URBAN PUBLIC TRANSPORT TODAY

E & FN SPON
An Imprint of Chapman & Hall

BARRY J. SIMPSON

Also available as a printed book
see title verso for ISBN details

URBAN PUBLIC TRANSPORT TODAY

OTHER TITLES FROM E & FN SPON

Transport Planning
An international appraisal
David Banister

Transport, the Environment and Sustainable Development
David Banister and Kenneth Button

Environmental Dilemmas
Ethics and decisions
Edited by R.J.Berry

Urban Regeneration
Property, investment and development
Edited by Jim Berry, Stanley McGreal and Bill Deddis

From Garden Cities to New Towns
Campaigning for Town and Country Planning 1899–1946
D.Hardy

Rebuilding the City
Property-led urban regeneration
P.Healy, D.Usher, S.Davoudi, S.Tavsanoglu and M.O'Toole

Write in Style
R.Palmer

Project Management Demystified
Today's tools and technioques
G.Reiss

City Centre Planning and Public Transport
B.J.Simpson

Marketing the City
The role of flagship developments in urban regeneration
H.Smyth

Development and Planning Economy
Enviromental and resource issues
P.A.Stone

Saving our Planet
Challenges and hopes
M.K.Tolba

For more information about these and other titles, please contact:
The Promotion Department, E & FN Spon, 2–6 Boundary Row, London, SE1 8HN

URBAN PUBLIC TRANSPORT TODAY

Barry J.Simpson
Civil Engineering Department, Aston University, UK

E & FN SPON
An Imprint of Chapman & Hall
London • Glasgow • New York • Tokyo • Melbourne • Madras

Published by E & FN Spon, an Imprint of Chapman & Hall, 2–6 Boundary Row, London SE1 8HN, UK

Chapman & Hall, 2–6 Boundary Row, London SE1 8HN, UK

Blackie Academic & Professional, Wester Cleddens Road, Bishopbriggs, Glasgow G64 2NZ, UK

Chapman &Hall Inc., One Penn Plaza, 41st Floor, New York NY10119, USA

Chapman & Hall Japan, Thomson Publishing Japan, Hirakawacho Nemoto Building, 6F, 1–7–11 Hirakawa-cho, Chiyoda-ku, Tokyo 102, Japan

Chapman & Hall Australia, Thomas Nelson Australia, 102 Dodds Street, South Melbourne, Victoria 3205, Australia

Chapman & Hall India, R.Seshadri, 32 Second Main Road, CIT East, Madras 600 035, India

This edition published in the Taylor & Francis e-Library, 2003.

First edition 1994

ISBN 0-203-36223-3 Master e-book ISBN

ISBN 0-203-37481-9 (Adobe eReader Format)
ISBN 0 419 18780 4 (Print Edition)

A catalogue record for this book is available from the British Library

Library of Congress Cataloging-in-Publication Data available

CONTENTS

PREFACE

Although we all have an image of what we think of as being public transport, when we come to define it, it is not quite so easy. We may think of public transport as any means of passenger transport available to anyone without restriction as to membership of any group, provided that the conditions of the operator are met, including payment. It may be publicly or privately owned and will run regularly, usually to a timetable.

Such a broad definition would include all kinds of localized transport such as moving pavements at airports for example, cable cars at ski resorts or in other mountainous areas, small-scale monorails or other railways at leisure parks, horses and carriages in some towns with a substantial tourist industry. These kinds of transport may be important locally but here I have restricted myself to the sort of public transport for longer journeys and which account for the main part of public passenger journeys. In effect, this means buses and railways.

There is a widening gap between what we expect of public transport and what can be delivered, given the circumstances in which we seem to expect it to operate. Our expectations for travel are increasing, both in quantity and in the standards of speed, reliability and comfort. Out-of-town shopping, leisure parks and business parks all involve more travel than did their predecessors. Cars are becoming more like mobile sitting rooms with all the home comforts such as CD player and telephone. To give all this up for a bus or train is asking a lot.

We all still recognize that there are many people for whom public transport is essential, particularly amongst the elderly, children and teenagers and others who have only limited access or no access to a car. Less obvious is the dependence of our cities for their existence on high capacity public transport. Yet there is still a prevalent view that local public transport, especially buses, is only for those who do not have a car, a welfare service for the needy. We still prefer to spend our money on cars rather than public transport, knowing

that we cannot all have unrestricted use of them. But we are slowly and patchily beginning to realize that we will have to face up to the reality that we must now find ways of restricting use of the private car more severely, and that will involve some transfer to public transport.

Public transport has suffered badly from the imposition of political dogma. Some parts of our public transport network are underfunded. Elsewhere, public money is being wasted. Some of out transport policies conflict and undermine the financial viability of public transport leading to poor value for money. Public transport needs to be coordinated and planned together with land uses under the Town and Country Planning legislation. The plain truth is that since the coming into force of the Transport Act 1985, no-one plans transport or even public transport as a whole. Not only has no-one the duty to do so, no authority even has the power to do so should they think it advisable.

By international comparisons, our public transport operators are on the whole quite efficient, given the unhelpful legislative and political context in which they have to operate. Even so, a great deal of improvement is possible without throwing a lot of money at our public transport networks. Certainly there are many opportunities to get better value for money at the same levels of public expenditure.

This book is about how local public transport can be made to address what will continue to be asked of it, about how public transport can be made a less unacceptable alternative to the private car than it is now. It is intended for officials, politicians and others interested in the land use/local transport conundrum, about the understanding and reconciliation of what at present is a misfit between demand for movement and the possibilities of achieving it. These should certainly include town planners and those working for passenger transport authorities and in fact anyone concerned with policy making and project appraisal for local public transport.

If passenger transport planning is about arranging for people to have accessibility to where they want to go, easily, quickly and in large numbers, we have been performing far below our best for a long time. This book is certainly concerned with the problem and hopefully provides a few clues as to how passenger transport planning can be nudged a little closer to the ideal.

Barry J.Simpson MSc PhD

1

ISSUES FACING LOCAL PUBLIC TRANSPORT

1.1 THE RISE OF THE PRIVATE CAR

The increase in the number of vehicles, particularly private cars, on the roads of Britain during recent decades is well known: in 1974 there were 13 399 000 licensed private cars, in 1983 15 543 000, and in 1991 19 737 000—an increase of 47% between 1974 and 1991. We might think that as the number of cars in relation to the population increases then usage per car will decrease: those acquiring cars may be those who give less priority to car ownership, some will be buying second cars. In fact the usage of private cars and taxis by passenger kilometer increased even faster than car ownership—by 87% between 1974 and 1989. The length of motorways in Great Britain increased from 1870 km in 1974 to 3070 km in 1990–64%—rather more than private car registrations. Meanwhile, the number of buses licensed has declined from 79 000 in 1974 to 69 000 in 1984 but rose following deregulation of local bus services under the Transport Act 1985 to 73 000 in 1990. The number of public transport passenger journeys declined from 6224 million in 1980 to 5085 million in 1990 (Department of Transport, 1991a).

As private cars have increased in numbers there have come to be fewer people dependent on public transport, but as land uses have become more orientated to the private car, the need to travel to shops, work or for leisure for example, has increased. Prior to the rise of the car, more of these were within walking distance. There was more likelihood of a good bus service to those too far away to walk than is the case nowadays, especially outside the large cities. Those dependent on public transport have become more dependent on it than were their predecessors in the 1950s and before.

One of the first effects of the rise of the private car to attract public attention was the inadequacy of roads to meet the spiralling demands to use them.

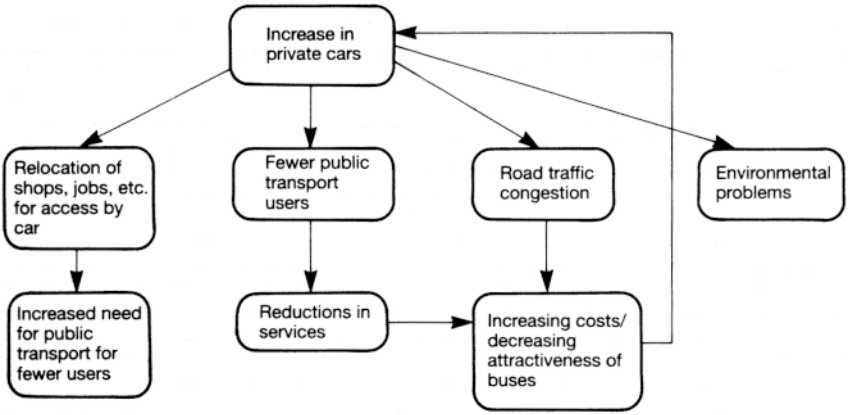

Figure 1.1 The main effects of increase in car ownership on public transport.

Before the motorways were started in the late 1950s, British roads were predominantly from town centre to town centre. Anyone travelling the length of the country would very likely have to pass through the centres of dozens of towns and villages. The volume of traffic pouring through towns incurred the wrath of residents. The slowing down of traffic annoyed the motorist. By-passes were an early solution for through traffic. Together with the motorways they were a boon for the coach industry. Neither were much use for local journeys but they did remove some of the traffic from towns. The speed of local buses in larger towns and cities came to be influenced increasingly by traffic conditions as well as the nature of the road, the number of stops and vehicle technology (Figure 1.1).

Throughout the 1960s, more road construction was seen as the solution and the foundations of the motorway network were laid. By 1972, the M6 reached as far as Carlisle. The M62 stretched across the Pennines. At first, construction was mainly outside urban areas. When attention was turned to large-scale urban road construction, opposition assembled with formidable force. The elevated A40(M), Westway, was opened in west London in 1970 and had a significant influence in demonstrating the costs of urban motorway construction. In 1972 and 1973 in particular, public reaction to the environmental damage caused by ever increasing urban road construction and the threat of more and more demolition of properties reached such proportions that the UK urban motorway programme was all but abandoned. Highway authorities did U-turns on motorways. Chairmen of planning committees 'rescued' the people from the ravages of urban motorways proposed by consultants whom they had engaged to do just that a couple of years earlier. Birmingham had just completed its inner ring road, several other large cities were part way there.

As well as public reaction against the environment of the motor vehicle, it

had come to be realized that the more roads being built, the more traffic that was being created by the temptation offered by better roads. Outside urban areas, motorway construction continued throughout the 1970s, increasing from 1075 kilometres in 1970 to 2290 kilometres in 1980. By the early 1980s trunk road construction was in decline. The M25 opened in 1986 and the M40 was completed in 1990 from London to Birmingham via Oxford after a long series of delays. This is probably the only example of a significant change in route of a motorway for environmental reasons.

From the mid-1960s there was a big decline in ridership on public transport. Car purchase had high priority amongst those with increasing disposable income. Whilst household expenditure on bus and rail fares rose from £1.89 per week in 1980 to £2.25 in 1989 (no account taken of inflation), expenditure on cars rose from £13–11 to £30.42 according to a Department of Employment Family Expenditure Survey (Department of Transport, 1991a, p. 51). This accounted for a large part of the increased demand for roadspace and road congestion and simultaneously took away many public transport passengers.

Private cars have increasingly become extensions of home: radio, stereo CD players, telephone and a whole range of other home comforts are not matched by local public transport. Cars have become easier and more comfortable to drive. One of the few advantages of public transport over the private car—ability to read a book, newspaper or do other minor jobs—really only happen on the longer train journeys. Asking the motorist to give up all these home comforts to return to the buses is asking a lot, even where services are reliable and convenient, particularly as the marginal cost of motoring is so low. Increasingly, public transport and particularly the buses have been left to the elderly, those at school, those not in employment and the less articulate—groups which are not able or inclined to press a case for public transport.

In some countries the increased demand for travel by car was addressed by a big increase in investment in public transport, partly to make it more competitive to the private car. Whereas in 1970 in France, investment in roads was around three times that in public transport, by 1980 these investments were practically the same. However, ridership and receipts did not increase to the same extent and by the 1980s deficits in public transport had become the prime issue.

1.2 EPHEMERAL INTEGRATION OF LAND USE/TRANSPORTATION PLANNING

Contemporaneously with the demise of the urban motorway was the rise of integrated transport planning supported by both successive Labour and Conservative governments. Passenger transport authorities for Greater Manchester, the West Midlands, Merseyside and Tyne & Wear took over

council bus operations and became responsible for the planning and finance of other bus and local railway services. The metropolitan counties came into operation on 1st April 1974 and were responsible for land use planning, public transport and traffic management amongst other functions until their abolition in 1986. In 1970 the Ministry of Transport was incorporated into the Department of the Environment until it was separated six years later.

Soon after 1979, integrated transport planning was dismantled. Public transport was separated from land use planning. The powers of passenger transport executives were reduced. In 1989, a £12 billion road programme was announced at the height of a flood of light rail studies (for details see section 3.5).

1.3 CAR-ORIENTATED LAND USES

Even with the surge in road building, traffic congestion was not being relieved nor speed reduction reversed to the extents envisaged. More and longer journeys were being undertaken. People were travelling further to work. There is quite a lot of evidence to show that when the speed of transport increases, following the opening of a new road or a railway, many people travel further to work to get a wider range of job opportunities rather than just spend a shorter length of time on the same journeys. More and more houses have been built on the fringes of towns where life without private transport would be at least inconvenient. Bungaloid housing, suburban in style and density, has spread to many former villages and with it, a suburban life-style in terms of employment, car ownership and shopping habits.

Land use changes and site planning have been designed for the use of the private car. Particularly in urban areas, car users as a general rule have more money to spend than public transport users and certainly have more capacity to carry away the results. Shopping developers have come to assess site potential according to the capacity of the roads and the size of the car parks possible. More customers buy in quantities appropriate to the freezer and car boot rather than the shopping bag and bus. Shops are pleased to oblige with bigger and bigger car parks. Some even provide assistance to the customer staggering out with a mountain of grocery to the car.

Land use planning policies have often acquiesced with the demands of the car. Many planners have had misgivings about land use decisions and site planning for the private car but the demands from developers have been irresistable. Any town where they were refused would risk being abandoned by the commercial firms that the councils thought they needed. Refusing planning permission for a large commercial development will normally mean a loss of local authority revenue in the form of lost taxes.

With the decline of local shopping, more and more people have to use or even acquire a car whether they want to or not. In many rural areas, any household without a car would have to live bordering on self-sufficiency and the quality of life would be worse in some respects than it was up to the 1960s.

Some land uses, including shopping, at first became more concentrated into larger premises and into town centres. This increased the need to travel. Town centre supermarkets took the place of street corner grocers. Later, in the 1980s ever larger out-of-town hypermarkets began to replace the supermarkets involving even more travelling and even greater dependence on the private car. As for work journeys, when shoppers are able to travel further, they do.

In the late 1980s we had the rise of the business park, many of them on greenfield sites. Out-of-town urban development including both shopping and businesses has been motivated partly by better road access than is usual within urban areas, partly by the scope for more car parking. Typically, close-to-motorway-junctions business parks have been planned in such a way that even if it were possible to get a bus to the edge of the site, there would still be a long walk through a bleak, rainswept 'park', probably without even a continuous footpath. Design is solely for private transport. So too is their location. Like out-of-town shopping, many business parks are on radial routes rather than suburb to city centre. Many are isolated from other traffic generators. Whereas the occupier(s) of a private car often has a single destination, those of a bus usually have many destinations. Public transport thrives on routes with a succession of traffic-generating uses and activities, not a single destination.

1.4 INCREASING ROAD CONGESTION

Increasing road congestion affects buses even more than cars. Buses accelerate more slowly and are less able to take advantage of gaps in streams of traffic. Buses operate to pre-determined routes and so, unlike private cars and taxis for example, are limited in making detours to avoid congested sections of road. Decreased speed makes buses less attractive to passengers, increases fuel costs per mile and increases the number of buses needed for a given service time interval.

Perhaps even more objectionable to passengers than a slow journey is the unreliability of bus services resulting from traffic congestion. Passengers may be unsure whether a journey will take 10 minutes or 30, whether they will have to wait one minute or half an hour, the timetables having been rendered fictional.

Fast-accelerating buses have been tried but these are unattractive, if not dangerous, particularly for the elderly, frail, or those encumbered with shopping or small children. Together these make up a very important part of

bus passengers. Unlike car passengers, all bus passengers have to stand for at least part of the journey, even if only when getting to and from their seats. On coaches, passengers are often warned of the dangers of leaving their seats before the coach stops. On buses they invariably have to and many have to stand for the whole journey.

Away from the larger cities, it is not so much road congestion but low demand which has been the problem for public transport. Low demand without high subsidy means high fares which in turn means even lower demand. Reductions in services and operating costs per bus mile have been the responses, by substitution of minibuses or even school buses or post buses for standard vehicles. Such unconventional means of public transport have increased since the mid-1980s (Robinson, 1992).

It may seem that increasing road traffic congestion, whilst contributing to the decline of bus services, should help the railways. Indeed it has, in London at least. The near impossibility of using a car for many journeys into central London has probably been the main reason for the survival of many rail services. But in smaller cities using the car is not nearly so difficult. The shorter journeys to work would not be so difficult even if there was the same level of congestion on the roads. In the London region, longer train journeys make worthwhile having to travel a considerable distance to a railway station. Elsewhere, lines and stations have been closed, many of them at about the same time as the increases in road construction and car ownership in the 1960s and early 1970s. This has made necessary even longer journeys to the stations which remain, hence the railway networks have entered a downward spiral of decline. To some degree, buses will have substituted for railways, but will also have lost some custom in bringing railway travellers to stations.

1.5 PUBLIC TRANSPORT FOR THE MOBILITY-IMPAIRED

Perhaps partly due to land use changes which have caused greater travel needs for almost everyone, the travel needs of the mobility-impaired have become increasingly recognized over the past decade or two. As well as the physically disabled, some recognition, perhaps not enough, has been given to the plight of the elderly and those encumbered with childrens' push chairs or shopping, for example. The needs of these groups may be addressed either by providing special services such as dial-a-ride (although these services are usually limited to the physically handicapped or the frail and elderly) or by adapting the normal public transport vehicles available to anyone. Low-floor vehicles, at first for light rail such as in Grenoble (Figure 1.2), more recently buses as in Caen, usually together with raised platforms to give level access, have been installed fairly widely, but still account for only a tiny fraction of public transport journeys.

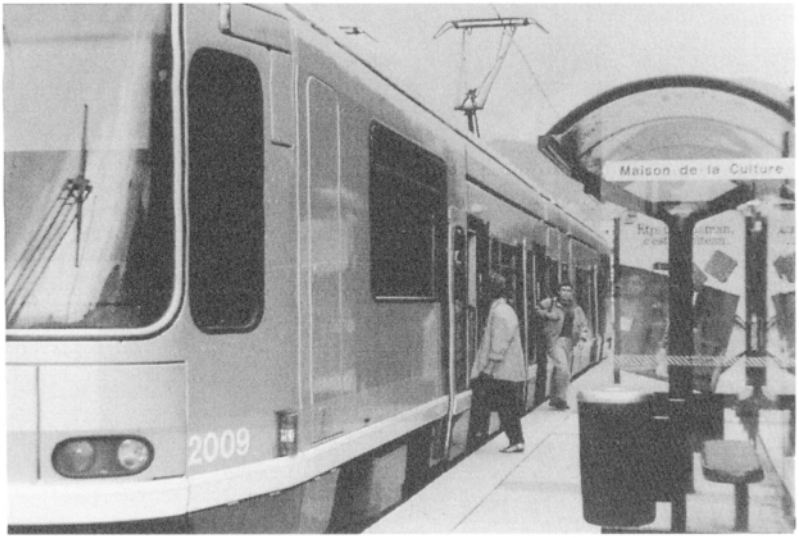

Figure 1.2 The Grenoble low-floor tram.

The French have made significant progress in access to public transport for the less mobile. Speaking in June 1992 at the Sixth International Conference on Mobility and Transport for Elderly and Disabled Persons in Lyon, Michel Gillibert, Secretary of State for Disabled People, claimed that by 1995, all new buses in France will be low-floor (Armitage, 1992).

Access to stations by those in wheelchairs can be achieved by ramp or lift (for underground stations). Although the access needs of the mobility-impaired may have been largely catered for in many of the new light rail systems, there remains the problem, even in towns fortunate to have such a system, of access to the other means of transport needed to get to and from the station.

1.6 PUBLIC TRANSPORT FOR THE YOUNG

The transport needs of children and teenagers are often considered only in terms of transport to school, yet many live in housing estates with little to attract their interest during their spare time. Desolate, extensive grassy areas separate low-density housing, designed only for those with wheels as well as feet. Cycling is not without hazard and even more risky, threat of theft means that there is too high a chance that a cyclist will not have a complete bicycle for the return journey.

1.7 FINANCE OF LOCAL PUBLIC TRANSPORT

It is often pointed out that levels of subsidy from the public purse are very low in the UK both for capital projects and operational costs. Many European cities have operational subsidies of over 40%, some over 60%, whereas UK cities mostly have less than 20%. Undoubtedly most UK cities compare very well in delivering value for money in local public transport services. However, there are a lot of factors which influence the level of subsidy needed, and high levels of subsidy abroad should not necessarily be used as a justification for increasing them in the UK. Some of the factors are as follows:

- land use patterns and densities of occupation (which affect the number of public transport users);
- policies towards the private car;
- levels of fares;
- frequency of public transport services;
- routes of public transport services—the number of socially necessary/loss making routes;
- period of operation of services—the number of off-peak services.

Policies in all of these areas will affect the level of subsidy justifiable.

An important and contentious issue in the subsidy of capital projects has been the difference in methods of assessing road and rail projects for government subsidy which, it has been claimed, favours subsidy of roads. Certainly investment in roads has been greater than in rail for a long time. Birmingham City Council and the Department of Transport have commissioned a study by the Institute of Transport Studies at Leeds University and the MVA Consultancy to find a common method of assessment for road and rail.

1.8 PUBLIC TRANSPORT HAS A POOR IMAGE

Public transport, especially buses, are widely regarded as being something to avoid by anyone who has private transport. This is partly due to misuse by some members of the public. A trip on the upstairs of a double-decked bus is quite likely to involve being caught in the cross-fire between youths shouting obscenities at each other in what to them is normal conversation. Usually they are unaware of how offensive other passengers find them.

Boys running more or less wild on the upstairs of buses on a Saturday or in school holidays is common on some routes. Even when accompanied by their parents, smaller children are sometimes allowed to walk on the seats, even when they are visibly causing a mess which would spoil the clothes of any unsuspecting passengers afterwards.

On some routes, buses are littered with drink cans, bottles, half-eaten take-aways and a motley collection of all manner of rubbish within an hour or two after having been cleaned in the garage. Some trains and buses are so shabby that anyone who is smartly dressed would be put off from using them.

Safety from assault is perhaps even more of a deterrent. Railways in some cities have got a bad reputation, particularly late at night, with fears for personal safety in both carriages and on stations. In some cities, this has had a serious commercial effect. As a result, closed circuit television has been installed, stations and carriages have been designed so that they are more open to view.

Public transport and particularly buses frequently fail to meet the standards of cleanliness that is now expected from many potential passengers. Car users will be accustomed to dressing decently without fear of having their clothes spoiled. They will be accustomed to choosing their company, a particularly important consideration for parents who do not wish to have their children exposed to the kind of language and behaviour that is liable to be encountered on some routes. Bus operators have a very difficult job on their hands in trying to attract motorists.

1.9 RESPONSES OF PUBLIC TRANSPORT

Since around the mid-1960s, the rise of the private car has caused local and central government to search for, and adopt with varying degrees of resolution, measures to support public transport. In many of the larger European and North American cities of at least 300 000 population, the centrepiece of the public transport response has been the development of urban railways. Most of these are entirely separate from road traffic. A few such as those in Nantes and Grenoble share roadspace at junctions, but all substantially offer an alternative means of travel to congested road conditions. Many of the light railways have been accompanied by significant pedestrianization projects and other city centre road traffic reduction measures. They therefore offer an alternative means of access and help to sustain shopping and other city centre activities which might otherwise be adversely affected by road traffic restraint.

The most common response to worsening road traffic conditions has been simple forms of bus priority such as the painting of bus lanes on existing carriageways. Violation by other road traffic has been allowed to happen on a big scale, a sign of reluctance to take a stand against the demands of road users rather than a lack of ability to uphold the traffic regulations.

There have been some isolated attempts to improve standards fo comfort, reliability and convenience of using local bus services but in general, standards have declined over the past two or three decades whilst

the expectations of those now travelling by means other than the bus have probably increased. It may be unkind, but probably largely true that only those with a low expectation in terms of speed, reliability or comfort will travel by local bus.

Public transport, particularly buses and urban rail in inner city areas has not only been losing passengers in terms of total numbers, it has been losing them selectively. Those who can get access to a car do so. It is only those who are left who use public transport. Problems of vandalism and assault of passengers on public transport has had more attention since the rise of the private car and the public image of buses in particular has deteriorated.

Unreliability of bus services is largely due to road traffic conditions beyond the control of the operator. Decline in convenience of using buses is partly due to reductions in services and routes as a response to rising deficits, partly because more and more people have moved from relatively densely occupied but convenient-to-serve inner city areas to low density suburban housing which, on average, is sure to involve a longer walk to the bus stop. The comfort of passengers has been sadly neglected in the attempt to pack in more passengers and produce cheap, rapidly accelerating vehicles. In continental Europe 200–passenger vehicles have been devised and 150–passenger buses are in common use. In Britain we have the minibus and certain models of single-decked bus where some of the seats are so tightly packed that only a child can fit in reasonable comfort.

The bus industry in the UK is still seen as a welfare service to be provided for the less fortunate as a matter of social conscience rather than as a commercial operation needing to meet customers' wishes. Cheapness of operation and cheapness of fares have had priority for a long time. Of course there have been some worthwhile attempts from operators to see services from the customers' viewpoints and to operate efficiently, but sadly there are still too many cases of muddled operation that should reduce a commercial operator to bankruptcy. They probably would do if users had an alternative means of transport. Only a small minority of bus stops have reasonably comprehensive information about timetables, routes and fares, important to reduce fumbling about with change as passengers board. Information on where to catch buses is hard to come by in many towns. The bus industry has had to face formidable problems but has not always helped itself by using the simple, easy, cheap and very obvious measures which would significantly improve services.

1.10 THE TRANSPORT ACT 1985

The Transport Act 1985 reflected a desire to introduce competition into local public transport and a concern with increasing subsidies. In addressing these issues, two main changes were imposed on local bus services: deregulation,

involving the removal of barriers to providing local bus services, and the transfer to the private sector of publicly owned bus companies. It does not apply to London.

Bus operators no longer had to get permission from the Traffic Commissioners to run a service. They simply have to register a local service with the Commissioners giving details of route, timetable and maximum size of vehicle (to judge the possibility of them being unsuitable for the route). No information on fares is required.

The previous arrangements of support for the whole public transport system were replaced by giving powers to local authorities to support what they regard as 'socially necessary' services which are subject to competitive tender. Concessionary fares have been continued, commercial operators being compensated by local authorities.

Independent companies were formed from the transport undertakings previously operated by local authorities. These have to compete for any subsidies in the same way as other commercial operators. The National Bus Company, which carried about a quarter of all local public transport journeys in England and Wales before 1985, was split up and sold.

Grants for the purchase of new buses were phased out but the 100% fuel duty rebate for local bus services was continued.

Whereas previously, local authorities.had a duty to plan and coordinate local bus services, coordination of all services is not now permissible. Any practice which may be deemed anti-competitive has to be registered with the Office of Fair Trading. This includes agreements between operators about fares and timetables, which bus stops and what kind of livery to use. The Monopolies and Mergers Commission may become involved if operators within a local area are bought up.

Deregulation has been accused of being the cause of many of the current problems in the local bus industry.

- There has been some reluctance amongst operators to enter into competition and many routes would not support more than one operator, but where there has been competition, it has resulted in buses running in bunches rather than at regular intervals.
- Fares have generally risen sharply (by 112% in metropolitan areas between 1985 and 1992, 60% in shire counties, and 76% in London, where services were not deregulated).
- Lack of cooperation between operators has resulted in poor connections between services.
- Companies are discouraged from agreeing to operate joint timetables because this might be deemed as preventing competition.
- The system of registration encourages destructive competition whereby services are withdrawn at short notice.
- Although there has been reduction in some fares where there is competition on a particular route, difficulties are experienced in

planning journeys due to lack of comprehensive information about timetables and on which services return tickets will be valid.
- Due to pressure to award tenders at the lowest price, more old, shabby vehicles are being retained. The number of maintenance staff employed in the bus industry declined sharply from 80 000 in 1984 to 58 000 in 1987.

The Transport Act 1985 has brought some benefits to some groups involved in public transport—the frequency of services has increased along some (mostly already busy) routes, subsidies have been reduced, benefitting taxpayers (grants to road passenger transport has decreased from £1031 million in 1984/85 to £936 million in 1990/91: Department of Transport, 1991a). However, the number of passenger journeys has declined in both metropolitan and shire counties between 1985 and 1991 whilst in London, journeys have increased. The consensus amongst those involved in managing, operating or using public transport is that the disbenefits are greater and revision of the legislation is awaited before many of the current problems can be adequately addressed.

1.11 POLITICAL ATTITUDES

British public transport faces an unstable immediate future. On the one hand there is a professed interest in maintaining and improving services by both the main political parties. The period since the late 1980s has seen a spate of public transport studies, particularly for light rail feasibility and a few lines have been built. On the other hand, no-one seems able and willing to take effective action against the root cause of most public transport problems—the unbridled use of the private car at very low marginal cost—and the coordination of land use policies with public transport infrastructure has, overall, been very poor. One the one hand we keep telling ourselves that we want a good public transport system whilst persuing land use policies orientated to the private car.

The results of land use polices remain for decades. When cities have taken shape under the influence of the private car, the bus or any other form of public transport, it will take several decades until land uses and densities could significantly adapt to a different form of transport. Large parts of British cities have grown with the bus and in the past two or three decades, the private car as the dominant form of transport. Reintroduction of rail or any other form of transport needing higher densities than those adapted to the bus, or even worse, the car, will be an uphill struggle.

In any case, the desire for car travel is here to stay. In particular it seems likely to increase amongst some of the groups at present using public transport. In 1975/76 69% of men aged 17 or over in Britain and 29% of the women

had a driving licence. In 1989/90 the figures had risen to 78% and 48%, respectively.

The motor car industry is a powerful political lobby. Large numbers are employed in it, even larger numbers dependent on it. In times of economic difficulty a government has to seriously consider the effects on employment of the taxation level on cars. In voting terms there is far more to be lost from having high levels of taxation than there is to be gained from the votes of those concerned to limit the number of cars on the roads. There is a substantial number of marginal Parliamentary seats close to where motor vehicles are manufactured.

Central and local governments have tried to tempt motorists out of their cars. The carrot of improved public transport has hardly ever proved successful without the stick of intolerable levels of congestion or lack of car parking. In a few cities such as Singapore and recently planned for Stockholm, charging for road space has been a policy. Very commonly in Europe, simply blocking up roads to varying degrees, by restricting access times, or category of vehicle has been carried out hand-in-hand with public transport improvements.

Public transport in Britain and particularly bus deregulation, has become caught up in insensitive political dogma and there are few signs that legislators know and care about what has happened. Public transport does not have a high priority with any political party because no connection is made between quality of services and the way people vote. The private car is much more influential in voting. Politicians fear the consequences of raising taxes. Addressing road traffic congestion is seen by politicians as a vote winner, so much so that they have even claimed that improving public transport will achieve this voluntarily and have used this as a reason for public transport investment. It seems that many politicians think that spending on public transport cannot be justified simply because we want a better public transport system—it has to improve road conditions as well. Maybe the public transport industry should not complain about the result even if the reasoning is flawed.

1.12 A PAROCHIAL VIEW

Public transport has quite different meanings from one part of the world to another. Table 1.1 hints at a few of the issues worldwide. There is a very large variation in the level of public transport service (people per bus) although it should be remembered that some of the cities have a substantial rail network; land use patterns in the developing world tend to be more mixed and will require less travelling and, especially in the USA, the low level of bus use reflects the very high level of private car use.

Table 1.1 Public transport statistics for selected cities

City	*Population (million)*	*Number of buses*	*Public transport journeys (million)*	*People per bus*	*Passenger journeys per person per year*	*Passenger journeys per bus per year*	*% subsidy*
Aberdeen	0.24233	233	34	1030	142	145 923	
Leeds–Bradford	2.0	1288	198	1553	99	153 727	
Stoke	0.34	511	25.1	665	74	49 119	5
Birmingham	2.6	1862	417	1396	160	223 953	
Leicester	0.28	578	58.7	484	210	101 557	
Algiers	2.5	657		3805			0
Abidjan	1.9	1208	271	1573	143	224 338	20
Accra	1.4	169	15.1	8284	11	89 349	
Addis Ababa	1.8	243	140.5	7407	78	578 189	
Conakry	0.75	100	20	7500	27	200 000	
Brazzaville	0.3	600	40	500	134	66 667	
Yaoundé	0.2	310	45	645	225	145 161	
Lubumbashi	0.45	100	20	4500	44	200 000	
Ahmedabad	2.4	669	243.6	3578	101	364 125	
Dalian	1.5	500	300	3000	200	600 000	
Ulan Bator	0.6	150	35	4000	58	233 333	
Katmandu	0.35	122	12	2869	34	98 360	
Baghdad	3.5	780	124	4487	35	158 974	
Georgetown Guyana	0.2	40	5.6	5000	28	140 000	0
Maracaibo	1.5	850	100	1765	67	117 647	
Caracas	3.5	800	300	4375	86	375 000	
Brasilia	0.6	1476	207	407	345	140 244	
Guatemala City	1.5	1124	402	1335	268	375 651	49
Guayaquil	0.8	1000	175	800	219	175 000	
Melbourne	2.9	1399	342	2073	118	244 460	
Brisbane	1.3	613	42.5	2120	33	69 331	
Memphis	0.75	256	14.1	2929	19	55 078	54
Omaha	0.54	187	6.6	2888	12	35 294	62
Oklahoma City	1.0	114	3.5	8772	3.5	30 702	90
Fort Worth	0.43	143	5	3007	12	34 965	74
Kansas City	0.45	295	18.1	1525	40	61 365	72
Aarhus	0.26	234	46.5	1111	179	198 718	41
Stockholm	1.6	1987	213	805	133	107 197	61
Gothenburg	0.6	259	44	2316	73	169 884	60
Hamburg	1.6	1337	199.4	1197	125	149 140	38
Frankfurt	0.6	417	26	1438	43	62 350	52
Munich	1.3	1146	179	1134	138	156 195	41

2

THE VARIETY OF PUBLIC TRANSPORT

Bus services continue to account for a very high proportion of public transport journeys, in many towns, over 90%. In larger cities of over about 2 million people, local railways might account for up to 50% of public transport journeys. The lighter varieties of railway, including trams, are a significant part of the public transport network in much smaller cities of down to around 100 000 population. In some cities, taxis account for a considerable number of urban journeys.

There have also been many innovatory public transport systems, either in terms of development of technology such as Maglev, or the application of technology such as the Parry People Mover, or in terms of management and organization, e.g. post buses, community buses, ring-and-ride, car sharing schemes, use of school buses by other members of the public.

The long-standing distinction between buses and trains has become a little blurred as a result of the development of vehicles such as Guided Light Transit which combine some of the features of each. However, the distinction between buses and trains is still of some merit, certainly in terms of the very high proportion of passenger journeys they account for and as a starting point from which it is useful to view the hybrid vehicles which have been developed, mainly since the 1980s.

2.1 BUSES

Buses come in many sizes, carrying from about nine passengers to over 200 in the case of the few double-articulated buses in service in Bordeaux. We may think that the differences between buses and railways are obvious, but nearly all the characteristics of buses are found in at least some kinds of railway. The essential distinction between buses and rail is that buses are not confined to a fixed track, although in some cases, as for guided buses, they

can operate on a fixed track when required. Trolleybuses operate on fixed routes if not fixed tracks. All the other characteristics of buses—rubber tyres, sharing roadspace with traffic and diesel power, for example—can be found amongst some kinds of railways.

For a long time the single-decked bus carrying about 45 seated passengers and up to about a dozen standing has been standard in many countries. In some of the busier cities, buses have fewer seats and more standing room to increase the carrying capacity. In Britain and in parts of the world which have been under British influence, the double-decked bus has been common, usually carring about 70 seated and a dozen standing passengers. Away from the towns and cities, single-decked buses have always been normal due to the lower number of passengers and difficulties in manoeuvring double-decked buses on some roads.

The double-decked bus is even more efficient than the single-decked bus in terms of roadspace usage and drivers' wages per passenger. It is still the predominant form in many British towns and cities but during the 1980s the double-decked bus began to fall slightly out of favour for a number of reasons. First, acceleration is generally not as fast as for single-decked buses. Slow acceleration may be a blessing as far as passengers are concerned but with deteriorating road traffic conditions, slow acceleration has put these buses at an even greater disadvantage when trying to get into traffic queues. A further problem with double-decked buses has been that the upper deck has been particularly prone to vandalism, and at night in some towns has been unpopular with passengers for fear of assault. The number of licensed double-decked buses in Britain fell from 25 600 in 1980 to 22 800 in 1990 whilst the number of single-decked buses rose from 43 600 to 50 100.

The double-decked bus has remained largely a British phenomenon. In continental Europe, the move to increase capacity of buses on a limited number of busy city routes has been to reduce the number of seats in existing buses or to introduce longer, articulated buses. With around 150 passengers, articulated buses have a higher capacity than double-decked buses. The existence of low bridges, tram, trolleybus or other overhead cables and other obstructions has also been against introducing double-decked buses.

Not all buses are purpose-built. Many minibuses are models of vans adapted to carry passengers. In the developing world, many kinds of van and lorry have been adapted to varying degrees to carry passengers. Vehicles are smaller and older, many having been bought from Europe second-hand.

2.1.1 Trolleybuses

Trolleybuses were common in Britain during the inter-war period. Worldwide there are still about 330 trolleybus networks, nearly half of these in what was

Figure 2.1 A trolley bus in Lyon.

the USSR. In Europe, there are 15 in Switzerland, 15 in Italy and 6 in France (Figure 2.1).

During the 1980s there were some initiatives to reintroduce trolleybuses into several west European cities including Bradford, but so far with only limited success. The main reasons for reviving the idea has been that they are regarded by many as being less damaging to the street environment, emerging as a more sensitive issue in many towns and cities during the 1980s. Being electrically powered, they produce no on-street pollution. There is, of course, some pollution in generation of the electricity to power them, but this is likely to be in environmentally less sensitive areas. They are also much quieter than buses, which may be a blessing environmentally but can also be a safety hazard to pedestrians, especially the blind, cyclists and others who may detect a bus coming from behind by sound rather than sight, hence their unfortunate nickname, 'whispering death'.

It has also been claimed that they can be used on steeper slopes than diesel buses, but there are few routes where this is an issue. The reasons for their limited success so far has been the higher capital and operating costs compared with diesel buses and their inflexibility of route. The British trolleybus industry is now defunct and maintenance would be difficult. In short, the benefits they offer compared with the diesel bus are not seen as being of much significance.

2.1.2 Minibuses

The term 'minibus' is often used loosely to represent any bus significantly smaller than the conventional single-decked bus carrying around 50 passengers.

Figure 2.2 Minibuses bring customers to the Merry Hill Shopping Centre in the West Midlands.

The Construction and Use Regulations 1986 define a minibus as having between nine and 16 passenger seats but the expression is still commonly used for vehicles with as many as 20 or 24 seats. Sometimes, buses with 17–35 seats are referred to as 'midibuses'. Only about 12% of minibuses are in service as passenger service vehicles (Figure 2.2). Others are used as company, school or college personnel carriers by health, school or social service authorities or are in private use, for example.

Small buses have been in service in rural areas and in specialized services in urban areas for many decades but they increased greatly in number in urban areas during the latter half of the 1980s, even in the central areas of cities as large as Manchester and Leeds. There have been a number of reasons for the increase in use in urban areas, apparently against the simultaneous trend towards larger, articulated buses in west European cities. The increased frequency of service compared with conventional services has been an important factor in the popularity of minibuses with the travelling public. Increased frequency has been allowed by lower capital and operating costs, including drivers' wages, and has resulted in an increase in ridership, compared with conventional buses. Minibuses also allow closer contact with the driver, important in districts and at times when passengers feel vulnerable to assault and in helping to reduce vandalism and maintain the cleanliness of the vehicle.

Increased ridership has been a factor in the trend from mini- to midibuses, so defeating some of the purposes of introducing smaller vehicles. In 1988/89 there were around 10 000 midibuses and 7700 minibuses operating as public service vehicles in the UK compared with 7800 and 8100, respectively, the previous year.

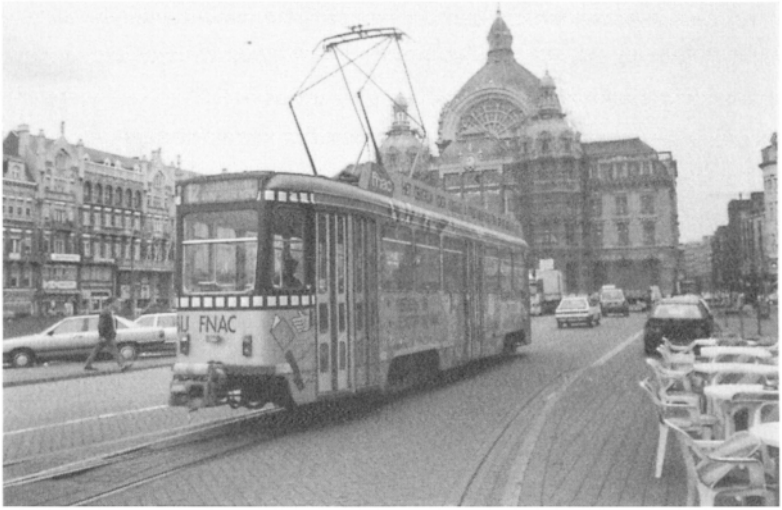

Figure 2.3 Trams have been retained in Antwerp.

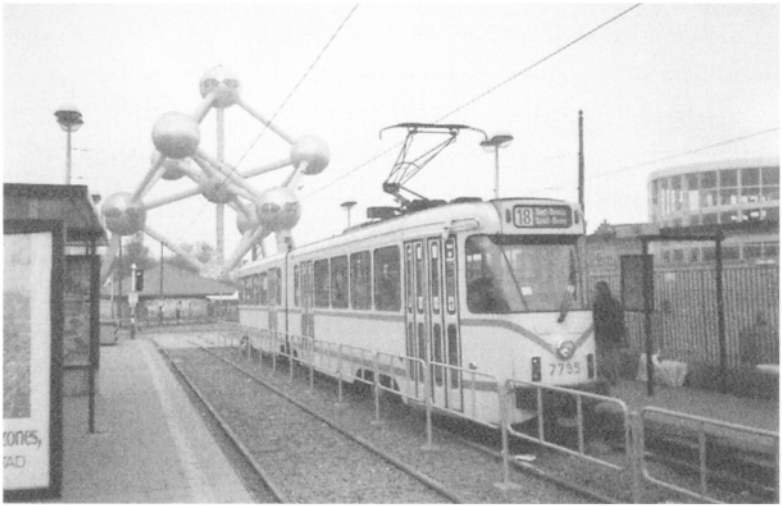

Figure 2.4 Trams operate along with the métro in Brussels.

2.2 RAILWAYS

Railways are at least as varied as buses. Traditionally they have had steel wheels on steel rails but recently, rubber on steel or concrete has become common. We sometimes hear objections to the use of the term 'railway' for many types of vehicle not having steel on steel and we have terms such as 'rapid transit' and 'people movers'.

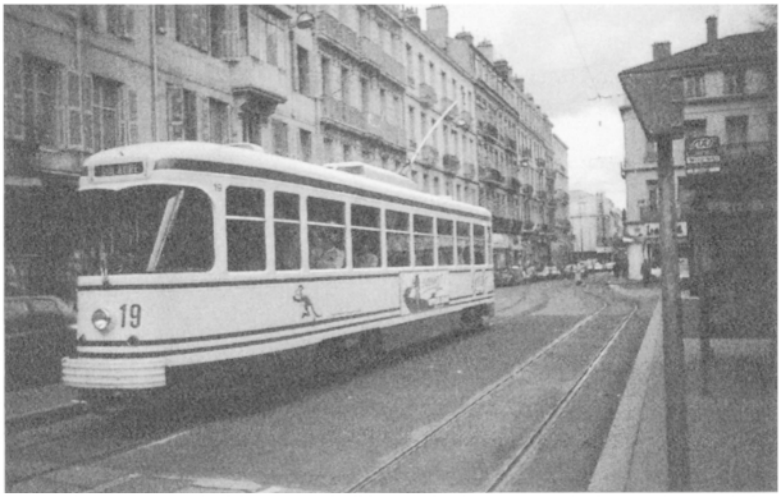

Figure 2.5 The St Etienne tram network is being modernized.

Figure 2.6 Some of the Nantes Tramway uses former railway track.

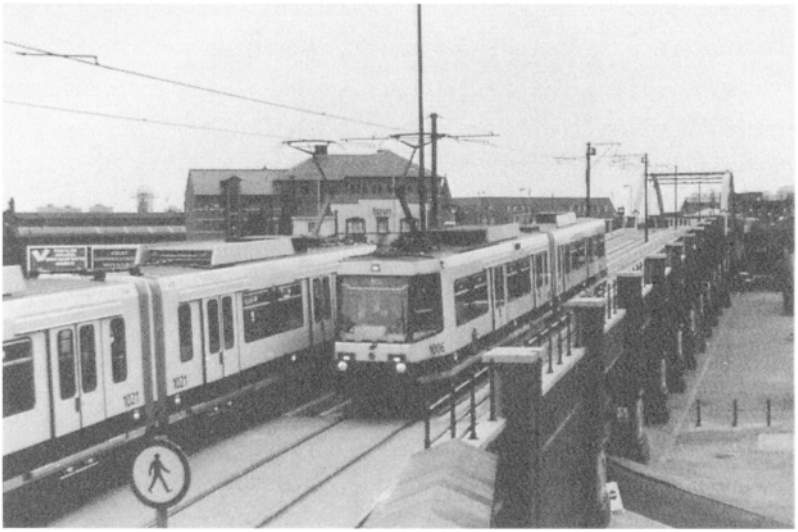

Figure 2.7 Manchester Metrolink.

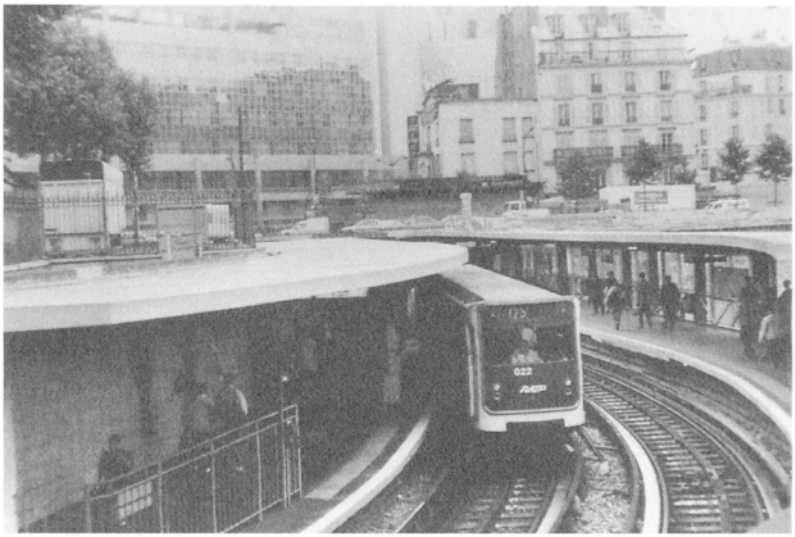

Figure 2.8 The Paris Métro at Bastille station.

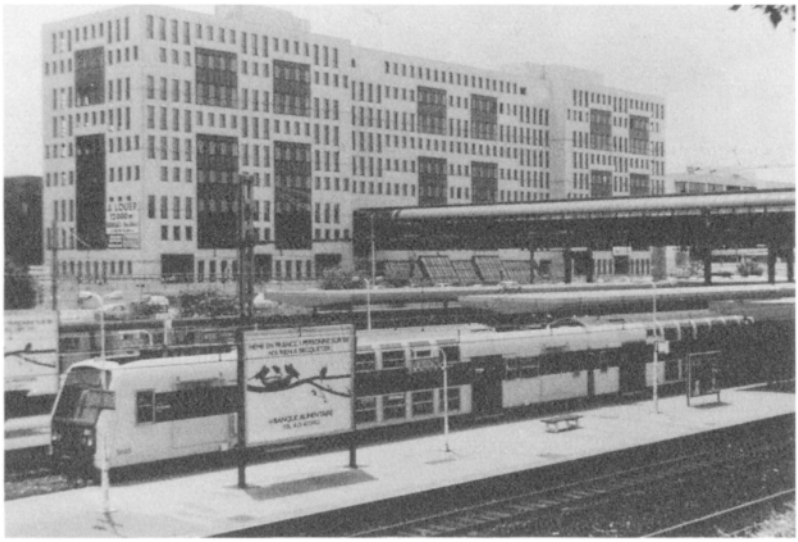

Figure 2.9 Double-decked RER train at St Quentin-en-Yvelines.

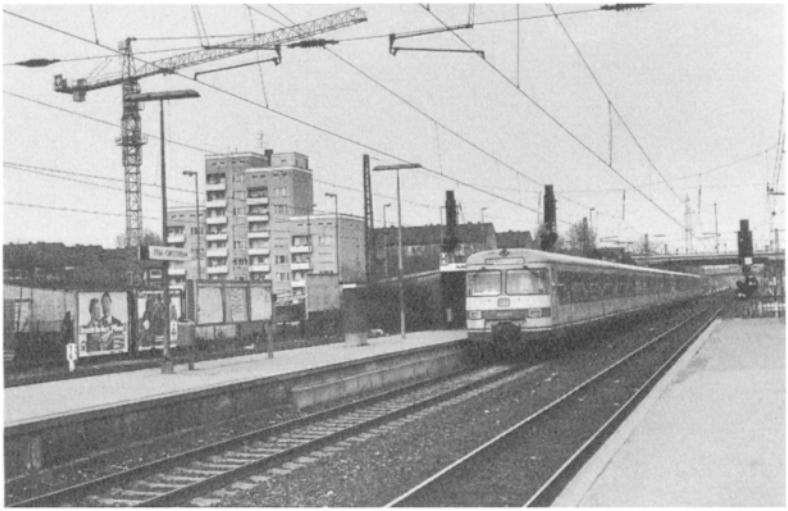

Figure 2.10 The Frankfurt S-Bahn.

Figure 2.11 The Frankfurt U-Bahn serves more local traffic than the S-Bahn.

Figure 2.12 The Tyne and Wear Metro opened in 1980 and was a milestone in British local rail.

