TfL Corporate Archives

‘MAPPING LONDON’
The TfL Corporate Archives acts as the custodian of the corporate memory of TfL and its predecessors, with responsibility for collecting, conserving, maintaining and providing access to the historical archives of the organisation. These archives chart the development of the organisation and the decision making processes. The Archives provides advice and assistance to researchers from both within and outside of the business and seeks to promote the archive to as wide an audience as possible, while actively collecting both physical and digital material and adding personal stories to the archive.

The Archives are part of Information Governance, within General Counsel.
“Mapping London” is intended as an introduction to the development and use of maps and mapping techniques by TfL and its predecessors.

The following pages highlight key documents arranged according to theme, as well as providing further brief information. These can be used as a starting point for further research if desired.

This document is adapted from a guide that originally accompanied an internal exhibition.
Tube Map Development: Individual Companies

• Prior to 1906, the individual railway companies produced their own maps and there was no combined map of the various lines.

• The companies were effectively all in competition with each other and so the focus was steadfastly on the route of the individual line, where it went, and why it was of particular use to you.

• Even when combined maps of a sort began to appear, following the establishment of the Underground Electric Railways Group, the emphasis often fell upon a particular line.

• Furthermore, the Metropolitan Railway did not become part of the Underground group until 1933 and although it recognised the need to illustrate how it connected with other lines, the maps it produced retained a very clear bias towards its own services.
Tube Map Development: Combined Railways Maps

- It was not until 1907 that any sort of map of completely independent lines was produced. This was done by the Underground Electric Railways Company of London, who published a map showing the Baker Street & Waterloo Railway, the Charing Cross, Euston & Hampstead Railway, the District Railway, the Great Northern, Piccadilly and Brompton Railway, the Metropolitan Railway, the Central London Railway, the City & South London Railway, and non underground railways. The first all inclusive map, showing eight railways in different colours and the connections between them was published in 1908.

- In 1913 the Central London Railway and the City & South London Railway were incorporated into the Underground Electric Group of Railways. This led to a substantial increase in the geographical area that the combined map now had to cover.

- The Underground map of 1919 saw two significant firsts: the Piccadilly Line was coloured blue for the first time, and the Inner Circle was treated as its own individual line.
In 1931, Henry [Harry] C Beck, an employee of the drawing section of the Establishment Offices, produced his first sketch of the tube Diagram and was urged by colleagues to send it to the Publicity Department. He did so, but it was dismissed as being too revolutionary. A year later he tried again and this time, the map was printed. 750,000 copies were printed as a first issue in January 1933, with another 100,000 following in February. The design was a hit.

The Beck map has formed the basis of the tube map right up to the present day, albeit with some minor adjustments – including the temporary use of diamonds and interlinked loops to indicate interchange stations, the reductions of diagonals, and the introduction of a locating grid, etc.

Many tube stations are very close together, especially in the central area where 71 stations jostle for position. In all official Underground maps since Beck, the lines depicted remain topographically faithful to the reality of the network and its connections, but the geographical reality is distorted. This allows the stations space to be shown. There is simply no effective way of presenting the network otherwise.
Tube Map Development: Harry Beck

- Beck’s creation did become mangled by other designers over time. In 1962, Garbutt responded to criticism of a current unpopular and angular version of the Underground map by creating a new design, restoring the map's elegant curves in a style more in keeping with Harry Beck's original. He undertook this project on his own initiative, to relieve intellectual boredom at home during two days in the Christmas break.

- But Beck remains the crucial figure in the development of the Underground Map as we know it today. Since 2001 there has been a re-evaluation of the value of the work of Harry Beck. His work on the map is now acknowledged, with a caption on the bottom right hand corner of all Underground maps stating: “This design is an evolution of the original design conceived in 1931 by Harry Beck”. The uniqueness of Beck’s Underground Diagram was its combination of simplicity and ease of use and it has come to be regarded as one of the design classics of the twentieth century, not only in London but throughout the world.
In 1981 a zonal system was introduced for bus and tube fares. Forming the foundation of the present zonal system, there were originally 6 zones – 4 for buses, and 2 for tubes (City and West End).

The adoption of this system assisted with simplifying the fares system, but added another element of information that had to be conveyed to customers.

The zones were added to the background of the Underground maps.

