WHAT LIGHT RAIL CAN DO FOR CITIES

A Review of the Evidence

Final Report: Appendices

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Contents Page

APPENDICES

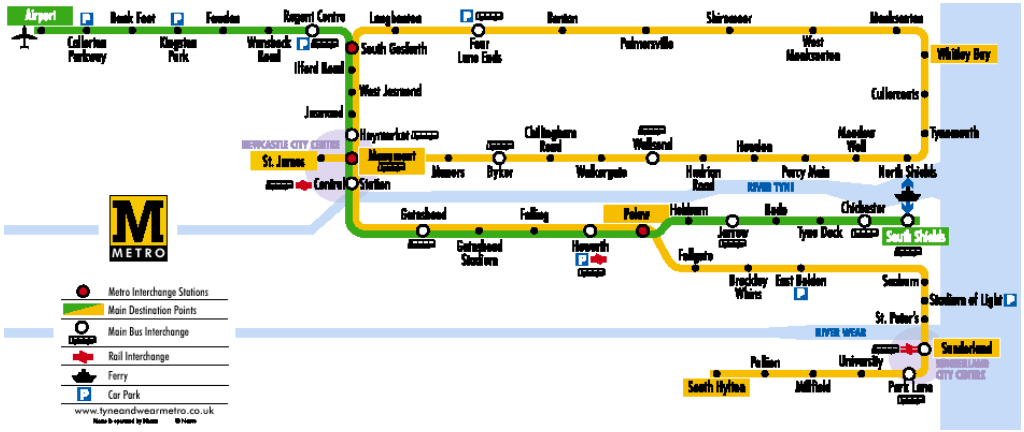
APPENDIX A

Operation and Use of Light Rail Schemes in the UK

A1. TYNE & WEAR METRO

A1.1 The Tyne and Wear Metro was the first modern light rail scheme opened in the UK, coming into service between 1980 and 1984. At a cost of £284 million, the scheme comprised the connection of former suburban rail alignments with new railway construction in tunnel under central Newcastle and over the Tyne. Further extensions to the system were opened to Newcastle Airport in 1991 and to Sunderland, sharing 14 km of existing Network Rail track, in March 2002. It is a metro-style system with some stations underground, including a major interchange at Newcastle Central Station. The network is shown in Figure A1.1.

FIGURE A1.1 TYNE AND WEAR METRO



Source: Nexus

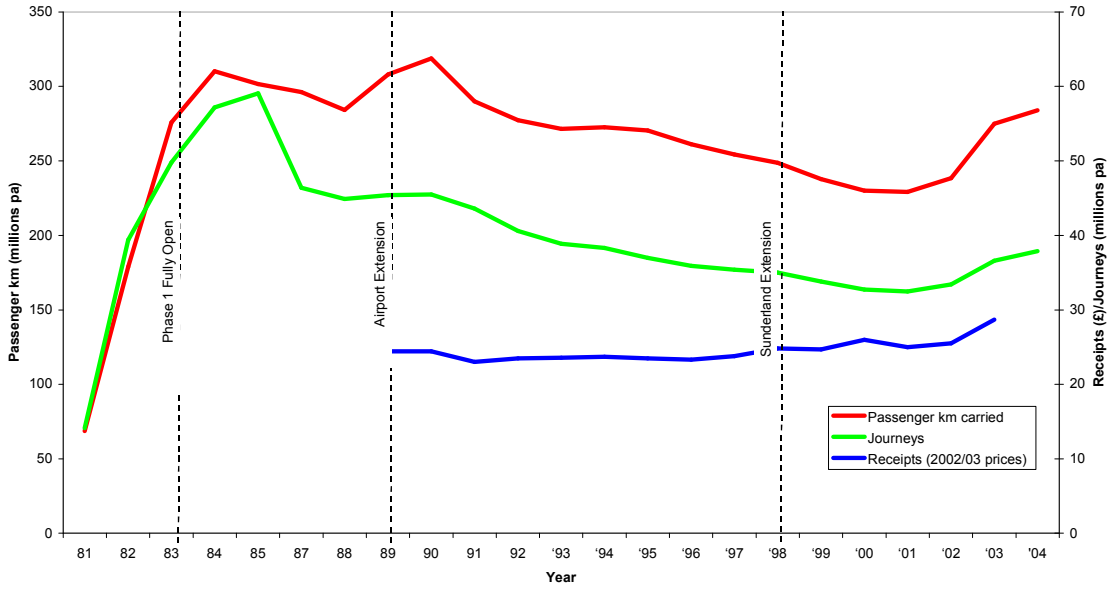
A1.2 The system is operated by Nexus (Tyne & Wear PTE), runs over 78 km of route (including shared track) and has 58 stations, some of which are shared with the national rail network. Nexus employs some 700 staff on the system and operates a fleet comprising 90 passenger cars, all of which are wheelchair accessible. Power is supplied by a 1.5KV DC overhead line.

A1.3 In 2002-3, the system delivered:

- 274.9 million passenger kilometers;
- 36.6 million passenger journeys; and
- £28.7 million in passenger receipts.

A1.4 Figure A1.2 illustrates the patronage and revenue on the system since it was opened in the early 1980s.

FIGURE A1.2 PATRONAGE AND REVENUE ON TYNE AND WEAR METRO 1981-2004



Source: Department of Transport Statistics

A1.5 Table A1.1 indicates patronage over the ten-year period between 1992- 2004

TABLE A1.1 PATRONAGE AND REVENUE ON TYNE AND WEAR METRO 1992-2004 (MILLIONS)

Year to March	93	94	95	96	97	98	99	00	01	02	03	04
Receipts (2002/03 prices)	£23.6	£23.7	£23.5	£23.3	£23.8	£24.8	£24.7	£26.0	£25.0	£25.5	£28.7	n/a
Journeys	38.9	38.3	37.0	35.9	35.4	35.0	33.8	32.7	32.5	33.4	36.6	37.9
Passenger kms	271.4	272.6	270.5	261.2	254.3	248.8	237.8	230.0	229.2	238.4	274.9	284.0
Loaded train kms	5.6	5.5	5.6	5.4	5.0	4.8	4.8	4.8	4.7	4.7	6.3	7.5

Source: Department for Transport (2003) Transport Statistics Great Britain - Table 5.22.

A1.6 Patronage grew rapidly as the network was opened between 1981 and 1984. At the time, bus services and fares were integrated with Metro, which contributed to an overall increase in public transport use in Tyne and Wear at a time when nationally there was a sharp decline[1]. Demand grew despite the effects of population decline, unemployment, declining economic activity and growth in car ownership in the region.

A1.7 De-regulation of bus services in 1986 meant that operators were no longer obliged to provide feeder services. In many cases, bus services started competing with Metro with the result that patronage declined from 1986. The impact was more marked on shorter journeys with passenger journeys declining more than passenger kilometres carried.

[1] Transport Research Laboratory (1985) – **The Metro Report: The Impact of the Tyne and Wear Metro and Public Transport Integration in Tyne and Wear**

A1.8 The recession of the early 1990s caused a further decline in demand for all public transport in Tyne and Wear[2], including Metro. It has also been affected throughout the 1990s by the performance of the local economy, rising car ownership and higher fares on Metro, the latter evidenced by the increased levels of revenue in the same period.

A1.9 In the first full year of operation of services to Sunderland, net Metro patronage increased by 3.3 million journeys, or 9.7%[3] and growth has continued subsequently. For example, ridership in February 2003 was 17.4% higher than the same month a year earlier. The use of Sunderland extension itself is likely to be somewhat higher than the increase in overall Metro demand as the extension's introduction took place at the same time as service reductions and fares increases elsewhere on the network.

[2] Davoudi, S. et al (1994) – **The Longer Term Effects of the Tyne and Wear Metro** – TRL Contractor Report 357

[3] Nexus (2003) – **Monitoring the Impacts of the Extension of Metro to Sunderland**

A2. DOCKLANDS LIGHT RAILWAY (DLR)

A2.1 The DLR is a fully segregated light railway, which was opened in 1987 at an initial cost of £77 million. It was originally part of a broader programme of infrastructure investment (including improvements to roads and utilities), by the Government and the London Docklands Development Corporation, to support modest regeneration of the redundant docks and surrounding areas to the east of the City of London.

A2.2 The profile of development, and the pace at which it was implemented in Docklands, changed significantly with the proposals for 10 million ft^2 of new office floorspace at Canary Wharf in the Isle of Dogs. Consequently, extensions have been built to improve links between Canary Wharf and the City of London, east London and south east London as follows:

- The extension to Bank Station in the City was opened in 1991 at a cost of £294m, providing a direct connection to the London Underground;
- The link to Beckton opened in 1994 at a cost of £280m; and
- The link to Lewisham, south of the Thames, opened in 1999 at a cost of £250m, and also provides connections to rail services in south-east London.

A2.3 The entire system was also systematically upgraded to cope with the higher passenger flows resulting from the increasing demand for travel to work and leisure in the Docklands area.

A2.4 The system presently runs over 27 km of route, much of which is elevated on viaducts. There are 34 stations that are all accessible to wheelchairs, generally by lifts. The system is operated as a franchise on behalf of Transport for London and employs in the region of 470 people. DLR operates a fleet of 94 passenger cars, all wheelchair accessible, and power supply comes from a 750V DC side rail.

A2.5 In 2002-3, the system delivered:

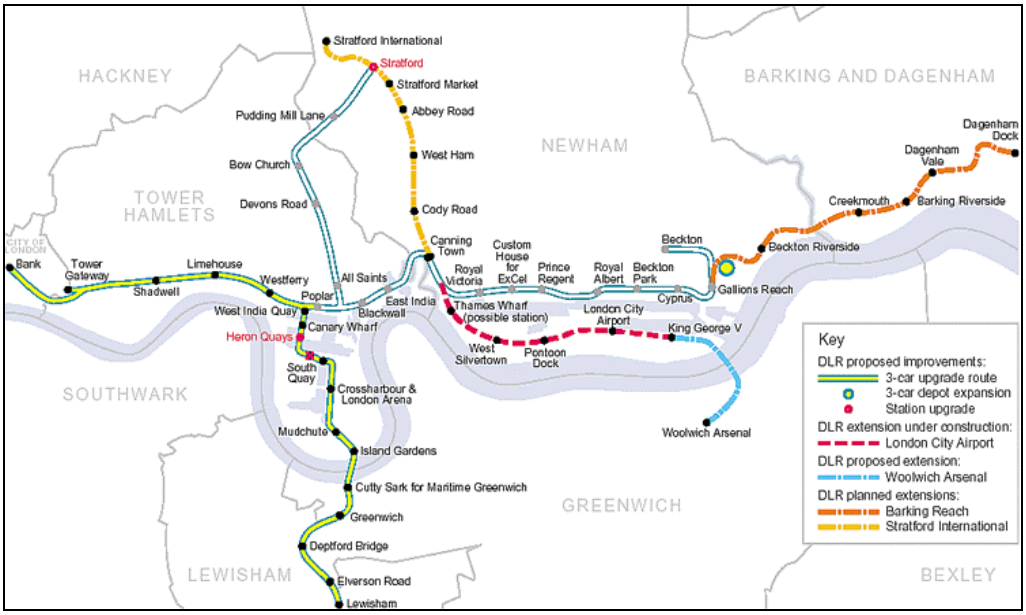
- 232.1 million passenger kilometers;
- 45.7 million passenger journeys; and
- £35.6 million in passenger receipts.

