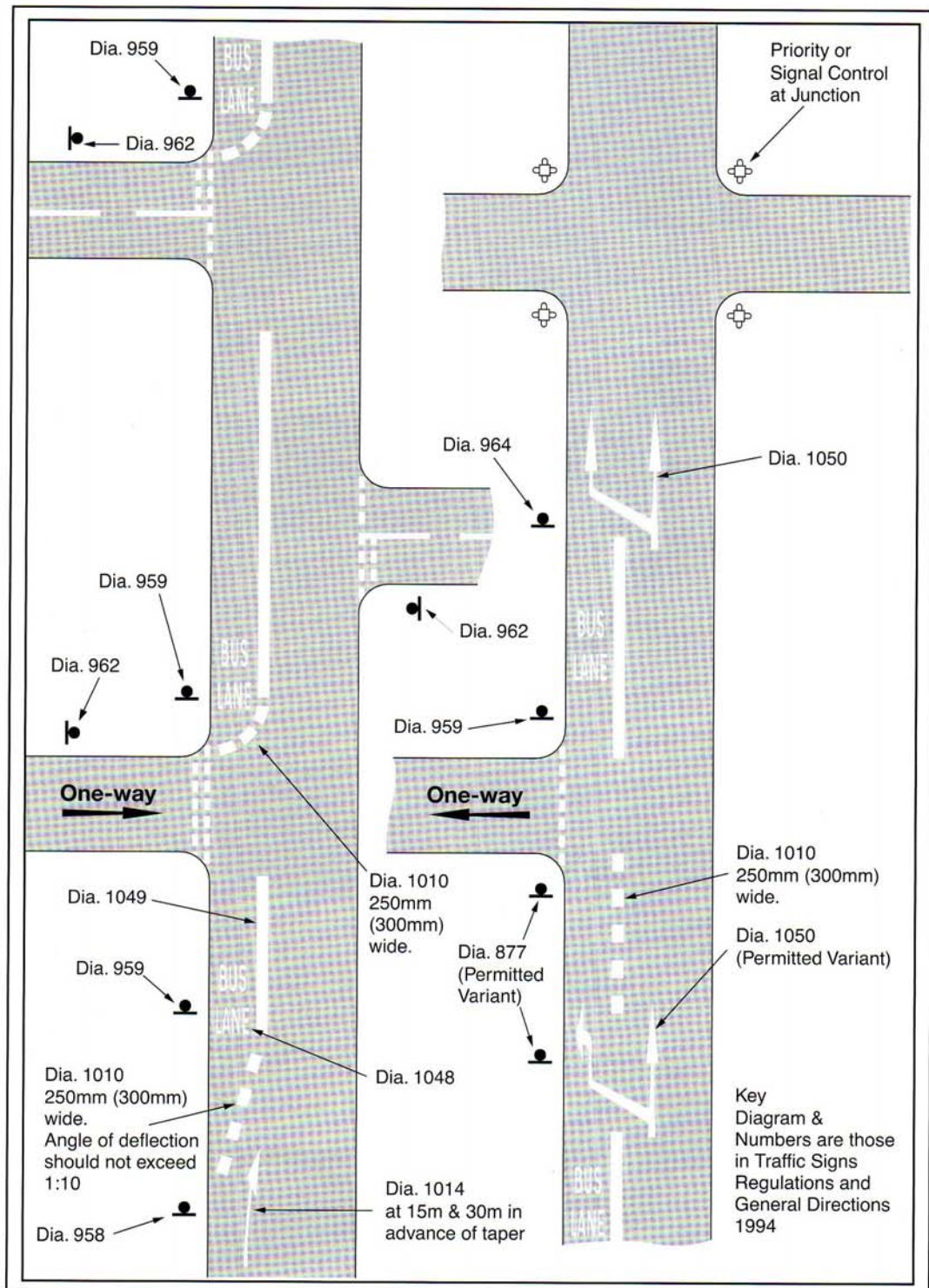
the appraisal. One other effect which may need to be considered is an increase in bus travel which is not a shift from other modes.

