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DOCKLANDS LIGHT RAILWAY

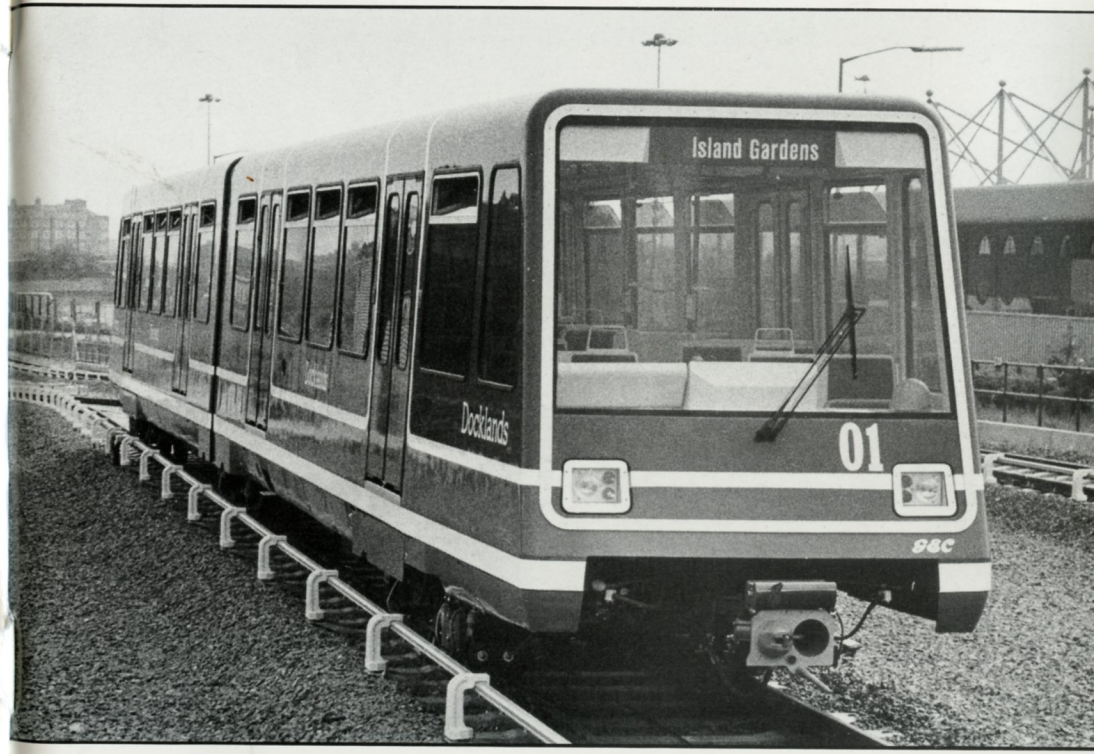
Docklands Light Railway

Official Handbook

STEPHEN JOLLY AND BOB BAYMAN

Capital Transport

Docklands Light Railway



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1987

Compiled by
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FOREWORD

This is the first official account of London's Docklands Light Railway and we hope you find it of use. Much has been written about this project and a lot of the published material has frankly been wrong or misleading.

My project team – now a railway company – are the people who do know most, if not all, of the events and decisions involved in this exciting project. This book sets the record straight and we feel modestly able to refer to it as our official handbook.

There is still much to be done to finish and then develop still further the railway to be of more use to more people in the East End and Docklands. So this book is definitely not the last word on the subject! At least it is the right word on the subject.

C F BONNETT
MANAGING DIRECTOR
DOCKLANDS LIGHT RAILWAY LIMITED

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INTRODUCTION

The Docklands Light Railway is a rare event in the British transport scene: a brand new railway being built at great speed in London using a fresh technology package and new operating attitudes.

As if this were not enough, the area that the railway is being built to serve is itself undergoing great change – urban renewal – on a scale unmatched in the rest of Europe.

To further spice the story, the money for the project is a cash-limited, non-inflation proofed sum of £77M made available by Government through two departments to two organisations in equal amounts. One organisation is the London Docklands Development Corporation (LDDC), receiving its share from the Department of Environment and the other is London Regional Transport (LRT), receiving its half from the Department of Transport.

Almost everything there is to say about the DLR involves some change of attitude when compared with other British railway technologies or operating procedures. The DLR team have prepared this book around a series of topics rather than as a chapter by chapter account. Any straight historical account of the project would be likely to involve large breaks in the text to explain the complicated inter-weaving of politics, technology, geography, history and much else!

CONTENTS

ORIGINS

Before the present railway came into existence and before the London Docklands Development Corporation was set up, London Transport had plans in the nineteen seventies to extend one of its tube lines into the Docklands area. The line, referred to as the River Line but seen always as an extension of the Fleet/Jubilee Line, would have passed under the Thames as many as five times before reaching the Thamesmead and Woolwich areas with a spur to Beckton. The great attraction of linking communities north and south of the river would have been moderated by the limited number of station sites that could have been provided. In addition, deep-level bored tube station construction below the water table is extremely expensive and it was the high cost of the scheme – £325m (close to £500m at 1986 prices) – that killed it off.

There remained a great need to improve public transport in the area, reinforced in 1981 by the creation of the Docklands Development Corporation who identified the requirement for permanent links to help attract and keep the confidence of industry and commerce in the area.

A light railway was seen as a suitable alternative and a number of route studies were undertaken by London Transport for the Development Corporation on a consultancy basis. In June 1982 a report called 'Public Transport Provision for Docklands' was submitted to the Government. This report was jointly prepared by the Development Corporation, the Greater London Council, London Transport and the Departments of Transport, of the Environment and of Industry. It unanimously recommended the building of two light railway lines of about 12km (7½ miles), costing £65m with a west-south route and a north-south route. The report asked the Government to note that the effect on the development prospects, the creation of new jobs and the increased number of firms which would be attracted to the area by a modern rail link were all factors that had been taken into account. It was also stated that an early decision was needed so that potential buyers of development sites could be promised that there would be a new railway which would be ready in time to serve the new developments.

In October 1982 – a remarkably short time – the Government agreed to fund the building of the Docklands Railway as a project of regional and national importance, and subsequently confirmed this under strictly controlled conditions. The cash outturn price was not to exceed £77m, to be funded equally by the Departments of Transport and of the Environment to the GLC and the LDDC. Both routes were to open in 1987 Although full advantage was to be taken of contemporary technology, technical solutions were not to be incorporated that could significantly increase the risk of cost-overrun or compromise the railway's completion date or reliable and economical operation. Finally, it was required that, when operational, the railway would not need revenue support from the Government.

The authorised cost figure was based on London Transport's planning estimates for a route which used a mixture of existing BR track, new and disused viaducts and cuttings, as well as a short section of street running, and which assumed a manually-driven, standard gauge, steel wheel on steel rail system with overhead current collection. Just ten stops were to be provided.

London Transport, acting as agents on behalf of the two joint clients, the GLC and the LDDC, was made responsible for preparing the Parliamentary Plans, constructing the railway and opening it on time and within budget.

The West India Docks in busier times, June 1970. The camera was pointed towards the north east with Poplar Dock and the power station at Blackwall in the distance.

LONDON'S UP RIVER DOCKS

London has been a port since Roman times, and as long ago as the 16th Century both sides of the tidal River Thames in the vicinity of the Tower of London were crowded with wharves and warehouses, resulting in considerable congestion and delays in handling cargoes. By the end of the 18th Century it had become clear that a solution had to be found to this problem.

The answer was the construction of enclosed, controlled water level docks and the first of these was opened on the Isle of Dogs by the West India Dock Company in 1802. In 1806 the East India Dock Company opened a dock at Blackwall and the West India Dock Company opened a second one on the Isle of Dogs. Meanwhile, a system which was later to be known as the Surrey Commercial Docks was under construction on the south bank of the Thames. St Katherine Dock was the next to be built, near the Tower of London. Work commenced in 1825 and the scheme was particularly controversial as it involved the destruction of a community of some 1,250 homes.

A lull in dock construction followed until the opening of the Victoria – later Royal Victoria – Dock in 1855. It was built down river from the existing docks and was the first to be designed specifically to take steamships. The year 1880 saw the opening of the Royal Albert Dock just east of the Royal Victoria. It was a dramatic one and three-quarter miles in length, and could take the largest ships then afloat. By 1900 the docks were in serious financial trouble, mainly because the older docks were not designed to take steamships and because over-capacity had led to damaging rate-cutting. The Government realised that the work required to overcome these deficiencies was beyond the resources of the dock owners and in 1908 an Act was passed to nationalise all of London's docks under the Port of London Authority (PLA).

In 1921 the final extension to the dock system was opened. Named the King George V Dock, it ran parallel to the Royal Albert and could handle the most modern shipping then in existence. The whole dock system suffered badly during World War Two, losing much of its traffic and sustaining extensive bomb damage. After the war, mechanisation began to take hold, resulting in a reduction in the labour force required. The older docks were not suited to modern vessels or to mechanised cargo handling methods, and closures followed.

Although the closures came very rapidly in the end, it should not be forgotten that for a period of time after World War Two the docks appeared to be enjoying something of a boom again. Ultimately, it was the growth of containerised traffic movements, with standard-sized containers being loaded and unloaded remote from quays and dockside sites, that led to the end of traditional loose and individually-packaged cargoes. The first dock to close was the East India Dock in 1967, followed in 1968/69 by the London and St Katherine Docks. The last ship left the Surrey commercial system in 1970 and during the following decade the remainder of the docks gradually ran down. Commercial freight activity within all of them has now ceased.

LONDON DOCKLANDS

It is widely believed that the regeneration of London Docklands is the most important Inner City redevelopment work of the 1980s in the Western World. Claims that it offers a unique set of opportunities for investors and businesses to set up new enterprises are easy to believe. Whereas the up-river docks became inaccessible to larger and larger container ships, those same dock areas are strategically close to the heart of the Capital. London now has a waterscape environment covering a total of 20 sq kilometres (8 sq miles) with the remains of the magnificent dock and wharf structures within large areas of dereliction.

The 1970s were an unhappy time for the up-river docks with traffic declining rapidly and with shipping and dock-related industries either ceasing to trade or moving away from the area. A series of plans were put forward, in some detail, to redevelop the area during the 1970s but, to summarise events, all of the plans lacked the financial clout to carry them through. The Government set up the London Docklands Development Corporation in 1981 charged with a ten-year programme to redevelop the docks. The Corporation has many similarities with the way in which new town development corporations have and do still operate on green field sites in other parts of the country. There is also an Enterprise Zone, the only one of its kind in the south east of England, covering a substantial part of the Isle of Dogs.

Working within a very tight timescale, the Corporation divided the area under its control into four segments. Along the north bank from the City is the Wapping area, the Isle of Dogs area including the Enterprise Zone, and the enormous Royal Docks sites. On the south side of the river the area extends from near London Bridge station to Rotherhithe and includes the former Surrey Docks areas.

The Development Corporation has operated with public money to prime private enterprise to invest. The public money has been spent on such developments as new roads, street lighting, telecommunications, water and sewerage schemes and, of course, the highly visible investment in improved public transport, the Docklands Light Railway.

The Docklands Corporation has been enormously successful in carrying out its task. By the time the 1985/86 Annual Report was published, every £1 of public investment in Docklands had resulted in an average of £6.40 private investment in all land in the area and £9.70 in the Isle of Dogs. Total private sector investment exceeded £1.1 billion at the time of publication of the Report in mid-1986. The pace of redevelopment has accelerated rapidly. Developments close to the railway at the time of contract was let to GEC-Mowlem in 1984 have been enlarged or, in some cases, replaced by even grander schemes. Some buildings already being refurbished or converted have since been taken down and replaced by greater structures promising more traffic for the railway as developers' confidence in the success of the area has increased.

It will, however, only be possible to accurately record the accelerating pace of change in the area in retrospect. Sites where one- or two-storey buildings were planned may now have seven-storey buildings going up, and the enormous financial city proposed for Canary Wharf has already generated excitement amongst developers and the incoming business community with the prospect of other schemes increasing in scale to match the entrepreneural spirit of the Canary Wharf project. Information about the London Docklands Development Corporation can be obtained from its offices located in the area or via the main telephone number, 01-515 3000.

This West German-built vehicle is running in Calgary, Canada. It epitomises modern Light Rail flexibility in a car-dominated urban environment.

WHAT IS LIGHT RAIL TRANSIT?

Light Rail Transit, also known as Light Rapid Transit, is a form of transportation that fits between the spheres of bus and conventional heavy railway operation. There are, it is estimated, over 300 systems in operation around the world. The whole industry has enjoyed a renaissance in the last twenty years, particularly in North America, but also in Western Europe where continued and continuing investment in improving the existing systems as well as opening some new ones, as in France, has taken place.

It can be argued that all forms of Light Rail system are hybrids because they blend features of other transit systems together in individual packages to suit individual area circumstances. The Docklands system is no exception to this rule, combining automatic operation with the retention of staff on trains, having a sophisticated signalling and control yet having no lineside signals, and keeping small and cheap stations yet having full disabled access through the provision of hydraulic lifts. A simple definition of Light Rail is difficult to achieve.

Flexibility and economy are the kingpins of Light Rail's attraction to transport operators and planners. With relatively small vehicles, such systems can often weave around existing townscapes, avoiding the need for extensive urban disruption. They do not need similar levels of staffing to heavy rail, yet at the same time they can cope admirably with passenger flows far in excess of those catered for by buses. Compared with buses, Light Rail can be fast, quiet and smooth. Experience of Light Rail investment in Europe and North America over the last 30 years has shown a Light Rail system is fully able to build up traffic while at the same time relieving vehicle congestion in city centres. Additionally it offers scope for making improvements to urban environments unobtainable where conventional railway access or relatively conventional bus access is the norm.

Light Rail may be beginning to sound like a solution for everyone's problems. Yet even a relatively cheap system requires initial capital investment which will always be greater than investment in running a bus service. In Britain the very popular Tyne & Wear Metro, serving Tyneside in and around Newcastle and Gateshead, is the only system currently in operation.

In discussing Light Rail in general, it is important not to have a narrow view of what the technology looks like. For example, tram poles and overhead wires might be thought to be necessary on all such systems, but they are not. Both overhead and low level current collection can be used in the same system in different environmental situations, or one system or the other can be used exclusively.

There is often a temptation to assume that street running – that curse of old-fashioned tram networks in Britain – is an essential part of a modern Light Rail system, but it is not. Street running does however allow further flexibility in choice of route, so that traditional railway lines, redundant railway land and street running can be combined to produce new packages of routes. Street running in the Mile End area once figured in the DLR plans, but in this particular case there were technical and environmental problems which subsequently sent the route elsewhere. Ultimately, the adoption of automatic driving for the Railway effectively ruled out street running for Docklands, yet Docklands is still a Light Rail-based system.

Typical line capacities are only of limited use in defining Light Rail. This type of system can economically cater for a large range of demands, with systems around the world carrying between 2,000 and 20,000 passengers per hour. Because of the rapid development of the Docklands area, the DLR – originally designed for movements at the bottom end of the scale – will, even before it opens, be facing demands somewhere near the top in a relatively short period of time.

Sometimes it is easier to define Light Rail by comparison: a bus service is easy to appreciate; it does not normally have dedicated track (except in the limited sense of some bus lanes), it is prone to traffic congestion, is usually diesel-powered, and is relatively noisy at times. It is not particularly big, yet it can still be intimidating to other road users such as cyclists.

Conventional railways do not look or behave like a Light Rail system either. They nearly always require gentle curves and a nearly-level route to obtain fast running speeds, and they need substantial engineering structures. Conventional railways tend to have high axle loadings on the trains and involve a substantial number of operating and engineering staff to provide a comprehensive and continuing service, but they do in return offer a fast, safe, high-capacity transport link that can serve certain well-defined corridors. Naturally, they require a lot of investment and investment levels will tend to be a lot higher than those of Light Rail.

Then again, London's Underground railways are a specialised segment on their own. To move large numbers of people safely in large cities, high capacity electric trains must operate through tunnels. Construction costs are now so high that, with the possible exception of the world's most populous cities, financial justification of new metro systems is impossible.

The best way to appreciate Light Rail systems is to visit some. There are many within 300 or 400 miles of London's Docklands, and a visit to places as close as Antwerp, The Hague, Rotterdam and Utrecht will quickly illustrate some of the wide variety of possibilities.

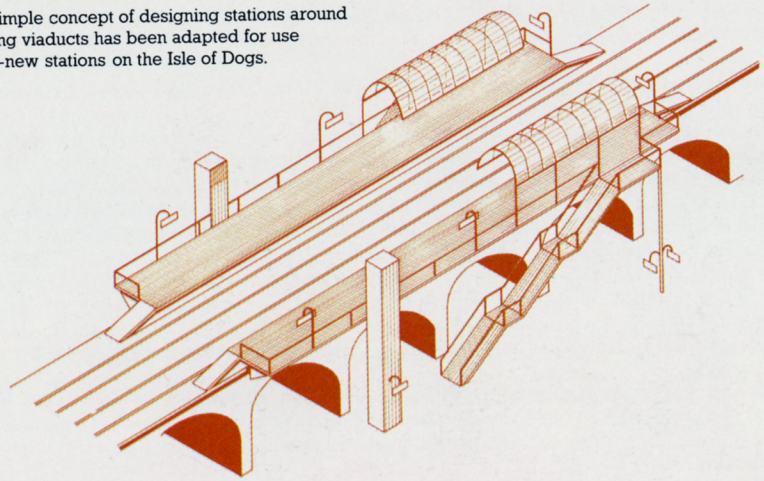
DESIGN OF STATIONS

As a general guide, the stations being built for the initial railway opening in 1987 feature platforms that are 30 metres (98½ feet) long with 9 metre (29½ feet) glass canopies. There will be hydraulic lift access between local ground level and platforms for the disabled and shopping-laden to use. Although hydraulic lifts are slower than electrically driven ones they are noted for their reliability, and a slower working speed has a safety advantage when used by the disabled. Standard access to the platforms will be by stairs. The design of stations includes a straight-edged platform to preserve a 75mm (3 inch) tolerance gap between platform and train to allow for unaided wheelchair access: the platform height will closely match train floor levels.