A2.6 The system is being expanded, with a new line to serve London City Airport presently being built. Approval has also recently been given for a £145m, 2.5km extension that will continue the Airport route from its eastern terminus at North Woolwich via bored tunnels under the Thames to a new station at Woolwich Arsenal, which will provide an interchange with rail and bus services.

A2.7 It is also proposed to increase the capacity of the route between Bank and Lewisham through the introduction of longer (3-car) trains. This will require longer station platforms, strengthening of viaducts and bridges, new rolling stock and depot expansion at Beckton. The longer trains could be running between Bank and Lewisham by 2009.

A2.8 Other future extensions to Stratford International Station from Canning Town and eastwards to Barking and Dagenham are presently under consideration shown in Figure A2.1.

FIGURE A2.1 DOCKLANDS LIGHT RAILWAY - ROUTES AND PROPOSED EXTENSIONS

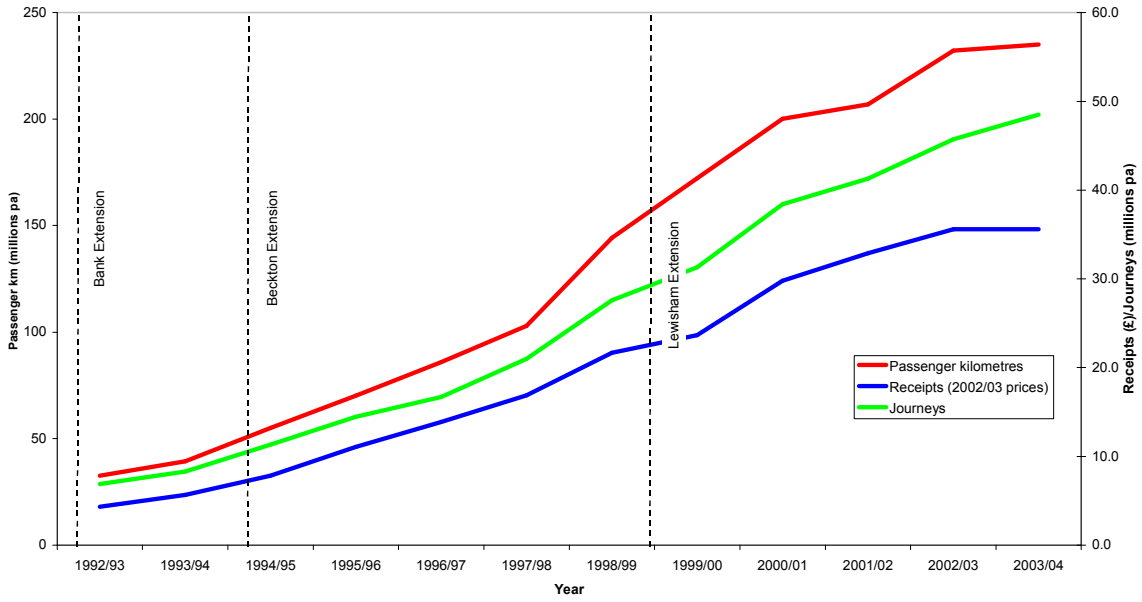


Source: Transport for London

A2.9 Transport for London also plans to build the Thames Gateway Bridge at Gallions Reach to connect Beckton to Thamesmead in Greenwich. The bridge is designed to accommodate light rail or other transit vehicles and could provide a further route for future extension of the DLR.

A2.10 The DLR now carries more than 46 million passengers per year. The growth in patronage and revenue during the 1990s is illustrated in Figure A2.2.

FIGURE A2.2 PATRONAGE AND REVENUE ON THE DOCKLANDS LIGHT RAILWAY 1992-2004



A2.11 Table A2.1 shows the patronage and revenue on the Docklands Light Railway between 1992 and 2004.

TABLE A2.1 PATRONAGE AND REVENUE ON THE DOCKLANDS LIGHT RAILWAY 1992-2004 (MILLIONS)

Year to March	93	94	95	96	97	98	99	00	01	02	03	04
Receipts (2002/03 prices)	£4.3	£5.6	£7.8	£11.1	£13.9	£16.9	£21.7	£23.6	£29.8	£32.9	£35.6	n/a
Journeys	6.9	8.3	11.3	14.5	16.7	21.0	27.6	31.3	38.4	41.3	45.7	48.5
Passenger kms	32.5	39.4	55.0	70.3	86.0	102.9	144.3	172.1	200.1	206.9	232.1	235.0
Loaded train kms	1.1	1.1	1.5	2.0	2.2	2.4	2.6	2.9	2.9	2.9	3.2	4.8

A2.12 Immediately after opening patronage growth was limited because of the decline in the London economy after "Black Monday"[4] and the consequent delay to many developments planned for the Docklands area. Hence, despite the opening of the Bank extension in 1991, patronage did not recover until the economy improved around 1993. In the years between 1994 and the opening of the Lewisham extension in 1999, patronage more than doubled and growth has continued at a similar rate since, despite the opening of the Jubilee Line extensions in 1999.

A2.13 The role of the DLR has been changed by the various extensions to the system and the impact of the Jubilee Line extension on patronage. The original purpose of the DLR was to provide direct access from the City to help spark regeneration. This was boosted by the extension to Bank which provided better access to labour markets

4 On Monday 19 October 1987, there was a worldwide stock market crash. Between 19 and 23 October, the London Stock Exchange Financial Times 100 Index fell in value by 25%

beyond the City via the Underground as well as better links between the City and financial businesses in the Isle of Dogs. The Beckton extension has helped regeneration further to the east in and around the Royal Docks. The Lewisham extension provides much better access to jobs for those living south of the Thames.

A2.14 DLR services are becoming more crowded in peak periods while demand in off-peak periods is also growing rapidly[5]. Peak period demand grew by 50% between 1998 and 2002 while off-peak demand increased by almost 75%. Table A2.2 shows weekday station counts over this period, showing average throughput (both people boarding and alighting).

TABLE A2.2 DLR AVERAGE WEEKDAY STATION PASSENGER COUNTS 1999-2003

Station	1999-00	2000-01	2001-02	2002-03	1999-03 Growth
Bank	45,458	41,910	43,989	45,336	-
Canary Wharf/Heron Quays*	43,590	47,798	50,424	63,845	+46%
Lewisham	10,305	14,044	16,447	19,671	+91%
Stratford	11,598	12,759	14,126	15,230	+31%
Crossharbour	14,830	12,856	13,425	12,971	-13%
South Quay	9,963	12,798	13,151	12,887	+29%
Canning Town	4,500	9,811	11,296	12,850	+185%
Limehouse	9,117	9,519	10,662	12,837	+40%
Tower Gateway	9,806	8,778	9,373	10,334	+5%
Shadwell	8,725	7,861	8,294	9,330	+7%
Westferry	9,223	7,596	8,187	8,904	-3%
Cutty Sark	4,357	7,081	8,077	9,675	+122%
Island Gardens	4,104	5,890	5,781	5,683	+38%
Greenwich	4,206	5,139	5,310	5,283	+26%

*Heron Quays Station was partially closed in 2001-02.

A2.15 Some of the highest levels of increase are at stations on the Lewisham extension, which have experienced a build-up of use since opening in 1999. Other stations with significant growth have been Canary Wharf, Canning Town and Limehouse, driven either by continuing development at Canary Wharf and elsewhere on the Isle of Dogs or the introduction of the Jubilee Line.

5 Arup (2003) – **Docklands Light Rail Market Plan Report 2002/3** – Final Report, Transport for London, pp.7

A3. MANCHESTER METROLINK

A3.1 Manchester Metrolink opened in 1992 at an initial cost of £140m. The original system comprised the conversion of the Bury and Altrincham suburban rail lines to light rail operation, linked by an on-street section through central Manchester. Service levels were increased, additional stops were provided and the major national rail termini at Piccadilly and Victoria were connected. An extension of the network to Salford Quays and Eccles opened in March 2000 at a cost of £160m.

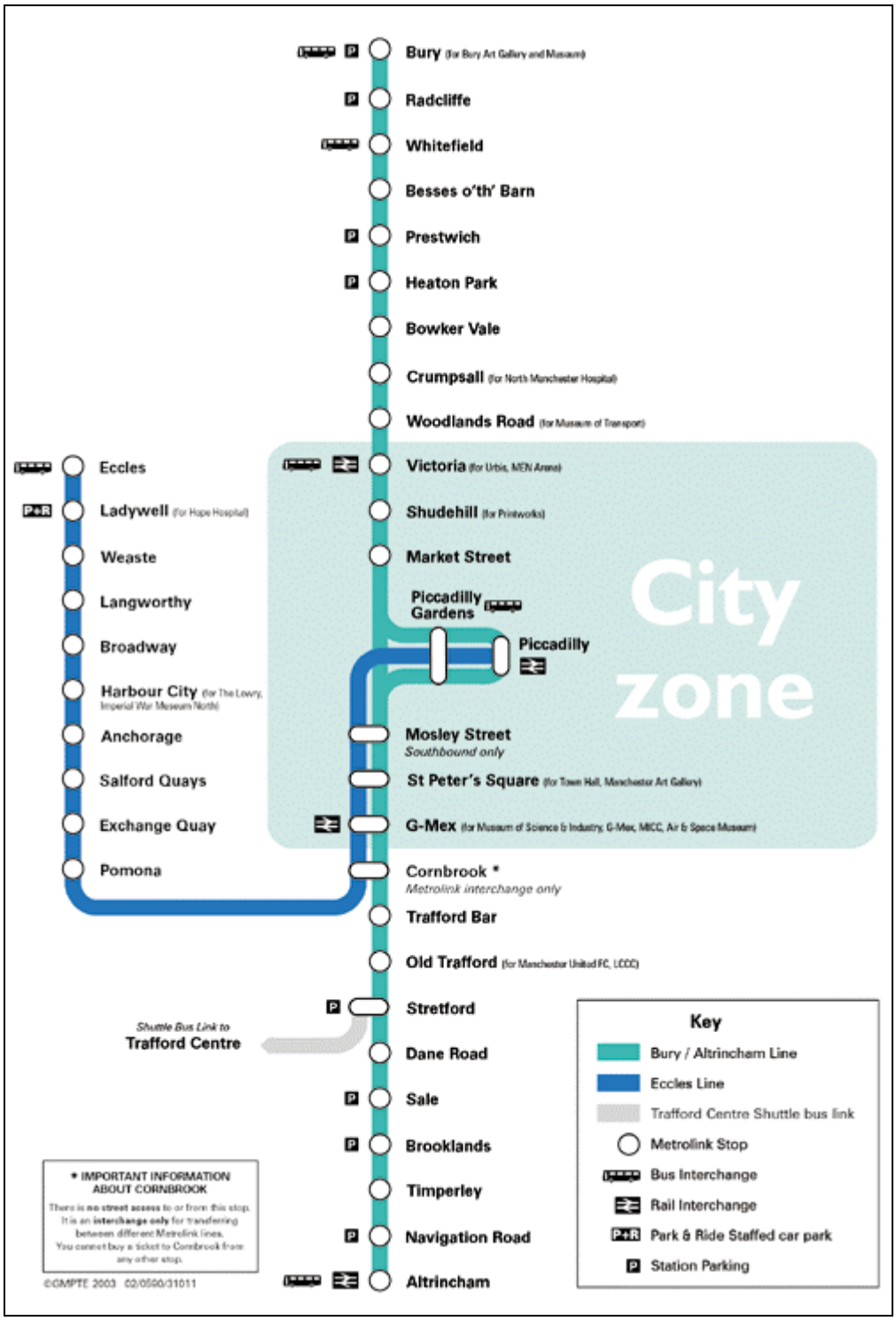
A3.2 The route is 39 km long and there are 37 stations. The system is operated under a Design, Build, Operate and Maintain Concession (DBOM) by Altram (on behalf of Greater Manchester PTE), who were appointed in 1998 to build Phase 2 and operate the entire system. The operator employs some 330 staff and runs a fleet of 32 trams. These have a high floor design, but are wheelchair accessible through level boarding as station platforms (raised in the city centre). Power supply is provided by a 750V DC overhead line.

