AET Conference 11th September 2000, Cambridge

LIGHT RAIL – IS IT WORTH PAYING FOR?

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1. INTRODUCTION

Do we, in the UK, really understand the potential of light rail in the context of urban development or integrated urban transport? We have only 6 out of a total of around 200 systems in Europe as a whole, and these have been conceived primarily as transport solutions rather than as catalysts of sustainable urban development. This paper explores the objectives and impacts of some UK light rail schemes, and suggests that inclusion of wider objectives would reveal much greater potential for light rail.

Interest in the UK in light rail as a mode of transport blossomed in the mid 1980s to the point where, by the late 1980s, some 30 – 40 towns or cities in the UK were reported to be considering light rail or some other form of rapid transit. This may have been partially a response by the larger local authorities and PTEs to their loss of transport responsibilities arising from bus deregulation, but interest in what LRT could potentially achieve was real enough. Unfortunately, neither the promoters of schemes, nor the Government in its use of grant criteria, included in their considerations the potential that arises from integrating transport infrastructure with planned urban development.

Tyne and Wear Metro and Docklands Light Rail were the first "modern" systems in the UK, opened in the 1980s. By the close of the 1990s only three new LRT systems had been added, namely the initial lines of the Manchester Metrolink network, Sheffield Supertram and Midland Metro Line One. The new millennium has seen Croydon Tramlink open in May 2000, the final section of the new Eccles branch of Manchester Metrolink open in July 2000, and agreements reached on Nottingham's system.

The experience of the other 30 – 40 cities of the planning of light rail systems has, however, generally proved to be painful for those involved in the process. Transport Planning professionals have frequently found that net system revenues (ie annual farebox revenue minus operating costs) fall well short of what is needed to repay the debt incurred in borrowing the capital required to construct the system and set up the operation; and that the non-user benefits (principally relief of highway traffic congestion and accident reduction) are insufficient to cover the funding gap and attract Section 56 Grant.

To this gloomy picture was added the rather discouraging pronouncement by the present Government early in its term of office that there was unlikely to be substantial funding for LRT on account of its high capital cost and the better returns considered to be available from investment in bus service enhancements. This position appears to have changed with the announcement of the Government's 10-year plan on 20 July 2000.

The Government perhaps has had a change of perspective, requiring the creation of a broader evaluation framework. Projects that may not have been justified only on transport benefit/cost grounds **may** be justified when other factors which bring benefits to the community are taken into account.

In this paper we review the objectives set for several modern British systems which have the classic LRT characteristics of substantial proportions of their operational mileage being on segregated right-of-way, but with key sections of on-street running. We review their costs and the factors which have led to a positive outcome in their evaluation.

In our presentation we shall consider some systems which have not been successful in making the case for investment, and whether there are "complementary measures" which would bring additional benefits to LRT systems which should be identified and included in the evaluation framework. Complementary measures have been and are the subject of current studies. We welcome this, but in our paper make the case for their consideration in a holistic approach to system design as distinct from being treated as a "bolt-on extra".

2. LRT SYSTEM OBJECTIVES

2.1 Manchester Metrolink Initial System

The initial Manchester Metrolink system comprised the Altrincham-Manchester service which took over the Altrincham-Castlefield Junction part of the suburban heavy rail network, the Bury-Manchester Victoria suburban rail service, and a cross-city centre street running section linking the two. In addition to providing a key link across the city centre the initial system also provided services to Manchester Piccadilly station via a short branch line which enabled a high proportion of cross-Manchester services to be routed via the principal main line station.

Whilst the primary driver of the development of the initial system was the need to replace the near life-expired rolling stock and fixed equipment which was operating on the existing heavy rail lines, the requirement for re-equipment presented opportunities to develop an altogether better rail product using LRT. Thus the principal objective set for the initial system was to overcome the structural deficiencies of the existing local rail system (which were resulting in a need for substantial and on-going financial support). This would be achieved by:

a) improving the accessibility of the regional centre of Manchester, and the important town centres of Altrincham and Bury;
b) improving on the low levels of reliability of the heavy rail services resulting from poor infrastructure and signalling, and conflicts between the local passenger services and InterCity and regional passenger and freight rail traffic on the network;
c) making the service more attractive to passengers through the provision of new rolling stock and improved frequency;
d) reducing (and preferably eliminating) the shortfall between the farebox revenues and the system operating and financing costs.