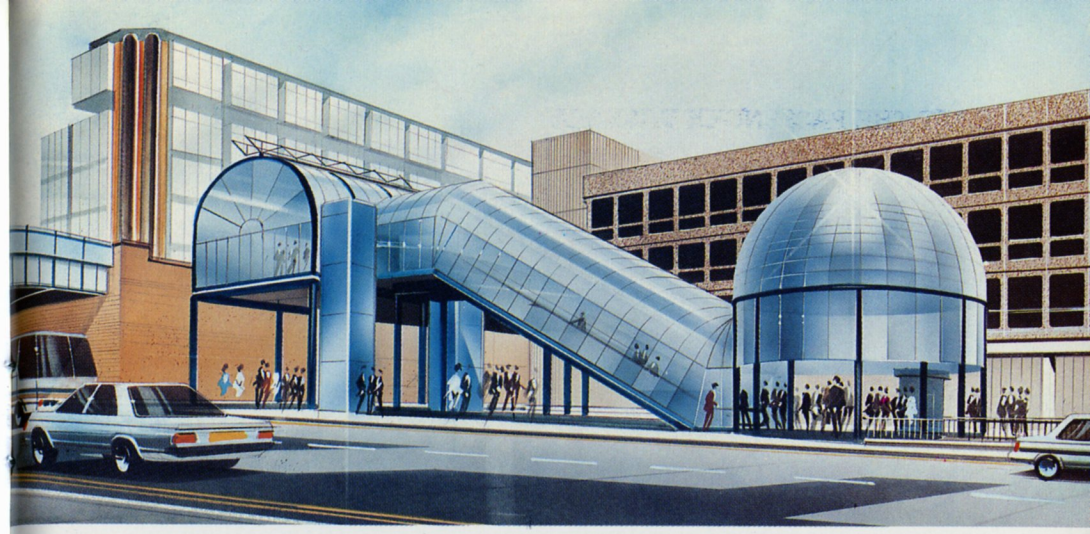
All stations will be fitted with closed-circuit television cameras (CCTV) which incorporate video recording facilities and all cameras will be monitored by the Controller in the Operations Centre at Poplar. Stations also feature a passenger alarm so that passengers can speak to the Controller in an emergency: pressing the alarm to speak will activate the video cameras automatically. All stations feature a public address system for the Controller to make one-off announcements as well as an extensive range of pre-recorded announcements. Platform indicators will display the time and destination of the next train to arrive, as well as other messages.

However, there are many exceptions to the simple principles of a typical station design. Firstly, although many of the stations are above ground level, much of the route between Poplar and Stratford is either located at or below street level. Therefore, the stations at All Saints, Devons Road and Bow Church are located in a shallow cutting and served from a ticket-selling lobby above the platforms. However, the distance between local ground level and the lower platforms at these stops is not great, being within the range of 3 metres to 5 metres (10 feet to 16 feet approximately). Not all of the elevated stations are built on the same kind of structure. The route from Tower Gateway towards the Isle of Dogs features stations located on or adjacent to existing brick arch structures, rather than being built on all-new structures.

Regarding individual sites, Tower Gateway is built on a new structure beside the British Rail viaduct; Shadwell is a one-off design featuring an island platform within the width of the existing arch viaduct; Limehouse is constructed beside the curved platform of the adjacent BR station and massive bridge over the Commercial Road; Westferry station site straddles the Westferry Road and Limehouse Causeway on a combination of existing brick arches and the more recently renewed bridge over Westferry Road.



The simple concept of designing stations around existing viaducts has been adapted for use on all-new stations on the Isle of Dogs.



Impressions of what the railway will look like have often dramatised the architecture, whereas the railway company would prefer a lower-key and more accessible atmosphere to be suggested! This 1984 illustration shows the Tower Gateway terminus viewed from the west side of Minories. The dismal-looking multi-storey car park behind the station is now being replaced with the Towergate commercial redevelopment.

The stations within the Docks on the Isle of Dogs are located on all-new structures. Crossharbour is a composite design partly elevated above an earth embankment; Mudchute is a new structure located to the north west of an 1872 brick arch viaduct, and Island Gardens is a new station on a piece of former railway land near the old railway terminus of North Greenwich.

Poplar station near the Operations and Maintenance Centre is another individual design featuring an additional track, that is three tracks, with two island platforms. This station will be used for trains entering and leaving timetabled service. At Stratford the DLR runs into a bay road at the western end of an island platform, with British Rail London-bound trains operating on the north side and the Underground Central Line westbound trains on the south side.

It is likely that a number of stations in the dock area of the Isle of Dogs will, sooner or later, be incorporated into major new commercial developments and form an integral part of them. If this happens, much of the standard fittings can be removed and used elsewhere to improve facilities at other stations.

All Saints station with glazed canopies in place and the stairs to East India Dock Road being assembled in August 1986.

WHAT THE PASSENGER WILL SEE

Because the stops are small and are often located between existing buildings, some of them will have only a minor impact on the local environment. However, there are a number of exceptions A: at Tower Gateway, a glass dome will dominate the local street scene and this theme is repeated at Island Gardens, where the architecture will reflect the shape and style of the nearby foot tunnel lift tower. Certain stops on the Isle of Dogs will also be prominent because of their positioning on top of bridges over water and quays.

A passenger in the vicinity of a station is likely to be able to identify the two hydraulic lifts for disabled and shopping-laden passengers to use. These lifts are clad in grey/blue engineers' brick with bright blue tops. Approaching the lifts the passengers will find a small area where ticket machines and validators are located. On the section from All Saints to Bow Church these concourses are over the running tracks and platforms, whilst most of the other concourses are below the trackbed underneath the railway bridge itself.

Again, there are a number of exceptions: at Tower Gateway the ticket machines and validators will be located in a glass-domed concourse at platform level, linked to the street at Minories by escalators. Shadwell features a ticket machine area in the old arches underneath the track. Limehouse features a combined British Rail and DLR concourse area beneath the running lines of the two operators. Westferry station, probably the most restricted and difficult site, features two small and separate ticket areas, one facing Westferry Road and the other in Limehouse Causeway.

Whatever kind of design has been used for a concourse, the scale is small and the passenger will immediately feel he or she is entering a smaller and less formal system than the London Underground. Consistently-applied combinations of red, white and blue signs will indicate what to do at each station site, but because of the smallness of the sites, the proximity of the validator, ticket machines, stairs to platforms and indeed the closeness of platforms and trains themselves access will be obvious.

The ticket machines will be housed in grey/blue brick structures similar to the adjacent lifts, and after the purchase of the ticket (assuming the passenger does not have a Travelcard, or has not taken the opportunity to buy a ticket in advance from an agent), the passenger will approach a validator column strategically placed near the staircase to the platform and validate the ticket. By using the stairs, or if more convenient, by using the lift, the passenger will reach the station platform. Again, the platforms will reinforce the impression of the railway's small size. There will be a covered canopy, seats, a 'Next Train' indicator sign coupled with public address when the train approaches, comprehensive handrails along the back edge of the platform, station lighting and an information panel.

When the train arrives, the automatic system will enable passengers to push a button alongside the doors to open them – as on the recent District Line London Underground trains.

Unusually, the doors will open inwards alongside the draughtscreens rather than sliding along inside the windows. This kind of door is typical of Light Rail vehicles, and is less demanding in weight and space than sliding doors contained within double-skinned body structures. It also gives a good draught-free seal when closed. Another reason for the door opening inwards and not protruding out on to the platform – which would be the alternative in a Light Rail application – is the provision of a same-level step between the car floor and the station platform, which is part of the package of designed-in features to allow easy access for wheelchairs and prams. The car floor is marked to indicate the inward sweep of the doors as they open.

Once inside the train the general dimensions of width and height will appear broadly similar to the trains on the District Line, although with a brighter, more airy atmosphere. Each car is articulated at the centre. Internally this is most noticeable by a turntable section of floor, which rotates slightly as the train negotiates curves. Each articulated unit is longer than a traditional railway carriage, but for the time being trains will be only one car long. Probably the most noticeable feature will be the absence of driving cabs; the Train Captain will not normally need to drive, so the passengers can sit back and enjoy the thrill of London's East End unfolding before them!

Seating, for 84 passengers, is mostly transverse in layout, giving passengers a good view out of the windows. Some longitudinal seating is provided, around the centre of the car, where spaces for wheelchairs are also included. Seat cushions are trimmed in red or blue moquette material.

To help passengers, each car will be equipped with maps and the destination of the train will be shown inside as well as externally by means of roller blind equipment. Public address is provided, but travellers will also have the benefit of personal help from the Train Captain. This is one of the passenger's biggest benefits of the automatic operation of Docklands trains.

Riding on Light Rail vehicles, to those not used to it, is a refreshing and stimulating change from travel on a bus or conventional railways. The vehicles are noticeably quiet and fast with dramatic but jerk-free acceleration rates. To many passengers, Docklands will not just be a railway but a whole new travel experience.

TRAINS FOR THE INITIAL RAILWAY

"What will the trains be like?" has been the most often-asked question when visitors have come to see the railway under construction. The short answer has been that the trains will be a cross between a conventional Light Rail Vehicle (LRV) and one built for automatic operation without driving cabs.

Many people are familiar with the various Light Rail systems running in north west Europe. The impressive Tyne & Wear Metro serving the Newcastle area in north east England is also a convenient reference. However, for every similarity with the Newcastle system there is an important difference. Although the Newcastle system vehicles are of approximately the same dimensions, they have half-width driving cabs and the Docklands vehicles do not. Apart from on Sundays, Newcastle cars normally run coupled together in pairs, whereas in Docklands, at least for the time being, they will not do so. Newcastle also has overhead power collection, whereas Docklands has protected low-level third rail. The Newcastle cars have bodies of heavier construction than Docklands because of the need to allow for the possibility of collision with British Rail locomotives and vehicles. The Docklands system, although operating close to British Rail, is a technically and physically separate system.

One of the problems facing the British companies competing to build the railway was the lack of a homebase design and construction facility for the vehicles. To design and build jigs and then construct a mere eleven units for the initial railway would have been a commercially unattractive proposition for any carbuilder. It was logical in the circumstances to go to a manufacturer already with the facilities for production runs of such vehicles. The German LRV industry is the strongest in the western world, with respected manufacturers. German LRVs have been supplied in large numbers to domestic systems and, for example, to North American systems where indigenous design and production facilities were missing. The DLR Contractor, GEC-Mowlem, has used the West German-based company Linke Hoffman Busch (LHB) to construct the carbody around GEC control and traction equipment.

LHB has used a welded steel structure similar to its previous production batches. A recent batch in build around the time the DLR contract was let was for Trondheim in Norway: indeed, the DLR vehicles have sometimes been referred to as stretched Trondheim units. This is not, however, an accurate comparison, since without driving cabs and without restrictions on the widths of the ends of vehicles for tight street running, the Docklands vehicles have a spacious end design with panoramic windows for passengers and a 'big train' look and feel about them. The end result, particularly after the dashing blue red and white livery has been applied, is to make the DLR vehicles look remarkably unlike other LRVs. Nevertheless, the general scale, lightness and thriftiness of construction in keeping weight down is still true to Light Rail principles.

In the end, all the fine words about LRVs and the definition of Light Rail might be of no value at all, when, as will probably happen, the public will regard the Docklands vehicles as just trains, just a little different because they are quieter, smoother and accelerate more smartly than other railway vehicles in London. Different, but still trains!

Above The interior design combines large side windows with crisp and simple detailing.

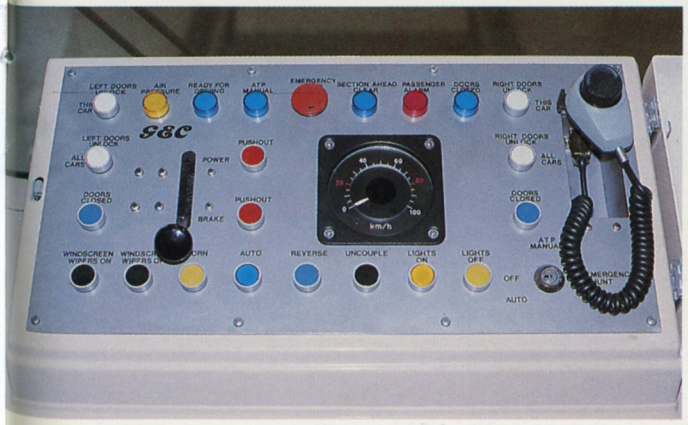
Interior view of car 03 showing a wheelchair in place near the centre of the car, seating finished in two colours of moquette and the red floor marking to show the area into which the doors fold back when opening.

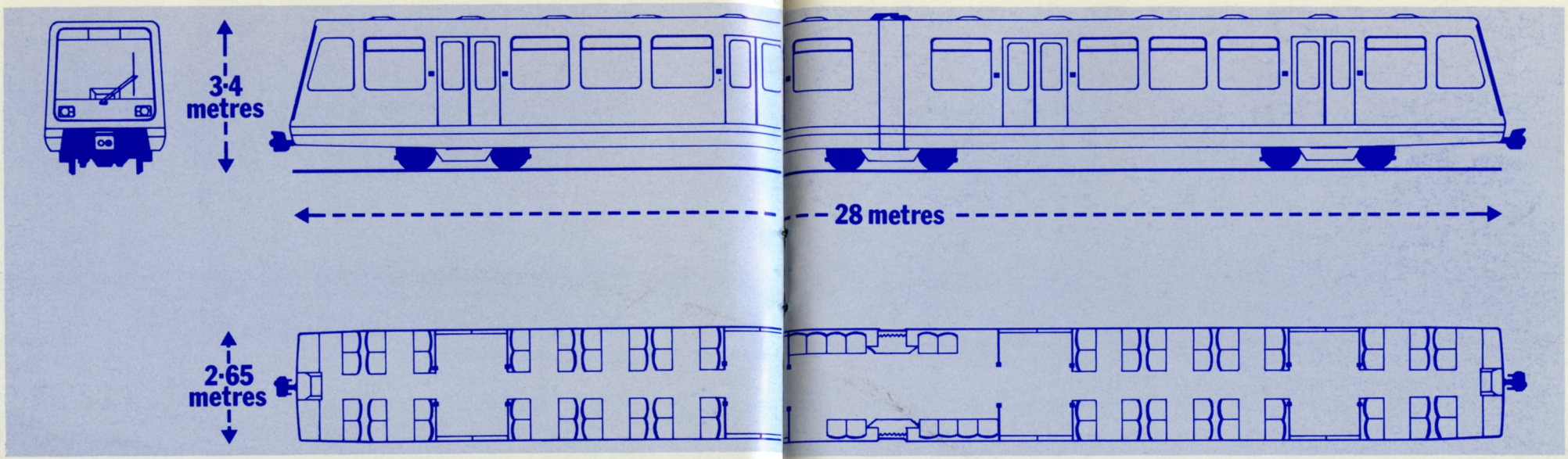
Cars 01 and 04 are fitted with on-board rail lubrication equipment. The neck of the filler pipe is just visible below the headlight on the left of this view.

As well as the 11 passenger cars, a single Wickham CT30 service vehicle is included in the contract for the initial railway. It is pictured helping to assemble steelwork at All Saints station.

Below left Picture of the Emergency Driving Position fitted to both ends of all cars to allow manual operation. The panel allows the Train Captain to operate all the doors from the end of the car.

Below right The under-arm power collection shoe can be fitted with a protective cover when not in use.





Layout of DLR cars as built showing mix of transverse and longitudinal seating. The cars are numbered simply 01 to 11. Normal operation is automatic, the Train Captain being free to move about the train to inspect tickets and assist passengers. Following automatic activation of the passenger 'door open' facility at the appropriate side, the Train Captain must initiate closure from any doorway on that side. The Captain's own doorway is closed separately, and there are controls for re-opening doors and for emergency braking. Emergency Driving Positions (EDPs) are provided at each end of the car. From these the Train Captain can drive manually either with the protection of the track-to-train safety signals in the ATP manual mode or at limited speed (12½ mph maximum), in the Emergency Shunt mode.

MAIN FEATURES OF THE VEHICLES

GENERAL
Two-body articulated units of the following dimensions:

Length – 28m (91ft 10in)
Width – 2.65m (8ft 8in)
Height – 3.40m (11ft 2in)
Weight – 39 tonnes(38.4 tons)

Bogie centres – 10.0m (32ft 10in)
Bogie wheelbase – 2.10m (6ft 11in)
Min track curve radius – 40m (130ft)
approx (tare)

Passengers – 84 seats, 130 standing
Capable of operating singly or as multiple-unit trains with automatic coupling.
Maximum design speed 80 km/h

BODY
Steel construction with polyurethane painted finish.

Four doorways each side per car, each of 1300mm clear opening, fitted with double inward-gliding doors, electro-pneumatically operated passenger control of door opening.

Seats – glass reinforced plastic frames with moquette covered cushions and squabs.

BOGIES
Of welded steel H-frame construction, with rolling rubber ring primary and airbag secondary suspension. Roller bearing slewing rings.
The outer bogies are motored, the longitudinal frame-mounted motor driving both axles via right angle gearboxes and flexible drives.
Single disc brake per axle, the actuators on the motored bogies incorporating spring-applied parking brakes.
Resilient wheels of 740mm (2ft 5in) diameter new, 660mm (2ft 2in) minimum.

TRACTION CONTROL
Supply 750 volts dc from an under-running third rail.

The two motors are fed in parallel from a two-phase chopper giving an overall frequency of 528 Hz. Each half of the chopper uses a single Gate Turn-off Thyristor (GTO).