B.46 Any predicted shift from car to bus should be incorporated into the economic appraisal according to the 'rule of half'. This should be with reference to the change in consumers' surplus across the relevant particular trips, but in most cases the changes in journey times would be a reasonable proxy. However it should be recognised that where the measures make car travel slower, the rule of half calculation needs to take that factor into account also. If a bus trip improves by 5 minutes and the equivalent car trip deteriorates by 5 minutes, those car travellers who change mode will on average be no better or worse off than before the scheme opened. (Their "gain" is in avoiding the 5 minute penalty to car travellers.)

B.47 A further complexity is the assessment of additional bus trips which are not a result of mode shift. It can be argued that these people impose a trivial cost on other bus users (if they significantly slow down services through longer dwell times at stops this should be incorporated directly in journey time calculations) or other resources. However their expenditure on bus tickets represents a freeing of equivalent resources (though netting off any relevant tax on such expenditures) elsewhere, which should enter the appraisal as a benefit. However, in a competitive bus market it can be argued that such additional revenue to the bus industry would be competed away by increased supply. This does involve additional resource costs, though also benefits other users since higher supply means lower waiting times or improved departure opportunities. It is impossible to make hard and fast rules on this question. If it is thought reasonable to include an additional benefit to reflect increased bus use it should be clearly explained in the presentation, and a check made to see whether the value for money calculation is sensitive to it.

WITHFLOW BUS LANE TYPICAL LAYOUT

FIGURE 1



BUS ADVANCE AREA

FIGURE 2

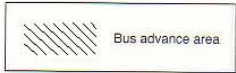


Fig. 2A

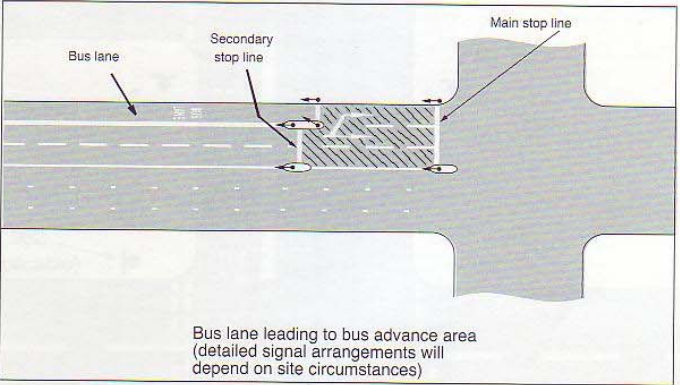
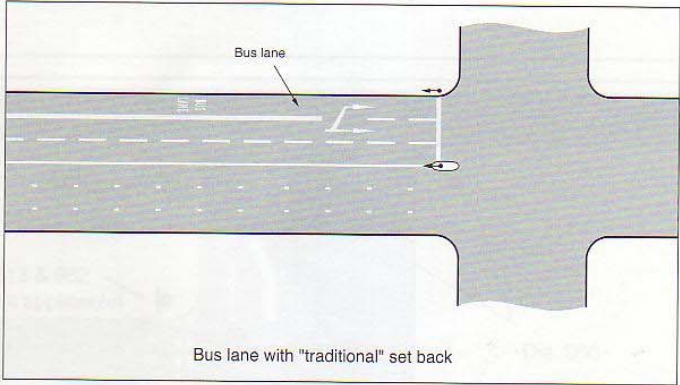