But customers now also needed to know when, or more specifically at what point on their journey, they would be crossing from one fare zone to another.

After some discussion, the Board decided that the most effective way to communicate this would be on the maps, or car line diagrams, that were displayed in each tube carriage.
The distinctive line colours that we today so commonly associate with the various Underground lines have not always been so static – some lines went through colour changes before being assigned their present day livery.

The Underground map of 1919 saw two significant firsts: the Piccadilly Line was coloured blue for the first time, and the Inner Circle was treated as its own individual line.

By 1949 some crucial modifications had been made to the map: the Circle line was shown as a completely separate route line with the colour yellow, and the Metropolitan Line was returned to the colour purple.

In the late 1980s various colour combinations for the lines were experimented with. At this point orange was chosen for the East London Line (which now forms part of London Overground) and pink was chosen for the Hammersmith and City Line.
Tube Map Development: What to Include

• Since the early days of the individual railways’ maps, they were often used to publicise the convenience of the available routes. This tactic is still employed today, albeit with the focus more on particular places of interest.

• A London Electric Railways Map of c.1909 was the first to use the ‘white line connector’ device for denoting interchange stations.

• The River Thames is the only surface feature included in Beck’s map. It’s inclusion acts as a quick visual indicator of whether the traveller is north or south of the River.

• In 1951 a locating grid was first introduced.

• Since the late 1960s, a debate has often arisen about the inclusion of National Rail lines on the Underground Map.

• In Jan 1972, the Transport Users Consultative Committee approached London Transport with a view to including the then British Rail commuter services on the map. Their case was unsuccessful.
The Underground Map is today one of the most marketable assets available to TfL, protected by copyright requiring TfL’s permission to reproduce it.

To use the map in a design, permission needs to be obtained from TfL’s appointed map licensing administrator.

To use the London Underground map in a commercial publication, a licence agreement needs to be signed and royalty and artwork fees may be payable.

To use the map in your design, you need to get permission from Pulse Creative, our appointed map licensing administrator, by calling 0161 614 2013 or emailing tfimaps@pulsecreative.uk.com.

To use the London Underground map in a commercial publication, you will need to sign a licence agreement and you may need to pay royalty charges and artwork fees.

To obtain approval to reproduce TFL and National Rail maps:

1. Place an order which is sent to Pulse Creative
2. Pulse Creative sends you a licence agreement and invoice
3. You sign and return the licence agreement and arrange payment to Pulse Creative
4. Pulse Creative releases the artwork to you
Until the 1960s, the organisation did not take steps to fully protect or exploit this asset. Correspondence and minutes of meetings in the Corporate Archives detail how slowly the realisation dawned that map designers such as Paul Garbutt should be asked to assign copyright in the work over to the company.

In 1960, Harry Beck challenged the London Transport Executive’s right to change his map design and replace his name without consultation. Beck felt that he deserved recognition for the diagram he had invented and developed for so long. Beck repeatedly claimed that money was not his objective but that he only desired the copyright. Beck never actually took the LTE to court though, largely because of financial and health constraints, and by the late 1960s he dropped the matter completely.

The question of copyright reared its head again in 1978 when London Transport decided to sue a manufacturer who was illegally using the design as a T-shirt logo. The manufacturer claimed that LT didn’t have 100% ownership of the map or own full rights to its usage. Counsel suggested that either LT and the map designer (Paul Garbutt) should prosecute jointly, or that the full rights to the map design should be transferred to LT. Garbutt duly transferred his claims without cost, although LT later voted to give him the monetary equivalent to that which an external designer would have received for the job.
The growth of the tube network presented huge challenges for the early map makers – in 1932 for example, 16.5 miles of new route had to be added to the maps.

The size of an issued travel map is a key consideration. If a map is too large then it becomes of little use whilst in transit due to its unwieldy nature. But all key network information still needs to be conveyed on the travel map and for this reason lines have over the years become kinked or placed at angles: The Central Line and the Northern Line were first kinked on the map in 1988.

The Underground Map has evolved over the years, reflecting and telling the story of the changes in London Underground’s network. And in many ways the map is now so recognisable around the world that it has come to represent London itself.

The challenge remains today. Should Overground and DLR lines be included on the Underground Map? How can the Elizabeth Line be added? Should planned extensions of existing lines be displayed? How should station closures be communicated? Is the Underground Map now too complex to be of use in its pocket form? Should a Zone 1-2 only map be issued?