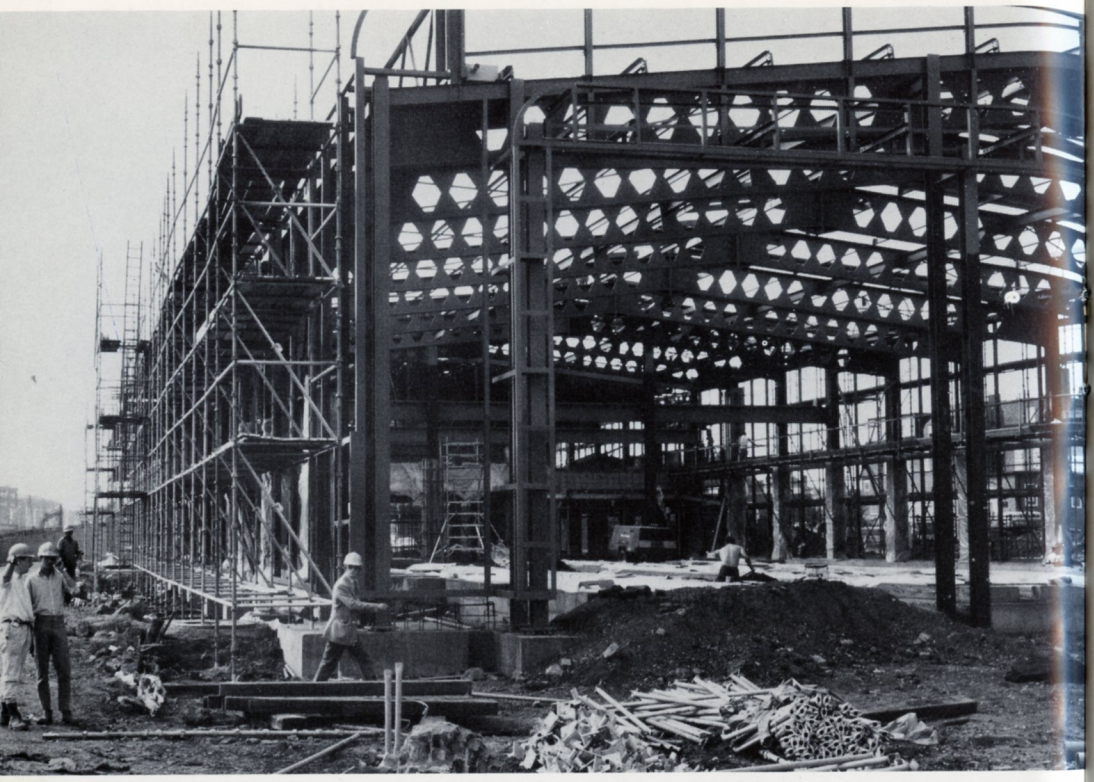
The motor fields are series fed in motoring, but separately excited in rheostatic braking. Regenerative braking is not provided.

Maximum accelerating current – 700 amps/vehicle.

AUXILIARIES
24 volt battery charged by an ac-dc converter operating at 600 Hz 10 Kva capacity.
Compressor – Hydrovane (rotary vane) type TB11/C14.

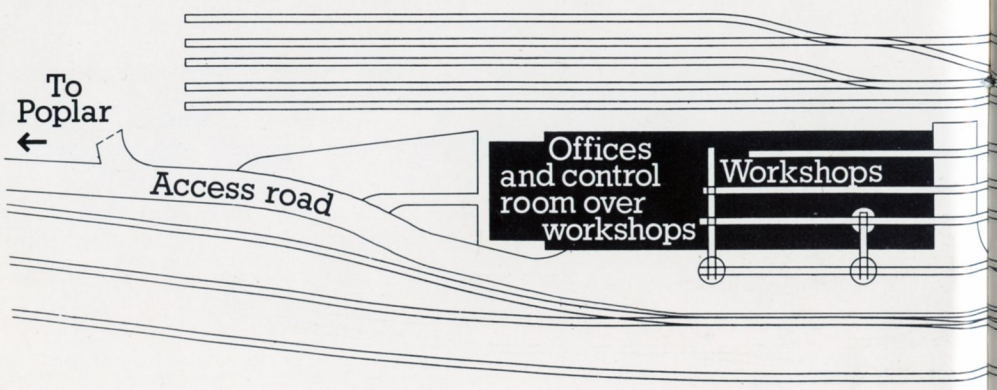
Automatic couplers – Scharfenberg.

PERFORMANCE DATA
Acceleration 1.0m/S^2
Service braking 0.8m/S^2
Emergency braking 1.2m/S^2



Imposing though the Operations and Maintenance Centre may be, it is rather smaller than a London bus garage and reflects the thrifty attitude of sending out major maintenance work for other parties to handle more economically. This photo looks west into the workshops in September 1985.

General layout of the Operations and Maintenance Centre in Poplar. Poplar station is immediately to the left (west).



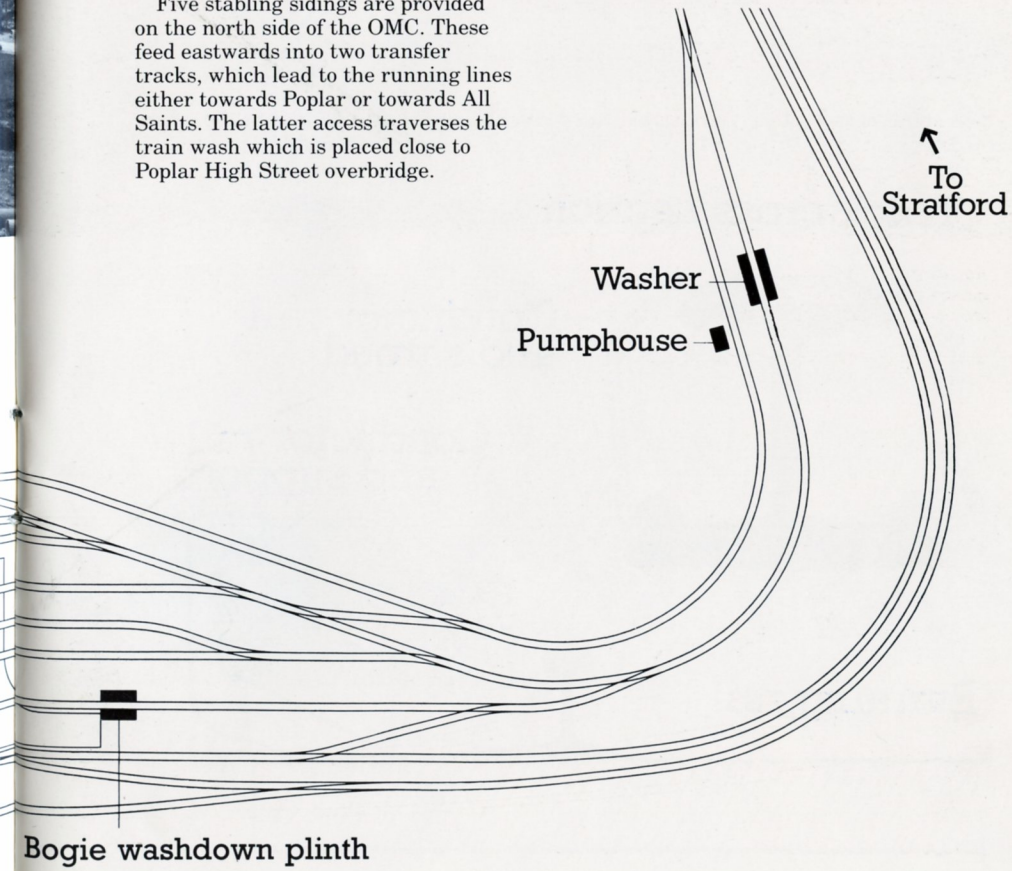
RAILWAY HEADQUARTERS

Not surprisingly, this local railway has local headquarters in Poplar – between Poplar High Street and the New Billingsgate Fish Market. The headquarters, the full title of which is the Operations and Maintenance Centre (OMC), contains all the administrative, operational and maintenance functions necessary for the running of the DLR.

The OMC is not designed to provide full heavy overhaul facilities for the small DLR fleet, concentrating instead on service maintenance with some overhaul and repair capacity. It is intended that the workshops could carry out all work up to a half-life overhaul, with selected items and certainly some larger items sent away for repair and refurbishment.

The steel-framed building built on piled foundations is finished in a distinctive blue profiled steel cladding with the reception and first floor control room located at the western end; all administrative and operational offices are located on first floor level above ground floor workshops and plant rooms. At the eastern end are the vehicle workshops, complete with three parallel tracks with sunken pits. The northernmost of the three pits is built around a so-called swimming bath pit that is substantially wider than the track gauge to allow for exterior low-level bogie inspection. There is an electrically operated 7.5 tonnes capacity overhead crane at the western end of the workshops operating at right angles to the lie of the pit tracks and extending out towards the south side of the building where there is a road vehicle access space.

Five stabling sidings are provided on the north side of the OMC. These feed eastwards into two transfer tracks, which lead to the running lines either towards Poplar or towards All Saints. The latter access traverses the train wash which is placed close to Poplar High Street overbridge.

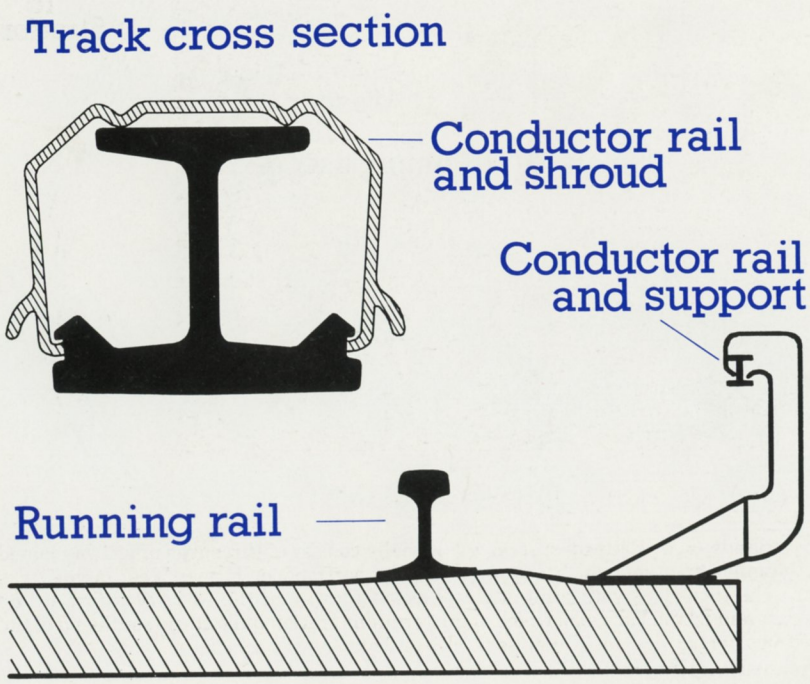


POWER SUPPLIES

The Docklands Light Railway obtains its main power supplies from two separate London Electricity Board (LEB) intakes at Poplar and through a substation located under the railway west of Poplar station. This substation feeds separately each track of each of the railway's three branches. Power for signalling and the Operations and Maintenance Centre is also obtained from these sources. The duplication of intakes and of substation equipment is intended to guard against total loss of supplies. However, in the event of this happening, essential lighting and communications circuits are maintained to permit safe and orderly evacuation of the railway. Station power supplies are obtained locally from the LEB street network and, again, a battery back-up system is provided to maintain an adequate level of lighting for safety.

Traction current is distributed at 750v dc by means of a small-section aluminium conductor rail with a stainless steel contact surface bonded to the body of the rail. The superior conductivity of aluminium compared to conventional steel rail, and the low current demands of the vehicles, permit the use of a single substation to feed the entire system. The current rail is of bottom contact type with a plastic shroud protecting the upper and both side surfaces, minimising the risk of accidental electrocution and avoiding the problem of snow and ice normally associated with low-level current collection systems. The trains themselves will be fitted with air-applied copper collection shoes on glass reinforced plastics arms, mounted centrally on each side of the motor bogies.

Cross-section of third rail with plastic shroud, also showing relative position of conductor rail to running rail.



Terminus of the initial railway is a site in Minories, where the cars are parked in this view taken before construction started. Fenchurch Street station and City tower blocks lie to the west in the background of the picture.
This and all the photographs on the following six pages were taken in August 1984.

THE ROUTES DESCRIBED

The Docklands Light Railway system will initially consist of three legs of railway joined at a triangular junction, which is built just to the north of the former West India Docks system. The three legs will terminate at Tower Gateway in the west, Stratford in the north east and Island Gardens, which is the terminus station built at the south end of the Isle of Dogs, facing Greenwich across the River Thames.

THE CITY ROUTE

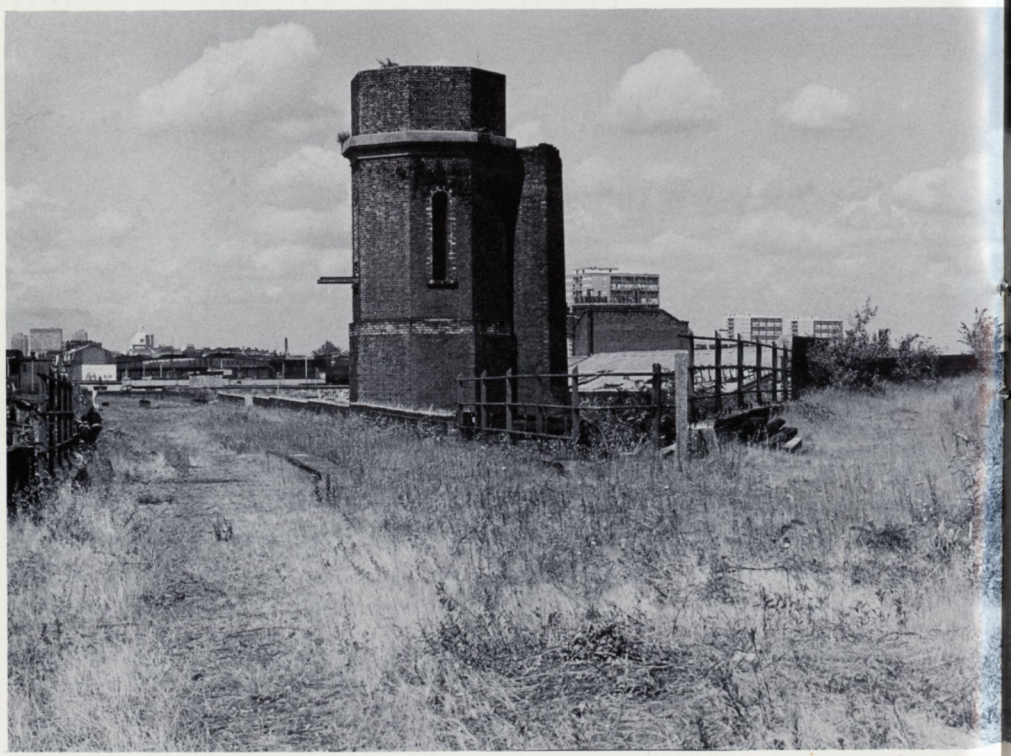
Tower Gateway terminus is built on a new structure close to the eastern end of the British Rail Fenchurch Street platforms. The DLR terminus is on the east side of the street called Minories. Nearby Tower Hill Underground station will provide interchange between DLR services and the Circle & District lines of the Underground.

From Tower Gateway (DLR) a new double track structure will carry the line east as far as Cannon Street Road. Between this point and Stepney the DLR will move on to the existing viaduct where British Rail has given up two of its former tracks. A station is being built at Shadwell, where the viaduct crosses Watney Street, for passengers to change for the East London Line Underground station in nearby Cable Street, or to reach Watney Market shopping centre to the north of the station.

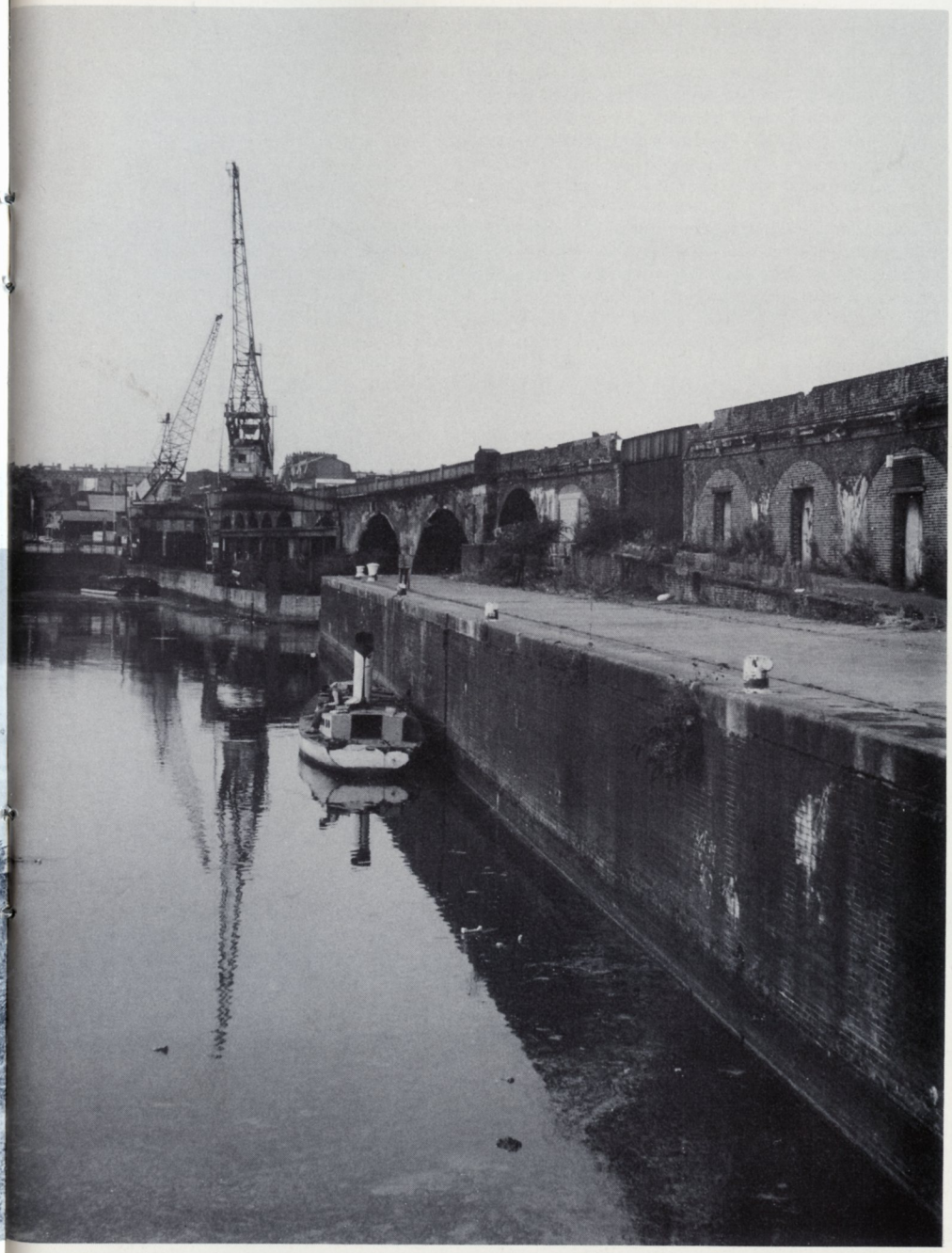
Near Limehouse by the British Rail Stepney East station, a new structure is provided to carry the line over Butcher Row. A new DLR station is being built to the east of Butcher Row, called Limehouse, allowing convenient interchange between British Rail and DLR services. British Rail's Stepney East station will be renamed Limehouse during 1987 East of this station the line leaves the BR alignment and follows the course of a disused railway viaduct. Although this structure was built as long ago as 1840 for the London and Blackwall Railway, it is still in good condition.