A3.3 In 2002-3, the system delivered:

- 166.6 million passenger kilometers;
- 18.8 million passenger journeys; and
- £21 million in passenger receipts.

1.1 Figure A3.1 indicates the alignment of the present system.

FIGURE A3.1 MANCHESTER METROLINK



Source: Greater Manchester PTE

A3.4 Future expansion of the system is planned to Rochdale via Oldham, Ashton-under-Lyne, Manchester Airport, Trafford Park, East Didsbury and Stockport.

A3.5 Figure A3.2 and Table A3.1 show the patronage and revenue on Manchester Metrolink over the period 1992- 2003.

FIGURE A3.2 PATRONAGE AND REVENUE ON MANCHESTER METROLINK 1992-2004

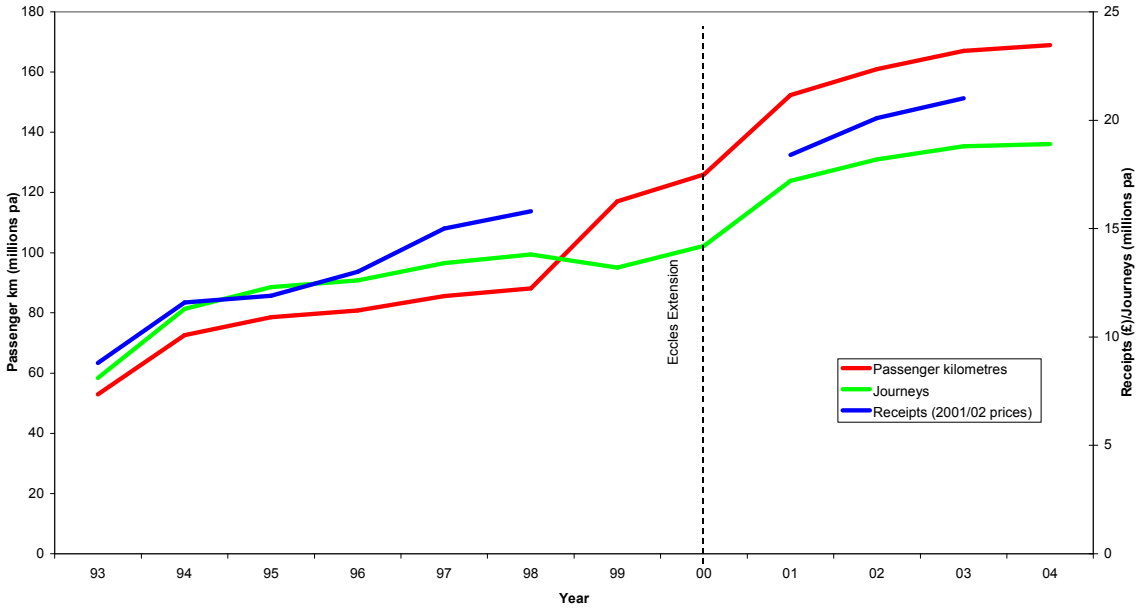


TABLE A3.1 PATRONAGE AND REVENUE ON MANCHESTER METROLINK 1992-2004 (MILLIONS)

Year to March	93	94	95	96	97	98	99	00	01	02	03	04
Receipts (02 prices)	8.8	11.6	11.9	13.0	15.0	15.8	..	..	18.4	20.1	21.0	n/a
Journeys	8.1	11.3	12.3	12.6	13.4	13.8	13.2	14.2	17.2	18.2	18.8	18.9
Passenger kilometres	53.0	72.6	78.6	80.8	85.6	88.2	117.0	126.0	152.3	161	167	169
Loaded train kilometres	2.0	1.9	2.1	2.1	2.3	3.2	3.4	3.6	4.4	4.5	4.6	n/a

A3.6 Patronage built up rapidly from the 7.5m passenger pa carried by the previous rail services. After two years of operation, Metrolink carried 65% more passengers than the rail services did in 1987[6] and by 2001 this had increased to 100% more.

A3.7 The system is now carrying around 19 million passengers per annum in total with nearly 3 million making journeys to or from the Eccles extension.

A3.8 Services to and from the city centre from both the Bury and Altringham corridors are now heavily crowded in peak periods, as shown in Table A3.2. The peak hour average load is over 95% of normal capacity, while individual trams carry in excess of 100%.

6 Oscar Faber (1996) – **Metrolink Monitoring Study: Vol. 1 – Impacts on Travel Patterns and Behaviour** – Department of Transport and GMPTE, Paragraph S.04

TABLE A3.2 PASSENGER ARRIVALS IN CENTRAL MANCHESTER BY TRAM, JANUARY 2003

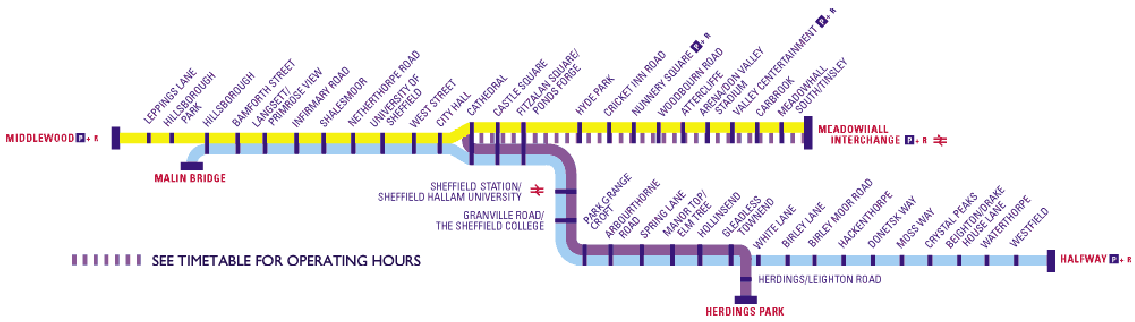
Route	Arrivals Between		
	0700-0759	0800-0859	0900-0959
From Bury			
Total inbound boardings	438	1,892	1,168
Load Factor	21.9%	94.6%	58.4%
From Altrincham			
Total inbound boardings	553	1,908	1,362
Load Factor	27.7%	95.4%	68.1%

Source: GMPTE - Count Survey 29th January 2003

A4. SHEFFIELD SUPERTRAM

A4.1 Sheffield Supertram opened in 1994/95 at a cost of £240m. The system has three lines, connected by an on-street section in the centre of Sheffield. The rest of the routes are a mixture of on-street and segregated sections. Several Park & Ride sites are operated. This is illustrated in Figure A4.1.

FIGURE A4.1 SHEFFIELD SUPERTRAM



Source: Stagecoach

A4.2 The system has an overall length of 29 km with 48 tram stops. The system has been operated since 1997 on behalf of South Yorkshire PTE by Stagecoach Holdings, which employs some 200 staff. They operate a fleet of 25 passenger cars of low-floor design which are all wheelchair accessible. Power is supplied by a 750V DC overhead line.

A4.3 In 2002-3, the system delivered:

- 40 million passenger kilometers;
- 11.5 million passenger journeys; and
- £10.2 million in passenger receipts.

A4.4 Future expansion plans are being considered, presently. Studies and discussions are on-going regarding the possibility of extending the system from the University to the Royal Hallamshire Hospital and an extension to Sheffield City Airport.

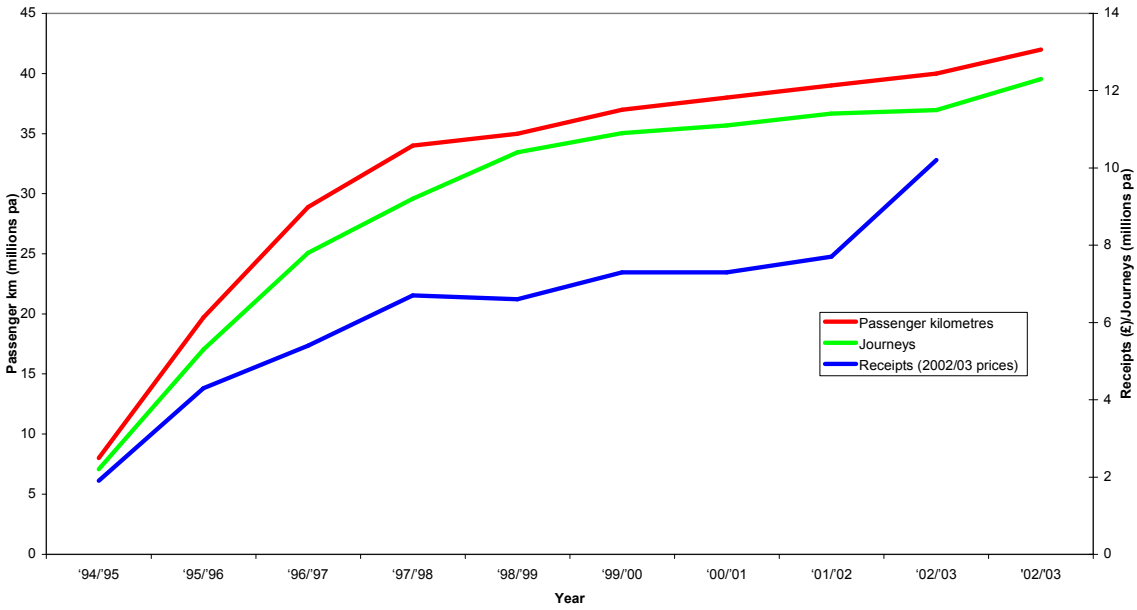
A4.5 Table A4.1 and Figure A4.2 set out the patronage and revenue on the system since it was opened in 1994.

TABLE A4.1 PATRONAGE AND REVENUE ON SHEFFIELD SUPERTRAM 1993-2004 (MILLIONS)

Year to March	95	96	97	98	99	00	01	02	03	04
Receipts ('03 prices)	1.9	4.3	5.4	6.7	6.6	7.3	7.3	7.7	10.2	n/a
Journeys	2.2	5.3	7.8	9.2	10.4	10.9	11.1	11.4	11.5	12.3
Passenger kms	8.0	19.7	28.9	34.0	35.0	37.0	38.0	39.0	40.0	42
Loaded tram kms	1.1	2.5	2.8	2.7	2.4	2.4	2.4	2.4	2.5	

Source: Department for Transport (2003) Travel Statistics Great Britain

FIGURE A4.2 PATRONAGE AND REVENUE ON SHEFFIELD SUPERTRAM 1993-2004 (MILLIONS OF JOURNEYS)



A4.6 On opening, the use of the system was significantly lower than was originally forecast. Annual patronage was estimated at the equivalent of about 6.6 million journeys per year immediately after full opening, increasing to slightly under 8 million per year after fare revisions (mainly reductions) were made. Monitoring carried out after the opening of Supertram indicated annual average patronage between 6 and 8 million passengers during the period November 1995 and August 1996[7]. Unusually, peak usage of Supertram was recorded during the middle of the day with lower flows during the conventional "rush hour" periods, particularly in the evening.