All of these question about how to manipulate and use the map effectively in order to communicate to our customers are being grappled with by the TfL Design team.
Interpretations of Tube Map

- The Underground Map is iconic around the world, leading many artists and enthusiasts to come up with a plethora of interpretations. Take a look at some of these:

  - Doctor Who Tube Map
  - The Great Bear
  - The London Christmas Map
  - Changing Stations (Daniel Liam Glyn)
  - Tube Map Radio (Yuri Suzuki)
  - Paralympics GB Medalists Map 2012
In 1855, Joseph Orsi, Leopold Foucaud, and Felix Carteret formed, in Paris, a company to become known as the Compagnie Generale des Omnibus de Londres, with its head office in Paris and a London office at West Strand. By the end of December 1855, when its prospectus was issued in England, contracts had already been entered into for acquiring most of the 810 horse buses then working in London.

Although the new company was French in origin, for all practical concerns it was a British concern. The everyday use of the French title in London was discontinued on 11th January 1856, in favour of London General Omnibus Company and on 1st January 1859 the undertaking became an English limited company.

On Monday 7th January 1856, the first buses run by the London General Omnibus Company appeared on the streets of the capital. For most of the period from then until 30th June 1933, more than half the buses running in London belonged to the LGOC. For more than 75 years the company was London’s principal bus operator, and the services it built form the basis of the network of bus routes operated by TfL today.
In 1988-1991 a new style of bus map was considered. In a precursor to today's Bus Spider Maps, Minotaur Designs were commissioned to develop and trial a ‘Star Map’. This map was intended for selected major hotspots on the bus network. For each of the 10-15 most important points within London, a separate star map would be produced. These would show, at a glance, how to get from the central point in the star to all other points in central London.

The start maps were to exclude all routes which did not pass through or lead to the centre of the star, show destination points geographically, use solid lines to denote direct routes and dashes to denote change of route was required. Each route was to be given its own colour.
Maps for Events

- Maps for events take 2 forms: those distributed to the public and those used in visualising and planning road closures, service patterns, and so on.
- London has played host to, and will continue to play host to, major events on a regular basis.
- Sporting events such as the Wimbledon Tennis Championships and the University Boat Race attract huge concerts occur throughout the year, and week after week there are crowds attending football matches, free cultural events, and any number of other activities. The mapping of all these events is key to providing successful transport operations for them.
- Being the capital city, London also becomes the focus and becomes the host for events of national and international significance. Foremost amongst these are royal events and state funerals.
- When Queen Elizabeth II was crowned on 2 June 1953, 5.5 miles of the transport network was sealed off. The London Transport Executive produced 2 million copies of a special folder map showing the coronation area, designed to make the public aware in advance of alterations to the network.
The scope of transport operations for the London 2012 Games was the most demanding the nation’s transport network has ever had to meet: 34 venues, 26 sports, 10,500 athletes, 8.8 million ticketed spectators and 22,000 media. For the Paralympics this was 20 venues, 20 sports, more than 4,000 athletes, 2.7 million ticketed spectators.

For the most critical hubs and interchanges, detailed work was undertaken to assess whether the stations would be able to handle the predicted levels of demand and if not, to develop Games-time station management plans and travel demand management targets. This included the use of a number of tools, including dynamic pedestrian modelling. Perhaps, the most high profile modelling work featured on the Get Ahead of the Games website using a process developed by the ODA and TfL called hotspot analysis. The so called ‘GLIM’ model helped identify a grid approach for the busiest stations during Games time. This information was available to travellers several months in advance and allowed them to effectively re-plan their travel patterns. This was one of the most effective examples of mass participation travel demand management undertaken during the Games.

The CORNETO model (Combined Olympic Route NETwork mOdel) was developed from existing ODA and TfL models to provide a strategic overview of the impact of the Olympic Route Network, road events/management, and the venues themselves on roads in London. The strategic model was based on SATURN software that is a proprietary highways modelling tool. The model was used to inform the public facing ‘Get Ahead of the Games’ advertising campaign to warn road users of the likely impact on London’s roads.
• Trial tramways were opened in May 1870, between Brixton and Kennington Church, and between Whitechapel Church and Bow Church. The trials were ultimately deemed successful and the 1870 Tramways Act began its route through Parliament.