The initial system was Phase 1 of an overall Metrolink concept for Greater Manchester. The Altrincham and Bury lines were selected for Phase 1 because they had the highest patronage levels, the oldest rolling stock and carried no rail freight. These factors were considered likely to generate sufficient benefits to justify building the on-street section in Central Manchester. The capital cost of the scheme was £150 million and the transport benefits were sufficiently high to enable the scheme to be submitted to the DoT in 1985 for grant assistance under Section 56 of the 1968 Transport Act. The grant was approved in 1989.

There is conclusive evidence from the monitoring studies that Metrolink has achieved the objectives. Passenger carryings on the former BR routes were 7.6 million in 1990, the last full year for which data were available and 12.7 million in 1994, two years after opening. The overall number of trips is slightly higher than was forecast prior to its construction with the increase in patronage being most marked in the off-peak and on Saturdays. There were more trips to the Altrincham and Bury town centres and fewer to Central Manchester than forecast, and approximately one million trips were made entirely within Central Manchester.

The greatest proportion of the increased patronage was represented by passengers who would otherwise have used bus services. Metrolink resulted in a net transfer from buses of around 3.2 million passengers in 1994. Monitoring of traffic levels did not provide conclusive evidence of Metrolink's impact on car use. However, there has been a transfer of car trips to Metrolink. Between 12% and 15% of Metrolink passengers would otherwise have used car if the previous rail system had continued operation, meaning that if Metrolink had not been built, up to 1.3 million extra car trips per annum would be made on the roads.

Commuters formed the dominant type of Metrolink passenger in the peak periods, particularly for trips to Central Manchester. Car based commuters were less likely to transfer to Metrolink than those who would otherwise have travelled by bus. This was due, in no small part, to the high availability of free parking for those making work trips. Conversely, the actual and perceived difficulties and costs of finding parking was a significant factor in switching car users to Metrolink in peak and off peak periods.

In financial terms Metrolink has also met its objectives, the farebox revenues being higher than forecast.

2.2 Midland Metro

Whilst having a reasonably well developed heavy rail network and local commuter services focused on Birmingham New Street and Moor Street stations, the West Midlands conurbation in the early 1980s was the largest in Europe without any form of independent local rail network, whether LRT or Metro. This was perceived to be an inhibiting factor in the drive to modernise the conurbation and attract investment. About that time integrated transport studies were demonstrating a need for a more balanced approach to transport planning than the programme of urban road building which had dominated the agenda until then. This led to the development the concept of a network of LRT lines (Midland Metro) which was adopted in Centro's 20-year Strategy. The Strategy identified amongst its objectives:

a) provision of a modern high capacity public transport system throughout the region;
b) provision of reliable, punctual, comfortable and accessible public transport services;
c) coordination of public transport planning with other policy issues having an impact on transport; and
d) development of a balanced approach to transport investment.

Midland Metro Line One between Wolverhampton and Birmingham, the first of the proposed network of LRT lines, was selected because of the comparative ease with which it was believed the powers for construction could be obtained vis-à-vis other lines and the ability to build a case for investment.

As another paper in Session D9 demonstrates, Line One has been successful in achieving a modal transfer from car to LRT, but the amount of the transfer is lower than had been forecast. There is a low level of usage for journeys on employers business, the businesses in the corridor perceiving car to be the most efficient way of making their business calls, in spite of some congestion on local roads. A variety of reasons have been put forward for this including:

a) an absence of park and ride;
b) the comparative remoteness of some stations on the route from the centres they purport to serve (eg Wednesbury);
c) the comparative ease of obtaining parking for car journeys at the destination of the trip, including Birmingham itself.

2.3 Croydon Tramlink

The Croydon Tramlink project, like Manchester Metrolink, had its origins in planning the re-equipment of an underperforming heavy rail line which was proving expensive to maintain and operate. In the early 1990s the Wimbledon - West Croydon Line had a 45 minute interval shuttle service, with stops at six intermediate stations. The service operated between 0630 and 1930 hours

approximately, and the volume of local rail trips between Croydon and Wimbledon was low.