A4.7 The patronage in the first few years was around 30% of that forecast when the scheme was being planned[8]. In part, the higher forecast patronage was due to the assumption made that the bus network would remain regulated. The system was intended to offer significant advantages over bus in terms of travel time, frequency and reliability, but, the combination of on-street running (with little or no priority to trams) and the competitive response of the bus operators meant that these advantages were not realized. The tram service provided initially, only managed about two-thirds of the frequency anticipated and journey times between Middlewood and Halfway averaged 60 minutes rather than the 47 minutes predicted[9]. Other factors identified as contributing to the shortfall in patronage included land-use changes (both an unexpected decline in the viability of Sheffield city centre and the non-occurrence of

7 Atkins and TSU (2000) – **Supertram Monitoring Study: Final Report** – SYPTE and DETR, para. 3.32

8 Haywood, P. (1999) – **South Yorkshire Supertram – Some Myths Exploded** – Journal of the Transport Economists Group, Vol.26, No.3, pp.1-12

9 Haywood P. (1999) – **Ibid**

expected developments elsewhere)[10]. An increase of road capacity from new road construction parallel and close to the alignment clearly was also not helpful in encouraging modal shift to the tram.

A4.8 In a post-script to the Monitoring Study[11], SYPTE noted that, subsequently, patronage grew at a rate of about 9%-10% per annum. Since then, patronage has continued to grow, at around 3% per annum. As Table A4.1 indicates, by 2002-04, patronage on the system had more than doubled since 1996 and has increased by 20% since Stagecoach took over the operation of the system at the end of 1997.

[10] David Simmonds Consultancy (2000) – **Case Study Evidence on the Economic Impact of Transport Infrastructure** – Annex F Case Study: Sheffield Supertram, Department of Environment, Transport and the Regions, pp. 5-6

[11] Atkins and TSU (2000) – **Ibid** – Post-script by SYPTE

A5. MIDLAND METRO

A5.1 The Midland Metro opened in 1999 at a cost of £145m. The system is a mixture of on-street and segregated running on new formations and a former rail alignment. It runs for 20 km between Birmingham City Centre and Wolverhampton and has 23 stations, all wheelchair accessible with step-free access to low platforms and streets.

A5.2 The system was built and is operated for Centro (West Midlands PTE) by the Altram consortium, employing over 150 staff and running a fleet of 16 low-floor vehicles, all wheelchair accessible. Power supply is provided by a 750V DC overhead line.

A5.3 In 2002-3, the system delivered:

- 50 million passenger kilometres;
- 4.9 million passenger journeys; and
- £5 million in passenger receipts.

A5.4 There are proposals for extensions to the system further into central Birmingham and from Wednesbury to Brierley Hill.

A5.5 Midland Metro carried about 5 million passengers in 2002-03. Table A5.1 sets out patronage and revenue since the opening of the system in May 1999.

TABLE A5.1 PATRONAGE AND REVENUE ON MIDLAND METRO 1999-2004 (MILLIONS)

Year to March	2000	2001	2002	2003	2004
Receipts (2002/03 prices)	..	£3.2	£3.9	£5.0	n/a
Journeys	4.8	5.4	4.8	4.9	5.1
Passenger kilometres	49.9	55.8	50.1	50.0	54.0
Loaded train kilometres	..	1.9	1.6	1.6	n/a

Source: Department for Transport (2003) Travel Statistics Great Britain - Table 5.23

A5.6 From opening, the operator was not always able to maintain contracted levels of performance. This led both to lower than expected patronage and adverse media coverage. Measures to address these issues were put in place and, since September 2001, the system has been operating more reliably. Patronage is growing and although the number of journeys made is still lower than forecast, the passenger kilometres carried is higher than was predicted[12]. This is due to the use of the line by more long-distance, but fewer short distance, journeys. Centro also reports that crowding is evident on Metro services at peak times and that passengers travelling towards Birmingham city centre often have to let full trams pass before they are able to board.

[12] West Midlands PTA (2003) – **Best Value Service Review: Metro Line 1 Operation – Gap Report** – August 2003, pp. 5

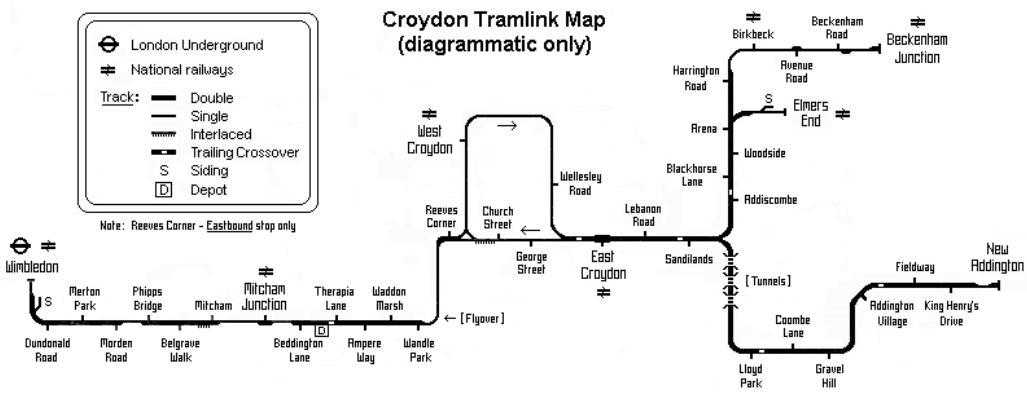
A6. CROYDON TRAMLINK

A6.1 Croydon Tramlink opened in May 2000 at a cost of £200m. Tramlink operates on three lines in and around Croydon in south London as follows:

- Line 1 runs on the former Wimbledon-West Croydon rail line. Connection to London Underground and national rail services is made at Wimbledon Station;
- Line 2 links central Croydon with suburban rail services in Beckenham. Part of the route between Birkbeck and Beckenham Junction uses a converted rail line running adjacent to a single line that remains in heavy rail operation;
- Line 3 serves New Addington to the south east of Croydon. Feeder buses provide further links in the area;
- An on-street loop serves the central area in Croydon and connects the three lines.

A6.2 This is illustrated in Figure A6.1.

FIGURE A6.1 CROYDON TRAMLINK



Source: Transport for London

A6.3 The network has a total length of 28 km with 38 stations, all of which are wheelchair accessible with step-free access to low platforms.

A6.4 The system was built and is operated on behalf of Transport for London by Tramtrack Croydon/ FirstGroup, who have a staff of about 190 people operating a fleet of 24 trams, all wheelchair accessible. Power supply is provided by a 750V DC overhead line.

A6.5 In 2002-3, the system delivered:

- 100 million passenger kilometres;
- 18.7 million passenger journeys; and
- £15 million in passenger receipts.

A6.6 Assessment studies are presently under way to examine possible extensions. These include existing rail corridors such as between Wimbledon and Sutton; and between

Crystal Palace and Beckenham Junction as well as on-street routes between Tooting and Sutton; and Purley and Streatham.

A6.7 Surveys by TfL and the Tramlink operators identified a total of 17.3 million people used Tramlink between October 2000 and September 2001. The growth in patronage and revenue since the system opened in 2000 is as shown in Table A6.1. Patronage is continuing to increase, with a 5% increase in journeys and passenger kilometres recorded in the last full year.

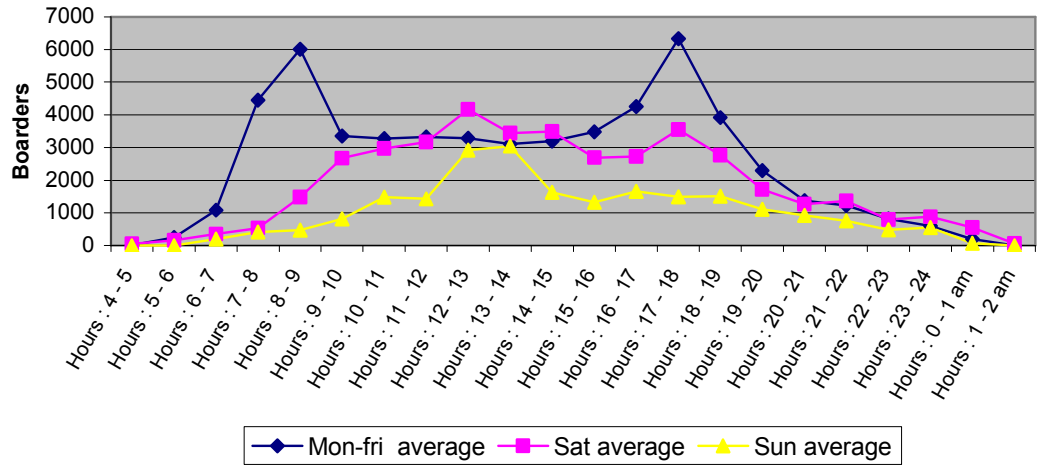
TABLE A6.1 PATRONAGE AND REVENUE ON CROYDON TRAMLINK 2000-2004 (MILLIONS)

Year to March	2001	2002	2003	2004
Receipts (2002/03 prices) £	12.6	13.2	15.0	n/a
Journeys	15.0	18.2	18.7	19.8
Passenger kilometres	96.0	99.0	100.0	105.0
Loaded train kilometres	2.1	2.4	2.5	n/a

Source: Department for Transport (2003) Travel Statistics Great Britain - Table 5.25

A6.8 Figure A6.2 shows boarding activity by time of day. Usage peaks, unsurprisingly, between 08:00-09:00 and 17:00-18:00 on weekdays and reflects the system's role in feeding rail and underground networks for passengers to central London. In contrast, on Saturday, the number of people boarding the system is higher at mid-day than on an average weekday, reflecting more use for shopping/leisure trips.

FIGURE A6.2 AVERAGE BOARDING ACTIVITY ON CROYDON TRAMLINK BY TIME OF DAY



Source: TfL (2002) - **Croydon Tramlink Impact Study: Transport Supply & Demand** – Working Paper 5 Final Report **March 2002. pp. 18**

A6.9 Tramlink replaced a rail service between Wimbledon to West Croydon which ran only every 45 minutes throughout the day, stopping at Wimbledon, Merton Park, Morden Road, Mitcham, Mitcham Junction, Beddington, Waddon Marsh and West Croydon. Tramlink now provides a more frequent service of up to 6 trams per hour and additional stops along the line at Dundonald Road, Phipps Bridge, Belgrave Walk, Therapia Lane, Ampere Way, Wandle Park and Reeves Corner.

A6.10 Table A6.2 provides a comparison of boardings and alightings for national rail and Tramlink services.

TABLE A6.2 COMPARISON OF TRAMLINK (2001) AND NATIONAL RAIL (1994) PATRONAGE FOR WEEKDAY 3HR PEAK PERIOD (07.00-10.00)

	Tramlink stations		National Rail Stations	
	Total board	**Total alight**	**Total board**	**Total alight**
Tramlink/ national rail total	2193	3632	474	572
Corridor total	3580	4483	474	572

Source: Transport for London (2002) – Croydon Tramlink Impact Study: Transport Supply and Demand – Working Paper No. 5 Final Report – Table H, p.p. 26.