• There was considerable opposition to tramways in Central London and in 1872 Parliament declared this a closed area for the tramcars. This ruling means that all of the early tramways were based around the edges of Central London.

• By 1875, the North Metropolitan Tramways had 29.5 miles of routes, working such places as Aldgate to East India Dock, Aldgate to Stratford, Finsbury Square to Archway.

• The London Tramways Company had a system of 20.25 miles, working among others from Greenwich to Vauxhall Bridge, Westminster Bridge to Brixton Station, and the Elephant to Kennington.

• The London Street Tramways had only 4.5 miles of track, running from Euston Road and King’s Cross to Archway and Holloway.

• Croydon had trams by 1879. By mid-1880 the combined mileage of the big three companies had risen to 63.25 miles. By 1881 trams were running in Tottenham and Edmonton. By 1889 there were 14 companies with 130 routes.
• In 1923 the number of passengers carried by buses leapt ahead of those carried by tram for the first time. From then on there was a steady decline in the number of trams in operation. Trolleybuses began to be looked at as an alternative.

• The First Annual Report of the London Passenger Transport Board, shows that it was responsible for 18 miles of route operated by trolleybuses. A Bill presented to Parliament to permit conversion of tramways to trolleybus operation became law on 31 July 1934. The 1935 LPTB Act contained provision for the conversion of another 59 miles of tram route, the 1936 Act another 51 miles, and the 1937 Act contained powers for the conversion of the whole LPTB tramway system.

• The trolleybus routes changed little between 1940 and 1950. But in 1954, London Transport announced that all trolleybuses were to be replaced by diesel buses. This marked the end of what had been the largest trolleybus fleet in the world, running over 253 miles of route.
Mapping London: Population Growth

- Looking at the development of London’s tube and bus maps it is obvious how the transport network has expanded. But the network only expands to either meet a demand or promote regeneration based on solid forecasts. So what can also be determined by looking at the maps is just how much London’s population and particularly its commuter ‘population’ has grown, as well as the geographical areas where this has been most apparent. Part of the work of TfL’s predecessors has been to not only meet the needs of this increased population but to also monitor/predict it.
Demand forecasting is an important part of the planning and appraisal stage of any transport infrastructure project. Demand is often shared amongst a number of modes; road, rail, and bus. Each of which have different characteristics and attractions to different users.

Modelling techniques are used in determining the relative attractiveness of infrastructure proposals.

Data will be collected and is vital in forming an accurate picture of present and likely future activity in a transport corridor.

Forecasts of future traffic/passenger growth are generally based upon:

- Straight forward extrapolation techniques using historic traffic growth figures
- Simple econometric forecasts which relate traffic growth to the growth in relevant economic indicators
- Detailed modelling of passenger behaviours using detailed economic forecasts.

Forecasting future traffic growth in new spheres or geographical areas may present some challenges:

- limited economic data
- little or no traffic/passenger count data
- data which is inconsistent with new economic activities
- declining economies.
Transport demand forecasting models can be generally categorized according to the steps involved in the traditional four-stage transport planning process. These steps include: (a) trip generation, (b) trip distribution, (c) modal split (or mode choice), and (d) traffic assignment.

In the trip generation stage, econometric models are established to forecast passenger transport demand, in terms of passenger vehicle trips or passenger vehicle miles travelled, based on future population projections.

These passenger demand prediction models can be estimated for both weekday/weekend, and by travel distance, region and trip purpose.

The time series analysis techniques involve extrapolating historic trends in transport demand into the future without considering the underlining causes of the trends.

Category analysis is also used to predict passenger transport demand by specific sets of criteria, such as car ownership, household size and income ranges.

A wide range of forecasting methods have been proposed in the field of transport and logistics. These models can be generally distinguished into: (a) pre-determined vs. random, (b) static vs. dynamic, (c) aggregated vs. disaggregated, and (d) analytical vs. simulation models.
When considering network developments and growth or mapping out service levels, TfL and its predecessors have always had to respond to external developments. These may be new housing estates, new towns, or different government or Mayoral priorities and strategies.