The line passes close to the Regents Canal Dock – also called Limehouse Basin – and then continues east crossing Westferry Road where another station, called Westferry, has been built. Then, after crossing West India Dock Road, the site of the North Quay high level triangular junction is soon reached, just to the north of the West India Docks, the final ascent to the junction being a spectacular 4.3 per cent gradient.

Urban dereliction can create some quiet spots in the middle of a city. On the left is the London and Blackwall Railway viaduct with the former hydraulic accumulator in the centre of the picture. Barely thirty yards behind the tower is the teeming life and heavy traffic of the Commercial Road.



Picturesque though it may be, docklands dereliction meant few jobs and poor prospects for eight square miles of London. Limehouse viaduct and the Limehouse Basin looking towards British Rail Stepney East station and the City.



THE ISLE OF DOGS ROUTE

The route through the Isle of Dogs to Island Gardens runs from the North Quay Junction (to the north side of the former docks) to West India Quay station, which is built in the space between two quayside warehouses on the former West India Import Dock. A series of new bridges then carries the line across all three docks in the West India system, with stations at Canary Wharf and Heron Quays.

After crossing the docks the route curves sharply to the east and descends slightly to South Quay Station before rising again in order to cross the Millwall Cut, again with a clearance of 8 metres (26 feet) above water level. From here the line descends and curves sharply to the south. The route then continues south on new structure, passing Crossharbour station near the Asda store at the District Centre (east of railway) and the Sports Centre (west of railway) housing a sports complex capable of accommodating 12,000 people.

After this station the alignment of a disused railway embankment carries the line south beside East Ferry Road to a point where it turns east and crosses the road on a new bridge which also supports Mudchute station. Leaving Mudchute station, the construction continues on to another old viaduct. This structure is a single track viaduct built in 1872 and it is still in good condition despite the fact that it has been totally disused since 1926. This 27-arch viaduct runs through Millwall Park ending at Manchester Road. Here a new bridge carries the line across Manchester Road to a two-platform terminus at Island Gardens. Passengers can cross the Thames to Greenwich using the nearby 1902 pedestrian tunnel.

Looking south from the London and Blackwall embankment in Poplar towards the West India Docks where the railway is carried through the gap between the warehouses. The distant warehouses behind the white ship are on Canary Wharf.

Towards the south end of the Isle of Dogs the new DLR uses the surviving 1872 viaduct. Visible on the skyline are the group of Greenwich attractions to which so many tourists flock, including the masts of the Cutty Sark on the right.

Island Gardens station site before demolition of the original arches, looking north in August 1984.

THE STRATFORD ROUTE

The line to Stratford heads east from the North Quay triangular junction and rapidly descends to Poplar station. The Operations and Maintenance Centre is on the northern side of the line, north-east of Poplar station. The route then turns into shallow cutting to follow the course of another disused railway to Bow.

Stations have been built at All Saints, Devons Road and Bow Church and there is provision for an extra station at Carmen Street should finance become available. North of the Bow Church stop the railway is reduced to a single track and a new climbing curve carries the track from the cutting of the former North London Railway to the embankment of the high level British Rail Fenchurch Street to Stratford line.

From here the line makes use of a surplus single BR track at the south side of the Liverpool Street to Stratford Main Line. An additional stop at Pudding Mill Lane between Bow Church and Stratford is also under consideration. Fortunately a bay platform, never used by normal services, is available at the western end of Stratford's up platforms, and this will be used by DLR trains. Passengers will be able to conveniently change to the Central Line and BR services, as well as leave the station to reach Stratford Shopping Centre and the bus station.

Poplar, looking towards the site of the DLR North Quay Junction. Remnants of the once extensive railway sidings remain in the foreground. The surviving West India Dock Company warehouses dominate the skyline on the left of the photograph, though the Nat West tower in the City is visible above the London and Blackwall embankment near the centre of the picture.

Although looking derelict and scruffy, the bay platform at Stratford provides a brilliantly simple chance for excellent connections at this important rail-bus interchange station.

Summing up the state and the nature of the route between Poplar and Bow, this photograph looks north towards the Fawe Street footbridge. Overgrown with small trees, the platforms of the former South Bromley station are on the left.

LOCAL RAILWAY HISTORY

About three quarters of the DLR re-uses existing railway routes. Some of these older railways have been disused for many years, others remained in service right up to the day the DLR took over the tracks. The origin, development and, in many cases, decay of these railways is closely tied up with the history of the docks and each of the three arms of the DLR covers a different generation of railway development.

THE CITY ROUTE

In 1836 an Act of Parliament was passed authorising the construction of 'The Commercial Railway' running from Minories, by the City Wall, 3½ miles east to Brunswick Wharf at Blackwall. The railway passed close by the Regents Canal Dock, the West India Docks and the East India Dock. The railway was not initially intended to handle freight – rather it sought to attract large numbers of passengers whose journey from London to the Docks had up until then to be made either by river – slow and often circuitous – or by road, which was even slower. Before the introduction of the telegraph, all messages had to be conveyed by hand and a continuous stream of clerks, message boys and businessmen travelled to and from the Docks daily. Additionally, the increasing popularity of the seaside had resulted in a growing number of steamer services from London to Kent and Essex resorts – services which could operate far more cheaply and efficiently if they started from Blackwall.

Two rival schemes had been put before Parliament for very similar routes to the docks and the unsuccessful rivals eventually merged with the Commercial Railway, with George Stephenson and George Bidder becoming the Company's engineers. In 1839, a year after construction had started, the company received parliamentary approval for an extension from Minories to Fenchurch Street and a formal change of name to The London & Blackwall Railway.

Opening on 4th July 1840 the London & Blackwall Railway was for its day a sophisticated and rapid system. Carried mainly on a 4,020-yard viaduct – the cheapest way of building in a congested urban area – the double-tracked railway was cable-hauled using a drum-to-drum system and seven miles of hemp rope for each track, with winding engines at either end of the line. Only from Poplar to Blackwall did the railway come first down to ground level and then into cutting.

The track gauge was wider than most other railways, being 5ft 0½in, and carriages, each with its own guard/brakesman, started every fifteen minutes from each terminus. From Minories to Blackwall a group of carriages started out together and as each station approached a carriage was detached and, releasing the rope grip, braked to a halt, whilst the rest of the train continued on its way. For Blackwall to Minories journeys, the rope direction was reversed and the individual carriages returned to the City. To ensure efficient regular operation, the railway relied upon the newly invented Cooke and Wheatstone electro-magnetic telegraph – one of the first recorded commercial uses of the telegraph system.

Within two years of opening the railway had extended into the City to Fenchurch Street and was experimenting with goods traffic. It was however isolated from the rest of the growing London rail network by virtue of its wide track gauge and cable haulage, the cables having a tendency to occasionally twist or snap, despite now being metal instead of hemp. To expand further the railway needed to standardise its equipment. In 1845 Parliament passed an Extension Act for the London & Blackwall Railway, authorising a connection with the Eastern Counties Railway at Bow and the change of gauge and haulage. The last cable-hauled train ran on 14th February 1849; from then on the London & Blackwall became a conventional railway.

POPLAR TO STRATFORD

The Eastern Counties Railway was incorporated in 1836, to run from Shoreditch to Norwich and Yarmouth via Chelmsford and Ipswich. After an uncertain start the company expanded, swallowing other smaller railway concerns. Within the London area the Eastern Counties railway helped promote and then bought the branch line from Stratford to North Woolwich in 1846/7 It had leased the line from Stratford via Bishops Stortford to Norwich and had established at Stratford what was to become a major railway works. The London & Blackwall now became part of the growing Eastern Counties passenger and freight network in East London, being eventually leased completely in 1865 to the Eastern Counties Railway, by now termed the Great Eastern Railway.

Other railways beside the Eastern Counties wanted to share in the lucrative docks traffic, and it was through a rival company, the North London Railway, that the DLR section from Bow Church to All Saints came to be built.

The North London Railway (NLR) started in 1846 as the East & West India Docks and Birmingham Junction Railway Company. The intention was to build a freight line linking the docks with the London to Birmingham line at Chalk Farm in North London, attracting goods traffic away from the canals. It took five years to build and open the line as far south as Bow, and it was not until 1852 that the railway reached Poplar. Here the railway company had bought the feeder reservoir for the West India Docks and converted it into a dock in its own right. Poplar Dock was served by a large goods depot with warehouses and an extensive yard of sidings with over 14 miles of track.

Passing through some of the more prosperous new suburbs of London, the railway company carried passengers from the start, although it was not until 1866 that passenger services extended south of Bow. Both passenger and freight traffic grew steadily in the 1860s and in 1863 the company, now titled the North London Railway, opened its locomotive and carriage works at Bow. Here, both engines and carriages were designed, built and overhauled for some sixty years until after the grouping of railway companies in 1923 when the works became an overhaul depot only.

The heyday of the North London Railway was the last twenty years of the nineteenth century. A small and efficient railway company using the first automatic ticket issuing machines in this country, the railway's passenger trains ran an average of two million miles a year at the turn of the century. Over its Poplar line ran three other major railway companies' freight trains, and around Poplar Docks were grouped huge warehouses owned by both the North London Railway and by the other railway companies.

WEST INDIA QUAY TO ISLAND GARDENS

In complete contrast to the NLR was the tiny neighbouring Millwall Extension Railway, the route of which is now used by the DLR from Crossharbour to Island Gardens. It began back in 1865 when construction work started on the Millwall Dock, where it was intended to provide the most up-to-date equipment for efficient cargo handling with the minimum labour. Millwall Dock was built with an internal rail network, designed around horse-hauled wagons – steam locomotives were too much of a fire risk with quaysides of wooden ships, often with canvas sails.

At around the same time, the Great Eastern Railway and the Millwall Canal Company (owners of the Millwall Dock) jointly proposed a railway which would develop the southern part of the Isle of Dogs. Running south from Millwall Junction at the top of the Isle of Dogs, the line would skirt the east side of the West India Docks and pass alongside the Millwall Dock to terminate on the bank of the Thames close by the jetty for the ferry to Greenwich.

Although this railway, the Millwall Extension Railway, would benefit its promoters, the neighbouring East & West India Docks saw the line as a threat, abstracting traffic, and they objected vigorously, especially to the proposed section through the West India Docks. Thus it was that the Millwall Extension Railway took six years to build, opening in 1871 to Millwall Docks and in 1872 to North Greenwich Station.

Single track throughout, with a passing loop at South Dock station, the railway was affectionately known locally as the 'penny puffer' The original locomotive and coaches survived until 1922 when three secondhand Great Western Railway Railmotors (a steam engine and carriage combined) were bought as replacements.

INTO THE TWENTIETH CENTURY

By 1926 few passengers used the Millwall Extension Railway – changing travel habits and increasing competition from motor buses bit deep – and in June 1926 the line to North Greenwich closed to passengers, although for many years parts of the route survived within the dock railway network. Competition from electric trams and motor buses was also affecting the London and Blackwall route from Fenchurch Street, and in the same month passenger services to Blackwall were withdrawn and the stations east of Stepney East closed. Only the North London Railway and Poplar line survived the inter-war years without station closures, continuing to enjoy quite substantial passenger traffic. The movement of freight continued and all three lines handled much dock traffic, although a section of the Millwall Railway had now been diverted to make way for an extension of the West India South Dock, and the section south of Millwall Dock had been abandoned altogether.

The railways suffered along with the East End as a whole from air attack in World War Two. The goods warehouses by Minories and the City were extensively damaged and the railway warehouses surrounding Poplar Docks were all but destroyed. Shadwell Station on the Fenchurch Street line closed to passengers in 1941 following bomb damage. The North London Railway Poplar line was crippled by a series of hits, and closed to passenger traffic in May 1944.

Around the East End a great deal had changed after war ended in 1945. Many of the densely packed streets and houses had been destroyed and there was little reason to restore withdrawn passenger services. The lines remained open for freight and for the next fifteen years continued to carry heavy traffic. However, cargo handling was changing in the docks and with it changed the type and size of ship. The Port of London Authority began to concentrate improvements on the larger down-river docks at Tilbury and gradually the docks were run down.

As traffic into and out of the docks declined, so the rail network was pruned back. First to go was the London & Blackwall line from Stepney East to Blackwall, closing in 1966. The Port of London Authority railways, which had included sections of the Millwall Extension ceased in 1970. In 1980 both the West India and the Millwall Docks closed. By then the North London railway route from Victoria Park to Poplar had been reduced to a single line and was becoming increasingly overgrown and derelict. Although not formally closed to traffic, services effectively ceased here after 1980.

The former North London Railway route between Poplar and Bow was built mainly in a shallow cutting. The DLR inherited several road overbridges that have required substantial rebuilding and improvement, particularly near Chrisp Street Market, north of East India Dock Road.

PRINCIPAL INTERCHANGE POINTS

Although the DLR is intended to link an area with poor public transport provision into the main London network, even the initial system features a large number of interchanges with bus and rail systems. The principal practical interchanges are:

GREEN ROUTE – CITY TO ISLE OF DOGS

Tower Gateway	Underground Circle & District lines at Tower Hill – 200 metres (218 yards) west of Tower Gateway Station.
	Minories Bus Station – 250 metres (273 yards) north of Tower Gateway Station.
	Aldgate Metropolitan line – 300 metres (328 yards) north of Tower Gateway Station.
	London Buses to the City and West End from adjacent streets.
	British Rail Network SouthEast services to Tilbury and Southend from Fenchurch Street Station.
Shadwell	London Underground East London Line in nearby Cable Street.
Limehouse (Stepney East)	British Rail Network SouthEast Fenchurch Street to Southend Line services.
	London Buses passing in Commercial Road.
Westferry	London Buses in Westferry Road.
Crossharbour	London Buses serving the Asda Superstore close to Crossharbour station.
Island Gardens	London Buses Isle of Dogs services.

RED ROUTE – STRATFORD TO ISLE OF DOGS

Stratford	British Rail Network SouthEast services between Liverpool Street and parts of Essex and East Anglia. North London Link services between Richmond and North Woolwich.
	London Underground Central Line.
	London Buses services at Stratford Bus Station.
Bow Church	District Line services from Bow Road – 200 metres (218 yards) south west of Bow Church Station.
	London Buses routes on Bow Road.
Devons Road	London Buses local service.
All Saints	London Buses serving East India Dock Road.

Although no large scale interchanges have been included in the fixed-price contract for the initial railway, there is an extensive range of local connections in the area. It must also be remembered that the initial system is a small railway, and a number of the trips made on it will be in lieu of travel by other public transport means and not as part of a longer journey involving complex interchange.

Naturally, much interest focuses on the journeys between the City of London and the Isle of Dogs, the green route, but it is expected that an increasing number of trips of an extremely local nature will develop when the railway opens in 1987 particularly to and from Stratford, the red route.

The Stratford route, cutting north to south across existing congested east to west traffic arteries, will provide a fast and frequent means not only of reaching the shopping areas of Stratford, but also of travelling south to the Asda Superstore, Crossharbour from the Stratford area. The Chrisp Street Market near All Saints station is strategically well-placed between Stratford and Crossharbour.

The location of the railway between the major tourist attractions of the Tower of London and Greenwich is also expected to attract tourists in large numbers. This traffic can only be enhanced by the enormous attractions planned for the docks areas, and by the spectacular views from the trains themselves as, soaring high above Docklands, passengers catch glimpses of the docks, the Thames, Greenwich and the buildings of the City.

The single biggest interchange deficiency with the initial railway is the siting of the City station at Tower Gateway. It is frankly admitted that this site is far from ideal. However, it must be remembered that in the cash-limited way in which this railway has been permitted to proceed, it has not proved possible with the money available to plan a more suitably-sited station, which would involve either tunnelling or an environmentally unacceptable intrusion of the viaduct into the City. A closer link with other existing transport facilities in the east side of the City is still wanted.

Plans did already exist before the plans for the exciting Bank extension. These included proposals for an underground loop via Aldgate East to the north of the present Tower Gateway site. All such schemes were too expensive: most of the termini on these tunnel extensions would in fact have cost more than the total sum now committed to the initial railway.

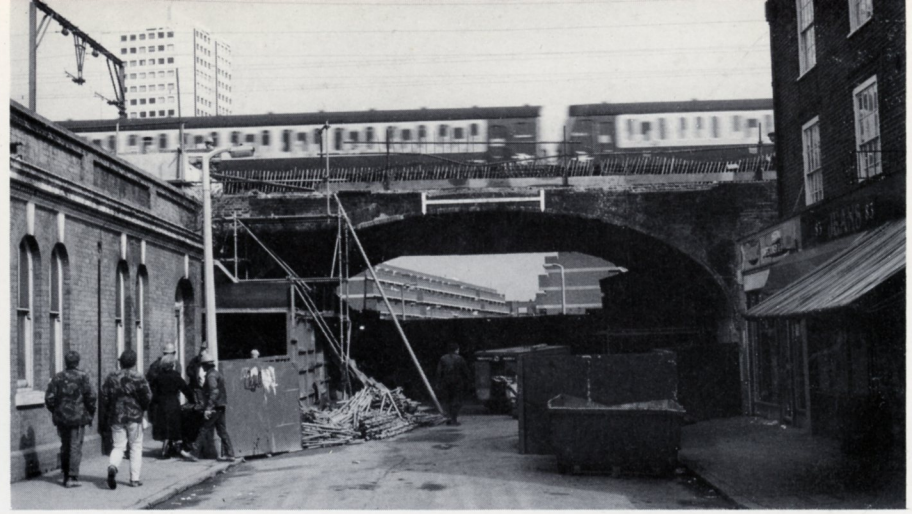
The proposed Bank Extension is a far more dramatic improvement to interchange facilities than anyone involved in the project could ever have originally hoped for, providing as it will interchange with major Underground lines, the Central and the Northern, the District and Circle via Monument Station and British Rail's Waterloo and City Line.

