Department for Transport

Green light for light rail

September 2011

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Foreword

Whether it is labelled light rapid transit, light rail or tram, this mode of transport is popular with passengers. It is also good for economic growth and good for reducing carbon, both key objectives of the Coalition Government.

During more than a century of development, light rail has proved itself an effective and efficient means of taking large numbers of passengers directly into and around the heart of a city, connecting communities and supporting businesses. The fact that, even against a uniquely difficult financial backdrop, we have announced since May 2010 our financial support for a number of light rail extensions in England demonstrates very clearly our belief in the benefits that light rail can provide.

However, past experience has shown that implementing light rail solutions has been too expensive. That is why I initiated a review to consider how the capital costs of light rail schemes can be reduced, so as to put light rail in a good place to compete for funds against other modes.

This report has made a number of recommendations for reducing costs. I would urge all parts of the light rail sector to work together on implementation to ensure that light rail is a more cost effective option for promoters in the future, so that more people can enjoy its benefits.

I would particularly like to highlight the two tram train pilots that the Department is supporting – in South Yorkshire and Hertfordshire. I believe that these pilots have real potential for roll out on other parts of the network, leading to regeneration of existing heavy rail lines and enabling the expansion of light rail systems at minimum additional cost. It also enhances the scope for more local control.

I look forward to continuing to work with the industry to progress these exciting opportunities.

Norman Baker MP
Parliamentary Under-Secretary of State for Transport

Executive summary

1. Light rail, trams and other rapid transit systems can play a significant part in improving the attractiveness and quality of public transport in major conurbations. This in turn can promote local economic growth and reduce carbon through modal shift.

2. Building light rail systems has, however, been expensive. The high capital costs have meant that in practice, even where passenger forecasts may justify its consideration, light rail has often not been seen as an affordable option for local transport authorities to pursue. This report has therefore examined the key cost drivers for light rail and the steps that could be taken to make this mode of transport more cost effective in the future.

Government action

3. The recommendations in this report build on the actions already taken by the Coalition Government in support of light rail. These include:

- providing funding for the refurbishment of the Tyne & Wear Metro, for extensions to Manchester Metrolink, an extension to Midland Metro Line One to Birmingham New Street Station and phase two of the Nottingham Express Transit;
- removing the requirement for light rail schemes to have a higher proportion of local contributions compared to other modes – all modes now compete on a level playing field; and
- incorporating higher monetary values of carbon and changing the treatment of indirect tax revenues in the Department's appraisal methodology, thereby improving the relative Benefit Cost Ratios of schemes that reduce carbon emissions compared to those that result in higher carbon emissions.

4. The Government has also committed to go further to help drive local growth through facilitating investment in infrastructure:

- consultation is currently taking place on proposals to enable councils to retain growth in their business rates. This reform package includes proposals for Tax Increment Financing to enable councils to pay for

future infrastructure developments by allowing them to borrow against projected business rate growth; and

- from 2015, we intend that decisions on local major transport scheme priorities will be taken at a more local level rather than by the Department for Transport.

5. These two proposals will reduce the current over-reliance of promoters on central Government to fund light rail or other local transport schemes, giving freedom to local areas to put together packages of funding and make decisions on scheme prioritisation.

Recommendations for local transport authorities and industry

6. This Review has examined the barriers to further investment in light rail and makes a number of recommendations for local transport authorities and industry, to complement the above action being taken by Government.

7. It should be stressed that implementation will require concerted efforts from all in the sector and many of the benefits will take time to reach fruition. UKTram has a valuable role in co-ordinating the actions of the light rail sector as a whole, and therefore, many of the recommendations are directed at this group.

Sector co-ordination to reduce duplication and increase effectiveness

- UKTram's role in mobilising collective action across the light rail sector needs to be strengthened. Key objectives will be to work with industry and European partners (including UITP – the International Association of Public Transport) to share best practice and identify further initiatives for cost reduction, and cost effective approaches to procurement as well as design standards in the UK and elsewhere.
- UKTram should publish on its website a yearly report of the work it has undertaken (including progress in implementing the recommendations of this review) in order to be more transparent to the sector and to demonstrate momentum in delivery.

Standardisation and Uniform Design

- UKTram should complete its report on standardisation and harmonisation as soon as possible, including estimates for cost reductions that should

flow from standardisation. This should form the basis of an implementation plan for a new uniform basis for project design of light rail systems which can be utilised across this country in the future. This would need to be updated on a regular basis to reflect latest best practice.

- In addition, UKTram should investigate in detail, the Besancon project in France or similar lower cost schemes, as well as considering further whether other low cost designs, such as the streetcar project in operation in Portland, Oregon, are relevant and worth pursuing in this country.
- The Department would not expect any funding to be provided for any light rail system unless it follows a more standard and uniform core design taking advantage of lower cost specifications.

Improving capability of promoters

- Improvements to procurement methodology should be developed through the setting up of a "centre of procurement excellence" within UKTram which can advise future promoters of the best procurement options for their project. The objective is to make scheme procurement more efficient and less costly, not least by ensuring that each new scheme learns from its predecessors through following best practice rather than reinventing the wheel each time.

Reducing the costs of utility diversions

- The Department for Transport will commence a consultation exercise inviting views from all parties on the interface between utilities and light rail.

Transport & Works Act (TWA) process

- Soundings from the light rail sector suggest that the majority are happy with the current process. Statistics also show that improvements to the timescales have been achieved. It is recommended that light rail promoters should share best practice on TWA applications to help minimise delays and costs. In addition, the Department would welcome any feedback from promoters on improving the TWA process and the Department's guidance on best practice.

Alternatives to conventional light rail

- UKTram should extend its remit to incorporate Ultra Light Rail and Personal Rapid Transit modes. It should work with the developers of these systems on producing a business case to see whether these modes offer value for money and have a future in England as well as considering whether they can be deployed in various locations, for instance on branch lines or in town locations. Such work should be undertaken in the next twelve to eighteen months.

Tram-train pilots: a major innovation

8. This Review has identified tram-trains as an innovation with significant future potential for whole-system cost reduction. Tram-trains are a hybrid of trams and trains which are able to run on existing rail lines as well as on the street, sharing the route with other road traffic and allowing travel between, around and directly into the heart of towns and cities. This is beneficial in two ways - avoiding construction costs and enabling better use of the existing infrastructure.

9. The Department for Transport announced on 24 March 2011[1] that the Government will provide funding for South Yorkshire Passenger Transport Executive, Northern Rail and Network Rail to undertake further work on the business and project case for a tram-train project pilot in South Yorkshire, as well as progressing the conversion of the St Albans Abbey line from heavy to light rail.

10. The business and project cases for these pilots will look at a range of issues such as the economic and environmental benefits. A number of other promoters are keen for these pilots to be completed as they are also considering the possibilities of incorporating tram-train into their transport plans for the future. The independent report[2] by Sir Roy McNulty into the value for money of GB rail also highlighted the possibility of a lower-cost regional railway including options for a complete transformation of appropriate routes to light-rail or tram-train operation.

Next Steps

11. **The Department will be discussing the issues and recommendations in this report with UKTram and other interested parties, in order to develop a sector-led implementation plan for getting light rail on the right track. As part of this work, a high level 'tram summit' of all interested parties will be held, hosted by the Department for Transport and chaired by Norman Baker, Local Transport Minister.**

[1] Tram-Train Press Notice, 24 March 2011 - http://nds.coi.gov.uk/clientmicrosite/Content/Detail.aspx?ClientId=202&NewsAreaId=2&ReleaseID=418792&SubjectId=36

[2] Realising the Potential of GB Rail, Final Independent Report of the Rail Value for Money Study, May 2011. Available at: http://www.dft.gov.uk/publications/realising-the-potential-of-gb-rail/

1. Introduction

Origins of review and approach taken

1.1 Promoting sustainable local travel and boosting economic growth, in a context of localism, is central to the Government's strategy for transport. By improving the attractiveness and quality of public transport, light rail and similar rapid transit systems can be effective means of supporting local economies and cutting carbon.

1.2 Building light rail systems has, however, often been expensive. The high costs have meant that in practice, even where passenger forecasts may justify its consideration, light rail has often not been seen as an affordable option for local transport authorities to pursue.

1.3 The terms of reference for this review were very straightforward - what are the key cost drivers for light rail; and what steps could be taken to help make this mode more cost effective in the future?

1.4 The review has considered evidence from the various inquiries that have taken place previously. This includes findings from the reports published by the National Audit Office, the Transport Select Committee and the All Party Parliamentary Light Rail Group (see Annex B for further details of these reports). Further evidence has also been provided by other organisations such as UKTram and scheme promoters, including research on costs of major infrastructure projects undertaken overseas for which the Department is very grateful.

What is Light Rail?

1.5 There is no universally agreed definition of a light rail scheme and various countries use terms such as tramway or rapid transit system. A more familiar term that is commonly used to describe light rail in England is 'tram'.

1.6 In generally understood terms, a **tram** or **light rail** operation is a public transport system that uses rail-based technology and which typically operates in urban settings. Vehicles are usually relatively lightweight, run on steel rails and are propelled by overhead electrical wires, although

there are some systems which use a third rail (such as the Docklands Light Railway) or, occasionally, diesel (outside the UK).

1.7 Guidance[3] published previously by the Passenger Transport Executive Group attempts to distinguish between 'tramways' and 'light rail'. It states that all 'tramway' systems have a significant element of their operation (measured either as a percentage of the system length, or as a significant economic element of the scheme) in the highway. As a system is given increasing levels of separation from, and priority over, other traffic, it moves from being considered a tramway to being a light rail system.

Figure 1.1 Sheffield Supertram

[3] PTEG, Advice Note for Promoters Considering a Light Rail Scheme, July 2009. Available at: http://www.pteg.net/NR/rdonlyres/19E6B342-4B5F-4D72-8BC0-A96C84E53AD1/0/Lightrailadvicenotefinal.pdf

1.8 **Trolleybus** systems have vehicles that run on rubber tyres like a regular bus but they are powered by electricity from overhead wires. Trolleybuses can have fast, smooth acceleration and are clean and quiet. The Leeds New Generation trolleybus vehicles, which are currently being investigated for Leeds, would likely be single articulated, single deck buses, with multiple doors (typically three or four sets).

1.9 **Tram-Train** is a light-rail public transport system where trams run both on an urban tramway network and on main-line railways to combine the tram's flexibility and availability and the train's greater speed. The Karlsruhe model pioneered this concept in Germany, and it has since been adopted on projects in Europe and more recently Australia announced plans for tram-train operation.

1.10 **Ultra Light Rail (ULR)** is generally defined as an intermediate transport system that runs on fixed track and may be self powered or externally powered, with or without some form of energy storage. Vehicles have lower axle weights than light rail and are best suited to meeting the needs of smaller passenger flows, although some ultra light rail promoters are now working on proposals for a larger vehicle to cater for additional passenger numbers.