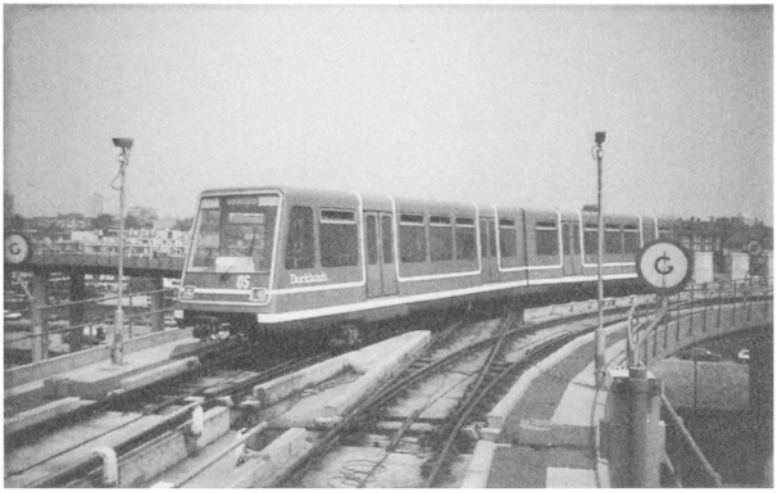

Figure 2.13 The London Docklands Light Railway provided access needed to develop the Isle of Dogs.

Urban rail comes in many forms. On the one hand we have trams, still common in Europe and making a return in a new form in a few west European cities including Nantes, Grenoble and Manchester (Figures 2.3–2.7). At the other extreme are suburban railways such as those of British Rail, the Paris Réseau Express Regional (Figure 2.9) and the German S-Bahnen (Figure 2.10). In between we have various 'metros'—the Paris Métro, German U-Bahnen, the London Underground, the Tyne and Wear Metro and London Docklands Light Railway, for example (Figures 2.11–2.13).

There are also suspended railways whereby carriages are supported from wheels attached to the roof, usually from a single rail. The Wuppertal Schwalbebahn (swallow railway), dating from the early years of this century is a well-known example (Figures 2.14 and 2.15). The Astroglide system and the Dortmund H-Bahn are more recent versions.

Non-suspended monorails such as the Von Roll monorail at the Merry Hill Shopping Centre in Dudley operate on a box-section girder (Figure 2.16).

There is a great deal of ambiguity and lack of consistency in the use of terms associated with the lighter varieties of urban railways. Tramways are fairly well understood. They are the older, mainly pre-Second World War varieties with varying degrees of modernization, together with the as yet small number of tramways of the 1980s and 1990s. Apart from the more spacious, smoother-running rolling stock, modern tramways have more separation from road traffic and more sophisticated signalling which improve comfort, access to carriages, speed and reliability. The modern versions are also included within the term 'LRT' (which can mean either 'light rail transit' or 'light rapid transit'. 'Light rail transit' is probably less inaccurate although

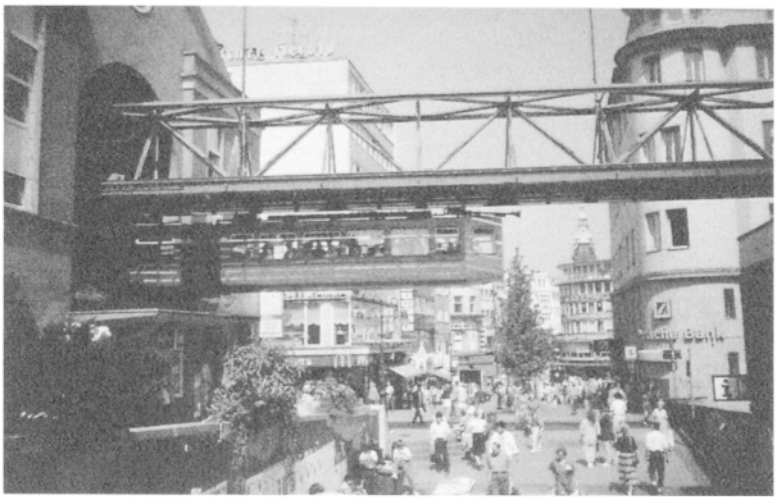

Figure 2.14 The Wuppertal Schwalbebahn leaving the main city centre station.

it is to be recognized that some rubber-tyred rolling stock or magnetically levitated vehicles do not run on anything commonly called rails. (The term 'light rapid transit' would be misleading when sharing roadspace and with closely-spaced stops.)

The lighter varieties of métro such as the métro léger in Lille and London Docklands Light Railway are also generally agreed as being LRT. There is less agreement about the Tyne and Wear Metro. Probably a majority of those associated with LRT would exclude it as being too 'heavy'. No-one would include the Paris Métro or the London Underground. 'Light' and 'heavy' do refer to the weight of the rolling stock, but also to a series of other features of the railway as well.

A further source of ambiguity which has recently come into use is to exclude from the definition of light rail rubber-tyred rolling stock running on steel or concrete track, sometimes referred to as 'guided transit'. I have not used this definition and would include such rubber-tyred systems as the Lille, Marseille or Lyon métros as light rail (Figure 2.17). 'Guided transit' can also be a source of confusion firstly in that it is sometimes used to refer to buses adapted to run on guided tracks and secondly because it is not at all clear why any railway does not come within the term.

Urban rail systems are of almost endless variety. Although we speak, for example, of tramways and métros, this refers only to the dominant characteristics of a system. Urban rail systems can (and in most cases do) combine characteristics to form hybrids which do not fit unambiguously into any of the commonly accepted categories of tramway, Stadtbahn (light railway; Figure 2.18), métro (U-Bahn) or heavy suburban railway (S-Bahn).

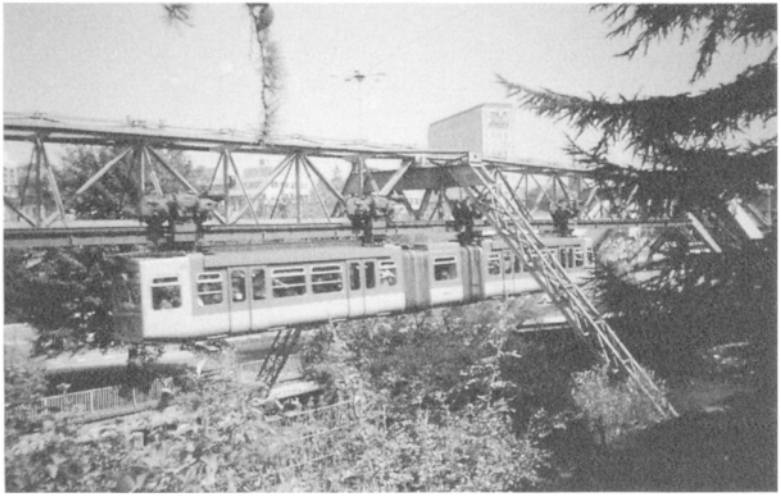

Figure 2.15 The Wuppertal Schwalbebahn.

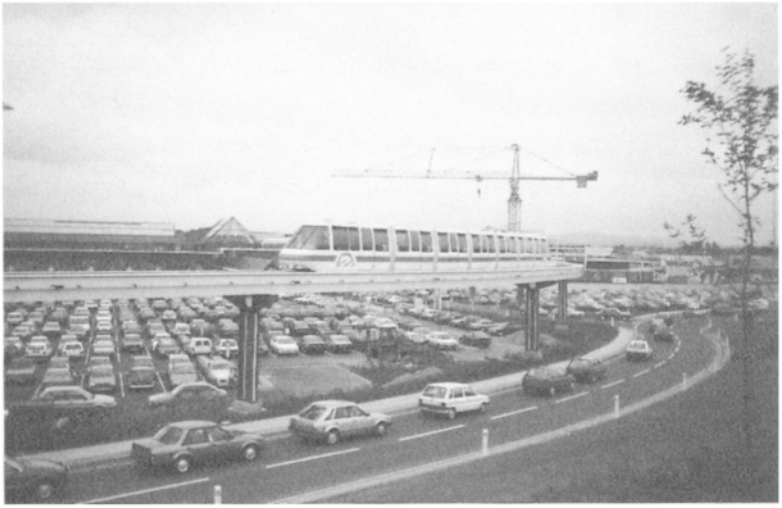

Figure 2.16 The Merry Hill monorail.

Figure 2.17 The Marseille Métro.

Figure 2.18 The Rhein-Ruhr Stadtbahn in Düsseldorf.

As the terms are commonly used at present, LRT includes modernized and new tramways and the lighter varieties of métro such as London Docklands Light Railway, the Lille VAL and arguably, the Marseille and Lyon métros. The main characteristics which determine into which category we place an urban rail system may be listed as follows.

2.2.1 Spacing of stations

In Europe, tramway stops are mostly not much more than 500 metres apart, métros up to about 1.1 km. Local rail systems with more widely spaced stations are usually not classed as being light rail: the London Underground, most suburban railways and the German S-Bahnen are examples. On the other hand, several North American LRT systems have stops averaging 1.5 or 2 km apart. Stations on the Paris Métro, which is never classed as light rail, are on average only about 0.5 km apart. To add to the ambiguity, it is common on large urban rail networks for the stops to be more closely spaced in the central area than in the suburbs. On this criterion, the London Underground resembles a U-Bahn or métro in the central area, whilst further out it is more like a heavier railway.

Spacing of stations is limited by the distance that passengers are willing to travel to stations and residential density. Urban form may also be important. In some German cities, relatively densely built neighbourhoods are separated by large tracts of open space, whereas in British cities of similar overall density, building density tends to be more uniform with less open space. The German pattern is more suited to public transport generally, especially railways, and more widely-spaced stations.

Lightness of rolling stock is compatible with frequent acceleration and deceleration and therefore close spacing of stops. Spacing of stations is important because it influences journey time (and therefore competitive power with the bus or private car). The distance that the public will be willing to travel to stations will depend to some extent on the length of journey anticipated on arrival and so spacing of stations will also influence journey length and the patterns of movements on the whole rail network.

2.2.2 Speed

Many tramways operate at about the same speed as buses in urban conditions (about 16 km per hour). The rolling stock is mostly no faster than buses nor does it accelerate more quickly. If sharing roadspace and with frequent stops, there is no reason why it should operate faster. Métros, being separated from road traffic, and with stations further apart, mostly operate at about 30–40 kilometres per hour and suburban railways faster than that, depending on spacing of stations.

2.2.3 Degree of separation from road traffic

Usually the term 'métro' is used for railways which are entirely separated from road traffic, but there are exceptions where there is some sharing, for example Manchester Metrolink, the Midland Metro proposals in the West Midlands. In fact, the term 'métro' is begining to slip into usage for systems much closer to what have traditionally been regarded as trams. Many tramways have to share crossings with road traffic, operated by traffic lights and some share other roadspace as well.

Being entirely separated from road traffic, many métros are powered by a third rail and are substantially underground in town and city centres. For tramways, overhead power supply is most common. Underground sections of track are more limited.

2.2.4 Driver control

As they share some roadspace, even if only at crossings, tramways operate at least partly by visual control of the driver. Métros on separate track can be fully automated, some of them being without a driver on board, for example London Docklands Light Railway and the Lille métro (VAL).

2.2.5 Rolling stock

Tramways are of lighter construction and less spacious than métros which in turn are lighter and less spacious than suburban railways. Trams are compatible with frequent acceleration and deceleration in networks with closely spaced stops, giving a very local service.

2.2.6 Capacity of the line

Modern tram carriages carry between about 180 and 250 passengers. Operating in pairs with a minimum headway of one minute, there is a maximum capacity for the route of about 15 000 to 20 000 passengers per hour in each direction. Métro trains mostly have a capacity of about 700 to 800 passengers with a headway of 1.5 to 2 minutes and a capacity for the route of about 30 000 passengers per hour in each direction. Speed, and so spacing of stations, affects the capacity of the line.

2.2.7 Maximum gradient of track

Some tramways operate on tracks of up to about 1 in 10. Métros rarely exceed 1 in 20 except where specially constructed. Examples are the rack-and-pinion métro in Lyon (line C) and the Poma cable railway in Laon (Picardy, France; Figure 2.19).

Figure 2.19 The Poma cable railway at Laon (France).

2.2.8 Maximum curvature of track

A minimum radius of 40–50 metres is typical for métros, whereas for tramways, the radius can be as low as 10 metres. Curvature of track and gradients feasible are important in urban areas where, to keep demolition of property and construction costs within acceptable limits, urban railways are often required to fit into tight situations. Steep gradients and tight curves limit speed. Tight curves may also cause a nuisance to those living nearby due to screaching of wheels and vibration. This has been the case with London Docklands Light Railway where there are a number of curves of smaller radius than normal for métros.

On several of the criteria listed above—spacing of stations, speed, weight of rolling stock, capacity of the line, gradient and curvature of track—métros occupy a position intermediate between tramways and heavy suburban railways. When occasion arises to refer to a particular railway as being a tramway, light railway, métro or whatever, where it is placed depends on which of the characteristics are judged to be dominant and there can, in many cases, be differences of opinion. Perhaps the single most definitive characteristic of light railways is their adaptability—their ability to run on heavy rail track or on-street through a city centre as required.

There have been many innovative forms of public transport over which there would be some dispute as to whether they qualify as being railways. I have tended to include any form of public transport which must be guided. I have taken the fixing of the route rather than the form of vehicle

or propulsion as the dominant criterion. Whilst vehicle form and propulsion do affect the relationship between choice of technology and spacing of stations it is the fixing of the route which has the dominant effect on land uses. Guided buses would be excluded as they can also operate off-track. Suspended cable railways are to be found in many mountainous areas, for example the Téléphérique in Grenoble, and may be included as railways although the specialized form and journey purpose make them rather different from railways used as a component of the local public transport network. There are also cable railways running on conventional track such as Poma 2000 in Laon (Picardy).

2.3 GUIDED LIGHT TRANSIT

Guided light transit, which is being developed in Bristol by Badgerline Rapid Transit, combines features of light rail and buses (Freeman, Smith and Willoughby, 1992). All wheels are steered, by guide arms attached to each axle and connecting to a central rail level with the road surface. Electric power is collected from overhead cable or from a diesel generator on board the vehicle. Vehicles can also operate non-guided on ordinary roads.

2.4 PEOPLE MOVERS

'People movers' has come to be used as a term for small scale (very) light railways, often carrying 20 or fewer passengers per car, usually with no more than a few kilometres of track, often within a single development such as an airport, shopping centre or leisure park. Nearly all are electrically powered.

David Catling (1992) describes the Otis Shuttle as a 'horizontal elevator'. Passively driven cars are fixed to an endless wire cable driven and guided by standard elevator systems. The cars are suspended 5 cm above the concrete guide way by air pads which reduce wear and maintenance, noise and vibration and because they spread the load, they also reduce the load-bearing needs of the track and structures supporting it.

Because the cars are pulled by cable, the route can be single track except at crossing points, and the cars do not have drive and control gear. Cars, each carrying up to 120 passengers can be coupled together in twos or threes and can operate at up to about 40 km per hour. The technology is suitable for routes up to about 2.5 km in length and capacities up to about 10 000 passengers per hour in each direction. To date, the Otis Shuttle has been installed at Tampa (Florida) connecting the Harbour Island Development with the city centre, in Serfaus, an Austrian ski resort, Sun City, a leisure park near Johannesburg and Narita International Airport in Tokyo. The Shuttle is

also being developed at the Paul Getty Museum in Los Angeles and at Cincinnati Airport.

The Parry People Mover is being developed by J.P.M.Parry & Associates Limited of Cradley Heath in the West Midlands (Gordon, 1991). This stores energy in a spinning flywheel which is charged at the beginning of the journey and topped up every 4–5 km from short sections of third rail whilst at stops for passengers. There are therefore no overhead cables and no third rail except sections of a few metres in length every 4–5 km. The current is picked up at low voltage and will not endanger people or animals. It is thought that the Parry system will be practical on routes up to about 30 km in length and can operate indoors, such as through a shopping centre, as well as outdoors. In 1992 a system was installed at Himley Park near Dudley. Perhaps the main advantage of the larger scale light rail systems over heavy rail is that they can operate in streets beyond a conventional railway terminus. A much cheaper substitute for light rail may be to retain heavy rail with a very light version of light rail such as the Parry People Mover connecting to the streets beyond.

In the past, flywheel transmission used flywheels to generate electricity which in turn powered motors to drive the vehicle. This Parry People Mover avoids this double conversion of energy by use of continuously variable transmission of energy from flywheel to rail wheels. This allows the vehicle to accelerate gently from rest whilst the flywheel is at full speed and maintains power when the flywheel is operating at the lower end of its speed range. The transmission system also allows energy to flow from rail wheels to flywheel when breaking or running downhill. The energy is fed back to the flywheel to use when restarting the vehicle.

By scaling down the technology it is claimed that costs can be correspondingly reduced. For example, an indicative cost for a 1.6-km loop with six vehicles operating a 2-minute service should cost around £269 000 in construction costs and £230 900 annual operating costs (1991 prices). The low cost, long life and easy maintenance is expected to make the people mover particularly attractive for developing countries.

2.5 MAGLEV

Magnetically levitated vehicles now have a history extending over several decades, although there are still only a few systems of limited scale in operation. A 600-m track connects Birmingham Airport to Birmingham International Railway Station. Because there are no wheels or other moving parts, there is no wear and tear and vehicles are immune from the effects of ice and snow. Also, it has been claimed that they can operate as fast as 400 km per hour.

A considerable amount of development of magnetically levitated vehicles has taken place in Japan where there are two separate programmes. In the

HSST (high speed surface transport) programme vehicles float above a T-shaped guideway by magnetic attraction with a maximum speed of 350km per hour. A study has been commissioned by the municipality of Hiroshima to examine the feasibility of a 52-km line from the airport to the city centre. Japanese Railways have also developed magnetically levitated vehicles which work by magnetic repulsion using on-board superconductive magnets. Speeds of up to 400 km per hour have been claimed.

Although technically proven, Maglev's lack of commercial success so far has been because it does not address any serious transport problems more adequately than conventional railways.

2.6 TAXIS

There have been many occasions when taxis have not been fully accepted as a means of public transport. There have been two main reasons for this. First, their higher price means that they are not serving the same markets as bus or rail. Taxis are not always more expensive when sharing but as a general rule, they do serve a different market from buses. Secondly, in terms of use of roadspace, taxis resemble private cars more closely than buses. In implementing road traffic restraint projects for example, there has often been a reluctance to grant the same priorities in use of roadspace to taxis as to buses or on-street trams but in the end, taxis are accepted more often than not.

Taxis are increasing in numbers quite sharply. The number of licensed taxis in England and Wales increased from 29 400 in 1980 to 44 000 in 1990.

2.7 BOATS

In a few cities, boats are an essential part of the public transport system. In western Europe we may think of Venice, Gothenburg or Hamburg for example. In Venice, boats account for around 105 million passenger journeys per year, compared with 134 million by bus.

There are many cities where there is a navigable river but where passenger transport is essentially confined to pleasure cruises rather than a means of getting from place to place. The essential difference between river transport in cities such as Paris, London or Cologne (Figure 2.20) and cities such as Hamburg and Gothenburg is that in Paris and London and in most cities on a navigable river, the distance by river is not much shorter than alternative routes by land. Under these conditions, river transport cannot usually compete with land transport in terms of speed, capacity and probably most important, cost of operation. River journeys are for those who find them pleasant rather than those who simply want to arrive at

Figure 2.20 Riverboats on the Rhine at Cologne.

their destination. Only where the water journey is much shorter than the land journey is boat transport for the strictly non-pleasure traveller. There also survive a number of ferries across a river such as the River Tyne between North and South Shields or connecting islands.

2.8 CONCLUSIONS

A very high proportion of public passenger transport journeys still take place by bus, train or taxi using technology which has been basically the same for decades. The new technologies of some people movers and Maglev, for example, have been so far applied in specialized and usually small-scale situations, sometimes as a demonstration of technology as much as a means of transport.

Several of the new technologies have been developed to avoid the use of wheels. This reduces the number of moving parts, wear, vibration, noise and spreads the load of the vehicle. It may also have advantages in ice and snow. So far, however, the wheel has proved to be one of the more lasting discoveries of mankind. The disadvantages associated with it are not widely regarded as being substantial and its simplicity, cheapness and adaptability have not contributed to the success of alternatives.

Perhaps the most fundamental urban transport issue facing us is how to achieve a practically acceptable transfer from the private car to public transport. There is a lot of fragmentary evidence to the effect that the newer forms of public transport are less unacceptable to motorists 'persuaded' out

of their cars than the older forms of public transport. For example, a survey by Kilvington (1992) showed a sequence of increasingly unfavourable reaction by motorists starting with light rail (least unfavourable) with heavy rail, guided bus and buses forming a sequence of decreasing acceptability to the motorists as a substitute for the car.

3

URBAN RAIL

Urban railways comprise many different kinds, as was explained in Chapter 2. At one extreme we have suburban railways like those operated by British Rail. At the other we have tramways such as those in Blackpool or Manchester. In between there is a range of metros and light railways such as the London Underground, the Tyne and Wear Metro and London Docklands Light Railway, intermediate in terms of the weight, capacity and manoeuvrability of rolling stock, distance between stations and the kind of service offered.

As far as local travel is concerned, the heavier varieties of rail like BR have always been more suited to the large cities than elsewhere. As a general rule, the larger the city, the more use that is made of heavy rail for local travel, but there are other factors, such as development density and urban form. For example, many German cities are well suited to heavy rail for local travel with high density development around the stations, separated by much more undeveloped land than is usual in British cities.

Urban rail, especially the heavier varieties face several problems which are difficult to address:

- few stations, and therefore few users who do not have a substantial distance to travel to get to them;
- stations which are inappropriately located for present-day needs;
- housing densities which are predominantly too low for economic operation of public transport, especially high-capacity railways.

In many cities, local rail services share track and stations with inter-city services. There are many cities of a million or more in population which have only one or two main stations in the city centre. After reaching the station, many travellers will have a substantial distance to go to complete their journeys. Where there are two or more stations it is quite common for cross-city journeys to involve a change of stations. The dual problem of lack of

connection for cross-city journeys and distance of railway station from many travellers' final destinations has been addressed by developing light rail on-street across the city centre to connect stations, as in Manchester or underground, especially if it is heavy rail, as in Munich.

3.1 RECENT LIGHT RAIL STUDIES

At the present time there are light rail lines or networks in at least 110 cities throughout the world, even if we exclude the 300 or so more elderly tram networks operating mostly in the former USSR and eastern Europe. It is impossible to estimate the number planned but it is fair to assume that it is considerably larger than the number built. In the UK alone, in around 50 towns and cities promoters have already carried out or engaged consultants since 1987 to prepare feasibility studies. In western Europe there are few cities over 250 000 population which have not reached at least this stage. In most of the cities which already have light rail, studies for its extension have been carried out.

Some of the objectives which have been set for light rail have been fairly international in application. There have, however, been differences in emphasis according to the political system and particularly in attitudes towards public/private investment and towards public service provision. In France and several other west European countries the emphasis has been on the improvement of public transport services as an end in itself, seen as facing a crisis in the centres and inner areas of cities of relatively high density (usually more than 7000 inhabitants per square kilometre) which has aggravated traffic congestion. Where separated from road traffic, light rail provides a faster, more reliable and higher capacity service than buses. In Britain, reduction of road traffic congestion has been claimed to be a consequence of urban rail attracting motorists. More credibly, light rail provides a means of avoiding congested traffic conditions.

Commercial development possibilities have had some consideration in Europe but it is in North America where commercial development resulting from light rail has had particular emphasis. In fact, evidence on these effects is often required by central and local government before finance is approved.

Urban rail has been developed partly to form a focus for urban growth, to act as a means whereby the land use planning system can be used to focus urban development near to the stations, thus reducing car-orientated sprawl. This is very clear in several German cities such as Hamburg and in Stockholm, for example. Amongst the reasons given for Lyon Métro Line D and the Lille Métro was improvement of urban structure.

Sometimes local politicians convey the impression that the main reason for urban rail is to promote the external perception of the status or image of

the city. Many light rail systems and proposals are associated with a particular local politician who might promote it wholeheartedly for the purpose of providing a project of lasting value to the city.

3.1.1 Does urban rail stimulate economic activity?

Since the late 1980s stimulation of economic activity and reduction of road traffic congestion have been claimed by promoters more frequently and at greater length than any other reason for building light rail or improving suburban rail in Britain. Department of Transport Circular 3/89 *Section 56 Grant for Public Transport* makes it clear that developers' contributions must have been sought before Section 56 subsidy will be approved. It is possible that a developer may contribute to a railway he sees as irrelevant to his business, regarding it as another tax necessary to get the required permissions, but a causal connection between public transport investment and commercial activity does seem to be implied by the Circular.

Accessibility is essential for all forms of economic activity—manufacturing, warehousing, offices, retailing, leisure—but for public transport to stimulate economic activity, two conditions must be met.

- The traveller must see public transport as offering advantages over other forms of access. This may be where there is a very high density of occupation, as public transport can bring large numbers of people with little use of roadspace or other land, compared with the private car. This is the basic reason why public transport is essential for the working of the very large cities such as London or Paris in their present forms, and why public transport is often successful in inner city areas where access is restricted by physical barriers, for example, docklands.
- Apart from transport facilities, the other conditions for economic activity, such as demand for goods, competitiveness of the locality, must be satisfied. These conditions have frequently been overlooked in public transport feasibility studies with an implied and mistaken assumption that good public transport is a sufficient condition for economic activity. Good public transport is never a sufficient condition and is a necessary condition only where other forms of access are lacking.

Public transport investment will coincide with increased economic activity only where both these conditions are satisfied. There may be circumstances where these are not met and where public transport investment such as in urban rail, is associated with commercial development. In such cases, there will have been other coercions such as the directing of the location of economic activity by the land use planning system. Cervero (1984 and 1985) examines some cases in North America. Walmsley and Perrett (1991) point to cases in France and North America. Tarricone (1992) quotes a claim that $1.2 billion in development has taken place or is planned along the 15-mile route of light rail in Portland

(Oregon). Although public transport may not have been the means of access chosen by the developer, it nevertheless allows development to take place.

Planned together with urban rail, public sector development such as shopping, business premises or high density housing can make good use of the high levels of accessibility, even though if promoted by the private sector, rail may not have been the chosen means of access.

There are also cases where the decline of an existing commercial centre has been stopped or the decline reversed with the arrival of a new urban rail system. Commerce in city centres often reacts favourably to the building of a métro, as in Lyon, because private car access is not so easy as is usual for out-of-town and suburban shopping and commerce. Good public transport is more important to a proprietor of commercial premises in the city centre than in the suburbs.

When the economy has been buoyant such as London Docklands during the mid 1980s, urban development has followed rail building but in such cases there has been demand for development locally, irrespective of whether urban rail was operating or planned. There are, however, a few cases, such as West India Docks in London, where an urban railway has opened up potential for development stifled by poor access.

Outside the large cities there are some situations where public transport is seen by promoters of commerce as offering substantial advantages over other forms of access. Amongst these will be towns where road traffic has been severely restricted, perhaps due to a particularly sensitive environment as in an historic town. Extensive and severe road traffic congestion together with limited car parking seem to be the most common incentive for mass use of public transport, especially railways. The size of car parks and capacities of roads have come to be the main transport criteria when the location of retailing, leisure and even offices are being planned by the private sector. Manufacturing industry as a general rule is employing fewer people in relation to the land area.

It is important to distinguish between situations where there are land uses and activities which benefit from public transport but are not suitable for the public transport to be economically viable, for example low density housing around stations, and situations where land uses and public transport are of mutual benefit as may be the case with high density flats. In only a limited range of circumstances, mostly in the large cities, can we look towards stimulation of economic activity as the justification for urban rail and other forms of public transport investment.

3.1.2 Does public transport reduce road traffic congestion?

Reduction of traffic congestion has been a claim frequently made in connection with the current urban rail proposals in the UK. This will come as no surprise. Department of Transport Circular 3/89, which sets out the criteria for public transport project subsidy gives a very clear impression that such a claim is

amongst the criteria for a successful application (Simpson, 1990b). For traffic congestion to be reduced, three conditions would have to be satisfied:

- substantial numbers of motorists would abandon their cars for the train;
- no-one else, such as another member of the household, would use the car left at home, or at least not use it where it would contribute to road traffic congestion;
- no-one else would take to the road to use the roadspace vacated by the new public transport user, i.e. there must be no latent demand for road travel supressed by traffic conditions which were unacceptable to those who would travel by road if there was an improvement in traffic conditions.

The first condition was met to some extent in Lyon and Lille for example when the métros opened (1978 and 1983 respectively). In the early years, around 30% of métro journeys were made by those who previously would have travelled by car, but this accounted for no more than 2–3% of journeys by road. Two to 3% reduction in the number of cars on the road could result in a noticeable reduction in traffic delay if the other two conditions were met, i.e. no replacement, but there is no evidence that they were, or indeed that they are ever substantially satisfied. Indeed, those situations where urban rail is built to address road traffic congestion are likely to be the very situations where there is latent demand for road travel. The situations where there is likely to be sufficient users to justify urban rail are also likely to have supressed latent demand for car travel.

The question of whether or not improved public transport reduces road traffic congestion is not one which can be settled by a survey of road traffic conditions. Even if there was a marginal reduction in road usage after the opening of a new means of public transport, this might be only a very temporary occurrence, lasting only until the demand for roadspace adjusts to the new conditions. For this reason, carrying out surveys of road usage immediately after the opening of a new railway for example, would be a waste of time. Later surveys would be rendered useless by the interference of other factors influencing demand for road space, in addition to the new means of public transport.

We may well wonder what would happen to road traffic conditions in London for example, if the Underground was closed, due to a strike perhaps. Congestion probably would increase, at least for a time. It that sense, the reopening of the Underground would relieve road congestion. But in this case we have a pattern of journeys committed with the assumption that the Underground is operating. If the Underground had never been built the pattern of journeys would be different and road traffic congestion would not necessarily be any more severe than it is when the Underground operates.

It seems most unlikely that there could be a permanent absence of latent demand for road space in cities where there is sufficent road traffic congestion for it to be an issue but this would have to be the case for public transport to relieve traffic congestion. The most realistic conclusion we can make is that improved public transport does not relieve road traffic congestion but it does allow access for more people for the same level of road congestion. As the French Commissariat Général du Plan (1992) put it (page 436):

> En ce qui concerne les déplacements urbains, la réalisation d'infrastructures lourdes de transport en commun dans les grandes agglomérations, telles Paris (réalisation du Réseau Express Regional (RER), prolongement de lignes de métro), Lyon, Marseille et Lille (création d'un réseau de métro) n'a pas permis d'éliminer la congestion.

The building of a railway or busway also provides a means of travel avoiding road traffic congestion. Before light rail, the large French provincial cities in general and Marseille in particular had, and perhaps still have, intolerable traffic congestion, fast-moving, dangerous traffic conditions, narrow streets, both carriageway and pavements, and limited regard to the regulation of parking. Before the métro, traffic conditions had reached a state beyond what was regarded as tolerable. Many people probably still regard traffic conditions as intolerable, but since the building of the métros, it is possible to make some journeys without having to tolerate these conditions.

Considering road traffic conditions and the plight of the pedestrian in Marseille even with the métro, it is understandable how the French cities were driven to seek an alternative. Even if light rail has not reduced road traffic congestion, in Marseille it has provided a means of escape and in Lyon, Lille and Grenoble it has provided access to the main shopping and commercial streets where road traffic restriction has been effective in improving the pedestrian environment.

3.1.3 Effects of urban rail on public transport usage

An improved form of public transport usually attracts some motorists away from their cars and causes some new journeys to be made, previously stifled by passengers not thinking that the inconvenience or costs of the old system justified the benefits gained on arrival. There usually is some increase in journeys, probably lasting for a long time. There may also be some land use changes which result in longer journeys being made, as the costs of travel, in the broadest sense, will have been reduced.

Although it will take some passengers away from the buses, urban rail can help to increase overall public transport usage. Following the opening of the Marseille Métro in 1977, bus usage increased. Although there was a

reorganization of bus routes and several other measures to increase ridership at the same time, the buses did gain custom from the improvement of the image of public transport with the opening of the métro and in bringing passengers to métro stations. Buses will lose some passengers to a new railway but may gain from elsewhere a greater number.

It would appear that it is possible to increase the overall level of public transport usage significantly and that investment in a new form of public transport such as an urban railway might be a significant part of this. This is not to say that such an investment might be more or less effective than other policies such as towards fares, types of ticket or reservation of road space for buses.

3.1.4 Loss of local shops

Improved accessibility is not always good news for weaker commercial enterprises. Economically weak and not-particularly-efficient firms can survive on captive local custom if poor transport does not allow locals to do business easily elsewhere. Local shops on the margin of economic viability can be lost if a new local railway for example allows some of their customers to travel out more easily. This appears to have happened following the opening of the métros in Lyon (Dalmais van Straaten, 1985) and Lille (Offner, 1986). The corresponding increase in trade of the more attractive shops such as the city centre has been observed by Chambre de Commerce et d'Industrie de Lyon (1983) and Watel (1984 and 1985). Comparable processes may happen with local leisure, social and cultural facilities.

Improved transport does tend to open up choice for some and weed out inefficiency. On the other hand, it can lead to the loss of local facilities with a decline in local identity and community spirit. As well as allowing people to travel further if they so choose, when local amenities decline, local people will have to travel whether they wanted to or not.

3.1.5 light rail opens up new opportunities for local residents

When a faster means of transport opens, passengers may use it to travel faster to the same destinations or they may choose to travel further. When we consider how far large numbers of people are willing to travel to work, out-of-town shopping or leisure parks, we can see that there are many people who are not averse to spending large amounts of time travelling.

Observed behaviour must cast doubt on the customary methods of costing travelling time at a substantial proportion of wage rates and the implied assumption that the costs are in some way calculated by the traveller. Behaviour suggests that there might be many people who subconsciously set themselves a limit as to how long they are willing to travel for a particular purpose and do not make a strenuous effort to minimize travelling. The benefits

gained on arrival are the focus of attention rather than the costs of getting there. Railways do open up the possibilities of travelling further to work and therefore a wider range of job prospects. This is particularly noticeable in a city such as Stockholm where quite concentrated suburban centres are separated by large areas of water, rock and forest and connected by Tunnelbana (heavy metro).

3.1.6 Have we got the right routes?

In some British cities, the initial routes proposed for light rail are not those which are likely to give the best financial returns. The choice has been a result of the need to avoid disturbance to residents and public confrontation at all costs. The decision-making rule has not been one of gainers compensating losers. It has been that there must be no losers, a condition close to impossible for a usable urban rail route.

In choosing light rail routes there are two basic options: go through the most densely populated areas close to high density activities such as offices, shopping and commerce, or take routes causing less disruption to existing users such as disused or lightly used railway lines. The first option is likely to give the greatest number of passengers for the railway but will cause substantial disruption to residents and property. In a few cities including Birmingham (in 1985), this kind of route network has been abandoned due to public opposition to the demolition and disturbance to property which would follow.

The kind of route which avoids disruption (and is also cheaper to construct) has been chosen to form large parts of the networks in cities including Bristol, along with some sections on-street. The Midland Metro first route substantially follows a disused railway line from Birmingham Snow Hill Railway Station to the centre of Wolverhampton. The drawback of this kind of route is that it does not have the ready-made clientèle of the high-street route option. Such routes must rely on light rail itself attracting some development, a prospect which has been in some dispute (Simpson, 1991b).

Routes by-passing urban development in order to avoid disturbance have been chosen only occasionally in Germany, rarely in France for example. Transport authorities in these countries have not found it necessary to jeopardize ridership prospects in order to avoid some disturbance or to save money on construction. In the USA, however, in many of the 30 or so cities considering building or extending urban rail systems existing rights-of-way form a substantial part of the routes (Tarricone, 1992) but doubts remain about ridership potential. Some US urban rail systems have very low ridership and need heavy subsidy.

3.1.7 Environmental improvements

Compatibility with pedestrianization and other environmental improvements is one of the most compelling reasons for light rail. The environment in many continental European city centres has been improved by traffic restraint which is both severe and on an extensive scale. Trams, métros, U-Bahnen or S-Bahnen have maintained access on the surface or underground. Gothenburg, Bremen, Frankfurt and Munich contain examples.

Railways are particularly suitable for maintaining access where there is road traffic restriction, for several reasons.

- Electric traction involves no air pollution on-street. In the confined spaces of many pedestrian streets, pollution from buses may be a significant nuisance, even though in terms of global atmospheric pollution, the contribution of buses must be small in comparison with that of the private car. In pedestrian streets, the standard of maintenance of buses will be important in controlling exhaust fumes.
- Railways are more suitable than buses for underground construction, especially if the buses are diesel-powered. Even where railways are on-street as are many tramways, because pedestrians know exactly where they will run, there is a greater feeling of safety than where buses operate in otherwise pedestrian streets.
- Railways have higher capacities than buses and give a greater degree of access for a given level of intrusion.
- Railways, especially grade-separated forms, seem to be more attractive to passengers of a wider range of socio-economic groups than are buses. They seem to be more acceptable to passengers, especially those who have to leave behind their cars as a result of traffic-restraint measures. They may therefore be more acceptable to shopkeepers and others worried about a decline in access when road traffic restraint measures are introduced.
- Although many railways have become disused and many bus routes continue for decades, the building of a railway does give the impression of being a more permanent assurance of continued access than does a bus route.

3.1.8 High capacity access

High capacity access open to everyone with little use of land and little environmental damage are the main justifications for public transport, especially railways, in large cities. Land uses, density of occupation and urban form would be very different in the absence of public transport. Over a long period of time, railways in particular, contribute towards higher density, more intense activities and more productive use of urban land than would be the case if there was greater reliance on the private car.

3.1.9 Comfort, reliability, speed

A charitable view of the level of complaints about suburban railway services may be that it is due to high expectations from passengers. In large cities, railways should, and probably do, provide a better level of service to passengers than do buses, mainly because they do not have to share road space with other traffic. Reliability will be particularly important in attracting passengers of occupational groups for whom punctuality is of great concern.

3.1.10 Cost, adaptability to urban surroundings

The standard suburban railways bring in large numbers of people to a few, often only one main station as destination. Stations are relatively far apart and may involve considerable travel to them. For many users there is another public transport journey from the main line station to the final destination. Suburban railways do not correspond as closely to the origins and destinations of passengers as do other forms of local public transport. They also have exacting requirements in terms of gradient and radius of curvature for construction and cannot fit into many of the tight situations in urban areas. High cost is also a deterrent to construction.

Light rail respresents attempts to overcome all these disadvantages of standard suburban railways whilst substantially maintaining the attractive features of comfort, reliability, speed, high capacity and little environmental damage. In particular, light rail can be fitted into constrained urban situations with relatively steep gradients and tight curves, where construction of heavier forms of railway would involve more demolition and disturbance to property and higher cost. Essentially, light rail is a compromise. There is some sacrifice of speed and capacity.

As a general rule, however, providing a light rail service is much more expensive than a bus service. A useful guide price in 1992 is about £12 000 per square metre for light rail vehicles (£19 000 for low-floor vehicles) compared with £4000 per square metre for buses, although by standardization it is expected to be able to reduce the cost of low-floor light rail vehicles to about £10 000 per square metre (Higton, 1992).

3.2 THE CONDITIONS UNDER WHICH URBAN RAIL HAS BEEN PLANNED

3.2.1 The prospect of bus competition for passengers

Deregulation of buses in October 1986 put future urban rail development outside London in a potentially competitive situation with them as well as with the private car. A competitive environment would be fundamentally different from the situation in most other developed countries which rely on

coordination of public transport services by metropolitan authorities. As well as competition along the proposed rail routes, it may also result in bus companies being unwilling to bring passengers to railway stations as they are free to route services to avoid them. It is not always at all clear why bus companies should choose to run services as feeders to the railways except where road conditions are so bad as to make bus services uncompetitive with rail for journeys, in inner urban areas for example.

3.2.2 Uncertainty about betterment

There will be uncertainty as to how much increase in land and property values may result from urban rail development and to what extent this may be channelled to contribute to the costs of the railways which created it.

When the current light rail proposals appeared mostly in the late 1980s, it was claimed that a great deal of employment-generating, profit-creating commercial, industrial and residential development would follow. At the time, experience from cities abroad suggested that the claims were exaggerated. To date, when given the opportunity to invest, the private sector in Britain, with one or two exceptions, has not been willing to gamble on recouping sufficient betterment to justify the investment.

One of the problems for many of the British light rail projects is that they are in conurbations with several large urban centres and are administered by several local planning authorities. If one part of the conurbation gets tough on the private car, as would be needed to reorientate journeys to public transport and create increases in land values near to stations, then motorists might abandon that centre in favour of another nearby. Light rail projects in relatively isolated towns stand a much better chance of creating betterment.

3.2.3 Limited public and political support

Apart from a few committed enthusiasts locally, in this country light rail has not had much public support when being planned. Ironically, sometimes where there has been private sector interest, perhaps because of it, there has been political opposition. The majority of towns with light rail projects are Labour-controlled. Throughout the most recent spate of light rail projects we have had a Conservative central government insisting on private sector involvement. Private sector profit has been an anathema to some city councils, even if promising to result in an improved public transport service.

3.2.4 Marshalling finance

In Britain, public transport has been seen as a social service to be provided for the underprivileged and others who do not have their own transport. In

what was West Germany it has long been regarded as a commercial stimulant, protector of the environment and one of the necessities of civilized urban life. In France, the métros have been justified as being protectors of the environment and a necessity in order to have an acceptable public transport service in highly congested city centres.

Unlike the situation in Britain, in both France and Germany there are earmarked taxes for public transport subsidy, versement transport and mineral oil tax (Mineralölsteuer). Thus there is a ready-made source of capital subsidy. Both have been amongst the most significant sources for the capital financing of urban rail development. The French payroll tax, versement transport is also used to contribute to the operating subsidies.

In Britain, public transport has had to compete for central government resources. It has often been pointed out that the rules for public subsidy of road construction are rather less exacting than for public transport subsidy. This possibly not only reduces the availability of funds for public transport capital projects, it also increases the need for them if it is to provide an attractive alternative to the private car.

3.2.5 Indecision

The length of time to get the necessary decisions continues to cost taxpayers dearly. Far too many of the 50 or so UK light rail projects are still awaiting a firm decision on finance from central government. The likely benefits and costs of light rail have been well known for some years. There is no excuse for the continued delay and uncertainty which is expensive for two reasons. Firstly, rail product manufacturers cannot plan ahead. Infrastructure is far too expensive, largely because each light rail project has to be treated as a 'one-off order. Unfortunately, much is purchased from abroad, such as from Germany. The second reason why delays in decisions are expensive is because other infrastructure, mainly roads, which are being built near to where urban rail is anticipated, are being modified in case it goes ahead.

Part of the cause for delay has been the rationing of finance from central government. It is a very curious financial policy which rations capital so much that the price is raised. If the eventual decision is to build no more light rail there would be a saving of money on staff time, consulants' studies and related infrastructure by taking that decision now. If the decision is that some rail is to be built, it will be cheaper if a commitment is made sooner rather than later.

3.2.6 The need for impartiality

Perhaps also part of the reason for delay in decisions is the lack of credibility of some of the proposals. There has been a lack of impartiality in that most of the rail studies have been carried out by those with a financial incentive to

come to the conclusion that it should be developed. There needs to be greater separation of the remuneration and interests of those carrying out the studies from the contents of the proposals.

3.2.7 Inadequate compensation for those badly affected by public transport proposals

One of the fundamental reasons why some of the light rail projects follow routes where there would be little disturbance to property and little potential for ridership is to avoid opposition of local residents who feel that they would be inadequately compensated for their losses. To save relatively small amounts of money on providing generous compensation we have wasted (probably larger) amounts on consultants' studies on routes which were easily seen to be the wrong ones. At the time of writing we have at least avoided the even bigger waste of money that would result from building any of the routes with inadequate passenger potential.

3.2.8 Local politics

Those proposing projects such as urban rail have to swim against the current of British local politics. British legislation encourages local politicians and officials to give higher priority to performance of their duties than use of their initiative. Where a local politician does exert a high degree of initiative in striving for a project such as for light rail there is little in the way of checks and balances to prevent a great deal of money being spent on consultants' studies and staff time on projects which could have been seen to be non-starters much earlier. It is not in the interests of either officials or consultants to point out that money has been wasted.

Political power in Germany is more decentralized than it is in Britain. German local government is more positively orientated towards action than British local government where stability takes precedence. In Germany and France there is considerable interest in local elections. Local politicians can have a high profile according to successes and achievements: publicity is not dependent on failure or scandal. In France in particular, some local politicians exert a great deal of political power in central government. At the time of the building of the Marseille métro, Gaston Deferre was simultaneously Mayor of Marseille and Minister for Planning. Alain Carignon was both Mayor of Grenoble and Minister of the Environment.

The political environment of the British light rail proposals is one of weaker local political power. Light rail has got caught up in the differences of view between a Conservative central government and the large Labour-controlled provincial cities proposing it. Nor was the case strengthened by the abolition of the metropolitan counties and the Greater London Council. Light rail projects are distinctly local to the metropolitan area. At present they are in a weakening political environment, benefitting neither from

local political power nor the imposition of central government power as would result from the creation of urban development corporations capable of implementing them.

3.2.9 Ambitious objectives

Light rail in Britain has been set a hard task. Those proposing it have felt it necessary to make claims about economic revitalization and substantial job creation. Continental cities have been able to be more realistic. Their promises have been limited to improving the public transport services, particularly for the disabled, the elderly, people with prams, heavy shopping and so on, whilst being conducive to pedestrianization and other environmental improvements. It has been accepted that urban rail will cost money and the means to provide it have been instituted. Other central governments have not required nor led municipal governments to feel that they would require exaggerated claims in order to get approval.

3.3 FACTORS INFLUENCING URBAN RAIL IN THE NEXT FIVE YEARS

3.3.1 How much reliance should we place on technology?

Should we address urban traffic issues with technological solutions, by urban transport management policies or by what combination of the two? A large part of the justification for urban rail is that it is possible to develop it as a part of policies to address the perennial problem of road traffic congestion. Urban rail can be developed as compensation to motorists for road traffic restrictions—'sorry, you can't use your car here but there is the tramway instead'. It is a means of giving access to city centres and elsewhere when such restrictions are made—a means of protecting commercial interests and others whose livelihoods depend on access. It is also a means of escape from road traffic congestion for public transport users.

Road congestion is a reflection of excess demand for access over supply. Urban rail is a means of increasing supply. A fundamental issue in public transport policy which has to be continually reviewed, is where to strike a balance between reliance on methods of increasing accessibility and methods of dampening demand, such as through land use planning policies or road pricing. The more we rely on technology to increase access, the more we are likely to turn to urban rail or other ways of increasing accessibility. If we acquired the determination to reserve adequate road space for buses, fewer towns would turn to urban rail.

Although not a great deal has been built, in recent years we have focused much discussion on new technology as a means of addressing urban traffic problems. When we consider what has been achieved

towards the solution of urban traffic problems by new means of transport where these have been built, we should probably conclude that more attention should be given to the factors which cause increasing demand for urban transport. Urban rail provides a means of travel which avoids road traffic congestion, but does not reduce congestion. It provides access where access has been reduced by road traffic restrictions. Alone, it does not reduce demand for travel. In fact, urban rail tends to increase travel demand and has in some cases, coincided with and perhaps caused land use changes which involve greater travel needs. Concentration of shopping into larger centres is a case in point.

3.3.2 Will land use/transport planning become re-accepted?

For several years now there has been at best lukewarm enthusiasm from many important figures in political control to accept that there are benefits from the co-ordination of land use and transportation policies. Practice leads us to believe that either it has not been fully accepted that land use planning and density policies offer the prospect of controlling the need for transport, or that prevailing opinion is opposed to the control of transport needs in this way, or that we do not wish to control transport needs. The involvement of the Department of the Environment in light rail has been peripheral. So too has been the rôle of the planning authorities in many of the towns and cities which have carried out light rail studies.

3.3.3 Policies towards Central Government subsidy

To date there has not been a great deal of difference between political parties in their records on urban rail. The small number of light rail systems in the UK have been influenced approximately equally by Labour and Conservative control both locally and nationally.

We may not expect a great deal of difference between parties in terms of availability of finance but there may be greater differences in terms of attitudes towards transport planning. A Conservative government gives no hint of reintroducing the possibility of local transport integration. This is bad for light rail prospects as the most significant advantages that it offers over buses are outside the scope of market calculations.

In recent years, there has been an attitude that if the private sector will contribute, then this 'market test' is an adequate demonstration of ridership potential. The problem with granting Parliamentary approval in the expectation that there will be a subsequent market test is that if there was a change of government, some light rail projects may be excused this market test. This would increase the chances of us seeing light rail developed in some rather odd places with few customers.

3.3.4 Interpretation of Department of Transport Circular 3/89 *Section 56 Grant for Public Transport*

This circular makes it clear that to qualify for Section 56 subsidy (Transport Act, 1968) a project must be 'the most cost effective way, from the viewpoint of the public sector, of achieving the desired objective'.

Amongst the most persuasive arguments for light rail will be compatibility with road traffic management measures and environmental improvements. In all but the largest cities (in the UK possibly only London), buses will probably provide public transport more cheaply and will be compatible with considerable environmental improvements, should road traffic management measures be pursued. In many of the larger cities outside London, there will be a choice of whether the extra costs of light rail will justify the greater scope for environmental improvement that could be made to accompany it, compared with buses. The problems will be firstly that the environmental benefits of light rail, although real, will be less evident than some of the benefits of buses and secondly, although buses will usually be cheaper overall, cost comparisons between light rail and buses will depend on factors such as ridership which in turn will be affected by policies towards road traffic.

There will be a great deal of latitude for differences in interpretation of the requirements of Circular 3/89. A strict interpretation will favour investment to buses. The objectives which would justify light rail are qualitative such as relating to the environment, or long term (increases in land use densities), neither of which are so easily and clearly demonstrated as the benefits of improvements to bus services.

3.3.5 The property market

It might be expected that the private sector's enthusiasm to contribute towards the capital costs of light rail would be related to the scale of income expected from affected land such as that around stations. The scale of income is certainly affected by the ups and downs of the property market, amongst other factors such as land use planning and density policies. In the past, prosperity in the UK property market does not appear to have been a potent factor in securing light rail development, except perhaps in London Docklands. Property prices were high around 1987 when many light rail projects were launched. Apparently this was not enough to secure much light rail development.

All development, and particularly high density commercial property, needs access, but rarely has light rail been seen by developers as the favoured means. Higher capacity, longer distance railways have contributed to the development potential around many British Rail main line stations. It may well be that light rail has most potential in districts where there is both development potential and restricted access—a common combination of

characteristics in other docklands as well as London. Development potential in many cases follows from a location close to a city centre and restricted access follows from the physical nature of the docks and in many cases, the location on an estuary.