Fig. 2B

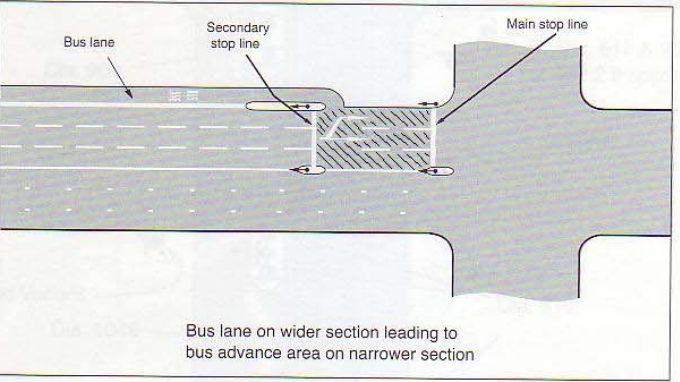
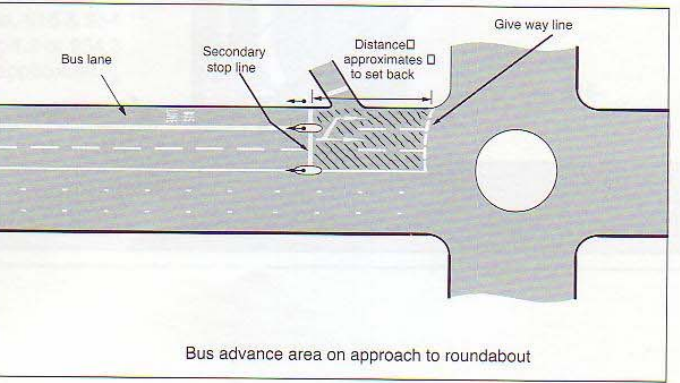
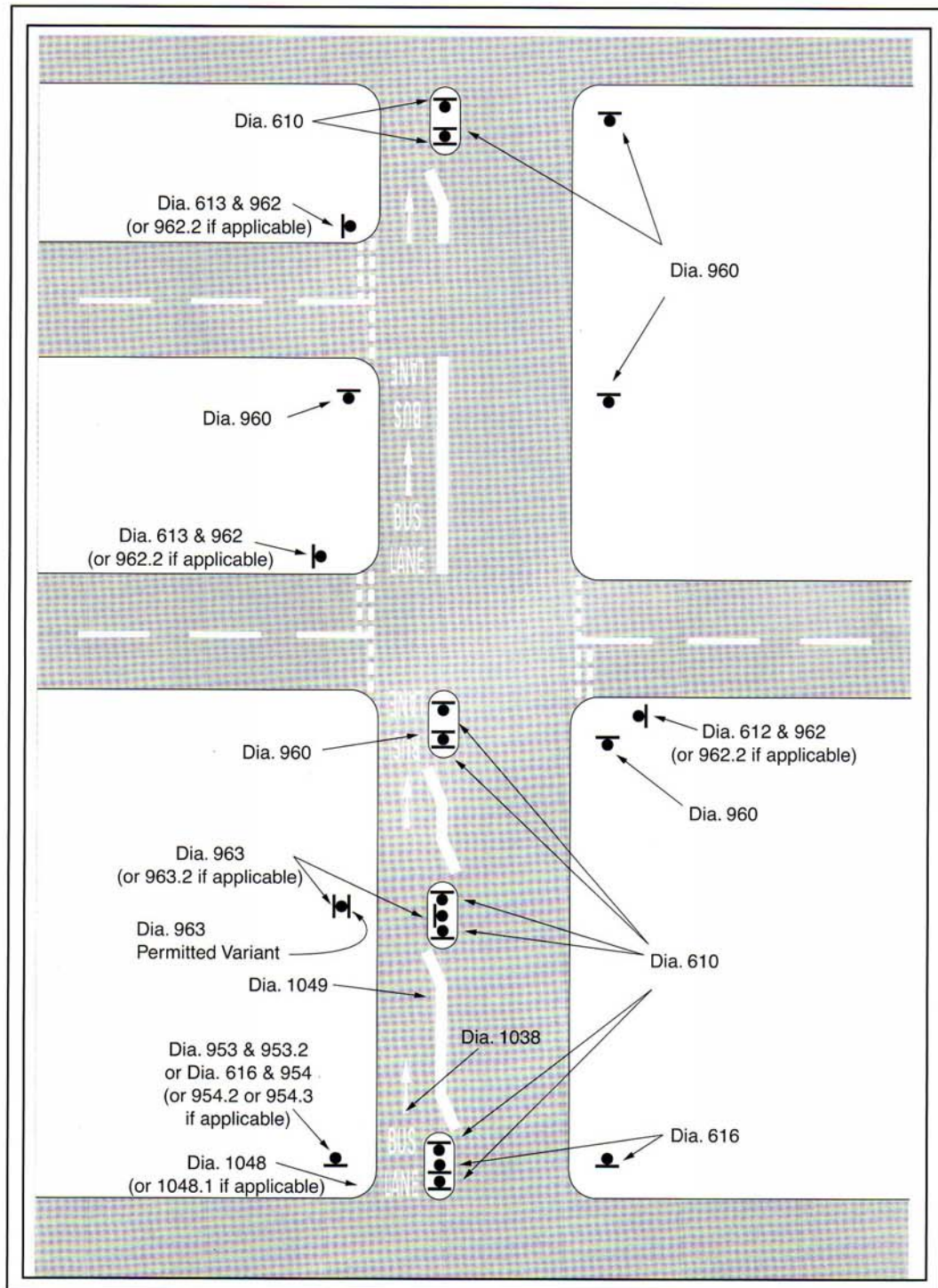