1.11 **Other Forms** - There are also other forms of light rail technology which do not fit neatly into any of the categories above. These include monorails and automated 'people-movers' called Group Rapid Transit (GRT) and Personal Rapid Transit (PRT). Whilst these technologies have so far generally been linked to more specialist applications such as at airports, this review has noted that a local authority in England is looking at GRT/PRT amongst a number of options that could provide a low-carbon public transport network[4].

1.12 **Gatwick Airport "Monorail"** - Gatwick Airport's North and South terminals are connected by a 0.75 mile (1.2 km) elevated two-way automated people mover track. Although colloquially referred to widely as a "monorail", the shuttle system runs on a dual concrete track with rubber tyres and therefore is not strictly speaking a monorail system. The original Gatwick transit system opened in 1983 when the circular satellite pier was built, connecting the pier to the main terminal building, and was the UK's first automated people mover system. A second transit track was constructed in 1987 to link to the new North terminal. The original satellite transit line was later replaced with a walkway and travelator link, but the inter-terminal shuttle remains in operation. The original people mover cars remained in continuous operation until 2009. They were withdrawn from service to allow the transit system to be

[4] Daventry District Council Web Page: http://www.daventrydc.gov.uk/environment-and-planning/regeneration/advanced-transport-systems/

upgraded as part of the airport's refurbishment programme. A new operating system and shuttle cars consisting of six vehicles was installed. The guideway and transit stations were refurbished at a cost of £45 million with the system opening for passenger use again on 1 July 2010.

1.13 A monorail system opened at the Merry Hill Shopping Centre near Dudley, West Midlands in 1991 but had to close down five years later due to health and safety concerns as well as a series of mechanical problems. There are a number of other monorail systems in operation, mainly at amusement parks.

1.14 This review is primarily focused on light rail and tram systems (referred to simply as "light rail" throughout the document), although other forms are briefly touched on in the report.

Structure of this report

1.15 The remainder of this report sets out:

- the development of light rail systems in England and planned extensions;
- evidence on the benefits of light rail;
- the cost structure of the light rail industry;
- potential obstacles to further investment in light rail; and
- actions and recommendations for Government, promoters and industry.

2. History and background on light rail systems in England

History of Light Rail

2.1 The first tramway commenced public service in New York in 1832. Twenty-eight years later, the first British tram system commenced operation in Birkenhead, Wirral using horse drawn trams.

2.2 Still in operation after over 125 years, Blackpool's tramway is the last remaining first-generation street-running tramway in the United Kingdom. The system involves street running in Blackpool and Fleetwood, with tram stops that are often no more than a bus stop-style sign. Between the two towns the tramway runs on reserved track with stops further apart, similar to more modern interurban tramways. The system is currently being upgraded to more modern design standards.

2.3 Leeds and Bradford became the first cities to operate trolleybuses in the United Kingdom in June 1911. The use of trolleybuses was at its peak in the 1930s and 1940s and was seen as a replacement for street tramways. However, like trams, this mode started to decline in the 1950s and was eventually replaced by buses, which were seen to be more flexible and cheaper. Bradford was the last urban area to operate trolleybuses in the United Kingdom, with the system closing down in March 1972.

2.4 Blackpool tramway was the only system that survived the cull of light rail and trolleybuses that took place in the UK in the 1950s and 1960s. This demise began to be reversed when local authorities were first given responsibility for developing plans for integrated transport following the Transport Act 1968. Funding mechanisms were put in place for the Government to make significant contributions towards the cost of public transport infrastructure projects through Section 56 Grant.

2.5 The then Passenger Transport Authorities (now Integrated Transport Authorities) were set up in the major conurbations outside London to take over responsibility for operation and development of public transport. Transport plans were prepared and it was recognised that improvements

to public transport were required. Originally, construction of new or re-opened rail lines was considered in some areas (including city centres), but these were generally found to be prohibitively expensive and disruptive. Light rail offered the opportunity to provide the same sort of quality at a lower cost and with more potential to be physically integrated into the urban fabric.

2.6 The Tyne and Wear Metro was built in the late 1970s and a “light rail boom” looked possible in the 1980s and early 1990s. At one point, more than thirty different schemes were being proposed up and down the country. Most of these schemes failed to materialise for various reasons. Some were not taken forward due to poor economic cases which meant that central government funding support was not forthcoming while others failed due to a lack of political support across the area in which they were planned to operate.

2.7 Notwithstanding the problems set out above, there are eight tramway/light rail systems currently in operation in England. These are in Croydon, London's Docklands, Birmingham, Manchester, Sheffield, Tyne and Wear, Nottingham and Blackpool. Data on these schemes can be found at Annex A.

2.8 The first of the modern light rail systems to open in this country was the Tyne & Wear Metro, opened in 1980. This uses light rail technology but is closer to heavy rail in operation, with no street running and substantial stations set quite far apart, largely inherited from the old rail routes on which it was based. There are underground sections and stations in the city centre, and the system also shares some track with heavy rail services on the route to Sunderland.

2.9 In 1987 the Docklands Light Railway opened, with a mixture of new viaduct construction and the re-use of abandoned railway alignments. This system is more of a light rail than tramway with no street running and substantial stations but many of the stops are much closer together than one would expect with a conventional heavy railway, and there are plenty of tight curves and steep gradients which would be unmanageable for conventional railway vehicles. Another aspect of this system is that it is fully automated and driverless. Since then, Docklands Light Railway has seen a number of extensions to the original system completed, including most recently the completion of the extension to Stratford International.

2.10 The first of the second-generation street-running tram systems was Manchester's Metrolink. The first stretch opened in 1992, using former railway alignments for much of its route, but with a section through the streets of the city centre. The system has since been extended with further sections currently under construction.

Figure 2.1 Manchester Metrolink

2.11 The next milestone was the opening of Sheffield's Supertram in 1994, with extensive street running, both shared use and reserved track.

2.12 Birmingham's Midland Metro Line One opened in 1999 as a single line serving one transport corridor. Most of the line uses a former railway alignment, with a short section of street running in Wolverhampton. In Birmingham the tramway makes use of platforms in Snow Hill main line station, although plans to extend the line on-street through the city centre to Birmingham New Street station are now being taken forward.

2.13 In 2000 came Croydon Tramlink in south London, a network of three lines (one with a short spur) radiating out from Croydon, where the trams run in a loop around the town centre on the street.

2.14 The latest new tramway to open, in 2004, was the Nottingham Express Transit, which once again combines the use of former railway alignments with extensive street running.

2.15 Today, there are approximately 400 systems in operation worldwide. Europe has the densest level of light rail systems with approximately 170 systems in operation but North America and Canada have also been active in the last decade in opening new systems. New schemes are also being built in the Middle East and Asia.

Current Activity in the UK

2.16 As of September 2011, there are a number of extensions to the Manchester Metrolink system under construction, funded with Central Government support and which will see Metrolink extended to Oldham and Rochdale, as well as Ashton-Under-Lyne and East Didsbury. Further extensions to the system are under active consideration by Transport for Greater Manchester, the local transport authority, using local sources of funding. In addition, the upgrade to the Blackpool and Fleetwood tramway is well underway and is nearing completion, as well as work commencing on the modernisation of the Tyne and Wear Metro.

2.17 Further extensions to existing networks are also close to final approval. These include extensions to the Midland Metro Line One into Birmingham city centre and to the Nottingham Express Transit system. In addition a new tram system in Edinburgh is being developed.

3. Advantages of light rail

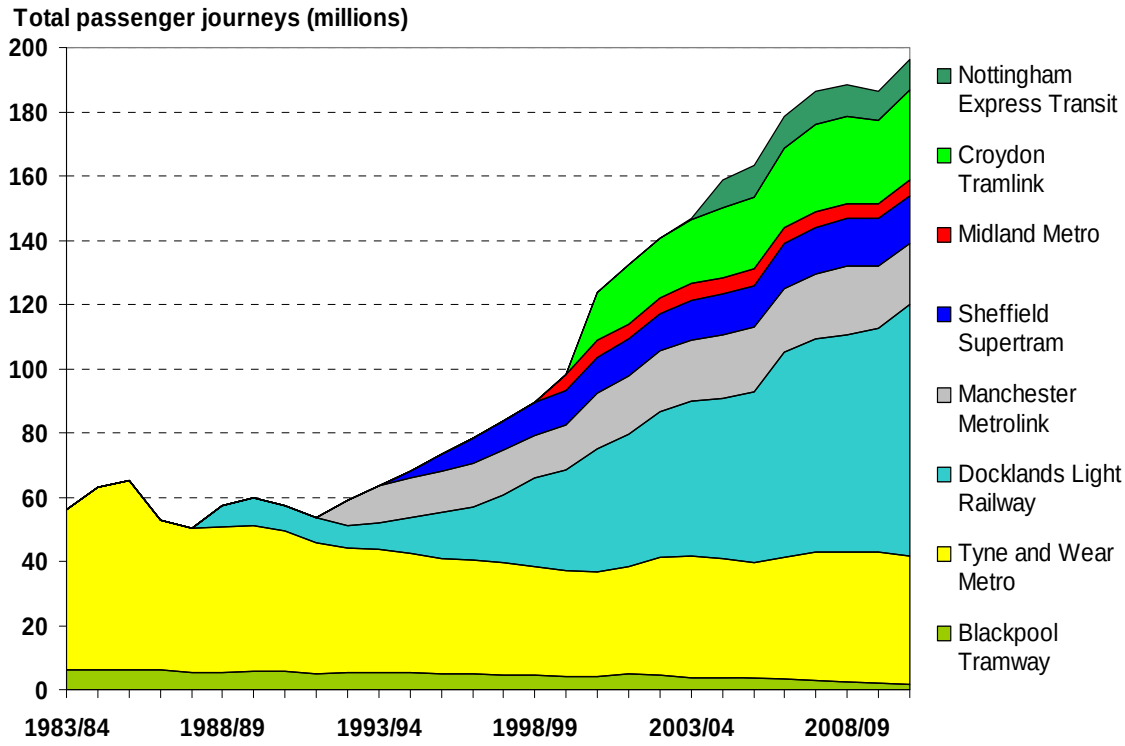
3.1 Light rail can play a significant part in improving the appeal and quality of public transport in major conurbations by moving large numbers of passengers quickly, reliably and with less pollution than the car or bus. This chapter examines the trends in light rail passenger journeys in England and the evidence of the benefits of light rail, including its impact on economic growth and carbon reduction.