LEGAL POWERS

Although the railway name centres on the descriptive title Light Railway, the DLR is not actually a Light Railway built under a Light Railway Order. Rather, it is a proper Act of Parliament railway established by the London Docklands Railway Acts of 1984 and 1985. The phrase Light Railway has been retained because of its association with Light Railway technology, but that is not to say that other titles have not been actively considered, because they have! Generally, the suffix Line has been avoided because Lines in London are not particular to one geographical area (the Piccadilly Line serves north, central and west London, for example), whereas the Docklands business belongs to only one area.

Of the two Acts, the 1984 one covers the City and Isle of Dogs sections, the 1985 Act the Poplar to Stratford leg. Although the first Bill was deposited in November 1982, it did not received Royal Assent until April 1984, due partly to the 1983 General Election and partly to the hearing by Select Committee of the House of Lords of an unresolved Petition from a printing company, who successfully claimed that its sensitive equipment would be adversely affected by the railway.

The second Bill was deposited in November 1983 (Private Bills, such as those for the DLR, can be deposited only in November of each year) and received Royal Assent in April 1985 after Select Committees of the Commons and of the Lords considered Petitions on behalf of two separate groups of residents adjoining the railway, near Bow Road, who were understandably concerned about visual intrusion, noise and vibration, although very severe limits had been imposed in the Contract.



Summing up just how difficult railway building and land and property acquisition are in an old-established urban area is this view of Watney Street, Shadwell. Shops have to stay open and pedestrian access to Watney Market through the arch has to be maintained while Shadwell DLR station is constructed to the right of this April 1986 picture. At this point, BR and DLR tracks share the brick viaduct.

PROPERTY ACQUISITION

At first sight it may seem as though the railway is blessed with being able to use a lot of redundant railway land that no-one else has previously claimed. However, almost the whole of the City arm has involved tenants trading from arches underneath the old viaduct and at certain other places on the system, notably in the vicinity of Bow Church Station, other very sensitive property and occupation matters have had to be tackled.

The DLR project team's philosophy has been to handle negotiations locally. Face-to-face meetings have been followed up with written replies, leading to legal settlements. It was feared that the coming of the railway would adversely affect local employment in destroying or damaging prospects for the companies trading under the arches. The methods used have kept disturbance to a low level but have not been able to eliminate problems completely.

The project team had to contact over 300 occupiers who were given notice that they might be affected: that is, those who occupied premises or land within the parliamentary Limits of Deviation, which is the document determining the route of the railway. All occupiers were visited and advised of the DLR proposals. The project team organised a small group to carry out this work, allowing known faces and names to deal with tenants rather than them having to deal with distant organisations, leading to possible misunderstanding. Each piece of land, building and arch along the route had to be categorised:

Category 1A	Tenants who must be permanently displaced.
Category 1B	Tenants who had to be displaced for the duration of works.
Category 2	Where part-temporary occupation of an archway or other property was essential to carry out works.
Category 3	Was defined as where occupation was not absolutely essential to carry out the works, but protective insurance might be required to cover for accidental damage during the construction period.
Category 4	Was where occupation was not necessary, but where warning of adjacent works would be required.

In the end, the mixture of relocation and resettlement in compensation terms included all or some of the following: temporary storage of business property, temporary reallocation within another arch, finding alternative premises away from the railway, settlement of money to extinguish a business and compensation for loss of income.

CIVIL ENGINEERING

Two-thirds of the 7½ route miles (12.1km) uses former disused or under-used railway lines. Even so, considerable new works – in volume and variety – have been necessary to accommodate the DLR.

Beginning with the City route, the terminus at Tower Gateway is constructed on a new reinforced concrete viaduct. A double track viaduct has been constructed eastwards parallel to the British Rail Fenchurch Street lines. In this area a reinforced concrete slab supported by both the existing viaduct and independent foundations is used. Elsewhere an independent steel and concrete composite design has been used. From Cannon Street Road (1 km east of Tower Gateway) the DLR joins the BR viaduct and actually takes over the tracks of the former BR lines on the south side of the viaduct. The existing 113lb flat bottom rails will remain for DLR use in contrast to the 80lb rail used elsewhere.

At Shadwell the existing viaduct carries a new island platform station built on the south side. A 200 metre reinforced concrete viaduct has been constructed south of the BR Stepney East station site to avoid the existing running lines and tie into the western end of the disused brick arch viaduct of the former London and Blackwall Railway. From here to the West India Docks the line uses more of the 1839-constructed viaduct. Generally, this structure was in remarkably good condition before work started: some arches required strengthening with a concrete overslab, others just repointing. Part of the viaduct is a grade II listed structure, in particular the 90 ft span arches at Limehouse Basin. As well as repairs to the arches, 11 wrought iron bridge decks needed replacing with new concrete decks. To maintain the traditional viaduct elevation the original side girders have been removed, refurbished and put back in place again. At West India Dock Road the two-span bridge has been reconstructed to include the original solid pink granite columns in the road, for so long hidden under black paint. Between this bridge and the North Quay triangular junction the railway rises up from the brick arches using the standard steel and concrete composite structure to gain height. This junction incorporates three double junctions with 40 metre radius turnouts.

South of the junction the Docks Crossing begins. Although maximum use of standard rolled steel sections is made elsewhere, especially fabricated 65 metre spans are provided in each of the three docks with an eight metre clearance to the water.

South of the docks the line turns east on a typical Light Rail 50 metre radius curve and then winds its way south through the island on standard elevated structure, though a fabricated length is needed to cross the Millwall Cut water link between the Millwall and West India Docks.

South of Crossharbour the railway descends on to the earth embankment before being carried on a short length of standard new viaduct (containing Mudchute station) to tie in with the 27 surviving arches of the single track Millwall Park viaduct. Some repair and drainage work, raising of the parapet and new handrails have been necessary. The southern end of the viaduct has to be raised to provide clearance over Manchester Road. False arches have been incorporated into the new Island Gardens Station site.

The route from North Quay triangular junction to Poplar and Stratford contains several one-off features. The Docklands Northern Relief Road bridge is a 50 metre span skew plate girder bridge provided to cross a future four-lane road. The line descends rapidly towards Poplar station on reinforced concrete viaduct over the top of the DLR electrical substation. Poplar station is constructed on retained fill to the west of the Operations and Maintenance Centre. The running lines turn northwards on a 60 metre radius curve, whilst the inside curve tracks to the workshops and stabling sidings include a 38 metre radius curve.

North of Poplar the trackbed has been re-ballasted and new drainage provided. A steel plate girder bridge has been built to carry the line over the Limehouse Cut Canal to replace the earlier badly decayed structure.

Bow Curve – taking the line from the old cutting to run beside BR on an embankment – features a 1 in 25 gradient and is laid on a 100 metre radius curve. New ballasted track is being laid towards Stratford on the alignment of a disused line and minimal engineering work is needed to adapt the western end bay platform for DLR trains to use.

An impression of the difficulty of shoe-horning a new railway into an old urban fabric is given by this westward-looking view of the Tower Gateway terminus site in November 1985. The British Rail electrified lines on the right impose their own limitation on overhead clearances, whilst the existence and then the partial demolition of the multi-storey car park to the left of the picture posed further restrictions.

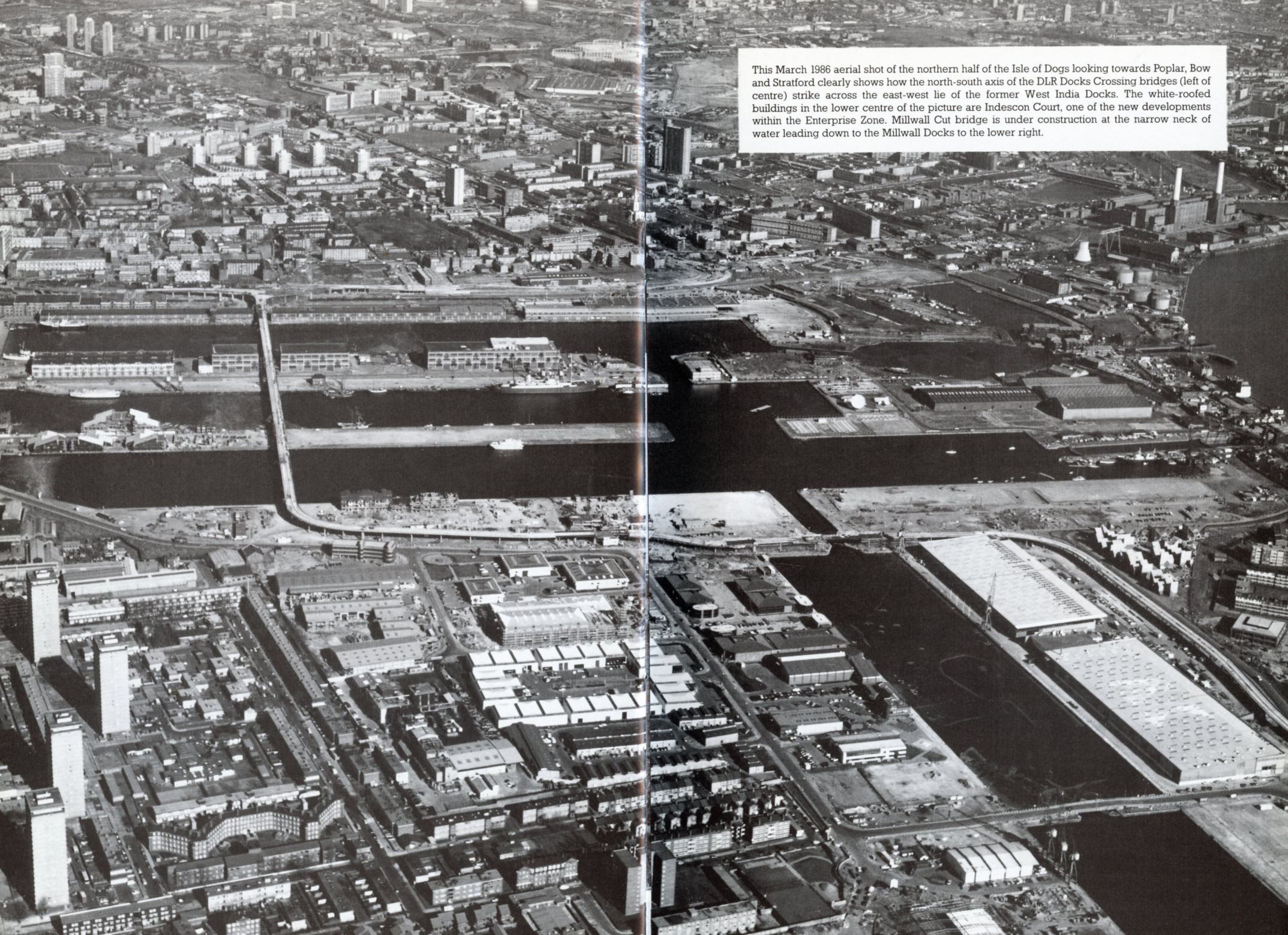
Reinforcing rods are just visible in the excavated holes to take the columns of the DLR viaduct in Cable Street (right side of the picture) in March 1985. A British Rail Class 302 train approaches Fenchurch Street station.

Steelwork for the future bridge decking in place over the crossroads junction of Cable Street (receding into the distance and to the east), Dock Street to the south (right of picture), Royal Mint Street (near camera position) and Leman Street (left of picture). Prominent on top of the steelwork in this December 1985 view are the bolt head reinforcements around which the wet-pour concrete decking will be added.

British Rail's coincidental re-signalling of the approaches to Fenchurch Street station included a reduction of running lines from four to two between Stepney East and Cannon Street Road. This allowed the DLR to position its tracks beside the remaining British Rail pair on top of the brick arch viaduct. This July 1985 view looking towards Stepney East station shows the remaining two BR tracks on the left and the recently taken out of service lines in the centre, ready for adoption by the DLR.

North Quay triangular junction, the heart of the initial railway, in February 1986. The great height of the junction above local road level is necessary in order to give clearance for pleasure craft in the West India Docks, which are immediately behind this camera position. The city route curves off to the left (west) and the Stratford route to the right (east).

One of the most difficult station sites is Westferry on the Westferry Road. The platforms straddle side streets with the access stairs located on separate sites either side of Limehouse Causeway where the cement mixer is parked.



This March 1986 aerial shot of the northern half of the Isle of Dogs looking towards Poplar, Bow and Stratford clearly shows how the north-south axis of the DLR Docks Crossing bridges (left of centre) strike across the east-west lie of the former West India Docks. The white-roofed buildings in the lower centre of the picture are Indescon Court, one of the new developments within the Enterprise Zone. Millwall Cut bridge is under construction at the narrow neck of water leading down to the Millwall Docks to the lower right.

High points in the engineering timetable for building the DLR were the placing of the three steel spans over the former West India Docks in June, July and August 1985, beginning with South Quay to Heron Quays in June. The second span is pictured here about to link Heron Quays with Canary Wharf in July.

In choosing a dramatic route over water linking derelict quays and maximising visibility of (and later from) the bridges it was hoped to excite developers and builders to quickly develop the area. This plan has been grandly successful with new development well under way a year before the railway opens. In May 1986 the Waterside development on South Quay already hides part of the elevated structures.

Re-using former railway land, new DLR tracks have already been ballasted beside East Ferry Road (right) on the old Millwall Extension Railway route south of Glengall Grove (background right) and Crossharbour station. New houses built on the western side belong to the Clippers Quay development beside part of the former Millwall Docks.

Almost as spectacular as the Docks Crossing is the descent from the North Quay triangular junction to Poplar station and the Operations and Maintenance Centre building (below the power station chimneys in this view). The lift towers of the future Poplar station can be seen to the right of the steel span DNRR bridge in this August 1986 photograph.

The Docklands Northern Relief Road (DNRR) bridge was the last major piece of structure to be built on the railway when it was positioned in March 1986 between the North Quay triangular junction and Poplar station.

All Saints, Devons Road and Bow Church stations all lie immediately to the south of busy main roads. The ticket lobby areas are located on steel-framed structures over the running lines. Devons Road stop is under construction looking north towards Bow Church in March 1986.

Bow Curve is a classic example of the ability of Light Rail to weave around existing structures where orthodox rail systems would need excessive demolition and land take. Here the DLR is changing direction from a north-south axis to an east-west one without destroying nearby residential property and in a situation where other British Rail lines must continue operating. In March 1986, the new line climbs and curves towards Stratford, right of picture.

The single-track DLR line into Stratford station, also seen in March 1986, is placed on the south side of the BR multi-track alignment. This part of the new railway is in a different landscape to the rest of the line, with high-speed trains passing on one side and acres of factories and warehouses close by on the other side.

PERMANENT WAY

It was originally planned to use a low-maintenance non-ballasted trackform throughout the system, but an extensive noise study demonstrated that ballasted track would substantially reduce noise levels and greatly benefit communities adjoining the railway. A concrete trackbed has been incorporated on all new elevated structures to keep to a minimum the imposed load and consequently to contribute to the economy of the design. In addition, it was specified that all curves less than 100 metre radius should be fixed to a concrete trackbed.

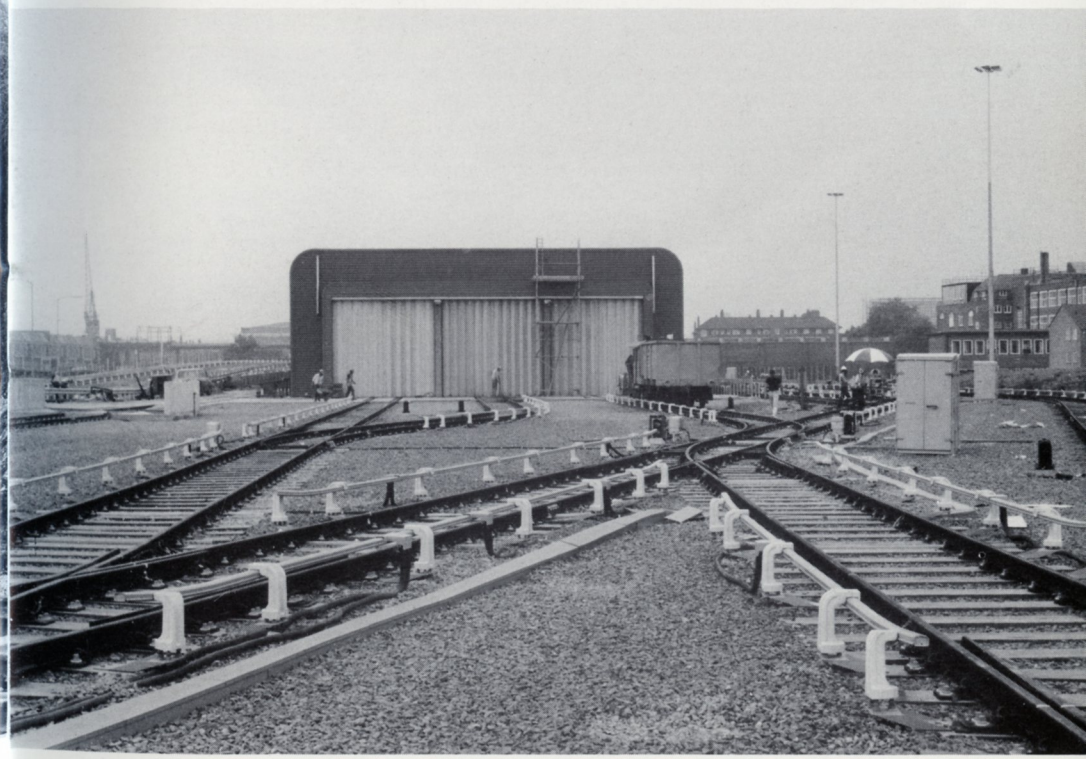
The standard rail cross section adopted for the system is BS80A 80lb per yard flat-bottom rail. The Pandrol 'e' clip fastening is used with adapted British Rail F24 type sleepers for ballasted track and a cast iron baseplate assembly on slab track. The fastening assembly incorporates 10mm thick rubber bonded corkpad between rail and baseplate or sleeper. Continuous welded rail is used throughout with alumino-thermic welds. At a location sensitive to vibration, where flats at Holyhead Close, Bow have been built on a raft deck over the line, James Walker sleeper soffit pads are being installed.

As a result of the tight railway geometry, 40 metre radius turnouts have been specially designed for the system. Where possible standard BR Cv 9¼ turnouts (adapted for 80A rail) are to be used.

Trackwork is fixed to a mixture of concrete, wood or continuous concrete slab according to circumstances. The tracklaying sub-contractor has worked north from Poplar, then south through the Isle of Dogs and finally west to the City. This train is laying concrete-sleepered track on the up line from Stratford in February 1986. In the background is All Saints station.