Fig. 2C



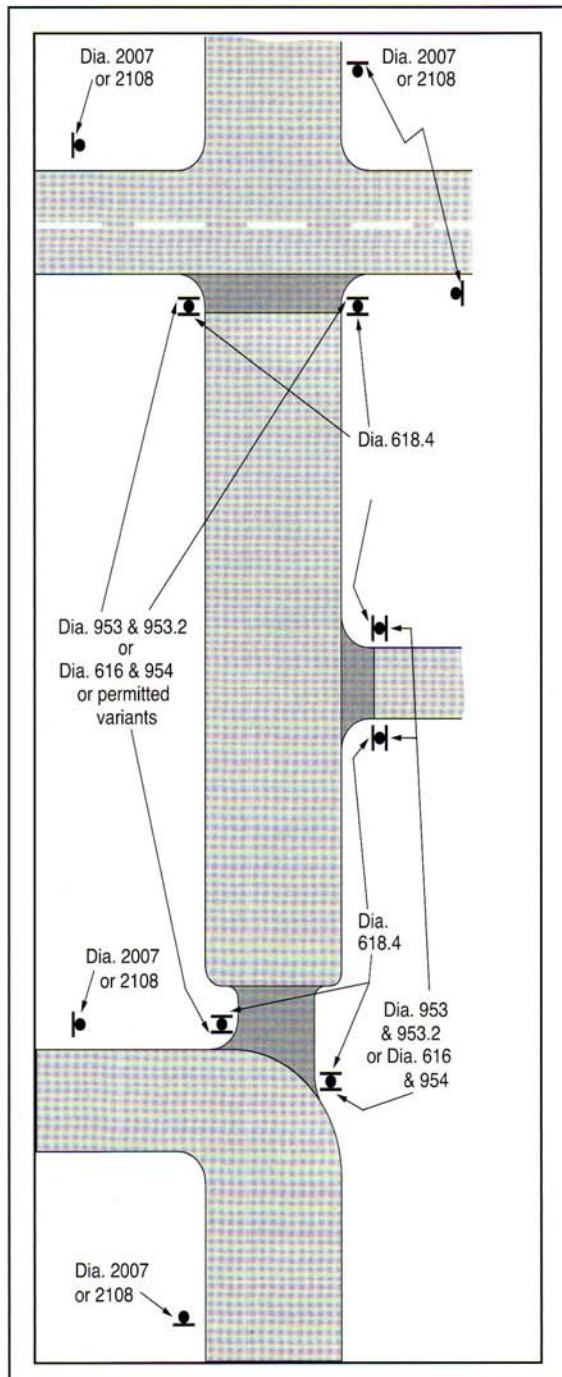
CONTRAFLOW BUS LANE TYPICAL LAYOUT

FIGURE 3



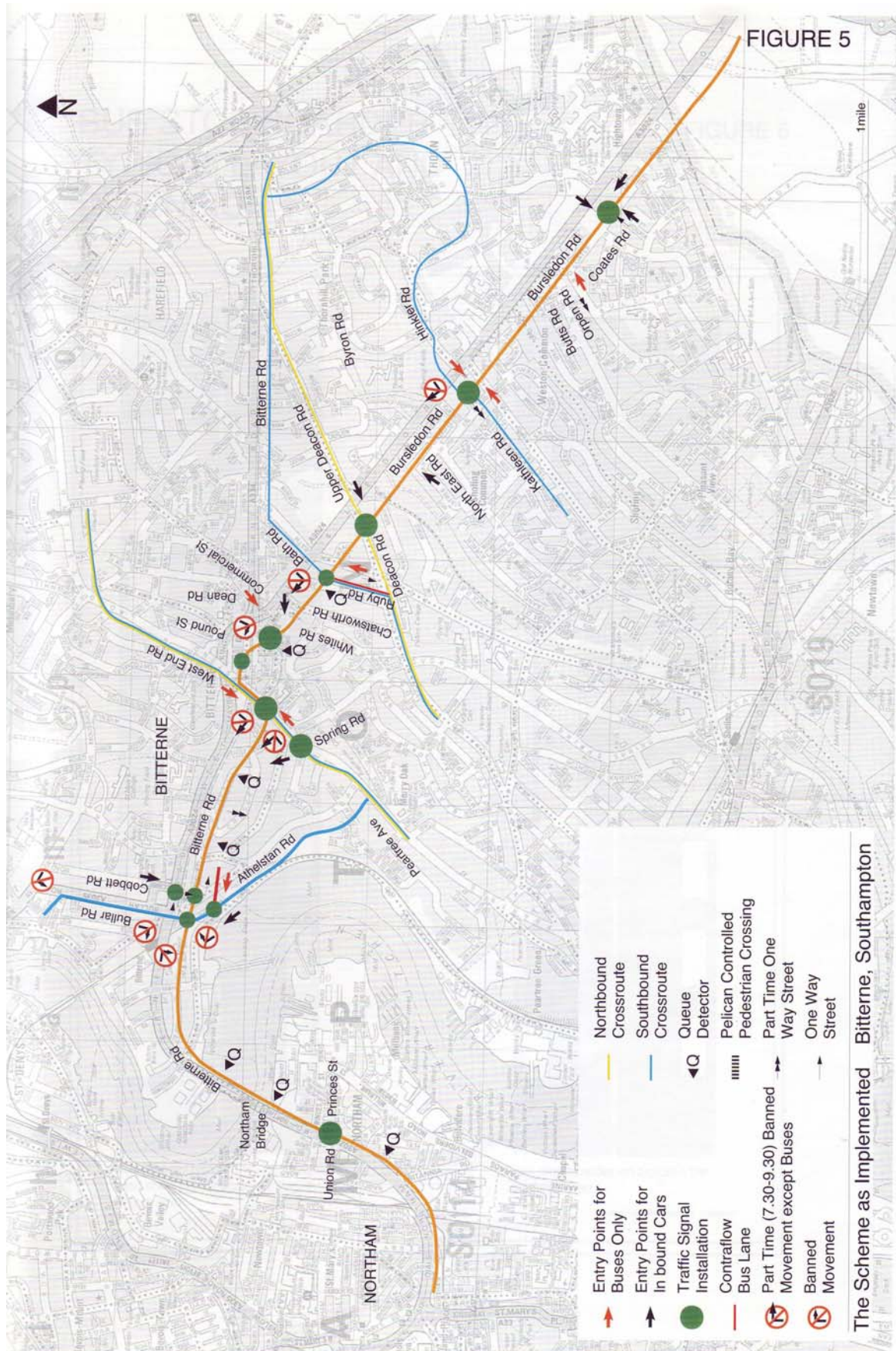
BUS ONLY STREET TYPICAL LAYOUT