Light Rail Usage

3.2 Figure 1 shows passenger journeys for light rail systems in operation in Great Britain since 1983/84. The overall trend has been upwards, with a slight decline in passenger journeys of 1.3 per cent between 2008/09 and 2009/10 (the first year-on-year decrease in passenger journeys since 1991/92). In the latest light rail and tram statistics published in August 2011, passenger journeys in England for light rail and tram systems have increased by 5.5 per cent between 2009/10 and 2010/11 with 196.5 million passenger journeys in 2010/11. This represents the highest number of passenger journeys to date.

3.3 The statistics show that the Tyne and Wear Metro system saw a decline in patronage from 1985 onwards in contrast to growth elsewhere. This was mainly due to the deregulation of bus services in 1986 which meant that bus operators were no longer obliged to provide feeder services and could start competing with the Metro. The recession in the early 1990s caused a further decline in demand for all public transport in Tyne and Wear including the Metro. However patronage increased on the system with the extension to Sunderland coming into operation in 2002.

Figure 3.1 Annual share of passenger journeys: England 1983/84 to 2010/11



3.4 In 2004 the National Audit Office (NAO) in their report[5] examined four light rail systems: Sheffield Supertram, Midland Metro, Croydon Tramlink and Manchester Metrolink. They found that actual passenger numbers fell well short of promoter forecasts in three of the four systems; as illustrated in table 3.1 overleaf.

3.5 The report concluded that shortfalls in patronage have been attributable to a range of factors including over-optimistic forecasting, early operational problems affecting services and competition from buses.

[5] National Audit Office Report, Improving Public Transport in England through Light Rail, 23 April 2004. Available at: http://www.nao.org.uk/publications/0304/improving_public_transport.aspx

Table 3.1 Light rail passenger patronage

System	Patronage (millions of passenger journeys)				% Difference between 2002-03 patronage and expected annual patronage	% Difference between 2010-11 patronage and expected annual patronage
	Expected Annual Patronage *(See Note 1)*	Patronage in First Full Year of Operation	Patronage in 2002-03	Patronage in 2010-11		
Sheffield Supertram	22.0	6.6 (1995-96)	12.0	15.0	45% shortfall	32% shortfall
Midland Metro Line One	8.0	4.8 (1999-00)	5.0	4.8	38% shortfall	40% shortfall
Croydon Tramlink	25.0	15.0 (2000-01)	19.0	27.9	24% shortfall	12% excess
Manchester Metrolink Phase 1	12.0	11.0 (1993-94)	19.0 *(See Note 2)*	19.2 *(See Note 2)*	5% excess	7% 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.

Modal shift

3.6 Many passengers prefer light rail to bus even when there are no differences in journey times or fares. The attractions of a fixed track system can be due to the following factors:

- Fixed systems cannot change easily so users can get to know them and understand the system easily.
- Permanence encourages people to plan their lives around the system with confidence - they will make transport choices based on its availability.
- It also encourages businesses to develop along the routes, which in turn concentrates development, so that it can be more effectively served by public transport.

- The system can be seen and advertises itself.

3.7 The 2004 NAO report examined the available evidence on modal shift based on evaluation studies by the Department and local authorities for schemes in Manchester, Sheffield and Croydon. It was estimated that around eighteen to twenty percent of light rail passengers previously used a car for the same journey. Since that report, Nottingham Express Transit's operators have produced data for Phase 1 and this reported that twenty per cent of passengers use the 3,000 Park & Ride spaces along the route and over thirty percent of passengers have transferred from cars to use the system.

3.8 The NAO report concludes that light rail systems are more likely to be regarded as attractive alternatives to the car if they are complemented by other measures, such as integration with other forms of transport (for example, bus services and park and ride schemes) and have higher priority over other traffic at junctions.

Economic growth and regeneration

3.9 The economic success of cities and towns depends on good, high quality transport to provide access to jobs, housing, retail and other services. Without this access no area is able to reach its potential. Most cities and towns in England, have over the last few decades, experienced significant growth in car use, which has led to rising levels of traffic congestion. At the same time, local authority planners have faced major challenges to maintain the vitality of city centres and to regenerate declining areas. Light rail has the potential to provide high capacity transport into and around major conurbations to reduce congestion, support growth and improve regeneration opportunities.

3.10 The 2004 NAO report examined the Manchester, Croydon and Sheffield evaluation studies and noted that the overall impact of light rail on road congestion in city centres was modest at best: annual average daily flow of traffic fell by about four percent in Croydon in the first year but there was little or no impact in Sheffield and Manchester. As people leave their cars and travel by light rail, some are likely to be replaced by other motorists using the free road space that they have vacated. Other complementary measures are therefore ideally required in addition to a new tram, such as the availability of park and ride schemes and careful pricing of city centre parking. The NAO report noted that no park and ride sites were put in place on the opening of any of these systems – they were initially not built in order to save money or were delayed because of planning procedures. The Nottingham Express Transit scheme, which opened in March 2004, was the first full system where

park and ride sites operated from the day that the system opened to passenger service.

3.11 The NAO also examined the impact of light rail on regeneration. They highlight that light rail has contributed to regenerating some rundown areas and to improved access for socially disadvantaged people. For example:

- Manchester Metrolink has helped to regenerate the Salford Quays and Eccles areas;
- 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 borough; and
- Midland Metro has contributed to the regeneration of land in the Wednesbury area of the West Midlands.

Figure 3.2 Midland Metro Line One

3.12 The National Audit Office report also explained that the full impact of light rail in regenerating rundown areas could take several years to achieve. From the four case studies the NAO study considered, they highlight that the Department had only evaluated the economic and development impact of the Sheffield Supertram. Evaluation of the Sheffield scheme

found that, although 1,600 jobs had been created, 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. Of course, in measuring regeneration and social inclusion benefits retrospectively it is difficult to separate the impact of light rail from other regeneration programmes or from changes in the local or national economy.

3.13 The Transport Select Committee, in their report following their 2004 inquiry into light rail[6], concluded that light rail systems may have significant regeneration potential, although they also suggested that a long term evaluation would ensure a clearer view of when light rail is most effective in securing regeneration, and what can be done to achieve the greatest benefits. The Select Committee report acknowledged that schemes will not all be equally successful in achieving their regeneration objectives. Nevertheless, they felt that some schemes, such as the Docklands Light Railway and Manchester Metrolink, have had significant regeneration benefits. This perceived regeneration effect is the aspect of light rail that is most attractive to promoters and to local authorities, who hope their area will benefit from a light rail scheme.

3.14 A follow-up study by Steer Davies Gleave (SDG) on behalf of the Passenger Transport Executive Group published in February 20057 suggested that light rail can improve the image of a city and contribute to economic regeneration and that installing a new tram system could provide a visible, permanent way of showing that an area is being invested in for the future.

3.15 A social and economic study by the Centre for Economic and Business Research for the West Midlands Passenger Transport Executive indicated that Midland Metro expansion would have the potential to create nearly 15,000 jobs and add nearly half a billion pounds to the West Midlands economy.

3.16 It is recommended that promoters of such systems consider and quantify the potential economic benefits of new tram schemes which in turn will make it easier for local authorities to capture the maximum developer contributions towards the funding for these projects.

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[6] House of Commons Transport Committee: *Integrated Transport: the Future of Light Rail and Modern Trams in the United Kingdom: Government response to the Committee's 10th Report of Session 2004-05* http://www.publications.parliament.uk/pa/cm200506/cmtran/526/526.pdf.

[7] Steer Davies Gleave, February 2005 - 'What Light Rail can do for Cities', available at: http://www.pteg.net/NR/rdonlyres/8F7971B0-721F-4019-9DC1-18065FEDA4F3/0/WhatLightRailCanDoforCitiesMainText_0218.pdf

Carbon Reduction

3.17 Climate change is the defining challenge of the 21st century. The Government is leading the charge internationally for global action on this key issue. It is also firmly committed to further action within the United Kingdom to reduce carbon emissions.

3.18 The de-carbonisation of our transport networks will play a considerable part in meeting the challenging targets for carbon reduction. The United Kingdom's Climate Change Act 2008 is the world's first national long-term legally binding framework. It commits the Government to cut emissions by at least 80% by 2050. To ensure the United Kingdom is on a cost-effective trajectory to meet this target, the Act provides for a system of rolling, five-year carbon budgets for the United Kingdom. However, the delivery of carbon budgets will require action by businesses and individuals as well as Government, and local authorities will have an important role to play.

3.19 Investing in public transport, including light rail, can play a key part in meeting this challenge. The Local Transport White Paper, *'Creating Growth, Cutting Carbon: Making Sustainable Local Transport Happen'*[8], published in January 2011, set out the Government's vision for a sustainable local transport system that both helps to create economic growth and reduce carbon emissions. The White Paper forms part of the overall strategy to tackle carbon emissions from transport and highlights the importance of local action in order to deliver this reduction whilst at the same time facilitating the access to local jobs that will boost economic growth.

3.20 This is why offering sustainable transport choices, at the local level is important, as short-distance, local trips are where the biggest opportunities for people to change the way they travel can be found given that two out of three journeys are under five miles.

Wider Benefits of Light Rail

3.21 Light rail schemes in operation have contributed to the removal of car trips from overcrowded roads which have led to the reduction in the amount of pollution caused by car exhausts. Tramways are one of the

[8] Department for Transport, January 2011, Creating Growth, Cutting Carbon: Making Sustainable Local Transport Happen. Available at: http://www2.dft.gov.uk/pgr/regional/sustainabletransport/

most environmentally friendly modes at point of use, for transporting large numbers of people. Trams are clean, emit no fumes and the systems create little noise pollution which can also lead to beneficial improvements to public health.

3.22 Many promoters have undertaken landscaping at stations which creates a pleasant, green environment for passengers waiting for trams and improves the appearance of land at locations. Emphasising the importance of good quality design throughout the tram network can discourage crime whilst at the same time encouraging legitimate use of the environment, resulting in safer and more pleasant surroundings for both the travelling public and local communities. Cross-sector benefits can be defined as the wider socio-economic benefits resulting from the operation of light rail schemes. However these are difficult to assess in monetary terms but they increase the value of the scheme to the local and wider community.

3.23 Light rail can also bring benefits to the mobility impaired through the provision of a fully accessible system. Benefits can also arise from the environmental enhancements resulting from bringing poor quality land into use.

3.24 Written evidence contributions to the Transport Select Committee in 2005 highlighted a successful light rail scheme should include the following elements:

- Serve a major urban conurbation.
- Have major traffic attractions along or at the end of routes.
- Serve corridors with significant volumes of traffic.
- Provide competitive journey times compared to other modes (car and bus).
- Be able to deliver a level of predictable regular and reliable journey time and service patterns using a high degree of segregation from traffic, with priority at junctions.
- Be perceived as safe.
- Offers good key interchanges with other modes e.g. park and ride, bus interchanges.
- Be well related to existing and future land-use developments

4. Cost structure of the light rail industry

4.1 The fixed infrastructure requirements of light rail means that the start-up costs for promoters are higher when compared to other modes, such as bus-based schemes. Given this, promoters will carefully need to weigh up both installation and operating issues before determining whether light rail is the best value for money option.