Rapid construction has not allowed many formal ceremonies to be carried out. One exception was a brief tracklaying ceremony at the OMC building on 18th October 1985. Chairman of the DLR Joint Board, David Hardy, who is also Deputy Chairman of LRT, handles the hardware with Christopher Benson, Chairman of the LDDC, on the left.

The eastern end of the Operations and Maintenance Centre workshops in August 1986, showing traditional timber-sleepered track and the bottom-contact third rail with continuous protective plastic covers in place.



RAILWAY MANAGEMENT

A unique feature of the Docklands Light Railway project is the particularly small size of the client management team. The form of design-and-construct contract allows the number monitoring progress of work to be kept low, but it is also true that keeping a small team has been part of the developing philosophy since the very earliest days of the project. Another key feature has been continuity: those who lived with the planning of the railway and are still here to see the building will also be intimately involved in operating it. This is a significant development and concentrates efforts on achieving a really first class end result. In many a public project – not just in public transport – those who design it, build it and operate it are often quite independent and separate groups with little mutual contact, leading to a lack of continuity and the use of the overworked phrase "Oh, I wouldn't have designed it that way!"

Within five years the railway has moved from being a project team of one person to the situation current in the middle of 1986, with a Managing Director leading a three-pronged team dealing respectively with the operation of the initial railway, the administration of the contract, and the development of extensions. Most members of the project team are LRT staff who cut their teeth on the Underground, often with an unusually broadly-based background. Contract administration has throughout been in the hands of consultants, while a variety of engineering and design consultants have been employed to evolve and develop original designs.

The project team life may be short so far, but it has at times been tempestuous, when the railway project's joint clients were originally the Greater London Council and the enterprising London Docklands Development Corporation, itself a baby of the Conservative Government elected in 1979. Add to this the good intentions of the three local authorities served by the railway – the London Boroughs of Tower Hamlets and Newham, and the City Corporation – and a good measure of activity from local pressure groups, and it takes little imagination to envisage the DLR as a political football par excellence.

Just as the tendering process for the railway was getting under way, the Government changed the rules to cause the contracting philosophy to take on the idea of the single design and construct package now in operation. As if that were not enough, as evaluation of the five tenders for the package was gathering momentum the GLC was removed from the DLR scene in an overnight change in June 1984, and LRT was boss – now itself a joint client and with its own brand of politics.

Eventually the contract settled down, and a sense of normality descended on the project, with the main item of concern being its incredibly short timescale (contract-award to public opening in 35 months) and the severe cash limits. This frenzied rush to completion was spiced in September 1985 with big business and American bankers getting down to serious development work on a new concept – a new underground extension to the far-from-completed initial outdoor system, and stretching the capacity from the original 1,500 passengers per hour to 13,000! It is no wonder that already DLR has played host to operators – and potential operators – from all over the world.

To achieve this the team has had to be flexible in the extreme and to use modern management and computer techniques to their limits. Some have dubbed DLR as a 'Mickey Mouse Railway' but, small as it is, every element of a large railway network is represented and must be initiated from scratch. London has no Light Railway experience of its own: neither does it have any experience of operating a financially independent system (obliged by Government to meet revenue expenses from the farebox) on such a small scale. Many other operators, both at home and overseas, have shown the way to go, and their help is gratefully acknowledged.

Europe	*USA and Canada*		*Far East*
Berne	Buffalo	Portland	Hong Kong
Glasgow	Calgary	Philadelphia Port Authority	
Karlsruhe	Edmonton	Transit Corporation (PATCO)	*Australia*
Newcastle	Pittsburgh	Newark	Melbourne
Rotterdam	Port Authority Trans	San Diego	
Utrecht	Hudson (PATH)	San Francisco (MUNI)	

RAILWAY STAFFING POLICY

Just as the small management team is flexible, so it is intended will all other members of the railway staff. Operating staff will be recruited and trained ab initio to work to specific new job descriptions. The job descriptions will have built into them a more flexible approach than is often the case in public transport systems in Britain and indeed other countries, although it is not without precendent in the western world. This flexible approach will be tailored to what is appropriate to a small scale transport operation employing modern technology in a different operating regime.

Staff will be trained in and around Poplar, and with shift working required for many of the jobs, living close to the Poplar Operations and Maintenance Centre will obviously be an advantage. Extensive experience in public transport operations will not be necessary. It is important to make the point that these are new jobs on a new sytem, and the relevance of other transport experience to the DLR is likely to be limited.

For operating the railway two grades of jobs are involved. Traffic Assistants, of which there will be roundly 45 vacancies to be filled, and Traffic Supervisors, to whom the Traffic Assistants will report. There will be about a dozen Traffic Supervisor jobs. A Traffic Manager will control these staff.

The final pattern of staffing for the maintenance of the railway has yet to be finalised. An option exists for the constructing and equipping contractor to enter into a maintenance contract for the entire railway, although irrespective of whether this option is taken up there will always be a need for much work to be carried out on a contract basis away from DLR premises. Cleaning duties will, in any case, be likely to remain with the railway management for separate handling by other contractors.

Light Rail is inherently economical in its use of staffing resources when compared with other forms of public transport, and the DLR being such a small unit means that the total number of jobs created will never be great. Far more important to East London are the tens of thousands of new jobs created in the Docklands areas as a direct consequence of the provision of the railway.

Principal contact between the staff and the passengers will be on the automatically-driven trains themselves. Any member of staff assuming those duties on the train will then be called the Train Captain, the title applying to the duty and not to the job description. Anyone carrying out a Train Captain's duty will have to want to get on well with the general public. With no separate driving cabs, continuous and varied contact with all kinds of passengers, involving revenue protection duties, will be the norm for this work. It would be correct to imagine that experience in any of the service industries – travel, tourism, hotels, restaurants, shops would be a useful background before training to work with DLR passengers.

Keeping staff on the trains as Train Captains, but freeing them of train driving and some safety responsibilities, allows them to develop contact with the passengers, and will be a major public relations gain for the railway. A smiling face and a helping hand will benefit the passenger – and the railway – more than any technical background could.

SIGNALLING AND CONTROL OF TRAINS

Trains will be automatically driven and conventional trackside signals will not be provided except in the vicinity of the Operations and Maintenance Centre (OMC) in Poplar. The service will be continually monitored by a central computer which will compare the position of trains with stored timetable information. The central computer will communicate with the train onboard computer when the train is at a station and docked over a device called the Docking Data Link. Depending on whether the train is running on time or is early or late, a stored speed/distance profile will be selected to adjust the standing time in the station and/or the running time to the next station. The train onboard computer controls the driving of the trains to the next station stop. The complete process is monitored by a controller at the OMC using a visual display unit which indicates the state of all signalling equipment and identifies the positon of each train.

The controller can step in to interrupt automatic running by controlling the routeing of trains using a keyboard. The monitoring and control system is known as the Automatic Train Supervision (ATS) System.

The Automatic Train Operation (ATO) system which controls the driving of trains from station to station takes into account the curvature and gradient of the track, and has the necessary speed restrictions programmed into it.

The system which ensures overall safety of the operation is called Automatic Train Protection (ATP). This consists of a number of subsystems which relate to both on-train and trackside equipment.

ATP at the trackside features conventional track circuits which positively and continuously detect the position of a train. Track circuits have formed the basic building block for a multitude of railway signalling systems, both simple and sophisticated, over many years. If a train attempts to enter a section of track which is occupied by another train ahead or if points ahead are not set correctly, then special frequency signals within the track circuit will be cut off, causing a brake application on the train. The placing of track circuits is such that should this occur, the train will alway stop well short of an obstruction.

The signalling systems also provide information to passenger information systems. Outputs from the ATS cause platform destination and next train time indicators and public address announcements to be made automatically as a train approaches.

The various routes which a train may take and the points over which they run are interlocked by Solid State Interlocking (SSI). This prevents the setting of conflicting routes on the railway and eliminates the possibility of derailing or colliding trains. Traditionally, this interlocking function has been done using electromagnetic relays. The SSI system uses computers to perform the task and is designed to an exacting standard to ensure that in the event of any equipment failure the safety aspect will be maintained. This type of equipment is already proving its reliability at sites on British Rail.

A third subsystem of ATP is the speed monitor. A separate profile of speed limits is stored in a series of trackside cable loops. The train constantly monitors its passage over the cable loops and in the event of an overspeed being detected the ATP onboard system causes a brake application and the train will stop safely.

A simplified signalling diagram appears on pages 62 and 63.

PASSENGER SAFETY

Although the elements of passenger safety are described in other parts of the text, this is such an important topic in the plans of the management team that a separate section explaining the development of the philosophy is necessary. Any discussion of passenger, and for that matter general public, safety can only be reasonably conducted when emotion is left out of the matter. Today, people seem less safe then they really are. At first sight, a railway system where none of the stations have staff in attendance in the conventional sense sounds unsafe. Yet this situation, which will exist on the DLR, must be calmly compared with the realities of staffing levels, staff-to-passenger ratios and staff response-to-incident times on other railway systems in London and the South East of England.

Firstly, in looking at a typical urban railway or metro station, one must bear in mind that usually the staff are in accommodation remote from platform areas which are not provided with any specific security system for use if any incidents should occur.

The package of protection methods adopted for the DLR and referred to internally as the PEP package (Passenger Environment Protection) seeks to improve on conventional philosophies by including a mixture of human and electronic surveillance backed up by a modern communication network. It is planned that the whole system in combination will aid passenger protection. This list is extensive: retaining staff on trains who will be freely circulating amongst passengers, observing their behaviour and observing passenger behaviour on platforms when train doors are open; a two-way radio network using police-type equipment; closed circuit TV cameras with video recording facilities surveying

platforms; small and easy to observe concourse areas at many of the stations, often overlooked by the large volumes of passing road traffic; the likely growing numbers of passengers in the future which will combine to make the system less vulnerable to isolated incidents; press-to-speak passenger alarms on the platforms which trigger the video camera recording whatever the reason for the alarm use; car-mobile travelling inspectors able to respond to incidents relatively quickly because of the localised nature of the system; and the closeness of Limehouse Police Station to the railway's control centre in Poplar. The local presence of all of the railway's management team, aided by the two-way radio network and staff training initiated in 1986 to respond to the safety and security problems of the 1980s are also relevant.

PASSENGER TIMETABLE

The philosophy behind the passenger timetable is based on the principle that the service should be so frequent and so consistent that passengers hardly need to consult conventional timetables. The standard timetable will operate between 7am and 7pm, Monday to Friday. A reduced service will operate before 7am and after 7pm, as well as all times on Saturdays and Sundays.

There will be eight trains an hour between the City and the Isle of Dogs (the green route), and eight trains an hour between Stratford and the Isle of Dogs (the red route), during the normal standard day, 7am to 7pm. At other times there will be six trains per hour over each leg of the railway. This will combine on the Isle of Dogs between the West India Docks area and Island Gardens to provide a particularly frequent service with trains hardly ever out of sight. Starting and finishing times will match the normal passenger expectations of the London Underground. Because of the simple nature of the timetable, confusion between 7am and 7pm, for example, is not likely to arise, so the still-unpopular 24-hour clock will not be used.

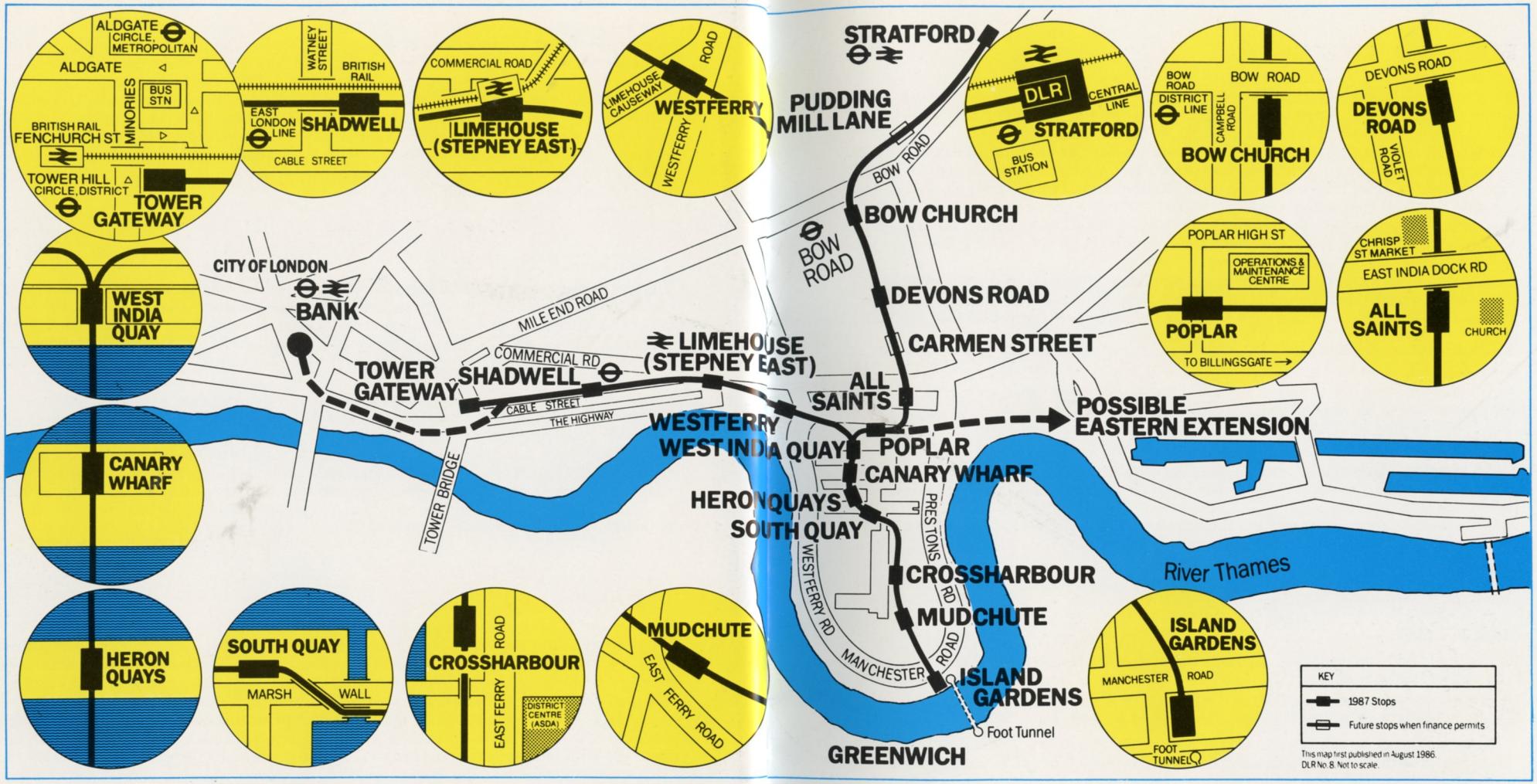
RAILWAY MAPS

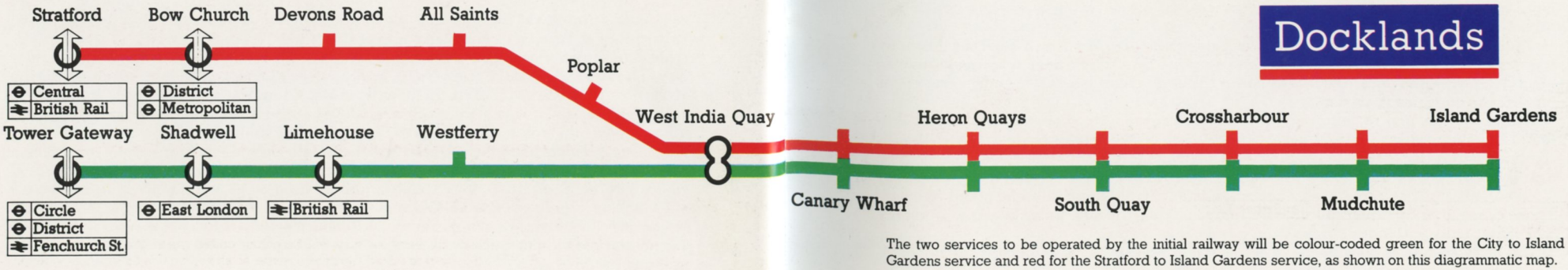
Any account of maps illustrating the railway is still an unfinished story. By mid-1986 at least eleven public maps have been produced – three by the GLC in its newsletters and a further eight by the DLR project team. Countless other versions have appeared in the excellent publications of the London Docklands Development Corporation and London Regional Transport, as well as elsewhere.

The GLC-inspired newsletters contained a map indicating former types of land being acquired to build the railway, but the siting and naming of many stations is now out of date. The DLR project team published its first map in the *DLR News* in November 1984. It was aimed principally at the local population, and was a visually robust design which simplified many other aspects of the area in concentrating on identifying station locations. Anticipating changes to station names, and other significant changes, no attempt was made to interpret the railway style in anything like a formal London Underground, British Rail or London Connections map at that time.

Designs for a series of related final maps for the opening of the railway are well under way. The style adopted for maps Nos 1–8 will not, it is expected, be continued into the life of the operating railway. Although maps from No. 1 onwards were designed for full colour with colour tinting it was not until Spring 1986 that the No. 6 map was so treated. Future maps will use the green (City) and red (Stratford) line colours.

A clear problem involved in relating the small Docklands Railway to the London Underground, or any London area map, is in the differences in relative density of station spacing. Integrating the Bank Extension into existing maps will also be a major problem to be tackled later in the decade. Differences in scale will mean that a number of maps will be needed, including line diagrams on DLR vehicles and DLR station signs (where line colour and individual routes will predominate) as well as joint publicity material with other operators.





Docklands

The two services to be operated by the initial railway will be colour-coded green for the City to Island Gardens service and red for the Stratford to Island Gardens service, as shown on this diagrammatic map.

FARES AND TICKETS

Although the DLR is financially separate from LRT and its other subsidiaries, its fares policy will reflect the established zonal fares system. In this context, Tower Gateway falls within Central Zone 1, Stratford in Outer Zone 3a and the remaining stations in Inner Zone 2. The fares chargeable will be the same as for the Underground.

Docklands passengers will be able to choose to buy ordinary single tickets from machines at each station, or in packs from local shops acting as agents. Agents will also supply season tickets, Travelcards and Capitalcards for use either purely on the DLR or through to the Underground and on BR's lines. If these particular tickets cover the appropriate fare zone, they automatically provide for travel on the DLR. In addition to normal ticketing arrangements, it is anticipated that a range of special promotions will be made to cater for the needs of tourists.