FIGURE 4



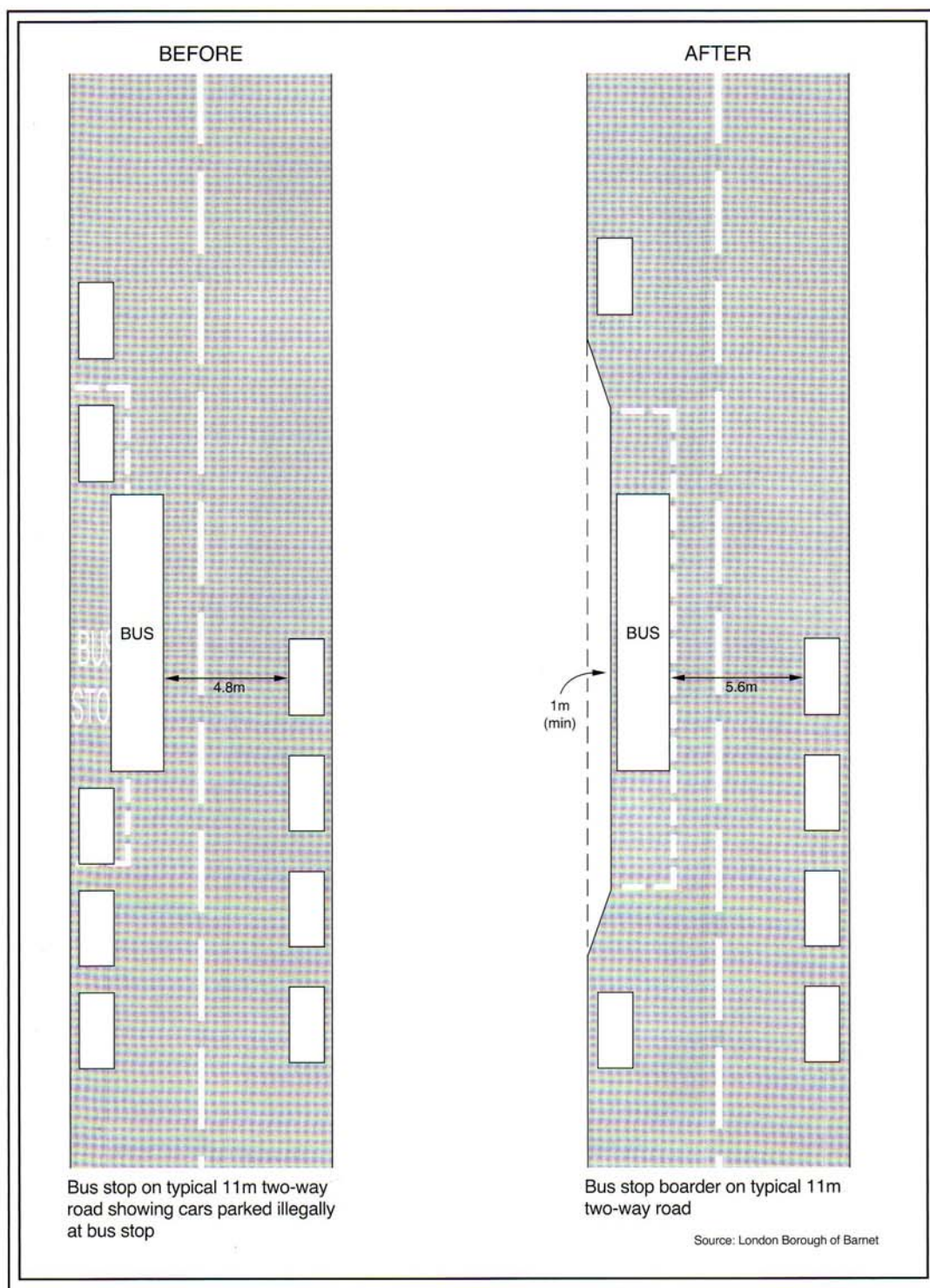
Notes:

1. "BUS ONLY" Carriageway markings may be authorised.
2. Signs to dia. 2007 or 2108 should be varied to include either
 - a) dia 616 (with no plate) or
 - b) dia 953 plus 953.2 plate according to entry signs used at commencement of Bus gate.