Breakdown of Capital Costs

4.2 Comparisons between the capital costs of light rail projects are difficult to make because no two schemes currently in operation in England are directly comparable. They all have different characteristics.

4.3 In general however, there is no doubt that the construction costs for light rail should be significantly less than building new heavy rail lines and can be reduced further through the re-use of existing infrastructure, as all schemes since 1980 have to some extent demonstrated. However, findings from the National Audit Office suggest that cost was the most significant factor discouraging the further development of light rail with 43% of authorities highlighting that light rail was too costly when compared with other options, such as buses. Problems identified included lack of standardisation in system design, heavy rail standards being applied to light rail, and the expense of diverting utilities – further information on these areas can be found in Chapter 5.

4.4 Based on the systems currently in operation in the UK, as highlighted in the National Audit Office 2004 report, the average the cost of a light rail scheme per mile is approx £20.3 million when uplifted to 2010/11 prices – see table 4.1 below:

Table 4.1 Capital costs of English light rail schemes

Existing systems and date opened	Length of track (miles)	Actual construction cost (£ millions)	Construction cost at 2010/11 prices (£ millions)	Construction cost per mile at 2010/11 prices (£ millions)
Manchester Metrolink Phase 1 1992	19.4	145	227	11.7
Sheffield Supertram 1994-95	18.1	241	361	19.9
Midland Metro 1999	13.1	145	191	14.6
Croydon Tramlink 2000	17.5	200	260	14.9
Manchester Metrolink Phase 2 2000	5	160	208	41.6
Sunderland extension to Tyne & Wear Metro 2002	11.6	98	121	10.4
Nottingham Express Transit 2004 (see Note)	8.9	180	210	23.6
Tyne and Wear Metro (1980-84)	36.7	284	727	19.8
Docklands Light Railway (1987)	8.1	77	162	20.0
Docklands Light Railway (Beckton extension) (1994)	5	258	387	77.4
Average	14.1	178.8	285.4	25.4
Non-representative underground sections				
Docklands Light Railway (Bank extension) (1991)	1	282	455	455.0
Docklands Light Railway (Lewisham extension) (1999)	2.5	220	289	115.6

Note – Value of PFI Grant for Nottingham Express Transit.

4.5 The NAO report in 2004 highlighted the construction costs of a few European schemes they had visited as part of their inquiry into light rail. Uplifting the costs per mile to 2010/11 prices suggests that on average they are slightly more expensive than a UK scheme, although this could be due to the small sample of schemes plus the majority of the schemes in England have sections of non-street running.

4.6 There are a number of areas which make up a typical cost of a light rail scheme and these are as follows:

4.7 **Site Preparation** – This includes preparing the groundworks for main construction.

4.8 **Traffic Management** – Light rail schemes, particularly in city centres, often have to interface with other modes, such as cars and cycles on shared highway. Part of the cost of a light rail scheme is traffic management, traffic signals, signage etc.

4.9 **Utility Diversions** – Light rail routes that run on highways are often deemed to require the diversion of utilities apparatus (water, gas, telephone) which is usually placed in roads and pavements. This has often been a significant part of the cost of a scheme. Space along the highway is often limited which can make this work expensive. There is also a high risk that during the initial phases of the design some of the utilities are not located, especially in central, older parts of cities, leading to additional and more costly work when they are subsequently located during construction.

4.10 **Trackbed** – Light rail track bed, in most cases, can be built to different and lower specifications to those used for traditional heavy rail construction. It has been suggested that as light rail projects are often designed by engineers/specialist advisors who are mainly experienced in heavy rail, they over specify in these areas, which increases costs unnecessarily.

4.11 **Trackwork** – Special grooved rail with switch magnets and crossovers is standard on modern systems. Such components can be very expensive and liable to significant cost increases given world demand. If the cost of commodity prices, such as steel, is not factored into cost estimates accurately, this is likely to increase the total outturn cost considerably.

4.12 **Power Supply** –This requires sub-stations, transformers, rectifiers as well as switchgear to name but a few items. Some schemes also have power distributors on top of the tram vehicles which require cable systems and cantenary (overhead line) poles.

4.13 **Signalling System** – Light rail systems are likely to involve tram vehicles sharing the Rights of Way with other road vehicles. In most cases a new signalling system will be required, which will also need to be supplied, installed and maintained.

4.14 **Control Centres** – Light rail systems are often controlled remotely from a central operation command centre. These facilities need to be factored

into any scheme costs these centres need to be equipped with up-to-date software and information systems, CCTV terminal station etc.

4.15 **Ticketing and Fare Collection Systems** - including the fare machinery at each tram stop and central computer hardware as well as any necessary staff and operational costs to run the system and to deal with ticket evasion.

4.16 **Rolling Stock (Tram Vehicles)** - can cost in the region of between twenty percent and forty percent of the capital cost of projects, depending on the specifications set by the promoter. Vehicles to date have largely been produced by non-UK manufacturers, thereby adding the need to consider possible currency fluctuations in any costings. Currently the most modern tram vehicle is designed to incorporate passenger information systems, CCTV systems, security features/systems etc.

4.17 **Tram Depots** - for storage and vehicle maintenance. These will need to be fitted out with equipment and tools. Some facilities include rail groundwork vehicles, rescue vehicles (vans) or small tower cranes, all of which can increase costs.

4.18 Differences in scheme costs are mainly due to the nature of the route alignments and the type of system constructed. Systems with a greater amount of street running and completely new routes tend to be more expensive, whilst it is less expensive to build on disused railway lines avoiding construction works.

Capital Cost Over-runs

4.19 Lessons can be learned from past experiences. Some light rail schemes saw their costs increase substantially after initial Government funding approval had been granted, with the result that proposals had to be abandoned.

4.20 Poor initial estimating was a factor in why costs for these projects increased above the Department's initial funding cap. There is evidence that not all costs were properly taken into account when initial cost estimates were produced. It is also clear that there were other reasons more attributable to real-world changes which could not have been foreseen by the promoters. Factors included:

- additional requirements by the Inspector following a Transport and Works Act public inquiry;
- a much worsened outlook for construction cost inflation; and

- increases in the figures quoted by the public utilities for service diversions from what was originally estimated, as well as insurance premiums increasing.

4.21 In addition, and due to experiences associated with other light rail schemes and difficulties at that point in time associated with the private finance contracting market, bidders and financial lenders also took a more cautious view of the risks of such infrastructure projects which resulted in an increase in their bids.

4.22 Cost increases on light rail projects have not only been a UK phenomenon. Research previously undertaken in the United States on behalf of the Federal Transit Administration highlighted a number of possible causes of this inability to accurately estimate, manage, and control project costs and many of these can be put down to a lack of experience in new tram systems, as well as over optimism of scheme promoters. Causes include:

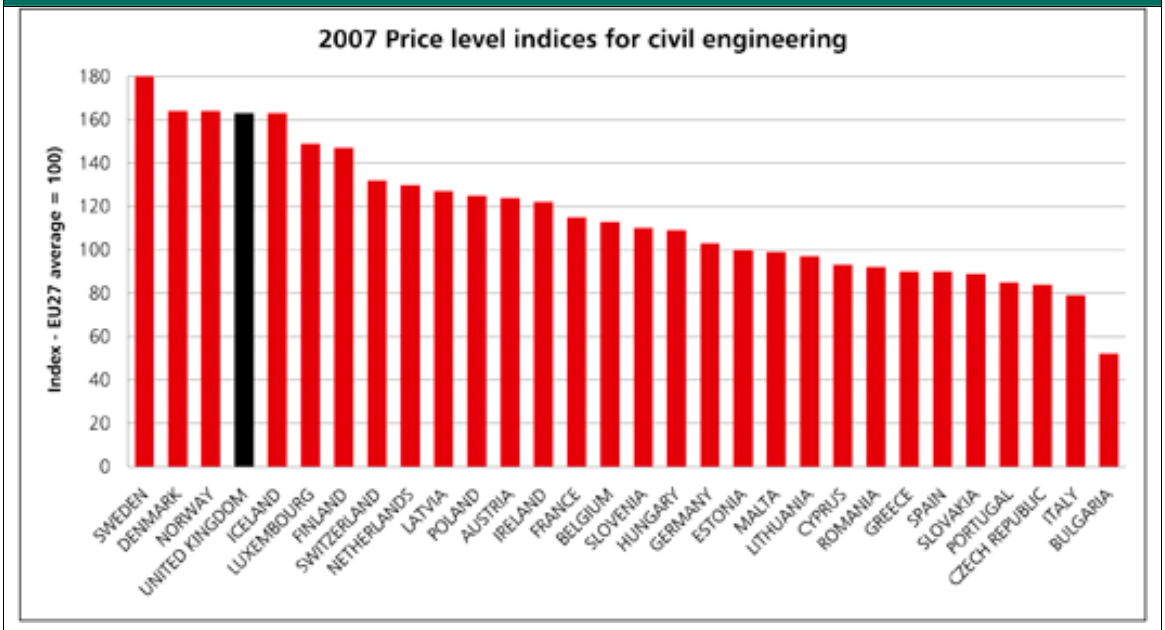
- Changing economic and market conditions
- Unforeseen engineering and construction complexities
- Relevant costs not included in early estimates
- Organisational and technical capacity to undertake the project
- Poor project and contract management
- Changes in project scope due to local politics or due to additional planning requirements.

4.23 It is vital that promoters of schemes have full confidence in the parameters of their scheme cost, viability and cost-effectiveness before they proceed.

4.24 More generally, and not just specific to light rail, Infrastructure UK (IUK), when pulling together evidence for their report entitled, 'Infrastructure Cost Review'[9], published in December 2010, highlighted the higher outturn costs of civil engineering infrastructure works in the UK in comparison with the rest of Europe (see figure 4.1 overleaf). They identified that there were clear opportunities to deliver projects and investment programmes more efficiently.

[9] HM Treasury / Infrastructure UK, Infrastructure Cost Review: Main Report, December 2010. Avalable at: http://www.hm-treasury.gov.uk/d/cost_review_main211210.pdf

Figure 4.1 Price level indices for civil engineering



Source: Eurostat Construction Price Survey - 114/2008

4.25 The IUK report concludes that while there is no single overriding factor driving high costs in the delivery of major infrastructure projects they are mainly generated in the early project formulation and pre-construction phases, due to factors such as ineffective cost management and fragmented supply chains. A full list of factors highlighted can be found in Annex C.

4.26 Whilst many of the factors go beyond just light rail and cover all major infrastructure projects, it is clear that improvements are needed in the development and management of light rail. The next chapter will focus on some of the key issues of specific concern to the light rail sector.