3.3.6 Land use patterns and densities

Outside London we have land use patterns and densities which have largely developed alongside road transport and which are therefore compatible with it. Developers of large traffic generators often do not show a great deal of interest in light rail or even in higher capacity railways sometimes. For example, the Brent Cross Shopping Centre is located about half a mile form the nearest London Underground station. The Gateshead Metro Shopping Centre is not on the Tyne and Wear Metro. Much recent shopping and office development in central Birmingham is not on the proposed Midland Metro routes. It may well be within the public interest that such development should be served by light rail. The external effects of rail are low. There are cases for public intervention such as by means of the town and country planning system. Lack of interest in light rail by the private sector should not always be seen as a reason for abandoning it. Because railways create low external disbenefits, lack of private sector interest may be a reason for directing commercial development towards them.

3.3.7 The environmental lobby

Environmental criteria have not been as prominent in the promotion of light rail in the UK as could be justified from experiences abroad. In many of the UK cities with light rail studies, the authorities concerned with environmental planning, in particular the town planning authorities, have not supported light rail as strongly as they would need to if the full benefit of light rail is to be gained. Light rail has been promoted largely by organizations who do not have a primary responsibility or expertise in relation to land use planning or the environment and in some cities they have not been adequately supported by those who do.

Understandably, claims for light rail sometimes appear to have been more influenced by what promoters thought central government would like to hear than by what could be justified in view of experiences where it has been developed. In turn, some of the criteria for approval by central government, such as reduction of road traffic congestion, give the impression that what was thought to be politically expedient has taken precedence over what is likely to be achieved with light rail: 'Doing something about traffic congestion is becoming a bit of a vote winner—let's tag it on to these light rail studies'. The result is that costly consultants' studies have been commissioned, apparently to prove the unprovable whilst the reasoning presented to support

what might turn out to be a good case, is largely a fabrication of partial truths selected to dance to the tune of political expediency. The problems with light rail and the environmental lobby are firstly that in many cities, residents seem to be willing to put up with conditions far worse than could be achieved. We could be forgiven for wondering whether we actually want city centres with traffic managment like Munich, Gothenburg or dozens of other cities in continental Europe. If we do, it is taking a long time to say so. Secondly, although light rail is desirable in connection with road traffic restriction, it is not essential. Large scale development of light rail in the UK on environmental criteria is unlikely.

3.4 THE NEXT FIVE YEARS

Most towns likely to think about light rail have already done so. Most of the present proposals will not be built in the next five years. Some should come to the conclusion that light rail is not the answer. Most will be simply shelved. A list of current light rail studies in five years time will be much shorter than it is now.

More cities will consider alternatives to light rail, particularly if this is imposed on them in order to satisfy the criteria in Circular 3/89. The Scottish studies have generally considered alternatives, of which light rail is one, more thoroughly than English studies. Authorities in Leeds have been considering alternatives for several years now, and more English cities are beginning to follow suit.

In many towns and cities, logic will be on the side of improvements to bus services to free them from traffic congestion on all-purpose road networks. Busways, and in particular guided busways can be supported by rational argument as fitting several objectives of public transport more cost-effectively than light rail. The problem for improvements to bus services is that they do not have enough political champions. Light rail in the UK has few, buses fewer. Light rail projects are more prestigious. Light rail tends to cause less disturbance to motorists—a powerful lobby which politicians usually avoid upsetting if they can.

Standardization clearly makes sense but it would need a spirit of cooperation which has been lacking so far in UK urban rail. It would also need commitment to light rail on a more significant scale than has been made so far. The political and financial obstacles to urban rail in the UK are formidable. We do not have a national plan for urban rail. Occasionally, about once every five or six years, a light rail project clears all the barriers and is built, but where, by whom and with what kind of technology is left to chance and ad hoc decisions. Standardization in the UK would need a change of attitude.

In public transport there is a long standing tradition whereby we invent high-tech solutions in search of problems whilst low-tech solutions provide

the services. Sometimes there are technological successes. Some of these are economic successes too.

Automatic, driverless operation has been adopted successfully in a few systems such as the VAL métro in Lille and London Docklands Light Railway. Street running would seem to need drivers on board. Many of the current UK proposals include street running but there is no reason why driverless operation should not be introduced elsewhere. It does have the advantage of allowing a more immediate response to changes in demand (since drivers' hours do not have to be considered) and reduces staffing needs. The Lille métro operates with about half the staff of the métros of similar scale in Lyon and Marseille.

Street running is attractive on grounds of construction costs, visual impact, access by users and perhaps safety to users (from assault). On the other hand, there are reservations on grounds of traffic safety. Eyes will be firmly fixed on Manchester. Research studies will be carried out on safety and environmental effects. The safety record in Manchester can be expected to have a considerable influence on proposals elsewhere.

A reading of the studies so far carried out would reveal at least 40 towns where at least one light rail line 'could be up-and-running' in five years' time. Technologically, this is possible. Unit costs would be significantly reduced due to increased scale of production. Above all, there may well be 40 or more towns where light rail would result in substantial public benefits, if planned as part of land use, density, environmental and road traffic management policies. For the number of light railways to amount to dozens even by the year 2000, there would have to be a change of approach from central government. The market test would have to be replaced by a policy of planned coordination. The rationing of finance which effectively allows only one approval per year (and even that is more than have received approval) would have to be replaced by a recognition that urban rail finance gives better value for money if provided in occasional large amounts rather than an even limited flow.

Under market test conditions there will not be a light rail revolution comparable to the tramways at the beginning of the century because light rail is not so clearly superior to the alternative forms of local transport as were the tramways at that time.

However, even a cautious guess might put the total at five or six cities with light rail in five years time, perhaps with one or two others under construction. Even this would be an acceleration on the past five years.

3.4.1 Hopes for the next five years

- Improvement in our performance in coordinating land use decisions with transport infrastructure decisions.
- Improved recognition of the effects of land use policies and development projects on needs and demand for travel. Recognition that the success or

failure of urban rail in a particular city is not a scientific fact to be discovered and measured by a feasibility study. Urban rail can be made to succeed or allowed to fail according to what support it gets from land use planning and road traffic management policies.

- Questioning of the belief in the reliability of the market test for urban rail investment.
- Questioning of the implication that public planning always hinders the private sector; opening our eyes to the possibility that land use/transportation planning can be used to support private sector investment.
- Central government studies, led by the Department of Transport, on the alternative means of addressing urban traffic problems including the relative merits of light rail and other means of improving public transport such as revised fares structure and forms of ticket.
- Central government guidance, led by the Department of Transport, on whether we are to go wholeheartedly for light rail, improvements to buses, both or neither. In the present situation of indecision, a great deal of money is being wasted on ad hoc rail studies repeating each other and route lines being held in reserve without much prospect of being used. Even if built, economies of scale and production in terms of rolling stock and equipment will be lost.

3.5 LIGHT RAIL STUDIES IN THE UK

3.5.1 London

A Bill for the extension of the Jubilee Underground Line from Green Park to Stratford is before Parliament. Olympia & York were to contribute 12.5% of project costs, but having gone into administration in May 1992, this now seems unlikely.

London Assessment Studies by Mott Macdonald and Roger Tym & Partners, Ove Arup, Sir William Halcrow and Travers Morgan have considered other Underground extensions:

- Kennington to Streatham (Northern Line)
- East London Line to Dalston
- Central Line to Chingford
- Shepherds Bush to Richmond (Central Line)
- Surrey Docks to Balham
- Queens Park to Ealing (Bakerloo Line)
- extension of the Metropolitan Line to Roehampton
- a new line from Chelsea to Hackney (Fulham Broadway (District Line) to Leytonstone (Central Line)).

At the Conservative Party Conference on 9 October 1990, Mr Parkinson, then Secretary of State for Transport, announced his approval of a BR link

from Paddington to Liverpool Street. The Chelsea to Hackney proposal can be taken forward 'if and when resources permit' (Heaps, 1990).

3.5.2 London Docklands

There has been concern about the number of failures on Docklands Light Railway and it has been proposed by the management to appoint a 'prime contractor' to increase reliability to meet specified performance targets.

Work is underway on an 8-km extension from Poplar to Beckton and it is expected to be complete by late 1992. However, due to the slower than expected pace of development in the Royal Docks it is possible that the line will initially be used to test new systems to increase reliability of the network and will not be open to the public immediately.

Consultants Kennedy Henderson and Halcrow Fox Associates have prepared proposals for a 2.5-km extension with five stations southwards across the Thames to Greenwich and Lewisham thus opening up the Isle of Dogs to commuters from south-east London. A Bill sponsored by London Regional Transport was deposited in 1990 and will allow building and operation by a private sector company to be selected in a tender competition in 1992.

In September 1990 it was reported that a private consortium had published plans for an overhead cable link from Woolwich Arsenal across the River Thames connecting British Rail stations to Docklands Light Railway and the City Airport (Wyse, 1991b).

3.5.3 Tyne and Wear

The 3.5-km extension to the Airport was opened on 22 November 1991. This has not qualified for a Section 56 grant but has been financed by the Airport (£2.36m), the EC (£2.45m) and from the sale of the PTE bus company (£7.4m).

The PTA is reported to have commissioned Steer, Davies Gleave to carry out a 10-month study due to report in the summer of 1992 on the possibilities for extensions of the Metro southwards to Pelaw, Sunderland and Washington (Wiseman, 1992a).

3.5.4 Dudley

A Swiss-built monorail was opened at the Merry Hill Shopping Centre on 31 May 1991. The initial length is 3.2 km with four stations linking the shopping area with a developing office and leisure area. Vehicles can carry up to 150 passengers, 56 of which can be seated.

3.5.5 Manchester

A particular problem in Manchester has been the lack of connection between the two main line railway stations, Victoria and Piccadilly. Light rail is seen as a solution to this problem, linking former British Rail lines from Bury and Altrincham with a few short but important new on-street sections in the city centre. Extensions are planned using BR routes to Oldham and Rochdale and new alignments to serve Salford Quays and Trafford Park. The total network promoted by Greater Manchester PTA could eventually exceed 100 km.

In the city centre the tramways connect Piccadilly Gardens, St Peter's Square, the Arndale Shopping Centre, Town Hall and other busy destinations. There are connections to existing bus and rail interchanges at Bury and Altrincham.

The first 32-km phase 1 system opened from Bury to Victoria Station in the centre of Manchester on 6 April 1992 and the remainder of the first phase to Altrincham on 15 June 1992. It largely uses existing British Rail track with short new sections of line on-street through the city centre and connecting the BR track. Funding is from Section 56 grants (Transport Act, 1968), the PTA and the private sector (around 5%). The contractors are GMA Consortium (Mowlem, AMEC, GM Buses and GEC Transportation).

It has been reported that around 170 will be employed initially (*Modern Tramway and Light Rail Transit,* January 1991, p. 25).

Transport Planning Associates are carrying out a before and after study of the effects of Metrolink on travel patterns, traffic and land use changes, see GMPTE (1990), Holt (1991), Holt (1992), Claydon (1992) Tyson (1992).

3.5.6 Sheffield

Parliamentary approval has been obtained for two lines with a total length of 29 km, half on-street. Construction started on phase 1 in August 1991, from the city centre to Meadowhall, 7 km to the north-east. This runs along the industrial Don Valley and terminates near junction 34 of the M1.

The remaining 22 km of the present proposals extend from Middlewood to the north-west of the city centre to Halfway in the south-east, connecting with the line to Meadowhall in the city centre.

South Yorkshire PTE has formed South Yorkshire Supertram Ltd to implement both lines and has selected Balfour Beatty as contractor and Siemens Duewag AG to supply the rolling stock. Initially there will be 25 eight-axle, double-articulated, double-ended, low-floor trams each with a capacity of 250 people. Project management has been by Turner & Townsend Project Management Ltd. The other consultants have been Design & Building Services (structures/design works, highway engineering, civil supervision, traffic management), Turner & Townsend Quantity Surveyors (payment/valuation, advance works valuations, contractual and cost advice), Kennedy Henderson

Ltd (design approval, rolling stock), Frank Graham Group (public consultation) and the John Brunton Partnership (architects and landscape architects). Cranfield Institute has prepared studies on access for the mobility impaired.

Possible extensions of Supertram have been studied, from Meadowhall to Rotherham town centre along the Don Valley and to the airport at Tinsley.

The PTE is also studying proposals for guided busways made by SY Buses Ltd (Yearsley, 1991).

3.5.7 Croydon

MVA, Kennedy Henderson and Maunsells have undertaken a feasibility study funded by London Transport, British Rail and the London Borough of Croydon. Proposals for Tramlink were published in February 1991 and a preferred route was adopted by the local authority in July 1991. Supported by the Department of Transport South London Assessment Study, Tramlink comprises an 18-mile network connecting Croydon to Wimbledon, New Addington and Beckenham Junction. There would be British Rail interchanges at Wimbledon, Beckenham, Mitcham Junction and East and West Croydon and a connection with the London Underground at Wimbledon. In the summer of 1991 Halcrow Fox were appointed to undertake an environmental impact analysis. Apart from the New Addington Branch, most is existing BR track. The total cost is estimated at £140m including property acquisition, environmental measures and £40m for rolling stock. Tenders have been invited for construction, supply of equipment and operation. A Bill was deposited in 1991.

In October 1992 an agreement was signed between the London Borough of Croydon, London Transport and Tarmac Construction, AEG Rail Systems and Transdev, a French tram and bus operator, to develop Tramlink (Wyse, 1991a).

3.5.8 West Midlands

A Bill promoted by West Midlands PTE received Royal Assent in November 1989 for the first 20-km line from Birmingham Snow Hill to the centre of Wolverhampton passing through the centres of West Bromwich, Wednesbury and Bilston. It uses the low-level line of the former Great Western Railway, now disused. Much of this passes through old industrial and residential areas, a considerable amount of it derelict or disused. All the first phase line is segregated from the highway except short sections in Wolverhampton town centre.

Funding is expected to be from Section 56 grants (Transport Act, 1968), local authorities and the private sector. An application for Section 56 grant was made in April 1990. In March 1992 it was announced that a further £3

million had been committed by central government for preliminary works for line 1, making a total of £4.5 million.

A second line has been proposed from Five Ways (an office centre 1 km west of Birmingham city centre) past the new convention centre and across the city centre via Birmingham Heartlands and along the southern border of the M6 and Chelmsley Wood to the airport. A third line is proposed to connect Dudley with Wolverhampton via Wednesbury, Darlaston and Walsall.

There are further proposals for a 4.5-km extension of line 3 from Dudley to the Merry Hill Shopping Centre and Brierley Hill and a 1.5-km single track loop in the centre of Wolverhampton connecting lines 1 and 3. The Bill also contains amendments to lines 2 and 3. A spur from line 2 to serve the Castle Vale estate has also been added. These proposals and those for lines 1 and 2 received Royal Assent in March 1992.

In September 1991 proposals were published to connect line 1 to the Bull Ring Centre and to line 2.

Consultants have included W.S.Atkins, Kennedy Henderson, Maunsells and Transportation Planning Associates. It was reported in March 1992 that MVA had been commissioned to prepared a Section 56 submission for line 3 (Ballinger, 1991a; Simpson, 1991b).

3.5.9 Edinburgh

Lothian Regional Council has proposed two light rail routes running northsouth and east-west, crossing at St Andrews Square and with tunnelling and street running in the city centre. These are the subject of public consultation prior to a Draft Order (the Scottish equivalent of a Parliamentary Bill). The north-south route has been costed at £300m for 18.5 km of track, which is unusually expensive.

Edinburgh has promoted greater public discussion of public transport options than has been usual in connection with light rail proposals in other cities. Options including metro, light rail and bus priority have been put up for extensive public consultation.

Halcrow Fox, Napier Polytechnic, Mott MacDonald, MVA, Blythe and Blythe, Steer Davies & Gleave and W.Tyson have acted as consultants.

An alternative light rail system put forward by Conservative councillors has been reported (*Construction Weekly*, 2 May, 1990). This would use 70km of disused or underused track with 59 stops, including the Haymarket to Abbeyhill route through Waverley Station. The technology would be similar to London Docklands Light Rail (Wilson, 1992).

3.5.10 Glasgow

The Strathclyde Transport Development Study proposes alternatives for public transport for the coming 20 years involving bus, light rail and metro in combination.

The *Surveyor* of 31 May 1990 (p. 12) reports the PTE's preferred option, a partially segregated radial network including lines to Drumchapel, Paisley, Neilston, Newton Mearns, Castlemilk, Tollcross and Easterhouse. Lines would be mostly segregated from road traffic on main routes into the city centre but unsegregated in the less busy suburban streets. The aim is to combine speed with good access in the suburbs.

Report number 9 of the Strathclyde PTE Public Transport Development Study of 5 March 1990 lists 12 routes with a total length of 100.65 km, 33.68 km of which is unsegregated.

Strathclyde PTE have promoted studies by Sir Colin Buchanan and Partners, Mott MacDonald and Halcrow Fox.

In 1991 a study was carried out by Transport Planning Associates and Ove Arup & Partners on the effects of street running including signalling, safety, highway capacity and costs.

Feasibility studies by Strathclyde PTE were expected early in 1992, possibly followed by search for a private sector partner (Wilson, 1990).

3.5.11 Leeds

In the late 1970s the West Yorkshire Transportation Study concluded that light rail might be feasible in Leeds but not in Bradford. Rights of way from the former tram network have been protected in the middle and outer suburbs but there are none in the city centre where delays to public and other transport are greatest.

A number of options have been published since the late 1980s including an automatic metro, guided busways and several light rail routes. The latest proposals are for light rail routes to Hunslet, Middleton and Tingley as part of an integrated transport strategy announced in February 1991 by Leeds City Council. These routes were part of earlier West Yorkshire PTE proposals. At the outer ends there would be park-and-ride facilities with the cost included in the fare. Steer, Davies Gleave have been commissioned to carry out a Section 56 study of the light rail line from Leeds to Tingley and Stourton. Feasibility studies are also being carried out for a Supertram line along the A660 in the north-west of the city.

Yorkshire Rider, the bus company formerly owned by the PTE favours guided busways at congestion points, and an experimental route is expected soon in Scott Hall Road between Sheepscar and Moortown. Guided busways have been proposed for York Road, Dewsbury Road and Stanningley Road.

3.5.12 Nottingham

The company Nottingham Rapid Transit has been formed to promote light rail and to invite tenders for build and operation. Equity in Nottingham Rapid Transit is split equally between Nottinghamshire

County Council, Nottingham City Council and Nottingham Development Enterprise. Nottingham Development Enterprise came into being in 1988 with the backing of the City and County Councils and the Nottinghamshire Chamber of Commerce and Industry. Its main objectives are urban renewal and provision of a suitable public transport system including the securing of private sector capital. It was reported in *Light Rail and Modern Tramway,* August 1992 (p. 215) that £500 000 had been contributed from the business community towards the cost of the Parliamentary Bill (about one-third of the total cost, the remainder coming from the city and county councils). The contributions are in the form of non-interest-bearing loan notes of between about £25 000 and £50 000 from companies which can be converted into stock in Nottingham Rapid Transit Ltd if the Bill is passed by Parliament.

The first proposed route extends 14 km northwards of the city centre to Hucknall. It is expected to share 8 km of existing BR track on the Hucknall route, the remainder being on-street. Light rail received much publicity locally from late 1990, emphasizing the environmental benefits. The present proposals are to use a modification of the Grenoble rolling stock adapted to gradients of up to 8% and with an 18-metre turning circle for use in city streets. Six routes are expected altogether, radiating from the city centre. Scott Wilson Kirkpatrick have prepared a feasibility study. The Greater Nottingham Rapid Transit Bill was lodged in November 1991 (Skelsey and Wyse, 1990; Cheeseright, 1991; Baker, 1992).

3.5.13 Coventry

In December 1990 public consultation took place on a route proposed by Coventry City Council and Centro from Willenhall north-westwards through the city centre to Canley in the west with branches from there to Warwick University and Westwood Heath Business Park and Tile Hill. The proposed system is entirely at-grade, mostly following road alignments, with street running in the city centre. Rolling stock and power supply appears to be similar to the remainder of Midland Metro. There would be some demolition of property in Earlsdon about one mile south-west of the city centre. There has been public reaction against this and the diversion of traffic (Ballinger, 1991b).

3.5.14 Middlesborough

Studies have been made by Steer, Davies and Gleave, R.Tym and Partners, G.Maunsell and Partners and Merz and McLellan for Cleveland County Council and Teesside Development Corporation, including conversion of 50km of the Darlington to Saltburn BR line via Middlesborough and Stockton town centres. During February 1991 a public consultation exercise on four options was undertaken, all including a route between

Middlesborough and Stockton. A 13.5-km route from Stockton to Ormesby via Middlesborough was subsequently adopted by the County Council. Caldair North East Ltd, a local bus company has proposed guided buses as an alternative (Wiseman, 1992b).

3.5.15 Watford

Studies have been carried out by MVA and Steer, Davies and Gleave for British Rail, Hertfordshire County Council and London Underground Limited involving the extension of the Metropolitan Underground line to Watford Junction. A report has also been prepared on the development of a rail connection between Croxley Green, Watford and St Albans.

3.5.16 Cardiff

Cardiff Bay Development Corporation have commissioned Transport Planning Associates (TPA) to carry out feasibility studies. TPA have recommended a guided light transit system from Cardiff Bay to the city centre and to Coryton and Radyr partly alongside BR tracks. Connections to Rumney, Cogan, Pentwyn, Ely and Thornhill are also proposed with vehicles running along normal roads.

British Rail has unveiled alternative proposals to convert some branch lines in and around Cardiff to light rail with some extensions including street operation. Initially, lines from Pontypridd and Caerphilly are proposed with extensions on-street through Cardiff city centre from Queen Street to Bute Street and the docks. Other possible routes are to Rumney, Barry and Penarth.

3.5.17 Chester

Joint study by Chester City Council and Cheshire County Council including the conversion of the Mickle Trafford line for light rail. Steer Davies and Gleave have been commissioned by the County and City Councils to study demand forecasting, detailed alignments and light rail specifications.

Lines from the zoo and Wrexham Road to the city centre and from Mannings Lane to the zoo line have been publicized. In July 1991 Chester City Council declared themselves against the proposal on grounds of lack of information.

3.5.18 Bristol

Several issues have affected the need for and design of the tramway: poor location of Temple Meads station for local traffic; growth in Northavon and the east Bristol fringe along the M4 corridor; growth potential of Portishead and Portbury; poor accessibility to south Bristol.

Promoted by a private company, Advanced Transport for Avon Ltd, a Parliamentary Bill for the first 15 km of route was passed in May 1989. This uses an abandoned railway line in the Avon Gorge to connect Portishead with Wapping in the city centre.

Two further Bills were put forward by ATA in November 1989. The Avon Light Rail Transit Bill comprises two routes from Temple Meads to Bradley Stoke north of the city and Temple Meads to Yate, north-east of the city with a common section as they approach Temple Meads. Between Filton and Bradley Stoke the route is proposed on-street, otherwise the proposals depend mostly on bringing into use former railway lines. The Bristol City Centre Bill is for a route on-street from Wapping to the main line railway station, Temple Meads passing through the main shopping and commercial centre of the city.

In the autumn of 1991, detailed route proposals for the section from Temple Meads to Bradley Stoke were published by Avon County Council reflecting growing public involvement in the project.

In early 1992 the Bills for routes to Bradley Stoke and in the city centre were still delayed but a Bill for a route from Lawrence Hill to Yate was expected later in the year. It is possible that the Bradley Stoke and City Centre Bills will proceed as 'late Bills'. ATA was wound up on 11 March 1992 following a petition from creditors (*Light Rail and Modern Tramway,* May 1992, p. 134).

The Badgerline Group is studying 'guided light transit' (the GLT 400 project) and the possibility of a route to Bradley Stoke and Stoke Gifford. A flywheel diesel/electric motor system designed by Magnet Motor GmbH is a possibility. A Belgian Consultancy, Transurb, has recommended routes, partly on public highways.

3.5.19 Cambridge

A feasibility study dated October 1990 has been prepared by W.S.Atkins & Associates. A 15-km line extends from Trumpington via the city centre to Oakington. One-quarter of the length, all in the city centre, is on-street. Three-quarters of the route uses existing railway alignments. The County Council considered raising money for its share of the costs by road pricing. However, it has since been reported that the County Council has decided against light rail due to the high cost and has commissioned consultants to study the possibility of guided buses as an alternative to light rail along the proposed light rail route.

3.5.20 Portsmouth

Studies for a Supertram light rail lines using some existing track from Fareham to Portsmouth via Gosport by Advanced Transport Projects, MVA, Kennedy Henderson, Ove Arup and Charles Haswell and Partners have been carried out for Hampshire County Council.

The results of a feasibility study by Ove Arup and funded by a consortium, South Hants Metro Ltd were made public on 3 July 1990. A light rail route was proposed from the shopping centre in Fareham via Fareham Station to Gosport Esplanade using some street running and the Gosport railway line. From Gosport Esplanade, the route tunnels under Portsmouth Harbour to Portsmouth and Southsea Railway Station. Following the failure of South Hants Metro, Steer Davies and Gleave have been commissioned to study the financial situation of the proposals.

3.5.21 Southampton

Promoted by the City Council, a Bill was deposited in November 1989 for a 4.4-km elevated line, described as an automated people mover. In January 1991 a carry over motion was not passed and therefore a new Bill would be needed in order to proceed. Funding will be by a special company with City Council investment expecting a commercial rate of return. Ernst & Young have been financial consultants and MVA carried out an initial study. Four contractors have been shortlisted. The Briway rubber tyred technology is a possibility.

It has been reported the £180 000 of venture capital has been attracted but substantially more is required as the City Council intends to take up only 20% of the capital (*Modern Tramway and Light Rail Transit,* January 1991, p. 27).

3.5.22 Swansea

Promoted by Swansea City Council, Welsh Tourist Board and South Wales Transport, consultants Merz and McLellan have proposed a 4.5-km tramway route from Swansea to Mumbles. Subsequently however, the City Council have indicated that a line along the Swansea Valley is more likely.

West Glamorgan County Council has commissioned a 10-year transportation study by Arup Transportation. The brief includes the feasibility of a tramway.

3.5.23 Stoke

Preliminary studies have been made by Steer, Davies and Gleave for the City Council and Staffordshire County Council. The City Council has also commissioned a study from Briway Transportation Systems to identify areas where there is potential for LRT. This recommends investigation of route from Stoke to Hanley and Adderley Green.

A further public transport study has been carried out by the MVA Consultancy and G.Maunsell & Partners.

3.5.24 Preston

TAS Ltd have undertaken feasibility studies for light rail from park-andride facilities close to the M6 at Red Scar and the M65 through the town centre. There would be 7.3 miles of track using a lightly used railway. Studies have also been made for busways on the same track.

In the spring of 1991 it was announced by Lancashire County Council that a full transportation study of the Preston area, including the possibility of light rail, was to be undertaken.

3.5.25 Plymouth

Preliminary studies have been carried out by Plymouth City Council, including the preparation of a brief for consultants to examine the potential for light rail. Preparatory studies have been made by Advanced Transport for Devon.

In April 1991 it was announced that Cornwall and Devon County Councils and Plymouth City Council have commissioned the MVA Consultancy to study light rail, guided busways and people movers in terms of demand in specific corridors, land development, impacts on non-users, tourism and the environment. Roger Tym & Partners will contribute on land development and tourism and Mott MacDonald on engineering and cost assessments.

3.5.26 Maidstone

The feasibility of light rail in Maidstone, Chatham, Gillingham and Rochester is being studied by Kent County Council. Steer Davies Gleave are studying the possibilities of light rail or guided buses on four routes: Strood to Gillingham, Park Wood to West Mailing, Maidstone Hospital to Bearsted and Maidstone to Chatham.

3.5.27 Milton Keynes

The Development Corporation is studying the use for light rail of central reservations allowed for within the original grid road plan including lines from Bletchley to central Milton Keynes and Stantonbury with branches to Newport Pagnell, Wolverton and Stony Stratford. Some elevated track may be necessary to allow penetration into residential areas.

3.5.28 Guildford

Guildford Rapid Transit Ltd, a subsidiary of Listavia International Consultants Ltd have made proposals for a rubber-tyred transit system connecting the railway station, the University of Surrey and Park Barn Estate.

3.5.29 Blackpool

Studies by Professor Lewis Leslie (Liverpool Polytechnic) for Lancashire County Council including rerouting and extension to the 7-mile Fleetwood to Blackpool line to connect with British Rail at Pleasure Beach Station.

3.5.30 Redbtidge (London)

A former British Rail line from Ilford to Newbury Park has been reserved for light rail in the Borough Plan.

3.5.31 Haringey (London)

The feasibility of a tramway or light railway between Alexandra Palace and Wood Green underground station is being studied by the London Borough.

3.5.32 Gateshead

Feasibility studies by the Ross-Silcock Partnership and Merz and McLellan for a tramway from central Gateshead to the Metro Centre and the Derwent Valley.

3.5.33 Hull

Preliminary studies by Steer, Davies and Gleave for Hull City Council, Beverley Borough Council, Holderness Borough Council and Humberside County Council.

3.5.34 Belfast

Preliminary studies by Queens and Ulster Universities and MVA for Northern Ireland Railways and the Northern Ireland Department of the Environment. Street running in the city centre to connect existing rail routes is a possibility.

3.5.35 Gloucester

A 45-km system connecting Gloucester with Cheltenham has been reported (*Surveyor,* 30 August 1990). The initial line would extend 24 km from Quedgeley to Cheltenham.

3.5.36 Swindon

A feasibility study is in progress by Transmark (British Rail) for Wiltshire County Council for light rail on corridors from Haydon Wick to Swindon and the riverside area.

3.5.37 Dartford

The Borough Council has commissioned a study by Steer Davies and Gleave on the potential of a circular route connecting Blue Water Park Shopping Centre and other commercial developments to the town centre.

3.5.38 Derby

The feasibility of a tramway or light railway in the central area pedestrian precinct is being studied by the City Council.

3.5.39 Bedford

Kennedy Henderson have undertaken a strategic study for North Bedfordshire District Council including light rail in Bedford.

3.5.40 Lancaster

A 25-km light rail system proposal came from the University of Lancaster Geography Department in 1990.

3.5.41 Norwich

Preliminary studies by Halcrow Fox for Norfolk County Council (Wood, 1990).

3.5.42 Exeter

Preliminary studies by Devon County Council and Advanced Transport for Devon.

3.5.43 Southend

Investigations by Sir Colin Buchanan and Partners for Essex County Council including potential for rapid transit.

3.5.44 Great Yarmouth

A private developer has submitted an outline planning application for an elevated monorail comprising 2.5 km of route and four stations. The County Council has been reported to have objected to the Borough Council who have received the application.

3.5.45 Chelmsford

Preliminary studies by for Chelmsford Chamber of Commerce including a town centre route with shopping and car parking.

3.5.46 Liverpool

A study has been made by Merseyside Development Corporation for a light rail from the city centre and Pierhead to the former Garden Festival site. Preliminary studies for light rail have also been made by Merseyside PTE. However, due to the high cost, Merseyside Deveopment Corporation has now turned attention to electric powered buses.

3.5.47 Leicester

Steer Davies and Gleave have carried out an evaluation of public transport options in the city including light rail, other rail and improvements to bus services.

Leicestershire County Council has proposed a light rail route from Narborough to Birstall, on-street in the city centre. The County Council has been advised that light rail would cost approximately ten times as much as bus priority measures but would have a correspondingly greater capacity. It has been reported that the County Council does not intend to proceed with light rail due to there being no realistic chance of funding (*Modern Tramway and Light Rail Transit,* June 1991, p. 10).

3.5.48 Aberdeen

Preliminary studies have been undertaken by the Scottish Development Agency, Grampian Regional Council and Aberdeen Beyond 2000.

3.5.49 Peterborough

The city council is reported to be making efforts to raise money to finance a light rail study.

3.5.50 Reading

Preliminary studies by MVA, Foster Wheeler and Kennedy Henderson for Berkshire County Council for two rapid transit routes involving street running along part of the A33 to Basingstoke (5.5 km) and the A3 to Bath (7.5 km) have been put into abeyance and guided buses are being studied as an alternative.

4

LOCAL BUS SERVICES

4.1 ISSUES

The improvement of local public transport has had increased attention since the mid-1980s. The principal focus has been on light rail, studies having been initiated in 50 UK towns between 1987 and 1989. In 1990 the Bus and Coach Council published *Buses Mean Business* which contained the idea of 'green routes' including priority measures, improvements to waiting facilities and passenger information. Since then, more attention has been directed on the improvement of bus services, particularly on the possibilities of the reservation of road space in the busiest urban areas to overcome the problems of road congestion which face bus service operators.

The rise of the motor car has been the underlying cause of responses to improve bus services. In urban areas the problems have, above all, been the effects of road traffic congestion on bus services and the related issues of decline in usage and increase in operating costs. In suburban and rural areas the main issue has been decline in usage.

Particularly in Scandinavia, Germany and Holland, environmental consciousness has resulted in a search for fuels to replace diesel for buses.

The increasing proportion of elderly in the population, together with trends in land use changes which have caused greater needs to travel to shops, health care, leisure facilities and for other purposes have resulted in increasing needs to provide transport for the elderly and others who experience difficulty in using standard public transport services. Minibuses have become invaluable in taking old people to the shops, health centre or day care centre, providing a personal and unhurried service with flexibility of route and sometimes special adaptations of the vehicles to help boarding. Such 'community transport' differs from the ambulance service in that fares are charged and that it does not

necessarily take people to health-related facilities but as a general rule it is not available to the public at large.

The problems facing local bus services have been compounded by the low esteem afforded to buses by so many politicians, officials in decision-making positions and by the public at large, even including regular bus users. Bus users are expected to put up with standards of discomfort and inconvenience which many potential travellers would find unacceptable and which bus users only accept because they have no alternative. There is still a big gap between power to legislate and make policy on the one hand and understanding of the bus industry and experience of using bus services on the other.

Journeys often involve more than one means of public transport. Public transport needs to be integrated—in terms of timetables, location of stops, tickets and special facilities such as for the disabled—so that journeys can be completed. Integration needs planning and this seems to have been declared illegal in the Transport Act 1985.

The standard of management within the bus industry remains variable. Some operators are conscious of the need to keep up standards of service. On the other hand, we can still see many bus stops without even the most elementary information of timetable and route plan, rendering the services impractical for anyone other than regular users. Bus stops do suffer from vandalism but that is not the cause of the lack of passenger information in most cases.

In some countries where there is high car ownership there have been strenuous efforts to address these problems by several means. In France there have been substantial innovations in many of the towns over about 120 000 population, partly because apart from Paris, none of them has an extensive local rail network although light railways are being developed in several cities. Even in what was West Germany, where substantial local railways, including tram networks operate in many cities, there have been significant improvements to bus services. In countries where there are well-developed rail networks, it is common for there to be steps taken to make the private car less attractive in city centres, as well as steps to make public transport more attractive.

4.2 WAYS OF IMPROVING LOCAL BUS SERVICES

Buses have come to be treated as a service for those who have no other means of transport. As well as simply improving the services for existing users, recently it has come to be recognized that bus services should provide an alternative for those who do have their own transport. Persuading motorists to abandon their cars for the bus will be an uphill struggle even in situations where traffic calming or other traffic management policies have reduced the convenience of the private car relative to public transport.

Improving bus services mainly in terms of reliability and speed has been a concern in the larger cities. Elsewhere, it would be more accurate to describe the problem as maintenance of a socially acceptable service in the face of decline in demand. Seven means of addressing the issues surrounding bus services may be recognized:

- bus priority;
- vehicle developments;
- integration of services;
- improved management of bus services by introducing new ways of securing services involving public and private sectors;
- use of information technology for bus operations;
- new fares structures and forms of ticket;
- improved information for passengers;
- measures to improve the environment on buses such as increased restrictions on smoking.

4.2.1 Bus priority

Bus priority is the manipulation of road traffic conditions so that compared to other vehicles, buses are favoured in the allocation of roadspace. Often, other selected vehicles, usually taxis, ambulances, fire engines and police cars are included in priority projects. Bus priority can be achieved by three principles:

- by reserving road space exclusively for buses and other selected vehicles;
- by manipulating traffic signals in favour of buses on road space which is shared with other traffic;
- by fiscal measures such as road pricing, fuel and vehicle taxation and road fund licensing.

In this country projects giving physical priority to buses are usually carried out by highway authorities and planning authorities.

Where there is road traffic congestion, bus priority is likely to be the most significant way of improving the reliability and speed of services. Without it, the other ways of trying to improve bus services such as vehicle developments, integration of services and improved information for passengers, would be likely to fail.

As well as improving services, bus priority also increases the capacity of bus services and, if bus services are frequent, the capacities of roads in terms of the number of people moving. Bus lanes with capacities as high as 39 000 passengers per hour in each direction have been reported in Brazil (Cornwell and Cracknell, 1990) and 725 buses per hour on a bus lane on Interstate 495 in New Jersey (Lessieu, 1984). Such capacities are

comparable with those of the lighter varieties of métro. Certainly 20 000 passengers per hour in each direction is a realistic target, even without particularly elaborate measures for overtaking at stops and for boarding and alighting.

Operational costs of buses at such high levels of demand will be higher than operating costs of urban rail but not necessarily so much so as to outweigh the lower capital costs. It is likely that urban rail will be essential to cater for demands of over 30 000 passengers per hour in one direction (Fouracre, Allport and Thompson, 1990) and normally it would be worth considering a light railway for demands even one-quarter of these, if they are sustained for a substantial part of the day.

For bus priority, there is a need for cooperation from the planning and highway authorities. Busways not involving loss of roadspace to other users will be relatively expensive. On the other hand, bus priority can give substantial advantages to passengers in towns and cities. There is more potential for stopping the decline in usage in towns and cities than in suburban and rural areas where public transport cannot provide an attractive alternative to the private car for those who have one.

In December 1991 it was announced that £10 million (in the form of supplementary credit approvals) had been earmarked for bus priority projects over two years by the Department of Transport. In April 1992, £4 million was allocated to 25 projects. In Sheffield £350 000 has been allocated towards bus priority in the Chesterfield Road/Abbeydale Road corridor south of the city centre. Tower Hamlets London Borough has been allocated £200 000 for bus priority in Docklands. Other projects receiving support include those for guided bus ways in Leeds, bus priority in Brighton and electronic passenger information in Blackburn.

Bus priority will obviously allow faster and more reliable services but four groups of questions arise from current initiatives.

- What are the quantitative relationships between speed and reliability on the one hand and the extent and form of bus priority measure? Will introduction of relatively modest bus priority measures significantly improve bus services? Will the improvements to services take place at certain times of the day?
- What will be the effects on the number of passengers? How many new riders will there be? Who will they be? Will bus priority make services sufficiently attractive to persuade motorists out of their cars?
- What will be the effect on accessibility? Will fewer cars come into town? Will commercial activity be affected? Will there be a significant change in the number of those coming into town and the purposes of their journeys? Or will the same people change modes of transport?
- If bus priority has significant effects and these are wanted, is it the most cost-effective way of achieving them?

These are all questions which should be addressed in deciding on policy towards bus priority. The answers are likely to vary to some extent from case to case.

Bus-only streets

Buses and other selected vehicles are often allowed into schemes where access is restricted for other traffic. In many cities, buses are allowed to use otherwise pedestrian streets so as to reduce the main detrimental effect of pedestrianization—reduction in access. One of the main justifications for light rail is that it can give fairly high capacity access to such streets with little environmental damage. Apart from a few of the small-scale people movers, light rail services are usually more expensive than buses. A large part of the justification for light rail in such streets depends on the contentious issue of whether buses are environmentally acceptable. In a number of continental European cities, trolleybuses have been introduced, for example in Lyon, or dual-mode buses as in Nancy.

Also, there are bus-only manoeuvres and bus gates whereby short lengths of road are reserved for buses to allow them to pass through where other traffic is restricted. Where traffic cells have been formed, it is usual for the access restriction to be relaxed for buses. Traffic in the centre of Gothenburg was replanned in the 1970s around the formation of five traffic cells bounded by a ring road. Apart from buses, trams, taxis and emergency vehicles, road traffic is not allowed to cross from one cell to another. The only way of getting into a cell is from the ring road (Figure 4.1).

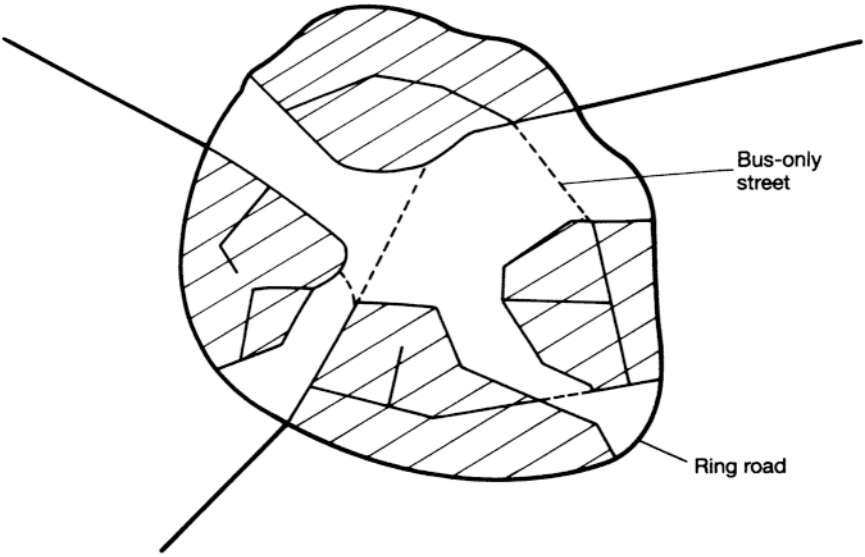

Figure 4.1 Ring road with traffic cells.

Bus lanes

Sometimes the term 'busway' is used where there is separation of buses from other traffic by a physical barrier such as a kerb, whereas 'bus lane' is where the reservation of roadspace for buses consists of nothing more than road markings and signs.

Bus lanes can be justified only where and when there is road traffic congestion. Along some roads there will be a case for making them part-time only, during peak periods. Otherwise the loss of roadspace to private cars will not justify the gains to buses, in terms of the capacity of the road to carry people.

Simply painting bus lanes on the road carriageway is a very cheap, easy way of giving some degree of priority to buses and other selected vehicles, commonly taxis and emergency vehicles. The problems are loss of roadspace to other vehicles, a contentious political issue, violation by other vehicles and lack of continuity of the bus lanes.

Often it is at junctions where there is the greatest need for bus priority and it is difficult to achieve continuous bus lanes through junctions in some cases. Roadside (as opposed to central reservation) bus lanes usually stop short of traffic lights at junctions, otherwise the other left-turning traffic (in the UK) would be severely impeded.

Sometimes it is also difficult to achieve continuity of bus lanes on sharp bends. Turning circles needed for buses would cause them to swing out of any bus lane unless it was widened on the bend and sometimes there is not sufficient space for that.

Bus lanes can be in the centre of the road but where they are at the side, as is more usual, the stopping of delivery vehicles in them is sometimes allowed. Where bus lanes are in the centre of the road, access for passengers is more difficult and some form of refuge is needed.

In some cities including Paris, the practice of designating bus lanes has fallen into disrepute because the lanes are frequently violated. Although buses do not get the clear path that was apparently intended, they do get some priority. Where there are busy streets with not-very-frequent bus services, the best use of roadspace is probably to have priority only when needed.

Presumably priority for buses could be increased by closer surveillance by police, traffic wardens (whose powers may need to be extended to moving vehicles). TV cameras are used to give evidence on traffic going through traffic lights at red and to issue fines. There seems to be no technological reason why TV cameras could not also be used to uphold observance of bus priorities.

Considering the low cost of painting bus lanes on normal road carriageways, even a small improvement in bus services could be considered a success. They represent a gesture from the transport authority that may be followed up by more committed and enforced priority for public transport. Collection of fines from vehicles parked in the bus lanes can also be a useful source of finance for public transport.

Slightly more emphasis can be given to bus priority by using tactile devices as well as white lines. Such devices include road studs and low raised kerbs which can be crossed when travelling slowly. Care has to be taken to avoid these being dangerous for cyclists and motor cyclists.

Busways

Violation by other road users can be reduced by building a kerb or other physical obstacle between the bus lane and the rest of the carriageway. In such cases where there is a physical barrier it is usually referred to as a 'busway' rather than a 'bus lane'. A physical barrier prevents other vehicles weaving in and out of the bus lane surrepticiously but results in a greater loss of roadspace. It is perhaps safer when the buses are travelling in the opposite direction to the rest of the traffic, but contraflow bus lanes without a barrier are quite common.

Sometimes, as well as a kerb, railings or other form of barrier to pedestrians are installed between busway and pavement or between busway and other road traffic or both. This is for pedestrian safety, as buses will tend to travel faster than the remainder of the traffic and may be travelling in the opposite direction, both of which will be safety hazards to pedestrians.

In a few towns, notably Redditch and Runcorn, roads for use only by buses and a few other categories of vehicle were constructed as part of the main transport network for the town in the 1960s (Figure 4.2). The concept has not been adopted much elsewhere. This kind of busway is most easily implemented in new towns or other situations where there is

Figure 4.2 Busway at Shopping City (Runcorn).

large scale expansion, otherwise, extensive demolition of property would be likely. This type of busway has commonly followed a circular, suburb to suburb to town centre pattern or a figure of eight pattern, crossing in the town centre, although there is no reason why busways should not be constructed on a radial, suburb to town centre pattern. The choice will depend on the development strategy for the town rather than any qualities of the busway.

This type of busway may be seen as an alternative to a railway in town of insufficient size or density to justify light rail. Busways are also more flexible in that the buses can use ordinary roads as well and the busways could be easily brought into use for other traffic if required. Busways may also be cheaper to construct than some, but not all, forms of railway.

In the early 1990s there has been renewed interest in bus priority accompanying the slow progress of many of the light rail proposals of a few years earlier. At the same time, the private financing of roads has been finding favour in government circles and road pricing has been making a (timid) comeback. It will be very rare for the capacity of a busway to be fully used by buses. Putting these concepts together, there may be some scope for privately financed busways charging tolls to a limited amount of other traffic. There would be problems to overcome. There would need to be lay-bys at bus stops or some other means of allowing other traffic to overtake buses at stops. Controlling the level of non-bus traffic would be a vital task, but information technology is far more sophisticated than it was in the 1960s when the earlier busways were developed. In any case, the early busways were not built to address traffic congestion in large cities.

In some cities with tramways, buses share some of the track. The buses may or may not be guided. Both forms are to be found in Essen and non-guided buses share short lengths of the Grenoble Tramway. Sometimes, pits just a few inches deep are dug at intervals between the rails so as to deter use of the tracks by vehicles with a smaller wheelbase than buses.

Both bus lanes and busways have the important advantage over urban rail for example in that they can be extended section by section. They do not need to have a substantial minimum length to be viable. Even one kilometre can be useful in speeding up buses through a particularly congested section of road. Busways often form part of the trunk section of a network with the branches or feeder services using normal roads. Incremental development is possible because there is no need for passengers to change vehicles. Bus services using normal roads can simply go on and off a busway at will. In fact most busways are only a few kilometres in length.

Where there are very frequent bus services on a busway, a very important factor influencing the speed and reliability of services and therefore the capacity of the busway are the provisions for the stopping of buses to allow loading and unloading of passengers and overtaking by

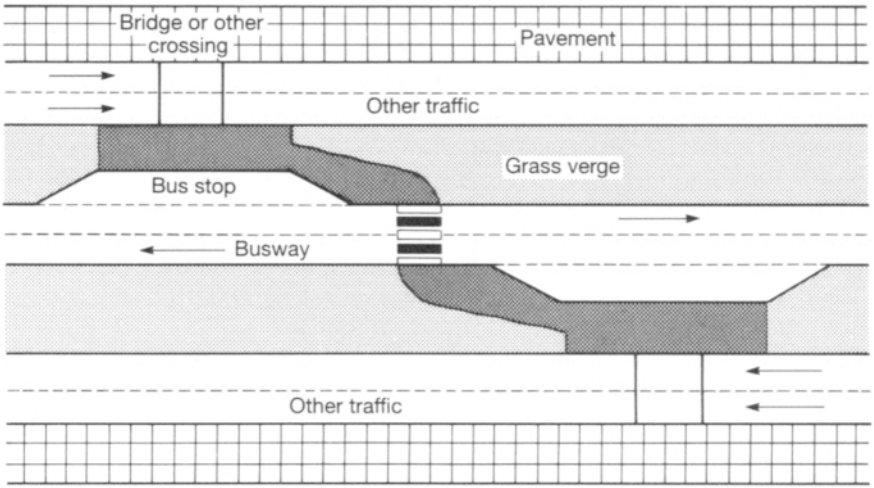

Figure 4.3 Layout for an ideal median busway. Where busways are needed, in congested urban roads, there will rarely be as much space as this.

other buses. In most cases, a simple lay-by will be adequate but at very high bus flows, several parallel bays may be needed to avoid buses having to queue at stops.

Space for construction of a busway will be in short supply in many cases. Busways are likely to be needed in congested urban traffic conditions. Apart from heavy demand for roadspace, one of the factors likely to cause congestion is lack of space for road widening. An ideal layout for a median busway is illustrated in Figure 4.3, but it is to be recognized that there will rarely be sufficient space to construct a busway to these standards, except where the busway is not needed.

In a few cases, bus services are arranged to end at the outer end of a busway, acting as feeders to other services on the busway. This allows very high loading on the busway and decreases the number of buses needed (and so saving on costs and increasing the speed and reliability of the buses and the capacity of the busway) but means that passengers have to forgo having a through journey, otherwise one of the principal advantages of busways over urban rail. Changing buses also means that some form of bus station or interchange area must be provided at the end of the busway.

Guided busways

The yard-or-so width saved with guided busways compared with non-guided bus lanes or busways may allow squeezing in a busway in a central reservation

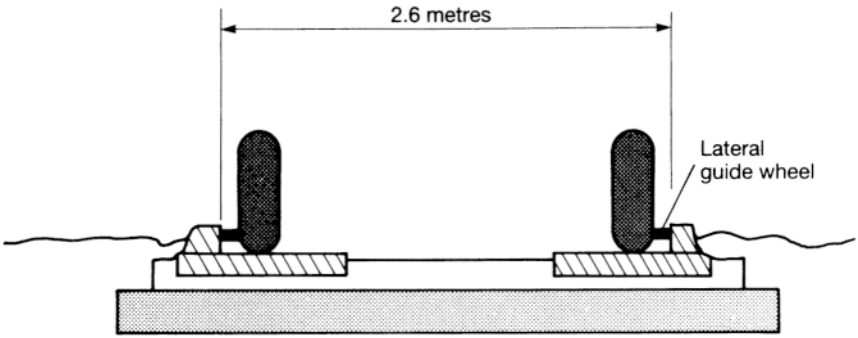

Figure 4.4 Guided busway: cross-section.

of say a four-lane two-way road without losing a lane of traffic (Figure 4.4). Roadway paving need only be provided where the wheels run, which makes guided busways cheaper to construct than bus lanes and reduces the temptation of violation by other vehicles. Guided busways are more suitable than bus lanes where there is a need to reverse the direction of flow, as there often is between morning and evening peak hours. The buses are standard vehicles adapted with small lateral guide wheels. They can be single-decked, double-decked or articulated. As for non-guided busways, they can be used on ordinary roads. Platforms can be built to give level access. They therefore combine the advantage of having reserved tracks whilst avoiding the disadvantage of being confined to them as are railways. They can also include steeper gradients and tighter curves than most forms of railway. Severance of access to bordering properties can be a problem with guided busways and sometimes they are combined with bus lanes to reduce this.