BUS STOP BOARDER TYPICAL LAYOUT AND DIMENSIONS

FIGURE 6



LAY-BYS AT BUS STOPS

(See also Reference 27)

FIGURE 7

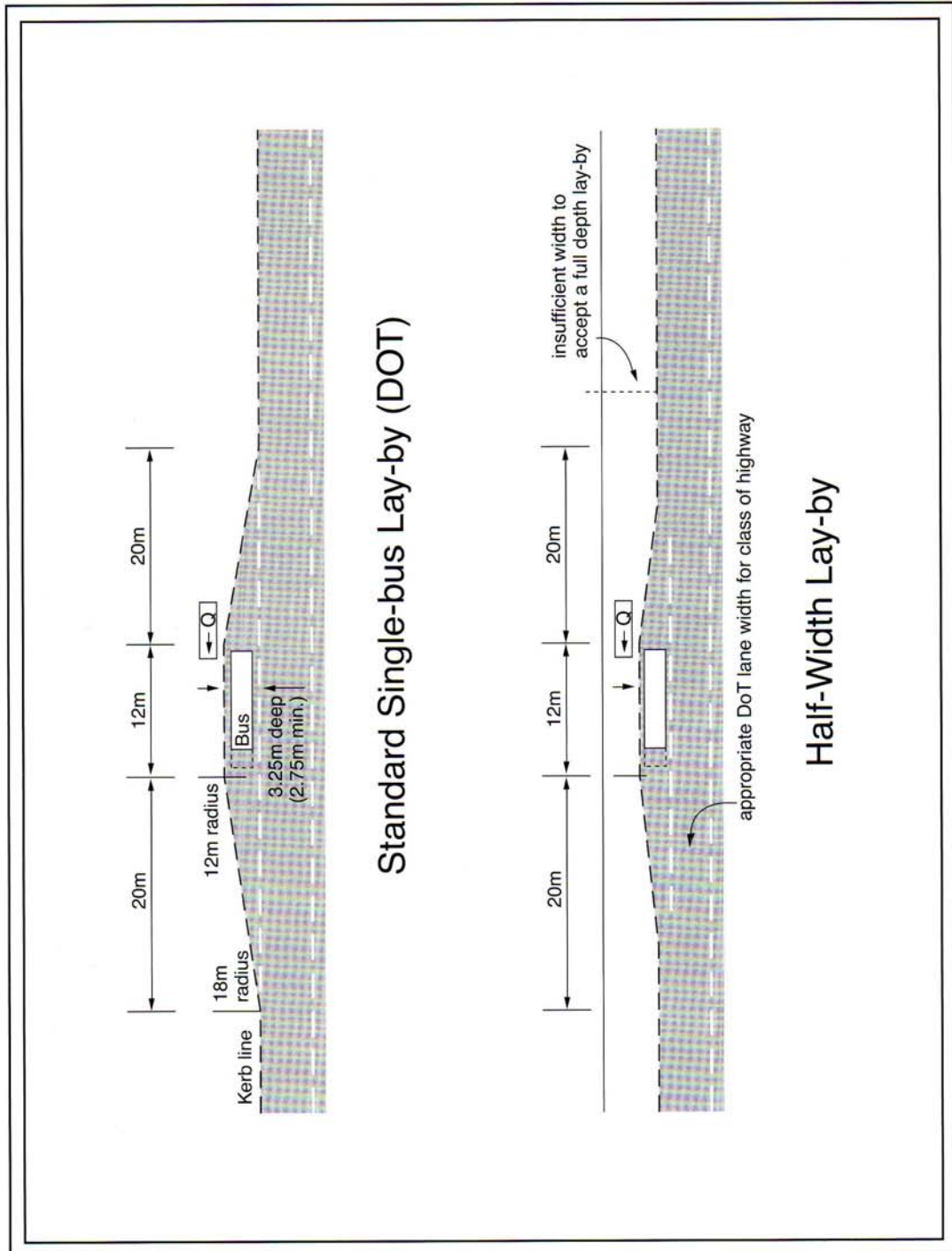