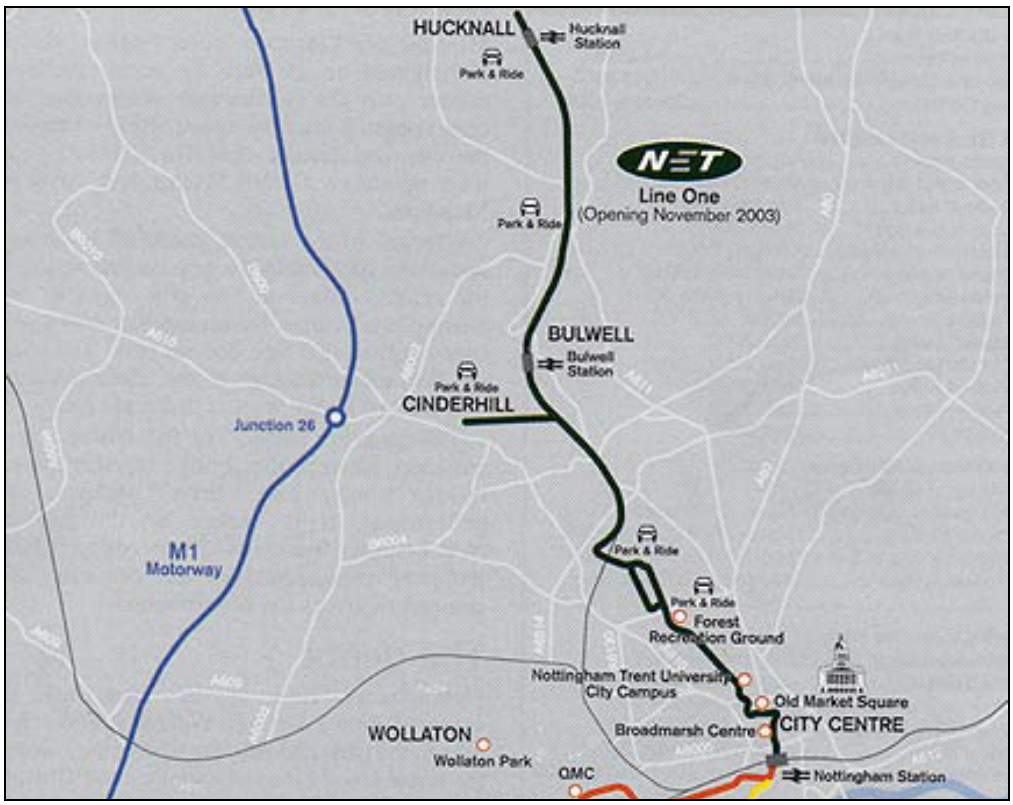
A6.11 Within the Wimbledon to West Croydon corridor there was an approximately eight-fold increase in the number of passengers between 1994 and 2001. The existing stations converted to Tramlink operation saw a five-to-six fold increase in the number of people using them. This growth exceeds general growth in rail travel in the rest of London in the same time period and is explained by:

- An enhanced operating frequency of 6 trains during the peak compared to one train every 45 minutes;
- The introduction of additional stops between Croydon and Wimbledon;
- An increased range of possible origins and destinations (all stops from West Croydon to Elmers End) which are accessible from Tramlink Route 1 without the need to interchange;
- An increased range of possible origins and destinations by interchanging with Tramlink Routes 2&3 and national rail stations and major bus focal points.

A7. NOTTINGHAM EXPRESS TRANSIT (NET)

A7.1 NET is the newest light rail scheme in the UK, opening in March 2004. NET Line 1 runs from Nottingham Station to Hucknall, with a spur to a park and ride site at Cinderhill. The system has several park and ride sites with 3140 spaces, feeder bus links, rail interchange and multi-mode ticketing. The system is 14 km long and has 23 stations, all with wheelchair and step-free access. This is illustrated in Figure A7.1.

FIGURE A7.1 NOTTINGHAM EXPRESS TRANSIT



Source: Nottingham Express Transit

A7.2 Nottingham City Council and Nottinghamshire County Council have contracted Arrow Light Rail Ltd to design and build NET and operate it for a 30-year period. The system is operated by Nottingham Tram Company, a joint venture between Transdev and Nottingham City Transport (the local bus company), who are both shareholders in Arrow. They operate a fleet of 15 trams, with power supplied by 750v DC overhead cables. Already, extension of the system through NET Phase Two is under consideration. Work is on-going on the development of two new lines to Clifton via Wilford and Chilwell via Beeston and Queen's Medical Centre.

A7.3 NET commenced passenger service on the 9th March 2004. The service has opened successfully and early performance has been well received. The initial opening timetable provided 10-minute peak services (15 minute inter-peak, 20 minute off-peak) between Nottingham and Hucknall and both Phoenix Park.

A7.4 Performance of the system is monitored against 24 individual performance measures. For each of the performance measures, the operator is required to meet a target performance. System reliability and punctuality performance figures for March were 99% and 98% respectively, which compare to targets of 96% and 95%. After applying weighting to each measure, and allowing for the reduced performance level permitted during the first twelve months of operation, the overall percentage achieved was 99%[13].

A7.5 In the first month of operation, the system carried some 450,000 passengers[14]. This grew steadily to around 23,000 journeys per day (Monday - Saturday) by June 2004 and around 25,000 by November 2004. Almost 5,000 trips per day have been made to or from the five park and ride sites. This level of patronage is broadly in line and possibly even ahead of first year forecasts.

[13] Information kindly provided by Nottingham City Council

[14] Department for Transport (2004) – **Light Rail Statistics: Key Facts**

APPENDIX B

Overseas Experience

B1. SYSTEMS IN WESTERN EUROPE

Location of New Light Rail Systems in Europe

B1.1 Table B1.1 sets out the new or extended light rail systems that have been built in Western Europe since 1980.

TABLE B1.1 LIGHT RAIL SYSTEMS BUILT IN WESTERN EUROPE (OUTSIDE UK) SINCE 1980

Year	Scheme	Type
2004	Dublin (Eire) – LUAS	Light rail
2002-3	Bilbao (Spain)	Light rail
2001	Lyon (France)	Light rail
2001	Messina (Italy)	Light rail
2001	Barcelona (Spain)	Light rail
2000	Montpellier (France)	Light rail
2000	Orleans (France)	Light rail
1997	Saarbrücken (Germany) - Stadtbahn Saar	Dual-Voltage system with On-street and joint operation over heavy rail Lines.
1996	Oberhausen (Germany)	To be extended by a further 6km.
1994	Strasbourg (France) – CTS	Car traffic reportedly down 17%.
1994	Rouen (France)	Metrobus - Public transport use reportedly up By 40%.
1994	Valencia (Spain) – FGY	Route 4 converted to tramway with low-floor trams.
1994	Goteburg (Sweden)	Light rail
1992	Paris (France) – RATP	T1 - St. Denis To Bobigny - Patronage reported doubled in 2 years.
1991	Stockholm (Sweden)	Heritage tramway converted to low-floor trams
1991	Lausanne (Switzerland)	Tramway replacing bus service
1990	Genova (Italy)	Light Metro, A "Turnkey" Contract.
1988	Valencia (Spain) – FGY	Electric Suburban Line Converted To Light Metro.
1987	Grenoble (France) – TAG	Patronage reportedly 26% up on former bus service.
1985	Nantes (France) – Semitan	After One Year Carrying 19% Of The Undertaking's Load.
1983	Utrecht (Netherlands) - Westnederland	An Interurban Tramway To Nieuwegen.

Source: Light Rail Transit Association and Hass-Klau et al (2003)

Use of Schemes in Western Europe

French Tramways

B1.2 The general characteristics of French systems (e.g. routes through high density environments, with more stops and higher frequencies) typically lead to higher ridership than UK systems. Additionally these schemes have generally been constructed in corridors that already have very high bus use, to bring the quality public transport service to the "next level". Table B1.2 on the following page shows the patronage from a number of French systems. For example, measured against route length the lowest ridership in France (Nantes Line 1 at 3,600 passengers per route kilometre) is 80% higher than the highest ridership in the UK, Croydon at 2,000 passengers per day per route kilometre.

TABLE B1.2 PATRONAGE ON FRENCH TRAMWAYS

		Annual (million)	Weekday Daily (000s)	Per Route km (000s)
Grenoble	Line A	..	69.7	5.40
	Line B	..	45.0	5.70
IDF (Paris)	Line T1	20.6	83.0	9.22
	Line T2	15.6	63.0	5.53
Lyon	Line T1	14.3	48.8	5.14
	Line T2	14.5	61.5	6.15
Montpellier	Line 1	21.7	65.0	4.28
Nantes	Line 1	..	65.0	3.63
	Line 2	..	95.0	6.79
	Line 3	..	23.0	5.00
Rouen	Line 1	13.2	60.0	3.85
Strasbourg	Line A	..	76.0	6.08
	Line B	..	76.0	6.03

Source: SEMALY and Faber Maunsell (2003) Comparative Performance Data from French Tramways Systems - Table 3-1

B1.3 These schemes all demonstrated substantial increases in patronage over previous bus use. Figures from a number of systems (Nantes, Grenoble, Rouen, Montpellier and Orleans) show an average 26% increase in annual passenger trips (i.e. bus and tramway) after the opening of the each city's first tramway line. This ranged from 18% to 36% [15].

B1.4 Before the new light rail line went into operation in Strasbourg, in 1991, 17,000 bus passengers had used the corridor daily; four years later this had increased to 65,000 passengers. The average LRT patronage was 55,000 passengers per day in 1997 and

15 SEMALY and Faber Maunsell (2003) – **Ibid** – Table 4.1

100,000 in 2002 (for Line A). In fact the forecasts for the system were 75,000 and during large parts of the day trams are overcrowded. As a result of this tram vehicles were extended to 43 metres from the original specification of 33 metres. [16]

German LRT

B1.5 Karlsruhe has one of Germany's most successful public transport operations, and the number of passengers on the network as a whole in the city more than doubled in the 15 years between 1982 and 1997. After modernisation of one of the tramlines, there was a reported increase of passengers from 2,000 in 1992 to 14,000 in 1997. However, this growth in public transport usage has not translated into modal shift, and only 16% of trips overall in 1998 were made by public transport. Similar levels of growth are reported in Freiberg[17].

Spanish LRT

B1.6 Line 4 of the Valencia Metro system opened in 1994. It was a pioneering scheme in Spain by reintroducing trams to urban areas. It is 9.7km long with 21 stations and was extended further in 1999 with 5 new stops. Patronage growth has been impressive from 3 million passengers in 1995 (first full year of operation) to over 6 million in 2003.

B1.7 The recently opened Bilbao light rail carried almost 1.2 million passengers in its first year of full operation (2003) and is exceeding forecasts.[18]

16 Hass-Klau, C. et al (2003) – **Ibid** – pp 83

17 Hass-Klau, C. et al (2003) – **Ibid** – pp 83

18 www.euskotren.es/euskotran

B2. SYSTEMS IN USA AND CANADA

Location of Schemes in North America

B2.1 Table B2.3 sets out the light rail systems implemented in the USA and Canada since 1980.