Guidance is usually by contact with the track. Guide rails direct the front wheels by contact with rollers fitted to the front axles.

In Essen, local tram and light railway track has been adapted so that it can also be used by guided buses (Figure 4.5). A light rail network of 76km, of which there are 21 km in tunnels, has been developed since the 1950s. However, this became underused and from 1980 shared use with guided buses was introduced on a 4-km route to the suburb of Kray, in the central reservation of an Autobahn and using a tunnel in the city centre. The guided bus system has been subsequently extended to 9.5 km. It has the dual advantage of saving on roadspace (loss of which is a frequent objection to bus lanes) and also discouraging violation by other road users. However, there are limitations as to where use of track can be shared. Frequent train services and long sections of tunnel are deterrents, even where buses are electrically powered. Raised platforms have been constructed at bus stops

Figure 4.5 Guided busways sharing railway track in Essen.

for the less mobile and to reduce boarding times. A fixed headway system using block signalling and failsafe emergency breaking is used on sections jointly used by light rail and buses. Substitution of guided buses for light rail has not been accompanied by any reduction in public transport usage, according to the transport authority.

In Adelaide, guided busways were chosen instead of, not as a replacement for light rail. The 12-km route runs from the city centre to the north-eastern suburbs in a linear park. It was opened in 1986. There are three stations, all with passing arrangements and platforms are constructed to allow level access. At peak times, 13 bus routes converge onto the busway. Many of the services continue to a city terminus two kilometres beyond the end of the busway and there has been some congestion of bus services in this section. Operating speeds are around 100 km per hour on the busway. Overall bus passenger journeys along the corridor served by the busway increased by around one-third after it was opened, the increase being particularly high off-peak. Around 40% of passengers on the busway previously travelled by car as driver and about 20% as passengers, figures higher than those generally attributable to light rail. Around two-thirds of busway passengers had the option of travelling by car, a very high figure for a bus service.

Despite the attractiveness of guided busways in principle, few have been built. Apart from Essen and Adelaide there are only a few experimental tracks. At Furth in Germany a project is underway to guide buses electronically. A buried cable emits a signal which is read by a transducer on the bus which in turn controls the steering. An experimental system at Rochefort in Belgium

involves central rail guidance with traction from an overhead line. The less simple forms of guidance add a great deal to the costs. Whereas the cost of modifying an ordinary diesel bus for kerb-side guidance is only around £3000 (1992 prices) the costs of some of the other forms of guided bus are comparable to those of light rail, i.e. 6 to 12 times that of a diesel bus per vehicle.

Priority at traffic signals

Where there is a bus lane approaching a junction controlled by traffic lights, it would be possible to introduce modified signals so as to include a phase giving priority to buses or any other selected vehicles. A higher degree of priority can be afforded if the signals are programmed so that when a bus approaches, these are automatically changed to green. Buses may be fitted with a transponder such as those manufactured by Siemens-Plessey Controls Ltd, which activates traffic signals as it crosses a special loop placed about 70 metres in front of the stop line.

Recently, Siemens-Plessey Systems have been installed for SELKENT and in connection with light rail in Hong Kong with Hong Kong Public Works Department. A traffic signal priority system is in use in Glasgow. All buses in London are being fitted with transponders to be used for selective vehicle detection at about 350 traffic signals in outer London. In the autumn of 1992 about half were implemented.

In Grenoble, there is on-vehicle traffic light control by the Phillips VETAG system. In Stockholm there has been an experimental system of on-board control of traffic lights and there is a substantial traffic light priority programme proposed for the city centre.

It is also possible to programme traffic lights to give priority to buses and other selected vehicles at junctions in connection with the use of sections of bus lanes. For example, buses turning left (in the UK or in countries where driving is on the right if there is one-way traffic) may be accommodated by a separate lane (on the left). By using an extra traffic light, selected traffic may be allowed to turn left even when the lights are against the remainder of the traffic travelling in the same direction. This is a more limited form of priority than where normal traffic lights are switched in favour of selected vehicles such as buses. It is less favourable to the vehicles selected, more complicated to operate and takes up some roadspace for the bus lane but it does have the advantage that it causes less inconvenience to traffic crossing the paths of the buses.

Local Transport Note 1 (Department of Transport, 1991c) introduced 'bus advance areas' (Figure 4.6). These involve 'pre-signals' or secondary sets of traffic lights. In congested urban conditions these may be typically about 20 metres in front of the main set, where there is more space available, up to about 120 metres. These allow buses (and other selected vehicles) through into the bus advance area (between the pre-signals and main signals) and

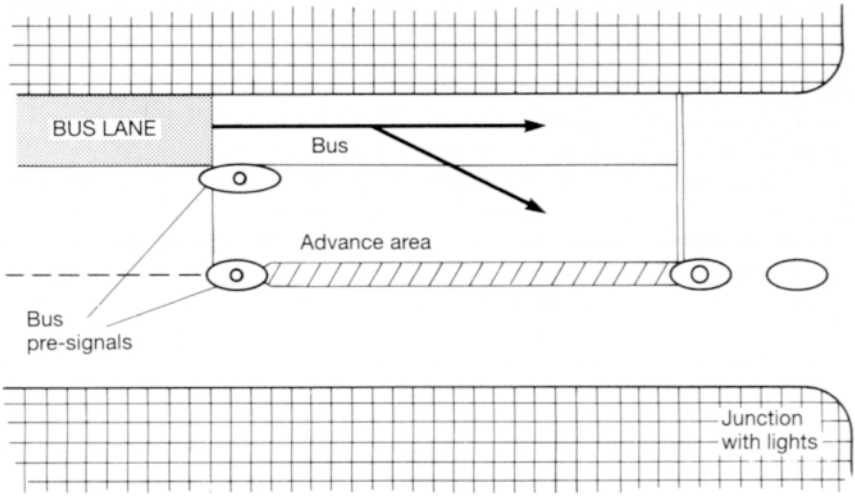

Figure 4.6 Bus advance areas.

stop other traffic. In this way, buses are given priority to reach the main signals first and so clear the junction at the first available green. Because buses are separated from remaining traffic, bus advance areas also allow the use of special traffic signals to allow buses to start from traffic lights slightly before remaining traffic. The advantage of bus advance areas/pre-signals over simple priority at traffic lights is that traffic at the junction other than that travelling in the same direction as the buses is not affected.

Where there are two or more traffic light-controlled junctions along a section of road, by adjusting the traffic lights, it is possible to transfer queues of traffic to those sections of road where there is a bus lane, so allowing buses to avoid the queue.

Part-time bus priority

As a general rule, priority for buses is needed only when and where there is traffic congestion, although small savings in time will be possible by manipulating traffic lights even when there is no congestion. Giving priority to buses in other circumstances will probably reduce the total capacity of a road to carry passengers. However, it is likely that reducing capacity in such circumstances will be of no consequence. If there is still no congestion, the reduced capacity will exceed demand for roadspace. On the other hand, giving priority to a selected group of vehicles such as buses may cause congestion to other vehicles which would not have happened if no priority had been given. Bus priority will certainly increase congestion to other vehicles where there would have been congestion in the absence of bus priority.

In some circumstances there will be a good case for bus priority only at certain times of the day, most likely morning and evening peak hours. This will be relatively easy to put into practice for priority dependent on traffic signals. For some kinds of bus lanes not involving kerbs or barriers it will be possible too, even if liable to cause confusion amongst drivers of vehicles other than buses. Some kinds of busway are designed for vehicles the size of a bus and will be unusable by others.

Fiscal measures for bus priority

Any of the taxes and duties on motoring have the potential to be set at levels which would give more or less priority to buses or to any other selected vehicles. Road pricing is perhaps the clearest and the one with the greatest potential for precision since it can be applied specifically to selected sections of road.

Road pricing is the charging of vehicles for use of selected roads or sections of road. Except in the case of tolled motorways, it is usually applied within a defined zone rather than to several roads physically separate from each other. Three main methods of charging are possible.

- Toll booths erected on entry or exit to the zone. In 1986 a cordon of toll booths was installed around the centre of Bergen. It was necessary to toll only six routes and one of these, being a bridge, was already tolled and so had introduced the idea of tolling to motorists.
- Supplementary licensing whereby an additional licence is needed to use roads in a defined zone. Such a system was started in Singapore in 1975. Licences may be purchased monthly or daily, the licence being displayed in the window of the vehicle. Charges have varied according to the type of vehicle. At first there was free entry for cars with more than three occupants but this has been withdrawn due to abuse. Inspectors were located at the 25 entry points to the restricted zone. Supplementary licensing needs extra staff but has coincided with, and probably caused, a substantial shift in the modal split towards public transport. A permit system was introduced in central Milan in 1985. Permits were issued free to residents and in limited numbers to employers. There has been a reduction in the number of vehicles entering the zone from about 130 000 to 50 000 per day and some transfer to public transport, but there has also been an increase in parking demand just outside the zone.
- Electronic tagging devices on vehicles and at entry points to a defined zone so that the presence of vehicles is detected and a bill sent to the owner periodically. An automatic debit system was introduced in Hong Kong in 1983. Vehicles carried an electronic number plate on the underside of the chassis which was detectable by roadside electronic loops positioned at entry points to the area defined for pricing. An argument raised against the system was that it was an invasion of privacy as movements were recorded.

A refinement of the principle, the Q-FREE AVI-System (Automatic Vehicle Identification System) has been developed by a Norwegian company, Micro Design AS. An AVI tag is atached to the vehicle windscreen which transmits information about the presence of the vehicle to an overhead toll plaza frame. A computer in each toll plaza records information about time and the vehicle and trasmits it to a central computer. Manual barriers cater for foreigners and others who are not registered with the system. Parking charges can be combined with road tolls. Once transactions are completed, only information relating to the number of passages is stored, in accordance with Norwegian law.

The system was introduced in Oslo in 1990 offering a choice of either manual or electronic collection, to cater for vehicles not fitted with the necessary equipment. A similar system was set up in Trondheim in 1991, where there have been several refinements. Within one hour motorists pay only once and within one month, users are charged only up to a maximum of 75 trips. Discounts are given between 10 a.m. and 5 p.m.

A system with some similarities, developed by the European Community, is PAMELA (Pricing and Monitoring Electronically of Automobiles). Road pricing has been proposed in Cambridge, modified to charge vehicles only when they are in congested roads, a refinement to direct charges more accurately to the relief of traffic congestion.

Road pricing is conceptually a very attractive way of addressing excess of demand over the supply of roadspace and has had a great deal of discussion since the problem arose. The only reason for the very limited application of pricing to date have been the political obstacles of gaining public acceptance. As pressures for more car travel become greater and greater so too will the pressures to introduce road pricing. There will come a time when the need for road pricing will become so great as to outweigh the political reasons against it, and it will be used as a means of limiting travel and transferring travel to public transport.

There are several ways, therefore, of giving priority to buses and other selected vehicles by reserving roadspace for them or by giving them priority for roadspace which is not reserved such as in traffic signalling. In choosing between the options there will be several criteria:

- availability of roadspace and other space to undertake priority measures;
- prevention of violation by unwanted vehicles;
- degree of inconvenience caused to other road users;
- flexibility—the possibilities of permanently undoing the priority measures if they become unwanted or having part-time priority if this comes to be all that is needed;
- safety of pedestrians, buses and other road users;
- costs of undertaking the priority measures.

Bus priority and particularly busways, guided or not, are being increasingly seen as an alternative to light rail. Their advantages of

incremental development, lack of need to change vehicles when entering them and low capital cost have been acknowledged for many years but it is only quite recently, with the slow progress of many light rail projects due to high capital cost, that attention has returned to busways. In many UK cities which have had light rail proposals since 1987, relatively low demand for public transport has long suggested busways to be worth serious consideration. Gardner (1992) points to the possibilities for busways where there is much higher demand of up to around 20 000 passengers per hour in each direction, particularly in developing countries where low cost and limited demand for 'hard' currency are important advantages of busways. He indicates likely costs between US$ 400 000 and US$ 1 million per kilometre (end 1989).

4.2.2 Vehicle developments

During the past decade in many continental European cities there has been a trend towards larger buses. Articulated buses have become commonplace and there have been trials with even larger buses with two articulations. The reasons seem to have been the desire to increase capacity and the number of passengers per driver, thereby reducing unit costs.

Increasing the number of passengers per driver however, becomes less attractive for larger vehicles. For example, assuming wages of £60 per day, an increase from 500 to 1000 passengers results in a decrease in wages costs from 12p to 6p per passenger. A further increase to 1500 passengers reduces costs to 4p. There comes a point where a small saving in unit costs is outweighed by the more frequent service possible with smaller vehicles.

The trend towards larger vehicles has depended on ever-increasing automation in ticket issue, off-bus sales of tickets, travelcards and other means of speeding up boarding. Larger buses have often been used as a cheaper substitute for building a tramway or métro or as a temporary substitute.

It is curious that whilst British cities have been facing similar public transport issues to those in many western European cities, in Britain there has been no significant trend towards larger buses during recent years. Possibly not a result of deliberate policy, the reverse has been happening. Some of Britain's large cities such as Manchester and Leeds have had large numbers of minibuses on routes within the city centre, at least for a spell. Lower wages paid to drivers have been significant but even allowing for this, it is hard to imagine that they could be more cost-effective than large buses in city centres.

Minibuses have provided more frequent services and helped attract more passengers to public transport because of this. In the West Midlands so far there have not been large numbers of minibuses but there has been a significant replacement of double-decked buses with single-decked buses of lower

capacity. As with minibuses, surveillance and protection from vandalism and assault of passengers are easier than on double-decked buses.

Fast-accelerating buses have been tried as a means of combatting road traffic congestion. Many of these are single-decked, some double-decked. Whilst they do reduce the disadvantages of road traffic congestion to buses, they are basically the wrong solution to the problem. Considering the composition of bus users, particularly the high proportion of elderly, frail and those carrying shopping, small children or push chairs, fast-accelerating buses are a desperately inappropriate response to urban road traffic congestion. What is needed is priority for road space, not the ability to charge faster into decreasing gaps in traffic queues. It is difficult to imagine that any transport authority with powers to apportion road space would ever consider fast-accelerating buses. They are more likely the desperate reponse of the bus operator, aware of the problem, but powerless to carry out an appropriate solution.

Even worse are the fast-accelerating buses with badly arranged seating and insufficient provision for passengers to hold to in order to keep their balance. Surely we now have models of bus on the road which should not have been licensed as passenger service vehicles.

Light rail studies have been carried out in about 50 UK larger towns and cities. Amongst the claims of light rail have been increased comfort, smoother ride and higher passenger/staff ratios. Simultaneously, in several of the same cities quite the opposite has happened to the buses: more standing passengers, fast-accelerating buses and smaller buses have all been adopted in the very same cities where light rail has been proposed, amongst others. To some extent, this situation has been an accompaniment of deregulation of bus services under the Transport Act 1985. Increased competition has favoured the retention of older, shabby buses, particularly amongst the smaller operators. Local authorities have been under strong financial pressure to award tenders for contracted services to the lowest bidder. Particularly for rural services and those at evenings and Sundays, this has resulted in poor quality vehicles.

A further development in vehicles has been in fuel, largely comprising attempts to find substitutes for diesel. The advantages of electricity are largely environmental. So far, the problems of unsightliness of overhead wires, lack of manoeuvrability of trolleybuses and higher capital and operating costs compared with diesel buses, have not been entirely overcome.

Articulated buses

Articulated buses are still not common in Britain but increased in numbers in several continental European countries during the 1980s. By 1987 there were 1500 of them in France, about 15% of the bus fleets operating in urban areas. Their advantage is their high capacity—about 150 passengers, including those standing. A disadvantage is their inability to negotiate tight corners,

which restricts the routes on which they can operate. There are liable to be problems with bus lanes. The capital costs of articulated buses also tend to be slightly higher per place than conventional buses but not enough to offset savings in drivers' wages where they operate near to capacity.

Megabus

A double-articulated bus to carry around 200 passengers has been developed in France and a prototype was tested from 1986 in several large French cities. The capital costs per passenger place are slightly higher than for single-articulated buses but it is expected that the extra costs will be more than offset by lower operating costs if they are used near to capacity. As for the smaller version of articulated bus, we may wonder what standards of comfort will be offered to the 200 passengers and whether this will help to tempt them out of their cars.

Ten vehicles have been manufactured by Renault/Heuliez for the city of Bordeaux. These are 24.38 metres in length and can carry up to 215 passengers, 65 of these seated.

Low-floor buses

Low-floor buses to ease access by the less-agile are produced in Holland. In the French town of Caen kerbs have been raised to 280 mm to coincide with the introduction of German Kässbohrer low-floor buses. London Transport has plans to try 30 low-floor buses on two routes and the Department of Transport is seeking a suitable local authority and bus company outside London for further trials.

Trolleybuses

West Yorkshire PTA have had plans for several years to reintroduce trolleybus services in Bradford but so far they have been thwarted by the very high capital costs (about three times that of a diesel bus of similar capacity) and the high operating costs. The electricity would cost around four times that of diesel fuel.

Trolleybuses have certain advantages over diesel buses: no on-street atmospheric pollution, less dependence on fluctuation in oil prices as electricity can be generated from several fuels, smoother ride. In the very few towns where steep streets are a problem for diesel buses, trolleybuses have the advantage of being able to negotiate steep slopes. They are also quieter than diesel buses, sometimes an advantage, sometimes a curse for a cyclist or pedestrian listening for one coming up from behind—hence the unfortunate nickname, 'whispering death'.

Apart from their high cost in Britain there are also the disadvantages of

Figure 4.7 Dual mode bus in Nancy.

lack of ability to manoeuvre around roadworks for example and the unsightliness of the overhead wires. The British trolleybus industry is almost defunct and their re-introduction is hampered by muddled and archaic legislation. Until recently, an Act of Parliament was needed to build one but under section 1 of the Transport and Works Act 1992, the Secretary of State for Transport may make an order.

Dual-mode buses

Following on from an EC initiative, three lines of dual mode trolleybuses/diesel buses were built in the French town of Nancy between 1980 and 1983 with a fleet of 48 vehicles (Figure 4.7). The intention is that the buses operate by electric traction on the relevant parts of the routes, mostly in the town centre but are able to continue under diesel power into the suburbs where there are no transmission lines. The routes in Nancy cost 356 million francs at 1987 prices, of which one-third was for rolling stock. Public transport usage on the three routes has been higher than it had been previously.

Dual mode buses are intended to gain the freedom from air pollution when operated electrically. In Nancy, dual mode buses are used along parts of the main shopping streets. Otherwise there are regulations for traffic restriction. However, this has not led to an environment of quality equal to that associated with the Grenoble tramway for example. In Nancy, pedestrians wisely keep to the footpaths, whereas in Grenoble they feel far more free to walk where they choose. In Nancy, diesel buses as well as dual mode buses operate in the 'pedestrian' streets. The net effect is a poorer environment than in Grenoble.

Tramways do, of course, have the inherent advantage that pedestrians know exactly where they will go, but even so, there is still a need for bus-orientated improvements to take more seriously and give more priority to the quality of the environment. This does seem to have been the case in Lyon, where a main city centre shopping street (Rue de la République) is served by trolleybuses. Otherwise, traffic is severely restricted and the effect comparable to that in Grenoble. The métro also runs under this street.

Battery buses

Volvo have developed the Cumulobus, a battery-powered bus. Fuel savings of around 30% have been demonstrated. In Stockholm, Cumulobus has been shown to be capable of operating for up to 3–4 hours or 75 km on a single charge.

Flywheel-powered buses

Flywheel systems have been used to power buses. Recent developments have been with the aim of reducing the wastage of energy when braking with consequent fuel savings, although this will also have the effect of reducing atmospheric pollution and maintenance as there will be less wear on brakes.

The Kess (Kinetic Energy Storage) system has been developed by BP and tested in Leyland buses. When the driver brakes, energy is transferred to the flywheel. When he accelerates, energy flows in the opposite direction. Flywheel technology has been available for over half a century but in the past there have been problems due to the weight of the flywheel and as a result of the stresses set up by its very rapid speeds of 16 000 or more revolutions per minute. Energy storage has also been a constraint. Flywheel power may have more potential for more energy-efficient steel wheel on steel rail railways such as the Parry People Mover than for buses where there is far more friction between tyre and road.

Ethanol-powered buses

In May 1990 Storstockholms Lokaltrafik introduced 16 ethanol-powered Saab-Scania buses into operation in Stockholm in an attempt to test how far they could contribute to the reduction of air pollution and to test their running and maintenance costs. A futher 16 were put into operation in September 1990. Svensk Etanolstiftelsen (The Swedish Ethanol Foundation) and Sekab, an ethanol manufacturer, are taking part in the project which is supported by the governmental Board for Technical Development and the National Energy Administration. The ethanol will be produced from waste and timber. Ethanol

power is seen as an alternative to electric traction but unfortunately does not contribute towards the reduction of carbon dioxide emission.

Low-sulphur fuel

The bus manufacturers MAN have tested buses using low-sulphur fuels in Nuremburg with significant reductions in nitrous oxide and unbumt hydrocarbons. Scania have tested low-sulphur fuels in unmodified buses.

4.2.3 Integration of services

Faced with competition from the private car, an important part of the response in western European continental cities has been to integrate public transport. Timetables of bus and rail have been coordinated, transport authority-wide bus services have been controlled and coordinated, services have been planned around the busiest public transport routes, frequently in Germany, Holland and the largest French cities, formed by railways. Tickets usable on all forms of public transport to make up a single journey are standard practice.

Apart from London, the British reaction has been quite different. Since October 1986 there has been free competition between local bus services. The Transport Act 1985 prevents a transport authority from coordinating all bus services. There are now two kinds of local bus service: those operated without subsidy and resulting from free competition between operators and services subsidized by the transport authority and put out to tender from operators. Competition and integration have been treated as being mutually exclusive. It sometimes seems to have been overlooked that it is possible to introduce competition for the provision of an integrated transport service. In the current situation, a transport authority may secure an integrated service but (the profitable) parts of it will be in competition from services over which it has no effective control.

4.2.4 Management of services

In many developed countries, the organization and management of public transport during the past two decades has become increasingly influenced by the need to control the spiralling demands for subsidy in view of the ever-increasing competition from the private car.

Introduction of the private sector into the provision of local public transport services has been seen as a means of checking these ever-spiralling demands for subsidy, or in the UK, of reducing what were already low levels of subsidy by standards in many developed countries. The general aim has been to strengthen the interest of those operating public transport in its financial performance. Usually the securing of a public transport service and the organization of it is in the public sector,

although in Britain, the ability of the public sector to organize a public transport service is severely limited by the need to comply with laws on competition. The operation of it is in some countries, predominantly in the public sector, in others in the private sector or carried out by firms in which there are both public and private financial interests. It is quite common to make the operation of services subject to competitive tender but rare for the determination of what services are to operate to be subject to equally explicit criteria of cost-effectiveness.

The form of contract between transport authority and operator is the vital part in setting out the financial interests. In Britain, two types of tender have become common since deregulation of local bus services under the Transport Act 1985. First, there is the fixed cost or minimum subsidy tender. The tenderer submits a price intended to cover the difference between operating costs and revenue. If revenue proves to be higher, the operator keeps it, so maintaining an incentive for the operator to market and operate services as effectively and efficiently as possible. This type of tender gives an advantage to an existing operator, who will be in a good position to estimate revenue.

A second type of tender is the revenue guarantee tender. Again, the tenderer submits a price based on operation cost and revenue, but in this case, the local authority keeps the revenue which is deducted from the price agreed with the operator. This type of tender is less effective in persuading efficient operation and marketing but does reduce the advantage of an existing operator.

The French law Transports publics d'intérêt local 1979 allows four types of contract when a transport authority invites tenders from operators.

- Contrat de gestion aux risques et perils—the operator is responsible for balancing receipts and operating costs but the transport authority may compensate the operator for reduced fares granted to defined categories of traveller, such as schoolchildren, students, old people with or without reference to income, members of large families, military personnel or the unemployed. The compensation may not exceed a percentage of operating costs, specified in the contract, for two successive contract periods.
- Contrat de gestion avec garantie de recettes—the transport authority guarantees a minimum contribution to the operator. It may also compensate for fare reductions as in the previous type of contract.
- Contrat de gestion à prix forfaitaire—the transport authority contracts to pay an annual lump sum determined from an estimation of operating costs irrespective of what the actual costs turn out to be.
- Contrat d'exploitation en gérance—the transport authority guarantees to cover deficits within limits set out annually. The transport authority provides the equipment needed for operation and assumes the risks of operation.

In practice, however, there have been many variations in form of contract. As a general rule, the clauses which increase the interest of the operator in financial performance have become increasingly common.

In rural areas the basic problem is lack of passengers. One of the responses to this has been the introduction of the community bus. A Community Bus Permit allows the holder to operate a minibus of 9–16 seats and to carry members of the public for fares. The driver must be a volunteer, although he may receive expenses and compensation for loss of earnings, and need not hold a PSV driver's licence. It is important not to confuse the community bus with community transport which is essentially a specialized service for the less mobile, mainly in urban areas.

4.2.5 Information technology for bus operations

Information technology is partly used to monitor how the system is being used, for example ridership, so that an appropriate response in service planning can be made. It is also used as a result of buses being forced to fail to keep to a pre-published timetable due to road traffic congestion.

Several management tools are basically ways of responding to timetable departures. Closed circuit TV cameras are quite commonly used to transmit information about traffic conditions. One of the most highly developed management information systems is the French Siclic (Système interactif centralisé à localisation instantanée cyclique). This allows collection of information on vehicle usage, number of passengers (even where travelcards are used), drivers' working hours and many other items of information as required. It allows both central control and drivers to know the position of each vehicle, to compare it with the timetable and to insert extra vehicles (or to delay departures) if required. Siclic can interact with computers controlling traffic by means of traffic lights for example, and can be used as a means of giving priority to buses (and other selected road vehicles). It can also be used as a means of supplying information to potential passengers. The time of arrival of the next bus can be displayed at stops or even at home via Minitel. This both saves money in providing a service by reducing inefficiency, and allows a better service to be provided, especially in congested traffic conditions.

4.2.6 New fares structures and types of ticket

In many large western European cities it is possible to buy a ticket at a flat or maximum fare, commonly the equivalent of about 70p, which can be used for any journey by any means of local public transport within a fixed period of time, commonly about an hour, as long as there is no retracing of any part of the journey, i.e. no return. Many of these cities such as Lyon, Marseille and Brussels, have a métro or tramway which will be used for a part of many of the journeys, together with a bus to or from the

station. As a general rule, the opening of an urban railway replacing busy bus routes will increase the need to change modes of travel. Railways are effective on routes of high demand but are not so good as buses in penetrating low-density suburbs where many journeys start or end. Through tickets may have become more of a necessity with the opening of suburban railways but can also offer benefits in a transport system dependent exclusively on buses. Even in such cities, through tickets will offer similar advantages: removal of anomalies whereby the cost of a journey is affected by how many times it is necessary to change buses; reduction in the number of times a ticket has to be bought, which reduces the staff time involved in selling tickets and the delay to the vehicle where these are sold by bus drivers.

Simple through-ticket fares structures also lend themselves to the selling of tickets off-vehicle from a machine or shop. This again reduces delays to vehicles whilst boarding but causes a need either for some form of ticket date stamping or other validation machine on the buses to prevent the tickets being reused. Even with this, off-vehicles sales are more prone to fare evasion than where tickets are issued on the buses with date, time, stage and other information to prevent reuse.

Magnetic cards using microchip technology allow the possibility of stored value ticketing consisting of a lump sum pre-payment followed by on-bus cancellation of units on the card when the card is used. Similar technology has been in use for some time in other fields such as the familiar plastic banking card and the telephone card. Smartcard technologies avoid the need to feed the card into a machine. Placing it close will do. There are problems, relating to cost of installation in an industry lacking in capital investment and the need to provide for those who use the bus only occasionally. Possible applications are discussed in Torode (1993) and Hill (1993), relating to London and Manchester respectively.

Other marketing policies have involved combining public transport tickets with admission to events such as concerts, flower shows or sports events. These are common in Britain. In Hamburg, arrangements have been made with some local hotels so that guests receive free passes on public transport during their stays

Deregulation of local bus services has made through-tickets and interchange of tickets between services more difficult to put into practice. Passengers cannot always use their ticket on the first bus which arrives. Sometimes they cannot use it for a return journey operated by another company. To make matters worse, it is often far from clear as to which buses are operated by which company.

4.2.7 Improved information for passengers

Many bus services could be improved a great deal by taking the simple measures of displaying timetables and route maps at all stops. Even this

apparently obvious and elementary good practice has been thwarted in our competitive environment where coordination of services between companies is virtually outlawed as an anticompetitive practice. Instability of some services has made the collection of up-to-date information close to impossible. In any case, no organization has the duty to collect and publish comprehensive information on services.

Where there is one-man operation, a table of fares at stops should also reduce time taken in boarding and should be regarded as essential where no change is given by the driver. More sophisticated passenger information systems should only be considered after these basic necessities have been met.

There are several systems to give information to passengers on the location of buses along a given route and to predict actual (as opposed to timetabled) time of arrival. The Romanse system (ROad MANagement System in Europe) is being developed as part of the EC Drive 2 programme in Southampton. Part of this project will involve relaying information to talking bus stop displays (A.Millar, 1992).

INFOPLUS is a French means of displaying information about actual (as opposed to timetabled) arrival times at bus stops or railway stations. It can be a product of Siclic. INFOSTOP and SID in Paris, SITA-SARI in Lyon, GURU in Valenciennes and TOPALEX in Caen follow the same principles.

SITU (système de recherche d'itinéraires en transport public) This operates in Paris and Nantes. By specifying origin and destination, date and time, a passenger can receive details about all the alternative forms of public transport available, including route, departure times and arrival times. The system can be called up from public terminals or Minitel.

AUTOPLUS performs a similar service in La Rochelle. There are four street terminals from which enquiries can be made by the public free of charge or alternatively it can be consulted from home by Minitel. Similar systems are BUSTOP in Bordeaux and METRO in Dunkirk. TELEBUS in Reims is a small system of video screens at some bus stops giving information on services.

DIGIPLAN (distributeur automatique d'itinéraires en transport public). This can be consulted by passengers to obtain a route plan on how to get to a specified destination. The plan appears on a computer screen and can be printed on paper for retention by the passenger. A system installed at Part-Dieu railway station in Lyon (one of the two main line stations) is used by about 1200 passengers each day and is thought to result in sufficient extra passengers to repay the cost within 3 years.

CRISTOBALD (centre de reservation et d'information de services de taxis ou de bus à la demande). This is a system which aims to reduce the cost of operating public transport services in rural and other areas of low demand. The services operate to a fixed route, timetable and with fixed stops but the form of vehicle is adapted to the level of demand, e.g bus, minibus or taxi. It depends on users calling on special lines connected to

the telephone system any time from half an hour to several days beforehand. It is installed in the district around Bayonne and Biarritz in France.

In Britain we have had dial-a-ride in Solihull, Sale and Harrogate, for example. In these projects, minibuses were used on semi-fixed routes in predominantly suburban areas where a high proportion of local people had access to a telephone. Minibuses were used and could be diverted from their routes to provide a door-to-door service at higher fares. The projects have now been mostly abandoned.

Display of passenger information by video screen is common at railway stations and bus stations where there is heavy demand. The problem with supplying it at local bus stops is that it is likely to be needed most where there are not many services—where demand is low. Where there is a very frequent service, a delay in arrival of some buses would be hardly noticeable. Electronic information systems tend to be expensive for the benefits they provide where demand is low. An information service by telephone is probably cheaper and if there is a high chance of getting an answer, it will be available to a large number of users. A display of video technology does, however, serve the purpose of demonstrating a concern for the quality of services and improving the image of the bus industry.

4.2.8 Measures to improve the environment on buses

One of the main issues affecting bus patronage which has not had a great deal of attention is the bad behaviour of a small proportion of passengers—offensive language, litter, children walking on seats. For a bus operator it is a difficult problem to address. One-man operation has probably exacerbated the problem and we must look to ourselves, the bus users, to take a more socially responsible attitude. Closed circuit television cameras are now standard equipment in some bus fleets. Heavy fines are threatened for graffiti vandals, but the rules are very difficult to uphold with a travelling public who mostly turn a blind eye and a deaf ear to misbehaviour.

Many public transport operators have increased restrictions on smoking or have a total ban. Public transport operators have reflected increased public consciousness of passive smoking and possibly also increased public consciousness of the smell and tainting effects on clothes of smoking.

4.3 CONCLUSIONS

There are several approaches to improving local bus services which in the UK have been thwarted by governmental obsession with competition, lack of political will to give priority to public transport and in particular buses and the low esteem afforded to the bus industry by politicians and public.

Some of the technological developments in the bus industry are solutions in search of problems. Others, such as bus priority measures, are solutions to acknowledged problems in search of those with the will to solve them. There are a number of simple and inexpensive ways in which bus services could be improved to address the decline in usage. Better information for passengers by simply providing timetables, fare tables and route plans at stops should rank high amongst priorities. Unfortunately, in purely commercial terms, it is worth remembering that bus users are largely a captive market where a slipshod service will be tolerated to some extent. Improvements in quality of service would have to be quite dramatic for bus operators to stand any chance of breaking into the non-captive market and even then, good bus services would be only a necessary, not a sufficient condition to attract motorists.

The deregulated, competitive environment has discouraged bus operators supplying even the most basic information to passengers (although it has to be admitted that the situation before deregulation was no better in this respect). If operators agree to a joint timetable which inhibits any of them from putting on extra services, the Monopolies and Mergers Commission may investigate on the grounds that competition has ended, even if this has led to the production of a coordinated and comprehensive timetable.

In the large cities, bus priority measures are the most pressing need but these usually mean action against other road users. That requires political courage and also runs the risk of adverse economic effects if the bus is not accepted as a substitute by the motorist.

The search for substitutes for diesel power are less clearly to the advantage of the operator and need the incentive of government support. The benefits are almost entirely in reducing air pollution. Exhaust gases from diesel buses must be very small in comparision with those from other road traffic but reducing them may be worthwhile as a gesture of public authority concern. The big steps in reducing air pollution would be from transfer of private car users to buses whether diesel or not, and goods to railways.

4.4 UK STUDIES FOR BUS PRIORITY

4.4.1 Leeds

'Dual transit' (not to be confused with the 'dual mode' buses in Nancy, France) is being develped by Yorkshire Rider using guided bus lanes where needed, with widely spaced stops, bus lanes and other bus priority measures and ordinary on-street operation elsewhere, with junction improvements and priority. A study has been carried out for a sector to the south of the city centre with a proposed busway extending 3 km from the city centre.

Studies carried out on York Road (A64) and Scott Hall Road (A61) east and north of the city centre were submitted in the 1992 Transport Policies and Programme (TPP). Guideways are proposed only at congestion points. Along York Road a former tram track along the central reservation will be used. Along York Road and Selby Road, which connects to it, 3175 metres are proposed as guideway. In addition, there are new bus-only lanes and complementary junction changes. Along Scott Hall Road, due to the narrowness of the central reservation, the guided busways will be for buses to the city centre at morning rush hour and away from it in the evening; 1860 metres are proposed as guideway with a further 800 metres of bus lane. The projects are expected to cost about £4 million for each route, less than 10% of the cost of light rail which had been proposed earlier.

4.4.2 Sheffield

In 1990, South Yorkshire Transport published proposals for bus priority along Abbeydale Road and Chesterfield Road south of the city centre, with guided busways along the sections within about 2 km of the city centre. The cost has been estimated at about £10 million of which £8 million would be for guideway construction.

4.4.3 Doncaster and Rotherham

Studies are being made by South Yorkshire Transport on similar principles to those proposed for Sheffield.

4.4.4 London Docklands

Central busways with stops combined with pedestrian crossings and priority at traffic signals have been proposed by consultants commissioned by London Docklands Development Corporation and London Transport in late 1990. Traffic signals are proposed which will allow buses to pull away first. These are thought to have advantages over continuing bus lanes up to junctions (Yearsley, 1991).

4.4.5 Middlesborough

A light rail route from Stockton to Ormesby via Middlesborough was adopted by the county council following a public consultation period on four options in February 1991. Caldair North East Ltd, a holding company which owns Teesside Motor Services and Tees and District Transport Company has proposed guided buses as an alternative, avoiding some of the most heavily congested roads. Two projects have been proposed, in Middlesborough (6.45 km) and Stockton (3.75 km), using routes along disused railway alignments and other disused land. The total costs of the two projects are estimated at

£15.4 million with a further £2 million for improvements to passenger information and waiting facilities.

4.4.6 Hull

Humberside County Council has been studying a route to Midmeredales 8 km north of the city centre where there are proposals for a large housing and commercial development on an 800-acre site. There are also proposals for routes to the west of the city centre.

4.4.7 Maidstone

Steer Davies Gleave are studying the possibilities of light rail or guided buses on four routes: Strood to Gillingham, Park Wood to West Mailing, Maidstone Hospital to Bearsted and Maidstone to Chatham.

4.4.8 Plymouth

In April 1991 it was announced that Cornwall and Devon County Councils and Plymouth City Council had commissioned the MVA Consultancy to study light rail, guided bus ways and people movers in terms of demand in specific corridors, land development, impacts on non-users, tourism and the environment. Roger Tym & Partners will contribute on land development and tourism and Mott MacDonald on engineering and cost assessments.

4.4.9 Reading

Preliminary studies by MVA, Foster Wheeler and Kennedy Henderson for Berkshire County Council for two rapid transit routes involving street running along part of the A33 to Basingstoke (5.5 km) and the A3 to Bath (7.5 km) have been put into abeyance and guided buses are being studied as an alternative.

4.4.10 Cambridge

A light rail feasibility study dated October 1990 has been prepared by W.S.Atkins & Associates. A 15-km line extends from Trumpington via the city centre to Oakington. One-quarter of the length, all in the city centre, is on-street. Three-quarters of the route uses existing railway alignments. The County Council is considering raising money for its share of the costs by road pricing.

However, due to the cost of about £68 million, the County Council has commissioned consultants to study the possibility of guided buses as an alternative to light rail along the same route. It appears that guided busways

may be feasible for less than one-third of the cost of the light rail proposals, partly due to savings in the costs of equipment such as barriers where the route crosses a road, and savings on the diversion of underground services, not needed for the lighter vehicles used on busways.

Park-and-ride is an important element of the project, the route connecting two car parks on the edge of the city.

4.4.11 Tyne and Wear

The Northern Group has proposed Guided Transit Expressway, with articulated vehicles connecting Sunderland and Newcastle via Washington. This is a similar route to one of the proposed Metro extensions. Short sections would operate as guided busways. It is expected that journey times would be reduced from 55 minutes on existing routes to 40 minutes. The total cost is estimated at only £5 million.

4.4.12 Leicester

Steer Davies and Gleave have carried out an evaluation of public transport options in the city including light rail, other rail and improvements to bus services.

Leicestershire County Council has proposed a light rail route from Narborough to Birstall, on-street in the city centre. The County Council has been advised that light rail would cost approximately ten times as much as bus priority measures but would have a correspondingly greater capacity. It has been reported that the County Council does not intend to proceed with light rail due to there being no realistic chance of funding (*Modern Tramway and Light Rail Transit,* June 1991, p. 10).

4.4.13 Bristol

Following numerous proposals for light rail since the mid-1980s, some of which have Parliamentary approval, Avon County Council and Badgerline Rapid Transit are studying 'guided light transit' (the GLT 400 project: Freeman, Smith and Willoughby (1992)). This involves a guide rail down the centre of the track. Buses (or trams?) can be single- or double-articulated, diesel or electric powered. A Belgian Consultancy, Transurb, has recommended routes, partly on public highways. A route to Bradley Stoke and Stoke Gifford is a possibility.

4.4.14 Portsmouth and Gosport

Similar technology to the 'guided light transit' proposed for Bristol is being studied by Hampshire County Council for Portsmouth and Gosport.

4.4.15 Strathclyde

JMP Consultants Ltd have been appointed by Strathclyde Regional Council to assess the feasibility of guided busways along three corridors in Glasgow previously identified as possible routes for light rail. Existing railway alignments were also considered for guided bus compared with light rail (Harrison and Hamilton, 1992; Yapp, 1992).

4.4.16 Liverpool

A study was made by Merseyside Development Corporation for a light rail from the city centre and Pierhead to the former Garden Festival site. Preliminary studies for light rail have also been made by Merseyside PTE. However, due to the high cost, the development corporation has now turned attention to electric powered buses.

4.4.17 Swansea

South Wales Transport, a local bus operator, has considered guided buses on six main corridors radiating from Swansea.

5

BUS AND RAILWAY STATIONS

Stations and stops create an impression amongst public transport users nearly as significant as that of the vehicles. Whilst we all hope not to spend as long there as on the vehicle, it is unproductive time. We are not getting anywhere and the time weighs heavily. Sometimes we will have time to idle away, maybe at an unearthly hour of the morning or night. Sometimes there will be a quick dash from one platform to another or we will need to buy a ticket quickly having arrived late. Information and clear signing will be our first need.

At bus and railway stations, travellers will have many different, sometimes urgent needs. For many a visitor, a railway station or a bus station is the first introduction to a strange town or even a foreign country. Local maps and information on local public transport services will always be in demand and for some stations, so too will information on other immediate needs such as hotels. It is not always feasible to have bus and railway stations close together but it is surprising that in so many towns the tourist office is at some distance from both, especially the railway station.

At first glance we might think it quite obvious what constitutes a railway station, a bus station or a bus stop but actually it is not always as unambiguous as that. Where a railway, segregated from road traffic, stops and passengers get on and off, is a station, even if there is only one train service. Light railways and trams have stops rather than stations. Only where several services come together may it become a station. Bus stations are where at least several services operate, but this can happen from some city bus stops, especially when they are grouped together. It is quite possible for more than 30 bus services to operate from two or three stops in a city centre, such as from Old Square in Birmingham.

The differences between a stop and a stations are not hard-and-fast, but there are a few observations which apply in most situations. In a station, space is reserved for public transport vehicles only. For stops, e.g. a tramway,

space may be reserved, but more usually it is not reserved exclusively for public transport. A station implies greater interchange between services than a stop. A station usually has facilities for waiting passengers such as ticket sales, refreshments. So too do some stops, especially for tramways and light rail, even if only from machines.

5.1 FUNCTIONS OF BUS AND RAILWAY STATIONS

Railway stations and bus stops and stations have several functions which will need to be considered in their design and siting.

- As a waiting area—information on arrivals and departures is needed to reduce the effect of unwanted waiting and possibly to allow those waiting to make use of their time, for example by leaving the station to do some shopping or other business, knowing that they will be able to time their return to catch their transport connection.
- As an interchange of public transport services, perhaps involving long distance as well as local services.
- Sale of tickets and advertisement of public transport services.
- Reception for change of mode of transport, e.g. car parks. Many railway stations have bus stations nearby (Figure 5.1). Car parks are located near to many railway stations, fewer near to bus stations.
- A focus for planning high density land uses. Stations are points of high accessibility which a large number of passengers can reach quickly and so are favourable locations for offices, shopping and other uses of high commercial value. This applies more to railway than bus stations, possibly because of higher capacities to handle passengers, possibly because of differences in the purposes of the journeys of the passengers. Some of the busiest railway stations have attracted substantial shopping centres within them and these contribute to railway finance.

There are many examples of stations which have attracted high density commercial development on site and close by—Victoria Railway Station in London, New Street in Birmingham, Piccadilly in Manchester, for example. There are even more which have not attracted commercial development. As a general rule, the high accessibility offered by a station is a favourable condition to stimulate commercial development but is not a sufficient condition to ensure that it will take place where other factors do not support it. It has been common practice in German and Scandinavian cities to relate the planning of land uses and the density of them to the location of local railway stations to make full use of the accessibility offered (Chapter 6).

Figure 5.1 Buses bringing passengers to the Stockholm T-Bana at Farsta.

5.2 ARE LOCAL BUS STATIONS NEEDED?

Many large cities function with only a small proportion of their local bus services using a bus station, some with no station at all. In a city such as Birmingham, five city centre streets act as terminals for a very large proportion of the bus services which enter the city centre. Two of them have been closed to traffic except buses and delivery vehicles for several years, and two more have recently been part of a city centre project severely restraining road traffic. Effectively these streets act as bus stations. The main function of a station which is absent is the sale of tickets, although there are a few agencies nearby which sell travelcards. There is not a great deal of interchange between services. The great majority of bus services are from suburb to city centre and so the only likely reason for changing buses would be for cross-city journeys. For such journeys, the distance to walk from one service to another will not be more than a few hundred yards and much of it will be past reasonably pleasant shopping frontages along taffic-calmed streets. There have been plans for a local bus station in the past. The shell of a bus station was built in the late 1960s underneath a large shopping and civic centre at Paradise Circus in the western edge of the city centre. This has never been used except for some parking and indeed, most of the shopping floorspace has never been brought into use. A bus station in such a location would probably not have allowed most passengers to alight as close to their destinations as do the present arrangements. Added to that, there would have been all the environmental disadvantages of the bus station being covered over.

Cities can function without local bus stations, so why do the majority of

Figure 5.2 Buses connecting to the Grenoble Tramway at Grand Place.

towns and cities have one? The main advantages of a bus station are that they make it easier to change from one service to another. Services stop close together and information for passengers can be made more easily available on a bus station than is the case if passengers have to go out on the streets to look for it. This may apply particularly in towns where the centre is not the final destination for a substantial number of travellers.

A further motive for having a local bus station could be to realize some of the economic effects of the accessibility offered by the bus services. Bus stations are highly accessible locations and if accessibility has an effect on land and property prices, we may not be surprised if bus station developers try to draw off some of these increases in property prices by going into the property development industry on and around the bus station. This has not happened to a great extent in Britain, perhaps because bus station developers see themselves as providers of a public service rather than as property developers, perhaps because bus stations are not regarded as prime sites for commercial development due to the relatively weak economic power of bus users. Certainly, the bus stations, even in the big cities in Britain, have not attracted offices or even shopping on a scale comparable to some of the main line railway stations.

Railways need stations more than do buses. They need interchange points for services more than do buses because railways are not so good for penetrating low density districts. A journey involving a railway is more likely to involve a change of transport than is a journey by bus and stations are an effective way of handling these changes (Figure 5.2).

A problem for stations, especially for buses, in the centres of large cities is

finding a suitable location. Stations need to be close to destinations. In the centre of a large city it will be impossible for a single location to be close to more than a small proportion of passengers' destinations. Several stopping points will be needed. Added to this, as a general rule, the closer to destinations, the higher are the land values. The fact that large numbers of people are converging on a limited area will push up land values. Bus stations need large areas of land. In several cities they have been put underground or at surface with car parks, shopping, offices or other buildings above. Enclosing buses in a confined space is always liable to make exhaust emissions, noise, leakage of oil and the other environmental effects of buses much worse than in the open. The environment of most enclosed bus stations varies from poor to disastrous.

Because bus stations are points of interchange between services there is a tendency to timetable departures so that they occur together, in order to minimize waiting time for passengers who change from one service to another. This applies more to less frequent longer distance services but does apply to local services to some extent. The problem of planning departures together is the peaking in use of passenger facilities. Some bus stations are completely inadequate to cater for the short surges in passenger numbers two or three times a day, but have facilities used far below capacity for the remainder of the time.

5.3 PASSENGER SAFETY

There are two main aspects of passenger safety to consider: safety from vehicles, track, electrical and other equipment and safety from assault. Sometimes attempts to satisfy one aggravates the other. For example, one way of making pedestrians safe from vehicles is to separate them by making pedestrian underpasses such as at an entry to a bus station. Under-passes however, are often accused as being places where assault and violent crime are relatively easy to get away with. Certainly there are a lot of people who think that this is the case and that image in itself, whether justified or not, will have an effect on their attitude and behaviour towards public transport.

Safety of pedestrians from vehicles can be addressed by several means. In bus stations, there should be a clear delineation and separation of passengers and vehicles. Passengers should not have to cross roadspace used by vehicles. Elimination of the need for vehicles to reverse will also help to reduce accidents. Unfortunately these represent ideal conditions. They are not always practical on the sites available and compromises have to be made.

Safety on railways is an issue where they run on-street as many tramways such as Manchester Metrolink do, but this does not particularly relate to the stops or stations. On the Lille métro, platforms at the stations are separated from the track by a partition with doors which open automatically when a train is in the station (Figures 5.3 and 5.4).

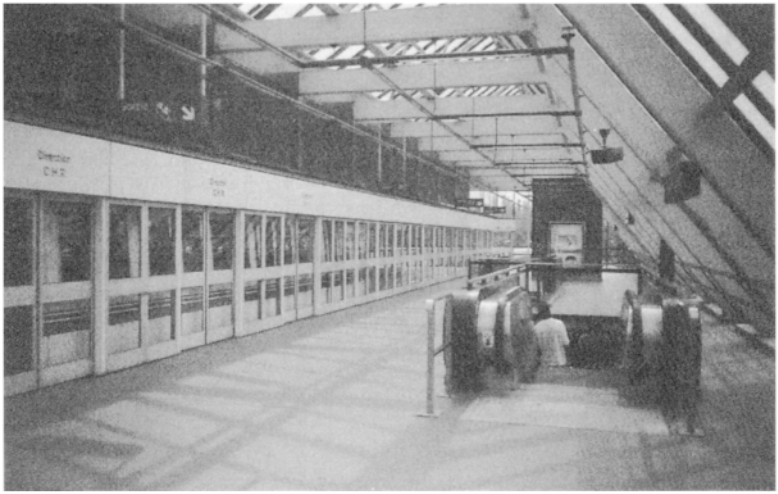

Figure 5.3 Automatically operated sliding doors separate passengers and track on the Lille Métro.

Figure 5.4 The Lille VAL Metro.

Both bus and railway stations are places where it is possible to loiter without being too conspicuous and are open to abuse. At quiet times of the day and night, waiting can be an ordeal for those fearful of their safety. This has very real commercial consequences in reducing the number of passengers and has been recognized by quite substantial and expensive efforts from public transport operators to improve passenger safety. Many of the stations on the London Docklands Light Railway were deliberately

Figure 5.5 Several of the stations on the London Docklands Light Railway are elevated and designed to promote passenger safety.

designed with an open plan and in an elevated position to make them highly visible to passers-by (Figure 5.5). Closed circuit television and alarms available to the public have become standard equipment on new railway stations and many bus stations.