5. Reducing the barriers to further investment in light rail

5.1 This review has identified a number of barriers that need to be addressed if the cost of light rail schemes is to be reduced. We do not suggest this list is exhaustive and encourage the sector, including private utility companies and others, to work together to identify ways in which joint working across the sector may achieve even further cost reductions.

Inefficiencies due to multiple industry standards

5.2 The rationale for standardisation in light rail system design, operations and practices is to reduce costs for both promoters and industry. Customisation of vehicles and systems effectively divides the market for those components into smaller markets. As tram manufacturers have no assurance that they will receive additional orders of the same tram specification from other customers, they are therefore forced to recoup their fixed costs on the initial order, which effectively drives up prices for the specific project.

5.3 Standardisation has been a recommendation made by all of the Parliamentary Inquiries into the costs of light rail. UK Tram has been taking steps to address this issue and it is vital that UK Tram publish their report on this issue in the very near future.

5.4 It should be noted that there have been good technical reasons for some scheme-to-scheme variations in the UK. For example:

- Higher standards of vehicle crashworthiness than for a street running system are required on the Sunderland extension of Tyne & Wear Metro due to the need to share heavy rail track with heavy freight vehicles (something that is now being approached in a different way in the tram-train trial recently announced).
- Gradients on the Sheffield system required additional power in the vehicles compared to some other systems.

5.5 Nonetheless, the development of common standards for new light rail development, with departures on an exceptional basis, is in the interest of both public and private sectors. In order to make significant savings in the overall cost of light rail schemes, standardisation of equipment needs to be pursued urgently and energetically, allowing the promoters to benefit from economies of scale.

5.6 Part of the problem has been each City has wanted its own design of vehicle, and each manufacturer has also wanted to offer a unique design. Consolidation in the industry and the encouragement of standard approaches by, for instance, the UITP (International Association of Public Transport), have been working closely with both operating and manufacturing companies in looking to achieve potential cost savings from grouped orders of light rail vehicles and the trend towards more modular designs which can be customised cosmetically (i.e. to look different in City A from City B), are beginning to improve this situation.

5.7 For existing systems, the gains from standardisation will need to be considered against the extra costs of changing systems which are already built. Nevertheless, there may be opportunities for savings for improvements or extensions to existing systems through more limited harmonisation, such as the adoption of common technologies or joint procurement among one or more promoters with broadly similar needs.

5.8 Indeed, joint procurement of tram vehicles has recently been investigated by two promoters in England, albeit not pursued on this occasion. This could have had the potential of achieving a reduction in unit cost of the tram vehicles required by up to five percent dependent on the degree of commonality in manufacturers' designs required to meet the different requirements of the two networks. Such joint procurement is however only possible where the timetable for both projects is similar as long gaps between manufacture of the two orders would not produce the same level of savings.

Over-specification

5.9 More optimally designed systems might be lighter and less technologically advanced and so far cheaper to procure and maintain. There may be a tendency to over-design projects as a consequence of promoters lacking the internal expertise to select designs that minimise lifecycle costs, or who are unable to withstand pressures from consultants or from local elected members to escalate project designs.

5.10 Both the National Audit Office Report in 2004[10] and the All Party Parliamentary Light Rail Group report in February 2010 highlighted that there is a perceived over-reliance on expertise and procedures from the heavy rail industry. One of the problems is that there are not many engineers who specialise in tram design and construction in the United Kingdom. This leaves the bulk of railway design experience with the heavy rail community and can often result in an unnecessarily cautious approach to scheme design which then affects both the capital and maintenance costs of such systems. This seems to be quite a common issue both here and overseas, particularly in those countries which have less experience of implementing light rail systems. Developers should work closely with designers of systems to ensure that they work to the brief of the client and to ensure that the system is not over-designed.

5.11 An example of a guide to a more uniform project design of light rapid transit systems is the guidance produced by Utah Transit Authority[11]. This serves as a guideline and whilst it does not substitute for engineering judgment and sound engineering practice, it uses the philosophy of budget-limited design - each major element of the system is designed so as not to exceed the construction budgets established for the project - with exceptions applying only in special cases.

5.12 There is also scope for cost efficiencies through making more use of common design approaches and more tailored safety standards for light rail schemes. There are currently many European standards that are eminently suitable for tramway applications but there are also many heavy rail standards that on first sight would appear suitable but which in fact have the tendency to import risk to the tramway applications.

5.13 This review notes that members of the light rail sector from the United Kingdom are currently participating in an area of work that is being progressed by CENELEC, the European Committee for Electro technical Standardisation. CENELEC is responsible for standardisation in the electro technical engineering field, which includes urban rail systems. The CENELEC working group is currently deciding which standards are currently acceptable and which ones need tailoring for tramways. It is envisaged this work will be completed by the end of 2011. It will then be for the industry, perhaps with assistance from the Office of Rail Regulation (ORR), to produce a best guidance document that will set out which are the most appropriate European standards for use in the tramway industry.

[10] HC 518 Session 2003-2004, National Audit Office, Improving Public Transport In England Through Light Rail, April 2004. Available at: http://www.nao.org.uk/publications/0304/improving_public_transport.aspx
[11] Utah Transit Authority Light Rail Design Criteria, July 2010. Available at: http://www.rideuta.com/files/UTALRTDesignCriteriaRevision5.pdf

5.14 In addition to this work, it is understood the Confederation of Passenger Transport is endeavouring to become a member of VdV, the association of German Transport Undertakings. VdV publish a vast number of tramway standards that are recognised throughout the EU and it is important that these standards are recognised in the UK and used in the procurement of tramways and tramcars. Virtually all tramcars are manufactured to VdV standards and the major European tramways use the VdV standards. Membership of VdV will give access to the standards and the ability to be party to new standards and revisions. The ORR fully supports the application of VdV standards and has published some of the VdV track standards on its own website. ORR believes that membership of VdV is essential to drive higher safety, reduce barriers to trade and to drive down costs.

5.15 Besancon, a city in eastern France, is currently promoting a lower cost tramway consisting of nine miles (14.5km) of track and thirty stations. Whilst the cost is still relatively high (c£200m) the point to note is that the local planning authority is breaking with convention and stipulating a low cost design which they suggest will help reduce costs of the project, when compared with other systems, by a third.

5.16 Examples of where the promoter has endeavoured to reduce the costs include:

- choosing rolling stock (trains, interior equipment) and equipment for stations (seating, ticket machines and information displays) from a standard range;
- using off-the-shelf information systems (in-vehicle announcements of next stations and wait times at stops) from existing bus systems;
- creating an efficient and functional depot on an uncovered storage siding;
- proposing simple designs for landscaping etc; and
- making best use of European competition.

5.17 The promoter is hoping that the tram will be able to meet growth in public transport demand in the years to come. The project has been the subject of numerous studies to maximise its efficiency, optimise its layout, reduce construction and operating costs and ensure it is integrated into the town.

5.18 This example indicates that further cost savings could be found by other promoters when designing their system. For example, greater consideration should be given to minimising the design of passenger

waiting shelters and station furniture - instead of roofs over platforms, simple bus-stop-style waiting shelters might be adequate to meet the needs of passengers. A good example of this in practice in England is the new Shepherd's Bush overground station which was opened in 2008 and which does not include a roof over the platforms.

5.19 Another example of a lower scope light rail system is the 'Streetcar'. These can be defined as light rail transit vehicles designed for local transport needs. They are powered by electricity received from an overhead wire. The 'Streetcar' concept is similar to light rail and can operate in shared vehicle lanes in city streets, in separated lanes, or on its own exclusive track. They usually have lower top operating speeds and thus are generally not suitable for long distance commuting. They also have less passenger capacity than light rail vehicles and usually operate as single articulated vehicles which enable them to be able to complete tight turns in urban areas.

5.20 Streetcar vehicles can be modern, vintage (antique) or heritage (reproduction) vehicles. More than a dozen North American cities have streetcar systems that have either been expanded or initiated operation in the past fifteen years. Many additional cities in the United States are now proposing new lines or have the idea under active consideration. This mode of transport has become popular because they provide cities with the ability to add a visible rail service. The construction costs for streetcar lines vary widely but normally have a capital cost that is much less than a conventional light rail system.

5.21 Many cities in America believe that Streetcars are popular because they are a good fit for densely developed, pedestrian-oriented, urban neighbourhoods and activity centres. Streetcars are having something of a renaissance in the US and the current US Administration believes these types of systems may help in stimulating economic growth.

5.22 The Department would not expect any funding to be provided for any light rail system unless it follows a more standard and uniform core design taking advantage of lower cost specifications.

Figure 5.1 Portland streetcar

Promoter capability

5.23 For the longer term and to save further costs, light rail promoters should consider pooling maintenance facilities and expertise. This could mean individual maintenance depots becoming 'centres of expertise' in a certain field which may help to produce further cost efficiencies. The UITP, in the work they have been undertaking with the light rail sector, has also highlighted the synergy for maintenance and repair strategies and processes. They have suggested that cost savings could be achieved by the joint pooling of spare parts (fewer sleeping assets; quicker availability etc.) and shared ownership between operators of heavy equipment etc.

5.24 Promoters with less experience on light rail projects maybe less effective at procuring services and managing costs than those with more in-house

expertise as they have to rely more heavily on external consultants. Greater sharing of expertise within the sector is therefore recommended and will also help to lower costs.

Local sources of finance

5.25 The All Party Parliamentary Light Rail Group in their February 2010 report recommended that greater devolution of funding and powers was required to fund tram schemes.

5.26 Tax Increment Financing (TIF), which has been used in the United States for many years, is one way of increasing local contributions to the funding of infrastructure projects. TIF enables authorities to use future gains in taxes to finance projects. When a development or public project is carried out, there may be an increase in the value of surrounding real estate and/or new investment. This increased site value and investment can in turn generate increased tax revenues. The increased tax revenues are the "tax increment."

5.27 In America, a TIF type mechanism has helped to fund a tram scheme in Oregon – see case study below:

Case Study – Portland, Oregon[12]

In the early 1990s, downtown Portland was dominated by dilapidated warehouses and office blocks. A plan was hatched in 1994 to redevelop two large brownfield areas and to connect them with a tram service. The initial phases of the tram network cost $103m, of which $22m as raised using TIF (Portland Streetcar Inc, 2008). Passenger services began in 2001 and weekday ridership now stands at around 12,000. The economic impact has been substantial. Many areas near the line saw increases in property values in excess of 400% between 2003 and 2008, and by 2008 $3.5bn of new development had sprung up along the route.

5.28 In April 2010, the Mayor for London introduced a levy[13] of 2p on non-domestic properties with a rateable value of over £55,000 in London in

[12] http://www.steerdaviesgleave.com/news-and-insights/introduction-tax-increment-financing-tif
[13] Greater London Authority, Final Prospectus, January 2010. Available at: http://www.london.gov.uk/sites/default/files/finalprospectus.pdf

order to help pay for Crossrail, a vital new east-west train link that will provide a major boost to London's economy. The Greater London Authority (GLA) has agreed to contribute up to £4.1bn as part of its funding contribution to the £15.9 billion Crossrail project using income generated from this new business rates supplement (BRS). Powers were granted to the GLA to introduce this under the 2009 Business Rates Supplements Act.

