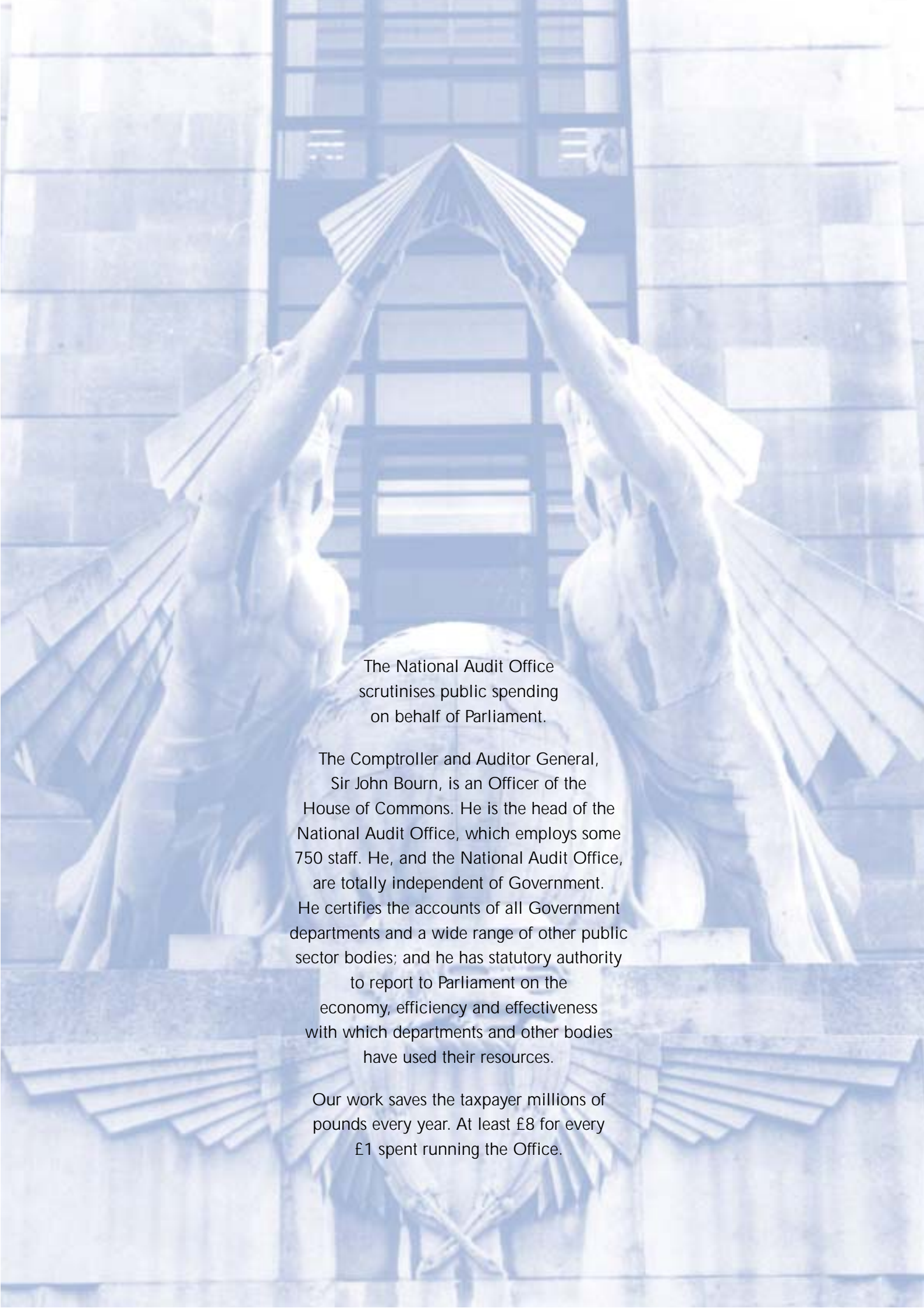


Improving public transport in England through light rail

REPORT BY THE COMPTROLLER AND AUDITOR GENERAL
HC 518 Session 2003-2004: 23 April 2004





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This report has been prepared under Section 6 of the National Audit Act 1983 for presentation to the House of Commons in accordance with Section 9 of the Act.

John Bourn National Audit Office
Comptroller and Auditor General 14 April 2004

The National Audit Office study team consisted of:

Stewart Lingard, Mark Southon, Claire Fisher and
Fiona Ashley under the direction of Keith Holden

This report can be found on the National Audit Office
web site at www.nao.org.uk

**For further information about the National Audit Office
please contact:**

National Audit Office
Press Office
157-197 Buckingham Palace Road
Victoria
London
SW1W 9SP

Tel: 020 7798 7400

Email: enquiries@nao.gsi.gov.uk

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Summary

- 1 This report examines the Department for Transport's work in funding the construction of light rail systems to improve public transport in England. Light rail is a modern version of the electric street tramway systems that were abandoned in the middle decades of the twentieth century. Local authorities decide whether a new light rail line or system is appropriate for their area and usually have to seek funds from the Department and be granted legal powers by the Secretary of State for Transport before their schemes can proceed. Since 1980, seven new systems¹ have been built in England, at a cost of £2.3 billion. At more than £1 billion, the Department's contribution represents the largest share of these funds.
- 2 Five of the seven systems were designed, constructed, operated and maintained by private sector companies. The Sheffield Supertram was built and originally run by the local Passenger Transport Executive but later run and maintained by a private sector company. The Tyne and Wear Metro was built, and is still run, by the local Passenger Transport Executive.



- 3 Improving public transport through light rail schemes exhibits many of the key issues highlighted in the National Audit Office's January 2004 report *Increased resources to improve public services*:

Complexity of the delivery chain, where delivery of light rail schemes depends upon several partners to be fully effective;

Capacity of delivery organisations, where local authorities that promote schemes need to have the capacity in terms of staff with the right skills to deliver new light rail systems;

Targeting of resources to improve public transport where there is greatest need, and for the most effective use of resources; and

Monitoring and evaluating performance, to determine the extent to which schemes are delivering the expected benefits, on time and within budget.

¹ Tyne and Wear Metro, Docklands Light Railway, Manchester Metrolink, Sheffield Supertram, Midland Metro, Croydon Tramlink and Nottingham Express Transit.

Departmental expenditure has been kept within budget in all but one of the six schemes that have been built

- 4 In five of the six light rail² schemes we examined, the Department paid either what it had originally agreed to contribute towards construction costs, or less. The Department paid more than it originally agreed on the Sunderland extension to the Tyne and Wear Metro. In the case of the Sheffield Supertram, however, the Department has incurred additional costs since the system opened. As a condition of contributing £220 million to the £241 million scheme, the Department required the South Yorkshire Passenger Transport Executive to privatise the operating concession after the system opened. Expecting privatisation proceeds of £80 million, the Executive secured receipts of only some £1 million mainly because of lower than expected passenger numbers, bringing the scheme a financial loss of £5.4 million in its first year of operations. The shortfall in privatisation receipts left the Executive with a debt that it was unable to service from its own resources. The Department decided to take over some of the debt, incurring service costs of some £6 million a year.

There has, however, been incomplete evaluation of existing systems

- 5 Each of the seven light rail systems built since 1980 has cost more than £140 million to build. The Department has contributed up to 93 per cent of these systems' total construction costs, while local authorities have drawn on a range of other sources, including their own monies and private finance, to complete the funding. In the *10 Year Plan for Transport*, the government envisaged that up to 25 new light rail lines could be built by 2010 if the scale of the investment anticipated by the *Plan* were achieved and proposals for new schemes offered value for money; 12 new lines are under development. The Department expects to pay no more than up to 75 per cent of the cost of building new systems. It has evaluated four of the six systems that have been running for several years, but none of their extensions. The evaluations have focussed on key aspects concerning patronage levels, travel patterns, passenger perceptions and congestion relief. The evaluations have not assessed whether systems have put in place the tangible assets that were expected, such as stations and vehicles, nor on a consistent basis whether the systems have delivered their anticipated benefits, such as quick and reliable services for passengers. In particular, they did not fully examine systems' impact on the local economy, or the extent to which systems were integrated with other forms of public transport such as buses. The Department therefore has an incomplete picture of what has been delivered for the significant amount of public monies invested in the schemes, and does not have as informed a base as it should have for the consideration of future schemes.

² Excludes the Nottingham Express Transit, which at the time of our detailed examination had not been completed.

Light rail has improved the quality and choice of public transport

- 6 Drawing on data from local authorities and the operators of five light rail systems, as well as the Department's evaluations, we found that light rail lines, stations and vehicles have been delivered much as planned. Light rail delivers fast, frequent and reliable services and provides a comfortable and safe journey. Local authorities monitor the performance of light rail operators and told us that, on the whole, they were satisfied with performance levels. The Sheffield Supertram and the Midland Metro, however, operated poorly for two years or so after they opened; their performance has since improved. In contrast, the Manchester Metro has attracted so many passengers that it experiences overcrowding at peak times.
- 7 Light rail has widened the range of public transport available. Light rail systems carry nearly 140 million passengers a year, up by 44 million, or 47 per cent since 1999. Systems have also encouraged a shift away from car use, while most people also think that they enhance the image of their host cities or towns.

Anticipated benefits have been over-estimated, however, and are not being exploited to the full

- 8 Light rail systems are delivering many of their expected benefits. For example, the routes of light rail lines often go through run down areas, such as the Croydon Tramlink to New Addington and the Manchester Metrolink to Eccles, which offer real benefits to the socially disadvantaged. Patronage, however, has fallen short of expectations and potential benefits have not been fully exploited. There are several areas for improvement:

Passenger numbers, and therefore passenger benefits, have been lower than expected

- The Department examines patronage level forecasts when it appraises the business case of a new scheme. Patronage is expected to build up over time, reaching maturity after some five years of operation. Actual passenger numbers have fallen well short of forecasts in three of the five systems that we examined. Shortfalls ranged from 24 per cent on the Croydon Tramlink after three years of operation, to 45 per cent on the Sheffield Supertram after 8 years of operation. Shortfalls in patronage have been attributable to over-optimistic forecasting, changes in the patronage base, early operational problems affecting services, competition from buses, and physical limitations on the routes selected for some light rail systems.



Light rail systems are not fully integrated with other forms of public transport

- Public transport systems are more likely to be regarded as attractive alternatives to the car if they operate in a joined-up, integrated way. Integration involves co-ordination between services, physical proximity allowing ease of interchange at stations, and through-ticketing and widespread availability of passenger information about routes, fares and timetables. Passengers consider the level of integration to be the least satisfactory aspect of light rail. Integration with bus services has been poor to moderate on many lines, and bus and light rail services have been in competition with one another on the same routes.

Light rail has had a limited impact on road congestion, pollution and road accidents

- The Department envisaged that light rail schemes would help to reduce urban road congestion, pollution and accidents by bringing about a shift away from cars. This is a demanding objective, against a background of increasing economic growth in recent years. For car owners, a light rail journey will rarely match the convenience of going by car, however good the light rail service on offer. There has been a shift away from cars, although there has not necessarily been an easing of road congestion or a reduction in pollution or road accidents. As people leave their cars and travel by public transport, some are replaced by other motorists using the free road space that they have vacated. Light rail cannot, by itself, reduce congestion significantly over the long term. Other complementary measures, such as park and ride schemes, are needed. There has been limited use of such measures, however, by local authorities with light rail systems in their areas.

It is not clear what impact light rail has had on regeneration and social exclusion

- The impact of light rail upon regeneration might take several years to become apparent and, to date, quantitative information about systems' impacts has been collected for only the Sheffield system. None of the evaluations has measured a system's impact on the inclusion of socially disadvantaged people, although social inclusion as an objective of light rail has been a relatively recent development. In measuring regeneration and social inclusion benefits, it is difficult to separate the impact of light rail from other regeneration programmes or from changes in the local or national economy. In July 2003, the Department published new guidance on how transport schemes' regeneration effects should be assessed.

Light rail systems in France and Germany are designed differently to their English counterparts

- 9 Our visits to Lyon and Grenoble in France, and Freiburg and Karlsruhe in Germany, revealed several key differences in the design of their light rail systems compared with systems in England that help to improve the delivery of benefits to passengers and local communities:

Light rail lines are usually segregated from, and given priority over, other forms of traffic at junctions

Cities in France and Germany have the advantage of a greater number of broad avenues where light rail can be placed without losing road space. Light rail is therefore always given priority over other road users, and it is rare for light rail lines not to be segregated from other road traffic, allowing light rail to deliver faster, smoother and more reliable services.

Systems are fully integrated with other forms of public transport

French and German systems are embedded in a fully integrated public transport network in which buses, for example, feed the light rail systems as well as serving non-light rail transport corridors. Timetables are co-ordinated and all cities have comprehensive through-ticketing arrangements, facilitating seamless journeys.

In France, street improvement is an integral part of any light rail scheme

In France, all new systems involve improving the streets through which the light rail lines run, with the laying of new road and pavement surfaces and new street furniture and the cleaning of the facades of buildings. These measures provide a significant facelift along the route to match the modern vehicles being introduced, although at additional cost.

Systems in England have been running at a loss

- 10 Given the level of public money invested in light rail systems, the Department requires assurance from promoters that systems will be financially viable and continue to secure benefits over the longer term. The Department expects light rail systems to be self financing and not to require any operating subsidy from government. Of the existing systems, three made losses over the period 2000 to 2003 and until 2002-03 the Sheffield Supertram also made a loss. Private sector concessionaires' losses ranged from £200,000 to £11.4 million, while the Tyne and Wear Passenger Transport Executive subsidised the Tyne and Wear Metro to cover an operating deficit of £647,000 in 2001-02. Only the Docklands Light Railway has made an operating surplus.
- 11 Revenues have mainly been affected by the shortfall in expected patronage levels but economies in building some schemes have also had an impact. The costs of construction, including the contribution made by the Department, have been largely kept within budget partly by cutting back on some of the features that were originally planned for systems. In some cases the absence of park and ride schemes has affected patronage, whilst the lack of CCTV security cameras at stations has hindered the enforcement of fares.