TABLE B2.3 LIGHT RAIL SYSTEMS IMPLEMENTED IN THE USA AND CANADA SINCE 1980

Year	Scheme	Type
1998	Salt Lake City	Shares Tracks With Freight Trains.
1996	Dallas - (Dallas Area Rapid Transit – DART)	Includes A 2km Transit Mall Through City Centre.
1994	Denver (Regional Transportation District – Rtd)	Service reportedly so popular that urgent order for more rolling stock placed.
1993	St. Louis (Metrolink) - (Bi State Development Agency)	On former heavy rail infrastructure, particularly a bridge across the Mississippi.
1993	Memphis	Modernisation of historic tram
1992	Baltimore - (Maryland Mass Transit Administration)	Shares Tracks With Freight Trains.
1990	Los Angeles - (County Metropolitan Transit Authority)	Blue Line (1990) Driver-operated Green Line (1995) Light Metro - Initially Driver Operated.
1987	Sacramento - (Regional Transit District)	Built on land intended for highway scheme
1987	Detroit	Light Metro and automated.
1987	San José (Santa Clara Valley Transportation Authority)	Partially-funded from a 5 Cent Federal Gasoline Tax.
1986	Portland - (Metropolitan Area Express – Max)	The First Place In USA to Operate Low-Floor Trams.
1986	Jacksonville	Light Metro And Automated
1986	Miami	Light Metro And Automated.
1985	Vancouver - Canada (BC Transit)	Light Metro And Automated.
1985	Toronto – Canada (Toronto Transit Commission)	Light Metro To Scarborough And Automated.
1984	Buffalo (Niagara Frontier Transportation Authority – NFTA)	Originally conceived as a Heavy Metro, but built as light rail on-street through main shopping area.
1981	San Diego (San Diego Trolley)	Start up fleet of 14 vehicles has become 123.
1981	Calgary – Canada (Calgary Transit)	Conceived as underground system, but because of high cost, scheme runs on street in 7th Avenue In The CBD.

Source: Light Rail Transit Association and Hass-Klau et al (2003)

Patronage on Schemes in the USA

B2.2 Even in a country like the US where the car is the dominant mode of transport, there are a number of LRT schemes showing substantial increases in patronage as shown in B2.4[19]. Some of these figures reflect the effect of network extensions and new lines being opened, however it shows a consistent pattern of growth, even at a national level.

TABLE B2.4 LIGHT RAIL PATRONAGE IN THE USA

	Percent Change						Pax. (000s)
	1998	1999	2000	2001	2002	2003	2003
Los Angeles, CA	3.1%	10.3%	2.3%	16.4%	7.1%	0.0%	30,732
Portland, OR	33.1%	51.6%	8.0%	8.7%	7.9%	3.0%	26,428
Dallas, TX	19.0%	0.5%	1.1%	3.4%	23.6%	16.1%	16,952
Denver, CO	8.6%	-1.3%	40.6%	35.9%	14.9%	2.0%	10,636
All US LRT	6.3%	0.7%	5.3%	3.5%	1.9%	0.4%	321,239

B2.3 If these trends can be compared against other public transport modes it shows growth of 28% in light rail between 1995 and 2003 against 10% on bus.

B2.4 In Boston, light rail forms part of a comprehensive mass transit system (the 4th largest in the US) that serves a population of over 2.5 million people. This includes 3 rapid transit lines and 5 streetcar routes as well as trolley buses, conventional buses and commuter rail routes. Table B2.5 indicates daily patronage in 2002.

TABLE B2.5 AVERAGE DAILY PATRONAGE ON THE BOSTON LIGHT RAIL SYSTEM 2002

Line	Passengers
Green Line	225,200
Red Line	214,200
Orange Line	160,900
Blue Line	55,900
Total	**656,200**

[19] www.apta.com/research/stats/ridership

B2.5 Houston's brand-new MetroRail line is reportedly already fulfilling expectations in terms of both mobility and urban development. Heavy passenger flows, apparently mostly attracted out of their cars, have been recorded on MetroRail trains in the Main St.-Fannin corridor[20]. In mid-February 2004, Metro reported that more than a half-million rider-trips had been carried on MetroRail during the LRT system's inaugural month, exceeding the monthly totals recorded by the mature light rail systems in Cleveland, Ohio, and San Jose, California[21]. Metro released its first monthly statistics on train ridership, which indicated 558,257 boardings on the Main Street line in January 2004, averaging to about 18,000 boardings per day (well on the way to fulfilling Metro's projection of 31,000 to 33,000 daily boardings by the end of 2004).

[20] www.lightrailnow.org/news/n_hou007.htm

[21] Houston Chronicle, 17 Feb. 2004

B3. SYSTEMS WORLD-WIDE

B3.1 Table B3.1 identifies new or extended light rail systems implemented in the rest of the world since 1980.

TABLE B2.1 LIGHT RAIL SYSTEMS IMPLEMENTED SINCE 1980 OUTSIDE WESTERN EUROPE AND NORTH AMERICA

Year	Scheme	Type
2003	Istanbul (Turkey)	Light Rail
1998	Valencia (Venezuela)	Light Rail, two operations
1997	Sydney (Australia)	Tramway
1997	Izmir (Turkey)	Light Metro
1997	Kyoto (Japan)	Light Rail
1996	Kuala Lumpur (Malaysia)	Light Metro
1995	Buenos Aires (Argentina)	Light Metro
1995	Ankara (Turkey)	Light Metro
1994	Mexico City (Mexico)	Light Metro
1992	Konya (Turkey)	Tramway
1991	Pyongyang (North Korea)	Tramway
1991	Monterrey (Mexico)	Light Metro
1991	Botosani (Romania)	Tramway
1991	Cheryomushki (Russia)	Tramway
1989	Molochne (Ukraine)	Tramway
1989	Guadalajara (Mexico)	Light Metro
1989	Istanbul (Turkey)	Light Metro
1988	Resita (Romania)	Tramway
1988	Hong Kong (China)	Tramway
1988	Ust Llimsk (Russia)	Light Rail
1988	Masyr (Belarus)	Tramway
1987	Brasov (Romania)	Tramway
1987	Buenos Aires (Argentina)	Tramway
1987	Cluj Napoca (Romania)	Tramway
1987	Ploeisti (Romania)	Tramway
1986	Kriviy Rih (Ukraine)	Light Rail
1985	Tunis (Tunisia)	Tramway
1984	Manila (Philippines)	Light Rail
1984	Constanta (Romania)	Tramway
1981	Stary Oskol (Russia)	Tramway
1981	Helwan (Egypt)	Tramway
1981	Ust Llimsk (Russia)	Tramway

Source: Light Rail Transit Association and Hass-Klau et al (2003)

B4. MODE-SHIFT FROM CAR TO LIGHT RAIL

Experience from Overseas

Schemes in Western Europe

B4.1 Evidence from 14 European cities showed an average of 11% of new passengers on LRT formerly came by car [22]. However the effect of trams on modal share is difficult to isolate as schemes in France involve major infrastructure changes i.e. pedestrianisation, modified road network and streetscape improvements. However even in France there is a wide range of modal transfer from only 7% in Paris (for the Issy-Val de Seine-La Defense line in 1998) to 37% in Nantes on Line 1.

B4.2 Interestingly for Nantes, the opening of Line 1 (in 1985) did not lead to increased mode share to public transport due to very high growth in car trips between 1980 and 1990, despite growth in public transport usage. [23] However between 1990 and 1997 (Line 2 opened in 1994) there was an increase in public transport trips by 15% whilst car trips slowed to 6% leading to mode shift transfer. Additionally satisfaction surveys in 1993 showed 16% of tramway users did not use the bus network before the building of the tram and 39% of them had a car available.

Karlsruhe

B4.3 The Karlsruhe tram system is based dual-system rolling stock, able to use heavy rail lines as well as on urban tram lines. The Karlsruhe scheme is notable because it integrates regional railway services and the city tram system, leading to passenger numbers doubling from 1985 to some 133 million in 1999. When the first Light Rail line opened from Karlsruhe to the regional town of Bretten in 1992, dual-system trams started running directly onto the mainline railway. The immediate increase in passengers beat even most optimistic forecasts, with almost 3½ times more people using the extended system than previously. The system has also been expanded on what has been termed the "pick-up-the-customer-at-his-front-door-approach"[24]. This comprises a dense integrated network of light rail and feeder buses, short journey times, and direct rail connections from the suburbs right into the inner city.

B4.4 In the Karlsruhe-Bretten corridor, 40% of passengers were former car users, and more importantly, only 25% of the light rail users were previous Deutsche Bahn rail users. In the Karlsruhe-Worth corridor 20% of the users had been a car user. This is important in the context of significant public transport patronage growth in these corridors e.g. Karlsruhe-Bretten +600% between 1992 and 1997, Karlsruhe-Worth +94% between 1996 and 1998 and Karlsruhe-Pforzheim +129% from 1996 to 1998. [25]

22 Hass-Klau, C. et al (2003) – **Ibid** – pp. 84

23 Buck Consultants International and Twynstra Gudde (2001) – **Light Rail, Long Term (Modal Split) Impacts** – LiRa Pilot No. 4, Nijmegan/Amersfoort, pp. 34-35

24 Muth, F. (2000) – **Karlsruhe: Back to the Future** – Tramways and Urban Transit, December 2000

25 Buck Consultants International and Twynstra Gudde (2001) – **Ibid** – pp. 44

Freiburg

B4.5 Freiburg is located in the southern Rhine Valley and is well known for being one of Europe's success stories in having successfully implemented a sustainable transport policy during the last 30 years with public transport a key ingredient to this.[26]

B4.6 Freiburg kept its trams despite widespread practice in the 1960s and 1970s of replacing them with buses and there are plans to expand the LRT network further. The city's public transport network has been complemented by expanded local rail network, the introduction of an integrated travel card for Freiburg and the region in 1991 and one of the largest pedestrianised areas in Europe. The success of Freiburg can be seen in keeping car use at a constant level despite increases in car ownership. In 1976 there were 231,000 cars counted on the main roads, 23 years later the figure was at 232,000. Public transport patronage has increased from 85,000 passengers per day to 186,000 in 2002. It is assumed that 30,000 car trips a day have been replaced public transport. These figures have to be seen in the context of population increase from 154,000 in 1961 to 208,000 in 2002.

B4.7 Because of the improvements, the modal share for public transport overall grew from 11% in 1982 to 18% in 1999. The car's modal share fell from 39% to 33% over the same period, although it had originally grown (at expense chiefly of walking and cycling) to 44% in 1989, during a time when public transport's share had also grown considerably. The figures appear to indicate that a consistent "environmentally-friendly" transport policy is able to keep car use at a constant level despite increases in car ownership[27].

Schemes in the USA

B4.8 The claim is often made that LRT patronage gains are at the expense of the existing bus system. Table B3.1 shows the analysis of five systems in the US that show a much less clear picture. [28]

TABLE B4.1 CHANGES IN US PUBLIC TRANSPORT PATRONAGE (1997-99)

	Bus	LRT
Dallas	+13%	+20%
Denver*	+1%	+17%
Los Angeles	+3%	+13%
Portland	Increase 1997-98, then decline of 1m in 1999	Increase in 10m
St Louis	Decline 1997-99	Decline 1998-99

NOTE: * 1996-98

26 Hass-Klau, C. et al (2003) – **Ibid** – pp. 87

27 Hass-Klau, C. et al (2003) – **Ibid** – pp.90

28 www.metrocouncil.org/transportation/LRT/LRT-transitpaper.pdf

Portland, Oregon

B4.9 A number of sources indicate LRT is having effects on reducing car modal share. For example, awareness survey of LRT passengers showed a high proportion of recreational use (40%) for those using LRT only (not transferring to other public transport modes). And of those LRT only users nearly all (93%) had a car available [29].