5.29 The Government is already taking action to make it easier for local authorities to fund infrastructure projects themselves. This is covered in Chapter 7.

External factors - Utilities and Diversionary Works

5.30 Utilities are private companies who provide an essential service of a kind that requires the establishment of a network of apparatus for its delivery. The services broadly divide into the categories of sewerage and the provision of water, gas, electricity and communications (telephones and cable services). The services are provided through the media of pipes and cables. In built up areas both are invariably laid in the ground within the highway.

5.31 When a new light rail system is built on-street, utilities such as water and gas mains are usually dug up and moved, in order to facilitate easy access for works to be undertaken. The diversion of this type of apparatus is a major factor in the cost of implementing light rail schemes. The International Association of Public Transport[14] have recorded that utility diversions can amount to around ten percent of the total project cost, depending on the extent of on-street running.

5.32 The need to minimise costs associated with utility diversions has long been highlighted as a key area of concern. Indeed the various inquiries into light rail have recommended that various concerns be addressed including:

- **records of utility apparatus and resulting cost estimates**: where utility companies do not have accurate records of the apparatus for which they are responsible, this can lead to scheme costs increasing if the original estimate of diversions works proves to be wrong;
- **the extent to which utility apparatus needs to be diverted**: light rail promoters argue that the current legislation may not facilitate the

[14] UITP Core Brief, 2001 - Diversion of Public Utilities for the construction of light rail and tramway systems.

most cost effective decisions on whether to divert apparatus or deal with these through other solutions;

- **sharing the costs of works** - see box below; and
- **deferment of the time for renewal**: where apparatus is replaced in a new position or refurbished to allow it to remain where it is, the undertaker benefits because the need to renew the apparatus has been deferred. Light rail promoters have suggested that the guidance on valuation of benefits is incomplete and the discount rate is out of date.

Sharing the cost of works

When apparatus is protected or diverted in preparation for the construction of a light rail system, the cost of the diversionary works is apportioned between the authority and the undertaker. Since 2000, the promoter for a light rail scheme pays 92.5% for any works to be undertaken compared to only 82% for a highway or major bridge scheme. Prior to 2000 the 82% was the same for all works. These figures were intended to reflect the proportion of diversionary works from which the utility companies derived operational benefit.

UKTram have examined the basis of the original regulations and argue that, based on updated information, the differential percentage contribution is no longer justified.

5.33 The Department is aware that there are some differences of views between light rail promoters and the utilities sector on how best to deal with these issues.

5.34 For some apparatus construction will result in the need to remove this and rebuild it away from the rail alignment. This will typically be the case for apparatus, such as stop taps, valves, washouts, jointing chambers and shafts giving access to manholes that break the surface of the highway directly in the line of the tracks.

5.35 Other apparatus may be inaccessible because it lies beneath the tracks, or only accessible when the railway is not operating. In these cases, some action may need to be taken to divert or protect the apparatus, or reduce the potential danger to an acceptable level. Since any interference with apparatus will impose a cost on a proposed scheme,

the ideal position would be to devise an alignment that requires no diversionary work.

5.36 UKTram have undertaken a study into this area with the main purpose to understand the approach to diversion of apparatus adopted by the relatively small number of UK tramways constructed in the last 20 years, and to attempt to compare this with experience on the Continent. The UKTram report[15] highlights a range of approaches that have been adopted in England to relocating utilities. The light rail systems in Sheffield, Manchester and Croydon opted to provide a clear corridor for the tramway whilst the Nottingham, Midland Metro and Croydon projects preferred to move as little as possible, while wishing to avoid major disruptions to future operations. The promoters for Midland Metro Line One scheme also relied to a significant extent on the preferences of the utility companies, while encouraging them towards leaving apparatus in place as far as possible. The level of co-operation by the utility companies varied but in most cases it was noted that there was a general willingness on the part of the utility companies to discuss proposals for diversion with the promoters or contractors for the tramway.

5.37 UKTram also explored whether there was a standard approach to the incorporation of apparatus into the tramway infrastructure as long as it was suitably protected. Each promoter had different approaches/views on this.

5.38 A recent example of the adverse implications for scheme costs of utilities diversions can unfortunately be found in the Edinburgh Tram project. Audit Scotland's Interim Report, published in February 2010[16] , estimated that the final extent of diverted utilities for the Edinburgh Tram project will be around 50,000 metres, with the cost of this work contributing to an overall increase in project costs to around £67 million, significantly higher figures than first anticipated.

5.39 This review has briefly investigated whether there are any solutions to minimise utility diversions for a light rail system. This is however a very complex area and it is recommended that further specific work is undertaken to examine in more detail possible solutions that have been highlighted as part of this review and in previous inquiries. In principle, however, if a means can be devised to avoid having to relocate utilities this would serve to reduce the capital costs of a light rail scheme considerably.

[15] UKTram Activity 1 - Protection and Diversion of Apparatus, June 2010: Available at: http://www.uktram.co.uk/Members-Area
[16] Audit Scotland, Edinburgh Tram Interim Report, February 2011. Available at: http://www.audit-scotland.gov.uk/docs/central/2010/nr_110202_trams_bw.pdf

5.40 We are clear that progress can be made in this area. Options which we would like to explore further include:

- the use of a lighter weight track-bed consisting of pre-cast concrete strips under each rail, although it is recognised this may not exclude some apparatus having to be diverted;
- the creation of diversionary routes for stretches of track alignment which run on-street and where utilities are more likely to be present under the highway
- accepting the temporary closure of sections of track. Further consideration could be given to the possibility of some sections of track having several permanent intermediate crossovers, particularly in heavy used sections of the route alignment. This could be considered to allow single-track service in such cases where, for example, a water main break, which might require temporary shutdown of service on one of the tracks for the duration of the repairs; and
- limiting utility works to off-peak hours. For any repair works to be undertaken during off-peak hours when the tram service is not in operation or at weekends to avoid disruption to the travelling public.

5.41 The Department is keen to explore in more detail the options for avoiding diversion of utilities as well as the case for reforms where diversions do need to take place. This includes understanding the extent to which changes in the interface between light rail and utilities may lead to reductions in costs for all parties versus redistribution of costs between the transport and utilities sectors. This work will be undertaken through a consultation exercise with the light rail and utilities sectors, under the auspices of the Highway Authority and Utility Committee (HAUC) Diversionary Works Group and UKTram. Key questions this work will seek to address include the following:

- Under what circumstances can diversion of utilities be avoided and what is the cost effectiveness of alternative solutions?
- If we do need to divert some utilities, are there more efficient and cost effective ways of dealing with this issue? For example, do we need to dig as deep?
- Could a more standard approach/agreement be adopted on utilities relocation?
- How can the reliability of early costs estimates for diversionary works be improved?

- Is the current apportionment of costs of diversionary works justified? How should other guidance (such as deferment of renewal) be updated?
- Should there be a more co-ordinated approach to the management of utilities for tram construction works?

5.42 Following consultation with the utilities and light rails sectors the Department for Transport will decide, along with other Government Departments, on whether any further action is required in these areas.

Statutory processes: Timescales for authorising light rail schemes

5.43 An Order made under the Transport and Works Act 1992 (the TWA) is the usual way of providing statutory powers for a new railway or tramway scheme in England and Wales. Applications are made by (or on behalf of) the promoters of the scheme. The procedure allows any interested person to have their say before decisions are reached. They can give rise to objections from people whose property or business is affected, or who may be concerned about the effect on the local environment. The aim of the system is to make sure that the Secretary of State can come to an open, fair and unbiased decision that takes proper account of all the relevant issues before deciding whether to make the TWA order.

5.44 At the decision stage, the Department for Transport's Transport and Works Act Orders Unit work to the following target timescales for issuing the Secretary of State's decision:

- If no objections are made, within 3 months from the end of the objection period.
- If all objections made are withdrawn, within 3 months from when the last objection is withdrawn.
- If the application is dealt with by written representations, within 4 months after the end of the written exchanges.
- If a hearing is held, within 4 months from when we receive the report of the hearing.
- If a public inquiry is held, within 6 months from when we receive the inspector's report.

5.45 Some Transport and Works Act (TWA) applications have taken significantly longer than anticipated. In recent years, however targets have been achieved in the majority of cases, often by a significant

margin. Further details of light rail applications and timelines can be found in Annex D.

5.46 Where cases have taken significantly longer, this is often due to factors, which would not be resolved by changes to the statutory procedures. For example, where open space issues have not been resolved at an early stage in the TWA process.

5.47 Experience suggests that the time taken to process cases has less to do with the procedures and more to do with other factors including how well an application is prepared and progressed by the promoter, the amount and quality of pre-application consultation on the proposals and the amount of opposition that a proposed scheme may generate. While the Department considers that the scope for further significant efficiency improvements through changes to TWA procedures is likely to be limited, we would welcome for consideration any proposals on procedural improvements from stakeholders.

5.48 The Department is also currently investigating whether there are any aspects of the TWA regulations which can be improved as part of the Red Tape Challenge initiative.

Alternatives to conventional light rail

5.49 Ultra Light Rail (ULR) is generally defined as an intermediate transport system that runs on fixed track, and which may be self powered or externally powered. A joint Memorandum[17] dated October 2009 submitted to the All Party Parliamentary Light Rail Group by a number of number of UK developers of Ultra Light Rail technology suggested that this technology could help revive unused and underused heavy rail branch lines.

5.50 The adoption of lightweight, self propelled vehicles on the Stourbridge branch, as part of the London Midland franchise, has proved that much smaller, simpler vehicles can operate on conventional rails. However some modifications to the track were required to ensure a smooth passenger ride.

5.51 The promoters of ultra light rail suggest that scheme costs are relatively modest compared to a conventional light rail system. However this technology has been subject to limited operational exposure, namely the Stourbridge operation and it is not clear what total scheme costs are, or whether such a scheme could offer value for money as no quality

[17] Memorandum submitted by Go! Co-operative, Lightweight Community Transport, Parry People Movers, Pre Metro Operations, Sustraco and TDI international

assured final cost breakdown or other information normally expected in a full business case has been made available.

5.52 Automated People Movers are generally used at airports for inter-terminal or satellite boarding gate connections or as driverless Metro style systems. Personal Rapid Transit, of which the ULTra system is one example, are vehicles described as driverless taxis operating on segregated, often elevated, tracks ULTra's first application in the UK is serving the long term executive parking at Heathrow Terminal 5. There are aspirations to roll the system out in a town environment.