5.4 BUS STATION DESIGN

Bays for buses in a station can be either at right angles to the passenger area, parallel to it, or in echelon. Bus bays at right angles or in echelon will need reversing space but give a greater capacity for the frontage of the passenger waiting area. This principle, with bus bays on at least two sides of the passenger waiting area, is often employed in larger bus stations. The alternative is for bus bays to be parallel to the passenger waiting areas. The main advantage of this arrangement is that there is no need for buses to reverse, so roadspace is saved and the risk of accidents, both to vehicles and pedestrians, may be reduced. The disadvantge is that fewer buses can draw up besides the passenger waiting area, so effectively the capacity is reduced. This arrangement is common in small stations. Where this arrangement is employed for large stations such as Dudley and Wolverhampton, it results in passengers having to cross the roadway between waiting areas. There may seem to be an added risk of accident, but the elimination of the need for buses to reverse will have the opposite effect.

Bays arranged in echelon take up more frontage than those at right angles

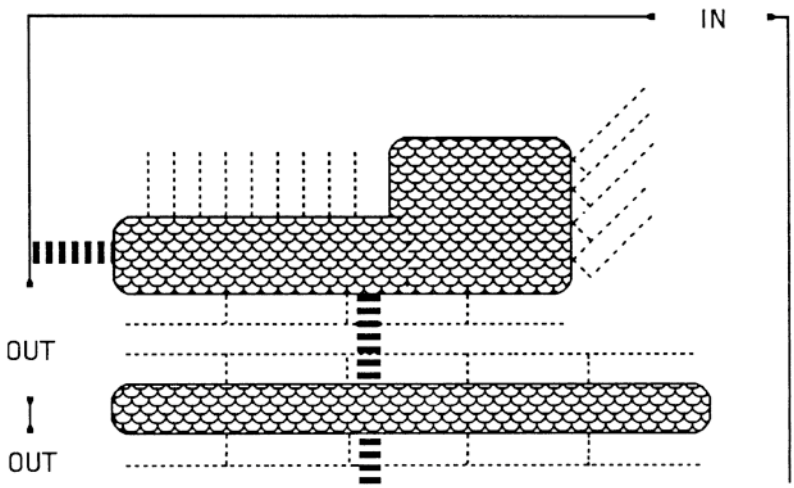

Figure 5.6 Bus station with bays parallel, at right angles to waiting area and in echelon.

to the passenger waiting area but have the advantage that less reversing space is needed. For this reason the layout is used in many stations (Figure 5.6).

5.5 SPACING OF STATIONS

The spacing of stations and stops is a very important consideration in planning any public transport service. There is always a choice between close spacing, which results in shorter travelling distances to stops but slower journeys once passengers get there, and the faster journeys possible with having fewer stops. Some services combine the two, with close spacing in suburban pick-up areas and wider spacing along the main radial routes to the city centre. Many rail services and some bus services do not stop at all stops on the route. Particularly for bus services, there is a risk of confusion amongst passengers. The possibilities of providing services of varying speeds along the same routes is limited.

Spacing of stops also affects journey length and clientèle. Wide spacing will be more suitable for those making longer journeys—partly because on a long journey, the irritation of closely spaced stops will be felt more, partly because wide spacing of stops usually means further from home to stop, which will be justified only by a relatively long journey on reaching the stop. The spacing of stops is more significant for railway journeys than for bus journeys, especially the heavier varieties of railway. This is because of the

slower acceleration and deceleration. For this reason, there is a relationship between the weight of rolling stock and the spacing of stops (Chapter 3).

5.6 ACCESS TO STATIONS

Access to stations for pedestrians will raise issues relating to safety and the need to make access attractive to passengers. For bus stations there will be some use of roadspace by pedestrians as well as vehicles unless there are severe barriers which will in most cases increase the distances walked. Design of a bus station with good access to platforms from two directions will reduce the need for pedestrians to walk across roadspace, especially if this coincides with the directions from which passengers come. Buchanan Bus Station in Glasgow is a good case. This solution is more achievable with bus stations on the fringe of a city centre rather than in the very heart of a city.

Presenting an attractive face to passengers and potential passengers is a significant consideration for both bus and railway stations. Many are on backland sites and even if only a few tens of yards from a main frontage, this may be enough to conceal an entrance to strangers. Combination of stations with commercial development such as shopping has benefits in attracting passengers as well as the benefits of the financial returns.

6

LAND USE AND PUBLIC TRANSPORT PLANNING

6.1 THE RISE AND FALL OF INTEGRATED LAND USE/ TRANSPORTATION PLANNING

Land use and transport planning in the UK were carried out in a more integrated and complementary fashion in the first half of the 1970s than they have been before or since. There was continuity of policies towards metropolitan planning from the Labour Government of the 1960s through to the Conservative Government of the early 1970s with agreement on the need for integrated metropolitan planning of land uses and transportation.

Under the Transport Act 1968 passenger transport authorities were created for SELNEC (South-East Lancashire/North-East Cheshire), the West Midlands, Merseyside and Tyneside. Two further passenger transport authorities for West and South Yorkshire were added under the Local Government Act 1972. The Local Government (Scotland) Act 1973 established the Strathclyde Regional Council which became responsible for the Greater Glasgow Public Transport Authority (created in 1972). These new passenger transport authorities took over operation of buses from the local councils and assumed planning responsibilities for other bus services and local railways. The Greater London Council became responsible for London Transport.

Under the Local Government Act 1972 the metropolitan counties were formed on 1 April 1974 and took over responsibility for strategic land use planning, transport planning and traffic management as well as public transport. Structure plans had been introduced in the Town and Country Planning Act 1968 and were prepared mostly for whole counties although some were for divisions of counties or urban areas.

During the first half of the 1970s the Ministry of Transport was part of the Department of the Environment but was subsequently separated as the Department of Transport.

Integrated land use/transportation planning was dealt two severe blows in 1986 with the abolition of the metropolitan county councils and the GLC on 1 April and by the virtual declaration of integrated transport planning as being illegal with the coming into force of the Transport Act 1985 on 26th October 1986. At the same time, the need for integrated land use/transportation planning became even more glaring. Economic growth in the mid 1980s coincided with increasing consciousness of road traffic congestion and in 1989 a road programme was announced to create 4300 kilometres of new or widened roads. At about the same time there was a flood of towns carrying out studies for light rail networks. Very few of them followed from any adequate study of transport needs and the involvement of planning authorities and the Department of the Environment was, on the whole, conspicuous by its absence.

6.2 THE NEED FOR LAND USE/TRANSPORTATION PLANNING

Public transport policies and projects should be planned as part of policies for urban or rural journeys involving land uses and private transport. Land use policies are a fundamental determinant of the need and demand for travel and should be a starting point in public transport policy making. Equally, policies towards private transport, especially the car, will have a big influence on the demand for public transport and should be an essential study leading to public transport policies. There are, therefore, two fundamentally significant influences on public transport policy—land use policy and road traffic management policy—which are both outside the control of the transport authority. Actually they are shared between local authority planning and engineering functions. The fact that transport authorities are responsible only for public passenger transport (and only part of that) has aggravated the situation. The plain truth is that since the coming into force of the Transport Act 1985, no-one plans transport or even public transport as a whole. Not only has no-one the duty to do so, no authority even has the power to do so, should they think it advisable.

6.3 STATUTORY LAND USE/TRANSPORTATION DOCUMENTS

Town and country planning legislation allows planning authorities to prepare land use/transportation plans but does not give them the powers to ensure that they are put into practice. The public transport policy content of structure plans and unitary development plans has varied a great deal but all of them contain policies and projects relating to the generation of journeys. As such they address some of the factors underlying the need for local public transport.

Transport Policies and Programmes (TPPs) have been submitted by local

to central government annually since 1975. Their main functions have become to make a local authority as bid to central government for consent to borrow money for expenditure on local roads in the next financial year, and for the Transport Supplementary Grant for improvements to roads of more than local significance, for bridge and carriageway strengthening projects and for safety projects.

TPPs include transport planning objectives, priorities and programmes for all modes of transport, pricing and expenditure proposals for the coming five years. They must be compatible with the structure plan but this allows for a wide degree of interpretation. TPPs can, and often do, include consideraton of land use planning policies in some detail and can amount to a plan for local journeys. It is curious that the outcome relates solely to the finance of road construction.

Annual Public Transport Plans (PTPs) were introduced under the Transport Act 1978 for non-metropolitan county councils and extended to metropolitan county councils under the Transport Act 1983. The county councils (or passenger transport executives) are intended to develop, in consultation with district councils and transport operators, policies to promote and coordinate an efficient public transport for the coming three years. They should include an estimate of how far current needs are being met and what services are needed short and long term. PTPs should contain an estimate of costs and proposals for obtaining finance.

Certainly there is sufficient scope within the town and country planning system and the TPP/PTP systems for the preparation of adequate land use/transportation plans. The problems of lack of coordination between land use and transportation policies is not due to any deficiency in the scope of the transport and planning tools at the disposal of public authorities. It is due to the cumulative effects of decisions which in land use/transport planning terms are bad ones and to the lack of powers amongst any authorities to implement the plans that they prepare.

The division of responsibilities between town planning authorities, local authority engineering policy and transport authorities has contributed to the lack of coordination between land use policy, public and private transport policies. This has had several serious effects. Big traffic generators have been too often badly located in relation to public transport capacities.

There are innumerable cases of hypermarkets located away from railway stations, even in cities where there is a well-developed rail network, such as London. This is certainly not in the interest of achieving an economically viable public transport system or of those affected by the road traffic caused by the hypermarket. It is dubious whether it is in the interests even of the hypermarket users. Although many would choose to use their cars, there would be a better choice if there was rail access as well and good public transport access would open up the hypermarket to a wider clientèle. Public transport infrastructure, particularly light rail, has been planned with inadequate support from land use and road traffic

management policies. Fixed track infrastructure such as light rail needs the support of land use planning policies if it is to succeed without large and continued operating subsidies and if it is to achieve it's principal aim of mass access with little environmental damage.

Unfortunately, some public transport policy studies have been no more than shopping lists of ways of improving the public transport system. They have started out by what amounts almost to an inventory of the public transport network including its shortcomings. (It is often overlooked that there can be no such thing as a shortcoming unless it has been demonstrated that there is a need or desire to remedy it.) Public transport studies should not start out by examining technology. They should start by examining what kind of public transport services are needed, then proceed to analyse what technological contributions may help to meet these needs.

Many public transport studies have lacked any indication of how they relate to policies towards private transport. This is understandable since transport authorities do not control policies towards private transport. However, it is unfortunate because it is largely the availability of the private car which has led to the demise of public transport services. Restrictive policies towards the private car may be expected to have an influence on public transport ridership. Public transport policies should not fall into the trap of trying to persuade motorists out of their cars by better public transport. It does not work. Motorists need to be dissuaded from using their cars by road traffic management measures. Improved public transport is the means of replacing lost accessibility by car.

The 'shopping list' type of public transport plan does usually have many policies and proposals which would be justified under a more rigorous approach involving land uses and private transport but there are several inadequacies which are commonly found. The proposals for public transport are neither measured against need for travel nor in relation to the rôle of private transport. The proposals for public transport may therefore be insufficient to meet needs or they may be excessive. They may well be justifiable but have not been justified.

6.4 INFLUENCES ON LAND USES BY TRANSPORT AUTHORITIES AND TRANSPORT OPERATORS

Transport authorities have a limited influence on the land uses and activities which give rise to need and demand for public transport. Their choice of routes, location of stops and fares structures will all influence land uses. For example, travelcards allowing unlimited travel for a fixed price will tend to favour centralization of land uses rather than dispersal. This will apply particularly for footloose land uses to which journeys can be easily changed and where travellers are not firmly committed to making the journey.

Travelcards will favour town centre shopping at the expense of local shopping. If unlimited travelcards were replaced by stored value tickets or smartcards, some loss of town centre trade is to be expected.

Although transport authorities may be able to have a significant influence on land uses, whether or not they consciously exert it is another question. How much deliberation would a transport authority give to the land use effects or introducing off-peak reduced fares or a maximum fare or unlimited travel tickets for example? The criteria when considering such proposals are more tightly related to the business of operating a public transport undertaking than the planning of land uses. Bus services in particular, are usually planned to follow land uses and activities, not to lead them. Certainly some transport authorities have presented light railway projects as though they would stimulate land use changes (and provide a clientèle for the railway) but the evidence that this will happen is unconvincing.

6.5 INFLUENCES ON TRANSPORT DEMAND BY A PLANNING AUTHORITY

There are several ways in which a local planning authority can influence the demand for transport.

- Land uses and density of building are controlled under Town & Country planning legislation. The separation of home and workplace, the degree of concentration of shopping into shopping centres, the locations of schools, concert halls, health centres and hospitals are all controlled by the need for planning permission under the Town & Country Planning Act 1990.
- Changes of use need plannning permission with the exceptions of those specified in the current Use Classes Order.
- Some intensifications of use, such as conversion of a large house into two or more flats also needs planning permission.
- The building of the transport infrastructure including off-street car parking needs planning permission (although it is difficult to control parking on spaces which are not specially constructed) and so we might expect the local planning authority to have the means to control the supply of mobility and influence modal split.
- The local planning authority usually plays an important part in projects for traffic restriction, pedestrianization and traffic calming which will influence the relative attractiveness of public and private transport and perhaps total transport demand.

There are, however, several causes which limit the influence of town planning powers on transport demand.

- Habits and preferences of individuals will mean that they do not always travel to the nearest shops or even the nearest school. How many people work at the nearest place of employment? How many people are employed nearer to your home than you are? For many people the prospect of a better job is well worth the travelling involved.
- The price of travel—fuel prices and other costs of motoring, public transport fares—is outside planning control.
- Within limits, activities can change in their intensity without needing planning permission. The number of people employed in a factory or office can change so long as no building works are involved, a football team can be promoted or demoted which will affect attendance, no planning permission is needed for businesses to close or buildings to fall empty.
- Planning authorities have only weak powers to promote commercial activity if the private sector is not enthusiastic. Public infrastructure can be laid on, development of a commercially unfavourable project can be linked to a lucrative planning permission elsewhere (Planning and Compensation Act 1991), but in the end, if the private sector is not interested, little can be done under planning powers. If the private sector shows no interest, the public sector must take on the rôle of the developer.
- Local planning authorities may wish to attract commerce or retail floorspace for example, in order to raise income from local taxes. They may be reluctant to impose too many regulations on an intending developer for fear that he may go elsewhere. Thus there may arise an element of competition between local authorities. In any case, traffic generation resulting from a large scale project such as a business park or out-of-town hypermarket will have effects much further afield than the boundaries of the local planning authority. Despite consultation procedures, the reality is that one authority's traffic generation often becomes the next one's traffic problem. One authority's revenue from business rates causes the next one's bill for road widening. Competition between authorities could be reduced if the Secretary of State for the Environment decided to call in more applications for planning permission and decide them himself. Regional, if not national, policies are needed.
- Planning regulation is relaxed in certain specified areas. In enterprise zones, the local planning authority must specify what kinds of development need permission. Otherwise planning permission is not needed.

6.6 PROFESSIONAL RESPONSIBILITIES FOR DECISIONS ON PUBLIC TRANSPORT INFRASTRUCTURE

Decisions about public transport infrastructure fall into three main categories: what kind of infrastructure is needed; where it is to be built—route lines; how it is to be built.

On the whole, it has been unfortunate that the local planning authority has not played a greater part in the first two categories. Of course they are involved in these decisions but too often it has been only in a consultation rôle to studies led by engineers, sometimes with unfortunate results. Mechanical and electrical engineers will have a significant rôle as consultants for the first kind of decision on what kind of infrastructure is needed and civil engineers will have a similar rôle on choice of routes, but these first two areas of decision are basically town planning matters. Engineers should be mainly concerned to check on feasibility not desirability. Desirability of a public transport policy or project is largely based on value judgements which will be matters for public and politician but there will be certain facts and informed opinions which will help. These may be in the form of ridership expectations for example and other matters more likely to fall within the established field of the town planner than the engineer. It is the third field of public transport decisions—how to construct—where decisions should be left primarily in the hands of engineers.

If political judgements are so significant in public transport decisions, why not leave it to the politicians to initiate policies, with professional officers assisting by estimating the consequences, should such policies be adopted, and otherwise being mainly concerned with the job of implementation? This is, in fact, close to what happens in many transport authorities. The problem with this approach is that there is not much likelihood of even coming close to optimization. The best that can be expected of the 'policies first, testing later' approach, is that the policies will be acceptable and workable.

6.7 WHAT ACTION IS NEEDED?

The planning machinery for preparing plans for local journeys is intact. The quality of the plans and policies already prepared has been variable, implementation much worse. The problem is that when it comes to specific proposals for development, planning decisions have too often succumbed to pressure to give way and to allow large traffic generators in situations badly located in relation to the public transport network.

We may wonder why a commercial developer should wish to build large traffic generators badly located in relation to the public transport network. The usual reason is a conflict of interest. The developer wants good access by car. He does not care much that the nearest local railway station is half a mile

away, whether there are any bus services or not or how much private car traffic will result from his project. These are all of minor significance to most commercial developers if they can have a site with a huge car park and high-capacity roads. Public authorities have the job of protecting the public interest and it is in their direction that we should look for a more rational approach to traffic generation policies.

If we came to accept that land use planning and density policies are a legitimate and effective means of controlling transport needs and that these needs should be regulated, the initiative for urban rail studies would come from planning authorities with policy and technical guidance from the Department of Transport. A proposal for a significant investment in public transport infrastructure such as urban rail would only follow after rigorous consideration of two areas of study by town planning authorities:

- formulation of policies towards urban journeys comprising policies which affect demand for as well as supply of transport, including land use plans, development control policies and traffic management policies;
- consideration of alternative means of supplying the levels of journeys planned for and the articulation and coordination between these means, as far as is legally permissible since the coming into force of the Transport Act 1985.

To be carried out thoroughly, both of these areas of study would be complicated and time-consuming. They would need a range of expertise, but primarily fall within the scope of town planning. It would be only later, in relation to route feasibility in physical terms, not economic terms, alignments and construction, that civil engineers should be called upon.

If we accept land use and transportation planning, only after these studies could urban rail, or any other form of transport investment be considered and possibly justified, and planned in such a way as to make best use of it. Planned in such a way, urban rail, or any other transport investment, would have to stand up to several tests.

- What part is it expected to play in our policies for urban journeys?
- What evidence is there that it will fulfil this part?
- What evidence is there that it is the most effective or cost-effective way of fulfilling this part?
- Are there any external benefits or costs which are not reflected in market prices?

This scenario of course, assumes that we accept local and central government regulation of transport need. It assumes that we accept that it might make sense to persuade traffic-generating commercial development to locate near to railway stations for example, by means of the town and country planning system for the benefit of railway operator, commercial developer and public at large. It

assumes that we accept that transport causes externalities not reflected in market prices and that the market does not always result in decisions which serve the public interest. It assumes that we will recognize that regulation may bring benefits to transport operators, property developers and the general public by reducing uncertainty of transport availability. It assumes that planning may reduce uncertainty of demand for railway equipment for example, thereby opening up the prospect of price reduction from economies of scale of production.

One of the fundamental causes of our urban transport problems is our half-hearted acceptance of these assumptions in word and our frequent overlooking of them in deed. The weakening of public transport regulation and of land use planning controls during the past decade both sum up prevailing attitudes to transport planning and reduce the possibility of achieving it. Whilst it is true that relaxation of some planning controls and other forms of public intervention do help the private sector to function more effectively and efficiently, it is a pity that the prevailing enthusiasm to weaken land use planning has overlooked the possibilities that some forms of planning actually help the private sector to function more effectively and efficiently. In short, the reasons why we need more clear and decisive planning of public transport and land use may be listed as follows.

- To check excesses of market forces where market prices do not reflect social costs and benefits, for example external environmental effects of the motor car.
- To coordinate transport demand and supply, for example by planning large traffic generators near to highly accessible locations such as railway stations. The market does not perform this task properly because travelling costs to the user, particularly the car user, do not represent the full costs of their journeys to the public at large.
- To support private sector initiatives such as in developing urban rail by coordinating land use decisions and road projects with their investments. At present we seem to expect the private sector to invest in light rail with no support or uncertainty of support from land use policies and sometimes even with competition from the construction of publicly funded high capacity roads following almost the same alignments.
- By allowing larger production runs, coordination and more decisive planning of public transport investments such as light rail or trolleybuses would also reduce the rather high cost of equipment and vehicles.

In the remainder of this chapter we will look in some detail at the way in which integrated land use/transportation planning has been considered in some continental European cities. Integration has been particularly careful in Germany and Scandinavia. Because there were several German case studies in my earlier books on town planning and public transport (Simpson 1987, 1988a and 1989b) I have concentrated here on Stockholm and Gothenburg with some rather more brief comparisons with Hamburg, Frankfurt and Munich.

Figure 6.1 Staden Mellan Broarna.

6.8 STOCKHOLM

Stockholm was founded in 1252 as a military stronghold by the Swedish ruler Birger Jarl. The original settlement was on the site of the old town, Staden Mellan Broarna, an island forming a relatively easy crossing point at the mouth of Lake Malaren (Figure 6.1).

Today the built-up area extends at least 25 kilometres north to south and 35 kilometres north-west to south-east over a spectacularly beautiful site comprising more than a dozen islands and fingers of mainland (Figure 6.2). Separation by sea, rocky terrain and forests has prevented the concentric, continuous urban sprawl common to many other large cities. The hard winters have favoured high density flat development rather than single dwellings and the physical nature of the the site has led to the concentration of transport along a more limited number of routes than would be usual for a city of 1.6 million people. This is particularly striking in the city centre where the railway routes south of the city converge on the western side of Staden Mellan Broarna before continuing north to T-Centralen and Central Railway Station (Figure 6.3). Here too is the only city centre road bridge between suburbs north and south of the centre although there are three others further west. The nature of the site has also discouraged urban road building and favoured high capacity public transport.

Stockholm became important after King Gustavus Adolphus designated it as the capital of Sweden in the 17th century. In the period 1620–1670 the population rose from 10 000 to 50 000. Several fires resulted in extensive rebuilding. They also gave opportunities for planning and this has been a characteristic of Stockholm since then. Sidenbladh (1965) gives an interesting account of the history of the planning of Stockholm. Public ownership of the land has made this possible. Before the 19th century, nearly all the land

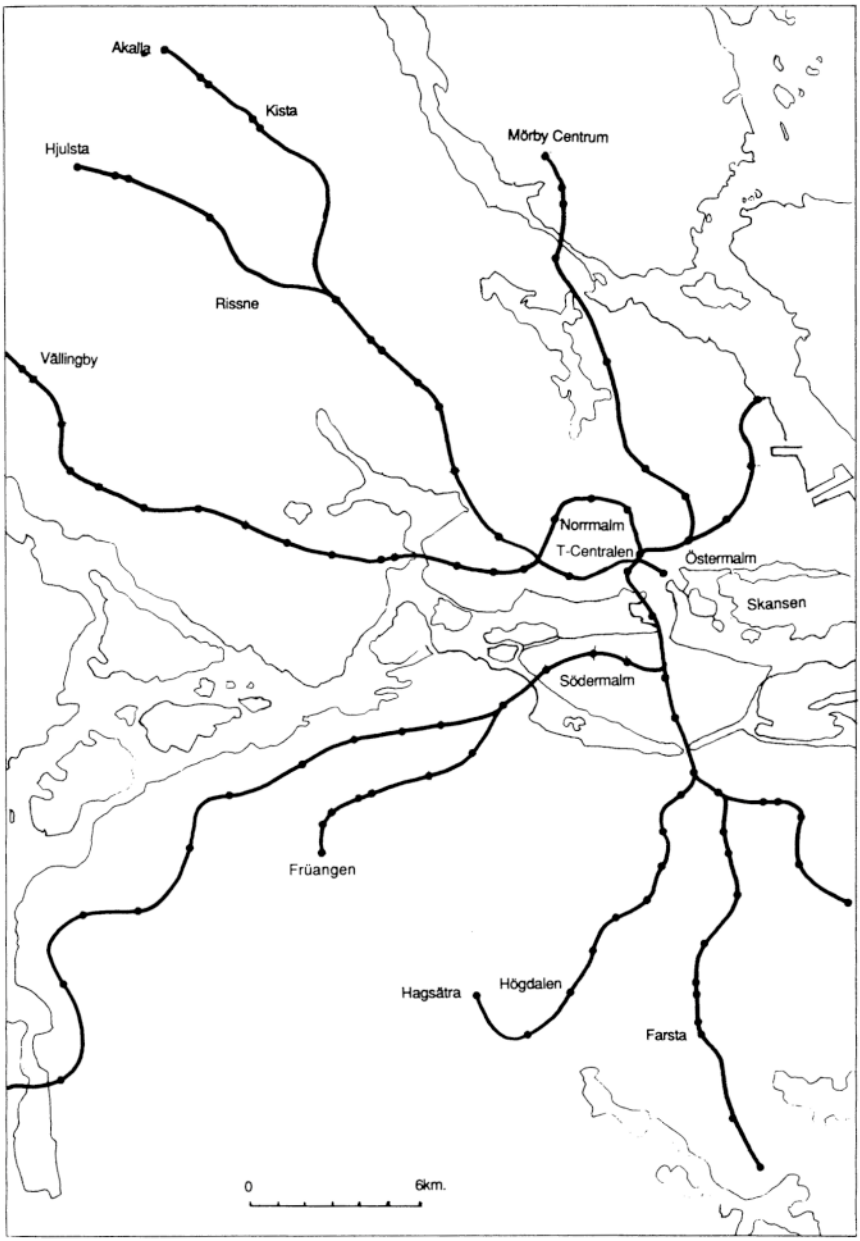

Figure 6.2 Stockholm.

Figure 6.3 T-Bana lines converge on T-Centralen.

belonged to the City or the Crown. The first plan of 1640 allowed builders to use land only for specified uses and building had to be completed within a specified period. However, land gradually went into private ownership. The new plan of 1866 was hindered by the cost of re-acquisition of the land. Now the local authority can buy land at market value before planning proposals, then may lease it to developers.

Sweden was a poor country in the 19th century. Industrialization came very late. Until the 1860s, Stockholm was little more than the seat of Parliament, the Civil Service and the King's Court, and a Baltic port. In 1850 the population was still only 90 000. The built-up area was confined to Staden Mellan Broarna and adjacent parts of Kungsholmen, Norrmalm, Östermalm and Södermalm within a radius of 1 kilometre from the centre of Staden Mellan Broarna.

Grid-iron streets were built on a substantial scale in the latter half of the 19th century when population increased more than three-fold to 300 000 in 1900. Much 19th-century housing has been improved or redeveloped from the 1960s. Up until the 1920s the land use pattern of housing and industry was very mixed, with the Central Business District (CBD) poorly defined.

As early as 1904 the City began to buy farm and forest land outside the city limits, then extended the city boundaries. Sweden avoided war and economic crises and income became more evenly distributed than in most west European countries. In the 1930s the City bought up peripheral agricultural land particularly in the south and west. Garden suburbs were modelled on the English pattern but with a much greater proportion of flats. By this time the city extended over most of Södermalm, Östermalm

Figure 6.4 Farsta Centrum.

south-west of Valhallavägen, Norrmalm south-east of Norra Stationsgatan and eastern Kungsholmen. There were dozens of physically separate suburbs such as Djursholm, Stocksund, Herserud, Sundbyberg, Appelviken, Höglandet, Langsjö, Stureby and Enskededalen, up to about 10 kilometres from Staden Mellan Broarna. Trams were important in serving the suburbs and a few adjoining small towns. In the early 1940s about 60% of the population of Greater Stockholm lived in the city centre; by 1965 this was less than 30%, today 20%.

These suburbs became inadequate for the expanding city and in 1941 the City Council decided to build an underground railway. Land use planning with density zoning around underground stations was planned from the beginning. The first underground (Tunnelbana or T-bana) was opened from the city centre to Hokarangen in 1950. The first section was from the western and southern suburbs through the CBD and was opened in 1957. The second line from the south west to north east opened in 1964. In 1965 Parliament decided to fund it out of car and petrol taxes for the first time.

The influx of population to Stockholm after the Second World War was greater then expected. In 1952, a plan for catering for this increased population was published. The basic plan for the city has been a series of secondary centres and satellites linked by rail-based public transport. Buses were to connect suburb to suburb and still do. Despite the relatively large geographical extent of the urban area today few parts are more than an hour apart by walking and public transport. Neighbourhood units were planned for up to 25 000 population, many of them on the T-bana. These have been planned as complete cities with CBD, local employment and housing of densities decreasing away from the centre and Tunnelbana station. Each is only about

Figure 6.5 High density flats around the T-Bana station at Akalla.

Figure 6.6 T-Bana station in the suburb of Rissne.

half an hour from the city centre by underground. By 1963, the total population of these suburbs was around 250 000. Together with high car ownership this has allowed many local residents to view their employment market as being much wider than the suburb where they live and there is much out-commuting. Good public transport has also been to the detriment of local shops and even some suburban shopping centres.

There was early segregation of car and pedestrian. Suburbs were designed to minimize the advantage of the private car despite its rapid increase: car ownership rose from nine per thousand Stockholm residents in 1945 to 190 per thousand in 1964 and to 339 per thousand in 1986. There was a main centre in the west (Vällingby, started in 1954) and two in the south (Högdalen and Farsta, started in 1960) each with planned populations of 50 000 to 80 000 (Figure 6.4). Later Skärholmen was developed in the south-west. Since 1970 there has been further expansion (Figures 6.5 and 6.6). Some of it is beyond the termini of the T-bana, particularly in the north-west and south, mainly in directions served by the suburban railway.

6.8.1 Public transport

Stockholm County now extends over 6488 square kilometres from Hallstavik in the north, Nynäshamn in the south and Ekero in the west and at the end of 1987 had a population of 1 593 333. Storstockholms Lokaltrafik provides public transport and operates the Tunnelbana (Figure 6.7), buses, commuter railways and a tram route on the island of Lidingö in the northeast of the city (trams were ended in the city centre in 1967). In January 1991, Stockholms

Figure 6.7 T-Bana at Farsta.

Lokaltrafik was reorganized into planning and operating divisions. T-bana, buses and local railways have been separated as a step towards inviting tenders to operate them, an activity which will have a familiar ring to it for those in several other west European countries.

There is a high level of bus service: 1987 buses (one for every 802 inhabitants) on 419 lines of 7595 km. In 1987 they accounted for 213 million passenger journeys. Despite good T-bana and railway services, buses are much in evidence in the city centre. Thirty routes are largely confined to the central and inner city and there are many other routes which terminate there. The main terminals are Slussen (immediately south of Staden Mellan Broarna), Norra Bantorget, Central Station, Ostra Station and Skanstull on the Ringvagen. All of these are on the T-bana and all except Skanstull are also on the suburban railway.

In 1987 the 13 Tunnelbana lines carried 227 million riders. The 116-km network is basically north-south orientated with five branches each north and south converging in T-Centralen and the single link between north and south routes on the western side of Staden Mellan Broarna.

Most of the commuter railways run on contract by Swedish Railways. In 1987 there were 278 km of track, 414 carriages and 58 million passenger journeys. Like the T-bana it is basically north-south orientated converging on Central Station. There are also two lines terminating at Ostra Station and one at Slussen. None of these is connected to the main network.

Twenty-five ferries are operated by a company owned by the County Council and accounted for 3.6 million passenger journeys in 1989.

Public transport usage, subsidy and car ownership are all high:

- 322 public transport journeys per inhabitant in 1987, closer to London (328 in 1990/91) or Paris (320 in 1991) than cities nearer to Stockholm in population: for example Hamburg (240 in 1990), Munich (210 in 1991), Birmingham (193 in 1990/91), Manchester (148 in 1990/91), Lyon (170 in 1991) or Marseille (120 in 1991);
- 61% of the total cost of running public transport came from Stockholm County in 1990.
- car ownership was 339 per thousand residents in the County in 1986.

6.8.2 The City Centre

The physical character of the old city has been conserved to a large degree, with attractive public buildings, old housing, restaurants and shops. Through traffic is largely restricted to the periphery. Within the long, narrow roads Västerlånggatan and Österlånggatan wind along the contours. These and the straight Stora Nygatan are connected by dozens of short alleys, too narrow for much traffic and in many of them it is restricted by regulation as well. On the western side of Staden Mellan Broarna, the main road and rail

Figure 6.8 Downtown Stockholm is remarkably free from tall buildings apart from these five.

thoroughfares connecting the south of the city to the remainder, separate the island from Riddarholmen, a small and most pleasant addition to the old city to the west. Separated to the east are Skansen and the three islands of Skeppsholmen, Kastellholmen and Beckholmen.

To the north the city centre extends into Kungsholmen, Norrmalm and Östermalm and to the south, Södermalm. Most of the commercial uses have concentrated on Norrmalm south of Odengatan (Figure 6.8). To the north and in Östermalm, Södermalm and Kungsholmen there are substantial areas of housing. Throughout these later extensions to the city centre, the street pattern is basically grid-iron, the patterns being separately fitted to each district. Valhallavägen forms a north-eastern edge to the central area. Sveavägen is a main route to 'down town' Stockholm from the north.

The only fragment of an inner ring road is Ringvagen to the south of Södermalm, and this is not grade-separated. The City Centre Plan of 1962 planned for 400 000 jobs. A ring of motorways about 4 km in radius was started after the Traffic Route Plan of 1960. This is now substantially complete except in the east. Within the ring, a north-west to south-east axis follows Klarastrandsleden and Söderleden. An east-west axis was also planned but has not been built. Otherwise the street pattern is being preserved as far as possible, traffic being restricted. Bus lanes are extensive in the older parts of the city.

About 230 000 work in the inner city and a further 110 000 in the centre. There has been much reshaping since 1945. The first stage, the well-known five tower blocks were built between 1953 and 1962.

Consideration has been given to pedestrians, cyclists and public transport as well as to motorists. In too many large cities, a walk across the

central area will involve detours around traffic barriers, being channelled down underpasses and in many other ways being subject to a long, unpleasant and inconvenient route so that vehicles may have priority. Not in Stockholm.

6.8.3 Traffic restraint

In 1968 a Parliamentary Committee on Traffic Circulation was formed to consider policy towards traffic in central Stockholm. One of its recommendations was to restrict traffic in many of the smaller streets without impeding the overall traffic circulation of the city. The City Council set out a series of objectives for traffic circulation in the city as a whole: to improve accessibility, to improve safety and to reduce traffic congestion. These were to be achieved by separation of modes (pedestrians, cyclists, buses, cars), identification and planning of a clear road hierarchy and by traffic zoning reflected in policies towards heavy through traffic and school catchment areas.

The heavy goods vehicles policy of 1973 defined routes, restricted overnight parking in residential areas and allowed access for vehicles conforming to defined noise standards, thereby encouraging noise reduction. For the private car there was a policy of improving suburb-suburb accessibility, addressing blackspots in terms of accidents, congestion or poor environment. For buses the policy was to improve accessibility, concentration on selected routes reducing the number of roads served by buses, and bus priority measures.

Parking policy was considered to be the most important way of controlling the private car. Overnight parking charges, a drastic reduction in on-street parking, on the spot fines and taxes on parking provided by employers were all introduced. These measures tried to limit the use of the car for commuting and to give priority to parking for business journeys.

In January 1970 the City Council of Stockholm decided to introduce experimental traffic measures to limit circulation in selected districts, starting with Östermalm (Figure 6.9). A plan for this district was approved by the Council in April 1972 and the scheme was opened in September of the same year. As a result of this, it was decided to extend the schemes to other districts including all those developed before 1950 when the use of the car began to increase so dramatically.

The Östermalm district covers an area 1.8 by 1.2km in the north-eastern part of the city centre with 19 000 residents and 23 000 work-places. The main aims were to reduce traffic accidents and to improve the environment.

A system of four traffic cells inhibiting direct routes from one to another restricts through traffic. There are parking restrictions on some streets. Parking metres are used to apply much higher charges near to Ostra railway station. There are also on-the-spot fines and a policy of using car

Figure 6.9 Traffic restraint in Ostermalm.

clamps but apparently not applied sufficiently strictly to deter abuse of the bus lanes. Bus routes have remained similar but selected streets have been made bus-only and the roads defining the boundary of the study area have bus-only lanes.

There is a network of pedestrian routes separate from road traffic and there are cycleways along lightly-used pedestrian ways and bus-only streets.

The main conclusions from the experiment are outlined in CETUR (1979).

- Shortly after implementation, traffic circulation within the district was reduced by 40%. However, the amount of traffic in the wider district increased by 4%, probably reflecting enforced detours caused by the scheme. Traffic on the roads bounding the study area increased by 30%.
- Buses became more regular but there was no detectable increase in passengers nor in pedestrians.
- There was a decrease in noise of 5 to 10 decibels in some streets but no detectable increase in the periphery as noise levels were already high there.
- There was a 30% decrease in accidents within the district but a 20% increase outside. In Stockholm as a whole accidents decreased by 12% during the same period.
- Public opinion was not entirely favourable: traffic problems were seen as being merely moved to the edge of the district.

Stockholm has a history of building control, land use and transport planning extending over 350 years. In the old town, adjacent islands and adjacent parts of the mainland the emphasis has been on conservation with heavy

traffic limited to a few corridors. To the north and south there has been extensive improvement and careful traffic management. Redevelopment has been limited and where it has taken place it has been high quality and with its own distinctive character. Further out there is the influence of the English garden suburb and new town planning adapted to the Swedish climate and housing requirements and also orientated to a high capacity T-bana network. Nowhere has the city been ravaged by the worst excesses of high-rise development, so common to many of the 19th-century districts in other west European cities, nor by the bulldozer mentality of the urban roadbuilders. It remains a city of extraordinary charm and interest, of human-scale building and characteristic high quality new-build set in a site of outstanding natural beauty.

6.9 GOTHENBURG

Gothenburg was founded in 1619 by King Gustavus Adolphus II as a fortress in order to lay claim to a territory which had been in dispute between Denmark and Sweden for 200 years or more. Dutch settlers played an important part in the original planning and building of the city and the remains of the distinctive canals and fortifications still influence the form of the city centre. Gothenburg remained small in comparison with Stockholm. In 1670 the population was 5000 or one-tenth of that of Stockholm. By 1750 it had grown to 8500 (Stockholm 60 000) and by 1850 to 30 000 (Stockholm 90 000). Today the city has a population of 420 000, a little over half that of Stockholm, and the greater urban area, 700 000 rather less than half that of Stockholm (Figure 6.10).

Gothenburg is the main Swedish port and is an important shipbuilding and industrial city, with firms including SKF and Volvo. The estuary of the river Göta forms an excellent sheltered harbour but also forms a barrier separating the harbour and industry in the north-west of the city from the remainder. The Älvsborgsbron to the west of the city centre and the Tingstadstunneln to the north-east were built between 1966 and 1968. Until then the Götaalvbron was the only bridge connecting the two parts of the city. At the time of the switch to right-lane driving in 1967, the whole road network was replanned and a substantial increase in capacity was achieved outside the central area. A ring road was completed around the CBD.

6.9.1 Some comparisons with Stockholm

In the 1950s and 1960s both cities decided against the prevalent attitude elsewhere that urban road building should follow the rapid rise in demand for transport by private car. Despite this, car ownership is high, but there is strict restraint on use of the private car, especially in the city centre, in recognition of the value of the environment.

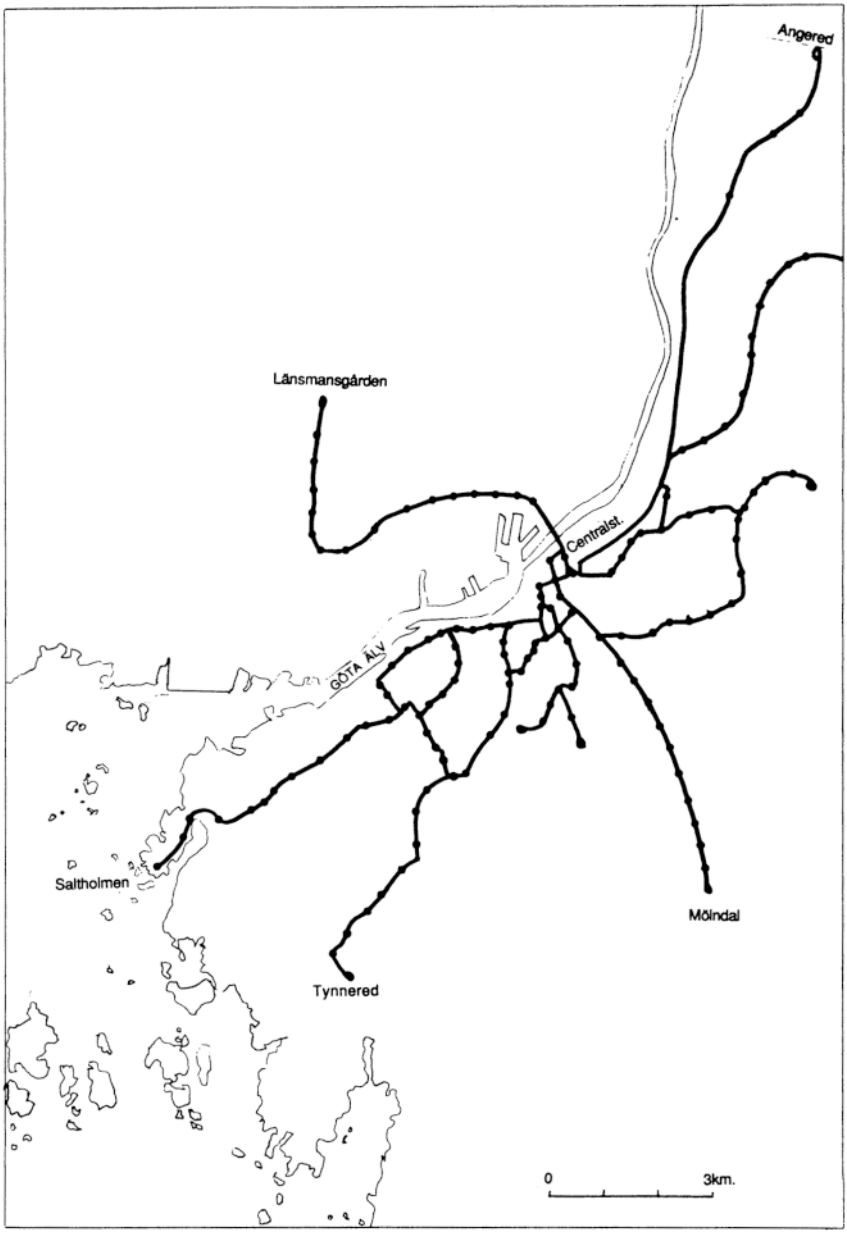

Figure 6.10 Gothenburg.

Figure 6.11 Tramways bring passengers to Central railway station in Gothenburg.

Table 6.1 Urban rail in Stockholm and Gothenburg

System	*No. routes*	*Route length (km)*	*Passengers per year (million)*
Gothenburg Trams	8	152.7	88
Stockholm T-bana	13	116	227

In both cities there has only been limited city centre redevelopment. Where it has occurred, it has been sensitively fitted to the urban environment with consideration to other city centre users as well as motorists.

There has been recognition of the rôle of public transport in maintaining the civility of the city centre backed up by a willingness to subsidize it to a high level (about 61% of operating costs in Stockholm and 53% in Gothenburg).

Each city relies on railways as the centrepiece of the public transport system. In Stockholm this is the T-bana, in Gothenburg the trams (Figure 6.11; Table 6.1). The difference in type of railway is due to the difference in size between the two cities. In the smaller city of Gothenburg, trams are adequate in speed for the shorter lengths of journeys and adequate in capacity for the lesser demand. The 281 Gothenburg trams operate on eight routes of total length 152.7km in 1984 (113.0km off-street, 21.4km on-street on separate lanes and 17.9km on-street). Where there are reserved lanes, both trams and buses use the same stops.

Whereas there is one bus for every 805 residents in greater Stockholm,

Figure 6.12 Trams bring passengers to the edge of the traffic cells.

there is only one for every 2316 in Gothenburg, a reflection of the similarity of services offered by the tram.

As well as being more closely spaced, the tramway stops are more evenly spaced than the T-bana stations. In several suburbs there are two closely spaced T-bana stations widely separated from the next suburb along the route. Apart from the route from the city centre to Angered, there are no comparable high-speed tramway sections.

In both cities, planning for public transport as an integral part of land use and development planning has been not only recognized but has also been acted upon. The reliance on fixed-track transport has been the central element of land use planning. In cities which rely on buses there is a temptation to plan land uses first, then make the public transport serve the development. The Gothenburg tramways and the Stockholm T-bana have been extended as a result of development decisions, for example to the Gothenburg new town of Angered, but both have also played a part in leading development as well as following it.

Each city has a transport authority responsible for coordination of infrastructure, timetables and fares throughout the whole of the urban area. In Gothenburg, planning of transport is carried out by the several local authorities that make up the 172 square miles (445 square kilometres) of the transport authority area. Since 1977 fares for regional transport services have been coordinated by the Association of Municipalities for the Gothenburg Region. The Göteborgsregionens Lokaltrafik AB (GLAB) was formed on 1 July 1983 taking over responsibility for coordination of fares for regional public transport covering 13 municipalities. GLAB comprises three counties and is a company owned by them. It purchases tram, bus, rail

and ferry services. The municipality assumes financial responsibility within the city area and owns Göteborgs Spårvägar which operates the trams, buses and ferries. Where Göteborgs Spårvägar routes pass outside the city, GLAB purchases the services outside the boundary. Göteborgs Spårvägar also sells services such as ticket printing and maintenance of ticket validating machines to GLAB.

In each city, strict control of road traffic has been accepted in the city centre. This has taken several forms: restrictions on parking, bus and tram priority, limiting vehicular access.

Both cities have used the principle of traffic cells. Gothenburg city centre within the line of the former fortifications and inner ring road was, in 1970, divided into five cells (Figure 6.12). As in the Östermalm district of Stockholm, the street pattern is basically grid iron and this helped traffic management of the cells. Important too were the wide streets created by the filling in of former canals, and the presence of the ring road. An important factor which has contributed to acceptance and success of the cells is that no group of people is significantly worse off. Taxi drivers protested at first because they were not regarded as being public transport and had to make long detours. Subsequently however, the ruling was changed to include them and they obtained the right to cross from cell to cell.

Traffic cells improve the situation for public transport a great deal but in the case of Gothenburg city centre, the area covered by the initial five cells contains only 5% of the total length of tram track (although a much more significant part of that where there is a danger of traffic congestion). However, due to the success of the initial cells in the city centre, further cells were subsequently formed in what was termed the central urban area to the south-east. Implementation was not quite as straightforward largely due to there being no ring road on which traffic could be diverted.

As a result of the formation of traffic cells, the distance travelled by cars increased by around 7%. Retail businesses and other commercial activities were affected only marginally. Some custom would be lost due to the absence of through traffic and a decrease in parking space but improved urban design attracted some customers. There seems to have been little effect on turnover.

6.10 A NOTE ON SWEDISH GOVERNMENT STRUCTURE AND ITS INFLUENCE ON LAND USE/TRANSPORTATION PLANNING

There are three tiers in Swedish government: central government, 24 counties and 280 kommuner (municipalities). Central government has regional agencies in the 24 counties to ensure local implementation of national policies. In Sweden central government provides money for metros and light railways but stations, tracks, signals, vehicles and power are paid for locally.

The 24 counties have elected regional councils or landsting and are mainly responsible for health care.

The 285 kommuner were reduced from 2500 in the 1940s. These levy income tax (about 30% of assessed income after deductions) to be divided approximately equally between themselves and the counties. They are responsible for a wide range of services, social welfare, schools, roads, housing, care of children and the elderly, housing and planning. They have a great deal of powers for traffic regulation. They can make traffic regulations and create such works as one-way streets, reserved bus lanes, turning restrictions, parking restrictions and parking charges. Under the 1979 Transport Act, public transport is a responsibility of both county and municipal authorities jointly. Each county has a department responsible for public transport including fares and integration of services. Transport departments can buy services from undertakings owned by state, municipality or the private sector. Stockholm is the exception. Stockholm County has financial responsibility for public transport.

The reduction in the number of authorities led to more centralization. It was supported by the Social Democratic government which was in office from the 1930s until 1976. A centre-right coalition came to power in 1976. There was a change in legislation in 1979 supported by the Social Democrats. Lagen om vissa lokala organ in kommunera, SFS 1979:408 and 1979:1167 give municipalities discretion to decentralize decision making to local area boards. Before that, below the council or kommunfullmäktige there were a number of functional boards responsible for various executive departments. Before 1979 each board had exclusive responsibility for its area; submunicipal organization was specifically prohibited. Now, neighbourhood boards can be created and entrusted with a wide range of responsibilities: social services and child welfare for example. These local boards can be given the right to review actions proposed by other municipal agencies which affect their area or their constituents. The legislation is not mandatory.

In Gothenburg, the Kommunstyrelsen or Municipal Board comprises 15 members elected from the Municipal Council and is responsible for central management functions, policy and strategic planning. Seven of the fifteen members are full-time politicians (kommunalrad). One is responsible for land use and regional coordination, another for transport and economic development. Long term policies are formulated by programme committees. The programmes for the whole municipality are hierarchical by means of objectives covering all municipal functions and are revised every one to three years. Programmes have a minimum time span of 10 years and provide a basis for medium term (four years) and short term (one year) investment and activity plans for the various functions of the municipality.

Short term economic planning is coordinated by the Budget Board and programmes by the Municipal Board. Transport is supervised by one programme committee but comes within three municipal departments: the

city planning office, construction by the Highways Office and operation of public transport by the transport authority. Each of these has its own sectorial board consisting of elected members which take decisions.

In Gothenburg, traffic regulation proposals are prepared by the traffic planning division of the city planning office. In many other cities this task would be left to the city engineer's department. Perhaps this explains why Gothenburg has been so successful in implementing traffic restraint. After discussion with other relevant interests they are submitted to the traffic board and are legally enforcable after approval.

Although the municipality has responsibility for all roads, it receives up to 95% of construction and maintenance costs for some roads from national funds and the National Road Board decides which roads receive the subsidy. Underground railways are subject to comparable influence, but this affects only a small part of the Gothenburg trams.

6.11 HAMBURG, FRANKFURT AND MUNICH

We now turn to three strong regional cities in Germany, none of which has been as severely constrained as Stockholm or Gothenburg by the physical nature of the site, but like the two Swedish cities, all have developed over several decades of integrated land use/transport planning with railways as the backbone of the public transport system. In each of the three German cities the S-Bahn (suburban railway) and U-Bahn (metro) systems converge on the city centre and have allowed high density commercial development without excessive road building or excessive traffic congestion (Figure 6.13).

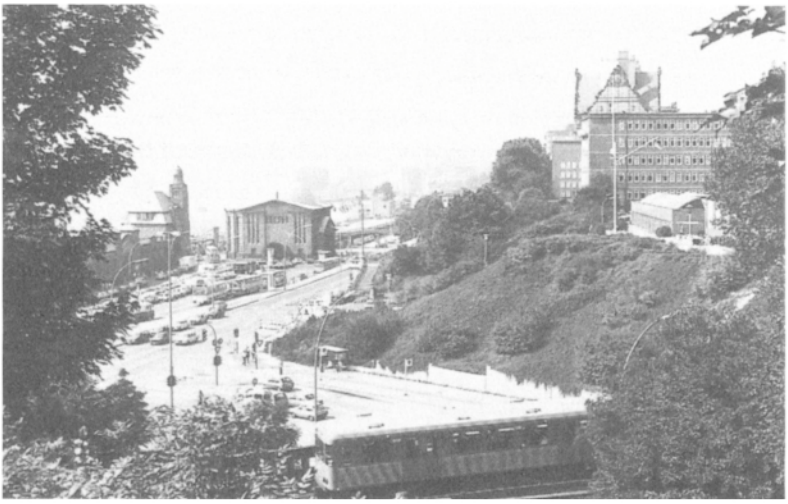

Figure 6.13 The Hamburg U-Bahn at Landungsbrücken.