Light rail systems in France and Germany have higher reported patronage levels than similar systems in England

- 12 Reported patronage levels on French and German systems are significantly higher than on comparable English ones. For example, there are 7.3 million more passenger journeys a year on the Lyon system than on the Manchester Metrolink, although Manchester has a larger population. We identified three key reasons for higher passenger numbers in France and Germany:

Light rail fares are heavily subsidised

In France and Germany, light rail fares are heavily subsidised by local government. For example, in Grenoble and Freiburg respectively, there is a 70 per cent and a 40 per cent subsidy from the local transport authorities, which help to encourage patronage.

Larger patronage base

The light rail system in Grenoble, for example, has 40 light rail stations and 53 light rail vehicles. By comparison, the Nottingham system has 23 stations and 15 vehicles. Potential passenger numbers are higher in France and in Germany principally because inner areas of cities tend to have higher population densities within a short distance of stations. Systems in France and Germany also tend to have more vehicles and stations. Service and fare integration also contribute to higher patronage levels on French and German systems.

Systems connect centres of social and economic activity

In France and Germany, light rail systems connect hospitals, universities and commercial and shopping centres, which generate passenger numbers. This has not always been the case in England, where some light rail routes have followed old railway lines remote from traffic generators. Future schemes being planned in England, such as those in Liverpool and Leeds and extensions in Birmingham, would expect to better connect, with centres of social and economic activity.

The Department needs to do more to improve value for money and there are barriers to the wider take-up of light rail

- 13 There are currently seven urban centres served by a light rail system. In its *10 Year Plan for Transport*, the government envisaged that up to 25 new lines could be built in England by 2010. It has, to date, committed some £1.4 billion towards the cost of building new lines; these are at various stages of development and might be running by 2010. It now considers, however, that the construction of 25 new lines by 2010 might not be practicable, offer value for money or be affordable. Buses are still expected to make the bigger contribution towards the Department's target of achieving a 12 per cent increase in passenger journeys from light rail and buses combined, by 2010.

14 Against this background we identified five barriers hindering the wider take up of light rail and a range of issues that need to be tackled if future systems are to be improved:

Barriers	Issues to be addressed
<p>Cost is the most significant factor discouraging the further development of light rail - 43 per cent of local authorities consider light rail is too costly when compared with other options, such as buses.</p>	<ul style="list-style-type: none"> ■ Lack of standardisation in systems' design drives up costs. ■ Costs are also inflated by applying heavy rail standards to light rail. ■ The diversion of utilities is expensive. ■ There are barriers to the development and adoption of new and cheaper technologies. For example, there are no government grants available to develop innovative, energy saving light rail technologies.
<p>Poor financial performance of some existing light rail systems is discouraging interest in supporting light rail and the costs of new systems are increasing partly as a consequence.</p>	<ul style="list-style-type: none"> ■ Better sharing of risk and alternative forms of procurement contract could help to reduce costs and attract private sector investors. ■ Improved pre-costing of passenger numbers would provide a firmer basis for assessing systems' financial viability before contracts are let. ■ Revenue collection also needs to be improved.
<p>Local authorities are concerned about being able to secure sufficient funds at local level to promote a system and help pay for its construction.</p>	<ul style="list-style-type: none"> ■ The costs of promoting light rail schemes can be substantial, while revenue funding generally for the development of local transport is limited. ■ Local authorities need to harness sources of funds other than the taxpayer. They have powers, as yet unused, under the Transport Act 2000 to raise funds to improve public transport through congestion charging schemes. The scope for local authorities to share in the wider economic benefits arising from light rail schemes, where schemes increase the value of local trade and land values, also needs to be explored.
<p>It takes too long for local authorities to be granted the necessary legal powers for light rail systems and whether schemes will be funded is uncertain.</p>	<ul style="list-style-type: none"> ■ The planning and approval process needs to be speeded up and decisions over funding approval need to be made clearer and more stable.
<p>There is insufficient in-house expertise in some local authorities to develop light rail and a lack of steer from the Department.</p>	<ul style="list-style-type: none"> ■ The Department maintains an arm's length approach to where light rail might be developed. Against this background local authorities do not know which schemes have a realistic chance of gaining approval. And, some local authorities are not always best placed to assess whether a light rail system would be suitable or practicable for their locality, lacking the knowledge about what has worked well elsewhere in this country and abroad.

The forecast costs of schemes currently under development have risen

- 15 The most significant barrier to the wider take up of light rail is affordability. New schemes are expensive to implement and costs are rising. Proposed new schemes are on average more than £3 million a kilometre more expensive to build than those that have already been built. Private sector concessionaires and other organisations are also concerned that the private sector might not be best placed to bear all the revenue risks of running a light rail system. The private sector's bearing of all of the revenue risks might also be driving up the cost of light rail schemes. Bids from private sector consortia for planned systems in Leeds, South Hampshire, and Manchester, for example, have all been higher than originally anticipated. Light rail schemes must compete with alternative options such as improvements to bus services which are usually less expensive to implement because capital investment is likely to be less. To stay within budget and reduce costs, promoters and builders cut back on facilities such as park and ride but this was counterproductive. While the passenger benefits of light rail are not necessarily matched by other modes of transport, the starting point for solving local transport problems is identification of the most cost effective solution.

There are fewer barriers to light rail in France and Germany

- 16 If all proposed new lines are in place by 2010, 10 cities or conurbations would be served by a light rail system. By comparison, there are already 11 cities in France, and some 50 cities in Germany, with a light rail system. Many of the challenges faced by the promoters of new French and German systems are similar to those of their English counterparts. Promoters in France and Germany, however, face fewer financial and other barriers in several key areas:

- **The costs of diverting utilities are lower**
In England, promoters have to pay 92.5 per cent of the costs of diverting utilities. In Germany, promoters contribute less, while in France they pay nothing.
- **Promoters in France can draw on local transport taxes to help pay for light rail**
In France, a local transport tax on employers is a major source of funds for developing light rail systems.
- **In Germany, "track share" is more common**
In Germany, there are more light systems that share their lines with heavy rail services through what is known as the "tram-train" concept. Tram-trains share lines, providing speed in out-of-town running combined with convenience and frequency of services into city centres.



Recommendations

17 We make the following recommendations:

Assessing whether value for money is being achieved

- i In conjunction with promoters, the Department should commission a comprehensive evaluation of the costs and benefits of every light rail scheme it has funded after it has opened to assess whether the expected number of vehicles and other infrastructure has been put in place, the frequency and speed of services are as expected, and systems are delivering the other expected benefits to passengers and local communities. Costs should be reviewed after one year; benefits, including services, and patronage and economic and social impacts should be evaluated after three to five years. The Department should make the lessons learned widely available to local authorities and other interested parties, by posting them on its Internet website.

Realising more benefits for passengers

As a condition of its grants for light rail schemes, the Department should require local authorities to build into the design and implementation of their schemes, where appropriate, measures to:

- ii integrate light rail with other modes of transport. The Department should look for evidence that the relationship between light rail and bus services has been considered including physical integration, as well as the provision of through ticketing arrangements and passenger information about routes, fares and timetables. The implementation of quality contract schemes for buses, for example, might provide a means of addressing poor integration of light rail and bus services;

- iii complement light rail and encourage passenger take-up, such as park and ride schemes; and
- iv secure speedy and punctual light rail services by, for example, giving priority to light rail vehicles over road vehicles at key junctions.

Improving the financial viability of light rail systems

- v Working with the industry and local authorities, the Department should evaluate the relative merits of different contract types for procuring light rail systems. The evaluation should identify the most cost effective procurement methods including an assessment of how long term financial viability could be improved.

Reducing the costs of implementing light rail

- vi The Department should seek efficiency savings by requiring promoters, as a condition of its grants, to demonstrate greater standardisation in the design of systems, vehicles and methods of construction. The Department should look for evidence that promoters have drawn on existing systems or have established partnerships with the promoters of other new systems to drive down costs.
- vii The Department and Her Majesty's Railway Inspectorate should consider the case for developing safety standards specific and appropriate to light rail and for addressing the current anomaly in requiring a safety case for light rail systems segregated from other traffic, where none is required for systems running on streets alongside other traffic.



- viii As a condition of grant, the Department should require promoters of new schemes to have adequate proposals to manage the risks associated with the cost of diverting utilities and the long term maintenance of them by the utility companies. The question of whether utilities need to be diverted at all should be addressed by promoters.
- ix The Department should re-assess whether the requirement that promoters of light rail systems should pay 92.5 per cent of the cost of diverting utilities is fair and reasonable, and whether it is consistent with its transport objectives.
- x The Department should bring this report to the attention of the Department of Trade and Industry and the Energy Saving Trust, for them to consider the case for including the developers of light rail technologies as eligible recipients of grants for energy saving technologies. The Department should also consider the case for establishing its own grant scheme to promote and develop innovative light rail technologies as a means of supporting the government's objective to reduce greenhouse gas emissions through cleaner vehicles.
- xi As a condition of grant, the Department should require those promoting or considering light rail schemes to consult with the Strategic Rail Authority and the wider rail industry at an early stage of planning to assess whether conversion or track sharing, or substitution of heavy rail by light rail, are viable alternatives.

Developing sources of funds, other than the taxpayer, for light rail schemes

- xii In its review of why local authorities are not using their powers under the Transport Act 2000 to raise funds for new local transport schemes, the Department should assess the extent to which this is curtailing the implementation of schemes - including light rail systems - through lack of resources, and the steps that need to be taken to bring this Act into practical use.

Adopting a more strategic approach to the development of light rail

- xiii The Department should indicate the types of area, in terms of transport need, population density, likely usage, and urban layout where it would be most receptive to local authorities' proposals for a light rail system, and prioritise new lines presenting the best business cases and the best fit with the government's national transport objectives.



Part 1

Introduction

- 1.1 Light rail is a modern version of the electric street tramway systems that were abandoned in England in the middle decades of the twentieth century. Light rail vehicles run on rails either built into the surface of the road or on tracks segregated³ from other forms of traffic. Light rail is more similar to buses than to heavy rail in terms of frequency, accessibility and capacity. Light rail vehicles are lighter, can accelerate and decelerate more quickly and can climb steeper gradients and go round tighter curves than traditional trains. Light rail stations and stops can also be closer together, making them more suitable for urban operation.
- 1.2 There is a range of light rail systems. Trams are at the lighter end of the range, generally operating on streets and publicly accessible places. Examples are the Manchester Metrolink and the Sheffield Supertram. At the heavier end of the range, light rail operates on wholly segregated track. The Docklands Light Railway and the Tyne and Wear Metro are two examples. In engineering terms, they are very similar to heavy rail but are still classified as light rail because they have light carriages and tracks with tighter curves and steeper gradients than conventional trains.

Seven new light rail systems have opened since 1980

- 1.3 Tramways were extensive in the UK during the late nineteenth and early twentieth centuries. At their peak, there were over 300 systems. From the late 1920s onwards, however, they were gradually closed down because they could not compete with motorised buses and cars and many systems were in need of renewal, for which there were insufficient funds. By the 1960s, only the system in Blackpool survived. Since 1980, however, seven new systems have been built covering over 235 kilometres of track on which some 138 million passenger journeys are made each year (**Figure 1**).

By comparison, each year there are some 950 million and 3.8 billion passenger journeys made on heavy rail and buses respectively, while the road network in England covers nearly 300,000 kilometres, on which there are some 28.3 billion car journeys each year⁴.

- 1.4 Germany and the Netherlands retained and adapted most of their original tramway systems, while France and Spain generally scrapped them. In many European countries there has been a renaissance of interest in light rail and many European cities have either updated their systems or have built new lines. Since 1985, 11 French cities have either upgraded existing systems or developed light rail systems from scratch. Germany now has 50 systems, while the Netherlands has five.

The government regards light rail as one of several options that local authorities might consider for their local public transport needs

- 1.5 In its *10 Year Plan for Transport* of July 2000, the government envisaged that up to 25 new light rail lines could be built in major cities and conurbations in England, and the number of passengers using light rail could more than double, by 2010. The Department for Transport would help fund a substantial expansion of light rail systems, where schemes offered good value for money as part of integrated local transport strategies.
- 1.6 The Department does not favour one mode of local transport over another but seeks to ensure that all options are considered and the most cost-effective adopted. The Department has replaced its previously separate targets for increasing the number of light rail and bus passenger journeys, adopting instead a target of achieving by 2010 a 12 per cent increase in passenger journeys from light rail and buses combined.

³ The term 'segregated' refers to running in a separate reservation, not on the street where cars and pedestrians can generally mix.

⁴ National Audit Office summary of figures on passenger and car journeys and length of the road network taken from the Department for Transport: *Transport Statistics for Great Britain (2003)* and *National Travel Survey 1985-86 to 2002*.

1 The seven new light rail systems that have opened in England since 1980

Some 138 million passenger journeys are made each year on the 235 kilometres of track covered by the seven new light rail systems that have opened in England since 1980.