Stations on the DLR are arranged for simple access – there are no barriers or gates – and once passengers are acquainted with a few straightforward procedures, they will find the system quick and easy to use. There are three elements to the station fares system:

1. Ticket vending machines

Robust machines which will issue tickets valid to any DLR or Underground station, as well as possibly some BR stations. These will accept coins and normally give change. They will be mounted in blue brick buildings near the street entrance.

2. Ticket validators.

So far, tickets from machines or agents are like vouchers – they have a value but are not quite ready for use and, indeed, once purchased do not have to be used straight away. Before travelling, passengers must validate these ordinary tickets – that is when the voucher becomes a travel ticket, and the time allowance for travel starts ticking away. The validators themselves are located on the way to the stairs and look at first sight like a simple bank autotill, but located in a tall blue totem pole. Passengers simply push the ticket in the slot and in an instant it is validated – both in printing and in magnetic encoding – and returned to them.

3. The Red Line.

As there are no barriers, passengers will themselves be responsible for having a valid ticket. A red line will be clearly visible on the "booking hall" floor, along with notices, and passengers entering this area to go to the platform will be liable to pay a penalty fare if they do not have a valid ticket or pass without good reason.

The procedure so far can be summarised as follows:

Passengers with DLR single tickets: (from a machine or agent) – must validate the ticket before going to the platform.

Passengers with tickets issued at Underground or BR stations, seasons, Travelcards and Capitalcards valid for the DLR can go straight to the platform, as their tickets will already be validated.

On the train, the Train Captain will want to inspect all tickets, to ensure they are valid. Inspectors will also board some trains and occasionally visit stations, so a ticket may be inspected more than once, and it is important that it is retained until after the passenger has left the destination station.

Train Captains and Inspectors will be able to charge a fixed penalty fare for anyone found travelling without a valid ticket, unless there is a good reason why this is so. DLR's communications systems will enable ticket machine faults to be detected and rectified quickly: in the meantime, all traffic staff will be aware of any failure on the system.

When leaving the system, passengers are again not hindered by gates and barriers. Those continuing by Underground will find that their tickets, provided they are valid, will operate any automatic gates at the interchange station.

The fares system is designed to meet the joint objectives of simplicity, resistance to fraud and integration with London's other transport systems.

MIGHT-HAVE-BEENS

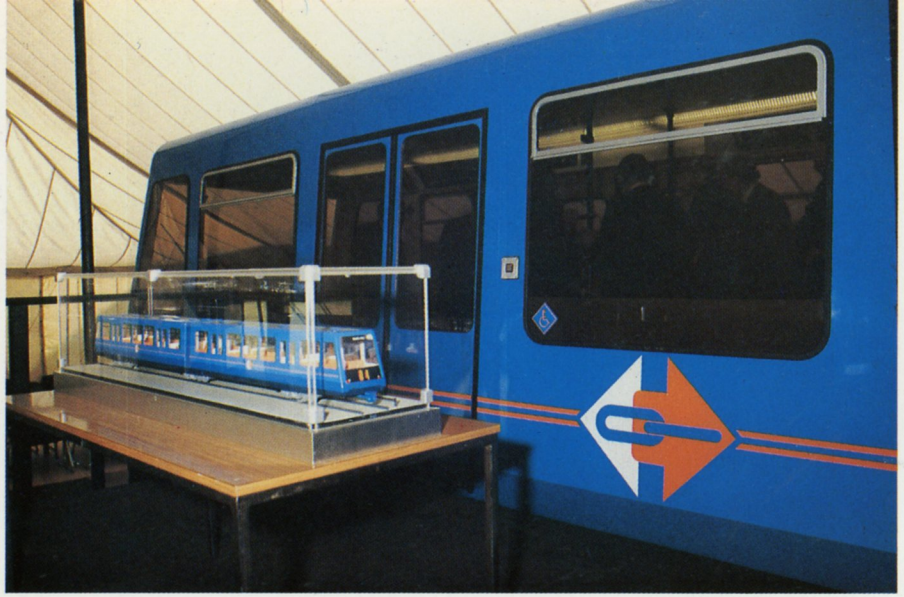
There are many might-have-beens about the DLR, and they include various trains, routes, station sites and names, liveries, and even railway names.

Although design consultants made carefully worked out proposals for the industrial design of the trains in 1983, the change in 1984 to the single-package tendering process meant that the commercial bidders made proposals based on the hardware available, or that could be developed, to meet the Performance Specification laid down by the clients. This specification related to capacity and performance objectives and did not dictate vehicle appearance. Some bids were based on derivatives of West German LRVs; others, such as the Canadian and French offer, featured rather smaller individual vehicles, similar to those now operating in Vancouver and Lille.

One of the most significant plans that did not become reality was the plan to run north to Mile End Underground station on the Mile End Road. Firstly, it was intended to have a street-based line running from the Limehouse area to Mile End along Burdett Road. Later the Poplar to Bow railway line – now part of the DLR – was utilised for the northern route but with the line then turning south west at Bow along the Mile End Road to Mile End. The tight timescale and extensive number of authorities and utilities with interests in subsurface London streets worked against both possibilities and there is little doubt that Stratford, a railhead for much of south east Essex, a shopping centre and bus interchange, is a much more worthwhile linking point for the Docklands system.

Many stations have changed names and a fair number have moved sites in response to changing circumstances. The number of stops planned has increased, aided by the competitive tendering process in 1984. The earlier GLC maps published in its newsletter are widely different to the current DLR. Although more than half of the current 16 station names have changed in barely two years, the DLR team has retained a preference for local geographical names rather than areas or district names with additions – north, south, etc which are a feature of the larger-scale and less intimate Underground network. Of the current 16 names, the origins of most of them can be discovered from local street maps or a London A-Z atlas, although some names do need an explanation. Mudchute station, previously Millwall Park, is named after the adjacent high-level plateau now used for a city farm, allotments and as an open space. The site itself was originally used for silt taken from the Millwall Dock. In the 1880s a Mr Duckham, Dock Engineer, devised a pneumatic dredger which sucked up mud and transferred it by pipes into a land settlement bed surrounded by clinker walls – the Mudchute. The recent change of station name followed representations by local people concerned that visiting football club supporters looking for Millwall's football ground would alight at Millwall Park station only to find that Millwall moved south of the river some years ago; a discovery that would likely lead to irritation and damage to local property! Poplar station, earlier referred to as Interchange, was designed to handle the east-west axis Beckton to City trains as well as the Initial Railway Stratford to Isle of Dogs service. With a Beckton service in place the earlier name would have its meaning restored. If the Beckton extension goes ahead the station will probably be renamed Poplar Interchange.

Regarding liveries and railway names, almost everyone has an opinion about these! The original design proposals made by consultants feature white-liveried units, not liked by the embryonic operating team for the expected difficulties in keeping this livery clean. The GEC-Mowlem designs produced several distinct livery choices before the Joint Board approved a blue, red and white scheme. The three main GEC-Mowlem proposals can be summarised as the blue, red and white design ultimately adopted, a yellow and grey scheme and a triple blue livery with traditional railway industry orange lining. As first presented, the successful scheme featured a stylised arrow and circle motif; the yellow and grey scheme incorporated a red "Clipper Rail" motif intertwined with a map of the River Thames curving around the Isle of Dogs. The triple blue livery (illustrated) included a nautical chainlink device surrounded by a double-ended arrow. Even then the logotype and graphics treatment was part of a separate series of work, only being implemented later in 1986 based around the logotype 'Docklands' rather than any contrived symbol or squiggle, distinctive or otherwise!



A livery that never was. An early concept of the DLR livery was a dignified triple-blue scheme with traditional railway orange lining and a chain and arrow symbol. This livery was used for the mock-up. Also visible is the contractor's table top model which has been repainted a number of times during the evaluation of the final livery.

The first official railway map – produced in this style by the GLC in March 1983 – reveals many differences with the final railway now built. This map also shows the street-based route at Mile End.

Docklands light rail stops

Tower Hill to Isle of Dogs Route.

1. Tower Hill
2. Shadwell – on site of old BR station
3. Stepney East – site depends on D.N.R.R.
4. West Ferry Road
5. North Quay (Poplar) – junction with North-South route
6. Canary Wharf
7. South Quay (Cuba St)
8. Glengall Grove
9. Millwall Park (E. Ferry Rd)
10. Island Gardens

Possible additional stations at:

Cannon St Road or Leman St
Hardinge Street
Newell Street
Heron Wharf

Mile End to Isle of Dogs route.

11. East India Dock Road
12. Fawe Street – or near alternative
13. Devons road
14. Bow Road – L.T. tube
15. Mile End – L.T. tube

If the Stratford route is chosen stops would be at:

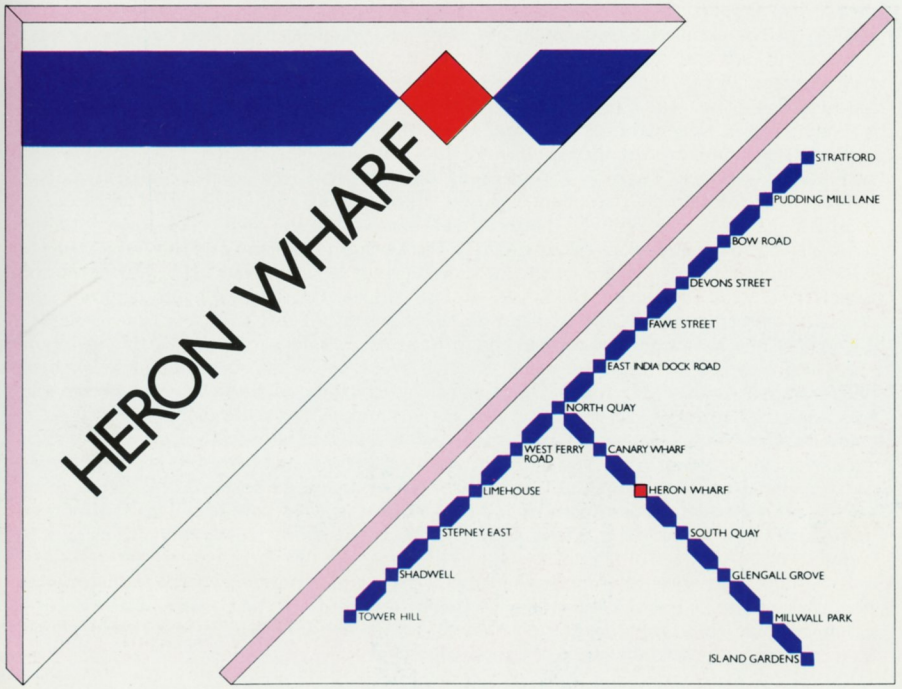
16. Bow Road
17. Stratford

With a possible addition at Marshgate Lane.

Light Rail Route
Stratford Route Option
Existing Railways:
L.T.
B.R.

Many of the earlier impressions of the cars featured all-white liveries, though red and blue speed stripes feature in this mid-1984 illustration.

Design consultants prepared a full set of proposals for the graphics in 1983 featuring distinctive triangular sail-shaped signs. Illustrated is a station sign for Heron Wharf (now Heron Quays) and an associated route map for use at the same station. Of the stations shown, three have not been built, Limehouse, Fawe Street and Pudding Mill Lane, though the latter two are protected sites where stations can still be built when and if finance becomes available. A site at Carmen Street has now replaced Fawe Street. Station name changes include Tower Hill, now Tower Gateway, Stepney East (to become Limehouse in 1987), West Ferry Road, now simply Westferry, North Quay, now West India Quay, Heron Wharf, now Heron Quays, Glengall Grove, now Crossharbour, and Millwall Park, now Mudchute. Poplar station is an additional site next to the Operations and Maintenance Centre; East India Dock Road station is now All Saints, Devon Street should have read Devons Road, and Bow Road is now Bow Church.



MARKETING THE RAILWAY

Although it might be thought that this railway will market itself simply by the obvious nature of the bridge structures and the elevated stations, this is not the case. There are many ways of writing and explaining marketing policies. The DLR's attitude is that there are four main segments of potential customers: shoppers, commuters, tourist and leisure use, and disabled use. Obviously, there are many other segments of the likely total market.

Much of the pre-opening marketing activity has been involved with informal contacts with businesses coming to the area. The railway has been helped enormously by the powerful effect of promoting Docklands itself by the London Docklands Development Corporation. Without this background effort, it would be impossible to promote this little railway without a vastly increased source of financing – which is not available in a cash-limited project.

The railway will hope to fill every seat and a lot of the floorspace all of the time. There are indications that there is plenty of potential balancing traffic: off-peak shopping traffic to Stratford, (an important regional shopping centre), tourist traffic from the Tower of London area to Greenwich via the railway, growing evening leisure use with the increasing number of facilities that will be found in the Isle of Dogs and Wapping areas, as well as the obvious growth in commuter traffic into and out of Docklands itself.

If, in a few years time, the railway is seen as an integral part of the Docklands community, rather than something new grafted on, the company's marketing and public relations policies will have been proven.

PUBLIC RELATIONS

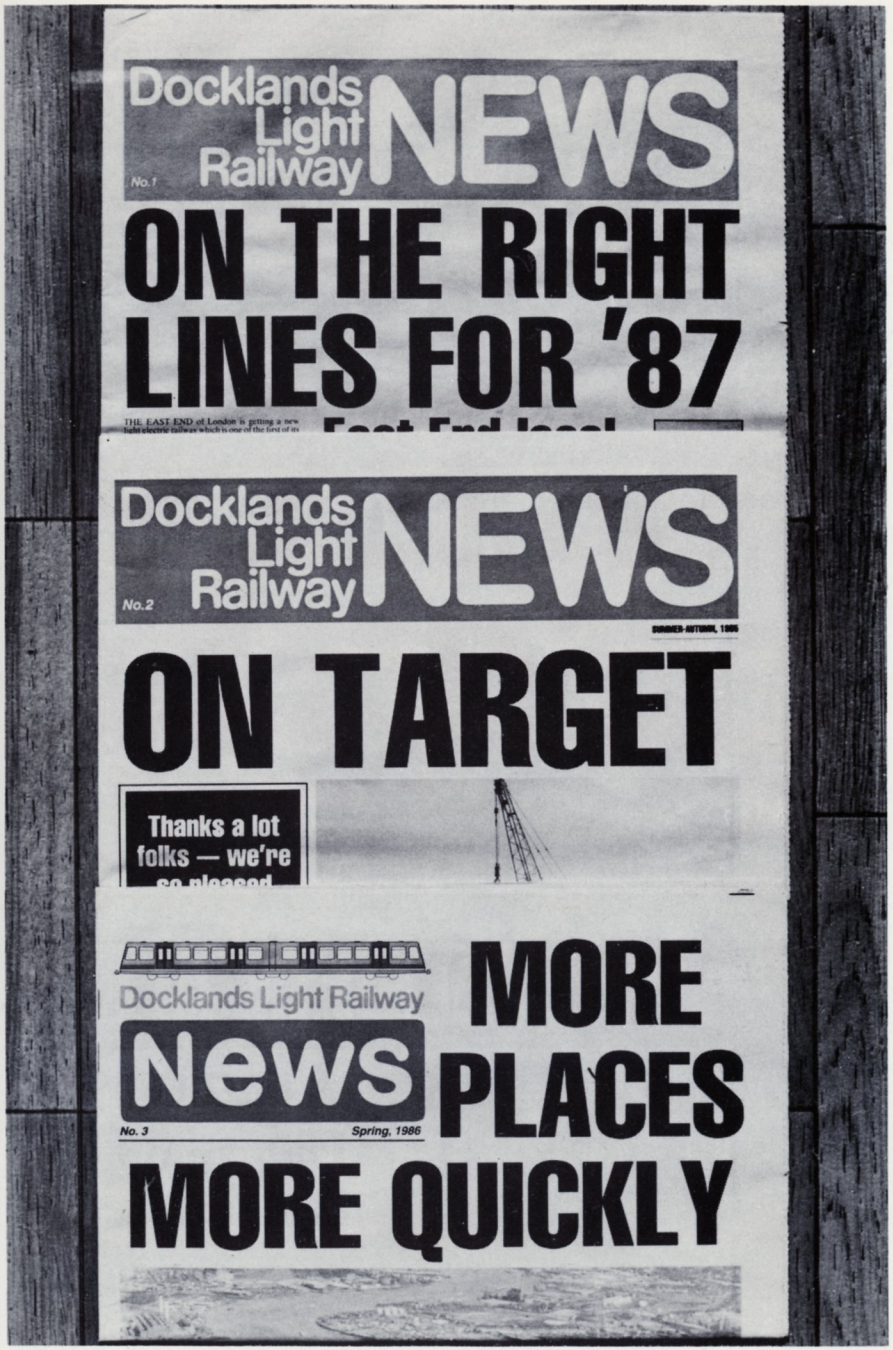
In order to be successful in an area of great change, the DLR hopes to be accepted by the existing local population for the benefits that it will bring to their lives. Without at least a measure of support, the novel package of technology and operating style to be used on the railway will be put at risk and will be less likely to work efficiently. There are many risks involved in not having local support, including the effects of a degraded passenger environment. The DLR project team has been keen from the earliest practicable date to be based in Poplar just like a local business, in advance of actually being set up as such: this was achieved in December 1984 within weeks of the contract to build the railway being signed. Contacts were set up at an early date with the local Police, Fire Brigade and Ambulance services. There is a continuing dialogue with the local Crime Prevention Officer. Local Planning Group meetings take place with all local authorities with powers to affect the local environment. Letters, meetings and discussions take place with the local action groups and social groups such as the Docklands Forum and the Association of Island Communities as well as more formal meetings on an ad hoc basis with local and prospective local businesses. Staff and leaders of local churches, schools, tenants' and residents' associations are also in communication with the DLR team.

During 1984 it was recognised that the future railway needed its own local voice in the area and this led to the publication of *DLR News* as a low-cost tabloid newspaper delivered door-to-door. Feedback from the local community suggests that the newspaper has been well received. Each edition produce a mountain of correspondence and fresh contacts. Over 60,000 copies of each issue are now distributed in the area.

Less obvious, but in some ways rather more important, has been the policy of "same day" response to local complaints, with face-to-face meetings between the complaining party and a member of the team. It is believed that a lot of potential aggravation and annoyance and misunderstanding has been eliminated by so openly facing up to complaints.