Heathrow Airport began life as the Great West Aerodrome in 1929. Development of the airport (ostensibly as a military airfield) began in 1944 and by 1946 it was renamed as London Airport and opened as a civil airport. Whilst London Airport (renamed Heathrow in 1966) was initially much smaller than the beast that it has become today, it still required serving by public transport. Both mainline and ‘Underground’ options were considered and despite objections by London Passenger Transport Board that an extension of their services to the airport would not prove financially viable, it was this solution that was deemed most appropriate.
Mapping London: Network Extensions

• From the opening of the very first underground railway, the Metropolitan, in 1863, the network has grown in order to meet passenger need or promote growth in certain areas. At first this took the form of entirely new routes or lines. Increasingly however, extra services were provided by extending existing lines. All served a demand, all required mapping out of routes and stations, some employed new techniques or solutions.

• The modern Northern Line began its life as 2 independent railways – the City & South London Railway (1890), and the Charing Cross, Euston, and Hampstead Railway (1907). In 1910, the Charing Cross, Euston and Hampstead Railway became part of the Underground Electric Railways of London (UERL). UERL took control of the City and South London Railway in 1913 - this was the cue for integration. In the south, this resulted in the line being extended in 1926 from Charing Cross to Kennington, and from Clapham Common to Morden.

• The construction of this extension and its loop meant that for the first time the populous region between Clapham and Wimbledon had direct tube connection with the West End and the Central Area. The new Underground station at Waterloo also afforded another means of direct travel between the main line terminal and North and South London, as well as easing congestion at Charing Cross.
Mapping London: Network Extensions

- The Victoria Line, which was opened in March 1969, was the first new Tube line to be constructed for over 20 years, and the first since World War II to be constructed in tunnels deep under central London.

- This vital new North-South link was designed from the outset to link 4 main line termini: Euston, St Pancras, King’s Cross and Victoria. Also, to facilitate passenger movements, every station (except Blackhorse Road) was to make an interchange with at least one other Underground or British Rail line.

- The official opening of the Line took place on Friday March 7 1969, with the stage from Warren Street to Victoria coming into operation.
In March 1988, the Secretary of State for Transport announced the setting up of a joint London Regional Transport/Network Southeast/Department for Transport study into overcrowding problems on both the British Rail and London Underground lines. At that time, 590,000 passengers were exiting from Underground stations in Central London during the morning peak. This compared with 428,000 in 1977 and 405,000 in 1982. Growth projections took into account employment projections, population projections, income effects, car ownership, traffic congestion, tourism, fares, and ticketing.

Extensions proposed or considered by the Study were:

- A new branch of the Victoria Line from Victoria to King’s Cross
- The ‘Figure Eight’ tube
- Waterloo & City Line extension from Bank to Liverpool Street
- Northern Line extension to Streatham from Brixton
- Central Line extension from Shepherd’s Bush to Richmond
- Bakerloo Line extension from Queen’s Park to Ealing Broadway
- Jubilee Line extension to Hainault or Ilford
When it was established in 1933, the London Passenger Transport Board [LPTB] had a very clearly defined area of operating responsibility – or ‘sphere of power’! The London Passenger Transport Act determined a ‘London Passenger Transport Area’ and within that a ‘London Passenger Transport Board Special Area’.

Essentially, the LPTB was handed a monopoly of local public transport. Within the special area services operated by the LPTB did not need road service licences etc, and no person or undertaking was allowed to provide a public transport service without written permission from the LPTB. In the London Passenger Transport Area outside the special area, the LPTB was required to hold road service licences.

The establishment of the London Passenger Transport Area enabled clear boundaries between operators, but also meant that the routes of licensed service providers, as well as those whose services entered the LPTB area, had to be closely monitored.

By 2000 and the establishment of Transport for London (in the 1999 Greater London Authority Act), the definition of a geographical area of responsibility remained – ‘Greater London’. However, the scope for growth was laid as the definition of the realm of responsibility was for transport services ‘to, from and within Greater London’. This means that placing a geographical distinction on the area of TfL’s services is very difficult – making the use of maps to display such information even more important.
Maps for Accessibility

• TfL offers a range of step-free maps and useful guides on topics such as getting around London, avoiding stairs, and assisted transport services. These are all designed to make navigating and using the network as easy as possible for those with disabilities.