At the same time Croydon town centre was suffering from high levels of traffic congestion and pollution, and there was increasing pressure on parking space. These problems, if left unaddressed, were considered sufficiently serious to threaten the future development of Croydon as a commercial and retail centre, especially in relation to other Outer London centres competing with Croydon for investment and growth. To continue to be successful Croydon needed improved public transport accessibility to enable growth in visitor numbers without worsening the growing problems of congestion and poor environment. The objectives for Croydon Tramlink can therefore be considered as:

a) to improve accessibility of public transport to Central Croydon;
b) to reduce the net cost of providing the public transport required to serve Croydon;
c) to reduce levels of noise and air pollution in Croydon;
d) to support the further development of Croydon as a retail and commercial centre.

Work carried out for the Croydon Tramlink Impact Study (CTIS) has demonstrated that Tramlink is successfully increasing the levels of accessibility in and around Croydon. Accessibility was measured both for public transport (using TfL's Railplan model) and private transport (using LB Croydon's SATURN model) for the following three situations:

1995/96 Before Tramlink:	Before the start of works;
2000 Before Tramlink:	On substantial completion of infrastructure works, but prior to commencement of revenue service;
2000 After Tramlink:	After opening of all of the Tramlink services and revision of the bus service network.

The CTIS 'after' surveys have not yet been carried out. It is therefore too early to determine whether the car-Tramlink modal transfer predicted (on which the Tramlink Croydon Ltd revenue returns largely depend) will be achieved.

3. SYSTEM CHARACTERISTICS

Some key characteristics of existing UK LRT systems are set out in Table 1.

Discussion of Light Rail often focuses on those characteristics that are of concern to transport promoters, investors and operators. In the UK at least, emphasis has tended to be on the financial costs involved in building and running the system, and the transport impacts.

The capital costs of LRT systems are substantial, though very much smaller than for metro and heavy rail systems, and their funding is heavily dependent on the farebox revenue forecasts. These in turn are dependent on a variety of assumptions such as the level of bus competition, in terms of service frequencies and fares, and the amount of parking available and its cost to the user.

Table 1 Selected Characteristics of Existing UK LRT Systems

	Tyne and Wear	Manchester Metrolink – Initial System	Sheffield	Midland Metro	Croydon Tramlink
Year of Opening	1981	1992	1994	1999	2000
System Cost (£m)	180	150	240	145	200
Existing Rail Demand	On most of the network	On most of the network	None	Between Birmingham & Wolver-hampton	Between Wimbledon and Croydon
Existing Bus Demand	Services remodelled	Services reduced		Services remodelled	Services remodelled
Rail Service Frequency	Enhanced	Greatly enhanced		30 minutes increased to 6 minutes	45 minutes increased to 10 minutes
Central Area Penetration	Greatly improved	Greatly improved	Enhanced	Unchanged	Greatly improved
Traffic Reduction		Mixed evidence			Not yet measured

The Manchester study showed how important the availability and cost of parking was to the choice of mode. Were the cost to be increased, the number of people transferring to Metrolink would increase. However, in carrying out the feasibility studies it was not possible to assume that there would be policy changes to allow, for example, charging for workplace parking provision. The scheme had to be justified on the status quo.

The transport evaluations carried out to date have had to consider the benefits and costs of an LRT scheme against the “Do Minimum” and other

investment alternatives such as bus and heavy rail. These comparisons have generally assumed a fixed pattern of land use and a fixed traffic restraint policy.

Such a limited approach to the evaluation of LRT (or indeed any major transport investment) brings two distinct problems:

a) potential contributions to social, environmental and sustainable development objectives is obscured, making it more difficult to justify schemes; and
b) transport and land use planners have little incentive to explore the wider range of impacts of schemes, resulting in sub-optimal specification.

The need now is to consider the totality of the urban scene and to prepare local plans which set out the transport and land use aspirations together and the means by which they can be achieved. This means that the planning of an LRT system is not just about finding a solution to an identified or assumed transport problem. It is about exploring the potential of LRT to create land use as well as transport patterns that deliver objectives of sustainable development and sustainable transport. This, after all, is no more than what is demanded by the Government in its aim for an integrated approach.

To facilitate this approach, a useful start could be made by separately specifying transport or LRT system objectives from land use and other objectives along the lines set out in Table 2.