System	Year opened	Route length (kilometres)	Passenger journeys in 2002-03 (millions)
Tyne and Wear Metro (with Airport and Sunderland extensions in 1991 and 2002 respectively)	1980-84	77	37
Docklands Light Railway (with Bank, Beckton and Lewisham extensions in 1991, 1994 and 1999 respectively)	1987	27	46
Manchester Metrolink (with Eccles extension in 2000)	1992	39	19
Sheffield Supertram	1994-95	29	12
Midland Metro	1999	21	5
Croydon Tramlink	2000	28	19
Nottingham Express Transit	2004	14	n/a ¹
Total		235	138

NOTE

1 The Nottingham Express Transit did not open until March 2004.

Source: National Audit Office summary of Department for Transport data

Local authorities promote light rail schemes while private sector consortia design, construct and run them

- 1.7 Local authorities are responsible for deciding on whether to promote the construction of a light rail line or system. In large conurbations outside London, passenger transport executives (bodies funded by local authorities with responsibilities for local transport strategic planning) have taken the lead in promoting light rail systems in their areas. City, and county, councils' transport departments have taken the lead in smaller cities. Since 2000, light rail systems have been considered within Local Transport Plans, the means through which local authorities seek funding from the Department for Transport for local transport schemes.
- 1.8 Private sector consortia designed, constructed, and now operate and maintain five of the existing seven light rail systems in England under concession agreements with local authorities. Nexus, the Tyne and Wear Passenger Transport Executive, runs the Tyne and Wear Metro. The South Yorkshire Passenger Transport Executive designed and built the Sheffield Supertram. The operating concession was sold to a private company. Consortia usually consist of transport operators, finance houses, vehicle manufacturers and civil engineers. Consortia bid to construct and operate systems against a performance specification.

Light rail schemes are built using public and private monies

- 1.9 To help pay for the construction of light rail systems, the Department for Transport pays local authorities capital grants and also supports them in borrowing funds. Central government has paid £1.2 billion (54 per cent), the largest share of the £2.3 billion that has been spent on the construction of light rail systems since 1980 (Figure 2). The Department has a long-established principle, however, that local bodies should contribute to the costs because light rail schemes primarily deliver local benefits. The Department expects to pay not much more than 75 per cent of total construction costs of individual schemes; in one case, the Department contributed 93 per cent. Local authorities are therefore expected to contribute their own monies, draw on European structural funds and bring in private sector funds. Some recent schemes have been built under the private finance initiative. Local authorities' applications for Departmental funding are subject to assessment by the Department to establish that schemes offer value for money to the taxpayer and contribute to the government's overall transport objectives. Since 1989, central government has not provided funds to any new light rail systems expected to require subsidies towards their running costs, although the Tyne and Wear Metro is subsidised by the Tyne and Wear Passenger Transport Executive.

2 Funding of the construction of light rail systems in England since 1980

Central government has contributed some £1.2 billion towards the cost of constructing light rail systems since 1980.

System and year opened	Central government contribution		Other funding		Total capital cost ¹
	£m	%	£m	%	£m
Tyne and Wear Metro (1980-84)	200	70	84	30	284
Docklands Light Railway (1987)	38.5 ²	50	38.5	50	77
Docklands Light Railway (Bank extension) (1991)	0	0	282	100	282
Manchester Metrolink (1992)	48	33	97	67	145
Docklands Light Railway (Beckton extension) (1994)	247 ²	96	11	4	258
Sheffield Supertram (1994-95)	220	91	21	9	241
Docklands Light Railway (Lewisham extension) (1999)	50 ²	23	170	77	220
Midland Metro (1999)	80	55	65	45	145
Manchester Metrolink (Eccles extension) (2000)	17	11	143	89	160
Croydon Tramlink (2000)	125	62	75	38	200
Tyne and Wear Metro (Sunderland extension) (2002)	37.5	38	60.5	62	98 ³
Nottingham Express Transit (2004)	167	93	13	7	180 ³
Total	1,230	54	1,060	46	2,290

NOTES

- 1 Actual costs at time of completion.
- 2 Funding for these schemes mainly came from the former London Docklands Development Corporation (LDDC).
- 3 Estimated construction cost.

Source: National Audit Office summary of data from the Department for Transport and the former London Docklands Development Corporation

What we examined

1.10 We examined:

- whether systems were delivering sustainable benefits at the expected cost; and
- the barriers to further development of light rail and how these might be overcome.

1.11 As part of our study we visited Lyon and Grenoble in France, and Freiburg and Karlsruhe in Germany, to compare how light rail systems are planned, promoted and operated abroad. A full list of our methods is in the [Appendix](#).



Part 2

Delivering sustainable benefits at the expected cost

2.1 This Part of the report examines whether systems funded by the Department have provided the expected infrastructure and vehicles and at the cost agreed by the Department, and whether they are delivering the anticipated benefits. It also assesses whether taxpayers' money has secured financially sustainable systems.

Some light rail systems have, or will, cost more to build than others

2.2 **Figure 3** shows that, in real terms, the construction costs of a sample of existing light rail systems have ranged from £5.4 million per kilometre to £21.2 million per kilometre. Expected construction costs for proposed systems range from £11.8 million, to £15.8 million, per kilometre.

3 Construction costs of a sample of existing and proposed light rail systems in England

The construction costs per kilometre of existing light rail systems vary significantly, while those of proposed systems are more similar.

Existing systems and date opened	Actual construction cost (£ millions)	Construction cost at 2003/04 prices (£ millions)	Length of track (kilometres)	Construction cost per km at 2003/04 prices (£ millions)
Manchester Metrolink Phase 1 1992	145	191	31	6.2
Sheffield Supertram 1994-95	241	304	29	10.5
Midland Metro 1999	145	160	21	7.6
Croydon Tramlink 2000	200	218	28	7.8
Manchester Metrolink Phase 2 2000	160	174	8.2	21.2
Sunderland extension to Tyne & Wear Metro 2002	98	101	18.5	5.4
Nottingham Express Transit 2004	180 ¹	180	14.3	12.6
Average	167	190	21.4	10.2
Proposed systems and planned year of opening	Expected construction cost at 2003/04 prices (£ millions)		Proposed length of track (kilometres)	Expected construction cost per km at 2003/04 prices (£ millions)
Merseytram - 2007	225		19	11.8
Leeds Supertram - 2007-08	442		28	15.8
South Hampshire Rapid Transit - 2007-08	171		14.3	12.0
Average	279		20.4	13.2

NOTE

1 Value of PFI credits. Actual construction costs are not yet known.

Source: National Audit Office summary of Department for Transport data

Lines we visited in France and Germany cost between £6.5 million and £16.3 million per kilometre to build

System and date opened or planned date of opening	Construction cost or expected cost at 2003-04 prices (£millions)	Length of track (kilometres) 2003-04 prices	Construction cost or expected cost per kilometre at 2003-04 prices (£millions)
Lyon - 2000-01	248	19	13.0
Freiburg extension to Vauban - 2004-05	18	2.7	6.5 ¹
Grenoble - 2005-06	220	13.5	16.3

NOTE

1 Extension did not require the vehicle depots and other infrastructure usually required by major networks.

2.3 Variations in construction costs are mainly due to differences in the routes taken by lines and the type of systems constructed. Systems with a greater amount of street running and completely new routes tend to be more expensive. It is less expensive to build on disused railway lines without tunnels and other major construction works. For example, the first line of the Manchester Metrolink made considerable use of old heavy rail routes, reducing the need for new land and street running.

In all but one of our case studies, the Department's contribution towards construction costs was what it originally agreed

2.4 In five of our six case studies, the Department paid what it had originally agreed to contribute towards construction costs (Figure 4). On the Sunderland extension to the Tyne and Wear Metro, the Department has so far paid seven per cent more than it originally agreed, although the final construction cost is not yet known. Control over expenditure partly reflects the nature of the construction contracts, where any cost overruns would have been borne by the private sector consortia.

2.5 As a condition of its £220 million in grants and borrowing approvals to pay for constructing the Sheffield Supertram system, the Department required the South Yorkshire Passenger Transport Executive to privatise the operating concession after the system opened. Privatisation proceeds were expected to pay off some £80 million of the Executive's loans for the scheme. In its first year of operation, however, the system generated an operating loss and quickly ran into financial difficulties, partly because of a shortfall in passengers. In 1995-96, for example, the promoters expected that the Supertram would carry 12.6 million passengers in the first year and make a profit of £150,000. In the event, it only carried 6.6 million passengers and made a loss of £5.4 million. It became apparent that the value of the operating concession would be much less than expected. In December 1997,

Stagecoach plc paid £1.15 million for a 27 year concession to operate the system - some £79 million less than if all the loans were expected to be paid off.

2.6 After the sale of the concession, the Executive was left with an outstanding debt that had grown to £100 million and cost some £12 million a year to service. The Executive was able to service £40 million of the debt from its own resources but sought assistance from the Department to service the remainder. The Department rejected the request for additional funds. The Executive took the case to the High Court, arguing that the Department had earlier committed itself to taking over the debt in the event that privatisation proceeds fell short of the value of the Executive's borrowings. Although the High Court ruled in the Department's favour, the Department agreed to take over part of the debt and cover half of the Executive's interest payments at a cost of some £6 million a year. The Department agreed to this arrangement so that local councils would not be prevented from meeting other government objectives in the South Yorkshire area.

Planned benefits are similar for each system, although their extent can vary

2.7 Light rail systems aim to deliver broadly similar types of passenger benefits, such as frequent, fast, reliable and comfortable services and access for disabled passengers. They also aim to attract patronage to public transport, encouraging people to shift from private cars to light rail and thereby reducing congestion and pollution. Light rail systems also aim to assist with the regeneration of run down areas. The extent of the anticipated benefits varies between systems, however, and depends on factors such as when the systems were built and their routes. For example, the first line of the Manchester Metrolink, which opened in 1992, uses an old heavy rail line and takes commuters from the suburbs into the city centre. The emphasis was on improving the speed and frequency of transport into the city centre. The second Metrolink line, by comparison, was built to help regenerate run down areas whilst also taking commuters into the city centre.

4 Estimated and actual construction costs and Departmental contributions on the six systems or lines examined by the National Audit Office

Total construction costs and contributions from the Department for five of the systems examined by the National Audit Office were in line with those originally expected and agreed.

System/line (year of opening)	Estimated construction costs (£ millions)		Actual construction costs (£ millions)	
	Agreed departmental contribution	Total cost of scheme	Departmental expenditure ¹	Total cost of scheme
Manchester Metrolink 1 (1992)	48	145	48	145
Sheffield Supertram (1994-95)	220	241	220 ²	241
Midland Metro (1999)	80	145	80	145
Croydon Tramlink (2000)	125	200	125	200
Manchester Metrolink 2 (2000)	17	160	17	160
Sunderland extension (2002)	35	98	37.5	Not yet known

NOTES

- 1 Includes grant monies and approvals to local authorities to borrow funds.
- 2 The Department incurred additional costs after construction of the Sheffield Supertram (see paragraphs 2.5 and 2.6).

Source: NAO summary of Department for Transport data

In France, street improvement is an integral part of any light rail scheme

In France and Germany the range of benefits intended from systems are similar to those in England. In France, however, all new systems also involve improving the streets through which the light rail lines run, with the laying of new road and pavement surfaces and new street furniture and the cleaning of the facades of buildings. The overall effect is to provide a significant facelift along the route to match the modern vehicles being introduced, although at an additional cost.



The Department has evaluated some, but not all, of the systems it has funded

2.8 Central government has spent some £1.2 billion on the construction of light rail systems since 1980 (Figure 2), paying between half and 93 per cent of the construction costs for the Tyne and Wear Metro, Sheffield Supertram, Midland Metro, Croydon Tramlink, and Nottingham Express Transit, but the Department has yet to evaluate, for all schemes, whether the expected infrastructure and vehicles have been provided at the cost agreed, and whether the schemes are delivering the anticipated benefits. The Department evaluated, with the relevant local authorities, the Tyne and Wear Metro in 1985, the Manchester Metrolink Phase 1 in 1996, the Sheffield Supertram in 2000, and the Croydon Tramlink in 2002. It has not evaluated the Midland Metro or extensions to existing systems, however, on which the Department spent some £80 million and more than £55 million respectively (Figure 2).

2.9 The evaluations focused on key aspects concerning: patronage levels, travel patterns, passenger perceptions and congestion relief. They did not, however, compare the systems' tangible assets, such as vehicles, track and stations, or other quantifiable measures, such as the frequency of services, with what was expected. Nor did they assess benefits achieved against what was expected of the systems when the Department agreed to fund their construction. Each evaluation used different evaluative criteria. Nor did the evaluations always or fully examine systems' impact on local economies or the extent of integration. The extent to which socially disadvantaged people have benefited has not been evaluated, although social inclusion as an objective has only been a recent development. The Department therefore does not have a complete picture of what has been delivered for the significant amount of public monies invested in the schemes.

Although many benefits have been delivered, some have not

2.10 We drew on the evaluation studies, and supplemented their findings with additional data provided to us by operators and local transport authorities, including the results of their passenger satisfaction surveys, to assess the infrastructure, services and benefits delivered by five major systems against the original expectations. We also evaluated other key benefits such as easing congestion and integration with other modes of transport if these were not originally expected (Figure 5). It takes time for systems to establish themselves. Two of the systems have been running for seven or more years, three systems for only two or three years. We therefore examined the systems' performance in their first year of operation after

opening and in 2002-03. In most cases, the systems are now delivering more of their benefits than in their first year of operation. We found that:

- actual passenger numbers have fallen well short of forecasts on three of the four systems examined;
- the systems have delivered many benefits to passengers, although Sheffield Supertram and Midland Metro began poorly;
- the benefits of integration with other forms of public transport and reduced road congestion, road accidents and pollution levels have been only partially achieved; and
- the impact of light rail on regeneration and social exclusion has not been fully evaluated.

5 Service and wider benefits' provided by five major light rail systems in their first year of operation and in 2002-03

Systems have delivered many, but not all, of the expected benefits.