In many of the large British cities, one of the problems of using suburban railways for journeys to the city centre is that there are only one or two stations in the city centre where passengers can alight. By contrast, the German S-Bahnen and U-Bahnen provide some element of distribution within the city centre and so many travellers will be taken closer to their final destinations. In all three German cities, the main railway station (Hauptbahnhof) is towards the edge of the centre of the city but local railway services continue beyond it, underground, to give very high capacity access. In Frankfurt and Munich this allows extensive pedestrianization of the commercial streets above (Figure 6.14).

In both Hamburg and Frankfurt, some of the most dense employment is peripheral to the centre—around Berliner Tor and in City Nord in Hamburg and in the banking and insurance district to the west and north-west of the Centre in Frankfurt—a policy pursued to reduce the overall amount of traffic within the city centre.

The population of greater Hamburg at 1.6 million is very similar to that of Stockholm. Munich is a little less at 1.3 million. The population of the rather more tightly defined City of Frankfurt at 620 000 is closer to that of

Figure 6.14 The Munich S-Bahn and U-Bahn have allowed pedestrianization of one of the main shopping streets above.

Gothenburg, although the public transport network is organized to cover a much wider area containing 2.4 million people.

As in Sweden, in the three German cities there is a clear definition of the rôle of each mode of transport. Regulation has meant that services by each mode are complementary rather than competitive.

The connection between urban growth and high-capacity high-speed transport axes has been recognized explicitly in Hamburg since at least as early as the 1920s. Consequently a large part of the present urban area has developed under sustained and coordinated policies between land use, density and transport capacity, particularly public transport. As the city expanded in area, in the 1950s arrangements were made with the neighbouring Länder (regional authorities) of Schleswig-Holstein to the north and Lower Saxony to the south.

The Hamburg Density Model (Kruger, Rathmann and Utech (1972), Utech (1982)) sets out very clearly the relationship between land use planning, density and rapid, high-capacity transport axes.

The model combines three concepts:

- axes of growth (eight in all, some of them branching);
- the structuring of the main transport network around rail transit with bus feeders and park and ride;
- a hierarchy of central places along the axes.

Maximum tolerable walking distances to public transport housing density are specified in the model. Both tolerable walking distances and density vary according to location within the land use scheme.

Comparable principles have been adopted in Frankfurt and Munich. These are set out in the Generalverkehrsplan (Traffic Master Plan) and Regionale Raumordnungsplan (Regional Land Use Strategy) (Frankfurt am Main, Dezernat Planung (1984)), Angerer (1983) and the Stadtentwicklungsplan (City Development Plan) for Munich (Landeshauptstadt München (1983b)). In all three cities, land uses have been controlled to make sure that the accessibility created by large scale public investment in transport infrastructure is not wasted.

A common pattern of land use/transportation planning principles has been followed. As well as the planning of urban growth along defined axes, concentric zones have been identified. In the outer zone, the private car is to be dominant with buses to the rapid rail axes and park and ride at stations. Park and ride is provided at rapid transit stations. In the inner zone, which extends up to about 6 km from the centre, public transport is dominant, mainly by rapid transit and the roads are designed mainly for business traffic. In the zone between there is also park and ride and a more dense bus feeder network.

In Hamburg, the Straßenbahn has been taken out of service, in both Frankfurt and Munich they are being replaced by U-Bahn, section by section.

Table 6.2 Inhabitants per bus in selected German and Swedish cities

City	*Inhabitants per bus*
Stockholm	805
Gothenburg	2316
Hamburg	1197
Frankfurt	1438
Munich	1134

Buses have been seen as being particularly suited to act as feeders bringing passengers to the S-Bahn and to a lesser extent, U-Bahn stations and for journeys within the suburbs. There are, however, some differences between the three cities (Table 6.2). In Hamburg there are 1337 buses in service, in Frankfurt 417 and in Munich 1146. The differences in the sizes of the cities will account for some of the difference but more important probably is that there is no Straßenbahn in Hamburg and so buses are used more for short journeys in the city centre and inner city than in the other two cities. In Frankfurt, only two bus services run within the inner ring road whilst nine of the 15 Straßenbahn routes operate within the same area. In Munich, eight of the 75 bus routes operating within the city, enter the inner ring.

The relative sparsity of buses in the three cities with trams (Gothenburg, Fankfurt and Munich) is a clear indication that to some extent, buses and trams substitute for each other.

In each of the three cities there is a conurbation-wide transport authority responsible for the planning of services and the coordination of fares (Simpson, 1988b). The Hamburger Verkehrsverbund (HVV) became the first West German metropolitan transport authority in 1965 formed from the seven pre-existing public transport companies operating in the sub-region, the two largest of which are the Hamburger Hochbahn Aktiengesellschaft which now operates the U-Bahn and about 70% of the buses and Deutsche Bundesbahn, and Bundesbahndirektion Hamburg which operates the S-Bahn. HVV has the duty to secure the provision of public passenger transport as effectively and efficiently as possible. Relations between HVV and its constituent companies are governed by contracts setting out the rights and duties of each, the distribution of income between them and details of their organization and working.

The Frankfurter Verkehrs- und Tarifverbund (FVV) coordinates the operation of public transport by the municipality (Stadtwerke Frankfurt) which operates the U-Bahn, Straßenbahn and about 60% of the buses and Deutsche Bundesbahn which operates the S-Bahn and the remainder of the buses. The FVV has a board and standing committee with equal numbers of representatives of the Stadtwerke Frankfurt and Deutsche Bundesbahn. It also has two managing directors, one nominated by each of Stadtwerke

Frankfurt and Deutsche Bundesbahn. There is an advisory body (Rat) consisting of representatives of the City of Frankfurt, the Land Hessen and the Bundesrepublik and an auxiliary advisory body (Beirat) which co-opts other relevant interests.

Like the Frankfurter Verkehrs- und Tarifverbund, the Münchner Verkehrs- und Tarifverbund has two partners, the City of Munich and Deutsche Bundesbahn, each nominating a director. MVV also has a board of directors, administrative board with representatives of the City of Munich, State of Bavaria and the Bundesrepublik and a managerial board responsible for the administration office, press and public relations and research. The City and Deutsche Bundesbahn own the transport infrastructure and bear commercial responsibility. MVV organizes transport provision and planning and investment and provides the partners with operating instructions. It also organizes ticket sales, pricing, distribution of fare receipts and compensation for services rendered.

The formation of metropolitan transport authorities was roughly contemporary with those in Britain, a few years before in the case of Hamburg. The field of responsibility was not very different until 1986 when British metropolitan transport authorities lost a large part of their powers.

Subsidy of public transport is high by comparison with that in British cities. Mineralölsteuer, a tax levied nationally on fuel for vehicles, has allowed heavy capital investment in rapid rail transit to service and permit a booming local economy in the 1960s and 1970s.

6.12 CONCLUSIONS ON SWEDEN AND GERMANY

The policies followed in the Swedish and German cities have a lot in common and contrast starkly with those in Britain today in several respects. The designation of railways as the centre of an urban public transport system is quite different from all British cities apart from London. The land use planning systems in Sweden and Germany have planned the good use of accessibility to avoid the weird spectacle of highly accessible locations surrounded by land uses which do not need to be there. It has been seen as a municipal responsibility to ensure that accessibility is not wasted, whereas the current attitude prevalent in Britain is that accessibility is a marketable commodity: if the private sector values it, there will be a demand and this must contribute to the transport infrastructure costs.

Even if we wanted them to change British cities it could not be done quickly. It would take decades. They have grown up to a land use and density pattern compatible with the bus and private car, with insufficient areas of high density to make railways viable.

In any case, should we want British cities to change? There is certainly a growing lobby in Britain demanding traffic restraint in our towns and cities. That implies either fewer journeys (which would be quite feasible if we had

land use planning policies more conscious of road traffic effects) or a switch to public transport. Public transport in general and urban rail in particular, are compatible with high capacity access at little environmental cost—high density prosperous city centres with little traffic intrusion. If we find traffic unpleasant, there is the solution, but at a cost. We are not used to paying up for the 40% to 60% subsidy that usually accompanies an integrated urban rail-based public transport system. On the other hand, such a system can support higher commercial development densities than we are use to in bus-orientated cities. There must be some scope for the increased commercial development to contribute to the costly public transport system, directly, or indirectly in the form of property taxes for example. The accountancy is far too complicated and insufficiently explicit to sort out what are the real costs of a highly developed rail-based public transport system. The costs of not having one are rather more visible.

7

CHOICE OF LOCAL PUBLIC TRANSPORT TECHNOLOGY

In settlements below a few thousand population, public transport needs will be to connect to other towns and villages. It is only for larger settlements of at least a few tens of thousands of population that there will be needs for public transport for journeys confined within the town. In much larger towns the basic question will be whether to have a rail-based network such as a tram or light railway to supplement bus services. This choice has been studied in several British towns of less than a hundred thousand population, but it is more commonly associated with towns of 250 000 population or more. In fact, there are several British cities of over 750 000 population where buses account for more than 90% of public transport journeys.

The number of people who will use a public transport service will be influenced by the number within reach of stops or stations of origin and destination. For journeys to work for example, this will mean residential density around suburban stations and density per unit area of land around stations and at the destinations. Usage of public transport is therefore influenced by densities of housing, offices, factories, shops and other land uses which are the origins or destinations of journeys. The number of people wanting to use public transport will have a big influence on what form of public transport is most suitable in terms of cost and effectiveness in providing a service. In general, high demands favour rail, the higher the demand, the 'heavier' the variety of rail (Chapter 3). There is also a relationship between lengths of journeys and what kind of public transport is appropriate. Buses, trams, métros, heavy suburban rail form a sequence of wider spacing of stops, higher capacities and longer journeys.

And so, lengths of journeys and land use densities will be amongst the most significant factors influencing what kind of public transport is most appropriate. Both land use densities and lengths of journeys are related to the size of an urban area, both geographically and in terms of population, although

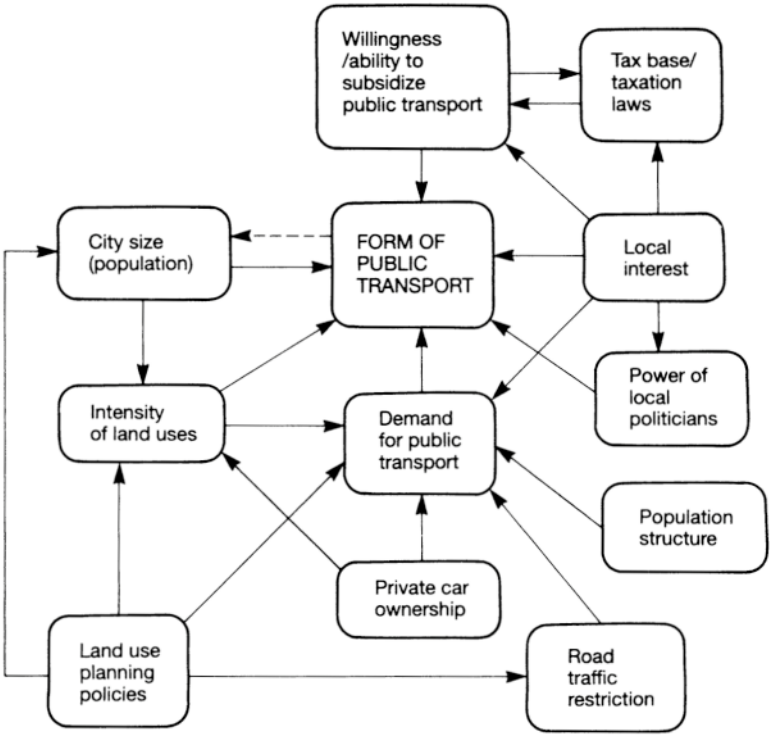

Figure 7.1 Some factors affecting choice of public transport policy.

the relationship is far from straightforward. Residential densities in most parts of Paris for example, are much higher than in London and journeys to work are shorter. Within a region of uniform building styles, however, there is some relationship between city population, land use densities and journey lengths by public transport.

There is a relationship between city size and the form of public transport but in fact, there is a whole network of interrelated factors affecting choice of local public transport technology, some of which are represented in Figure 7.1 for which a few notes of explanation now follow.

- Power of local politicians—urban rail projects need local initiative and ability to implement them. Senior local politicians of several French cities which have recently developed urban rail networks simultaneously held positions of cabinet rank in central government. In Germany too, local politics is held in relatively high esteem with highly articulate holders of full-time posts in large cities.
- Local interest—not just public interest but the interest of those in positions able to implement urban rail. In most cities developing light rail, it has been seen by local politicians as a matter of civic pride.

- Willingness to subsidize public transport—few West European cities with a substantial urban rail network subsidize their public transport at less than 40% of operating costs.
- Private car ownership—in some cities with highly developed urban rail networks, there is also a high level of car ownership, for example, Stockholm, Gothenburg and most former West German cities. In many cases, there are severe road traffic restrictions in the centre and inner city with a high level of public transport usage. Car usage is diverted to the suburbs.
- Population structure—in some towns the young, housewives and the elderly have disproportionately high public transport needs. In some large cities, people of working age have higher public transport needs.
- Taxation laws—in some countries including France and Germany there are special taxes earmarked for use on public transport and these have provided large amounts of money to build urban rail.
- Tax base—for example rateable values, number of people eligible to pay a local income tax, firms eligible to pay payroll tax and their incomes/turnovers.
- City size—total population is an important indicator of public transport demand. Continuously built-up area is perhaps the most satisfactory geographical definition. In some cities this is quite close to the local authority administrative unit. In other cities, the boundary of the transport authority area is a better geographical definition.
- Land use planning policies have an influence on demand for public transport in three ways:

  — restriction of the private car, e.g. by pedestrianization;
  — effects on intensity of land uses;
  — in determining the degree of segregation and separation of land uses and therefore the demand to travel between them.

- Intensity of land uses—the amount of office or commercial floorspace per unit area of ground, housing density. Due to higher density, flats are much more economical to serve by high capacity rail systems than are houses. As we look from west to east in Europe, winter temperatures fall, the proportion of flats increases and urban rail systems play an increasing rôle in local urban public transport.

The remainder of this chapter falls within two parts. First, there is an analysis of criteria which have been used for choosing between public transport technologies. Secondly there is an investigation of the main choices facing many urban areas today—the choice between buses and light rail, tramway and métro, buses and minibuses.

7.1 CRITERIA FOR CHOOSING BETWEEN FORMS OF PUBLIC TRANSPORT

Occasionally, as in a new town or a town perhaps in a developing country where there is only a very limited public transport system, there may be something approaching a blank start in public transport terms. A large part of the future public transport system may be installed as a single project and the choice of what technology or combination of technologies is a very real one. Even in cities in developed countries with established public transport systems there are choices for replacement of routes using new technology, such as bus routes replaced by a métro.

Change need not be so radical or large scale for choice of public transport technology to be a significant issue. In many towns it will be worthwhile considering whether some bus routes could better be operated with minibuses rather than standard buses.

When faced with choice of form of public transport, an essential and early task is to consider what issues public transport is expected to address and what are the aims of operating and developing a public transport system. It is still assumed sometimes that the issues and aims of public transport are too obvious to need much serious thought. It is, however, not as simple as just providing transport for those who do not have a car. Reduction of road traffic congestion, maintaining economic prosperity locally, reduction of atmospheric pollution for example, are all recognized nowadays as issues on which public transport has an influence.

Considering issues and aims of public transport together, we can draw up a series of criteria for choosing public transport technologies. A serious constraint in arriving at decisions is that not all these criteria are fairly and squarely within the field of operation of the transport authority. Some of the criteria are within the provinces of the local planning authority, public transport operator or any of several other public and non-public bodies. Several municipal departments and central government departments will have a part to play in representing the public interest in relation to these criteria and some of these bodies are consulted in only a rather informal and sometimes haphazard manner.

7.1.1 What kind of service is needed?

The choices relate to the spacing of stops and the number of routes. Closely spaced stops give slow services but with only short distances to get to the stops for users whilst widely spaced stops give faster services but involve greater distances to the stops. A large number of routes dispersed amongst the area served will allow only relatively infrequent services.

Lower capacity forms of public transport services—buses or minibuses—are more suitable for closely spaced stops and dispersed routes, railways for widely spaced stops and concentrated routes.

7.1.2 Market to be catered for

In comparison with buses, there is a tendency for local railways to attract people with higher incomes, more car drivers and to be used for more journeys to work. In short, railways are perceived by users, promoters and others as being more 'up-market' and as a stronger competitor to the private car than are buses. This seems to apply particularly to the faster, higher capacity forms of local railways which cater for longer journeys. It is possible that it is really the speed and reliability of the service which creates the difference in clientèle between railways and buses. If that were so, we might expect the difference to disappear if bus priority measures were adopted on an adequate scale.

7.1.3 Cost

The capital costs of a rail route will, for many towns, vary several-fold depending on choice of rolling stock, technology and whether underground, surface or viaduct construction is used. Even the lowest cost will be usually much higher than the costs of bus services on the same route, except for some of the ultra-light people movers. There are however, such large variations in the cost of rail construction that even this is not always accurate. Proposals for a north-south tramway route in Edinburgh have been costed at £16m per kilometre (1991 prices) and this is by no means the top of the range. By comparison, a 1.6-km loop of the Parry People Mover has been costed at £269 000, or little more than one hundredth of the cost at Edinburgh. The capacities and terrains are different, but do not explain the cost difference. However, rail is nearly always more expensive than buses and only in times of very low interest rates will the capital cost differences between bus and rail be insufficient to favour buses in terms of total cost of providing a service.

Comparisons of operating costs between buses and rail are even more unclear. With high levels of ridership, rail can be cheaper, particularly in networks such as the Lille VAL where the métro operates without drivers. Certainly in the central areas of large cities, métros and other urban railways do operate with lower staff/passenger ratios than buses and operating costs are very likely lower. In the suburbs the opposite is probably often true but it would be a drastic step for a transport operator to curtail suburban sections of an existing network on the grounds that buses could provide a service more cheaply. In any case, there would be some effect on the viability of the inner urban sections of the rail network, having lost some of their customers from the suburbs.

In choosing between buses and rail on cost criteria there are two fundamental questions to pose.

- Will the capital costs of rail be so much higher and the interest payable be such that any savings in operating costs will never balance this out?
- Will the form of public transport network be such that for most of the time and over most of the network, ridership will be higher than the 70 or so passengers that could be accommodated on a bus?

7.1.4 Maintenance

Public transport systems allow for a certain number of spare vehicles beyond the number in service at peak times and this is influenced by the servicing needs of the vehicles. In some developing countries where access to spare parts and servicing skills is not as good as it might be, the proportion of vehicles out of service is too high. To keep all parts of the network in service, maintenance of track and fixed equipment may be even more urgent.

Simplicity, ease of access to and replacement of parts and standardization of parts are all virtues for any form of technology, especially in situations where there are liable to be problems with the supply of spare parts and skilled maintenance staff.

7.1.5 Adaptability to the route

The physical nature of the route—steep slopes, tight bends between buildings, the subsoil, geology and water table (for underground or viaduct construction), width of roads and sharpness of bends (for buses)—will all sometimes affect what kind of public transport is chosen. Any form of public transport can be installed on any route, but the cost of construction will be high and there may have to be a great deal of disturbance to property if we choose for a highly constrained route a form of public transport not easily adapted. One of the advantages of light rail over other forms of railways is that they are more adaptable to tight curves, inclines and other route constraints and can therefore be used to take passengers right through city centres and close to their final destinations.

It is possible to recognize a sequence of increasing adaptability to route, starting with minibuses as the most adaptable, through single-decked buses, double-decked buses, articulated buses, tramways and métros to heavy rail, the least adaptable.

7.1.6 The environment

TEST (1991) concluded that rail systems perform better than road transport on nearly all environmental criteria. In terms of the street environment, the main possible advantage that buses offer over rail is the absence of overhead cables, supporting poles and other infrastructure. Even this hardly applies to flywheel-powered railways. Rail offers clear

advantages over buses in terms of lack of on-street air pollution, less noise, less ambiguity of path in pedestrian streets and fewer vehicles for a given route capacity. Buses do tend to cause more intrusion than rail but how much more depends a great deal on how the bus services are operated. The standard of maintenance of buses has a big effect on the air pollution from them and the width of the street affects how much this is felt.

7.1.7 Land use effects

Whilst our older cities are littered with disused railway lines, it would take very careful scrutiny to detect disused bus routes. The adaptability of bus routes to changing land use patterns is good for the operator but it does mean that there is a lesser commitment to property developers intending to invest near to a transport terminal. The prospect of bus services is probably less attractive to commercial developers than the presence of a railway station, although it has to be said that the coincidence between commercial development and rail services has been inconsistent. Some main line railway stations such as Victoria in London have attracted a lot of commercial development. Some other urban railways have attracted none.

What can be concluded is that railways do give potentially higher levels of accessibility than buses and where other circumstances are favourable, this might be translated into more intensive use of land, higher densities and land values. High capacity access does permit, but does not necessarily cause, a more compact city where total travelling is potentially less.

7.1.8 Ridership

The options regarding form of transport will have a range over which each is the most economic form in terms of cost per passenger-kilometre. As a general rule, railways are able to provide place-kilometres cheaper than buses but usually cost per passenger-kilometre is important.

It is possible that the advent of a public transport service will increase demand for the service itself. London Docklands Light Railway has played a part in permitting the high density development of West India Docks and in turn has helped to create demand for itself. However, many other conditions as well as availability of transport have to be present for high density commercial development to take place and there needs to be great caution exerted before assuming that transport-generating uses will follow the initiation of a public transport service.

Sometimes it is true that the form of public transport operating nearest to full capacity is the most economical form. A bus service operating at one-third capacity will probably be more economical than a train service on a comparable route which would probably be much less than one-third full. However, a rail service operating half full may cost less per

passenger-kilometre than buses on a similar route, even if they are more than half full. Because of differences in cost per place-kilometer, the percentage of places filled is a very unreliable guide to the economics of choice between forms of public transport.

7.1.9 Access for the disabled, elderly and other mobility-impaired passengers

Railways have the advantage for the mobility impaired. Level access from a platform is more easily provided (although often there is none), there tends to be more space in railway vehicles for wheelchairs, childrens a pushchairs or luggage and most railways offer a smoother ride than buses. There is however, the problem with railways, that for many journeys, another form of public transport is needed to get passengers to stations. These too should be adapted to the needs of the travellers.

Low-floor buses have been introduced in France, Holland and Germany for example, but even these will need some form of kerb or platform for level access. Buses do not lend themselves as readily as railways for level access because of the need for kerbs or platforms which do not always fit easily into the street scene and because vehicles need to draw up to an exact position in relation to the platform. This is one of the benefits of guided buses.

7.1.10 Comfort, reliability, speed

To suggest that railways are superior to buses on these criteria may cause a wry smile from some rail commuters. Nevertheless, as a general rule they are better. Many rail services have a bus alternative, so rail users must think so too. The discomfort of bus journeys is more a result of pinching space standards than any inherent deficiencies of the motor bus. Unreliability and low speed could also be remedied by adequate priority measures. The only reasons why buses are uncomfortable, unreliable and slow is because operators have a keen eye on cost, manufacturers oblige and those involved in road traffic management do not give enough priority to public transport. When designing carriages it is assumed that bus users are at least 20% smaller than rail passengers. The comfort, reliability and speed of a public transport service is more a result of decisions on how the service is to be implemented than on choice of any inherent qualities of the vehicle.

7.1.11 Creating impressions

Sometimes a particular form of public transport infrastructure is chosen because the promoter thinks it will create a desired impression amongst users and other relevant parties, perhaps clients, industrialists or developers. The

600-metre Maglev connection between Birmingham Airport and Birmingham International Railway Station is a demonstration of technology as well as a means of transport. The monorail at the Merry Hill Shopping Centre between Dudley and Stourbridge is an entertainment as well as a way of travelling around the site. The trams at Blackpool are as much a seaside novelty as a means of transport.

In the past two or three decades many continental European or North American cities have built light rail partly as a demonstration of civic pride and confidence in the future, a sentiment echoing those behind some of the magnificently ornate 19th-century railway stations and town halls for example. Railways are not merely a means of transport, they have been also statements of civic confidence, hence the relative lack of cost consciousness towards them, compared with buses.

7.1.12 Passenger safety

There are two kinds of safety to be considered: safety from accidents involving vehicles and safety from assault and other crime. Along with reliability and speed of service, safety from accidents is an argument for public transport on its own right-of-way rather than sharing roadspace with other vehicles. This applies particularly to the street running of light rail. Although on balance a separate right-of-way is becoming increasingly favoured, it does have the disadvantage of being less in contact with the environment of the users and can be more remote than public transport sharing rights-of-way.

Safety from assault has become an increasingly significant issue especially on railways. For both buses and railways, more open designs have been used to improve visibility and contact with all parts of the vehicle or station. Replacement of compartment trains by corridor trains, of double decked buses by single decked buses are instances.

7.2 SOME OF THE MAIN CHOICES

As for other project choices, here we have a cost-benefit situation with all the complications that are involved. (An outline of the main problems is contained in Simpson (1985), Chapter 9.)

Clear objectives for public transport are an essential requirement in the choice of technology. A problem has been that the decision on technology is usually made by organizations who even collectively, are not responsible for all the significant objectives likely to be attributable to public transport. A clear case is that investment in public transport for environmental reasons is likely to be undervalued because transport authorities are not primarily responsible for environmental protection. The same applies to the Department of Transport. The peripheral involvement of planning

authorities and the Department of the Environment in public transport decisions is unfortunate.

7.2.1 Buses or minibuses?

Minibuses have been in use for several decades but were not much used on stage services by public transport operators until the latter half of the 1980s. Their advantages over the conventional buses that they replaced may be listed as follows.

- Minibuses are cheaper to buy and to operate (in terms of cost per vehicle, not cost per place). Minibus drivers' wages are lower.
- A more frequent service can be provided with minibuses for the same cost as a conventional bus service. Increased frequency has been important in attracting more passengers.
- The driver can keep closer surveillance on a minibus, thereby reducing vandalism and litter. This also gives passengers an assurance of safety from assault.
- Minibuses are more manoeuvrable. They can operate on routes difficult for conventional buses and can so give a finer service network. They also cause less damage to kerbs and street furniture on tight bends.

The main problems with minibuses are as follows.

- Cost per place per mile is higher than for conventional buses and so where there is heavy demand they are more expensive to operate.
- Many models seem to have a shorter working life than conventional buses.
- Minibuses usually lack of space for passengers and luggage and are not as comfortable for passengers.

7.2.2 Buses or light rail?

The choice between buses and rail is one which exists primarily for the most heavily used routes in urban areas. There are however, exceptions. Some varieties of people mover are suited to quite low ridership and may compete with buses on economic criteria with passenger flows as low as 4000 to 5000 per day in each direction. However, as a general rule, few towns below about 200 000 population have routes used heavily enough to support local rail except a few tram routes.

Above perhaps 2–3 million population, some routes are so heavily used that the absence of a local rail network would give rise to conspicuous inconvenience. In the developed world, most cities of even 1 million population are seeing it as a matter of civic self-respect that they should develop a metro or other local rail network. For cities of over about 200 000 population, the prospect of some form of rail is worth considering. The choice is whether to rely entirely on buses or whether to have a

railway network as the backbone of the public transport system complemented by bus services. A few large cities such as Frankfurt rely almost exclusively on railways for public transport in the city centre but the great majority of city centres have a substantial number of bus routes and rely on buses for public transport in the suburbs.

In rural areas the choice is not whether to build rail or use buses but whether to maintain any rail service they might have or switch to buses. Nearly all viable rail services in rural areas are inter-urban. Even for such lines as these, rural stations will fall into disuse if there are insufficient users to justify trains stopping frequently, which results in slower and less attractive services.

We may well wonder why rural railways are nearly always 'heavy' in the sense explained in Chapter 3, if lack of demand is the problem there and considering that light rail is cheaper and of lower capacity than heavy rail. Some of the newer local rail rolling stock is lighter in construction that its predecessors, but rural rail is still basically 'heavy'. Amongst the reasons, we may surmise that reluctance to replace existing rolling stock and equipment explains a great deal. Gradients, radii of curvature and spacing of stations fit 'heavy rail' but could be used for light rail. Platform height is perhaps one of the main problems.

Despite the tough conditions under which public transport has to operate, there are signs of some revival of interest in local and even central government. It is difficult to say to what extent the surge in interest in light railways in the UK from the mid 1980s has been a consequence of a revived interest in public transport and to what extent it has contributed to it. Certainly the proposals for improvements to bus services have been more modest than those for light railways. Studies have been of smaller scale but they have increased since 1990 or thereabouts, both in scope and number.

At first, in nearly all of the 50 or so towns where light rail studies had been carried out, there was no serious consideration of improvements to buses as an alternative or complementary means of addressing the same issues as light rail. Edinburgh, Glasgow and Leeds were amongst the exceptions and recently several other towns have taken buses more seriously. This clear and obvious omission has not gone unnoticed. Perhaps Department of Transport Circular 3/89 has helped the bus studies along by insisting that in order to obtain a grant, a scheme must be 'the most cost-effective way, from the viewpoint of the public sector, of achieving the desired objective'.

It is likely that many of the light rail studies for settlements of less than 300 000 to 400 000 population will have to recognize that improvements to bus services may prove to be more cost-effective than light rail on several criteria. Light rail will have the advantage only where journeys are long enough for buses to be regarded by significant numbers of travellers to be too slow or too uncomfortable or where the environment is

particularly sensitive. The bus industry will miss important opportunities if it is not ready to respond as the majority of the light rail studies fail to show it to be superior to investment in improvements to bus services, or show a need for the support of buses to bring passengers to the stations and otherwise complement a railway network.

Light rail tends to be better in terms of capacity, comfort, access for the elderly or disabled, air pollution and compatibility with environmental improvements such as pedestrianization. Light rail may offer a faster service than buses. It certainly does when buses do not have priority over other road traffic, but it is doubtful whether it would provide a faster service than buses on reserved rights of way.

Light rail has been claimed to incur lesser operational costs than buses, largely because there will be a lower crew/passenger ratio when light rail is operating near to full capacity. On the other hand, there are costs of maintaining power supply, signalling equipment and track and the costs of maintaining the vehicles may be higher due to the need for more specialized skills being needed. Buses usually involve much lower capital cost per passenger than light rail, they are more flexible in terms of route and due to their relatively extensive and close networks of services, usually involve fewer changes of transport than does rail. As there are generally many times more bus stops than railway stations, most passengers will have shorter distances to travel to pick up a bus than a train. Rail on the other hand, does tend to support higher densities of land use, more intensive use of land and probably higher land values.

Such a comparison can only refer to buses and light rail in a rather generalized way. Both light rail and buses vary a great deal in terms of their performance on the criteria mentioned. Some of the very light forms of people mover are much cheaper than more standard forms of light rail but have very low capacities. Lightweight people movers can be more competitive with buses in terms of capital and operating costs and are suitable for closely spaced stops. In a general way, however, rail is more suitable for longer journeys than buses, journeys which tend to be associated with larger settlements.

Part of the reason for enthusiasm for light rail is transport authorities' presumption (probably justified) that there is public demand for improved local transport services—improved in terms of several criteria including speed, comfort, reliability and compatibility with environmental improvements in city centres.

One of the most potent reasons for developing light rail has been decision makers' and probably public perceptions of image, for want of a more precise expression. Buses have long been perceived as being rather down-market, not the kind of transport to be used by those who value their time. An aspiring executive would feel less uncomfortable on the local railway than a local bus. Speed is important in this perception. In a study comparing ridership on the new French métros in Marseille, Lyon and Lille

and the new French tramways in Nantes and Grenoble, it was found that the tramways, which operate at speeds little faster than buses, do indeed have a similar clientèle to buses in terms of socio-economic groups, whereas the métros which operate faster, cater for a higher proportion of the more prosperous groups.

Light rail has been shown to be compatible with pedestrianized shopping streets. In cities such as Grenoble, Gothenburg or Bremen, surface tramways operate in otherwise pedestrian streets to give access with little environmental damage. In Lyon, Lille, Frankfurt and Munich for example, underground railways fulfil the same rôle.

If buses are to be used for the same purpose, careful attention will need to be paid to protecting the quality of the environment and the upholding of road traffic restrictions. In Nancy, dual-mode trolleybuses/diesel buses are used along parts of the main shopping streets. Otherwise there are regulations for traffic restriction. However, this has not led to an environment of quality equal to that associated with the Grenoble Tramway for example. In Nancy, pedestrians wisely keep to the footpaths, whereas in Grenoble they feel far more free to walk where they choose. The net effect is a poorer environment than in Grenoble.

Does the building of light rail take away or increase the custom for buses? Evidence suggests that it does both. Typically around 70% of passengers on the newer light railways such as in France formerly made their journeys by bus. The opening of light rail, as expected, does take away a substantial number of bus passengers. However, in a study of 53 transport authorities in Britain, France and West Germany, ridership on buses in cities with light rail was higher than in cities without (Simpson, 1988b). The result may have been influenced by the rationalization of bus services which often accompanies light rail development. Also, authorities with rail-based networks tend to be larger, and public transport usage does tend to increase with city size.

In some cases, however, there is an increase in bus usage following the opening of urban rail. In Marseille, the number of public transport passenger journeys between 1968 and 1977 (when the métro was opened) varied between 80 and 90 million per year. This figure included some journeys on the short tramway. In 1984 the number of journeys by bus was 96 million. The Marseille métro was built in an environment where a conurbation-wide transport authority ensures coordination between modes of public transport. The questions arise as to whether there will be any significant differences due to the British competitive environment and if so, will they favour buses or light rail?

Regulation is more likely to be favourable to capital-intensive fixed track transport rather than buses. Buses are more able to compete with rail rather than vice versa. Bus operators, unlike the operators of fixed-track systems, can change route and compete or withdraw as appropriate.

The land use pattern is equipped for buses. The housing density of British cities is low by comparison with most continental European cities. The low density has no doubt been influenced by the development of all large British cities except London using the bus as the dominant form of public transport. A change to a land use pattern compatible with rail transport could take place, but it would take several decades before it could happen on a substantial scale. In the meantime, urban rail would have to operate with densities predominantly loo low for it to be economic.

7.2.3 Choosing a suitable form of urban rail

In western Europe, most cities of over about 350 000 population have given some thought to light rail development in recent years and several have developed it or upgraded tramway or métro systems which they already had. In continental Europe there has been a tendency in cities of less than about 600 000 to 700 000 population to opt for some form of tramway with métros in larger cities.

In Gothenburg (population of the city 424 000, of the region 700 000) the idea of replacing the existing extensive but in parts elderly tramway network was discussed at length during the early 1970s. It was eventually decided to modernize and upgrade the tramways to what are perhaps amongst the most sophisticated anywhere.

The French cities of Nantes (conurbation population 475 000) and Grenoble (373 000) also opted for tramways, following métro development in the larger cities of Marseille (1 110 000), Lyon (1 220 000) and Lille (936 000). Several German cities such as Frankfurt (population of transport authority 2 400 000) and Munich (1 300 000) are gradually replacing parts of their tramway (Straßenbahn) networks with sections of U-Bahn (heavier variety of métro in Munich, lighter variety in Frankfurt).

Elsewhere in what was West Germany however, the choices between Straßenbahn (tramway) and U-Bahn (métro) have been less clearly related to city size. Whilst the largest cities of Berlin (population 3 180 000), Hamburg (1 600 000) and Munich (1 300 000) have local railways clearly recognizable as U-Bahnen, Cologne (1 100 000) and Hanover (1 100 000; Figure 7.2) have updated Straßenbahnen, more accurately described as light rail than U-Bahnen. The Rhein-Ruhr conurbation (population 7 000 000) is served by a Stadtbahn somewhat intermediate in character between tram and U-Bahn (métro). Cologne, Hanover and the Rhein-Ruhr conurbation show that light rail can serve cities considerably larger in population than have been associated with tramways in France. In Bremen on the other hand (population 548 000), there was a conscious decision to opt for a modernized tramway system instead of a U-Bahn. Bremen is one of the largest ex-West German cities not to develop a new U-Bahn or

Figure 7.2 Light rail in Hannover.

Stadtbahn during the past 30 years (except, of course, cities such as Hamburg and Berlin which already had one).

There have been some differences between these choices made on the continent of Europe and the proposals being made in several British cities. The British proposals are mostly tramways despite in several cases, being for cities of a size far larger than that thought suitable for tramways in some continental European cities. The lower density of most British cities is probably the explanation, as métros and U-Bahnen need higher demand than tramways.

There is room for different systems in the same city. Buses operate in every city but their rôle varies. In British cities, apart from London, they account for a very large proportion of public transport journeys and form a main structure to the network as well as very local stopping services. Many cities have a network of limited-stop services whose purpose is similar to that of rail networks in continental European cities.

Light rail can have any of several purposes. It can be a very local link such as Maglev from Birmingham Airport to the Birmingham International Railway Station, the monorail at the Merry Hill Shopping Centre in Dudley or the Poma 2000 railway connecting the SNCF railway station to the town centre in Laon (Picardy). Such railways are influenced only indirectly by city size in that the population of the conurbation will support the shopping centre or other traffic generator associated with them.

Alternatively, light rail can be the backbone of the public transport system for a whole city like the Gothenburg Tramways. The rôle of light rail can fall

anywhere between the two extremes, as in London Docklands. A city can rightly contain several different kinds of light rail operating for different purposes.

Choice of the form of light rail does have quite clear effects in terms of ridership. Tramways tend to be treated more like buses in terms of who rides on them, for what purpose and for what length of journey than do metros.

8

CHOICE OF ROUTE FOR LOCAL PUBLIC TRANSPORT

Even for railways and other fixed track public transport for which the choice of route should have been clearly seen as an important decision, it has not always been treated as being as significant as it merits. Whilst it is true that some of the recent light rail studies, such as those in France, have included a rigorous examination of route alternatives with a view to finding the best one rather than just a satisfactory one, this has certainly not been the case even in some of the most advanced of the British light rail projects.

In a few cases, politicians have placed great emphasis on the desirability of building a railway, apparently without appreciating the significance of the route in affecting whether or not it succeeds. Their professional advisers have sometimes taken the 'easy life' solution by supporting a route which will be easy to build in political and technical terms.

Discussion about route has been limited and sometimes confined to whether the route is satisfactory rather than whether it is optimal. The question of what criteria should be used for choosing the route has had little discussion. The processes by which routes have been chosen have not been sufficiently explicit. Certainly many of the routes are not those which would attract most riders and some of the routes would not attract sufficient to be viable.

Choice of route is important for buses too. Routes can be easily changed but usually continue for decades. Their adaptability is not a reason for playing down their significance. In fact, route research and monitoring should be a continuous activity for bus operators, as it is with some of them.

Particularly for bus routes, there will be a trade-off between service frequency and the number of routes operated. Bus routes can be operated with a very wide range of frequencies from one bus every few minutes to one bus in as many hours or even days. It is not necessarily uneconomic to operate

infrequent bus services if that is all that demand justifies. For railways it is different. A very infrequent service will not justify the capital investment in track and fixed equipment. For this reason, where there is a choice to develop railways or buses along a particular route, service frequency will be a significant criterion.

In choosing routes for public transport, there are two kinds of decision to be made, relating to the kind of route pattern and the choice of route location.

8.1 ROUTE PATTERNS

8.1.1 Radial

Usually from suburb to town centre, these are very common for bus routes in larger cities. Some railways are also radial, particularly where local services use track which was designed for travel over longer distances between towns. Such main line stations are often located on the periphery of the city centre with poor penetration within the centre to take passengers close to where they wish to go.

Some radial bus routes give quite good penetration for distributing passengers within the city centre. Others terminate on the near side of the city centre. The choice is an important matter of policy for the bus operator or transport authority. Good penetration tends to cause services to be slow and unreliable due to traffic congestion.

8.1.2 Cross-city

These form two radial routes crossing the city centre. In the larger cities of over about half a million population, cross-city bus routes are less common than in smaller cities. This is because traffic congestion in the city centre is a deterrent to buses. In order to avoid delays, departures from timetables (particularly on the second half of cross-city routes) and high costs of operation in congested conditions, some bus operators use the principle of ending services on the near side of the city centre from where the bus is coming. The problem with this kind of route is that it results in many passengers having considerable distances to walk from the terminus.

Railways, in fact any form of public transport with a reserved right-of-way, usually form a cross-city pattern, unless they are operating on old tracks which were not built for local travel. A cross-city pattern, as operated by most métros and tramways eliminates the need for depots and turning space on valuable city centre land and will increase the speed of operation. In many cities, cross-city railways have been formed from two or more radial routes.

For both radial and cross-city routes, especially for buses, there will

usually be a merging of services onto a small number of radial roads as they approach the city centre. A mile or two from the city centre, where services have merged, there may be a very large number of services on some of the radials. There arises the question of whether suburban services should end where services merge, connecting to high capacity services for the remainder of the journey to the city centre. Some light railways have been planned on this principle, the railway providing the high capacity access to the city centre, connecting to bus services which come together at interchanges at the termini of the railway. This kind of public transport network is likely to be more economical to operate than one where a large proportion of services go through to the city centre, but has the considerable disadvantage of causing the need to change vehicles for a large proportion of users.

8.1.3 Orbital routes

These are most common in large cities, although in a few cases they have been part of the pattern of new settlements. In Runcorn and Redditch, bus-only roads have been constructed as part of new town development. These connect new suburban commercial centres to each other and to the old town centres and in Runcom, also to Shopping City, which amounts to a new town centre.

Orbital bus routes may be operated as distributors within a city centre or they may connect radial or cross-city services, usually also connecting suburban centres of some significance in terms of journey patterns. It is quite rare for orbital bus routes to operate on more than very limited sections of specially constructed orbital roads. These are mostly located away from the start and end points of public transport journeys and are therefore in the wrong locations for orbital bus routes. Many of the roads used by orbital bus routes are quite narrow and winding compared with radial roads, not constructed for high capacity traffic. They are, however, less congested as a rule, and so orbital bus services are not necessarily slower than radial services.

Orbital railways are characteristic of only the largest cities although there are a few cases of circular routes which pass through the city centre and cater for radial as well as orbital traffic. The Glasgow Underground is a case in point. Some orbital railways such as the Circle Line of the London Underground act as city centre distributors, and as connections for cross-city journeys, connecting several of the main line stations.

8.1.4 Suburb to suburb routes

These function as partial orbital routes. Usually they connect suburbs which are significant in terms of transport demand and so act as radial routes to suburbs rather than radial to the main city centre. Like orbital routes, they

are most common in the larger cities, of over about a million population. In smaller settlements, it is less common for there to be suburban centres which are sufficiently well developed to attract a significant number of passengers from other suburbs.

8.2 CRITERIA FOR CHOICE OF ROUTE LOCATION

8.2.1 Ridership

Satisfying travel needs is obviously a fundamental purpose but it is also worthwhile to ask whether it is a purpose of public transport to stimulate travel demand. Some public transport routes (and even worse, roads) have been 'justified' on the grounds that they will create demand for travel. This is rather like justifying the digging of holes in roads on the grounds that they cause a need to fill them in. The travel may result in other benefits such as genuine job creation (rather than transfer). If it does, stimulating travel demand will be worthwhile.

Public transport routes, particularly fixed track routes such as railways and busways, have been used to complement town planning policies relating to the structuring of settlements and the connecting of suburbs to each other and to a city centre. Many continental European city structure plans are based on a hierarchy of central places connected by rapid transit routes, usually railways.

The number of passengers on a future railway for example is conventionally estimated from the effects of rail trip generating factors within a specified distance (commonly about 400 metres) of each station. Trip generating factors will include resident population (for outward migration), age structure, household size, car ownership, types of occupation, number of people employed (inward migration). These will play a big part in the general location of route and stations, modified very locally by access requirements. Similar factors will affect the number of passengers travelling by bus but there will be more emphasis on the route and less emphasis on stops. Being closer together, the consequences of a less-than-ideal location will not be as serious.

Special benefits for targetted groups, for example bus routes near to old peoples' homes will also have some influence on the locations, of stops more than of routes.

In estimating the number of public transport journeys there is a lot of scope for the forecasts to vary a great deal according to the assumptions and opinions used in the calculations particularly if there are assumptions about land uses around the stations after the line is built. Realistic forecasts would have to rely on studies of the journey patterns of people with origins or destinations around the stations, comparing these with the mode of transport available, including the private car as well as public transport.

It is possible that the opening of an improved means of public transport

will persuade some motorists to use it instead of their cars, but it would be unwise to assume this on a significant scale unless there are severe disincentives to travel by car such as tight parking control or severe road traffic congestion. It is likely that a new means of public transport will cause some new journeys to be made, mainly for optional rather than essential reasons. Some new building or intensification of land uses may take place around stations but this should not be assumed unless there is good evidence of local demand for it.

Walmsley and Pickett (1992) found that rapid transit systems on average carry around 50% fewer passengers than forecast (and cost around 50% more). One of the contributory factors seems to have been the use of models for forecasting highway traffic. When forecasting public transport ridership there is the additional task of forecasting choice between modes (between car, bus and light rail perhaps). Even if commercial development follows the opening of a public transport route, only a proportion of those travelling will use public transport.

Where it is possible to use before and after data on public transport systems, revealed preference techniques may be used to derive behavioural data on travellers. Where there is no before and after data, stated preference techniques may be employed, whereby potential travellers are asked to choose between transport modes under varying conditions such as frequency, speed, fares and other factors liable to affect their choice.

8.2.2 Convenience for passengers

Choice of bus routes in city centres will usually involve a trade-off between a high degree of penetration in order to take passengers close to their final destinations following what are often slow and circuitous routes along congested roads, and little penetration, with only a few stops on the near side of the city centre from where the bus is coming. Where there is little penetration, services will be inconvenient for many passengers in that they will not be close to their final destination but the services will be faster and the timing more reliable.

In the suburbs there will be choices between the degree of penetration of minor roads with slow, circuitous routes and the directness and speed of radial routes.

Convenience will be reflected in ridership to some extent but not fully. Most public transport passengers do not have an alternative and if inconvenienced have to put up with it.

8.2.3 Ease of construction

Ease of construction may be seen in both technological terms and in political terms. Proposed rail routes usually cause some adverse reaction from residents and others very close to the route or in the way of it.

Compensation for loss of property is usually at market value. This is inadequate. If market value was enough to fully compensate, more properties would be for sale. Under such conditions, it is not surprising that there will be a reaction against any route which will result in demolition of property. Nor is it surprising that promoters of public transport projects take the easy way out by choosing routes which avoid property demolition, even if there is hardly anyone nearby to use it, especially if the project is not to be funded by those who propose it.

Sections of lightly used railway lines have been included in many of the recent British light rail projects. These will be easy to construct in technological terms in comparison with new routes and as they involve no demolition of properties and little disturbance by way of noise or vibration for example, will raise no vociferous objections. Demolition of a limited number of properties to construct a route which would be well used raises far more objections than the waste of money on a route where hardly anyone would use it.

Public transport proposals hardly ever get a lot of public support. When built, métros, tramways, even bus routes which few people said they wanted, often attract a lot of users. As proposals we hardly ever see the vociferous support comparable to the protests from a limited number of people who feel aggrieved, nearly always from those who live (too) near to the route.

To be useful, public transport routes have to come close to the places where people live, work, do their shopping and all the other activities for which they might use public transport. Except in a new town situation, public transport routes, nearly always railways, will come too close for comfort as far as some local people are concerned. There will be some property demolitions. The solution is to pay generous compensation to those who lose their properties or are otherwise adversely affected, in order to secure a route which would be well-used.

8.2.4 Cost of construction

As a yardstick we might expect underground construction of a railway to be around five times that of surface running and viaduct construction about twice that of surface construction. For a detailed analysis of costs see Simpson (1990c).

Underground construction depends for its justification on there being very high costs in terms of demolition and disturbance to property and activities by surface construction. Because of the exclusive and uninterrupted right-of-way, underground railways often have a higher capacity than local surface railways, or at least a surface railway would be very disruptive if given sufficient priority for capacity equal to that of an underground railway.

Cost-benefit analysis provides a useful framework for putting construction

costs into perspective. Some of the costs and benefits likely to be very influential in determining choice of route and form of construction (surface, underground or viaduct) and type of technology may be listed as follows:

- assumptions about interest rates;
- forecasts of ridership and assumptions about revenues;
- assumptions about non-user benefits: the question of whether there is any relief of road traffic congestion, the value of the part played by public transport in environmental improvement projects near to the route;
- ground conditions.

Walmsley and Pickett (1992) found that rapid transit system costs were on average around 50% higher than forecast. Above all, this was due to optimistic forecasting. Other contributory factors were deviations from the systems originally planned, costs of environmental improvements and ground conditions more difficult than anticipated. The cumulative effects of small changes in design or standards causing delay and cost increases were also significant. Manpower productivity was often not as high as forecast, making operating costs higher than anticipated.

8.2.5 The environment

Noise, vibration, even the visual effects of public transport can sometimes be factors which cause a route to be planned so as to avoid particularly sensitive areas. Certainly these are amongst the objections which have been raised by residents against proposals to build railways, even light railways, close to their properties.

Increasingly common, however, and particularly in city centres where a large proportion of buildings close to public transport are non-residential, light railways are seen not as a destroyer of the peace and quiet of the locality but as a complementary part of projects to improve environmental conditions. This is partly because the occupiers of offices, shops and other non-residential buildings are not as sensitive to noise, vibration and other environmental consequences of public transport as are residents. They are more accustomed to such effects from heavy traffic. It is also because public transport is seen as replacing the far greater environmental effects of road traffic.

Light railways, and to a lesser extent buses, provide high capacity access with far less damage than the private car. They can therefore be used to provide the access needed to town centres after the private car has been restrained. There are many cases where railways, particularly tramways and métros or bus routes have been planned to serve streets where other road traffic has been severely restrained.

The issue of public transport in environmentally sensitive areas is taken up in more detail in the next chapter.

9

PUBLIC TRANSPORT AND ROAD TRAFFIC RESTRAINT

9.1 WHY CITIES NEED ROAD TRAFFIC RESTRAINT AND PUBLIC TRANSPORT

Urban rail and to a lesser extent, buses, give higher capacity access than the private car with less environmental damage and less demand for land devoted to transport in the form of highways and parking spaces. Public transport therefore gives two advantages for commercial prosperity in town centres: a high level of access, and it allows road traffic restriction or traffic calming with consequent environmental improvements. If the environmental improvements are effective, presumably they will result in greater demand for access, hence the significance of public transport in providing it.