6. Tram-train pilots – a major innovation

Tram-Train concept

6.1 A tram-train is a rail vehicle fitted to operate both as a street running tram and as a train on main line railways. Bespoke tram-train vehicles rather than either traditional trams or heavy rail passenger trains are required as they will have to be compatible with two subtly different types of network without compromising safety or capacity.

6.2 A tram-train as used in mainland Europe is a lightweight three-car articulated tram vehicle, equivalent in length to a 2 car, heavy rail Diesel Multiple Unit, such as a Pacer. These are fitted with the normal equipment for on-street running as well as being able to operate with main line electrification, signalling and communications equipment. The centre section of the vehicles has seating designed for longer journeys, whilst the end units are designed for hop-on/hop off with mixed seating and standing room.

6.3 This concept was originated in Karlsruhe, south-west Germany, and the first through-running of tram vehicles on to a national heavy rail network began in September 1992. The 'Karlsruhe Model' is considered the reference point for similar developments worldwide and tram-train has been adopted by many cities throughout Europe including Den Haag, Alicante, Nordhausen, Saarbrucken and recently Kassel where a dual fuel (electric/diesel) version has been used. Traditionally they have been dual voltage electric vehicles with 750V DC for the city tramway sections and 1500V DC, 15,000V AC or 25,000v AC depending on the main line system.

Figure 6.1 Karlsruhe Tram-Train (on the left side of the picture)

Source: Google Images

6.4 Tram-trains are available that broadly fit the GB railway structure gauge and will operate with minimal adaptation, accordingly offering an existing proven design of rolling stock for certain types of urban and regional services. Tram-trains are lighter than conventional rolling stock and will almost certainly have less impact on the track. With the improved performance, particularly in braking, there may be an opportunity to simplify or eliminate signalling on lines where only tram-trains operate, thus saving on infrastructure costs.

6.5 A vision for tram trains would be that they would travel through the city centre on the tram track sections and at a suitable location transfer onto main line railway tracks and travel through to the suburbs. Once in the suburb, either new tram stops could be located on the main line close to residential areas or the tram train could leave the main line tracks back onto a tramway through the suburb. This would save the cost of constructing a new line, either in street or segregated, between the city and the residential areas.

6.6 This would give the benefit of a direct service from near home to the traveller's real destination in the city centre, be it for work, leisure or shopping. Another advantage could be helping to ease congestion at mainline train stations, such as Manchester Piccadilly, as some local services could be transferred onto the tram trains thereby improving the capacity for through services.

6.7 In 1994 the then Cardiff Bay Development Corporation proposed a tram-train system featuring track sharing with local mainline trains on the Cardiff Valley lines, with services then extended through urban streets to reach central and southern areas of the city. However the HMRI (Her Majesty's Railway Inspectorate) who at the time were the body concerned with railway safety were unwilling to give their approval and the proposal was not taken forward.

6.8 Whilst, for example, both the Manchester Metrolink and Croydon Tramlink systems have been very successful in revitalising formerly closed and open but under-used mainline railway routes, it should be noted that they were both complete conversions from heavy rail to urban tramway and do not involve any aspect of track sharing. The first location in England where light rail and heavy rail vehicles share tracks is on part of the Sunderland extension of the Tyne & Wear Metro. However, this is not categorised as a tram-train as the Tyne and Wear Metro is a fully signalled off street system.

Tram-Train Pilot in England

6.9 The Department for Transport announced on 24 March 2011[18] that the Government will provide funding for South Yorkshire Passenger Transport Executive, Northern Rail and Network Rail to undertake further work on the business and project case for a tram-train project.

6.10 The pilot, in South Yorkshire, will connect the tram system in Sheffield to Rotherham Central Station and the Parkgate Retail Park nearby. A short connecting line will be required in the Meadowhall South tram stop area onto an adjacent main line and thence to Rotherham, together with a small section of electrification.

6.11 The proposed Tram-Train Trial Pilot in Sheffield has a number of key objectives:

[18] Tram-Train Press Notice, 24 March 2011 - http://nds.coi.gov.uk/clientmicrosite/Content/Detail.aspx?ClientId=202&NewsAreaId=2&ReleaseID=418792&SubjectId=36

- to understand the issues with operating from main lines onto tramways;
- to determine industry costs for tram-train operation;
- to understand changes required to standards to enable operation; and
- to gauge passenger perception.

6.12 Overarching the pilot, of course, is the prerequisite that safety must in no way be compromised. Network Rail will be undertaking the outline design for the infrastructure. The business and project case will look at a range of issues such as the economic and environmental benefits. A detailed technical learning report will be produced to give guidance to potential tram train system promoters and thus prevent them re-inventing the wheel each time. The Pilot will look at industry standards and determine those that may prevent or significantly increase the cost of introducing tram train systems. The work will include close liaison with the rail industry to revise such standards, or produce an enabling standard that will ease the safe introduction of tram trains onto the main line railway.

6.13 If successful, the tram-train concept will enable cities with trams to extend their existing systems onto adjacent main lines at minimum additional costs when compared with a new tramway. Many other promoters are keen to see the outcome of this work as they are also considering the possibilities of incorporating tram-train into their transport plans for the future.

6.14 Tram-train has the potential to be used for some regional and rural lines around the country which are currently unprofitable or where services are limited. The independent report[19] by Sir Roy McNulty into the value for money of GB rail also highlighted the possibility of a lower-cost regional railway including options for a complete transformation of a route to a light-rail or tram-train operation. As the Report identifies, these solutions would possibly involve initial capital expenditure, but have the potential to provide a significant whole-system cost reduction.

[19] Department for Transport & ORR - Realising the Potential of GB Rail, Final Independent Report of the Rail Value for Money Study, Detailed Report, May 2011. Available at: http://www.dft.gov.uk/pgr/rail/strategyfinance/valueformoney/realising-the-potential-of-gb-rail/

Conversion of St Albans Abbey Railway Line to Light Rail

The Department is currently working with Hertfordshire County Council and Network Rail to look at the possibility of converting the St Albans Abbey Line from heavy to light rail. The single track Abbey Line runs for 6½ miles between Watford Junction and St Albans Abbey Station in Hertfordshire. The current rail service consists of a train every 45 minutes in each direction. Around 450,000 passengers per year use the service which is operated by London Midland train operating company.

It is generally accepted that the frequency of services on the route needs to be increased. To achieve this goal, consideration is being given to converting the Abbey Line to operate light rail or tram vehicles rather than traditional heavy rail vehicles. Assessments undertaken so far indicate that it should be possible to run a more frequent 20 or 30 minute service on the Abbey Line at approximately the same cost as the current heavy rail service operation.

The proposed conversion to tram operation would take advantage of the lower operational costs of light rail, compared to heavy rail.

The Department and Hertfordshire County Council consulted on these proposals at the start of 2010. The results of the consultation were made public in the autumn. Some 67% of the total respondents supported the proposals.

Further work to develop the scheme and to resolve issues around land ownership and responsibilities for maintenance and renewal of structures and bridges is underway. A decision on the future for this proposed scheme is expected in the near future.

If the proposals are taken forward, the County Council may decide to apply to the Secretary of State for a Transport and Works Act (TWA) Order to transfer Network Rail's statutory responsibilities for the Abbey Line to them. If the County Council make a TWA Order application, the Secretary of State for Transport would consider it on its merits and on the basis of all relevant evidence at the time.

7. Actions and recommendations

7.1 This final chapter sets out the actions and recommendations to enable greater investment in light rail, covering all parts of the sector – Government, local transport authorities and industry.

What has Government already achieved?

7.2 The Local Transport White Paper[20] published in February 2011 sets out the Government's vision for a sustainable local transport system that supports the economy and reduces carbon emissions. It explains how the Government is placing localism at the heart of the transport agenda, taking measures to empower local authorities when it comes to tackling these issues in their areas. The White Paper committed the Government to this review of light rail.

7.3 The Government has supported a number of light rail schemes since coming into office in May 2010. Decisions announced include:

- **June 2010** –confirmed funding support for the upgrade of the Tyne & Wear Metro system; and
- **June 2010** – confirmed funding support for two Metrolink extensions to the existing Manchester Metrolink system. These extensions, currently under construction and due to be in operation by 2013 will extend the system from Droylsden to Ashton-under-Lyne in Tameside and from Chorlton to Didsbury in South Manchester. The Department for Transport is providing a funding contribution of £120 million towards the cost of both the infrastructure and eight new trams.

[20] CM 7996, Department for Transport, 'Creating Growth, Cutting Carbon: Making Sustainable Local Transport Happen' February 2011. Available at: http://www.dft.gov.uk/pgr/regional/sustainabletransport/pdf/whitepaper.pdf

- **February 2011** – announced intention to support an extension to Midland Metro Line One to Birmingham New Street Station which would also include a fleet of new trams.
- **March 2011** – announcement that Nottingham Express Transit Phase 2 was able to move forward to the final stage in the funding approval process, following savings to the project costs. This decision allowed the promoters, Nottingham City Council, to continue its procurement process and, subject to approval of a final business case, award the concessionaire contract. The scheme consists of two new extensions - the Chilwell and Beeston route would run from the railway station to the south west of the city, and the Clifton route would run from the railway station to the south of the City.

7.4 In addition to specific scheme decisions, the Government has also made a number of policy decisions which affect light rail.

7.5 The process for assessing local major schemes following the Spending Review has been changed. Under the previous local major schemes guidance, promoters of light rail schemes had to contribute 25% towards the total capital cost of a scheme compared to 10% required from promoters of other modes. The revised process for prioritisation of schemes during the Spending Review 2010 has removed this disparity though nationally there is an onus on all promoters of schemes in all modes to reduce overall costs and maximise local and third party contributions in a competitive funding process.

7.6 The Secretary of State for Transport informed the House of Commons in April 2011[21] of changes to be made on how transport projects are to be prioritised. As part of this, in line with the Coalition Agreement, the Department has updated its appraisal guidance. This measure incorporated the latest monetary values of carbon, published by the Department of Energy and Climate Change, which are higher than previous values. It also treated indirect tax revenues (such as fuel duty) in a way consistent with the Department for Transport's 'in-draft' benefit-cost ratio (BCR) formula. These changes tend to improve the BCRs of schemes that reduce carbon emissions including light rail schemes and weaken the BCRs of schemes that result in higher carbon emissions.

[21] Review of Decision Making in the Department for Transport - http://www.dft.gov.uk/press/speechesstatements/statements/hammond20110427

What Government will do in future?

7.7 The Secretary of State for Transport, in a statement to the House of Commons on 26 October 2010[22] explained that in the longer term, the Government wants decisions on local transport priorities to be decided closer to the point of delivery. The statement highlighted the Department's intention to work with Local Enterprise Partnerships and local authorities to identify the best approach to local decision making on future transport priorities. The Department will very shortly be commencing a consultation exercise seeking views on proposals on how we can devolve the capital funding for local major transport schemes.