B4.10 Additionally, a study[30] showed that the outer LRT corridor was less likely to be "car oriented" (car use declined by 1%) and households with two or more cars had grown at a lower rate than in bus served corridors. Interestingly these comparisons were undertaken between 1980 and 1990 to gauge effects of LRT opening in 1986. Since then the network has been expanded further.

Wider Economic Impacts: Experience from Overseas

B4.11 The UITP set up a working group to report on the effects of light rail on urban areas based on a survey questionnaire to all operators of light rail systems, and there were 34 responses and detailed case studies were also carried out for Nantes, Laussane and San Diego.[31] The results of the sample responses as a whole showed 12 of 34 cities reported that anticipated impact on urban development was an important aspect in the choice of light rail transit.

B4.12 The responses reported 6 cities experiencing an increase in shopping business generated adjacent to LRT lines, 5 cities reported the development of new shopping areas and 4 cities reported increased employment. In two of the detailed cases (Laussane and San Diego) it was acknowledged that "the construction of the light rail system has given a real impetus to urban development by creating new housing, offices and shops".

Schemes in Western Europe

B4.13 In recent years, France has adopted a new approach to the strategic planning of transport in major urban areas. Plans de Déplacements Urbains (PDUs) are holistic transport plans designed to integrate with other strategic policy objectives including better environmental sustainability and urban regeneration and renewal. The basis of the PDU system stands in contrast to the transport planning system in the UK – the PDUs provide the policy tools to implement transport investment as a stimulus to future economic growth, and to formalise other policy objectives – such as road traffic reduction and urban renewal, which are not seen as explicit investment benefits in British appraisal systems[32].

B4.14 PDUs are administered across areas defined as transport planning 'perimeters', which are essentially city region boundaries. The original stated objectives of the PDUs at

29 www.trimet.org/inside/ridership.htm

30 Dueker, K.J. and Bianco, M.J. (1998) – **Effects of Rail Light Rail Transit in Portland** – DP97-7, Transportation Research Record

31 Hue, R. (1997) – **Ibid** – UITP, International Light Rail Commission, Brussels

32 Docherty, I. (2004) - **Innovative Public Transport And The Urban Renaissance** - Unpublished Working Paper City Development Group University Of Glasgow, pp. 5-6

their inception in 1982 were to support a "more rational use of the car", and to ensure integration between the needs of pedestrians, cyclists and public transport users. These were refined in 1996 to stress the need to manage the demand for mobility, safeguard the environment by improving air quality and conserving energy, and improve public health by promoting 'active transportation'. Policies were to deliberately favour the development of the least polluting and most energy-efficient transport modes. The 1996 legislation made it obligatory for each urban area in France with a population exceeding 100,000 to adopt a PDU, and in 2000 PDUs were officially integrated into national urban renewal strategy. There is therefore a clear, statutory link in France between transport investment and urban renaissance objectives.

B4.15 A recent survey of tram schemes in France[33] similarly notes that the French Internal Transport Law (LOTI) requires cities that implement major urban transport infrastructure schemes using public funds to evaluate the projects against criteria that can "verify the socio-economic efficiency of the investment." These evaluations are, in essence, "before and after" studies of the projects from a socio-economic point of view.

B4.16 A survey questionnaire of 34 light rail operators[34] has reported "…light rail improves the image of the city. 11 cities reported that favourable public perception played an important role in the choice of LRT; 3 cities reported that residents and shopkeepers previously anti-LRT had changed their minds after the opening of the LRT system".

Nantes, France

B4.17 The tram system in the western city of Nantes was the first of the "new generation" to be implemented in France, with the first line opening in 1985. The city authorities have used the "implantation" of the tramway as a focus for a variety of renaissance initiatives. Most importantly, there has been a concerted effort to reduce road traffic in the city centre to create a more attractive urban environment through pedestrianisation and the 'greening' of key corridors and spaces. Policy makers in the city regard the transformation of Nantes city centre as having hinged on the land use and behavioural changes brought about by the tramway. In particular, they point to the fact the for every new trip by tram created, an additional unrelated trip on foot is made, which is seen to explain the renewed vitality of retailing and other key city centre activities[35].

B4.18 Another study[36] notes that the introduction of the tramway in Nantes appears to have a standardised effect on commercial and residential development. Since 1985 when the scheme opened, 25% of new office development has occurred within the tramway corridors. Likewise, one-quarter of the city's residential development is within the corridor, mainly smaller homes and apartments. No changes in price have been attributed directly to the tramway.

33 Egis Semaly Ltd. and Faber Maunsel (2004) - **Comparative Performance Data From French Tramways Systems** - South Yorkshire Passenger Transport Executive, pp. 28-29

34 Hue, R. (1997) – **Light Rail, the City and its People** – UITP, International Light Rail Commission, Brussels

35 Docherty, I. (2004) – Ibid – pp. 6

36 Egis Semaly Ltd. and Faber Maunsel (2004) - **Ibid** - pp. 28-29

Strasbourg, France

B4.19 Much has been written about the tram system in Strasbourg, France. There was clear political backing for the scheme, as Mayor Catharine Trautmann believed from the beginning that a modern rapid transit system should be one of the main ingredients of a revitalisation of Strasbourg's business district, even threatening to resign if her proposals for the tram were not implemented. The first line was integrated with city-wide public space refurbishments, as part of a general public transport refurbishment. This had reportedly a very positive effect on tourism in the city, and there is general agreement locally that the quality of life has increased. One of the main parts of the scheme has enabled a large part of the city to be made car-free, or at least free from through traffic. This has been combined with provision of park and ride facilities lots were built on the edge of the inner city. A second line presently is being built. Strasbourg is an excellent example of an integrated refurbishment strategy, particularly in terms of combining improvements in urban design with traffic management measures in ways which enhanced both, so that the whole became more than the sum of its parts'[37].

B4.20 The major change in Strasbourg's land use since the scheme opened in 1994 has been the growth of retail services in the city centre. Lease prices have increased within the centre, with growth linked to the pedestrianisation of the city centre attached to the tramway projects as well as to non-tramway economic factors. Home prices are 7% higher in areas well-served by public transport. The tramway has had little impact on office / commercial land use[38].

B4.21 Elsewhere, it is noted that during the construction of the scheme in Strasbourg, retail traders experienced loss of up to 30% of their turnover. The local authority responded by increasing car parking spaces, and turnover subsequently recovered by 1999. When Line 2 was constructed, extra parking was provided on a short-time basis in advance of construction commencing, and no such reduction in retail turnover was noted in this case. The operators of the system claim that the urban environment has been improved, and decentralisation has reduced. The City Council in Strasbourg also claim that prices of homes along the tram route have increased, with homes close to stations costing about 10% than comparable properties elsewhere in the city. People living in the tram route corridor also apparently move home less often, indicating that people are more content with these locations. It is also noted that large supermarket developments have occurred at the two outermost stops on Line 1, but this appears to have added to the economic prosperity of the area overall, rather than detracting from activity in the city centre[39].

B4.22 Other commentators have noted that building the new tram in Strasbourg involved a complete design of the city centre. Before this, only a small part of the city was pedestrianised, and up to 55,000 cars per day entered the main Kleberplatz (now fully pedestrianised), many looking for a place to park. The pedestrianisation scheme

37 Buck International Consultants (2000) – **Ibid** – pp. .22

38 Egis Semaly Ltd. and Faber Maunsel (2004) - **Ibid** - pp. 28-29

39 Hass-Klau, C. (2003) – **Ibid** – pp. 102-103

associated with the implementation of the tram increased the car-free area of the city by ten-fold[40].

B4.23 One review of the effects of light rail on economic development showed that light rail increased the number of shoppers attracted to the town centre. For example, there were 88,000 people in Strasbourg in February 1992 and this increased to 146,000 in October 1995 after Line 1 opened and 163,000 by 1997 when Line 2 opened. It was claimed this increase in shoppers led to retailing turnover increases that in turn led to higher rent values and property prices[41].

Montpellier, France

B4.24 Most of the vacant land along the line built in Montpellier was or is still owned by the city authorities, and some was developed by them to provide new offices, while some was sold in order to build new houses. The rate of construction along Line 1 of the Montpellier scheme is described as "remarkable"[42]. However, it is noted that acceptance of the level of development that has taken place by local people has been highly correlated to the overall marketing of the tram system, and establishing in their minds that the investment was positive and important for the city. This apparently has not always been the case in France.

Grenoble, France

B4.25 In Grenoble, the most noticeable reported change in land use since the scheme opened in 1987 has been the amount of tertiary level (service-based) activities locating in the tramway corridors. Health and law professionals, in particular, consider public transport access for their clients as a factor in determining office locations. For homes, property prices and the quantity of properties available were noted to rise as soon as construction of a tramway begins, but the effects diminish after three to four years. Estate agents see the tramway as a selling point for properties within 100 metres of the line; on the other hand, rental prices have not noticeably increased due to the tramway[43].

Turin, Italy

B4.26 The current programme of new transport infrastructure development in Turin is perhaps the best example in Europe of such investment being implemented as a means to stimulate future economic growth, rather than dealing with existing problems such as traffic congestion in the short term. In 1998, the city of Turin and its surrounding municipalities published a wide ranging strategic plan for the metropolitan area designed to reposition the city as a leading European regional centre for the 21st century. *Torino Internatzionale* is a cohesive set of urban policy interventions designed to capitalise on the city's recent economic success, whilst at the same time

40 Hass-Klau, C. et al (2003) – **Ibid** – pp.103

41 Crampton, G.R. (2003) – **Economic Development Impacts of Urban Rail Transport** – ERSA Conference, 27-30 August 2003, pp. 8

42 Hass-Klau, C and Crompton, G. (2004) – **Ibid** – pp.190-192

43 Egis Semaly Ltd. and Faber Maunsel (2004) - **Ibid** - pp. 28-29

addressing major regeneration tasks such as the renewal of one of Europe's largest former industrial sites around the Fiat complex at Lingotto.

B4.27 The Plan's first policy priority is improved connectivity, with significant investment directed at stimulating regeneration of key city locations. The construction of the city's first metro line, a €700 million fully automatic 15 km route with 21 stations due to open in stages from 2005, is designed to improve links within the city centre, and to improve connections between the city and the major southern development areas in and around the Expo and conference centre at Lingotto. This investment is specifically designed to stimulate the comprehensive redevelopment of a key north-south corridor in the city, the Spina Centrale, which will represent Turin's strategic growth corridor for the next 20 years. This corridor links the existing city centre with the new commercial and exhibition areas around Lingotto. As in Dublin, the construction of the metro is also to be used as a device to reduce road traffic in the city centre as part of a concerted programme to improve its environmental quality and attractiveness as a place to live and invest[44].

Freiberg, Germany

B4.28 It has been suggested Freiberg illustrates that there is higher growth in property prices or rents on offices along light rail corridors in comparison to elsewhere. Offices in an industrial area that has direct tram access have the same rent than offices located at the city centre fringe. Additionally rent at the periphery with very good road access was nearly 30% per square metre lower[45].

Laussane, Switzerland

B4.29 In Lausanne, Hue[46] gave specific examples of the extension of a commercial centre (Croset) as well as the new commercial building (Provence-Centre) close to light rail station Mallet and new student halls built near the light rail line in the commune l'Ecublens.

Schemes in the USA and Canada

Portland, Oregon, USA

B4.30 Portland introduced light rail in 1986 when, after citizens had won a battle to remove a freeway along the CBD waterfront, the city had implemented a groundbreaking growth management scheme and shifted its transport policy. Light rail was assessed against other transit proposals and preferred on account of its low operating costs, its high ridership forecast and farebox recovery ratio, its low impact on the urban fabric, its popularity in the public and its contribution to pollution abatement in the CBD, besides general system characteristics such as superior safety, speed and reliability[47].