• The Journey Planner tool can show the best way to make a journey and includes information on whether stations are step-free from street to platform or street to train, plus details on manual boarding ramps and raised platform sections. When planning journeys, you are able to specify your accessibility requirements in relation to step-free access, escalator provision, walking distances within stations and use of stairs. You can also save journey preferences, including access requirements, for future searches.

• The step-free Tube guide is available in smartphone apps. Tube accessibility data electronically is now published so that developers can incorporate detailed information about access into their apps. This includes the information contained in the step-free Tube guide, locations of level access areas on platforms and information about toilet provision.

• In the 1980s, London Transport and London Regional Transport worked with the Royal National Institute for the Blind to produce a tactile and braille map of the Central London tube area. In addition, station plans of some central area stations were also produced.
Legible London

- Legible London is an easy-to-use signage system that presents information in a range of ways, including maps and directional information, to help people find their way.
- TfL developed Legible London to help both residents and visitors walk to their destination quickly and easily. It's integrated with other transport modes so when, for example, people are leaving the Tube they can quickly identify the route to their destination.
- Disability groups are liaised with to ensure the Legible London design is as inclusive as possible. For example, the Legible London maps show steps, pavement widths and pedestrian crossings.
- Launched in 2007, Legible London is now working successfully across the Capital, with more than 1,700 signs, in nearly every London borough.
- Legible London was trialled in November 2007 in the Bond Street area. Three pilots were then installed in 2009 in the South Bank and Bankside, Clear Zone, and Richmond and Twickenham. Evaluation research carried out before and after the pilot showed a high level of approval for the system. Legible London was then rolled out more widely across the capital, including East London, in time for the 2012 Olympics.
The Legible London signs are placed at strategic locations, and aimed at the average pedestrian. They present information clearly, logically and succinctly. It’s been designed to be in synch with the way people think and act when moving on foot from one place to another. It uses accessible maps of different scales to convey quickly not only the immediate surroundings, but to show how the area connects to those around it. Simple 3d drawings of notable buildings have been incorporated into the maps to fix given points in people’s minds. A clear, easily understood hierarchy of place names has been developed so people can appreciate the general in relation to the particular.

As a means of guiding people on foot through one of the world’s most organic and complex cities, Legible London is based on proven scientific research, particularly into the process of ‘mental mapping’. But it also draws on examples of best practice around the world, and other systems that have stood the test of time, including Bristol Legible City and the UK Road Sign system.
The Chelsea-Hackney Line was first proposed in the 1974 London Rail Study - the first major review of London’s rail network since the 1940s. Its aim was to review arrangements of passenger rail travel in Greater London as well as cross-boundary services into Central London due to rapidly increasing employment. The study examined financial, economic, social and environmental implications of possible network developments and modifications to meet future passenger demand as well as efficient use of resources.

Initial aims of the line’s development included improving service reliability, creating transport links to areas poorly served, and easing congestion - particularly on transportation serving the south west London boroughs.

Even after the 1974 study was published, the project ceased to develop much further until the Department of Transport published the Central London Rail Study in 1989. A choice between a revised Chelsea-Hackney Line and North-South Crossrail were proposed to combat demand of rapidly rising transport congestion. The objectives entailed “congestion relief on Central London rail services, particularly the District and Piccadilly Lines around Earls Court, the Central Line between Leytonstone and the City, and the Victoria Line” as well as “reduction in passenger journey times, particularly in the Hackney, Dalston and Chelsea areas, which are at present mainly dependent on buses for most public transport journeys”. A route via Victoria, King’s Cross and Angel was selected by the study team for main analysis. It was also proposed that the line could link into the Hainault branch of the Central Line which could reduce passenger loadings by 5,000 per hour.
As a result of the 1989 study, a Chelsea-Hackney Line route was proposed. Between 1989 and 1990 an extensive feasibility study was undertaken to ensure the chosen route was geologically, geographically and financially viable to enable deposit of a Parliamentary Bill in November 1990. The alignment was originally planned to take over the District Line branch from Wimbledon to Fulham Broadway - later changing to Parsons Green. The route would pass through underground tunnels in Central London with stations at the following locations:

- Kings Road Chelsea (new)
- Sloane Square
- Victoria
- Piccadilly Circus
- Tottenham Court Road
- King’s Cross
- Angel
- Essex Road (new)
- Dalston (new)
- Hackney Central (new)
- Homerton (new)

After Homerton the planned route ran along the Central Line to Leytonstone and then along the Central Line branch to Hainault. Further planning established that a terminus at Epping was deemed a viable route option.