Service/benefit	Manchester Metrolink Phase 1		Sheffield Supertram		Midland Metro		Croydon Tramlink		Manchester Metrolink Phase 2	
	1993	2003	1996	2003	2000	2003	2001	2003	2001	2003
Fast, frequent and reliable journeys	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
Integration	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
Comfort and safety	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
Access for mobility impaired	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
Easing congestion ²	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
Reduction in road accidents	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
Reduction in pollution levels	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
Regeneration and social inclusion ³	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
Enhanced city image	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good

■ = Good achievement ▲ = Moderate achievement □ = Poor achievement

NOTES

- 1 Direct passenger benefits would reflect actual patronage, which in most cases has been lower than forecasts.
- 2 System evaluations (paragraph 2.27) found that while there has been a modal shift from cars to light rail of up to 20 per cent, the impact on congestion has been a lot less or nil. The Croydon Tramlink achieved a four per cent reduction in traffic levels.
- 3 Regeneration did not form part of the motivation for the construction of the Manchester Metrolink Phase 1. Tackling social exclusion as a government objective has only been prominent since 1997.

Source: National Audit Office assessment of information from impact assessment studies, operators, local transport authorities and passenger satisfaction surveys

Passenger numbers, and therefore passenger benefits, have been lower than expected

2.11 Patronage levels have fallen short of expectations. Promoters estimate passenger numbers in the business cases they submit to the Department. They expect patronage levels to build up over time, usually reaching maturity after five years of operation. We found that actual passenger numbers have fallen well short of expected patronage levels in three of our five case studies (Figure 6). Shortfalls ranged from 24 per cent to 45 per cent. Sheffield Supertram failed to reach its expected annual patronage level after five years and, at their current rates of patronage growth, neither Midland Metro nor Croydon Tramlink will reach their expected annual patronage levels after five years. The number of passenger journeys on the Midland Metro has risen by about five per cent after three years of operation. The Manchester Metrolink Phase 1 is the only system to have exceeded its expected patronage, benefiting from the regeneration of the city centre and growth in the local economy over recent years.

2.12 When the Sheffield Supertram opened in 1994-95, the promoters expected some 12 million passenger journeys in the first year; in the event, there was a shortfall of more than 5 million journeys (45 per cent). The promoters expected 22 million passenger journeys after five years. By 1996, it was clear that the original forecasts would not be met and the South Yorkshire Passenger Transport Executive, with the help of consultants, appraised expected passenger levels and reduced its forecasts to 13 to 15 million passenger journeys a year. The Executive has implemented several measures, such as park and ride schemes, to boost patronage. By 2002-03, annual patronage had risen to 12 million passenger journeys.

Light rail systems have delivered many benefits, although two systems began poorly

2.13 The five systems we examined have contributed to a 35 per cent increase in light rail capacity, from 162 kilometres in 1999-2000 to 220 kilometres in 2002-03, and a 47 per cent increase in the number of passenger journeys made by light rail over the period, from 94 million to 138 million. In passenger satisfaction surveys, systems have generally scored highly for their speed, reliability and frequency, especially when compared with buses, on most routes. The journey time from Wolverhampton to Birmingham on the Midland Metro, for example, is 44 minutes less than on the equivalent bus that runs on a parallel route. Light rail systems have widened the range of public transport available and generally provided attractive services for passengers. Passenger groups and other stakeholders we consulted commented favourably on the achievements of the existing light rail systems.

2.14 Lines and stations have been built, and vehicles provided, much as planned. There were some changes to the plans of approved systems, however, which affected some expected benefits. For example, in the case of the Midland Metro, 26 stations were planned but only 23 were built because of cost constraints. The promoter told us that two of the three stations were located where low levels of patronage were expected. Overall, the local Passenger Transport Executive considers that accessibility to the system was not significantly affected.

6 Expected annual patronage levels compared with levels achieved in first year of operation and 2002-03 for the four systems examined by the National Audit Office

There have been significant shortfalls in patronage on three of the four systems examined. There was also a shortfall on the Manchester Metrolink Phase 2.

System	Patronage (millions of passenger journeys)			Difference between 2002-03 patronage and expected annual patronage
	Expected annual patronage ¹	Patronage in first full year of operations	Patronage in 2002-03	
Sheffield Supertram	22.0	6.6 (1995-96)	12.0	45% (shortfall)
Midland Metro	8.0	4.8 (1999-2000)	5.0	38% (shortfall)
Croydon Tramlink	25.0	15.0 (2000-01)	19.0	24% (shortfall)
Manchester Metrolink Phase 1	12.0	11.0 (1993-94)	19.0 ²	5% (excess)
Manchester Metrolink Phase 2	6.0	3.0 (2001-02)		

NOTES

1 Promoter's expected patronage when a system reaches maturity, usually five years after opening.

2 Manchester Metrolink Phases 1 & 2 combined.

Source: National Audit Office summary of Department for Transport data

2.15 For several systems, but for the Manchester Metrolink Phase 1 in particular, there has been a deterioration in the level of comfort experienced by passengers due to the systems attracting more passengers than expected and causing overcrowding at peak times. In 2002, the Department agreed to pay a grant of £5.7 million to the Greater Manchester Passenger Transport Executive to purchase new carriages to deal with the overcrowding.

2.16 Local authorities monitor the performance of their light rail operators, checking the number of tram kilometres travelled and service frequency. They told us that, on the whole, they were satisfied with performance levels. Although there had been operational problems from time to time, such as vehicle breakdowns, these were usually short-lived and rectified. All systems provided good access to wheelchair (and push chair) users and all enhanced the image of their cities and towns.

2.17 All of the systems experienced teething problems, such as signalling and vehicle failures, when they first opened. Two systems performed poorly for around two years after they opened, however, in terms of the services they provided:

- the Sheffield Supertram did not initially have priority over other road traffic at traffic lights and road junctions. As a result, journey times were extended and punctuality was poor. These operational difficulties attracted poor press coverage to the system, which affected the image of the system; and
- the Midland Metro provided a poor service that did not achieve its targets for frequency and reliability. Poor rolling stock availability and vandalism caused over 100 services to be cancelled in the first year. The service had a target that 98.6 per cent of its journeys would run within three minutes of the scheduled timetable but between February 2001 and January 2002 it achieved 92 per cent on average each month. Since then, performance has improved to the satisfaction of the Passenger Transport Executive and has averaged 99 per cent each month.

In French and German cities, broad avenues allow new light rail lines to be segregated from, and given priority over, other forms of traffic at junctions

In France and Germany, light rail is always given priority over other road users, allowing it to maximise the benefits of faster, smoother and more reliable journeys. High quality rights of way are achieved by a combination of segregation from other traffic along most, if not all, of the length of major routes and traffic signal pre-emption, which gives light rail absolute priority. Cities in France and Germany, however, tend to have a greater number of broad avenues than cities in England, where light rail can be placed without losing road space.

2.18 Action was taken to improve the Sheffield Supertram's speed of journey, reliability and punctuality, as well as its image. Action included giving the Supertram a higher degree of priority at road junctions. Although light rail vehicles are often given priority over other vehicles at road junctions, the Manchester Metrolink and Croydon Tramlink have to stop at some key junctions and are therefore slower than they might be.



Systems have not been fully integrated

2.19 The Department considers that public transport is more likely to be seen as an attractive alternative to the car if its component parts operate as a joined-up, integrated network. Key aspects of an integrated public transport system include:

- good co-ordination between different public transport modes;
- interchange at stations; and
- through-ticketing and widespread availability of information about routes, fares and timetables.

Co-ordination between different public transport modes

2.20 Journeys can be improved on all public transport if passengers are able to make seamless journeys. We found that integration with bus services was poor to moderate on four of the five systems when they first opened - the exception being the Croydon Tramlink. Outside London, local transport authorities initially had problems dealing with the impact of bus de-regulation, which began in 1986. Routes and timetables were unco-ordinated, and bus and light rail services were often competing with one another on the same routes. Bus services were not de-regulated in London. When the Docklands Light Railway and the Croydon Tramlink opened, bus services were changed so that they did not run along the same routes as the new systems. This encouraged higher patronage of both systems.

In France and Germany, light rail systems are embedded in a fully integrated public transport network

Buses have not been de-regulated in France or Germany, where they are fully integrated with light rail. Bus routes are diverted so that buses become "feeders" to light rail. Timetables are co-ordinated. Bus routes cross light rail routes but do not follow them. In Freiburg in Germany, there are public and private bus operators, but neither competes with light rail for the same passengers.

2.21 Local authorities told us that integration is possible where local bus companies have a significant role in the light rail operating consortium, such as Nottingham City Transport, in the case of the Nottingham Express Transit, where there are integrated bus and light rail timetables, information and ticketing. Local operators, however, have to ensure that competition law enforced by the Office of Fair Trading is not being broken, where one operator runs both light rail and buses. Many organisations that we consulted, including the Institution of Civil Engineers and the Institute of Logistics and Transport, considered that light rail was still not fully integrated with buses.

2.22 Competition can, however, be of benefit to passengers. The current regulatory regime for bus services allows bus operators to respond to demand on a commercial basis with local authorities able to subsidise services where needs are not met commercially. The regime does not allow local authorities to encourage light rail patronage if it means that cheap, convenient bus services are curtailed.

2.23 Under the Transport Act 2000 local transport authorities are expected to adopt an integrated and strategic approach to meet the public transport needs of their area, including the development of a local bus strategy. The Act also gives local authorities powers to introduce quality contract schemes for bus services, where they are the only practicable way of implementing a local authority's bus strategy. Quality contracts, which have to meet

certain statutory criteria to be approved by the Department, would give local authorities the power to specify service patterns, frequencies and fares. Bus companies would bid for the right to operate specified services. Quality contracts could provide a potential means of addressing poor integration of bus services with light rail. To date, however, no quality contracts have been implemented. The Department is currently considering cutting down, from 21 months, the statutory period between a quality contract scheme being approved and its coming into force, and issuing guidance.

Interchange at stations

2.24 Physical integration, involving the location of light rail stations near other public transport hubs such as train, underground and bus stations, can encourage greater use of all forms of public transport. People can be discouraged from using light rail systems where changing to other modes is confusing or involves walking some distance. The Passenger Transport Executive in Manchester considers that a key factor in the success of the Manchester Metrolink has been the system's physical integration with other forms of public transport. The main Metrolink station is next to the main bus terminal in Piccadilly Gardens, there are close connections with heavy rail stations at Deansgate, Piccadilly and Victoria and there are purpose-built interchanges at Bury, Altrincham and Eccles.

2.25 Physical proximity has not always been achieved in other light rail systems, however, or has had to be developed since the systems opened. The Midland Metro, for example, terminates at Snow Hill Station about one kilometre short of Birmingham's main railway station at New Street, which is adjacent to the main shopping area. When the Sheffield Supertram opened in 1994-95, access to the city's main railway station was via steps. A new station footbridge and lifts to link directly through to the Supertram were not built until 2002. Even in places such as Manchester, where it has been relatively successful, integration is the aspect with which passengers are least satisfied.

Through-ticketing and information about routes, fares and timetables

2.26 Tickets that are easy to buy and allow passengers to move easily from one form of public transport to another can encourage people to use light rail. There is a high degree of through-ticketing on the Croydon Tramlink and the Docklands Light Railway, where season travelcards, offering unlimited pre-paid travel within specified zones, can be used on the systems themselves as well as on buses, trains and the London Underground. Most heavy rail passengers can travel on light rail systems as part of the price of their rail ticket. No obligations have been placed on light rail and bus operators outside London to provide through-ticketing, however, although local

authorities do have the power to introduce such obligations. Birmingham and Newcastle, where there are light rail systems, offer travelcards but elsewhere light rail tickets are not accepted by some bus operators inconveniencing passengers as they change from one service to another. Through-ticketing arrangements for light rail are therefore not as comprehensive as they could be.

All French and German light rail systems have comprehensive through-ticketing arrangements

In Lyon, for example, tickets are valid on light rail, regional heavy rail services, buses and the underground system. Passengers may purchase travelcards or batches of single tickets at discounted rates, facilities that are particularly useful to the occasional traveller. A single organisation is responsible for distributing information, maps and timetables and for promoting all forms of public transport in the city.

Reduced congestion, road accidents and pollution levels have been only partially achieved

2.27 In its *10 Year Plan for Transport*, the government envisaged that light rail would help to reduce congestion and pollution in urban areas. Reductions in pollution levels and road accidents depend, to a significant extent, on the degree to which congestion has been eased by encouraging people out of their cars. The Department's and local authorities' evaluation studies found that 18 to 20 per cent of light rail passengers previously used a car for the same journey in Manchester, Sheffield and Croydon. They also found that the drop in the number of cars on the road in Croydon helped to reduce the number of road accidents, which fell by 11 per cent in the Croydon Tramlink's first year of operation.

2.28 The studies found, however, that the overall impact of light rail on road congestion in city centres has been modest at best:

- In Croydon, for example, the annual average daily flow of traffic was estimated by the assessors to have fallen by four per cent in the Croydon Tramlink's first year of opening although elsewhere the benefits have been less. Transport for London told us that the Tramlink also facilitated an overall redesign of the local highway in places and the introduction of signals at junctions which led to improvements in traffic flow.
- In Sheffield and Manchester, the assessors found little or no impact. Light rail systems provide limited capacity compared with other forms of transport and serve at most two or three main routes into a

city centre. Even where the reduction in road traffic along these routes has been substantial, there has been little impact on the other main routes.