44 Docherty, I. (2004) – **Ibid** – pp. 6-7

45 Crompton, G. R. (2003) - **Ibid**

46 Hue, R. (1997) – **Ibid** – UITP, International Light Rail Commission, Brussels

47 Scheurer, J. et al (2000) – **Can Rail Pay? Light Rail Transit and Urban Redevelopment with Value Capture Funding and Joint Development Mechanisms -** Institute for Sustainability and Technology Policy (ISTP), Murdoch University, Perth, Australia

B4.31 Following earlier attempts at downtown revitalisation after the demolition of the waterfront freeway and pedestrianisation of the retail centre, a lot of hope was placed onto light rail's capability to further boost the rebirth of the CBD. Herein, like in San Diego and the Canadian cities, may well lie the most crucial early success of the scheme when development interest rose, shoppers and entertainment visitors took to the neatly refurbished and pedestrianised streets and squares, and the residential population rediscovered downtown as a trendy place to live. Despite early consideration of this function in an evaluation of station area potential, the mechanism did not work quite as impressively along the suburban corridor that light rail served. While variations in public transit ridership and the modification of nearby properties show slightly more favourably in the rail corridor than in other suburbs not served by LRT, the overall effect has been modest and, if anything, conveyed the concept that more must be done to achieve full benefits from the transport and land use interplay. Encountering itself in the favourable position to implement planning incentives, Portland's metropolitan council introduced ordinances mandating the concentration of higher-density development around public transit, granting tax breaks for transit-oriented design and embedding its second radial light rail line to the fast-growing Western suburbs into a comprehensive urban master plan, aiming at converting each station precinct into a node of activities. Even before the line opened in September 1998, private developers within 800 m of the future stops had invested some US$ 500m. In addition, a recent proposal for a branch line to the International Airport pioneers a public-private partnership model.

Vancouver, Canada

B4.32 This provides a good example of a city where urban form has been deliberately re-shaped to exploit the advantages that light rail can bring[48]. The key interchanges on Vancouver's Skytrain system, developed since the mid 1980's, have mixed commercial, office, residential, retail and markets within short walk of the station, set in attractive public areas and green spaces to encourage walking and cycling. The Metrotown development is connected to the system by covered, elevated walkways. Throughout the system, a network of feeder buses supports the light rail service, and specific attempts to integrate facilities to promote bicycle access have also been provided. New housing within the Skytrain corridor since the implementation of the scheme consists generally of quality high-rise towers, 3 to 4 storey condominium style developments and townhouses. The pace of redevelopment around many Skytrain stations is reported as extraordinary, and is continuing, particularly near city centre city. In helping fund Skytrain, the provincial government directed the local authorities whose area it serve to actively support the scheme by re-zoning areas around stations for higher density, mixed uses.

B4.33 This typically has resulted from a planning process that has a long tradition of community involvement. In Vancouver, local area strategies were designed for residents and businesses located within a ten-minute or 800m walk of stations, through public meetings and establishing local advisory committees[49]. These strategies were

[48] Scheurer, J. et al (2000) – **Ibid -** pp. 4-4 to 4-7

[49] See, for example, City of Vancouver (1987) – **Broadway Station Area Plan: Summary** – Planning Department

aimed at providing new housing near the stations without compromising the quality of life for existing residents, creating sub-centres with diversity and character, and encouraging further medium density residential development and commercial mixed use development. In transport terms they were also specifically designed to increase train patronage, but at the same time minimize potential adverse impacts of this, such as parking problems.

Edmonton and Calgary, Canada

B4.34 To offer superior rail service with minimum capital expenditure, Edmonton (1978) and Calgary (1981) pieced their networks together from sections of abandoned railroad right-of-way, insertion of trams into pedestrianised shopping streets, medians of freeways or other large roads, and some tunnelling in congested areas. The vehicles are all but identical to those used in Frankfurt, Germany since the late 1960s, thus avoiding considerable research and development expenditure in this field. While Alberta's economic growth rates did not hold and the once-ambitious plans for network expansion were trimmed considerably in both Edmonton and Calgary, it is notable that comprehensive network planning has made light rail the backbone of the public transit system from day one, with bus lines rerouted to feed into rail stations, offering integrated fares and coordinated transfer times. The clustering of urban growth around the rail routes and the revitalisation of the CBD areas, which have early become standard practice throughout Canada, play a further significant role in boosting both Edmonton's and Calgary's ridership levels to more than twice the figure commonly experienced in US light rail system. It is obvious, however, that patronage demand has plateaued since the construction of new lines was deferred, which possibly correlates to a saturation phenomenon in urban densification around the rail and continue to consolidate to car-dependent patterns. Both Edmonton and Calgary not only triggered a rail revival across the continent, they furthermore advanced innovative approaches to financing as well as integrated transport and land use planning. Station areas along both LRT systems were subject to rezoning to allow for higher density, downscaled parking requirements, incentives for pedestrian-friendly design and some publicly subsidised housing – a programme that proved particularly successful in the further consolidation of the CBDs[50].

B4.35 Babalak[51] examined the impacts of light rail systems on land use and urban growth patterns in terms of stimulating development in city centres, declining areas and improving the pattern of urban growth. This included looking at 7 schemes in the USA. She found that the St. Louis and San Diego systems had had the greatest impacts on their city centres. In St. Louis, the positive image of the system coupled with free fares in the city centre had been particularly attractive, and the San Diego system was well integrated with new residential and retail developments, helped by incentives to developers such as tax reductions and relaxation of car parking requirements.

50 Scheurer, J. et al (2000) – **Ibid**

51 Babalak (2000) – **Ibid**

Dallas

B4.36 In 1999, the Centre for Economic Development and Research at the University of North Texas conducted a study of the Dallas Area Rapid Transit (DART) light rail system's economic impact[52]. One part of the study focused on changes in property values. Appraisal data on 700 commercial and residential properties located within a quarter mile of the 15 existing light rail stations revealed that between 1994 and 1998, total property values increased in 11 of the 15 rail station neighbourhoods. Property values around DART stations increased 25 percent more than in the control neighbourhoods. Some rail stations experienced larger gains, including the Cityplace-Mockingbird- Lovers Lane corridor.

B4.37 The largest property value increase was at the Lovers Lane Station, where values increased by 66 percent overall. Office property values rose 73 percent. Cityplace had an overall 59 percent gain in property values with office values up 69 percent and retail values up 67 percent. Around the Keist Station, retail property values rose 84 percent; vacant property values increased 44 percent. The largest increase in residential property values was seen at the VA Hospital station, where values rose 65 percent. The largest increase in industrial values, 35 percent, occurred in the area around the 8th and Corinth Station.

B4.38 The study also examined changes in occupancy and rental rates surrounding rail stations. A total of 200 office buildings, retail properties and industrial sites within a quarter mile of existing DART light rail stations were examined. Average occupancy rates for Class A office buildings near DART stations jumped from 80.2 percent in 1994 to 88.5 percent in 1998, an increase that far surpasses the 1 percent gain citywide. Rents rose from $7.40 to $23 per square foot. Occupancy rates for Class B office buildings increased 4.9 percent, with rental rates rising 40 percent. Occupancy of Class C buildings rose 1.6 percent to 46.4 percent. Rental rates increased 21 percent to $11.39 per square foot. Rental rates for classes A and C were similar to citywide rates. Occupancy rates for industrial properties increased 16 percent; rents increased 27.4 percent.

B4.39 On the retail side, rental rates rose 29 percent between 1994 and 1998. However, occupancy rates declined in community retail centres. Neighbourhood retailers' rental rates increased 3.3 percent, while occupancy rates rose 6.2 percent. Strip centres experienced a 4.2 percent increase in occupancy rates and an 18.4 percent gain in rental rates.

Santa Clara County

B4.40 To gauge the value-added associated with being near light and commuter rail transit in Santa Clara County, a hedonic price model was estimated i.e. a model that examines the component prices of each attribute affecting land values.[53] For the purposes of the

[52] Reported in Cowley, J.S. (2001) – **All Aboard! Dallas Blazes Light Rail Trail** – Tierra Grande, Journal of the Real Estate Centre, Lowry Mays College and Graduate School of Business, Texas A&M University, Publication No.1436, January 2001

[53] Cervero R. and Duncan M. (2001) – **Transit's Value- Added: Effects of light and Commuter Rail Services on Commercial Land Values** – Urban Land Institute and the National Association of Realtors, November 2001

study, data observations for commercial, office and light industrial properties were selected for 1998 and 1999. These dates were considered to provide sufficient time lapse for the benefits of proximity to light and commuter rail services, which were introduced in the county in the early 1990s, to have taken form.

B4.41 The main report findings that being within walking distance of an LRT station in Santa Clara County increased land values on average by over $4, or by 23% in relation to mean per square-foot value of sampled commercial parcels of $17.51. And for properties in commercial business districts and within a quarter of a mile of a CalTrain commuter rail stop, this premium was higher – over $25 per square foot, or more than 120% above the mean property value.

Portland

B4.42 A research study [54] examined the impact of light rail on single-family home values in the Portland Eastside LRT corridor using distance to stations as a proxy for accessibility and distance to the line itself as a proxy for nuisance effects. The study concluded that a median-priced house at a station had a 3% higher value than a comparable unit 200 feet away, 5% higher than one 400 feet away, 7.5% higher when 600 feet away and 10% higher when 1,000 away.

San Diego

B4.43 The UITP review[55] reported new restaurant and office developments around the 'international' station of San-Ysidro in the early 1980s. There was also the development of a commercial zone close to the station of ChulaVista-Palomar St, and office buildings employing 600 adjacent to the National City-24th Street station. More recently, San Diego has seen the construction of 500 apartments close to Amaya station.

54 Chen et al (1997) – **Measuring the Impact of Light Rail Systems on Single Family Home Values –** DP 97-3, Transportation Research Record

55 Hue, R. (1997) – **Ibid** – UITP, International Light Rail Commission, Brussels

APPENDIX C

People Interviewed During the Study

C1. PEOPLE INTERVIEWED DURING THE STUDY

TABLE C1.1.1 PEOPLE INTERVIEWED FOR THE REVIEW

Name	Affiliation
Luke Albanese	Project Director, Light Transit, Transport for London
Neil Georgeson	Light Transit, Transport for London
Tom McGrath	Metro, Centro (WMPTE)
Chris Chatfield	Principal Project Manager, Metro, Centro (WMPTE)
Colin Rowley	Metro, Centro (WMPTE)
John Bird	Metro, Centro (WMPTE)
Andrew Gardiner	Metro, Centro (WMPTE)
Simon Sadler	Senior Transport Planner, Metro, Centro (WMPTE)
Graham Read	Head of Planning, SYPTE
Bernard Garner	Nexus (TWPTE)
Peter Gross	Orpheus Project Manager, Nexus (TWPTE)
Bill Tyson OBE	GMPTE
Chris Deas	NET Development Manager, Nottingham City Council.
Robert Niven	Docklands Light Railway
Richard di Cani	Docklands Light Railway
Jim Berry	Canary Wharf Group.

APPENDIX D

Full Bibliography

D1. FULL BIBLIOGRAPHY

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CONTROL SHEET

Project/Proposal Name:	WHAT LIGHT RAIL CAN DO FOR CITIES
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REVIEW

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