The left hand column lists what we call “transport system objectives”. Attempts to justify LRT on these alone have often proved impossible. The right hand column lists objectives involving wider land use and social objectives. If these are added in, the reality of LRT potential is more fairly represented, and the justification of schemes as part of a range of measures would be clearer.

The table gives only broad objectives. For individual schemes and systems objectives need to be more closely specified, in order to ensure that the services provided meet the intended purposes.

Examples of the choices that may be presented are:

a) the extent to which transport service certainty can help to kick start redevelopment opportunities;
b) the extent to which the central core of the urban area can or should be car free;
c) the scale and affordability of charges to individuals (through fares and parking charges) and businesses (through rates and rents);
d) the way in which funds from one source (e.g. workplace parking) could finance what would otherwise be a shortfall in the funding of an LRT project;
e) the value of orientating new development to the network, and linking areas of high passenger generation;

f) the importance of limiting development in areas not so linked;
g) the relative merits of housing or other land uses around key public transport stops;
h) the (social) distribution consequences of different types of system and different operational and financial structures.

Table 2 Potential Transport and Land Use Objectives for LRT

Transport or LRT System Objectives	Land Use and Other Objectives
1. Increase proportion of motorised trips made by public transport, and the total number of public transport trips	1. Open up areas where there is a latent demand for redevelopment but poor accessibility
2. Reduce congestion and accidents	2. Reinforce and/or revitalise the role of the city centre by improving its accessibility
3. Increase public transport capacity on routes with demand higher than can be readily provided by bus	3. Improve accessibility to jobs from residential locations, and to the workforce from places of employment
4. Reduce operating costs in corridors with high demand	4. Create an enhanced "city image" to attract investors and visitors
5. Increase journey speeds and reliability	5. Create certainty to attract development
6. Remove pollution at point of delivery	6. Social inclusion – "access for all" to jobs and leisure
7. Transform existing but poorly performing heavy rail system	7. Knitting together disparate centres
8. Improve other quality attributes (e.g. comfort and conspicuousness)	

In practice, such issues will need to be explored in relation to specific locations, and to specific groups of people and activities. The final section of this paper looks at some important issues that have emerged from the much larger range of experience in other west European countries.

4. REFINING THE LRT CONCEPT

It is suggested above that if the role of LRT is understood within a wider and more specific framework, it will be easier to justify expenditure on new and better systems, and to ensure that their potential is fully realised. The following are key points which deserve fuller consideration.

- ***Trams versus LRT?*** In the UK it is assumed that the new light rail systems (Manchester, Sheffield, Croydon) are simply the modern version of trams. But they have little in common with many of the European tram systems. A distinction can be drawn between systems that serve street frontage development (i.e. trams or strassenbahnen) and those that are more akin to segregated metro or suburban rail

systems. The key factor is that street trams serve frequent pick up and drop off points and provide an intra-neighbourhood as well as inter-neighbourhood service.

- ***On-street or underground?*** Some cities have converted their trams into a metro-type system, at least in the city centre, by taking them off the street and placing them in tunnel. This has had a number of disadvantages, including releasing roadspace that has led to an increase in traffic (e.g. Bochum). Services running sub-surface or in tunnel are generally much less convenient for users.

- ***Visibility and image***. The visibility of public transport on the street is of major significance. Underground or tucked away in a cutting or on an embankment to the rear of properties, the system looses its connection with the local community and is unlikely to be used so spontaneously, or for such a broad range of trips. On the street, the vehicles (bus or tram) are seen, and people can see shops and other activity from them. Trams on the street (as opposed to buses) have the important advantage that the rails offer a means of knowing the routes. "Just follow the tramlines" used to be a popular way of offering directions, but this doesn't work with bus routes!

- ***Speed versus access?*** Where stops are few (widely spaced) and where they are relatively distant from the areas they serve (i.e. away from street frontage and front doors), light rail can offer a fast suburban service, but cannot function like a tram. In this respect LRT performs the same function as a suburban heavy rail system, but with the important difference that it provides street access within the city centre (Manchester, Sheffield, Croydon).