The negative side of public transport is that it is less convenient than the private car, particularly if there are goods to carry. This disadvantage of public transport can be reduced by improving services but not fully overcome. It will usually be necessary to restrict the private car, deliberately or passively by failing to cater for motorists' demands for roadspace and parking. Otherwise, if parking and road capacity are adequate to meet motorists' demands, there will be no substantial change in modal split towards public transport.

Very high levels of accessibility by private car are becoming increasingly unacceptable due to the large amounts of land required for roads and parking, unacceptable levels of noise, smell, air pollution, severance by roads and car parks and the visual effects of cars and car parks. In any case, a large minority, if not a majority of people do not have access to a car. City centres and suburban centres under the influence of the private car spread out. Shops, offices and the other buildings that people want to get to become separated by large areas of land devoted to parking and by high capacity roads, impossible to cross except by underpass, unpopular

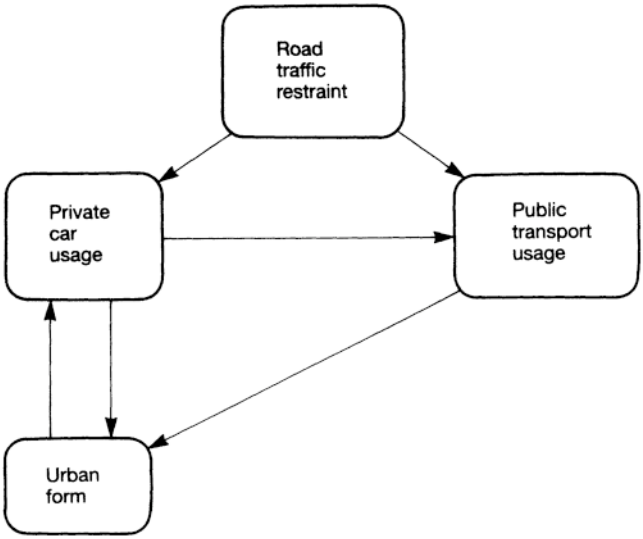

Figure 9.1 Interaction between private and public transport, urban form and road traffic restraint.

due to fear of assault, or bridge, unpopular due to their appearance and the effort needed to climb them, especially for the disabled and those with prams for example.

Supermarkets, hypermarkets, megastores and business parks come to consist of isolated buildings dotted amongst a prairie of tarmacadam and a tangle of roads, fine for wheels, inconvenient for legs. When dependent on the private car, city centres disintegrate, become difficult to serve by public transport and impossible for the pedestrian. City centres need road traffic restraint. Traffic restraint needs public transport in order to maintain access. To be economically viable, public transport needs restraint on the private car. Without restraint on the private car, public transport usually needs very high levels of subsidy as is the case in many cities in the USA for example.

These relationships are sketched in Figure 9.1 in which road traffic restraint can take the following forms.

- Physical restrictions on vehicular access—the restriction or exclusion of defined categories of vehicle or on defined days or at defined times of the day. Emergency vehicles of course will be exempt and often so too will those with disabled orange badges. In many cases, delivery vehicles will be allowed at specified times such as early in the morning.
- Stopping up of streets—definition of an area to which there is a reduction in the number of access points so as to discourage through traffic. Traffic cells operate on this principle.

- Traffic calming measures—redesign of carriageways introducing more bends for example, humps, roundabouts, reducing carriageway width, low speed limits and other devices to reduce speeds of vehicles.
- Restriction in the number of parking places—restrictions on stopping and waiting, pricing of vehicle parking.
- Road pricing—the charging of a fee to use specified roads by such measures as toll booths, use of electronic vehicle detection devices and supplementary licensing.

In Figure 9.1 the term 'urban form' refers to density of building, spacing between buildings, capacity of the road network, degree of segregation of land uses and separation of related land uses such as home and work, size of schools, health centres and other sites where the catchment areas will be affected by the size of the facility.

The relationship between private and public transport usage has been shown as one way to reflect that an increase in private car usage will cause a decrease in public transport usage. It will not always be the case. The reverse relationship has not been shown, implying that more public transport journeys do not decrease car usage. This is based on the assumption that there is latent demand for car travel which will be released if some motorists transfer to public transport. Again, the relationship is much more complicated than can be represented on a diagram.

The relationship between urban form and private car usage is two-way. Cities developed under the influence of the private car are of low density and have other characteristics already mentioned. Conversely, urban form, if controlled by town planning policies, will affect the capacity to accommodate the private car and therefore the use of it.

Road traffic restrictions will affect both public and private transport usage both in terms of numbers of journeys and modal split and these will influence urban form in terms of density, layout and the configuration of land uses.

The fundamental reason which limits the extent and severity of traffic restraint by many city authorities is the high level of demand of the use of the private car and the authority's fear of how motorists would react to restraint: reactions in terms of their deserting the city to go elsewhere, possibly also in terms of voting behaviour at the next election by motorists and others affected such as shopkeepers.

Some forms of traffic restraint such as speed limits and the restriction of parking, waiting or even use of roads by heavy goods vehicles are commonly applied over large areas of our towns and cities. Some of these policies will have an effect on local public transport, mostly favourable, as the restrictions apply mainly to other traffic. However, the main forms of traffic restriction which affect urban public transport are those which are directed at the private car and mostly applied over limited areas, most commonly town centres.

Traffic calming has been applied both in city centres and in suburbs. There are many well-known city centre projects. Many have been carried out together

Figure 9.2 The Dusseldorf Straßenbahn in a pedestrian street.

Figure 9.3 Avenue Alsace Lorraine in Grenoble has been pedestrianized.

with pedestrianization. This refers to the restriction or total prohibition of vehicular access, whereas traffic calming refers to reduction in speed. More often than not, the streets affected include principal shopping streets—streets where the environment is commercially significant and where there are large numbers of pedestrians and a high risk of traffic accidents.

Suburban traffic calming is, in many cases, in districts of housing built in long streets on a grid iron pattern in the two or three decades prior to the First World War. Such a street pattern has allowed vehicles to reach quite high speeds. Traffic calming offers a very significant reduction in accidents between vehicles and pedestrians and an even more significant reduction in the seriousness of the injury in those which do occur.

Wherever applied, traffic calming will reduce the capacity of roads to take vehicles but only in areas of heavy demand will it reduce the number of vehicles which actually do gain access.

It is in city centres where traffic calming is very likely to reduce the number of vehicles gaining access. This is because in traffic congestion, speed is the main determinant of the number of vehicles able to use the roads and traffic calming reduces speeds. In areas of lighter traffic demand, after traffic calming measures have been put into place, the same number of vehicles as before will use the roads, at lower speed.

It is therefore in areas of heavy traffic demand that, after implementation of traffic calming and other restraint measures, access by public transport is needed as a substitute for loss of access by the private car. It is these areas which are the main interest to us—streets where the demand for access exceeds the reduced capacity after introduction of road traffic restraint (Figures 9.2 and 9.3).

9.2 PUBLIC TRANSPORT ISSUES IN TRAFFIC-CALMED AREAS

9.2.1 What level of public transport access is needed and how close must it penetrate into the calmed area? How much walking is acceptable?

What are the opportunities for diverting bus routes from within the calmed area to the edge of it?

9.2.2 Are diesel buses compatible with achieving a high quality environment in pedestrian and traffic-calmed streets?

There have been many attempts to use more 'environmentally friendly' forms of public transport—trams, trolleybuses, dual mode (diesel/electric buses). They have two disadvantages when compared with diesel buses. First, most of them do not have equal freedom of route. Urban rail, trolley-buses and other buses powered electrically from overhead wires are fixed to a defined route. These routes do not penetrate into suburbs as finely as diesel bus services. Passengers will often have to take a diesel bus to get to them and so 'environmentally friendly' forms of public transport tend to involve travellers in more changes of vehicle. If, when pedestrianization or traffic calming of city centre streets takes place, light rail, trams or trolley-buses replace all

diesel bus services in the pedestrian streets, many more passengers will have to change from diesel bus. If, in order to avoid this, only some diesel bus routes are replaced, the remaining diesel buses in pedestrian/traffic-calmed streets will result in environmental benefits being largely lost.

The second disadvantage of most 'environmentally friendly' forms of public transport is that they are more expensive in terms of capital costs and usually also in terms of operating costs. There are some exceptions: some low capacity people movers for example.

Diesel buses do operate in many pedestrian/traffic-calmed streets but are often regarded as environmentally second-best compared with electric power. There are several questions relating to diesel buses in pedestrian/ traffic-calmed streets.

- How serious are the environmental disadvantages of diesel buses as perceived by users and potential users of the streets affected (mostly shopping streets)? Are there any commercial effects?
- How are these disadvantages related to street width and design? It is to be expected that the environmental effects will be perceived as being worse in narrow streets. To what extent does this occur?
- In pedestrian streets, fixed track vehicles have the advantage that their paths are clearly marked for pedestrians. In a street with a tramway, pedestrians have a greater sense of security and a greater freedom to cross the track than in a street with buses. How far can this disadvantage of buses be reduced by clear road markings and carriageway design? The narrowing of carriageways has been a feature of many traffic calming projects, narrowing to what is little more than that needed for a tramway.
- How can the environmental disadvantages of diesel buses be reduced to a minimum? Is there a need for more thorough inspection of vehicles to ensure that emissions are kept low? Deregulation of local buses under the Transport Act 1985 was a big step in the wrong direction.

It is somewhat ironic that the rise in interest in traffic calming in Britain has been accompanied by the demise of the great majority of the light rail proposals published between 1987 and 1989. Around 50 towns and cities were engaged in these studies, of which only Manchester and Sheffield have so far succeeded. One of the most potent reasons for light rail is that it can be developed as a significant part of a package of environmental improvements and traffic restraint measures.

9.2.3 How do underground and street running of public transport compare in effectiveness?

Effectiveness may be defined in terms of the number of users. Perhaps a cost-effectiveness criterion should be used instead of effectiveness alone. As a

Figure 9.4 Street running in Manchester.

yardstick, underground construction may be expected to cost around five times per unit length that of street running. There are wide variations of costs in city centres. Sometimes street running can be expensive and involve longer routes than underground construction but it would be wise to be suspicious of any cost estimate where a street running option is more than one-third that of underground construction for a similar route.

As well as high cost, underground construction has the serious disadvantage that it is dissociated from the commercial, leisure and other activities of the city. A tramway winding through a pedestrian street is highly visible, tempting to use and adds to the life of the street (Figure 9.4). Underground construction is unpopular in some cities and potential users may avoid it for fear of assault.

Tramways with street running may fit well with traffic calming projects. Many of these projects involve reduction in carriageway width, making space which may be usable for street running.

Most of the worlds largest cities however, have opted for underground railways in the city centre. Underground railways are faster than street running and consequently have higher capacity. Street running cannot have exclusive right-of-way in a city centre due to the severance that would result both for road traffic and for pedestrians. Street running always involves some sharing of roadspace with other traffic, even if only at crossings. There are always some delays due to interaction with traffic and pedestrians. Accidents with other vehicles and with pedestrians are a risk. The other main advantage of underground construction is that it does not impede surface traffic and land uses, at least when construction has

been completed. Underground construction by tunnelling will involve much less disturbance during construction than cut-and-cover, whereby a trench is dug and then roofed at street level.

Unresolved questions about street running and underground construction relate to the consequences for ridership: are there any differences between street running and underground construction in terms of their attractiveness to users? Are there any differences in the effects on economic prosperity of the streets they serve?

9.2.4 If there is to be street running, how much priority is to be given to public transport?

Because priority for public transport will involve delays to other road users, the degree of priority is a question of political choice. The level of priority can be quite easily changed.

If the track is at street level there will be sharing of roadspace at junctions. It will need to be decided whether priority is to be given to public transport by automatic switching of traffic lights in favour of public transport vehicles as they approach junctions. Priority will increase speed and reliability of public transport a great deal but at the expense of other road users.

Away from junctions, decisions will have to be made on whether exclusive right-of-way is to be given to public transport and the degree of surveillance of, and penalties for, infringements by other vehicles. Again, these are largely political decisions. Parking vehicles in bus lanes reflects not only thoughtless behaviour by motorists but also a lack of surveillance and/or penalties which are too lenient, if we believe that public transport really should have priority.

The design of traffic calming features can be selective in favour of public transport. Road humps extending the full width of the carriageway are indeed a restriction on buses, perhaps an unnecessary one. Use of low circular mounds instead selectively favours buses and other vehicles with a wide wheel base.

9.2.5 What degree of traffic restraint is needed?

The attractiveness of the city in drawing people to it and the degree of competition from other urban centres will be very significant. The stronger the restraint, the more likely that motorists will consider it to outweigh the advantages to them of an improved environment and therefore the greater the likelihood that they will consider looking elsewhere. In a conurbation with several large centres such as Birmingham and the Black Country, motorists will easily be able to travel to another centre if severe traffic restraint is introduced into one of them. A more isolated city such as Cambridge will be able to introduce more severe road traffic restrictions without fear of causing the motorists to go elsewhere.

As far as the effects on public transport are concerned, the form of traffic restraint will be less significant than the severity of it. The kind of traffic restraint will be most relevant in terms of the kind of vehicle and journey purposes affected which in turn will affect the level and nature of the demand for public transport

9.2.6 What rôle is there for park and ride?

For park-and-ride to succeed it has to be more attractive than complete journeys by private car. As well as positive measures including good suburban car parking and attractive public transport services, for success, park and ride will need measures to make travelling by private car less attractive. Parking restrictions and charges are most commonly used although other road traffic restraint measures may succeed.

If a métro, tramway or other fixed track form of public transport is to be used, park and ride may be particularly useful in bringing passengers to it. A form of public transport on its own right-of-way will also provide faster and more reliable services from and back to the park-and-ride car park compared with buses sharing roadspace. The problem with fixed track public transport for park-and-ride is that demand will rarely be sufficient for public transport to be economically viable. Rather than rail being developed as part of a park-and-ride project, it is more likely that park-and-ride will be an addition to a rail project. This may not be so for low capacity, very light railways such as the Parry People Mover for short distance park-and-ride.

9.2.7 How much car parking is to be provided?

Traffic calming projects in town centres often include additional car parking on the edge of the project area which will influence the needs for public transport access.

9.2.8 Policy towards cycling

Whether cycling is allowed in the restricted area and what provisions are made for parking have a significant effect on public transport patronage in some continental European cities. Possibly, cycling also acts as a check on public transport fares in some continental European cities for example, as many public transport users are also cyclists or potential cyclists.

9.2.9 The design of traffic calming measures

Road humps are a calming measure for the private car, a nuisance to buses and an intolerable obstacle to ambulances, fire engines or police cars giving chase. Low circular mounds instead of humps extending the full width of

the carriageway can give some priority to vehicles with a wide wheel base, including buses and fire engines (and lorries). There is still a need to develop traffic calming measures which can select vehicles. Lack of selectivity will lead to early remodelling of some of the recently implemented projects.

9.3 TRAFFIC CALMING SHOULD BE PART OF A PACKAGE OF TRANSPORT AND TOWN PLANNING MEASURES

For traffic calming to succeed, it will need to be supported by complementary policies relating to private and public transport and to land use planning. Road traffic restraint will cause motorists to consider public transport as an alternative.

When implementing a central area traffic calming project, it is very likely that provision will have to be made for traffic diverted onto other roads. Additional car parking on the periphery of the calmed area may be needed, with park and ride if it is at a significant distance. Ultra-light, low capacity rail may have potential for such short distance park and ride.

Public transport services will need to be at least sufficiently attractive to fill the shortfall between demand for access and ability to achieve it by private transport. In many towns this will involve development of new means of public transport infrastructure, perhaps including light rail and bus priority.

'Green route' has crept into the transport vocabulary to refer to a particular kind of traffic calming project, usually along a formerly busy radial route, and at the same time giving priority to buses. The measures employed might include narrowing of the carriageway, additional pedestrian crossings, mostly at-grade, lay-bys for buses with priority when pulling out and bus lanes.

9.4 SUMMARY AND CONCLUSIONS

Traffic calming and other road traffic restraint measures reduce the capacity of the road network. They reduce supply of roadspace, not the demand for it. In fact, by making shopping and other streets more attractive, they may increase demand for roadspace to get there. Where there is unsatisfied demand for passenger travel by private car, public transport needs to be in adequate shape to act as the means to satisfy it.

The main issues relating to public transport in such circumstances have been reviewed. Whilst public transport does make possible a big increase in accessibility, there remain some problems of inconvenience compared with the private car. Ways of reducing this inconvenience have been examined. Where road traffic restraint has been applied, public transport should be seen as the essential means of maintaining accessibility and the prosperity

of the locality. Any authorities concerned with the local economy should be aware of the need to make public transport sufficiently attractive to fulfil this rôle.

More thought needs to be given to the design of traffic calming measures to reduce the effects on buses and even more seriously, on emergency vehicles. Alternative policies to increasing access by public transport, such as land use planning policies to reduce the need to travel, were reviewed in Chapter 6.

10

INTEGRATION OF PUBLIC TRANSPORT SERVICES

Integration of public transport services with the land use decisions which affect the demand for transport was the subject of Chapter 6. That is a long term task which can only take place effectively if continued for decades. Now we move on to integration of public transport services one with another—a short term task which can be put into practice in a matter of days.

Integration means the speedy, convenient and economical connection of services to make up complete journeys for passengers from origin to final destination. This should include integration of timetables, ticketing and any specialized facilities needed such as special services for the disabled or elderly.

One of the big advantages of the private car is that if parking is available, it gives a door-to-door service. Public transport will never match this but with the integration of services it is possible to get closer to it than would otherwise happen.

10.1 INTEGRATION OF TIMETABLES

Integration of timetables so that services connect has been practised ever since there has been public transport but was dealt a severe blow by the provisions for competition between operators in the Transport Act 1985. A transport authority can still secure an integrated public transport service but cannot prevent other operators setting up other services in competition with it. The planning of the whole of the public transport network as an integrated service is at present illegal. It is regarded by the law as being anti-competitive practice.

Railways have greater needs for integration than do buses. This is partly because railways tend to be used for longer journeys and penetrate low

density areas less closely than do buses. This means that many journeys start by bus (or car) to a railway station before the main journey by rail can begin. A much higher proportion of journeys by bus involve no change of transport. Another reason why integration is so important for railways is that services tend to be less frequent than bus services. Many urban bus services operate 'every few minutes' at peak periods rather than to published times. The consequences of badly fitting timetables are more serious.

Integration of services is necessary for transport services to specialize. In low density suburbs it is very likely to be possible to provide a more frequent service for a given cost with minibuses. They are also able to negotiate roads difficult for standard-sized buses. These could be used to bring passengers to faster, more direct services with more widely spaced stops operated with standard-sized buses or rail.

At interchanges it is good for passenger relations to have a bus or train waiting for departure. Even if the departure does not take place for some time, it gives passengers an assurance that the service will operate. Waiting seated on a bus or train is likely to be more comfortable than in the open too.

10.2 INTEGRATION OF TICKETS AND FARES

In the UK, integration of tickets is still not as well developed as it might be. On most services, tickets are not transferable from one service to another. The familiar 'not transferable' condition on tickets actually means 'this is not an integrated service' as far as tickets are concerned. Changing services usually adds to the cost for the passenger. In the UK, it is not common to be able to buy a ticket which will be valid from origin to destination on two or more services, although tickets allowing daily, weekly or monthly unlimited travel are common. The effect of lack of integration in tickets is to discourage use of public transport, especially railways. Often, a bus journey to a railway station followed by a railway journey will be more expensive than to take a bus for the whole journey.

Allowing transfer of tickets between services may result in some loss of revenue although there would be some compensation to transport operators from increasing ridership if public transport is made more attractive and from easier boarding, as fewer tickets will be issued. Transfer has been less of an issue with the increase in use of travelcards allowing unlimited travel for a specified period, but will still be important for occasional public transport users. Transferabiliry may be significant in attracting motorists to public transport, as they may be reluctant to buy travelcards.

10.3 INTEGRATION OF SERVICES FOR THE LESS MOBILE

In the past decade there has been increasing attention given to the less mobile in gaining access to public transport. The low-floor tram has been developed and is in service in Grenoble and elsewhere. Low-floor buses have been developed in France, Holland and Germany. These developments will need connecting services which offer similar qualities if they are to be used fully. Some of those benefitting from low-floor entry, such as those with childrens' push chairs, are not particularly immobile. Negotiating steps is the problem. Others, however, such as the elderly and disabled may also have mobility problems and so cannot travel long distances to special-access public transport vehicles.

10.4 DOES INTEGRATION NEED REGULATION AND PLANNING?

If we accept that integration of public transport offers better services to passengers we might think that this would be good for business. It would make public transport as a whole more attractive to passengers and would take place under free-market conditions without planning or regulation.

There are certainly some examples of a public transport company operating services specifically to connect to another form of public transport in which they have no financial interest. There are many cases of buses operating services to airports (Figure 10.1). In general, however, this happens only where there is no hope of the first public transport operator securing the whole of the journey. It is a quite different situation to expect a bus company to operate services to a railway station if there is any prospect for the bus company to

Figure 10.1 Buses connecting to Birmingham Airport and Maglev (elevated).

take passengers for the whole of their journeys. Even less likely seems the prospect of one bus service being operated as a feeder to another operated by a different company.

10.5 ARE INTEGRATION AND COMPETITION INCOMPATIBLE?

There can, of course, be competitive tenders to provide parts of a planned and integrated public transport service.

The other kind of competition where public transport operators also decide what services to provide is less clearly compatible with integration. For there to be competition, there must be at least two operators willing to provide a similar service. There must therefore be duplication, or at least a threat of it. It is possible that one criterion on which two services compete with each other is the convenience with which they connect to a third service.

10.6 FINANCIAL RULES DO NOT FAVOUR INTEGRATION

When it is proposed to build a transport project, the rules for financial approval usually come close to requiring justification in terms of the one part of the transport system that is being proposed. Any wider effects on the whole of the public transport system count for little. It is therefore very unlikely that a project such as an urban railway would be built if alone, it does not satisfy financial criteria, despite the possibility that it may allow the whole of the public transport network to operate more efficiently and would perhaps be justifiable if this was considered.

Equally, the possibility of a transport project making the transport system as a whole less efficient is also not considered sufficiently. There are many instances of new roads taking away passengers (and goods) from railways and causing the need for increased subsidy if they are to be retained. Bus services will usually benefit from new road construction (although road improvements may also cause even more public transport users to take to their cars) but these are normally counted amongst the benefits of constructing the road. The problem is that the financial appraisal is rather selective.

10.7 PARK-AND-RIDE

From 1981 to 1986, park-and-ride projects were initiated in seven towns in Britain and in 29 from 1987 to 1990 (Department of Transport, 1991b). In addition to these, free or subsidized parking is offered at many suburban railway stations intended for train users. Projects may be directed at

journeys for any purpose but work and shopping are most common. Around one-third of the park-and-ride schemes operate only in the pre-Christmas period, one-seventh in summer only and nearly two-fifths for five or six days per week.

Most of the park-and-ride projects which have been developed have arisen from a desire to curb the use of the private car in a town centre. Some have followed proposals for a new or improved public transport route such as a light railway.

Park-and-ride is carried out for two main purposes:

- to shift the modal split towards public transport, thereby allowing the reduction of environmental damage in town centres and/or an increase in the number of people who are able to gain access to town centres;
- to reduce needs for parking and to a lesser extent, roads in town centres, allowing more intense urban land uses and potentially higher land values.

To claim that park-and-ride will reduce the number of private cars and traffic congestion is probably false. Far more effective would be to restrain road traffic by traffic management measure and by pricing. The high price of parking seems to have been an effective deterrent in Plymouth (Heseltine, Bentley and Nelson, 1992). Park-and-ride will, however, provide an alternative form of access where such traffic restrictions have been introduced and will increase the number of people who can gain access to a town centre for a given level of traffic congestion. The persuasive element of a fast, frequent and cheap public transport service from the suburban car parks to city centre is far less effective in getting motorists out of their cars but may perform an important function in softening the blow of traffic restrictions on the private car.

Because park-and-ride involves a change in the mode of transport and because in many cases it depends on road traffic congestion dissuading motorists from continuing in their cars, we might expect park-and-ride to be suited to long journeys in larger cities although there are several significant projects in smaller cities, many of them with historic centres, including York, Canterbury, Oxford, Bath, Chichester, Norwich and Chester. Where traffic flows freely in the city centre and where there is ample parking, we cannot expect park-and-ride to be successful.

In smaller towns, the success of park-and-ride is dependent on the enforcement of strict parking controls. In Cambridge, a limited version of park-and-ride was started in October 1989, comprising 550 spaces in two car parks, following earlier proposals for 2000 spaces in four car parks. In the early years, the project seems to have had little success in encouraging commuters to switch modes. The majority of use has been by shoppers at off-peak times and has not produced any detectable reduction in traffic flows on either radial roads or roads in the city centre. If park-and-ride is to be effective in reducing commuter flows, it will need to be carried out

on a more substantial scale. Also, there will have to be stricter controls on non-residential parking. There are 17 000 spaces in the central area and 23 000 spaces in the remainder of the city. On the other hand, reduction in commuter flows will not in every case be the only reason for park-and-ride. Even if there is no reduction in road traffic, any transfer from private to public transport will allow more people to enter the central area for a given level of road usage.

In Exeter, the first park-and-ride project was opened in 1988 with 480 parking spaces, followed in 1989 with a second car park of 300 spaces. Both were aimed primarily at the commuter. Parking is free with a return bus fare of 70p to the city centre (November 1992). Buses are every seven minutes from 7 a.m. to 6.30 p.m. In July 1991 around 750 cars parked daily carrying 1100 passengers (Flint, 1992).

In many towns, temporary park-and-ride schemes operate just before Christmas, particularly on Saturdays when they can use school play-grounds, council office car parks and depots as car parks with special bus services. The problem with this kind of project is that the car park is not likely to be particularly suitable in terms of location near to a radial road or ring road on the edge of a built-up area or in terms of security, access or visibility for those trying to find it.

Park-and-ride is a rather wasteful use of the motor car. Leaving a valuable asset out of use is a poor use of resources. The car cannot be used for business journeys or by anyone else, such as another member of the household. In addition, there is always some risk of theft or vandalism to the car and sometimes a charge for the parking. Park-and-ride also takes up large areas of land for parking near to the stations where good accessibility is likely to result in higher land values than average for the district. It is therefore a rather profligate use of suburban land.

If a motorist can arrange for someone else to provide a lift to a railway station or bus stop, the two problems (wateful use of the car and need for parking space at the station) can be avoided. This arrangement has sometimes been referred to as 'kiss and ride', a term rather presumptuous of the relationship between driver and passenger. The drawbacks of this arrangement are the use of the chauffeur's time and the passenger's need for a lift on the return journey.

A fast, reliable and attractive public transport service from the park-and-ride car park is an essential but not a sufficient condition for success. In the larger cities, the 'ride' part of park-and-ride is usually by rail at least for journeys to the city centre. Around 17% of Network Southeast commuters to central London park at or near stations (Niblett and Palmer, 1993). The longer journeys associated with large cities and the more extensive congestion on roads will favour rail in providing an attractive public transport connection. In smaller cities, however, such as Oxford and Luxembourg and to suburban centres of large cities such as Croydon, Ilford, Kingston upon Thames and Romford, park-and-ride has relied on

buses. Bus lanes, priority at traffic lights, guided busways and other forms of bus priority may be useful in securing an attractive public transport service from the park-and-ride car parks.

In the smaller towns in particular, there are problems in justifying a frequent public transport service from the car parks to town centres due to limited demand and the peaking of it. Low capacity people movers such as the Parry People Mover (Chapter 2) may be worth considering in such circumstances.

Park-and-ride, like the pedestrian underpass, is one of those good ideas which will succeed if public reaction is as hoped. The main reason why so many pedestrian underpasses are seen as unpleasant and dangerous is that they have been mistreated by a small proportion of users. Foreseeing public behaviour is far more difficult than most routine constructional tasks and is still afforded much less attention, prestige and recognition in transport planning.

For park-and-ride, mistreatment of the system by vandals and car thieves is an issue, but probably more significant to success is the need to understand the motivations of motorists in using their cars. The challenge in making park-and-ride succeed lies more squarely in the realms of psychology than engineering. The evidence available conclusively points to the need for restraints on the motorist, in the form of lack of parking, high parking charges, traffic restrictions or congestion. The task is how to implement measures such as these, as part of park-and-ride projects, whilst causing a transfer to public transport, rather than a transfer of motorists to using their cars to different destinations, or not at all. Here we have yet another reason for coordination of land use/transportation policies from town to town.

10.8 SUMMARY

10.8.1 Conditions favouring the success of park-and-ride

- Parking should be available on the edge of the area where road traffic needs to be addressed, with easy access from a busy radial road or on an orbital road joining two or more radials. It should be easily visible from inward bound traffic.
- Parking should be in short supply beyond the park-and-ride car park into town, particularly in the town centre.
- Public transport services should be attractive or at least bearable to motorists. If park-and-ride is needed, there will very likely be road traffic congestion on the city side of the parking area. For bus park-and-ride it is very likely that bus priority will be needed to make a bus journey approach the quality of a car journey that motorists are expected to forgo. Comprehensive passenger information, reasonable fares and service

frequency will be helpful. In short, public transport operators will need to remember that they are providing for those who have an alternative means of transport.

10.8.2 Reasons for and against park-and-ride

For

- Gives access to town centres with relatively little environmental damage from traffic.
- Increases the potential access to city centres and decreases the need for car parking, both of which will tend to increase land values.
- Park-and-ride is compatible with road traffic restrictions and environmental improvements in town centres. Indeed, it is very likely that road traffic restrictions will be needed if park-and-ride is to be used on any substantial scale.

Against

- Park-and-ride is a wasteful use of cars which are left in car park. In many cities the heaviest traffic, when park-and-ride is needed most, is when a high proportion of journeys are to or from work. Using park-and-ride for work is a particularly wasteful use of the car due to the long period that it is out of use and because business journeys from work will be prevented.
- It increases the possibility of vandalism and theft of cars.
- It is a profligate use of suburban land.
- To be successful, park-and-ride needs strict traffic control and parking restrictions in the destination areas (usually town centres). Many local authorities are unwilling to take such measures for fear of keeping motorists out of town.
- Park-and-ride needs good and frequent connections by public transport. In many cases, such services will be uneconomic due to limited patronage, the one-way nature of journey demand and the peaking of demand for only limited times of the day.
- Park-and-ride requires motorists to leave the home comforts of their cars for a means of transport which they will probably regard as less comfortable, less convenient and which may not take them as close to their final destination or take them anywhere as quickly as their own cars.

11

FINANCE FOR LOCAL PUBLIC TRANSPORT

British local authorities are not allowed to raise funds by means of local income taxes or sales taxes. Capital costs for public transport are considered for central government assistance under Section 56 of the Transport Act 1968. To be eligible, projects should be of sufficient size to justify spreading the costs beyond local users which as a general rule means projects costing more than £5 million. Grants are normally paid at 50% of the net cost after deduction of any net income and grants from other sources. The criteria for subsidy are set out in Department of Transport Circular 3/89. Some of the implications are explained in an article by myself in *Surveyor* 4/11 January 1990. Some public transport infrastructure will be eligible for assistance from the European Regional Development Fund. The contribution may be as high as 30% to 50% of the expenditure being made by the local authority or public transport authority.

Subsidy of local railway services from PTEs can be made under Section 20 of the Transport Act 1968. Section 63 of the Transport Act 1985 allows shire counties to subsidize the operation of local public transport services including railways.

11.1 FACTORS AFFECTING THE LEVEL OF SUBSIDY NEEDED

There are several factors which influence the extent to which revenue from public transport covers the costs. Fares policy is important. Few public transport authorities price fares solely for profit maximization. It is common for public transport operators to receive contributions, usually from local government, for reduced fares for the disabled, large families, schoolchildren, the elderly or other groups for whom it is recognized that public transport provides a service priced below the cost of operation and below the level of benefits to the passengers. Service frequency affects the level of subsidy needed.

Most public transport authorities provide a service more frequent than is justified on economic criteria, particularly off-peak.

For both buses and railways, the extent of the network affects profitability. Very large networks will probably include lines which serve low density suburbs. For railways, these will be more likely to involve subsidy if there are still repayments to be made on capital costs. Operating costs will not be nearly so much affected by low usage on the suburban sections of long cross-city train routes. Choice of route and the likely effects on ridership are an important issue in connection with the current light rail proposals in Britain. Routes have followed one of two basic patterns. Some have been built through districts of high demand such as along busy high streets and through city centres. Others have avoided disturbance and demolition of property by choosing routes mostly away from areas of high demand such as along disused railway lines. The age of the network will affect maintenance costs and the need for replacement of equipment.

Overall management of the public transport network will have an important influence on number of passengers per vehicle and finance. Competition between buses and railways is hardly conducive to filling vehicles. In fact, a necessary condition for there to be competition is that there must be spare capacity on at least one of the competing services.

Perhaps more fundamental and certainly more long lasting influences on public transport usage are policies towards land use planning and road traffic management. Land use planning policies are more significant for railway economics than for buses. Buses are more able to respond to land use changes whether controlled or not. Policies towards the private car and parking will clearly affect the number of public transport users. So too will policies towards priority for buses such as by means of bus lanes or priority at lights. The extent of priority will influence reliability of services, speed and very likely, the number of users and revenue. It will also influence operating costs. In congested traffic conditions, buses travel fewer miles per gallon of fuel, involve higher staffing costs per mile and more buses are needed for a given frequency of service. Some of the effects of road traffic congestion on bus operating costs can be seen by looking at the timetables in almost any large city. Times allowed at peak hour are longer than off-peak.

Lastly, staffing levels and staff relationships influence operating costs. Some transport authorities have a high level of absenteeism. The Lille métro operates with low levels of subsidy partly because of the small staff enabled by the trains operating without drivers.

11.2 SOURCES OF PUBLIC TRANSPORT FUNDING

Only a small proportion of public transport systems in the developed world cover the whole of their capital and operating costs from fares and lesser

sources of revenue such as advertising. In what is probably the great majority of cities it would be possible to operate a profit-making public transport network but in practice, accepted obligations to provide a public service mean that many uneconomic routes and service frequencies are operated. Fares policies are influenced by ability to pay and other social and political criteria as well as by economic considerations. All of these policies are pursued to varying extents and they go a long way towards explaining the variations in subsidy needed from town to town and from country to country.

In market-orientated environments such as the USA or Britain, development gain has been seen by governments as a means of raising contributions towards the capital costs of public transport infrastructure. In less market-orientated environments, and particularly where there is no land or property market or where there are powers to suspend these markets, public transport infrastructure, most often railways, have been planned as essential and interrelated parts of an urban land use/transportation system. There are no direct transfers of money between public transport and land development. This approach has been followed in several west European countries which otherwise operate market economies as well as in countries with planned economies. Some cases were explained in Chapter 6.

Since revenue is usually insufficient to cover the costs of public transport, particularly when we include initial capital costs, other sources are needed. A wide variety of taxes have been used to raise money for public transport subsidy. Local property taxes have been used in USA cities including Denver, Milwaukee, Miami, San Francisco and Boston. In some cases the proceeds are dedicated to public transport, i.e. they are not for use for any other purpose. Many European countries have property taxes from which some of the proceeds are used for public transport, but earmarking of the proceeds for this purpose is rare.

In Britain, business rates may reflect, amongst other things, accessibility to public transport and the proceeds may be partly used (but not specifically earmarked) for public transport subsidy. Although property taxes may reflect increases in values due to public transport improvements, there are cases where the reverse has happened: public transport investment has coincided with, and probably contributed to, a decline in property values and so there may be justifiable claims for reductions in property taxes. This has happened along some of the older commercial and shopping streets near to the new French métros as in Lyon and Lille. The arrival of the métro has helped to concentrate commercial activities into the city centre and other more prosperous areas and has encouraged customers not to use their local shops, even if they are close to the métro.

In some USA cities, development rights above or below public transport infrastructure have been sold, as in Washington DC and Denver. There have been also been relaxations in land use or density zonings in return for contributions towards the cost of public transport. This is not necessarily just a case of using development permissions as a way of extracting money

from developers. Presumably the justification for increased density was that the securing of the public transport infrastructure improved accessibility and this justified increased density of occupation or justified development of a kind which needed greater accessibility.

Local business taxes have been a source of finance for public transport, the tax being related to turnover, profitability, or as in the case of the French tax versement transport, employees' salaries. Using payroll taxes for public transport subsidy is quite common in Europe and North America, for example in Portland. In Vienna, a payroll tax has been used exclusively for the construction of the underground railway.

Taxes have been placed on motorists with the proceeds used to subsidize public transport. These taxes may be as sales taxes, at registration, on the annual road tax or as in Germany, as a fixed sum on fuel sales. In the USA, federal government levies 9 cents a gallon national tax on gasoline with 1% of the proceeds dedicated to public transport. Fuel and motor vehicle excise taxes provide significant revenues for public transport subsidy in several USA cities. These are the only forms of state subsidy in Miami and provide significant amounts in Chicago, Detroit, Los Angeles and Seattle. Ninety per cent of the funding of the San Diego Trolley came from the Californian state petrol tax and the rest from the state sales tax. In Santa Clara (California) a 5% fuel tax has been used to fund the local contribution to the San Jose light railway. In June 1990, a referendum throughout California resulted in a vote for a 5 cents a gallon increase in fuel tax to be spent on transport, although only $0.5 billion out of a 10-year yield of $15 billion is dedicated to public transport.

In the French région Ile-de-France, part of the proceeds of motoring fines are used to subsidize public transport.

Since 1 February 1990, tolls have been charged at 18 entry points into Oslo. Only motorists travelling towards the city need to pay. Twenty per cent of the proceeds, after operating costs, have been earmarked for bus and tram services.

It was planned to introduce road pricing from 1 January 1991 into inner districts of Stockholm including Kungsholmen, Norrmalm, Östermalm, Södermalm and the city centre with the proceeds dedicated towards public transport. An extra 40 buses were bought for the effects of road pricing, with four new express routes but the project was not implemented.

In what was West Germany, a tax on fuel (Mineralölsteuer) has been used since 1966 to finance local public transport and roads in approximately equal proportions. Originally set at 3 Pfennigs per litre, it was raised to 6 Pfennigs in 1971. Ninety per cent of the proceeds have been used to contribute towards the capital costs of local railways—Straßenbahnen, Stadtbahnen, U-Bahnen and S-Bahnen. Between 1968 and 1977 local railways were opened in cities including Cologne, Frankfurt, Munich, Nuremburg, Hanover, Bonn and Rhein-Ruhr. The remaining 10% has been spent mainly on bus stations, workshops and park-and-ride.

All the taxes mentioned so far have been argued to come from sources which have a relationship with public transport, even if in some cases the connection may be rather tenuous. Other taxes dedicated to public transport include taxes on hotels, tobacco, e.g. in Boston, or alcoholic drinks. Regional sales taxes are used in Atlanta, Los Angeles, Chicago, Cleveland, Denver, San Diego, San Francisco, St Louis and Seattle with a percentage of general sales taxes dedicated for public transport funding.

Some cities raise revenue for public transport from services that they provide. Bridge and tunnel tolls are particularly important in New York. Parking charges are used in several countries. It Italy and Germany the proceeds of public services such as gas, electricity and water supply have been used. Several USA cities including Philadelphia have used the proceeds of lotteries.

Central government may contribute to local public transport either as part of an overall subsidy to local government services as in the UK and Germany or specifically for public transport services as in Italy. Central government may also contribute by giving loans at concessionary rates as in Germany.

In the USA, private sector finance for public transport has been secured by leasing, whereby private sector investors purchase vehicles (often from the transport authority) and rent them back to the transport authority. Private sector investors usually gain taxation benefits. In 1990, plans were announced to New Jersey Transit to lease locomotives from a Swedish company and San Diego Metropolitan Transit Development Board entered into an agreement with a German company.

11.2.1 Betterment

Recoupment of betterment as planning gain has recently come to prominence as one of the main intended methods of financing capital investments in public transport. It has an appealing logic and fairness and in the right situations can yield significant contributions. It is, however, unpredictable in terms of amount and timing and is relatively difficult to collect, involving many skilled personnel in comparison with other ways of financing public transport. Often, there is a second purpose behind the recoupment of betterment in addition to that of raising money. It can be used as a way of testing the confidence of private sector developers in a project—a way of testing the viability of a project.

Here, I have used the term betterment to refer to increases in land or property values associated with public or private investment whether these are realized or not. Development gain is used in a more limited way and refers to situations where the public authority may use their powers to recoup some betterment. Planning gain is still more restricted and refers to the recoupment of betterment by town planning powers.

The possibilities of using planning gain as a source of finance for public

transport have become an increasingly significant issue since the late 1980s in the UK in relation to the development of light railways. Nearly all of the 50 towns which have had light rail studies since 1987 are looking towards central government finance under Section 56 of the Transport Act 1968. Amongst the policy guidance set out in Department of Transport Circular 3/89 is that developer contributions must have been explored. In a few cases, including London Docklands Light Railway, contributions have been secured, as they have for a few new railways stations on BR lines, for example, Birmingham International Station. Using planning gain for railways has a much longer and more extensive history abroad, particularly in the USA.

For capital investments, fixed track transport, mainly railways, are more likely subjects for recoupment of planning gain than are buses, although it is possible that some fixed installations such as bus stations or busways might provide a situation where planning gain may be collected.

And so there are some situations where increases in land values may be demonstrated and planning gain collected. Increases in land values may be shown to at least coincide with public transport investment, even if it cannot be shown that the public transport investment caused the increase. There are also situations where the proceeds of planning gain are distributed without any attempt or obligation to show that the transport infrastructure receiving the proceeds gave rise to increases in land values. Subsidies to bus operating costs from local property taxes or payroll taxes are a case in point.

Does public transport create betterment?

Downtown areas of New York, London and in fact most large cities could not function as they do without high capacity public transport. Land values would be much lower. Viewed at a local scale, there are many cases where high-density commercially-valuable property has been developed close to, or even on top of main line railway stations. Montparnasse (Paris), Victoria (London), Piccadilly (Manchester) and New Street (Birmingham) are a few examples. The big question, and one impossible to answer with certainty, is whether public transport has just allowed these activities to concentrate together or whether it has allowed them to come into existence. Despite electronic communications, physical closeness is still important to many commercial activities as in the City of London. It is hard to believe that all city centre activities could exist there or elsewhere without high capacity public transport.

Mass accessibility is a necessary but not a sufficient condition for certain land uses to flourish. There are many cases of railway stations failing to attract commercial development despite a great deal of effort. For success in attracting commercial activities it seems that there must already be demand within the city or district and other means of transport

such as by car, must be impractical or at least perceived as being inferior to travel by public transport.

The relative permanence of railways and other fixed track means of transport will concentrate betterment but this does not necessarily mean that it will in all cases increase the total betterment when viewed in the city or region as a whole. There has been very little new commercial development around any of the five new French light railways opened in Marseille (1977), Lyon (1978), Lille (1983, second line 1989), Nantes (1985) and Grenoble (1987). On the other hand there are certainly cities where the prospect and opening of an urban rail network has been accompanied by shopping and other commercial development around the stations but in most cases it is not entirely clear whether commercial activities would have occurred in the district had the railway not been built. The railway stations may have been focal points for development which would still have taken place in the district without the railway. In some cities such as Toronto, Calgary and Edmonton, commerce was also directed close to urban rail stations by land use planning policies.

There are cases where fixed track public transport has affected the location of betterment when supported by land use planning policies. To affect the location of development without such support, public transport has to be seen as being the preferred means of transport to large numbers of people—a condition most likely to be fulfilled where the private car is restricted by road congestion, lack of parking or road pricing for example. There are cases where potential for commercial activities, formerly stifled by poor access, has been released by improved public transport. The London Docklands Light Railway seems to have been a significant factor in the development of Canary Wharf and other sites in Docklands. Here public transport has come close to creating betterment.

Whether public transport creates or only affects the location of commercial activities and changes in land values is perhaps a question of more relevance to public policy on compensation than public transport finance. If there are losses in prosperity as well as gains this will certainly be an issue of concern to both local and central government as well as those directly affected.

Collecting development gain

Irrespective of whether public transport is the cause, if there are increases in economic activity and land and property values, then some of the gain will be collected through the normal taxation systems—company taxes, rates, VAT and so on. Some will be collected in the form of additional fares from extra passengers due to the increased level of activity. There are in addition several methods of collection aimed more specifically at development gain: planning obligations under the Planning and Compensation Act 1991, public/private partnerships, methods of channelling development gain

directly to the public sector and local taxes such as the French versement transport, broadly aimed at some of the beneficiaries of public transport investment.

Statutory agreements

Statutory agreements between local planning authority and applicant for planning permission have been possible under the Town and Country Planning Act 1971 Section 52, replaced by Section 106 of the Town and Country Planning Act 1990 and now by planning obligations under the Planning and Compensation Act 1991.

Under Section 52 of the T&CPA 1971, local planning authorities had a great deal of freedom to determine the scope of agreements. Rehabilitation of property, provision of community buildings, dedication of land for public use, provision of highways beyond the development site and contributions towards the cost of car parking facilities or the public highway network have been amongst the public gains from such agreements. In some cases agreements have resulted in developers carrying out what at the time of applying for planning permission appeared to be development with poor commercial prospects in return for a permission with better prospects. Housing has been built in inner city districts for example, where low prices in the late 1970s dampened the enthusiasm of the private sector but where the local planning authority wished to ensure housing development. Discussions of the scope of such agreements and surveys of their application under Section 52 and other legislation are contained in Jowell (1977), Hawke (1981) and Henry (1984).

Planning obligations may be entered into unilaterally or by agreement with the local planning authority. They apply to beneficiaries in title. An obligated party may apply to the local planning authority to have an obligation discharged or modified and may appeal to the Secretary of State for the Environment if the local planning authority either fails to determine an application or determines that the obligation shall continue unmodified.

It has been suggested that gain should not be imposed if the proposal would, without the gain, meet the standards necessary for a grant of planning permission (Jowell, 1977), a sentiment confirmed in DoE Circular 22/83. Amongst the DoE tests of reasonableness applied to Section 52 and 106 agreements and which still apply to conditions on planning permissions, is a stipulation that the infrastructure must be needed for the development to go ahead and that the development ought not to be permitted without it. There may be several grounds on which contributions to the cost of a high capacity public transport system may be legitimate on this criterion. For example, an urban railway may allow the servicing of higher density development than would otherwise be desirable. Thus the expectation of contributions to the cost from developers enjoying higher densities may be quite legitimate.

If public transport infrastructure, perhaps a light railway or bus station, could create increases in land values, it may be possible to recoup some of this increase by granting planning permissions near to the railway or bus station subject to the carrying out of non-commercial development elsewhere, provided that this could be shown to be needed in order for the original development proposal to be allowable. For example, a railway station is opened near to an ageing swimming baths. Due to the improved accessibility, a firm of developers wishes to redevelop the site of the swimming baths for offices. A condition of granting planning permission for the offices may be replacement of the swimming baths, or perhaps contributions to a more comprehensive sports centre elsewhere.

A problem in sharing any gain would be the measurement of it. In order to achieve conclusive negotiations, public and private sectors would need to have some form of assessment of how much gain would be created and when. There would be a need for some form of 'base line' property valuation for comparison with later values. Achieving this would raise problems of just when did properties begin to rise in value as a result of the expectation of improved public transport and how these effects are to be separated from other influences on property values.

Without a reliable estimate of gain and its timing, a prudent developer would err on the side of caution. This may result in lengthy negotiations over sites which in the meantime would be underused. Property values may fluctuate resulting in repeated negotiations but no development. In order to conclude negotiations, the local planning authority may accept an agreement which produces only a poor return for the public purse. However, where the local planning authority is also the land owner, they can introduce an element of competition by inviting alternative proposals from the private sector, thereby achieving a measure of the market estimate of betterment.

Public/private partnerships

Planning obligations cover only situations where planning permission is required, which will account for only a small part of betterment created by public investments. Less restricted in their application are partnerships between public and private sectors. Where a land or property owner sees the prospect of development of an urban railway for example, sufficiently close to where the owner has an interest, the owner may be willing to make a contribution to the railway to make sure that it goes ahead. This kind of agreement however, seems unlikely to succeed after the public transport investment has been committed, whereas planning obligations could succeed after commitment to investment.

There are several reasons why property developers might have an interest in public transport, particularly railways. In some situations, railways may release potential for development where this has been stifled by poor access.

The Isle of Dogs in London Docklands is a good example, where Dockland Light Railway has greatly improved access since it was opened in July 1987. An urban railway, or even a proposal for one is likely to smoothe the hurdle of obtaining planning permission for commercial or other development requiring mass access. More dense development has been allowed near to stations than would otherwise have been the case.

Urban railways have, in many continental European cities including Grenoble, Munich and Gothenburg for example, been developed as part of a programme of town planning measures, traffic management and other environmental improvements which together are likely to enhance land values. Pedstrianization, carefully sited car parking, formation of traffic cells, traffic calming and landscaping are just some of the measures which have been accompanied by urban rail and which together are usually associated with commercial success. Public transport and in particular urban rail, has been essential to maintain high levels of access compatible with little environmental damage.

The developers Olympia and York contributed to the extension of the Jubilee Line of the London Underground from Green Park to Stratford. The developers of the Bishopsgate Goods Yard in London have agreed to contribute £50 million towards the cost of building a new station on the Central Underground Line (*Construction Weekly,* 5 September 1990). There are many cases of developer contributions in North America. At the Gallery Center in Philadelphia for example, developers of the shopping centre contributed towards the capital costs of an urban railway. It is common for public sector negotiations to be carried out by specialist development agencies rather than regard it as another job for the transport authority. In Philadelphia, the Redevelopment Authority carries out negotiations for the public sector. In Portland (Oregon, USA) the Transit Investment Corporation was created to foster private sector development around the light rail stations.

It is particularly important that the public sector assists the provision of public transport infrastructure by using all the powers at its disposal: land acquisition and assembly of ownership, directing development by planning powers, adopting compatible policies towards the private car and road traffic restriction, financing of related amenities such as open space, roads and footpaths, landscaping and the securing of urban aid and any other public grants which may be available. This requires a coordinated local authority response, not one limited to the powers of the transport authority.

Coordination of the private sector response is a problem. There is a tendency for developers to be willing to contribute only if they know that others in the same position will also contribute. This is an understandable reaction, not only for reasons of equity but to be reasonably sure that sufficient contributions will be received for the public transport infrastructure to go ahead. Coordination of private sector response is more

likely to be achieved where the gain is concentrated geographically rather than dispersed and where there is one or only a few representatives of private sector interests. Shopping centre developers have been able to speak for a large number of interested parties.

Channelling development gain directly to the public sector

Rather than engage in public/private partnerships, the public sector can suspend or at least drastically modify the property market by engaging in large scale land acquisition at pre-investment prices, either by buying at market values before public transport investment has had any effect, or by buying at prices which allow for this effect.