2.29 Congestion discourages some people from using their cars. As people leave their cars and travel by public transport, however, some are likely to be replaced by other motorists using the free road space that they have vacated. The objective of reducing congestion through light rail schemes is therefore demanding, especially against a background of increasing economic growth in recent years. For car owners, a light rail journey will rarely match the convenience of going by car, however good the light rail service on offer. The impact of light rail on congestion contrasts with the impact of Transport for London's congestion charging scheme in central London, where the charge acts as a financial disincentive for motorists and has reduced the number of vehicles being driven in the charging zone by 60,000 a day or 16 per cent⁵.

2.30 Light rail cannot by itself reduce congestion significantly over the long term. Other complementary measures are needed to discourage car use. These might include higher city centre parking fees, reducing the number of car parking spaces available and "park and ride" schemes. We found, however, that there has been limited use of such measures in our five light rail case studies (Figure 5). No park and ride sites were put in place on the opening of any of the systems - sites that were planned on the Sheffield, Midland Metro and Manchester Phase 2 schemes were not built in order to save money, or were delayed because of planning procedures. Sites have been built alongside each line since opening. The Nottingham Express Transit, which opened in March 2004, is the first full system where park and ride sites operated from the day that the system opened.

The impact of light rail on regeneration and social exclusion has not been fully evaluated

2.31 Light rail systems have contributed to regenerating some run down areas and the inclusion of socially disadvantaged people. For example:

- Manchester Metrolink has helped to regenerate the Salford Quays and Eccles areas⁶;
- Croydon Tramlink has helped to attract inward investment to Croydon and brought good transport links to relatively socially deprived areas such as the New Addington area of the borough⁷; and
- Midland Metro contributed to the regeneration of land in the Wednesbury area of the West Midlands⁸.

5 *Congestion Charging Six Months On, Transport for London, October 2003.*

6 *Greater Manchester Passenger Transport Executive.*

7 *Economic and regeneration impact of Croydon Tramlink, South London Partnership, July 2003.*

8 *West Midlands Passenger Transport Executive.*

2.32 The full impact of light rail in regenerating rundown areas could take several years to achieve. To date, of our five case studies the Department has only evaluated the economic and development impact of the Sheffield Supertram. Evaluators found that, although 1,600 jobs had been created by the Sheffield Supertram, there was no established methodology for identifying the regeneration benefits at the planning stage and they did not know how the jobs estimate had been made. Elsewhere, quantitative information on the number of jobs created, for example, has either not been collected or not been evaluated on a consistent basis. In measuring regeneration and social inclusion benefits, it is difficult to separate the impact of light rail from other regeneration programmes or from changes in the local or national economy. In July 2003, the Department published new guidance on how the promoters of local transport schemes should evaluate the schemes' regeneration effects.

Several systems have been operating at a loss

2.33 Light rail schemes are expensive undertakings. Once they have been built, they cannot readily be relocated elsewhere or altered - unless at considerable cost. The Department therefore requires assurance from promoters that systems will be financially viable and that its investment will continue to secure benefits over the longer term. While agreeing to invest significant amounts of public money in the construction of light rail

systems, the Department expects the operation of the systems to be self financing and not to require any operating subsidy from the government. The Department's appraisal of promoters' business cases has a key part to play in helping provide such assurance before systems are approved.

2.34 If any concessionaire were unable to continue to run its system and an alternative operator could not be found, contract arrangements would allow for operations to be handed back to the relevant local authority that promoted the scheme. Clawback arrangements in the terms of the Department's grant allow the Department to reclaim any monies if a system runs into financial difficulties and the local authority decides to dispose of it.

2.35 The Midland Metro, Manchester Metrolink and the Croydon Tramlink, all operated by private sector companies, made financial losses over the period 2000 to 2003 (Figure 7). The Sheffield Supertram, also operated by a private company, made a loss in 2001-02 and a profit in 2002-03. Over the three years, losses ranged from £200,000 on the Sheffield Supertram to £11.4 million on the Midland Metro. The Tyne and Wear Passenger Transport Executive subsidised the Tyne and Wear Metro to cover an operating deficit of £647,000 in 2001-02. By comparison, in 2002 the Docklands Light Railway operator Serco Docklands Limited, made a surplus at operating level. Tramtrack Croydon Limited, the concessionaires of the Croydon Tramlink, are re-negotiating their finances with banks to enable them

7 Summary of concessionaires' company accounts 2000 to 2003

Systems run by the private sector made financial losses over the period 2000 to 2003.

Concessionaire	Sheffield Supertram		Midland Metro		Manchester Metrolink		Croydon Tramlink	
	South Yorkshire Supertram Ltd		Altram LRT Ltd		Altram (Manchester) Ltd		Tramtrack Croydon Ltd	
Year to	30 April 2003	30 April 2002	31 December 2002	31 December 2001	31 December 2002	31 December 2001	31 March 2003	31 March 2002
	£millions		£millions		£millions		£millions	
Turnover	8.3	7.7	4.9	4.3	21.2	19.8	15.4	13.4
Operating profit/(loss) before interest	0.0	(0.2)	(1.4)	(11.7) ¹	2.3	1.7	(0.2)	(1.6)
Net interest receivable/(payable)	0.1	0.0	0.2	0.3	(7.8)	(7.7)	(8.6)	(7.9)
Profit/(loss) before tax	0.1	(0.2)	(1.2)	(11.4)	(5.5)	(6.0)	(8.8)	(9.5)

NOTE

1 The operating loss in this year includes exceptional items of £7.9 million (items which must be disclosed separately within a set of accounts because of their nature or size - in this case a reduction in the value of the company's assets). If the exceptional items were not included the loss would be £3.5 million.

Source: National Audit Office summarisation of company accounts (the latest financial statements as at February 2004)

to continue in business. In the case of Midland Metro, the concessionaires (Altram LRT Limited) are re-negotiating their concession deed with the West Midlands Passenger Transport Executive.

2.36 We examined the financial performance of systems and found that:

- revenues have been lower than expected because of the shortfall in passenger numbers; and
- economies made in the construction of systems have affected revenues.

Passenger numbers, and therefore revenues, have been lower than expected

2.37 Paragraphs 2.11 and 2.12 set out the shortfalls in patronage levels, which reduced passenger benefits. These shortfalls also brought operators reduced revenues. We identified several reasons for the shortfalls:

Over-optimistic forecasting

- Local authorities forecast patronage levels using modelling guidance set out by the Department. The data used should be based on numbers of people travelling down proposed routes, although only crude data might be available on wholly new routes. The forecasts are scrutinised and approved by the Department, using independent consultants, and are made available to potential operating consortia so that they can form their own view on the robustness of the estimates and build them into their revenue forecasts. In the case of the Croydon Tramlink, the private sector concessionaire developed the transport model used by the promoter to forecast a patronage level of 27 million to 28 million - some 2-3 million higher than the public sector promoter. The concessionaire's estimate also took into account additional passengers expected by including an additional tram vehicle on the New Addington branch. Investors, project managers and transport organisations, such as Transport 2000, consider that forecasts of patronage levels have been over-optimistic and encouraged concessionaires to bid more for the contracts than they otherwise might have done. They also pointed to the need for promoters to show that their systems would be used by large numbers of passengers, in order to attract private sector funds and grants from the Department.

Change to the patronage base

- The patronage base for the Sheffield Supertram changed significantly between the date the system was approved and the date of opening. Having planned the Supertram in the mid 1980s, the local authority demolished or redeveloped several council housing estates before the system opened in 1994-95. Along the Supertram's planned route, high density housing was replaced by lower density housing. Sheffield City centre also lost jobs to out-of-town developments, and employment moved away from the route and became more dispersed.

Early operational problems

- The Sheffield Supertram, Midland Metro and Manchester Metrolink Phase 2 line experienced operational difficulties, such as poor vehicle reliability and broken ticket machines, in their first year of operation. Potential passengers were discouraged from using the systems, while broken ticket machines meant lost revenue from passengers who were using the systems.

Competition with buses

- In cities outside London, buses have competed directly with light rail services. For example, when the Sheffield Supertram first opened, privatised bus services actively competed against it in terms of fares and frequency of services. Initial fares on the Supertram were between 25 and 50 per cent higher than the equivalent bus fare. The lack of traffic priority initially given to the Supertram (paragraph 2.17) also took away much of the speed advantage that had been assumed relative to buses.

Physical limitations on the selected route

- The systems in Manchester, Sheffield and Croydon run on city centre streets and are attractive to customers wanting an alternative to the car. The Midland Metro line, however, does not run on the streets of Birmingham. In addition, some sections of the line run in a deep cutting below street level that has to be reached by stairs, ramps or lifts and is therefore less accessible to potential passengers than on-street systems.

2.38 Reported patronage levels on French and German systems are significantly higher than on comparable English ones (Figure 8). For example, there are some 7.3 million (38 per cent) more passenger trips a year on the Lyon system than on the Manchester Metrolink, although Manchester has a larger population.

8 Comparison of light rail systems in Lyon and Grenoble with systems in England

Systems in Lyon and Grenoble carry more passengers per kilometre of track, and have more stations and vehicles, than similar systems in England.

	Major urban areas			Smaller urban areas	
	Lyon	Manchester	Birmingham	Grenoble	Nottingham
Population (million)	1.4	2.6	1.5 ¹	0.4	0.8
Number of lines to system	2	2	1	2	1
Number of stations	38	36	23	40	23
Length of track (kilometres)	19	39	20	20	14
Number of vehicles	39	32	16	53	15
Annual number of journeys (millions)	26.3	19.0	5.0	30.0	11.0 ²
Annual number of journeys per kilometre (millions)	1.4	0.5	0.3	1.5	0.8 ²

NOTES

- 1 Population of Birmingham, Sandwell and Wolverhampton combined.
- 2 Estimated figures.

Source: National Audit Office analysis of data collected from local transport authorities in Lyon and Grenoble and the Department for Transport in England

Higher patronage levels in France and Germany are due to a variety of factors

Heavily subsidised fares

When considering the value for money of a proposed scheme in England before deciding to invest in it, the Department expects the scheme to be self-financing. It does not expect to subsidise the system's operation or its fares. In France, primary legislation has established the right of French citizens to have access to affordable, high quality public transport. Local governments consider public subsidy is required to provide such services. In Grenoble, for example, the local transport authority provides a 70 per cent subsidy of light rail fares. In Freiburg in Germany, there is a 40 per cent subsidy.

Larger patronage base

The light rail system in Grenoble, for example, has 40 light rail stations and 53 light rail vehicles. By comparison, the Nottingham system has 23 stations and 15 vehicles. Potential passenger numbers are higher in France and in Germany principally because inner areas of cities tend to have higher population densities within a short distance of stations. Systems in France and Germany also tend to have more vehicles and stations. Service and fare integration also contribute to higher patronage levels on French and German systems.

Connections with centres of social and economic activity

In France and Germany, light rail systems connect hospitals, universities and commercial and shopping centres, generating high passenger numbers. Future schemes being planned in England, such as those in Liverpool and Leeds and extensions in Birmingham would expect to better connect with centres of social and economic activity. This has not always been the case in England, where some light rail routes have followed old railway lines remote from traffic generators.

Economies made in the construction of systems have affected revenues

2.39 We found that, when promoters came under pressure to keep costs within the budget agreed by the Department, they sometimes cut back on the systems' planned features. While not significantly affecting the infrastructure of the systems themselves, these economies affected revenues once systems were up and running. On the Midland Metro, for example, three stations out of 26 in the original design of the system

were not built and a lathe for grinding vehicle wheels as part of regular maintenance was not purchased. When vehicle wheels wore down, the vehicles had to be taken out of service and their wheels sent away for repair, reducing service levels and patronage. The Passenger Transport Executive later spent £1 million on a lathe to improve services. On three lines, planned park and ride sites were not built (paragraph 2.30), nor were planned security systems, such as CCTV cameras, always put in place to help enforce fares.



Part 3

Barriers to the wider take-up of light rail

- 3.1 In the *10 Year Plan for Transport*, the Department envisaged that up to 25 new lines could be built by 2010 if the scale of investment anticipated by the *Plan* were achieved and proposals for new schemes offered value for money. There are currently 16 lines in operation and a further 12, at various stages of development, might be running by 2010 (Figure 9). The Department has so far agreed to contribute some £1.4 billion to the cost of these schemes. There are also plans to develop other lines before 2010 such as an additional line for the Merseytram, the Nottingham Express Transit (2 lines) and the Sheffield Supertram (3 lines). By 2010, however, the total number of light rail systems will represent only a fraction of the 300 systems that were in operation in England in the 1920s, light rail's heyday. Buses are expected to make the biggest contribution towards achieving the Department's revised target of a combined 12 per cent increase in light rail and bus trips by 2010.
- 3.2 The starting point for solving transport problems in a city or major thoroughfare is identifying the most cost-effective solution. Light rail must compete with other options, such as improvements to bus services, and be justified on cost-benefit grounds. Light rail, however, does appear to be hindered in its further development. This Part of the report therefore examines factors that need to be addressed for light rail to make a bigger contribution to the government's aims of improving public transport, including reducing the cost to the taxpayer, securing funds from other sources, speeding up the delivery of schemes and adopting a more coherent approach to the development of light rail in key areas of the country.

9 New light rail systems and lines under development

At least twelve new lines might be running by 2010, with their construction funded by some £1.4 billion from the Department.

System	Expected to open	Number of new lines	Expected Department contribution £ millions
Under construction			
Docklands Light Railway: London City Airport extension	2005	1	30
In development			
South Hampshire Rapid Transit: Fareham to Gosport	2007-08	1	170
Leeds Supertram	2007-08	3	354
Docklands Light Railway: Woolwich Arsenal extension	2008	1	Note 1
Manchester Metrolink Phase 3	2010	3	520
Merseytram Line 1	2007	1	177
Midland Metro extensions to Brierly Hill and Birmingham city centre	2007-08	2	165
Number of new lines to which the Department has agreed to give funds		12	£1.4 billion

NOTE

- 1 Planned and funded by Transport for London.