The alignment was protected between Parsons Green and Leytonstone by a Safeguarding Direction issued by the Secretary of State for Transport on 7 February 1991.
In 1994 London Transport Planning published a report into the strategic review of the Chelsea-Hackney Line. Other route options were explored due to changing passenger forecasts predicated over the next century, technological advancements, and political and socio-economic considerations as urban regeneration became a key objective of the line.

Eventually 3 route options were considered:
- Via Battersea
- Via Chelsea
- Via Fulham

From Hackney Central Station, 3 termini options were also proposed:
- To Epping
- To Stratford
- To Woolwich

These 3 schemes were known as the North-East South-West Express Metro (due to fewer station stops) and were projected to cost approximately £1 billion less than the safeguarded route.

London Regional Transport continued to develop feasibility studies on possible routes up to the late 1990s. The shadow Strategic Rail Authority's 2000 London East-West Study also proposed further options and explored a combination of a Crossrail and Chelsea-Hackney Line alignment.

In 2007 Crossrail took over the Chelsea-Hackney Line, with existing plans establishing the origin of Crossrail 2 - a major infrastructure project linking Surrey and south-west London to north-east London and Hertfordshire via an underground tunnel through the central area.
A modelling assessment between 2010 and 2011 enabled two Crossrail 2 route options to be seriously considered based on issues of overcrowding, connectivity and accessibility:

- “Metro Option” between Wimbledon and Alexandra Palace
- “Regional Option”, a similar route to the Metro, but linking existing National Rail lines to the north and south-west of London

The original Chelsea-Hackney safeguarded alignment between Wimbledon and Epping was discarded. It was not seen as a feasible option to provide relief to existing tube lines apart from the District Line.

Crossrail continue to work with a range of technical experts, environmental and heritage teams, town planners, engineers, operators, transport planners and local specialists to minimise disruption and develop the best possible route to benefit the Greater London population and beyond, which is expected to grow from 8.6 million today to 10 million by 2030.

Taken from Crossrail Website
As London grew and flourished in the early 1970s, its transport needs continued to develop and soon the need for a new line that provided better cross-Capital links began to seem more pressing. In the 1974 London Rail Study, published by the then Greater London Council and Department for Environment, that line got a name – “Crossrail.”

In October 1990 the Government gave the go-ahead to British Rail and London Transport to develop the east-west Crossrail scheme. In November 1991, a private bill was submitted to Parliament. Unfortunately, the onset of the recession in the early 1990s hit hard and this, combined with the increased constraints on public finances, proved key factors that lead to Parliament rejecting the Bill in May 1994.

But the October 1990 announcement had safeguarded Crossrail’s route, ensuring that future land development would not prevent the scheme from going ahead. Soon members of the Government, with the support of the opposition Labour Party and members of the business community began to explore means of putting the scheme back on the agenda.

A small team within London Underground continued to manage the safeguarding, and worked with developers to ensure the project could proceed if it was resurrected.

The Crossrail Act 2008 finally gave Crossrail a confirmed route - Maidenhead and Heathrow in the west to Shenfield and Abbey Wood in the east, with new rail tunnels (and stations) under central London as required.
Addressing Engineering Accuracy with Mapping

- The UK National Coordinate System, Ordnance Survey National Grid (colloquially called BNG), was determined when the original Crossrail scheme was developed in the early 1990s to be too coarse for the engineering accuracy required by Crossrail, as it could result in distortions of up to 200mm per kilometre travelled due to the curvature of the Earth’s surface. Therefore a new projected coordinate system was required, to minimise the grid distortion within the Crossrail area. This became London Survey Grid (LSG) and combined existing OS survey stations with new ones, reducing the overall distortion to 1mm per kilometre travelled.

- A number of zones were designed, each with corrective parameters to help adjust for minute curvature of the ground, to help with this minimisation, resulting in a 7 parameter shift zonal transformation methodology, which could be used to translate data between LSG and BNG. Adoption of this within the Crossrail CAD Standard ensured that all design and construction data was created within a real-world context and allowed for a greater ease of interoperability between CAD and GIS.
Mobile GIS

- A mobile GIS solution was deployed by Crossrail using customisable apps on mobile/tablet devices. Site boundaries and land ownerships were verified during Crossrail construction works to ensure health and safety regulation was adhered to. A cloud-based central repository ensured both site and office users had the current model, enabling seamless data exchange. They were also able to utilise mobile capabilities such as photo attachments and on site GPS.