As far as limited resources have permitted, a rolling programme of visits to the railway has taken place. It has not been easy to speak to all of these many and varied groups, given the very tight timescale of the railway's development, but to date over 4,000 people have visited the project since construction began.

The first three issues of *DLR News*, a tabloid newspaper distributed free to local people.

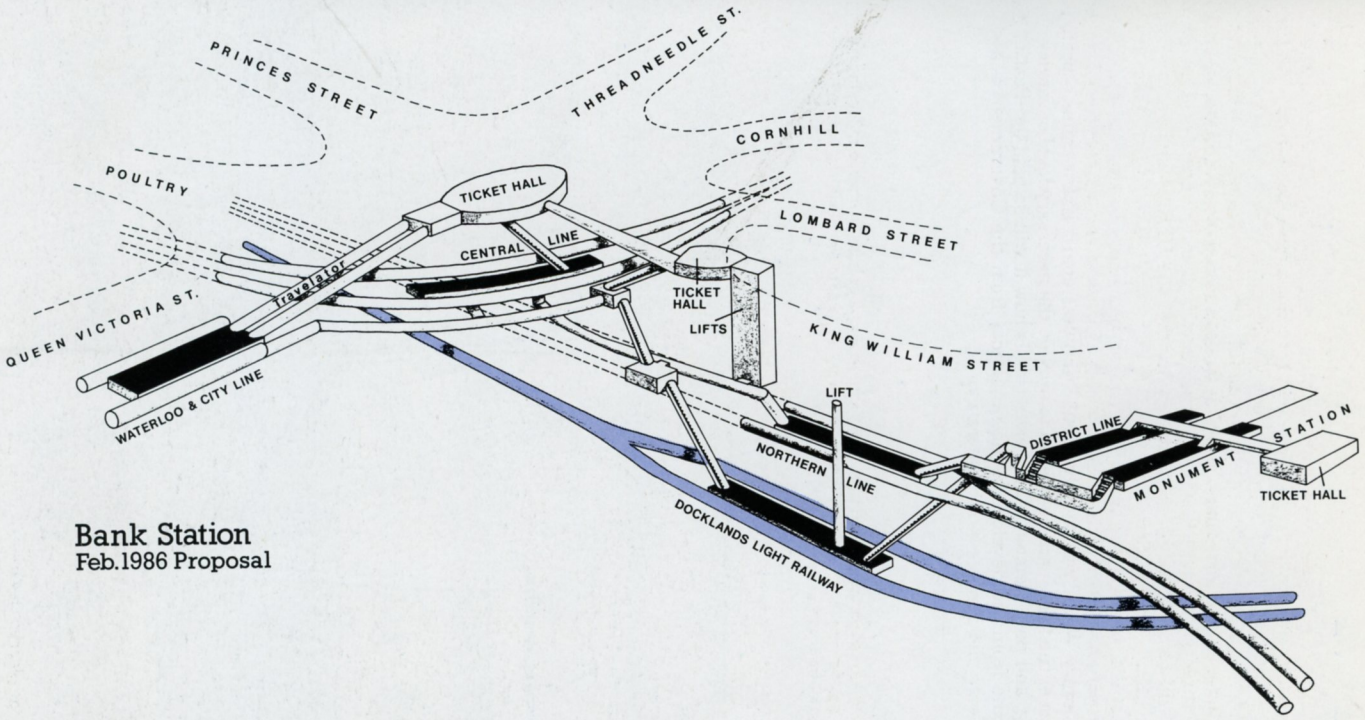


CITY EXTENSION

The success of the Isle of Dogs as a development area – which is at least in part because of the DLR – has encouraged many big projects. In particular a massive scheme, with three high rise towers and up to 10 million square feet of offices, has been proposed for Canary Wharf in the West India Docks. This would be an international financial trading centre, together with hotels, shops and other offices. For this to succeed the developers, who are a consortium of three investment banks, want a direct link to the heart of the City of London. This will be achieved by a 1.5km extension of the DLR, westwards to a new station under King William Street in the City. This will give direct links to the Underground stations at Bank and Monument, giving access to the Central, Circle, District, Northern and British Rail's Waterloo and City lines. The heart of the City, and the heart of Canary Wharf will be only about 9 minutes apart. Extra trains – perhaps tripling the size of the fleet – will be needed to provide the necessary level of service.

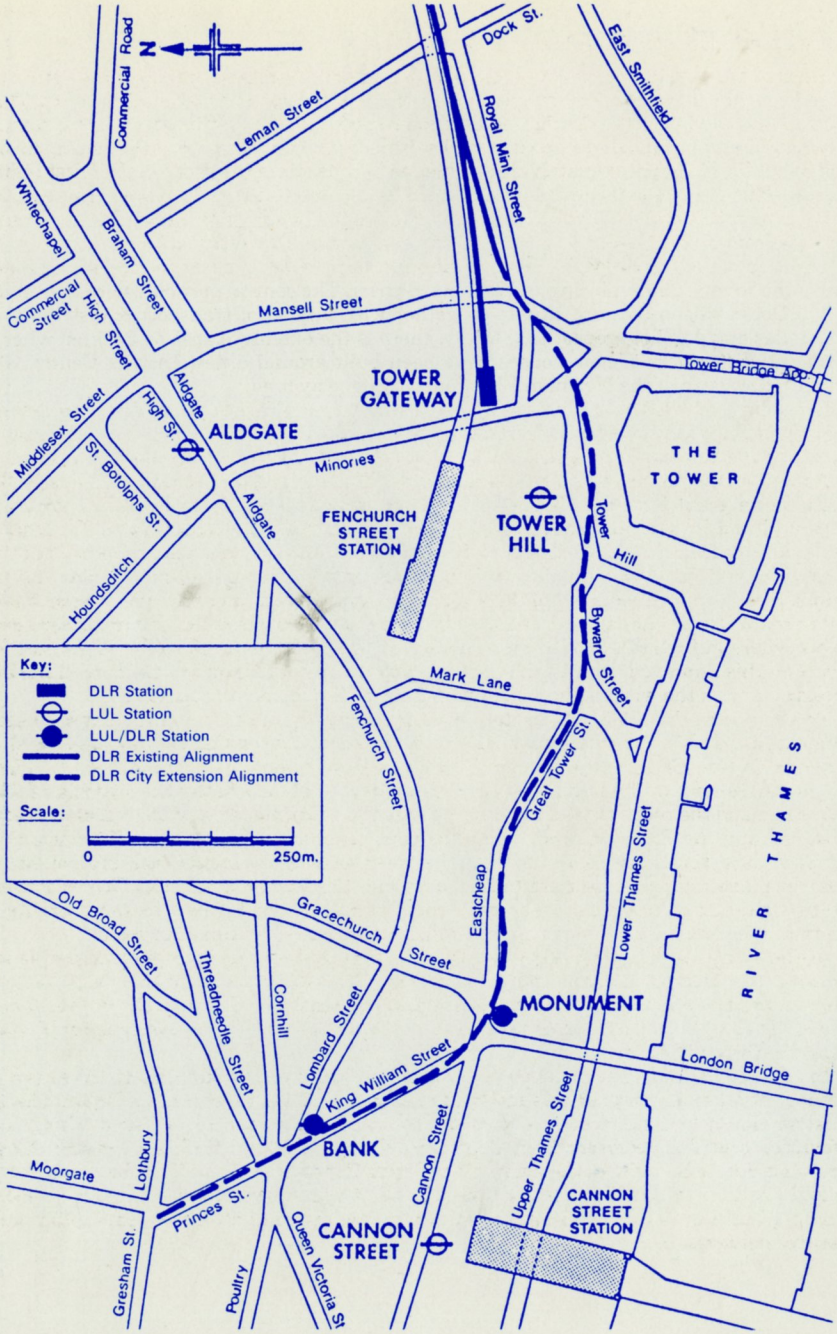
One exciting, and new, element of this extension is how it will be paid for. Part of the money will come from the developers, the remainder from the Government – a good example of private and public sector co-operation.

This 1986 architects' impression of the future Bank DLR station shows granite finishes to reflect the majesty of the Bank of England above. If built, the station is likely to feature spacious concourses giving an atmosphere quite different to the deep-level tubes.



Bank Station
Feb.1986 Proposal

Proposals to extend the railway to Bank involve deep-level bored tube tunnelling beneath the other tunnel railways in the area. This plan shows escalator links to Bank and Monument stations as well as a vertical lift shaft to the Docklands platforms to preserve disabled-access standards.



The alignment of the planned City extension.

EASTERN EXTENSIONS

The initial DLR system only serves that part of London's Docklands already in the process of redevelopment within the first five years of the Development Corporation's life. The extensive area of the Royal Docks and Beckton remains to be linked into the DLR system.

When discussing London's up river docks, it needs to be remembered that each one of the Royal Docks is approximately three times as long as one of the docks in the West India Docks system, and a journey from the eastern lock gate entrance of the Royals system to the western end of the Royal Victoria Dock is virtually the same length as the train journey from Tower Gateway to North Quay Junction on the initial railway.

The area of the Royals and Beckton divides into three zones. There is an industrial zone along the River Thames, facing the Thames Barrier. The central portion where the three Royal Docks themselves are situated together with a band of transport & distribution industries and derelict properties. Thirdly, there is the extensive area at Beckton where substantial numbers of new houses have been built around a new District Centre, all lying to the south of the Newham Way dual carriageway road.

Extending the DLR network towards this housing area of Beckton would bring massive material savings in time for the commuting population in that area. However, the route by which Beckton can be reached has been subject to discussion and some controversy.

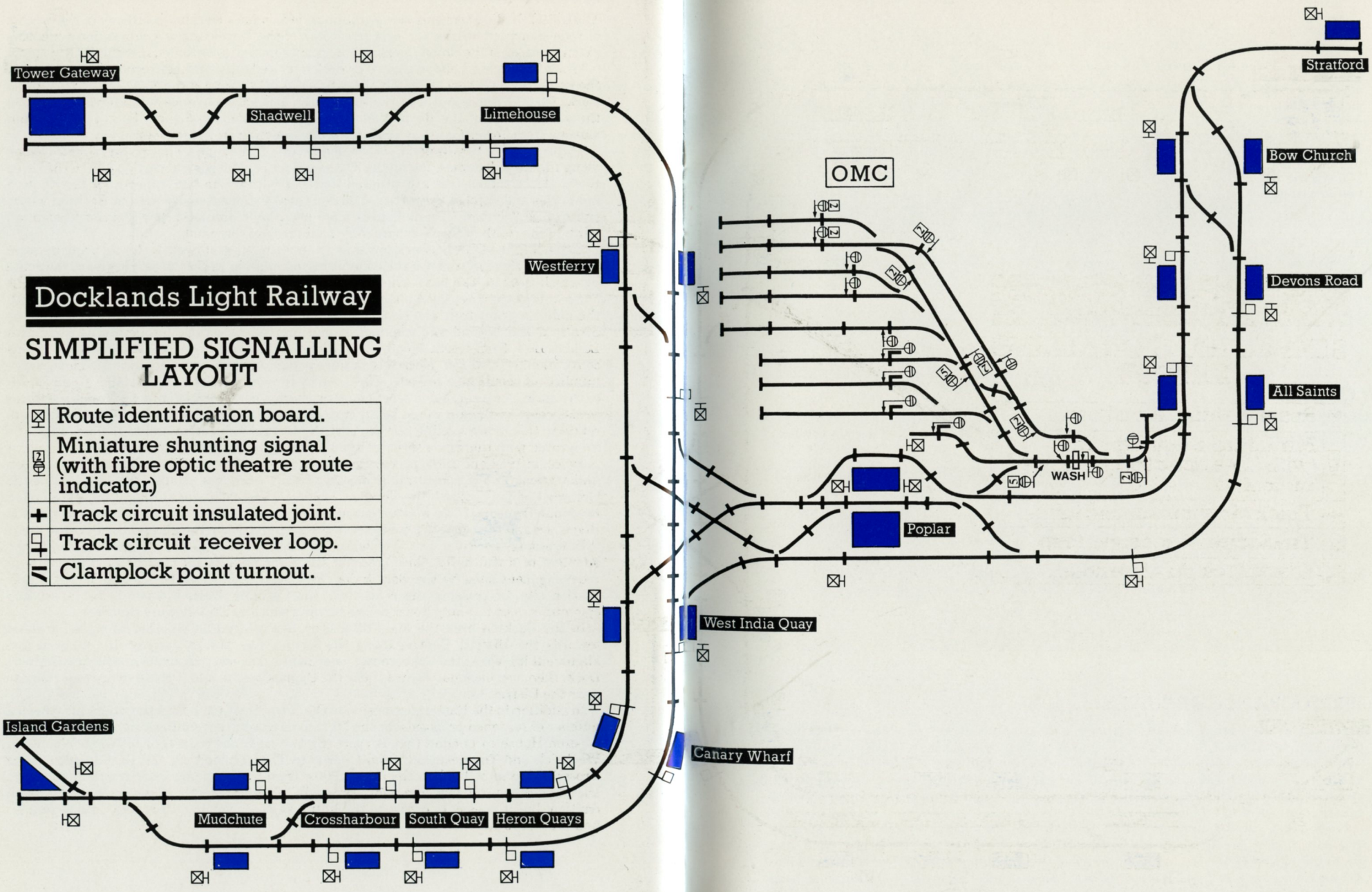
As well as the discussion about extending the DLR to Beckton, British Rail has, with the aid of a grant from the GLC, electrified the railway from North Woolwich towards Stratford and beyond and renamed it and revived its service to operate as the North London Link from North Woolwich to Richmond in West London. The existence of this conventional third-rail electrified railway means that the potential to move large numbers of people into and out of the area by conventional railway remains. Connections to the main Central London termini are circuitous however, but direct excursion services to elsewhere in Britain would be an obvious possibility. Any extension of the DLR has to relate to this improved line serving part the Royal Docks area, and at the same time be integrated with the whole series of simultaneous redevelopment proposals.

Twice, in 1984 and 1985, preparatory work for depositing a Bill in Parliament has been undertaken. Public consultation meetings have been held under the auspices of the Greater London Council, the London Docklands Development Corporation and London Regional Transport. The main areas of controversy concerned firstly the crossing of the River Lea and the route to take to serve the east end of the Royals and the Beckton area.

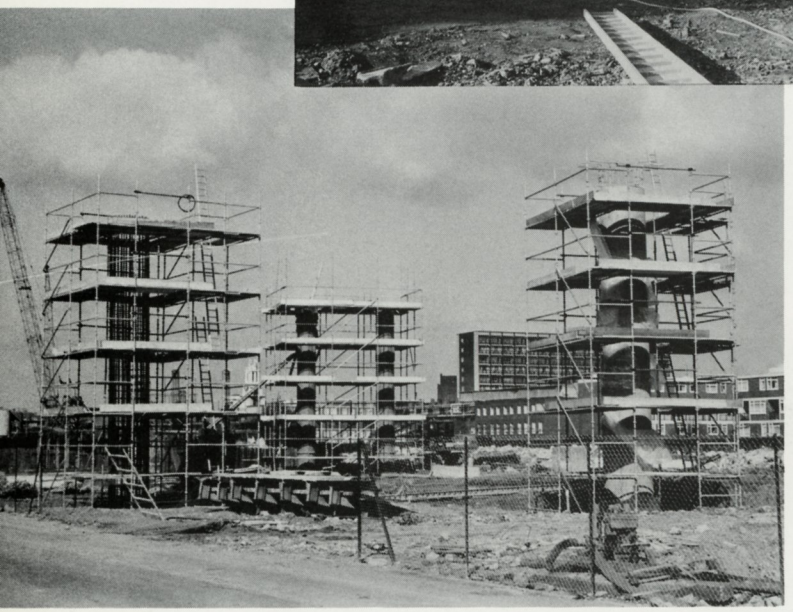
In crossing the River Lea the choice has been reduced to two options. These are the adoption of a southerly route crossing the river near to its mouth, serving potential redevelopment sites by the East India Docks and the former Brunswick Wharf Power Station site, or crossing the river near the Canning Town Flyover to serve existing communities at Canning Town before turning south again following the river.

In the Beckton area the main discussion has centred on whether to cross parkland towards the District Centre, using the former Gas Works railway line (a protected alignment known as the 'coke' route), or continue due east, parallel with the Royal Albert Dock, then loop back northwards near the Cyprus area in a half-circle sweep to terminate near the District Centre.

In addition to the Eastern extension to the Royal Docks and Beckton, there have been a number of reasoned proposals for the DLR to be extended from Beckton to Barking; from Custom House to London City Airport (by two separate routes) or to North Woolwich, Woolwich and Thamesmead; from Cyprus to Thamesmead via the East London River Crossing due to be built in the early 1990s; from Canning Town to Stratford; and from Island Gardens to Lewisham. Only time will tell whether any of these plans will reach fruition, but it is easy to envisage the initial system evolving ultimately into a comprehensive network.


Tower Gateway
Shadwell
Limehouse
Westferry
Docklands Light Railway
SIMPLIFIED SIGNALLING LAYOUT
Route identification board.
Miniature shunting signal (with fibre optic theatre route indicator)
Track circuit insulated joint.
Track circuit receiver loop.
Clamplock point turnout.
Island Gardens
Mudchute
Crossharbour
South Quay
Heron Quays
Canary Wharf
West India Quay
OMC
WASH
Poplar
Stratford
Bow Church
Devons Road
All Saints

Structural steelwork and stair support columns in place in January 1986 for Limehouse station around and above the London and Blackwall brick arches. In the background can be seen the new DLR structure over Butcher Row.



Reinforced concrete columns rise above the ground in April 1985 for the high-level triangular junction at North Quay.

PHOTOGRAPHIC ARCHIVES

The DLR Project Team has an extensive photographic library of views of Docklands during construction of the railway. Serious historical researchers and people wishing to purchase photographs should write to Docklands Light Railway, Marketing Department, PO Box 154, Poplar, London E14 9QA to make an appointment. There is an administrative charge of £5 minimum per visit and copies of black and white prints, colour slides or colour prints have to be charged at cost.

Over 5,000 views taken since 1981 indicate the dramatic changes taking place in Docklands, not just in the railway construction itself but in the background and surrounding areas as well. Indeed, many of the buildings used for referencing when taking railway photographs have since been demolished! The speed of progress has been such that photographs are generally reckoned to be out of date three weeks after they have been taken, so the whole collection already has considerable historical interest.