- ***Integration with communities served and development.*** The planning of light rail or tram systems in relation to urban development is surprisingly rare. At the strategic level one can find examples of lines serving major new areas of development (Manchester Salford, Sheffield Meadowhall), but more often lines are built to satisfy a given demand. Perhaps the most dramatic example of a major restructuring of urban development around light rail is the new ring-rail system in Amsterdam. This has created major nodes around which have been developed large scale commercial uses, including an international business centre, conference centre, sports facilities and headquarter offices. Such large-scale developments are often difficult to fit into inner-urban brownfield sites, and especially so in historic cities like Amsterdam.

  Den Haag also has reorganised both tram routes and major office development to work with synergy at the Central Station area, and this has succeeded in dramatically increasing the mode share of public transport to Government offices relocated there.

  At the smaller scale, it is also relatively hard to find development

oriented specifically to trams or light rail. Street trams of course do not require any particular effort to achieve such orientation other than stops being sited near front doors, and densities of activity being sufficient to support the service. But light rail needs greater attention to focus development around the stop, both to maximise custom and accessibility, and to create a distinctive community around the public transport system. A good example of attempting the latter is Portland, Oregon, which has developed distinctive "Station Community Area" plans for each of the stations along the "Westside Max" line.

- ***Lines or networks?*** The odd line may be useful to serve a specific purpose (e.g. to link and airport to a city centre), but the real benefits come when a network of routes is available, allowing a broad range of origins and destinations to be served. Grenoble has tried to achieve this by not distinguishing tram from bus routes on the map of its network! In other words, the aim is to offer an integrated network, with the passenger not being so concerned with whether the vehicle that arrives is a tram or bus.

- ***Cost and value for money (fewer and better routes, or more but lower quality routes).*** Tram and light rail systems are expensive compared to bus, but not compared to heavy rail, especially if tunnels are avoided. For focusing or structuring urban development, however, rail based systems are vastly superior, not only because of their superior quality and capacity, but more importantly because they can offer certainty to potential property investors. Thus the usually assumed disadvantage of rail, that it is inflexible, becomes one of its greatest strengths. Conversely, the assumed advantage of flexibility of the bus is it's a major disadvantage.

- ***Certainty.*** Property developers will be reluctant to invest until a high quality service is certain to be provided, and certain not to be taken away. Rail systems can offer much more in this respect.

- ***Integration with bus, metro and heavy rail (timetable, tickets, fares, information)*** The most convenient and enjoyable aspect of travelling by public transport in European cities is that multi-mode, multi-ride tickets mean that there is no penalty for changing services or between rail and bus. In many British situations one may be confronted with different fares, different tickets, different types of information (if available at all). Car users simply vote with their wheels!

- ***Park and Ride, integration with car.*** It is sometime said that in the USA "public transport is something you drive to". The ubiquitous move towards car-based urban development in the UK means that if public transport is to be used by people living or travelling to car-dependent locations, then Park and Ride must be provided. But it is a reflection of the car-based arrangement of development, and not a true aspect of public transport-oriented development. Park and Ride can in fact work against public transport orientation because the car parking is located

(necessarily) at the very sites most accessible to the public transport service, and where the highest intensity of development should be provided. This is true of urban and suburban Park and Ride, but the conflict may be somewhat less in the edge-of-town or out-of-town "Parkway" type situation.

- ***Hybrid rail*** (e.g. Karlsruhe). The main UK light rail schemes have taken over former suburban railways or alignments. In Karlsruhe the trams share rails not only with suburban trains, but also with regional expresses and freight trains on main lines. This is a product of innovative technology to ensure compatibility of power and signalling systems. The new tram in Stockholm has adopted the Karlsruhe concept, and it seems to have potential for much wider application.

5. CONCLUSIONS

There is a new opportunity to consider the introduction light rail in British cities. This has been produced by the prospect of increased funding for local transport, new sustainable development objectives, and the push to find integrated solutions. To make the most of this opportunity, local authorities and other promoters will need to integrate proposed LRT schemes with land use proposals and wider aspects of transport. This will enable them to:

- make a better case for funding;
- demonstrate the full potential of LRT;
- build on the lessons of existing schemes.

The Government can encourage this broader approach through the new approach to appraisal (NATA).

The narrow base of scheme evaluations, confined mostly to quantifiable transport impacts, have precluded many schemes and stifled interest in LRT. By including the wider range of impacts and benefits, LRT solutions are likely to be better designed and better matched to their intended purpose. They are also more likely to attract funding support.