Source: National Audit Office summary of Department for Transport data

Several factors limit the further expansion of light rail in England

3.3 We surveyed 72 local authorities with transport planning responsibilities in England that do not have, or will not soon have, a light rail system. Of the 51 local authorities that responded, seven had included a proposal for a light rail system in their Local Transport Plan. Of the other 44:

- 17 had not considered light rail as an option for meeting their local transport needs, mainly because they considered their population base to be too small to justify a system; and
- 27 had seriously considered light rail in the past 15 years, but had no firm proposals.

For those areas where light rail is feasible and could be a cost effective option offering value for money, local authorities identified five main barriers standing in the way of its development (Figure 10).

Action needs to be taken to reduce the costs of light rail systems

3.4 Cost is the most significant factor discouraging the further development of light rail. Local authorities with smaller populations considered that less expensive systems would be needed before they would regard light rail as a viable option. Many of the stakeholder organisations we consulted also told us that high costs were preventing the further development of light rail.

10 Barriers discouraging the wider take-up of light rail

Several barriers stand in the way of the further development of light rail.

Barriers	Authorities mentioning the barrier (%)	Issues to be addressed
Cost is the most significant factor discouraging the further development of light rail - 43 per cent of local authorities consider light rail is too costly when compared with other options, such as buses.	43	<ul style="list-style-type: none"> ■ Lack of standardisation in systems' design drives up costs. ■ Costs are also inflated by applying heavy rail standards to light rail. ■ The diversion of utilities is expensive. ■ There are barriers to the development and adoption of new and cheaper technologies.
Poor financial performance of some existing light rail systems is discouraging interest in supporting light rail and the costs of new systems are increasing partly as a consequence.	34	<ul style="list-style-type: none"> ■ Better sharing of risk and alternative forms of procurement contract could help to reduce costs and attract private sector investors. ■ Improved forecasting of passenger numbers would provide a firmer basis for assessing systems' financial viability before contracts are let. ■ Revenue collection also needs to be improved.
Local authorities are concerned about being able to secure sufficient funds at local level to promote a system and help pay for its construction.	25	<ul style="list-style-type: none"> ■ The costs of promoting light rail schemes can be substantial, while revenue funding generally for the development of local transport is limited. ■ Local authorities need to harness sources of funds other than the taxpayer. They have powers, as yet unused, under the Transport Act 2000 to raise funds to improve public transport through congestion charging schemes.
It takes too long for local authorities to be granted the necessary legal powers for light rail systems and whether schemes will be funded is uncertain.	18	<ul style="list-style-type: none"> ■ The planning and approval process needs to be speeded up and decisions over funding approval need to be made clearer and more stable.
There is insufficient in-house expertise in some local authorities to develop light rail and a lack of steer from the Department.	11	<ul style="list-style-type: none"> ■ The Department maintains an arm's length approach to where light rail might be developed. Against this background local authorities do not know which schemes have a realistic chance of gaining approval. And, some local authorities are not always best placed to assess whether a light rail system would be suitable or practicable for their locality, lacking the knowledge about what has worked well elsewhere in this country and abroad.

Source: National Audit Office survey of local authorities

Costs are increasing

- 3.5 The average cost in real terms of systems built between 1992 and 2004 was £10.2 million per kilometre. This compares with an average of £13.2 million per kilometre estimated for the planned schemes up to 2007-08 (Figure 3). Investors told us that making the private sector shoulder as many risks as possible is inflating the cost of light rail.
- 3.6 Several financial organisations and concessionaires we consulted expressed concern that the private sector might not be best placed to bear all of the revenue risk of running a light rail system and that this was increasing the costs of building new systems. John Laing plc, with considerable experience in the Manchester, Midland and Docklands schemes, considered that consortia were well equipped to bear the burden of construction risk but not full revenue risk, which is affected by patronage and fare levels and maintenance, factors over which they have limited control. In their view, investors are either avoiding this sector or seeking greater margins for taking on revenue risk and the public sector is therefore not best served by the private sector bearing this risk.
- 3.7 Tramtrack Croydon Limited told us that accepting revenue risk over a long period (the Croydon Tramlink concession is for 99 years) has meant that their business is dependent upon areas of public policy over which it has no control or influence. For example, the company cannot control fares, parking provision, traffic priorities, planning consents along the Tramlink route, competing public transport services or road provision - all of which have an impact on the Tramlink's revenue. The company considers that forecasting of revenue is more complex and uncertain than when it bid for the Tramlink concession and the accuracy of their overall patronage predictions were undermined as a consequence.
- 3.8 The Department acknowledges that there are problems with the private sector bearing all of the revenue risks and that the price of light rail might have been inflated as a result. The bids from private sector consortia for constructing and operating the new light rail systems being planned in Leeds and South Hampshire, and the extensions to the Manchester Metrolink, have been far higher than originally anticipated. The Department has asked the promoters to reconsider their proposals to bring down costs. Promoters have suggested that they might take on a proportion of the revenue risk.
- 3.9 The Department has a key interest in controlling costs, given that it is prepared to fund up to 75 per cent of the cost of building systems. The Department can influence methods of procurement and how project risks, such as revenue risks, should be allocated between the public and private sectors.
- 3.10 The type of procurement contracts under which systems have been built and run has had a bearing on cost and operating revenues. Systems have been built under different types of contract - the Manchester Metrolink Phase 1, the Midland Metro and the Croydon Tramlink, for example, were all built and run under design, build, operate and maintain type contracts. The Lewisham extension to the Docklands Light Railway was built under a design, build and maintain contract with a separate contract for operating the line. The Nottingham Express Transit was built under a PFI scheme whereby the concessionaire only receives payment if construction and service targets are met. While construction costs have been kept under control (paragraph 2.4), it might be significant that the operating concessionaires of schemes built under design, build, operate and maintain contracts have all incurred financial losses. How the other types of contract will affect operational finances over the long term has yet to be seen, but the Lewisham extension, for example, was built earlier than planned and to budget and the operator and maintenance contractor have both met their respective service targets. In bidding for the Lewisham extension infrastructure project the concessionaire knew what was to be provided through a specification and the operator in turn was aware of the facilities he would have available. Revenue risk was allocated to each party based on realistic revenue forecasts.
- 3.11 The Department has recognised that cost escalation is a problem including whether proposals are realistic in terms of their estimated cost and forecast levels of patronage. Against this background, we examined some of the main influences on costs and found that:
- lack of standardisation drives up costs;
 - costs are inflated by light rail adapting heavy rail specifications and safety arrangements;
 - utility diversions are expensive, but there might be scope for savings; and
 - there are barriers to the development and adoption of new rail technologies.

Lack of standardisation drives up costs

- 3.12 The signals, vehicles, tracks and stations for each light rail system have many common features, and promoters and consortia face many similar challenges in planning their systems, such as how to divert utilities, minimise disruption during construction and lay rails on streets in the most cost effective way. Promoters and others told us, however, that they often had to start from scratch for each new system and that this had contributed to higher costs than necessary. Serco Metrolink and AEA Technology considered that costs could be reduced by greater uniformity between schemes. Transport 2000 told us, for example, that the vehicles used on the

Midland Metro were overly complex compared with other vehicles used elsewhere. There are several reasons for the lack of uniformity:

- a different team of promoters and consortia is involved each time a new line is planned and built;
- promoters and consortia are reluctant to share information because they are in competition with each other and for Departmental funds; and
- the image of a system is important for attracting passengers, particularly car users, and each town or city wants to promote its own rolling stock design.

3.13 All of the local authorities that have, or are promoting, a light rail system, voluntarily share some information about planning and developing schemes at meetings of the Light Rapid Transit Planning Group run by staff from Passenger Transport Executives. There is a lack of national guidance, however, on how to implement a light rail system and few common technical standards or specifications for light rail design. The Department has built up considerable experience of dealing with schemes and is in a unique position to provide more advice and guidance on how to implement a scheme cost-effectively.

Costs are inflated by light rail systems adapting heavy rail specifications and safety arrangements

3.14 Light rail has borrowed some design specifications from heavy rail. As a consequence, some designs have been over-specified, bringing higher costs. Engineering experts also told us that the Midland Metro's signals and overhead wires were designed for heavy, rather than light rail, purposes and were expensive to build and maintain, increasing the cost of the system by some £20 million. Each new vehicle for the Nottingham Express Transit, for example, has cost £54,500 per metre length of vehicle compared with up to £51,000 per metre for each new Turbostar train introduced by Anglia Railways, a train operating company, to run on the UK's heavy rail network, for similar sized orders.

3.15 Safety on all railways, including light rail, is regulated by Her Majesty's Railway Inspectorate, part of the Health and Safety Executive. There is no safety legislation specific to light rail, and infrastructure and rolling stock safety are assessed through the same process as used for heavy rail. If a light rail system is mainly segregated, like heavy rail, the operator must produce a safety case on how it proposes to address safety risks to the satisfaction of the Inspectorate. In contrast, when a light rail system runs mainly on streets and is not segregated from other traffic, the system is deemed to be a "tramway" and a safety case is not required. These arrangements are anomalous, as both the segregated and on-street parts of these systems operate by line of sight so that drivers can stop in the distance they can see ahead. Tramways do not have some of the risks of heavy rail associated with higher speed, signalled operations.

Utility diversions are expensive, but there might be scope for savings

3.16 Utilities, such as water and gas mains, are usually dug up and moved when a new light rail system is built on streets in order to facilitate easy access in future. Utility diversions can be a significant capital cost of a light rail scheme. In the case of the Croydon Tramlink, for example, diversions were estimated to cost more than £19 million - nearly 10 per cent of the scheme's £200 million construction cost.

3.17 The New Roads and Streetworks Act 1991 aimed to improve the standard of repairs to roads and reduce the disruption to traffic caused by diverting utilities. The Act was intended to establish fair contribution rates to be paid by developers for diverting utilities. The promoters of light rail systems had to pay 82 per cent of the costs of diverting utilities; since 2000, they have had to pay 92.5 per cent. Promoters that we consulted considered that their share of the costs of diverting utilities was unreasonable given that, when utilities are diverted, the utility companies might gain new infrastructure worth more than the 7.5 per cent contribution they are required to make. Promoters' contributions towards the cost of utility diversions are lower in Germany, while in France light rail developers pay nothing (Figure 11), although it should be borne in mind that higher costs might fall on utility customers.

11 Contributions to the cost of diverting utilities in England, Germany and France

Promoters in England pay a higher percentage of the costs of diverting utilities than their counterparts in Germany or France.

Percentage of costs borne by the Light Rail Promoter	
England	92.5 per cent
Germany	60 per cent for water, gas and sewerage; 80 per cent for telecommunications
France	Nil

Source: Department for Transport and German and French transport authorities

3.18 Finding the location of pipes and wires can be costly - the Croydon Tramlink promoters, for example, spent £250,000 establishing the location of utilities along their route. There is also no incentive for utility companies to progress works quickly, nor much incentive for them to control costs. In the economic appraisal for the Merseytram system, a risk factor of 29 per cent was placed on the estimated cost of diverting utilities, more than double the general project cost risk of 12.5 per cent.

3.19 It is not clear that diversions are always necessary. While the Croydon Tramlink was in the planning stage, for example, London Transport questioned whether wholesale utility diversions were really necessary since the need for access to utilities in some places was highly unlikely. Turner and Townsend, construction and management consultants, who have worked on several light rail schemes including the Supertrams in Sheffield and Leeds, told us that designers assume utilities will need to be diverted, but not necessarily for technical reasons and more often because of concern that utility companies will make unreasonable and frequent demands to repair their pipelines.

There are barriers to the development and adoption of new light rail technologies

3.20 New light rail technologies, including non-electric light rail⁹, might offer scope for reducing costs. The promoters of ultra light rail, for example, claim it offers low cost, energy-efficient services with minimal pollution. The passenger carrying capacity of ultra light vehicles (around 50 passengers) is currently less than conventional light rail vehicles (around 200+ passengers). Smaller vehicles make ultra light rail more suited to less heavily-trafficked routes, but there are no technical constraints to increasing capacity to conventional trams.

3.21 There has been a small-scale demonstration of an ultra light scheme in Bristol (Bristol Electric Railbus) and one is underway in Stourbridge. Neither has been funded by the Department for Transport and the technology has not yet been used for a full system. The scheme in Bristol ran a service in the harbour area for 30 months from 1998 to 2000. Its promoter told us that an ultra light system could be developed on a four-kilometre route in Bristol for around £670,000 per kilometre, much less than the £5 million to £21 million per kilometre of existing light rail systems. There are barriers, however, to the adoption of new light rail technologies:

- In its *10 Year Plan for Transport*, the government committed to accelerate the take-up of cleaner vehicles and fuels in order to reduce greenhouse gas emissions by 12.5 per cent by 2010, compared with 1990 levels. There are, however, no funds available from the Department for Transport to develop innovative technologies that could be used in light rail schemes. Promoters of new light rail technologies are ineligible to apply for grants to develop energy saving transport technologies under the Department of Trade and Industry's Foresight Vehicle Programme or the Energy Saving Trust's New Vehicle Technology Fund, because such grants are for road-going vehicles only.

- Local authorities are not necessarily best placed to promote, develop or adapt innovative technology. They are generally perceived by innovators to be risk-averse and cannot afford to spend money on new and untried technologies.