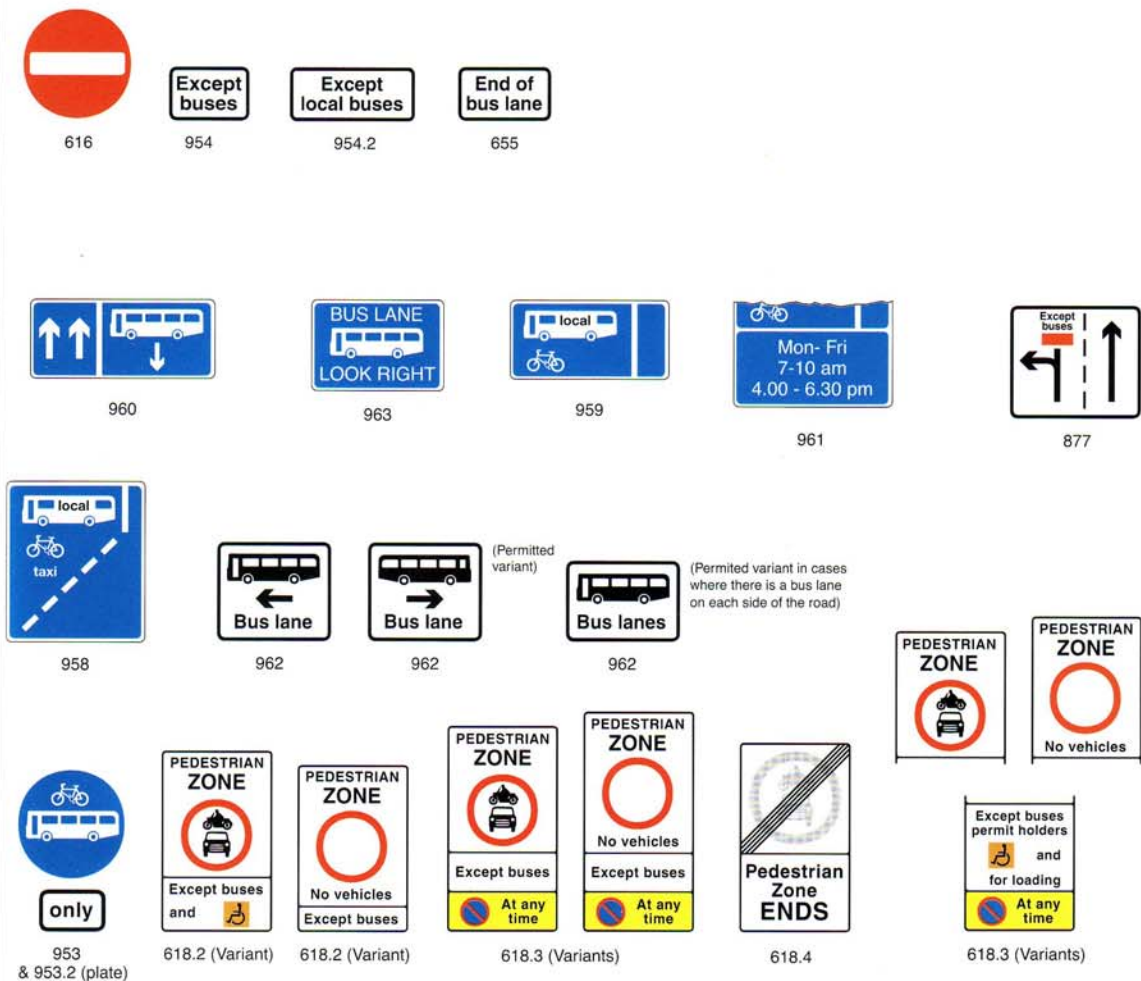


FIGURE 8

SIGNS FOR USE WITH BUS LANES



SIGNS FOR USE AT BUS STOPS



CARRIAGEWAY MARKINGS FOR USE WITH BUS LANES