7.8 In addition on 18 July the Government published[23] proposals to enable local authorities to retain business rates and to let them borrow against future rate income. Legislation will be set out later this year so changes start as soon as possible. The consultation was the outcome of a review into local government funding that sought to repatriate rates to create a financial incentive for councils to promote local growth, to reduce dependency upon central Government grant, and to maintain protections for business and vulnerable areas. The reform package includes proposals for Tax Increment Financing to enable councils to pay for future infrastructure developments by allowing them to borrow against projected rate growth. Councils are not currently permitted to retain their rates so cannot borrow against them. Rate retention would remove this barrier. The consultation sets out two options. An open structure that lets councils invest and take on the risks alone or one with stronger Government controls that guarantees revenue and disregards the levy or reset processes

7.9 These two proposals would reduce the dependence of promoters on the Department to fund light rail or other local transport their schemes, giving freedom to local areas to put together packages of funding and making decision on scheme prioritisation.

Recommendations for local transport authorities and industry

Sector coordination to reduce duplication and increase effectiveness

[22] Investment in Highway and Local Transport Schemes. Available at: http://www.dft.gov.uk/press/speechesstatements/statements/hammond20101026
[23] http://www.communities.gov.uk/news/newsroom/1947298

7.10 UKTram's role in mobilising collective action across the light rail sector needs to be strengthened. Key objectives will be to work with industry and European partners (including UITP – the International Association of Public Transport) to share best practice and identify further initiatives for cost reduction, and cost effective approaches to procurement as well as design standards in the UK and elsewhere.

7.11 UKTram should publish on its website a yearly report of the work it has undertaken (including progress in implementing the recommendations of this review) in order to be more transparent to the sector and to demonstrate momentum in delivery.

Standardisation and Uniform Design

7.12 UKTram should complete its report on standardisation and harmonisation as soon as possible including estimates for cost reductions that should flow from standardisation. This should form the basis of an implementation plan for a new uniform basis for project design of light rail systems which can be utilised across the country in the future. This would need to be updated on a regular basis to reflect latest best practice.

7.13 In addition, UKTram should investigate in detail the Besancon project in France or similar lower cost schemes in further detail, as well as considering further whether other low cost designs, such as the streetcar project in operation in Portland, Oregon, are relevant and worth pursuing further in this country.

7.14 The Department would not expect any funding to be provided for any light rail system unless it follows a more standard and uniform core design taking advantage of lower cost specifications.

Improving capability of promoters

7.15 Improvements to procurement methodology should be developed through the setting up of a "centre of procurement excellence" within UKTram which can advise future promoters of the best procurement options for their project. The objective is to make scheme procurement more efficient and less costly, not least by ensuring that each new scheme learns from its predecessors through following best practice rather than reinventing the wheel each time.

Reducing the costs of utility diversions

7.16 The Department for Transport will commence a consultation exercise inviting views from all parties on the interface between utilities and light rail.

Transport & Works Act (TWA) process

7.17 Soundings from the light rail sector suggest that the majority are happy with the current process. Statistics also show that improvements to the timescales have been achieved. It is recommended that light rail promoters should share best practice on TWA applications to help minimise delays and costs. In addition, the Department would welcome any feedback from promoters on improving the TWA process and the Department's guidance on best practice.

Alternatives to conventional light rail

7.18 UKTram should extend its remit to incorporate Ultra Light Rail and Personal Rapid Transit modes. It should work with the developer of these systems on producing a business case to see whether these modes offer value for money and have a future in England as well as considering whether they can be deployed in various locations, for instance on branch lines or in town locations. Such work should be undertaken in the next twelve to eighteen months.

Next Steps

7.19 **The Department will be discussing the issues and recommendations in this report with UKTram and other interested parties, in order to develop a sector-led implementation plan for getting light rail on the right track. As part of this work, a high level 'tram summit' of all interested parties will be held, hosted by the Department for Transport and chaired by Norman Baker, Local Transport Minister.**

Annexes

A.1 Data on Existing Light Rail Schemes in England[24]

System	Blackpool Tramway	Tyne and Wear Metro	Docklands Light Railway	Metrolink	Sheffield Supertram	Midland Metro	Croydon Tramlink	Nottingham Express Transit
Route length (miles)	11	48	21	25	18	13	17	9
First section opened	1885	1980	1987	1992	1994	1999	2000	2004
Extended since opening of initial network	yes	yes	yes	yes	no	no	no	no
Street running	yes	no	no	yes	yes	yes	yes	yes
Tunnel sections	no	yes	yes	yes (short ex-railway tunnels)	no	Yes (short ex-railway tunnel)	yes (short ex-railway tunnel)	no
Elevated sections	no	no	yes	yes	no	no	no	yes
Former railway alignments	no	yes	yes	yes	yes	yes	yes	yes
Replaced 'heavy rail' service	no	yes	Some Sections	yes	no	no	yes	no
Track gauge	standard (1435 mm)	Standard (1435mm)	Standard (1435 mm)	Standard (1435 mm)	Standard (1435 mm)	Standard (1435 mm)	Standard (1435 mm)	Standard (1435 mm)
Electricity supply	550v DC: overhead trolley wire	1500v DC: overhead catenary	750v DC: third rail	750v DC: overhead catenary/ trolley wire	750v DC: overhead trolley wire	750v DC: overhead trolley wire	750v DC: overhead trolley wire	750v DC: overhead catenary/ trolley wire

[24] DfT Light Rail and Tram Statistics 2010/11, available at: http://www.dft.gov.uk/statistics/releases/light-rail-tram-2011

B.1 Previous Reports/Studies Undertaken

Over the last twenty years or so a number of reports/inquiries on light rail have been undertaken. Many of the key findings have been similar in that they listed a number of barriers to implementation of light rail and cited one of the main reasons as being the high cost of delivering such a project.

It is evident from this review that whilst some action has been taken both by Government and other organisations, including UKTram, further work is required in order to ensure cost efficiencies in the implementation of light rail schemes in the future. These have been factored into the issues and recommendations in the main report.

The reports are as follows:

Date	Title of Report	Weblink if available
1987	House of Lords, Science and Technology Committee, Innovation in Surface Transport (session 1986-87), HL 57.	
1991	House of Commons Transport Committee, Urban Public Transport: The Light Rail Option (session 1990-91), HC 14.	
2004/5	National Audit Office (NAO) and Public Accounts Committee (PAC) reports: "Improving public transport in England through light rail"	http://www.nao.org.uk/publications/0304/improving_public_transport.aspx and http://www.publications.parliament.uk/pa/cm200405/cmselect/cmpubacc/440/44002.htm
2005	PTEG, 'What Light Rail Can do for Cities'	http://www.pteg.net/PolicyCentre/LightRail/Whatlightrailcandoforcities
2005	House of Commons, Transport Select Committee - Integrated Transport: The Future of Light Rail and Modern Trams in the United Kingdom HC 378-II	http://www.publications.parliament.uk/pa/cm200405/cmselect/cmtran/378/37802.htm
2010	All Party Parliamentary Light Rail Group Light Rail and the City Regions Inquiry - Final Report	http://www.pteg.net/PolicyCentre/LightRail/LRInquiry

C.1 Factors Contributing to Higher Costs of Infrastructure from Infrastructure UK's Report

Contributing Factor to Higher Costs	Possible Reason
Stop-start investment programmes and the lack of a visible and continuous pipeline of forward work	Lack of certainty of budget commitment to programme investment reduces efficiency, suppresses innovation and has a negative impact on industry's appetite to invest in the UK
Standards and regulation compliance	In the UK there is a complex web of planning, consents, regulation, process and standards, which absorb time and add considerably to cost. While these systems are designed to protect the rights of citizens and ensure high quality, safe infrastructure, the cost impact is considerable and is exacerbated by a risk-averse culture that can lead to over specification, excessive assurance, monitoring and scrutiny throughout the delivery process.
Lack of clarity and direction	They suggest that projects are commenced before the design is sufficiently complete and the role of client, funder and delivery agent also becomes blurred.
Over-specification	Tendency to apply unnecessary standards and to use bespoke solutions when-off the shelf designs would suffice.
Lack of targeted investment by industry in key skills and capability	This limits the drive to improve productivity performance.
Poor commissioning	Poor practice in commissioning is a major cause of inefficiencies in the specification, design, procurement and construction phases
Ineffective cost management	The processes of budget preparation, approval and management do not provide effective incentives to minimise the outturn costs. Insufficient consideration is given to the assessment, placement and management of contingency and risk budgets, where the current process can lead to perverse behaviour
Fragmented supply chain	The private sector construction industry for infrastructure in the UK is not structured to optimise efficiencies and maximise

	productivity through the supply chain. It has tended towards a relatively large number of smaller construction companies acting as main contractors by comparison to its European peer group. The various technical trades and suppliers tend to exist as separate companies engaged through sub-contracts, rather than being part of a vertically integrated supply chain. This fragmentation of the contracting industry contributes directly to low skills development, training and productivity that add to costs of construction.
Contractual approach	The UK generally adopts a more contractual approach to infrastructure projects and programmes compared to other countries, which can lead to perverse behaviour particularly in tough market conditions, where low prices achieved under competition may be increased at outturn as a result of claims. There is concern that behaviour in the current economic climate may result in a return to an adversarial culture.

D.1 Transport and Works Act - Light rail and guided bus applications determined by DfT since 1 September 2005

TRANSPORT AND WORKS ACT ORDERS	2006 Rules?	Decision Date	App date	Time from app'n receipt to decision stage (months)	Target time to decision (months)	Actual time to decision (months)	Additional time (beyond/ahead of target) (months)	Total time (months)	Target Met?
PUBLIC INQUIRY CASES									
Docklands Light Railway (Capacity Enhancement) Order		Oct-05	Jun-04	16	6	5	-1	21	Yes
Docklands Light Railway (Stratford International Extension) Order		Oct-06	Aug-05	10	6	4	-2	14	Yes
Docklands Light Railway (Capacity Enhancement & 2012 Games Preparation) Order		Jul-07	Aug-06	9	6	2	-4	11	Yes
Nottingham Express Transit System	Y	Mar-09	Apr-07	20	6	3	-3	23	Yes
EXCHANGE OF WRITTEN REPRESENTATIONS									
Greater Manchester (LRT) Order – 'Roe' case		Feb-06	Jan-03	35	4	2	-2	37	Yes
Greater Manchester (LRTS)(Media City Extension) Order	Y	Apr-09	Jun-08	7	4	3	-1	10	Yes

Nottingham Express Transit System (Amendment) Order	Y	June 11	Aug - 10	7	4	3	-1	10	Yes
UNOPPOSED									
Midland Metro Order	Y	Jun-10	Feb-10	2	3	3	0	5	Yes