Systems need to be, and be seen to be, financially viable

3.22 Thirty-four per cent of local authorities responding to our survey were concerned that they might have to bear some financial burden if the systems they promoted were not financially successful. The concessionaires of some existing systems have reported annual operating losses (Figure 7), and there has been a drop in private firms' interest in bidding to build and operate new light rail systems. Firms have dropped out of the bidding, for example, to build the Leeds and South Hampshire schemes and the bids that have been tendered for those schemes and the Manchester Metrolink Phase 3 have been far higher than anticipated to cover the additional risks.

Sources of funds, other than the taxpayer, need to be developed

The costs of promoting a scheme can be substantial

3.23 Promoting a light rail scheme typically costs about £1 million a year. The promoters of the Nottingham Express Transit estimate that it cost them £6 million to promote their scheme up to the start of construction. In our survey, some 25 per cent of local authorities considered that the cost of promoting a scheme was too onerous and a significant barrier to the development of light rail in their areas.

3.24 The Department does not usually provide funds for promotion lest it encourage the development of speculative or unrealistic proposals for schemes, although it did provide £1.5 million to the promoters of the Midland Metro in 1991 for further planning and design work. The Department, instead, considers local authority applications for the reimbursement of their preparatory costs up to £850,000, but only once a scheme is fully approved. In contrast, in 2001 and 2002 the Scottish Executive awarded discretionary grants totalling £14.5 million from their Integrated Transport Fund to the promoters of a proposed light rail network in Edinburgh to help with designing and taking the proposal through to start of construction.

⁹ Traditional light rail systems are powered by electricity extending over the full length of the system. New forms of light rail vehicles might be non-electric light rail or hybrids using various energy storage devices to supplement electricity. Fuels instead of electricity include hydrogen and liquid petroleum gas. Ultra light systems use diesel engines and lead acid batteries.

3.25 In February 2003, a review of Local Transport Plans by consultants for the Department concluded that insufficient revenue funding was being made available to local authorities to complement the increased capital allocations they were receiving. The consultants considered that this was contributing to administrative and project management burdens involved in delivering local transport capital schemes.

Other potential sources of local funds remain untapped

3.26 In its *10 Year Plan for Transport*, the government envisaged road congestion charging schemes becoming an important source of funds for the anticipated expansion in light rail systems. Under the Transport Act 2000, local authorities can develop congestion charging schemes to help support the delivery of their Local Transport Plans, which could include light rail schemes. The Department estimated that, by 2010, congestion charging schemes outside London could generate net revenues of around £314 million a year.

3.27 No local authority has yet opted, or is planning, to use congestion charging to help fund a light rail scheme. Nottingham City Council is developing a Workplace Parking Levy scheme to provide funds towards the cost of developing future extensions to the Nottingham Express Transit. Local authorities have been reluctant to introduce congestion charging because of concerns that they will lose business and employment to neighbouring areas that do not. They are also reluctant to introduce charging before public transport alternatives are in place, even though part of the rationale for congestion charging is to generate funds that can then be used to put those public transport alternatives in place. Although central government expects to contribute up to 75 per cent of light rail construction costs it still leaves local authorities with a substantial amount to be funded from other sources.

In France, a local transport tax on employers is a major source of funds for developing light rail schemes

In Grenoble, for example, the regional transport planning authority raises nearly 60 per cent of its annual budget from a 1.8 per cent tax based on the salaries of employees in firms employing ten or more people.

3.28 There might be scope for local authorities to take a share in the wider economic benefits arising from light rail schemes and use them as a source of funding for schemes. A study by consultants on the impact of the Croydon Tramlink for Transport for London in 2002 found that the system had led to increased local trading, although the size of the impact was not quantified. There is, however, no direct mechanism by which local authorities may share in any increased revenues. In September 2003, the Department set up a review team to examine the business case for the proposed Crossrail project in London. As part of the review the team are examining the funding options for the project including how much might be raised from central government and how much from other sources. Other sources might include a supplementary increase on the rates of London businesses or early receipt of funds related to the projected increase in land values along the routes, which are expected to rise by up to 10 per cent.

Planning and approving systems takes too long and is uncertain

3.29 Modern light rail systems are complex undertakings, taking many years to complete. In Leeds, for example, proposals for a light rail system were included in the city's transport strategy as early as 1991, yet the Leeds Supertram is still under development. Excluding the time spent on initial feasibility and design work, the seven systems currently running in England took an average of eight and a half years from seeking legal powers to starting service. Although these timescales might be little different from other major civil engineering schemes - the Jubilee Line extension, for example, took 10 years between legislative approval and opening - local authorities consider that it takes too long for them to be granted legal powers and for them to prepare their business cases and have them approved by the Department.

It takes too long for local authorities to be granted legal powers

3.30 Before 1992, promoters had to obtain legal powers through a Private Bill, an approach that was uncertain and subject to the availability of Parliamentary time. On average, it took almost two and a half years to obtain Parliamentary approval. In 1992, the Transport and Works Act was introduced, primarily to reduce the increasing volume of private bills for light rail schemes that were taking up a disproportionate amount of Parliament's time, although it was expected the new legislation would bring time savings for uncontroversial

proposals and make it easier for promoters to plan. Under the Act, promoters apply to the Secretary of State for Transport for an Order, giving them broad powers including for the compulsory purchase of land. People whose property or business is affected may object. If there are many objections or the case raises complicated issues, the Secretary of State is likely to appoint an independent inspector to hold a public inquiry. Since 1992, all major light rail systems and lines in England have been subject to public inquiries, although none has been rejected following a public inquiry.

3.31 The Department has little control over the length of time taken in the early stages in the process of seeking legal powers. The time taken over a public inquiry, for example, depends on the number and weight of objections received. The Department does have control, however, over the time between receiving the report of the inspector of a public inquiry and the final decision made by the Minister, provided that the inquiry produces the information needed for the Department to come to an informed decision. The Department has targets for making decisions on applications: within six months of receiving the inspector's report for applications that go to public inquiry; within four months for applications where objections are dealt with by an exchange of correspondence between parties to a scheme (also called written representations); and within three months for applications where there are no objections. The Department has often found it necessary, however, to refer back to parties for more information after an inquiry has finished. We found that the targets have only been met in four of the 20 applications made for an Order for light rail systems since 1992 (Figure 12). In seven cases at least a year was taken. On average, it took nearly two years to obtain legal powers, with the Leeds Supertram extension taking the longest at nearly four and a half years.

3.32 The Department increased staff resources for processing applications in mid-2001 from six to 12 staff. Since 2001 the backlog has been cleared and the time taken to deal with public inquiry applications at the decision stage, for example, has fallen to an average of just over seven months. In February 2002, consultants commissioned by the Department to review the implementation of the Transport and Works Act recommended that the Department should:

- speed up procedures further, for example, by scrutinising applications for an Order at an early stage and gaining tighter control on matters that should not need further investigation at the final decision stage;
- update model clauses in Orders to reflect recent changes to legislation and policy; and
- improve guidance about procedures to promoters for dealing with Transport and Works Act applications.

3.33 The Department consulted with stakeholders on improvements to Transport and Works Act procedures in September 2003 and received responses by December. It is preparing legislation to change the procedures by the end of 2004. It also intends to issue new guidance before the revised procedures come into effect. Model clauses in Orders are being updated and the Department expects to consult with stakeholders on them later in the year.

The Department's guidance on business cases has changed frequently and preparation of such cases can be prolonged

3.34 The Department prepares guidance to promoters on how they should prepare their business cases when they seek grants from the Department. Since 1988, there have been five major changes to the guidance. Promoters told us that the changes can have a significant impact on the appraisal of a scheme and much of the preparation work, at the very least, has to be re-done. In some cases the changes might mean that a scheme becomes harder to justify under the new criteria, adding to the general uncertainty over approval. The length of time taken to prepare business cases has also been prolonged by changes to guidance.

3.35 Whilst the Department has targets for deciding on applications for an Order, it has not until recently had a target for scrutinising business cases. Promoters consider that there are not enough staff in the Department with the right skills to assess their business cases and that it takes them too long to make a decision. The Department told us that there are lengthy discussions with promoters before business cases are formally submitted and that approval is often delayed by promoters' failure to provide adequate and complete information. It took 18 months for the Department to approve the business case for Merseytram Line 1, for example, partly due to difficulties in quantifying regeneration benefits and other key cost-benefit requirements. Following the Merseytram application, the Department determined that in future it would only assess completed business cases satisfying the Department's guidance and that it would aim to assess them within four months of receiving them.

12 Time taken to obtain legal powers to build or modify a light rail line

In only four of the 20 applications made since 1992 has the Department met its targets for dealing with Transport and Works Act applications.

Transport and Works Act Order and the Department's targets for approving an application	Application Date	Time from application to inspectors report or start of decision stage (months)	Time taken for decision stage (months)	Total time (months)	Was the target met?
Applications involving a public inquiry (6 months)					
Greater Manchester - Airport Extension	August 1994	16	12	28	No
Greater Manchester - Eccles Extension	April 1995	9	8	17	No
Leeds Supertram - Extension	July 1996	15	38	53	No
Greater Manchester - Aston-under Lyne Extension	December 1996	9	11	20	No
Tyne and Wear - Sunderland	May 1997	11	8	19	No
Greater Manchester - Trafford Park	January 1998	25	12	37	No
South Hampshire Rapid Transit	March 1998	14	24	38	No
Greater Manchester (Land Acquisition)	January 2000	8	5	13	Yes
Docklands Light Railway (Silvertown and London City Airport Extension)	March 2000	12	12	24	No
Greater Manchester (Trafford Depot)	November 2000	10	7	17	No
Docklands Light Railway (Woolwich Arsenal Extension)	May 2002	17	4	21	Yes
Merseytram (Liverpool City Centre to Kirkby)	October 2003	Under consideration by the Department			
Exchange of correspondence or written representations (4 months)					
Leeds Supertram (Land Acquisition and Road Works)	June 1998	16	15	31	No
Unopposed (3 months)					
Greater Manchester (Modification)	August 1993	4	3	7	Yes
Greater Manchester (Land Acquisition)	December 1993	12	9	21	No
Greater Manchester (Land Acquisition)	October 1996	21	3	24	No
Greater Manchester (Mumps Surface Crossing)	April 1997	16	30	46	No
Greater Manchester (Moor Road Modification)	January 1998	6	5	11	No
Greater Manchester (Ashton Moss Variation)	March 1999	17	4	21	No
Greater Manchester (Didsbury)	April 2003	3	3	6	Yes

Source: National Audit Office analysis of Department for Transport data

A more strategic approach is needed for the development of light rail

- 3.36 Although the Department envisaged that by 2010 up to 25 new lines could be built, and aimed to increase the number of light rail passengers, it has had no strategy for achieving such growth. The Department has maintained an arm's length approach to the development of light rail, considering that it is for local authorities to decide whether light rail is appropriate for their areas. It plays no role in identifying where light rail might be promoted and, until recently, has not prioritised which proposed lines should be allocated funds and built.
- 3.37 The lack of strategic prioritisation of schemes was highlighted by the case of the Midland Metro. This system was granted legal powers in 1989 and provisional approval in 1991, but could not proceed to construction until 1996 partly because the Department had insufficient funds while the Sheffield Supertram was being constructed. In 1993, the Department had noted that the Midland scheme had a better economic case than the Sheffield scheme but the Sheffield scheme had been approved when funds were available.
- 3.38 The absence of a strategic, structured approach to funding has also led to uncertainties about the availability of central government funds, which have discouraged some private sector investors. In 1993, for example, the consortium that won the contract to construct and operate the Midland Metro withdrew from the scheme because of delays in obtaining government funds. Centro, the West Midlands Passenger Transport Executive, considered that prospective financial contributions from developers were lost because of the delay.
- 3.39 To address the problem of uncertainty, in 2001 the Department started to give provisional approval to schemes before promoters applied for Transport and Works Act powers, based upon the Department's initial assessment of business cases. Provisional approval was not, however, a guarantee of Departmental funds. Promoters have mixed views about this development. On the one hand it gives them, at an earlier stage, an indication about the likelihood of their schemes receiving government funding and reduced the risk of subsequent wasteful expenditure trying to obtain Transport and Works Act powers. On the other hand, uncertainty has been transferred to the provisional approval stage and might not have the desired effect of speeding up the process.

Some local authorities are uncertain about whether light rail is suitable for their urban areas

- 3.40 Some local authorities do not necessarily have sufficient expertise in transport planning to assess whether a light rail system would be suitable for their area. In response to our survey:
- 38 per cent of local authorities regarded their urban populations as being too small to support a light rail scheme. However, while all of the existing English systems are located in major metropolitan areas, such as Birmingham and Manchester, there are new systems in Orleans and Grenoble in France serving populations of 271,000 and 381,000 respectively. In Germany, there are many systems in cities with populations of less than 200,000, although some date from the early half of the twentieth century; and
 - 27 per cent of local authorities were concerned that light rail would have an adverse impact on road space available for motorists and that light rails' infrastructure would be too intrusive, particularly in historic town centres with narrow streets. The displacement of road vehicles by light rail is also a key concern of local residents' groups, who fear that vehicles will be displaced onto side streets where they live. Most systems in England have so far avoided these problems by being built mainly on disused heavy rail routes or on regenerated land. Further take-up of light rail might, however, involve towns with narrow and historic streets.

Fitting light rail systems into existing street patterns has not been a barrier in France or Germany

In general, mainland European cities have wider streets and their use of road space is less controversial than that of cities in England. However, we found that in Grenoble and Lyon in France and in Freiburg in Germany - cities with historic centres and narrow streets - these concerns have been largely overcome by turning streets into pedestrian and light rail zones and by sympathetic installation of light rail facilities. In Bordeaux in France, the local transport authority is experimenting with a hidden third rail system, avoiding the need for overhead wires and their aesthetic impact on the streets through which light rail would run.