- As the mobile app was deployed to a number of field personnel, each would survey the map with their respective contract site. The responsible user upon visiting the physical site would swiftly recognise any incorrect site boundaries on the virtual map, and as a result the user added an event to the map. By leveraging the functionality of mobile devices, such as GPS to locate the event, photo taking as attachment items to provide as evidence, and filling the event form with ability to markup geometry, this information could be reported back to office almost instantaneously when synchronised with the cloud. Users reported that by using the mobile app, surveys were conducted without paper datasheet duplication and were faster than traditional methods. As the editable layers automatically synchronise to the AGOL platform every time an addition, amendment or deletion was made, all users could view what other users were creating out in the field almost instantaneously.
Managing Land and Property Information

- Crossrail construction could only begin once “Entry to land” had been facilitated following the serving of notices.
- The greatest challenge for the GIS (Geographic Information System) team was collating the vast quantities of data gathered from many different sources, supplied in different coordinate systems, huge volumes of Digital Terrain Models, and the integration of different systems. All this information needed to be seamlessly joined and integrated.
- In April 2009 the Final Land Acquisition Boundary (FLAB) was created. The FLAB represents the boundary of land that Crossrail required. Land Acquisition areas were divided into: Freehold; Temporary Use – exclusive; Temporary Use – in common with others; New Rights.
- It was decided to keep the attribute data inside an Access database file and the geometry information within Bentley MicroStation format. The spatial extensions of FLAB areas were recorded digitally within the CAD system and then topologically cleaned; attributes captured onto the FLAB database were checked by the GIS Team. The final FLAB model was loaded into the Crossrail Property Register web application.
- The approved FLAB Model was used to define the Land Acquisition Parcels, which were then used to obtain consent for acquisition. Once the FLAB was approved by the property team it was loaded into Crossrail Maps -a web based geographical system browser. Here the users could use different functionalities such as measurement tools, displaying multiple layers and various base maps; and creating custom PDF printable purpose-specific maps used for checking gaps in the FLAB model.
In 1979 the Conservative Party came to power and frustrated by progress in regenerating Docklands, in 1981 set up the London Docklands Development Corporation. The Corporation charged London Transport with mapping out transport options but based on a cheaper light rail alternative to a new Underground line. The Docklands Light Railway was born, opening in 1987.

It was effectively conceived as an upmarket tramway with single vehicles operating under automatic control. The original layout was a three-pronged star, with Poplar at its centre, Tower Gateway to the west, Stratford in the north and Island Gardens, on the north bank of the Thames, to the south.

Use of existing railway formations made for low-cost construction over much of the route but the centre section through Canary Wharf involved a new overhead route. It cost £77 million, had 15 stations, and was 13 miles long. The train service operated as two routes – Tower Gateway to Island Gardens and Stratford to Island Gardens.
Digitised Material

• We are often asked why a document is not available digitally and surprise is particularly expressed at the fact that, proportionately, virtually none of the collections are available in an electronic format. The reason for this is first and foremost the sheer scale of the collections. The Corporate Archives holds over 155,000 files of material. To digitise all of these to a legally and professionally acceptable archival standard would cost in the region of £25 million.

• But that is not stopping us from making inroads. We have already digitised a substantial set of our staff registers, which date from 1863 and provide invaluable information for those interested in family history, social history, company history, and economic history. These are available to the public online through Ancestry.co.uk.

• We have also, in conjunction with the London Transport Museum and the London Transport Museum Friends, successfully digitised our joint collections of staff magazines. These date from 1914 and have been digitised with optical character recognition meaning that they are fully searchable electronically.
Most of our paper records are stored in a salt mine in Cheshire under secure conditions that meet British Standards for storing archival materials. Our public reading room is based in central London. Visits are by appointment only so you must book first using the contact details on this page.

Email: corporatearchives@tfl.gov.uk

Our catalogue contains over 155,000 descriptions of our material. It is available online at http://www.tflcorporatearchivescatalogue.co.uk/CalmViewA/