This approach has been common in France which might account for the lack of commercial development around the new light railways. Zones d'aménagement concerté were introduced in 1967 for areas where substantial physical development was expected over a short period of time. Many cover areas which in Britain might have been declared action areas but they include wider powers to control land and property prices. Responsibilities for payment for infrastructure and the sharing of profits from development and increase in land values are set out in agreements (conventions de ZAC). ZACs have been used to control property speculation and to ensure the planning and implementation of development around several métro stations, in Marseille for example.

Zones d'intervention foncière (ZIFs) were introduced in 1975 to extend the powers of communes (the lowest level of local authority in France of which there are 36 433). In ZIFs, communes have the right to be informed of land transactions and they have right of first refusal on land and property at the previous year's prices to further planning and social policies. Like ZACs, they have been used to control speculation around métro stations where there may be a rapid escalation in property prices without the large scale development appropriate to ZACs.

In the USA it is common for public authorities to become engaged in land transactions in connection with transport investments. In Portland for example, the transport authority bought land near to a proposed second light rail route in central Portland and Gresham and then leased it back to a private developer to build a hotel and shopping centre.

A local tax on betterment created by public transport: versement transport

The French payroll tax, versement transport, was introduced in 1971 in Paris. Since 1983 it has been available to all French towns of more than 30 000 population. Transport authorities decide whether to levy it, and at what level up to a maximum percentage and ceiling laid down nationally. Since 1988

the maximum percentage in the Paris commune and the département Hauts-de-Seine has been 2.2%, in the départements SeineSaint-Denis and Val-de-Marne 1.8% and the other Paris départements 1.5%. Outside greater Paris, the maximum level is 1% except in towns with a fixed track public transport system where the maximum is 1.75%. Nearly all eligible towns levy it but not necessarily at the maximum level.

The tax is charged to firms employing ten or more people on the salaries paid by them. Firms organizing their own transport for employees are exempt.

Revenue from versement transport is used only for public transport. When originally introduced in 1971 it was to be used only to compensate for reduced fares for employees. However, it came to be used for general fares subsidy and this was acknowledged in the law of 4 August 1982 relating to the participation of employers in public transport finance. It is used to reduce municipal contributions to operating subsidy and to finance capital investments. It has been essential for the new light railways in Marseille, Lyon, Lille, Nantes and Grenoble and several others currently being built or planned as in Rouen, Strasbourg, Rheims and Toulouse for example. In Nantes, VT provided 60% of the capital costs.

Versement transport was introduced at a time when public transport was in steep decline. Increased fares support, public transport reorganization and the development of métros were used to reverse the trend. In Paris it enabled the continuation of the travelcard which has greatly increased public transport usage. Outside Paris it has been used as a means to strengthen the economies of the large provincial cities and the commercial prospects of their central areas in accordance with policies of decentralization of activities from Paris to the provinces which have been pursued for more than two decades.

Versement transport may be seen as a way of recouping betterment from some of the main beneficiaries of public transport. It widens the employment catchment areas of all employers but not equally. It takes no account of the nearness of an employer's premises to a métro route for example, or for that matter, any measure of the standard of the public transport service. Any effects of investment of versement transport on land and property values will be concentrated spatially, not equally distributed throughout the transport authority. In fact, it is quite possible that a métro can lead to a loss of trade for some of the economically weaker firms near to the route. The local clientèle may tend to travel out of the district after the opening of an improved means of public transport. It is possible that an employer may thus be required to pay towards a means of transport that will contribute to a decline in his business.

A location-based tax such as versement transport may cause movements of jobs in order to avoid it. Often this means movements further away from the city centre. Since about 1980, in many transport authorities including the region Ile-de-France, there has been a slowing down in the increase in proceeds to such an extent that other sources of finance have been increasingly sought.

For more than a decade now however, versement transport has provided the necessary means of finance for large capital investments in public transport. To this extent it has been effective and successful. The main objections which will prevent such principles being applied in the UK are on grounds of equity and accountability. Taxing the few to provide benefits for the majority may be a recipe for political success but is not likely to be adopted in the current political climate in Britain. On grounds fo equity and accountability, versement transport is worse than was the domestic rating system.

11.3 SOURCES OF FINANCE: A COMPARISON

Methods of raising finance for public transport, as well as many other services, can be judged under several headings.

11.3.1 Is enough money raised?

In Britain so far, very little of the necessary finance for public transport has been raised directly from the collection of planning gain. No more than two or three of the 50 towns thinking about light rail have even raised 5% of capital costs in this way.

Heavy taxation of increases in land and property values is liable to stifle the initiatives needed to create these increases. When heavy taxation has been introduced in the past, developers have sat tight in the hope of a change in government, although in the UK at present, this is probably not a prospect that many developers would gamble on waiting for. Taxes on some commodities including tobacco and even fuel do not always keep pace with the needs for funding.

11.3.2 Reliability

The amount of betterment created is closely dependent on the state of the local economy and will vary a great deal over periods of only a few years according to factors largely outside the influence of the public transport promoter. The amount collected will depend on several other influences as well, not least of which will be the skill and initiative shown by public authority negotiators. Most commodity, property or payroll taxes will fluctuate less quickly but most reliable of all are those from central government general taxation.

11.3.3 Side effects

Locally applied taxes such as sales taxes and even payroll taxes, whilst relating areas benefitting to areas paying, are liable to cause movements of shopping

or even place of work or residence. Some of these shifts may be welcome. Versement transport seems to have coincided with increases in suburban jobs, outside the areas of transport authorities applying the tax.

Sometimes, local taxes are accompanied by changes in municipal boundaries, usually outwards from urban centres. This may be to come closer to the functional area of a conurbation so as to bring users of services within the area of payment. Ability to levy versement transport has depended on transport authority population which has encouraged communes to band together as a transport authority so as to meet the population threshold.

As well as the purpose of raising money, collection of planning gain may be used as a device to test property developers' opinions on the viability of public investment such as in transport infrastructure. Where contributions are voluntary, i.e. where developers have a choice as to whether to contribute to ensure that the public investment project goes ahead, such contributions have been seen by central government as part of the decision making process in planning public investments.

11.3.4 Accountability

Accountability refers to the power to control expenditure by those who pay for it. Control of expenditure of the proceeds of taxation is usually in the hands of local or central government. Methods of taxation where payment is evenly spread over the electorate perform well on this criterion. Accountability was one of the reasons for replacement of the domestic rating system by the Community Charge. Development gain, payroll taxes and commodity taxes such as on tobacco as sources of finance for public transport all perform badly on this criterion.

11.3.5 Equity

The fairness and justice of a tax is something about which we will all have our own opinions. In terms of the political practicality of a tax, equity has recently been shown to be amongst the most contentious criteria. Opinions on the fairness and justice of the Community Charge were sharply divided but it was clear that public objections on these grounds were the prime reasons for its abandonment.

As well as the sense of justice and fairness, 'equity' also has the connotation of symmetry or impartiality. The Community Charge was not a flat-rate tax levied on all equally but it was closer to one than was the domestic rating system (or most other taxes including the Council Tax). Equity in this sense seemed to be the main focus of objection.

Amongst the reasons for collecting betterment has been the desire to relate payment for services to those who gain from investment, perhaps spurred on by appeal to a public sense of justice as well as by the opportunity to collect

money. The same reasoning—to relate payment to gains from services—has been used to reduce the level of subsidy. According to our interpretation of equity, we can use it to justify giving to or taking away from the less well-off members of society.

11.3.6 Openness to public scrutiny

The collection of most forms of tax are more open to public scrutiny than recoupment of betterment. Financing projects from betterment often involves quite complex and unique arrangements.

The proceeds of collection of planning gain need not necessarily be earmarked or dedicated for a particular purpose. Where they are dedicated, we might expect easier scrutiny of their use but there would remain the question of whether these were new funds or funds replacing government or other expenditure.

11.3.7 Application to all those eligible

As has been said many times in relation to the debate on local government finance, taxes on properties are more difficult to avoid than taxes on persons. Sales taxes on a particular commodity such as petrol are also relatively easily applied. There are no methods of recouping betterment which apply to all gainers. Increases in property values may extend some distance from railway stations and may be due to many other complex and unprovable causes as well as to increases in accessibiltiy. Taxes to properties are easily administered but there are complex questions about the extent of liability and justification for applying them.

11.3.8 Administration costs

As well as the number of firms, people, properties or goods taxed, reflected in the number of transactions, the degree of routine in collecting the revenue will affect administration costs. Taxes will generally be more straightforward than the recoupment of betterment. Another factor affecting administration costs will be the need for surveillance to apply to all those eligible. Taxing goods, firms or people may prove more expensive than properties in this respect.

11.4 EARMARKING (DEDICATION, HYPOTHECATION) OF MONEY FOR PUBLIC TRANSPORT

The precision by which the proceeds of a particular source is earmarked is important because this affects the degree of competion for resources. Some taxes are earmarked for public transport, no more precisely than that. Some

are allocated for capital costs or for capital costs of a particular network. The more precisely defined the recipient, the less competition there will be between projects for the money.

Dedication of revenues helps the planning and programming of investment and may allow transport authorities to secure loans at lower interest rates. It also demonstrates to the contributors what they are getting for their money. On the other hand, by stabilizing the source of finance, dedication of taxes has reduced the incentive for economy and efficiency.

In North American cities there has been a strong tradition of dedication of the proceeds of a particular tax for both public transport and road construction. In Europe there has been less dedication of taxes although versement transport (France) and Mineralölsteuer (Germany) are important exceptions.

An alternative to the earmarking of taxes are defined formuli for the allocation of subsidy from central government. This applies to many other local services as well as public transport. A common type of formula is of the kind that links subsidy to contributions from the relevant municipalities. In the USA there are specific percentages to be matched by state and municipal government, the percentages varying from one subsidy programme to another. For public transport, the main criteria for central government subsidy are population, density of population, level of service and ridership.

11.5 CONCLUSIONS

Recouping betterment is generally not a reliable source of public transport funding but is a useful supplementary source where fixed-site investments collect together or create increases in land or property values. Taxing betterment to use the proceeds on public transport investment is fraught with problems of equity and tends to stifle development. Rather than attempt the compulsory sharing of gain by taxation, an alternative approach is to regard increased accessibility from public transport investment as a marketable commodity which developers and other potential gainers may be willing to buy.

There is more opportunity for collecting a share of increased values for the public purse where these increases are concentrated geographically and in the hands of only a few private sector negotiators. Public authorities can foster these conditions by appropriate land use policies. Powers of land assembly are very important.

Negotiating with the private sector requires skilled specialist staff to be employed by the public authority who can reflect and coordinate all the many ways in which a public authority can aid development and achieve a rapid settlement. Negotiating should not be left to specialists in other fields such as engineers who can represent only a small part of a public authority's powers

to achieve development. Private sector involvement does appear to be favourable to the creation of planning gain. The alternative approach is for the local authority to buy land and effectively take over the rôle of the private sector as has happened in some French cities. To date, this has reduced profits to the private sector from increased values but has not been very successful in promoting development to use the increased accessibility. There has been more success in preventing development gain than in channelling it into the public purse. Recoupment of development gain from public transport investment requires a spirit of enterprise from the public authority. In order to achieve this it may be worthwhile to consider introducing some of the conditions of employment of the private sector, including methods of remuneration.

12

PUBLIC TRANSPORT PRICING

Since at least the days of the stagecoach the common principle in pricing has been for fares to increase with distance travelled in steps or stages representing groups of stops. This still is the underlying principle on most public transport routes but since the 1970s it has become increasingly modified. Before then we had day return and period return discounted fares and these have continued on some routes, although they are less common now.

Discounts for the elderly, schoolchildren and sometimes other groups, including students in higher or further education, have continued too, although there may have been some changes in the reasons for them. There is now less emphasis on social welfare and more on economics. Since the 1970s, weekly, monthly and other period tickets, usually allowing unlimited travel, flat fares, where the fare is the same irrespective of distance travelled, and maximum fares, where fares are staged up to a maximum and are flat for longer distances, have all become much more common.

12.1 MOTIVES IN PRICING

12.1.1 Providing a public service

Public transport is still operated as a service for those without private transport and there is still consideration given to the needs and means of those using it. Although this principle has weakened in the UK since the early 1980s we still have public authorities responsible for the provision of a public transport service. The principle of providing a public service at reasonable cost is still strong, perhaps the dominant principle in many other countries.

12.1.2 Cost of providing a service

Given limits on willingness and ability to subsidize public transport, the costs of providing a service are very likely to influence fares, particularly away from the large cities where the number of customers is limited. Where there are only small numbers of passengers the level of fares is probably closer to that which would maximize income and further away from a level which would reflect the social conscience of the transport authority.

12.1.3 Filling empty places

The cost of extra passengers on a scheduled service, the marginal cost, is very low as a general rule, far less than the average cost. In pricing fares, there is thus an economic incentive to maximize the income of a public transport service, paying little attention to the costs of operation as this will be almost the same irrespective of how many passengers use it. To maximize income, a public transport operator may try to identify the fare which will produce the largest income, or may operate several fares on the same service, adjusted to what the operator sees as the ability or willingness of the targetted markets to pay. Thus students for example, often get discounted fares in an attempt to fill up, at above marginal cost, places which would otherwise be empty. This may also apply to discounts for the elderly, although in this case it is possible that many of their journeys are optional and so they will be more sensitive to price even if their income is not low by comparison with those of working age.

Standby air fares were an early example of an attempt to fill up otherwise empty places at fares higher than marginal costs. In recent years a similar principle has been introduced to some coach services, including National Express. The principle of discounted standby fares however, hardly applies to local public transport. In effect, all non-booked services are standby and that includes nearly all local public transport services.

Cheaper fares after the morning rush hour are common, partly to spread the demand, partly because many journeys after this time are optional rather than work journeys and so will be more sensitive to price.

12.1.4 Simplifying boarding

On heavily used routes, time spent by passengers boarding a bus or train will substantially affect the speed of the service and the number of vehicles needed to operate a given frequency. Many bus operators introduced prepaid travelcard or season tickets at about the same time as one-man operation of buses.

Flat fares also simplify boarding but to a lesser degree than period tickets. They are not common in Britain and are mostly confined to short services

such as distributors within a city centre. On the continent of Europe, many cities operate a flat fare unlimited travel ticket valid for a period related to the time needed to make the longest journeys possible within the area of operation, typically one hour or one hour and 15 minutes. Many of the cities which operate this principle, including Lyon, Marseille and Brussels have a significant métro or other local railway where many of the passengers will wish to use a bus to get to the stations and perhaps another bus to take them to their final destinations.

12.1.5 Excluding other companies

Where there is more than one transport company operating along a similar route, a further motive for operating travelcards and books of tickets at discounted prices is to discourage their customers from changing to other public transport operators.

12.1.6 Bargaining for subsidy

Public transport operators are usually reimbursed by transport authorities for concessionary fares such as for the elderly. Because the principle is usually to compensate for loss of income, this may be a consideration in pricing fares.

12.1.7 The expense account customer

Some travellers are immune from the level of fares. British Rail first class travel is priced at a level which reduces crowding on parts of trains. The expense account traveller is much more influential in the pricing of longer distance travel, particularly by rail and air, than in local travel.

12.1.8 Protecting the environment

In many countries, transport authorities are willing to subsidize fares down to a level which they think will curb the use of the private car as a means of limiting damage to the atmosphere, noise and all the other ways in which for a given number of journeys, public transport is agreed to be less damaging than the private car.

Even after subsidy, the cost of local public transport is typically four to six times the marginal cost of car travel, excluding parking costs. Transport authorities are therefore very much affected by policy towards parking charges, which is outside their control.

12.1.9 Competition between operators

One of the principal motives for the deregulation of local bus services was apparently to keep fares under control, perhaps even to reduce them. There

are indeed cases of services being operated at lower fares than those of a well-established, usually large, bus company which may be cross-subsidizing.

Competition may also come from private transport and this too may help control fares. In some continental European cities such as Bremen, where there is a high level of cycle usage, there is some evidence that cycling is more commonly seen as an alternative to public transport than to the private car.

It is often said that public transport only caters for those who do not have a car available or where there is sufficient traffic congestion or parking is lacking to such an extent to make the private car unattractive. This is probably very close to the truth for buses, less so for railways. Where it is true, no influence will be exerted on the levels of fares.

13

POLITICS OF LOCAL PUBLIC TRANSPORT

13.1 CONFLICTS OF INTERESTS

City centres have become characterized by the noise of road traffic, the smell of vehicle exhausts and delay to both road users and pedestrians caused by too many people moving by means which take up too much space. Buses and trains contribute to atmospheric pollution and noise but in a very much smaller way than the private car per passenger mile. We all know how to reduce the unwanted effects of traffic but collectively we choose not to do it. If not backed up by road traffic management measures restricting the private car, campaigns to persuade motorists out of their cars and on to the buses and trains are no more than window dressing, a gesture to appear to be doing something, and there will be no substantial effect on the level of road traffic.

In all but the smallest cities, where access can be on foot, high density land uses make it necessary to have a system of public transport. Relying on the private car would take up too much space in the form of roads and car parks. Densities would be rendered too low for the convenience of the pedestrian. So public transport is necessary to maintain access to city centres. Nevertheless, shopkeepers recognize that access by car is important to them. Even if they are located in the city centre they will want car parks, the bigger and nearer the better. They will even consider relocating to an out-of-town site where they can have bigger and bigger car parks, not caring so much about public transport services. And so we have a big demand for city centre parking together with a need to keep walking distances acceptable. Multi-storey and underground parking help achieve both requirements but do nothing for noise, air pollution or public transport.

In short, there is a conflict of interests. Motorists, shopkeepers, proprietors of commercial properties and other urban activities would like to have

unrestricted access by private car. Although technically possible, the land use consequences and the effects on the environment would be unacceptable, to those who want access by car as well as everyone else. We have to resolve the two related questions of how much access by private car is to be allowed and how it is to be allowed, which will influence who is to have it. Public transport is the alternative which can provide very high capacity access, with little or no environmental damage in the case of underground railways. It is the answer to the conflict. The problem is how to make it acceptable to the motorists accustomed to the comforts of his mobile extension of home and how to convince proprietors of businesses dependent on the arrival of the motorist that this has been achieved.

A further source of conflict of interests arises when public transport projects are proposed. A new railway route will increase access and to most local residents or others who have a local interest, such as business proprietors, this will be welcome. The problems arise for those whose properties are too close to the route. Demolition of property usually causes opposition, basically because the level of compensation does not fully compensate.

Many transport projects have failed because the promoters did not anticipate associated conflicts of interest, or where compensation is involved, they may not have had the powers to do much about it. There are many projects for local railways and other public transport projects which would have been very likely to produce substantial net benefits but have been abandoned because of opposition from quite a small number of losers, opposition which could probably have been avoided if proposals for implementation had been more sensitive to local interests.

Those whose properties are very close to the route, particularly if they are residential properties, may feel that they are losing more than they are gaining and oppose the proposals. To avoid protests and political repercussions, transport authorities have prepared projects which will affect noone, for better or worse. The spate of light rail projects announced in 1987 and 1988 included many routes which were clearly far from optimal in terms of attracting passengers and almost as clearly not even viable. Large amounts of public money were wasted in employing staff and consultants to prepare projects on what were predictably the wrong routes. Now, attention of transport authorities has returned to bus priority. The temptation to build where they are technically and politically easy, rather than where they are needed, is still there. Indeed, bus priority will be needed only where there is congestion and these will be the precise routes where there is a shortage of space and where construction will be technically and politically difficult.

13.2 HOW MUCH DO WE CARE ABOUT REDUCING THE ENVIRONMENTAL EFFECTS OF TRAFFIC?

We are not awaiting any scientific or technical discoveries to show us how to improve the quality of the environment of our towns. There are several well-known and effective measures which could be used. What we are waiting for is the will to adopt effective traffic management measures. Practically every town in the land has some form of traffic restriction and improved street environment but in only a few towns are there more than one or two restricted enclaves—a few pedestrian streets perhaps—in what are otherwise towns choked by traffic. Our reluctance to address the effects of near-to-unrestricted car usage must cast doubt on whether collectively the effects of the motor car are really seen as being particularly detrimental. Do we want substantial traffic-free areas in town? Are we bothered by the current state of our towns and cities? Clearly we are not sufficiently bothered about the environment to find it unacceptable, or we would not continue to accept it. We all like nice traffic-free streets in the city centre but we like even more to use our cars to get there.

There has been an attitude for more than a decade that cities are not meant for walking in, except for a few 'pedestrian areas'. Indeed, the expressions 'pedestrian street' and 'pedestrianization' have slipped more and more into everyday speech almost as though other streets were not for pedestrians. There is, however, some increase in concern about the environment. The recent interest in traffic calming is not a result of technical discovery. It results from increased concern about the environmental effects of the motor car.

Even in Britain, where the effects of the private car have been less than in many other countries, there has been an attitude that only the under-priviledged do not have at least one car. Abroad, we can even see universities and other organizations comprising buildings scattered over many acres without even footpaths connecting them. You are supposed to get into one of your cars when you want to go from building to building. Some new towns, new neighbourhoods and even a few city centres have been planned in such a way as to make walking very circuitous for all but the shortest of journeys.

The individual motorist does not see his own actions as being anti-social or detrimental to anyone in more than a negligible way. The prospect of giving up the convenience of using his car for a minute contribution to the cleaning up of the atmosphere and reduction in traffic noise is not one which the vast majority of motorists will accept. This is the basic reason for the damage to the environment locally as a result of road traffic and for the demise of local public transport. Would a guarantee of collective reduction in traffic be sufficient to persuade motorists to reduce use of their cars for public transport? Politicians still seem to think not, but they appear to be less sure than they were a few years ago. Collectivity of restriction on private car

usage is certainly enforceable by traffic management measures or financial measures such as parking charges and road pricing.

How many motorists use their cars for journeys of only a few hundred yards which could be easily done on foot? If there are no disincentives to use their cars, such as lack of parking at the destination or the likelihood of extensive traffic congestion, how many motorists consider using public transport even where there is a good service? Who can blame the motorist for not giving up the comfort and convenience of car with a marginal cost around 5p per mile for the discomfort and inconvenience of public transport at more like 25p per mile?

Few members of the public accept that air pollution from vehicle exhausts is such a serious issue that they are willing to let it affect the way they vote at elections. We may also wonder whether they would even be willing to reduce the use of their cars if this was part of a regulated and concerted action by all road users. They are even less likely to take unilateral action by voluntarily reducing their use of their cars without an assurance of similar action by other road users.

The shock of seeing large areas of forests dying has coincided with increased public environmental awareness in continental Europe, including action against vehicle exhaust emissions. In this country we have had no effects quite so strongly visible. A fall in car sales is presented to us as bad news. Faced with a general election, a government may well reduce car tax, a popular move, especially in parts of the country where the motor industry is concentrated and where there are several politically marginal parliamentary seats. They may even abolish car tax as part of an effort to 'kick start' the economy.

Many rural areas have become impossible to live in without private transport. Why is the bicycle not seen as an answer? It would appear to provide an alternative to many car journeys at least for those physically capable of using one and in good weather. It would be a suitable means of transport for some individuals but would not solve the main public transport problems in so many rural areas—that of the viabiltiy of providing a public transport service.

In fact, an increase in bicycle use may well make the problem worse. It is quite possible that it is public transport which cyclists see as the main alternative, not the private car and that the bicycle provides more competition to public transport than it does to the private car. Analysis of modal split data in cities where cycle usage is appreciable often reveals that the negative relationship between cycle usage and public transport is stronger than the negative relationship between cycling and car travel, that is, an increase in cycling is accompanied by a bigger decline in public transport usage than car usage. It is also possible that high cycle ownership tends to help keep down public transport fares. The threat of public transport users getting on their bikes is quite a potent one.

Many motorists take an uncompromising attitude and will not sacrifice

speed or comfort. In many towns there is also a high degree of inertia in favour of the private car. High car usage makes cycling conditions difficult and dangerous. Shops, offices and other destinations are, not surprisingly, more keen to provide car parking than facilities for bicycles. Cars are much better than bicycles for carrying away the mountain of grocery that supermarkets would like to sell to every customer. The promise of a company bicycle does not have the same effect as a company car in attracting and rewarding what companies see as the staff they want to have. The motor car is very convenient for some journeys involving loads and once purchased, motorists get into the habit of using it for all journeys whether the special convenience it gives is needed or not. This unthinking attitude has been helped along by the low marginal cost of motoring. Once you have a car on the road, it costs very little to use it, typically about one-fifth of the cost of a public transport journey, and that assumes only one person per car.

13.3 LAND USES AND LIFE-STYLES

Land uses and life-styles become adapted to transport systems. Cities where local railways account for a high proportion of journeys are more dense than those reliant on buses which in turn are more densely developed than those with a very high proportion of journeys by private car. This is what we would expect, knowing the level of accessibility offered for a given land consumption by these means of transport. This relationship develops over a period of decades depending on the pace of urban renewal and development and will take a similar time to change if the mode of transport is changed. Apart from London, English large cities have developed a land use pattern dependent on the bus as the main means of public transport, with a rapidly increasing reliance on the private car during the past four decades. Introducing light rail now has the problem that land uses are too low for it to be justifiable on economic criteria. Switching from bus to rail is a problem, from car to rail an even bigger one.

Life-styles too become adapted to a means of transport. Families get used to buying a hundredweight or more of groceries weekly, rather than a daily bagful. Shops become geared to this pattern too. Parents get into the habit of taking children to school by car, adding to peak hour traffic. A company car has become an early symbol of success by many an aspiring executive. A company parking space with the user's name on it may be equally coveted if it is in central London or somewhere else where land is precious. Whilst government fiscal policies over several years have tight-ened up on company cars, so too have policies towards public transport subsidy and we have had no action on subsidized company parking.

Taking away an existing privilege is politically damaging. Car manufacturers generally offer discounts to employees and free parking. Even

relatively spacious suburban car factories have become so congested with employees' cars that production has become affected. Consultants have been called in to confirm the obvious but distasteful fact that privileges will have to be curtailed, to light the blue touch paper by suggesting that car workers travel to work by bus.

From time to time we hear of government-sponsored research projects on how to reduce the need for transport. Even the most casual observer of the town and country planning system will be able to point to an endless list of land use decisions which seem certain to increase the need for travel, badly located in relation to public transport but with huge car parks. Initiating such projects seems to be a particularly transparent attempt to use research as a means of parrying criticism for lack of action.

13.4 PUBLIC TRANSPORT ALLOWS BUT DOES NOT CAUSE A REDUCTION IN TRAFFIC

Public transport, especially rail, gives mass access with little environmental damage. It gives the opportunity to take road traffic management measures to clean up the environment without reducing access. In fact, there must be many towns where a switch from car to rail usage would give access to a greater number of people. So why have we been so slow to develop local rail as a means of access and distribution within the city centre, or even to give buses the substantial priority that they would need to form a credible alternative to the private car?

Since 1990 or thereabouts there have been a number of studies on bus priority (Chapter 4). Probably amongst the reasons why there have not been more are doubts about whether motorists would abandon their cars for the buses, even with priority and secondly, fear of the political repercussions of taking roadspace away from the private car and designating it for buses. The underlying reason why we do not have more public and less private transport in towns is not doubt about whether the environment could be improved as a result of the change: it is whether public opinion values environmental improvement greater than the inconvenience of a reduction in car use.

It was argued in Chapter 3 that light rail alone does not significantly reduce the level of road traffic, a conclusion that can be expected to apply to other forms of local public transport to at least some extent.

13.5 THE GRIP OF THE ENGINEERING PROFESSION ON TRANSPORT POLICY MAKING

Of course we look towards the engineering professions to guide the construction of public transport projects. Whilst there have been

construction problems such as those relating to the corrosion of concrete structures, many of the most serious and widespread issues in transport projects have resulted from an inability to understand public reactions to them. Misuse of pedestrian underpasses making them unpleasant and dangerous, not construction faults, has been the main cause of their poor public image. One of the main tasks underlying so much public transport policy rests on gaining and understanding of the motivation of the motorist, what causes resistance to public transport and how to overcome it. Expertise in psychology is more difficult to convincingly demonstrate in public than are engineeering skills. We are left with a situation where some of the most significant issues in public transport policy making are being left on the sidelines or are being addressed in an amateurish way by officials operating outside their fields of expertise.

What has caused this situation to happen? It is not a lack of those educated in the right disciplines for the work in hand. The long-established and firm grip of the engineering professions as reflected in their professional institutes is one factor. Another may be public expectations. We have come to expect that a bus priority project or a light rail project will be dominated by engineering considerations. If the construction was faulty it would be more publicly obvious than if the failure was due to a lack of understanding of what causes people to use it.

13.6 WHAT DO POLITICIANS REALLY THINK ABOUT LOCAL PUBLIC TRANSPORT?

For Members of Parliament, local public transport is not a big issue. The connection between the Transport Act 1985 and the quality of local public transport services is drawn by few public transport users. Those responsible for passing this legislation appear to have been allowed to feel largely immune from the consequences of it. Road traffic congestion is a far bigger issue to a goverment at Westminster. To be seen to be doing something about it is regarded as politically beneficial. There has been a temptation to tag on an alleged reduction in road traffic congestion quite indiscriminately to almost any central government funded projects where it seems that it might look believable.

Department of Transport Circular 3/89 which ostensibly sets out central government criteria for finance of public transport capital projects, implies that light rail can be expected to result in a reduction in road traffic congestion. Politicians can speak quite plausibly to the press about how light rail will reduce traffic congestion. Most journalists will swallow the connection and pass on the good news to the motorist. To anyone who has carried out any research into the question, it is well known that only under very unlikely circumstances will an improvement in public transport result in a significant and permanent reduction in road traffic in the absence of any

other action to reduce road traffic. So why did the circular include such a condition? We are left wondering what are the real criteria for financial approval. It seems that we can only have money for public transport if we pretend that it will please the motorists by clearing the roads a little for them. We have to pay consultants to play the charade of calculating non-user benefits to motorists. So strong is the grip of the private car lobby in voting when compared with public transport users. Consultants will find it financially rewarding to play along and pretend that traffic congestion is being relieved. Senior civil servants close to ministers do not find favour by telling the minister he is talking through the top of his hat, especially if he thinks that relieving traffic congestion is a vote winner.

Even in local politics, the quality of public transport services does not appear to be the contentious issue that might be expected. It is rare for there to be any conceited public demands for bus priority. Buses with lower space standards and with dangerously fast acceleration can be introduced with no more that a few curses under their breath as the elderly or encumbered struggle pitifully to keep their balance.

EC research initiatives offer money to develop passenger information systems, packed with state-of-the-art telematics and festooned with more flashing lights than the average Christmas tree. Meanwhile at the local bus stop, there is a 50% chance of no timetable, 70% chance of no fares table (please have exact fare ready to speed up boarding; no change given), 90% chance of no route plan and a 20% chance that it will not even reveal which buses stop there.

Whilst recognition of the demise of public transport is to be welcomed, the most pressing needs are not technical ones. What is needed is to set the conditions under which public transport has a clear rôle to play and where it can attract sufficient passengers for success.

Local politicians on the whole have been more keen to be associated with rail than buses. Light rail has been seen as something new and exciting, technologically advanced compared with buses. It is a symbol that the public authorities are keen to do something for the town. Improvements to buses are much easier, faster and cheaper to carry out and have the advantage of not being confined to a fixed route. We may wonder whether it is because they are cheaper and technologically more simple that they lack the prestige and appeal of light rail. There appears to be a certain amount of kudos related to the cost of a project as well as the level of service it will provide.

13.7 SUBSIDY

In many countries there has been a growing concern in recent years about the level of subsidy demanded by public transport, both for capital costs and even more so, for operating costs. The Final Report of the Royal

Commission on National passenger Transportation for Canada (1992) echoes a sentiment which can be heard in many other countries including the United Kingdom in being guided by the need for a system supported by the travellers who use it and not by Government subsidies and by the sentiment that passenger transportation should be treated more like a business.

In the United Kingdom we hear about non-user benefits being allowable in the cost-benefit calculations when deciding whether or not a project is to receive subsidy under section 56 of the Transport Act 1968. The problem for public transport projects in gaining approval is that much of the benefit offered by public transport compared with the private car is in the form of the relative lack of externalities, environmental damage. The legislation does not rule out a full consideration of externalities, neither does it give an assurance that they will have any influence in making decisions.

13.8 MAKING PUBLIC TRANSPORT PROJECTS MORE ACCEPTABLE

An important step in increasing political acceptability is to separate public transport projects from what have been seen as unacceptable side effects. These effects have been of two main kinds: loss of roadspace to other vehicle users and demolition of property where a new railway is being constructed, for example. Bus priority measures usually involve some loss of roadspace to the private car and this seems likely to have contributed to the smallness in number and scale of the proposals and projects already adopted.

Bus priority must be located where it is needed, where there is traffic congestion, not where it is easiest to build because there is space available. A solution might be to reduce the likelihood of public transport being seen as the cause of inconvenience to the motorist. An alternative, which has been proposed for Cambridge, is to present public transport investment as the result of restrictions on road traffic, in this case, road pricing proposals. Improved public transport investment is the compensation for the cost and inconvenience to motorists.

Several light rail projects have been abandoned following public protest at the loss of a limited number of properties along the route. Public transport projects need to be near to demand. It is no solution to sidestep public protest by locating the route away from habitation where there will be a lack of users. The solution must be adequate compensation, but this is not always in the hands of the promoter. It should be recognized that market values plus removal expenses are not adequate compensation for loss of a home. If the market value was adequate to create willing sellers, there would be more houses on the market. Compensation should be substantially more than market value. The extra compensation would be money well spent if it secures the right route.

For several decades now we have been told that our cities will be strangled by the motor car and will grind to a halt. Occasionally they are: a Friday evening or a Saturday afternoon shortly before Christmas perhaps. But mostly we keep moving. Road traffic congestion has been at or near the maximum tolerable level in some cities for several decades now. It gets no worse. Motorists abandon their cars and take to public transport or find some way of avoiding their journey. The equilibrium theory or maximum tolerable congestion/minimum tolerable speeds has been proved broadly correct for a long time now. This would seem likely to have two consequences for the future: the daily period of maximum tolerable congestion/ minimum tolerable speed will continue to extend (although the potential for this is quite limited now) and London traffic conditions will extend to other cities. So too might London-type public transport systems including an increased part for rail. Certainly deteriorating road traffic conditions will help public transport on separate tracks or lanes.

There is still a lot of room for improvement of public transport services by very simple means such as fixing adequate information to bus stops. Almost equally obvious is the desirability of considering very carefully any reduction in standards of comfort on vehicles. Many of the practices in the bus industry give the impression that decision makers never use their own services. It is very rare to see an inspector on the smaller, less spacious vehicles and never in the seats spaced only to match the needs of a child. Many bus operators still give the impression that they have never thought about who is supposed to use their services and what are their requirements, so necessary for commercial reasons as well as in providing a public service. A useful first step would be to do some arm twisting to ensure that all senior staff and members of transport authorities use their own bus services whilst carrying two shopping bags and a child in a push chair.

Local public transport retains its Cinderella status in Britain because users and potential users allow it to do so. Most public transport users have no alternative means of transport and feel that they have to put up with whatever is on offer. If they had an alternative, many bus companies would either have to reform or go out of business. Of course there are a few articulate users and supporters who will take on those who continue to provide a slipshod service or ill-informed or badly thought-out policy but the overwhelming majority of users are too young, too old, too illinformed or too lethargic to create the political rumpus that is needed to get better services.

BIBLIOGRAPHY

Armitage, R. (1992) French bread, British crumbs. *Surveyor,* 2 July, 10–11.

Baker, B. (1992) Light approach in Nottingham. *Surveyor,* 30 January, 13–14.

Ballinger, M.V. (1991a) Midland Metro. *Modern Tramway and Light Rail Transit* , February, 39–43.

Ballinger, M.V. (1991b) Midland Metro part 5: a tramway for Coventry? *Modern Tramway and Light Rail Transit,* July, 223–26.

Bushell, C. and Stonham, P. (eds) (1993) *Jane's Urban Transport Systems,* Jane's Publishing Company, London.

Cancalon, F. and Gargaillo, L. (1991) *Les transports collectifs urbains,* Celse, Paris.

Catling, D. (1992) The Otis Shuttle. *Highways and Transportation,* June, 12–13.

Cervero, R. (1984) Rail transit and urban development. *J. American Planning Association,* **50**, 133–47.

Cervero, R. (1985) A tale of two cities: light rapid transit in Canada. *J. Transportation Engineering,* **111**, 633–50.

CETUR (1979) *L'organisation des déplacements dans la politique d'aménagement de huit villes Européennes,* Centre d'Etudes des Transports Urbains, Ministère de l'Environnement et du Cadre de Vie/Ministère des Transports, Paris.

Chambre de Commerce et d'Industrie de Lyon (1983) *Déplacements, moyens de transport lies aux achats (Journeys and modes of transport for shopping),* Lyon.

Cheeseright, P. (1991) On the fast track to reducing congestion. *Financial Times,* 11 July.

Claydon, G.B. (1992) Trams return to Manchester's streets. *Light Rail and Modern Tramway,* August, 201–3.

Commissariat Général du Plan (1992) *Transports 2010.* Rapport du groupe présidé par le Commissaire au Plan. La Documentation Française, Paris.

Cornwell, P. and Cracknell, J. (1990) Busway transit: the regulated option? *Urban Transport International,* November/December.

Dalmais van Straaten, C. (1985) Commerces, déplacements et aires de chalandise dans les centres secondaires: quelques cas de l'agglomération Lyonnaise (Trade, journeys and catchment areas of secondary centres: some cases from Greater Marseille). *Transports, Urbanisme, Planification,* 5, 73–84, Centre d'Etudes des Transports Urbains, Ministère des Transports/Ministère de l'Urbanisme et du Logement.

Department of Transport Circular 3/89 *Section 56 Grant for Public Transport.*

Department of Transport (1991a) *Transport Statistics Great Britain, 1991,* HMSO, 41/C7000.

Department of Transport (1991b) *Park and Ride,* Traffic Topics No. 5, Traffic Advisory Unit, September, HMSO.

Department of Transport (1991c) *Keeping buses moving,* Local Transport Note 1/91, December, HMSO.

Department of the Environment Circular 22/83 (1983) *Planning Gain. Obligations and benefits which extend beyond the development for which planning permission has been sought.*

Durand, B. and Pêcheur, P. (1985) Evolution des transport urbains. *Transports, Urbanisme, Planification,* 5, 5–21, Centre d'Etudes des Transports Urbains, Ministère des Transports/Ministère de l'Urbanisme et du Logement.

Erskine, W. (1983) *State and local financing of public transit systems,* US Department of Transportation, Washington DC.

Fawcett, P. (1989) *Minibus services,* Croner Publications.

Flint, D.S. (1992) A traffic and parking plan for Exeter, *Highways and Transportation,* November, 11–15.

Fouracre, P.R., Allport, R.J. and Thompson, J.M. (1990) *The performance and impact of mass rail transit in developing centres,* TRRL Report 278, Crowthome, Berkshire.

Frankfurt am Main, Dezernat Planung (1984) *Generalverkehrsplan '76–'82 Netauswahl, Straße, Scheine (Traffic Master Plan '76–'82, network options, road, rail).*

Freeman, J.D.F., Smith, T.A. and Willoughby, P.J. (1992) *Guided light transit in Bristol: the viewpoint of the promoter,* PTRC 20th Annual Summer meeting, University of Manchester Institute of Science and Technology, proceedings of seminar D, 117–128.

Gardner, G. (1992) A study of high capacity busways in developing cities. *Proc. Instn. Civ. Engrs. Transp.,* 95(August), 185–91.

Gardner, G., Cornwell, P.R. and Cracknell, J. (1991) *The performance of busway transit in developing countries,* TRRL Research Report 329, Crowthorne, Berkshire.

Gomez-Ibanez, J.A. (1985) A dark side of light rail? The experience of three new transit systems. *J. American Planning Association,* **51**, 337–51.

Gordon, A. (1991) The Parry People Mover—arriving soon. *Modern Tramway and Light Rail Transit,* September, 291–95.

Greater Manchester Passenger Transport Executive (1990) *On the right track,* papers presented to the conference on Manchester Metrolink, September.

Harrison, D.A. and Hamilton, D.M., (1992) Strathclyde guided bus study. *Highways and Transportation,* June, 14–17.

Hawke J.N. (1981) Planning agreements in practice. *Journal of Planning and Environmental Law,* 5–15; 86–97.

Heaps, C. (1990) The growing railway. *Modern Railways,* April, 197–201.

Henry, D. (1984) Planning by agreement: a local survey. *Journal of Planning and Environmental Law,* June, 395–400.

Heseltine, P.M., Bentley, R. and Nelson, J.D. (1992) *Capturing the car user: the potential of park and ride,* PTRC 20th Annual Summer meeting, University of Manchester Institute of Science and Technology, proceedings of seminar C, 173–185.

Hibbs, J.B. (1989) *Marketing management in the bus and coach industry,* Croner Publications.

Hibbs, J.B. (1985) *Bus and coach management,* Chapman and Hall.

Hibbs, J.B. (1975) *The bus and coach industry—its economics and organisation,* Dent.

Higton, A. (1992) A versatile value-for-money, modern LRV. *Light Rail and Modern Tramway,* August, 204–6.

Hill, M. (1993) *Opportunities for a prepayment card system,* paper presented to the conference *Smart Card '93,* 16–18 February, Wembley Conference Centre, Lowndes Exhibition Organisers Ltd.

Holt, D. (1991) Extension prospects for Metrolink. *Modern Tramway and Light Rail Transit,* May, 147–56.

Holt, D. (1992), The dawn of Metrolink. *Light Rail and Modern Tramway,* August, 199–201.

INRETS-CRESTA and Kuhn, F. (1988) Les transports guidés de surface. Situation actuelle et persectives. Tome 4. Les réseaux Français (Guided street-level modes of transport. The present situation and proposals. Volume 4. The French networks). Institut National de Recherche sur les Transports et leur Securité, Centre de Recherche et d'Evaluation des Systèmes de Transports Automatisés, 20 rue Elisée Reclus 59650, Villeneuve d'Ascq.

Jowell, J. (1977) Bargaining in development control. *Journal of Planning and Environmental Law,* 414–33.

Kilvington, R.P. (1992) *New modes for old problems,* PTRC 20th Annual Summer meeting, University of Manchester Institute of Science and Technology, proceedings of seminar D, 51–67.

Kruger, T. Rathmann, P and Utech, J. (1972) Das Hamburger Dichtemodell (The Hamburg Density Model). *Städtbauwelt,* 36.

Laboratoire d'Economie des Transports (1984) Financement des transports urbains (Financing urban transportation) Actes du Colloque International, Lyon, September.

Landeshauptstadt München (1983a) *Materialien zum Stadtentwicklungsplan 1983 (City Development Plan 1983: report of survey),* Referat für Stadtplanung und Bauordnung.

Landeshauptstadt München (1983b) *Stadtentwicklungsplan 1983 (City Development Plan 1983),* Referat für Stadtplanung und Bauordnung.

Lefèvre, C. and Offner, J-M. (1990) *Les transports urbains en question,* Celse, Paris.

Lessieu, E. (1984) *I-495 exclusive bus lane. Speed/volume study.* Port Authority of New York and New Jersey.

Malabry, M. (1985) Routes, Val et Centre Commercial (Routes, the Val métro and the commercial centre). *Transports, Urbanisme, Planification,* 5, 85–104, Centre d'Etudes des Transports Urbains, Ministère des Transports/Ministère de l'Urbanisme et du Logement.

Millar, A. (1992) A time for Romanse. *Surveyor,* 2 July, 14–15.

Millar, R. (1992) *Docklands busway—the acid test for bus priority in London,* PTRC 20th Annual Summer meeting, University of Manchester Institute of Science and Technology, proceedings of seminar D, 167–182.

Moyes, T. (1992) Five years of British bus deregulation. *Geography,* **77**, 70–72.

Niblett, R. and Palmer, D.J. (1993) Park and ride in London and the South East. *Highways and Transportation,* February, 4–10.

Offner, M. (1986) *Aspects méthodologiques d'un suivi exploratoire du VAL sur deux quartiers Lilloise,* Institut de Recherche.

Pucher, J. (1988) Urban public transport subsidies in Western Europe and North America. *Transportation Quarterly,* **42**, 377–402.

Quin, C., Houée, M. and Méyère, A. (1990) Le financement des transports collectifs urbains dans le pays développés, Ministère de l'Équipement du Logement, des Transports et de la Mer, La Documentation Française.

Robinson, S.E. (1992) Unconventional public transport in shire counties. *Highways and Transportation,* June, 18–23.

Royal Commission on National Passenger Transportation (1992), *Directions,* Final Report, Canada.

Sanson, H. (1984) Pour l'organisation d'un pole secondaire autour du terminal métro à Caluire (secteur nord de l'agglomération Lyonnaise) (Development of a secondary centre around the métro terminal at Caluire (in the north of Greater Lyon)). *Transports, Urbanisme, Planification,* **1**, 37–54, Centre d'Etudes des Transport Urbains, Ministère des Transports/Ministère de l'Urbanisme et du Logement.

Sanson, H. (1985) Pratiques d'échanges voitures particulières—transports collectifs et activités commerciales (commercial activity at points of change between private and public transport). *Transports, Urbanisme, Planification,* 5, 105–16, Centre d'Etudes des Transport Urbains, Ministère des Transports/ Ministère de l'Urbanisme et du Logement.

Sidenbladh, G. (1965) Stockholm: a planned city, in *Readings from Scientific American,* Cities, their origin, growth and human impact, 187–94.

Simpson, B.J. (1985) *Quantitative methods for urban and regional planning,* Gower, Aldershot.

Simpson, B.J. (1987) *Planning and public transport in Great Britain, France and West Germany,* Longman, London and New York.

Simpson, B.J. (1988a) *City centre planning and public transport: case studies from Britain, West Germany and France,* Van Nostrand Reinhold.

Simpson, B.J. (1988b) Local public transport systems in Britain, France and West Germany. *Traffic Engineering and Control,* May, 288–93.

Simpson, B.J. (1988c) Hold-ups on the line. *Surveyor,* 30 June, 18–20.

Simpson, B.J. (1988d) Bradford bounces back on the trolleybus. *Surveyor,* 24 November, 18–20.

Simpson, B.J. (1989a) Slamming on cash brakes. Surveyor, 8 June 1989, 18–19.

Simpson, B.J. (1989b) *Urban Rail Transit—an appraisal,* Transport and Road Research Laboratory CR140, UK Department of Transport.

Simpson, B.J. (1989c) Liaisons Dangereuses. *LA Week,* 16 November.

Simpson, B.J. (1989d) French Lessons. *Transnet News,* **13**, December, 14–15.

Simpson, B.J. (1990a) Competition for Section 56 grants. *LA Week,* 11 January, 15.

Simpson, B.J. (1990b) A bumpy ride for light rail? *Surveyor,* 4/11 January, 16–17.

Simpson, B.J. (1990c) *Urban Rail Transit—costs and funding,* Transport and Road Research Laboratory CR160, UK Department of Transport.

Simpson, B.J. (1990d) Pushing for the green light. *Surveyor,* 28 June, 22–23.

Simpson, B.J. (1990e) Bringing back the bus. *Surveyor,* 8 November, 11.

Simpson, B.J. (1991a) Going off the rails? *Surveyor,* 13 June, 16–17.

Simpson, B.J. (1991b) Right track for Midland Metro? *Surveyor,* 18 July, 14–16.

Simpson, B.J. (1991c) Taking the brakes off. *Surveyor,* 5 December, 16–18.

Simpson, B.J. (1992) Northern light shines. *Surveyor,* 2 July, 16–17.

Simpson, B.J. (1992) Digesting congestion. *Surveyor,* 24 September, 11.

Simpson, B.J. (1993) Priority for light failure. *Surveyor,* 7 January, 15–16.

Skelsey, G.B. and Wyse, M.J. (1990) Light rail for Greater Nottingham. *Modern Tramway and Light Rail Transit,* **53**(December), 409–15.

Tarricone, P. (1992) Rail revival. *Civil Engineering,* January, 36–9.

TEST (1991) *Wrong side of the tracks? Impacts of road and rail transport on the environment: a basis for discussion,* TEST, 177 Arlington Road, London NW1 7EY.

Torode, R. (1993) *A farecard system for London's buses,* paper presented to the conference *Smart Card '93,* 16–18 February, Wembley Conference Centre, Lowndes Exhibition Organisers Ltd.

Tyson, W. (1992) Planning and financing Manchester Metrolink. *Proc. Instn. Civ. Engrs. Transp.,* **95**(August), 141–50.

Utech, J. (1982) Das Hamburger Dichtemodell 1980 und seine Wirkungsmöglichkeiten auf das Schnellbahn Fahrgastaufkommen (The Hamburg density model 1980 and its possible effects on the use of the railways by passengers). *Verkehr und Technik,* **9**.

Walmsley, D.A. and Perrett, K.E. (1991) *The effects of rapid transit on public transport and urban development,* TRRL Research Report 258, Crowthorne, Berks.

Walmsley, D.A. and Pickett, K.E. (1992) *The costs and patronage of rapid transit systems compared with forecasts,* TRL Research Report 352, Crowthorne, Berks.

Watel, M. (1984) *Déplacements, transports et commerce. La presqu'île 1975–80 (Journeys, transport and commerce. The peninsula (city centre) 1975–80),* Journée Nationale d'étude 6/12/84, CETUR, CETE, CECOD, Lyon.

Watel, M. (1985) Activités commerciales de la presqu'île de Lyon (Commercial activities in the peninsula (city centre) of Lyon). *Transports, Urbanisme, Planification,* **5**, 53–71, Centre d'Etudes des Transports Urbains, Ministère des Transports/Ministère de l'Urbanisme et du Logement.

Wilson, J.S. (1990) Strathclyde studies light rail. *Modern Tramway and Light Rail Transit,* September, 291–98.

Wilson, J.S. (1992) The value of Edinburgh Metro confirmed. *Light Rail and Modern Tramway,* February, 30–33.

Wiseman, R.J.S. (1992a) Tyne & Wear Metro: Airport line opens, Sunderland planned. *Light Rail and Modern Tramway,* March, 58–59.

Wiseman, R.J.S. (1992b) Cleveland Advanced Transit, *Light Rail and Modern Tramway,* June, 148–51.

Wood, C. (1990) Light rail for small cities: prospects for Norwich. *Modern Tramway and Light Rail Transit,* June, 192–96.

Wyse, W.J. (1991a) Croydon opts for Tramlink. *Modern Tramway and Light Rail Transit,* June, 187–92.

Wyse, W.J. (1991b) DLR update. *Modern Tramway and Light Rail Transit,* October, 327–34.

Yapp, C.J. (1992) *Guided bus: a practical solution to problems of urban congestion,* PTRC 20th Annual Summer meeting, University of Manchester Institute of Science and Technology, proceedings of seminar D, 105–116.

Yearsley, I. (1991a) On track to beat congestion. *Surveyor,* 31 January, 8–10.

Yearsley, I. (1991b) Congestion buster. *Surveyor,* 22 November, 15–17.

Yearsley, I. (1991c) Stepping on the right level. *Surveyor,* 28 November, 11.

INDEX