There is scope for better co-ordination between local authorities, where proposed light rail systems would cross authority boundaries

3.41 Most of the existing light rail systems in England are in areas where Passenger Transport Executives have public transport planning responsibilities. These bodies, which cover several local authorities, are able to ensure that light rail schemes are consistent with the overall transport planning policies for their areas. New schemes are increasingly being built outside major metropolitan areas, however, where there are no Passenger Transport Executives to co-ordinate transport policy. In these places, potential problems can occur if the ideal route of a light rail system crosses local authority boundaries and an authority's planning area does not match the travel to work area for the light rail system. Understandably, different authorities have different transport objectives.

3.42 Light rail systems that cross local authority boundaries have had mixed success. The Nottingham Express Transit, which involves Nottingham City and County Councils, and the South Hampshire Rapid Transit, which involves Portsmouth City and Hampshire County Councils have been planned without problems. There have, however, been difficulties in Bristol. The first line of the Bristol Rapid Transit scheme was jointly promoted by two unitary councils, Bristol City Council and South Gloucestershire Council, and was given provisional approval by the Department in March 2001. Technical problems, however, emerged in serving the planned Almondsbury terminus and two alternative routes were investigated: one to an out-of-town shopping centre at Cribb's Causeway and a line to Bristol Parkway railway station. In late 2002 the Cribb's Causeway option was evaluated as having a negative cost benefit ratio and the scheme was dropped. Bristol City Council alone put forward a revised application for legal powers later in 2003 for a shortened route to Parkway railway station. The target completion date for the original line was 2004 but a target date for the revised proposal has not yet been set.

3.43 In our survey, two local authorities considered that they were unable to develop schemes because the ideal route went beyond their planning area and they did not anticipate co-operation from neighbouring authorities. Many small local authorities face the same difficulty. The construction and management consultants, Turner and Townsend, considered that there needed to be better co-ordination to avoid systems becoming subject to too many changes and routes being chosen that were sub-optimal.

3.44 Since 2000 Regional Transport Strategies, drawn up by the eight English Regional Chambers or, potentially, by future Regional Assemblies, are intended to guide the future development of transport in a region over the subsequent 15 to 20 years. The Office of the Deputy Prime Minister and the Department issue best practice guidance on how Regional Transport Strategies should be

prepared. Local authorities can also prepare joint Local Transport Plans or adopt additional joint strategies, within which light rail plans might fit. Joint strategies offer the potential to improve the alignment of transport plans with travel to work areas, but few such strategies have been prepared to date. A review of joint working by consultants for the Department in 2003 found cases of significant differences between travel to work areas and plans but little evidence of joint working.

There might be scope to convert some heavy rail lines for light rail use

3.45 The Department envisages that most of the new lines to be built by 2010 will involve on-street running and routes into city centres. However, replacing heavy rail with light rail services on certain routes might offer scope to improve the value for money achieved by the Department from funds it commits to both heavy, and light, rail. The Greater Manchester Passenger Transport Executive, for example, receives a subsidy from the Strategic Rail Authority of some £75 million a year for heavy rail services in the city. In contrast, the Manchester Metrolink carries more passengers than the city's heavy rail services, yet receives no operating subsidy.

3.46 Developing light rail as a heavy rail replacement might be less expensive than developing light rail from scratch. It is easier to develop light rail along heavy rail routes because land purchase and utility diversion issues are likely to be less complex or non-existent. The Manchester Metrolink between Bury and Altrincham, for example, has the lowest capital cost of all English light rail systems in real terms, mainly because it runs along the route of a heavy rail line. Other systems that use former heavy rail routes, such as the Midland Metro and the Croydon Tramlink, are also at the less expensive end of the cost range.

The "tram-train" concept, a form of light rail, has been developed in Germany, and will soon be developed in France

In Karlsruhe and Saarbrücken in Germany, tram-trains share existing heavy rail lines in out-of-town areas and switch to light rails in the city centres. They have the advantage of fast speeds out of town with the convenience and frequency of service into city centres. Tram-trains are also under development in Grenoble in France.





3.47 Services for passengers might also be improved, and capital costs reduced, were light rail systems to share existing heavy rail routes. Several organisations told us that, in their view, there was greater scope for track sharing in England than existed at present. The Institution of Civil Engineers told us that track sharing has yet to find significant applications in the UK compared with Europe, and that there were considerable opportunities on lightly used parts of the heavy rail network. Promoters were frustrated, however, by the administrative and financial complexities of track share and were discouraged from suggesting track share. A 14 kilometre stretch of the Sunderland extension of the Tyne and Wear Metro is the only track share in England.

3.48 In June 2003 the Strategic Rail Authority published its Network Utilisation Strategy, setting out ways of making better use of the existing heavy rail network in the face of capacity constraints on the network. The Strategic Rail Authority told us that it was receptive to the further development of light rail to help improve the cost-effectiveness of some local urban rail services. Potentially, through some re-aligned track for light rail, it could free up network capacity for longer distance passenger and freight services. In addition, the development of light rail systems might reduce the need for some major infrastructure upgrades on the heavy rail network. The Strategic Rail Authority emphasised, however, that safety and operational issues (such as different wheel profiles between heavy and light rail) would have to be addressed before track-sharing could be implemented more widely.

Appendix

Study methodology

Focus Group

We convened a focus group of promoters from Passenger Transport Executives and local authorities representing a cross section of cities with either existing, or proposals for, light rail systems. We obtained their views on:

- how well existing systems were performing against their planned objectives;
- how the costs of future light rail systems could be reduced;
- the financial losses made by operators - causes and potential remedies;
- the scope for attracting funds for light rail from sources other than central government;
- how the process for delivering light rail systems could be speeded up;
- how the barriers to developing new systems could be overcome; and
- whether promoters of new light rail schemes were learning lessons from existing systems in planning new lines.

The focus group comprised representatives from:

- Greater Manchester Passenger Transport Executive (Manchester Metrolink)
- West Yorkshire Passenger Transport Executive (Leeds Supertram)
- Transport for London (Docklands Light Railway, Croydon Tramlink, West London Transit)
- Tyne and Wear Passenger Transport Executive (Tyne and Wear Metro)
- Nottinghamshire County Council (Nottingham Express Transit)
- Blackpool Borough Council (Blackpool Tramway)
- West Midlands Passenger Transport Executive (Midland Metro)
- Hampshire County Council (South Hampshire Rapid Transit)

Case studies

We selected for detailed review in 2003 the then four most recently opened systems: Manchester Metrolink (Phase 1 and 2), Sheffield Supertram, Midland Metro, and the Croydon Tramlink. We also examined the construction costs of the Sunderland extension to the Tyne and Wear Metro:

- **Manchester Metrolink:** First line opened in 1992 between Altrincham and Bury passing through the centre of Manchester. A second line opened between Eccles and Manchester in 1999. The first line was built mainly on an old heavy rail line but with significant street running in Manchester. The second line used former heavy rail track and segregated street running.
- **Sheffield Supertram:** Opened in 1994-95. Comprises two lines between Middlewood and Halfway and Sheffield centre and Meadowhall. The system has a high proportion of street running.
- **Midland Metro** - Opened in 1999. It comprises a single line running between Wolverhampton and Birmingham, mainly on the line of a former heavy rail track.
- **Croydon Tramlink:** Opened in 2000 with lines between Beckenham Junction, Elmers End, New Addington and Wimbledon passing through Croydon town centre. Partly on a former heavy rail line and partly on street running.
- **Sunderland extension to the Tyne and Wear Metro:** Opened in 2002 from Pelaw to Sunderland. For 14 kilometres of its length it shares track with heavy rail services.

The main issues we addressed in the case studies concerned:

- construction costs and whether the systems were built on time and to budget;
- the Department's planned and actual funding contribution to new systems;
- expected benefits of the systems and whether they have been delivered;
- performance of the systems and whether service targets have been met;
- post-construction evaluation of schemes by the Department; and
- systems' financial performance and long term sustainability.

For each case we examined the Department's files, interviewed key personnel and reviewed local authority documents and operators' company accounts.

Survey of local authorities

Local authorities are the main promoters of light rail schemes. We surveyed 72 local authorities in England currently without light rail systems - primarily those outside the main metropolitan areas, of which 51 (71 per cent) responded.

We ascertained their views on:

- the extent to which they had considered light rail as a transport solution to their area or their reasons for not considering light rail at all;
- the difficulties experienced in taking forward light rail proposals and the extent to which these were caused by financial, administrative or legal barriers, or whether they were related to adverse impacts such as disruption during construction; and
- how the barriers to developing light rail in their area could be overcome and how the current arrangements for implementation could be improved.

To identify the difficulties facing promoters in planning and building new systems, we also interviewed the promoters of proposed light rail systems in:

- Nottingham (Nottingham Express Transit)
- Liverpool (Merseytram)
- Bristol (Bristol Rapid Transit)
- Edinburgh (Edinburgh Tram)

Consultation with stakeholders

We met or consulted various organisations with an interest, or an active involvement, in light rail systems, and invited their comments on:

- the benefits of light rail and whether they are being delivered by existing systems;
- whether existing systems could be improved and if so how;
- whether there are barriers to the efficient delivery and construction of new systems; and
- how those barriers might be overcome and how the current arrangements for developing light rail could be improved.

We consulted with 21 organisations:

Private sector investors, light rail builders and consultant advisers	<ul style="list-style-type: none"> ■ Innisfree Limited - the largest investor in the Nottingham system, and involved in consortia bidding for the Manchester extensions and the new South Hampshire and Leeds systems ■ John Laing plc - a partner in Altram, owning the Manchester (until 2003) and Midland light rail system concessions, and involved in the PFI concession for the Docklands Lewisham extension ■ Siemens plc - involved in consortia bidding for the new South Hampshire and Leeds systems ■ AEA Technology - consultants ■ Steer Davies Gleave - consultants to promoters of light rail schemes, to concession bidders and to the Department for Transport ■ Turner and Townsend Group - project management for the Sheffield, Croydon, Nottingham and Leeds light rail systems
Private sector operators of light rail systems	<ul style="list-style-type: none"> ■ Tramtrack Croydon Limited - operator of the Croydon Tramlink ■ Serco Integrated Transport - operator of the Manchester Metrolink and Docklands Light Railway ■ Pre Metro Operations Limited - operator of a light rail system at Stourbridge ■ Arrow Light Rail Limited - operator of the Nottingham Express Transit
Promoters of new light rail technologies	<ul style="list-style-type: none"> ■ Parry People Movers Limited ■ Advanced Transport Systems Limited ■ Pre Metro Operations Limited ■ Bristol Electric Railbus Limited
Transport academics	<ul style="list-style-type: none"> ■ Professor Lewis Lesley, formerly Professor of Transport Science, Liverpool John Moores University ■ Professor Roger Mackett, Centre for Transport Studies, University College London

Consultation with stakeholders *continued*

- Other organisations
- Confederation of Passenger Transport - consultative body representing the interests of the road passenger transport industry, bus, coach and light rail operators
 - Health and Safety Executive
 - Institute of Logistics and Transport - professional body for individuals and organisations working in or with an interest in the logistics and transport sectors
 - Institution of Civil Engineers - professional body for civil engineers
 - Institution of Highways and Transportation - professional body for those involved in the design, construction, maintenance and operation of sustainable transport systems and infrastructure
 - Network Rail
 - Strategic Rail Authority
 - Transport 2000 West Yorkshire Group - promotes the development of sustainable transport modes; public transport, walking, cycling and planning policies that do not encourage car use

International Comparisons

We visited two cities in France and two in Germany to obtain comparative information on how light rail systems are planned, promoted and operated. In carrying out the visits we were accompanied by consultants from MVA Limited (formally Martin Voorhess Associates), who have considerable experience in advising the promoters of both English and foreign light rail systems. We chose the cities to give a breadth of experience and characteristics. They were:

- Lyon (France) - A major metropolitan centre comparable in size and importance to English major metropolitan centres, such as Manchester and Birmingham. The system has three lines built between 1996 and 2003. We interviewed key officials representing the local transport and planning authorities and the operator.
- Grenoble (France) - A smaller regional centre, comparable to places in England such as Nottingham. System built in 1985 and extended in the 1990s. We interviewed key officials representing the local transport and planning authorities and the operator.
- Karlsruhe (Germany) - A medium sized city of 270,000 inhabitants - has had a light rail system since 1900 but upgraded and extended over the years. Pioneer of the 'tram-train' concept in the 1980s. Our consultants, MVA Limited, introduced us to the main features of the system.
- Freiburg (Germany) - A relatively small city with a population of some 200,000 inhabitants and a historic centre. System built in 1901 but updated over the years and extended in the 1990s. We met with key officials representing the local transport planning authority and the system operator.

We examined:

- Systems basics: including numbers of lines and stations; track length; extent of segregation from other traffic; number of vehicles; patronage; and fare prices.
- Systems benefits: including speed, frequency and reliability; prioritisation over other traffic; extent of integration with other modes of transport; ticketing; accessibility; regeneration; and impact on congestion relief.
- Construction of new systems: including promotion arrangements and planning; total costs and costs per kilometre; speed of construction; and costs of diverting utilities.
- New technological developments: including the tram-train concept and the extent to which it has been implemented.
- Funding arrangements: including subsidisation and local transport taxes.

Expert Advice

We drew on the experience of experts for advice:

- Mr Bill Tyson, OBE, Chairman and Managing Director of Greater Manchester Passenger Transport Executive's Transport Management Group, promoters of the Manchester Metrolink.
- Mr Andrew Last, a consultant with MVA Limited, who has worked on many of the light rail projects in England including Croydon and South Hampshire system, and an expert on comparative public transport practice across Europe. Andrew Last and colleagues from MVA Limited accompanied the NAO as advisers on visits to France and Germany.