CHAPTER FOUR:

THE URBAN MORPHOLOGY OF LONDON'S RAILWAY TERMINUS AREAS, THEIR URBAN PHYSICAL PATTERNS

This chapter is the first in a series of urban scale studies of London's railway termini. This first chapter will focus upon the morphology of the terminus areas in terms of the physical structure of the built form. This will be complemented in the following chapter by the, perhaps, more sophisticated analysis of morphology offered by Hillier's configurational approach. This chapter starts by investigating the mutual physical impact of the terminus buildings and their related structures on their urban contexts. Through a figure and ground study, the research focuses on the morphological evolution of all London's terminus areas, since before the arrival of the railway lines up until the present time, and discusses how they relate to their current urban conditions, introduced in Chapter One. The aim of this study is to isolate a potential urban mechanism intrinsic to the development of both blighted and vital terminus areas that could suggest an objective approach to transforming them successfully from nodes into places in the city.

The study in this chapter is structured into three sections. The first section presents a historical review of the development sequence of London's termini. This will address the influence of the different railway companies that were responsible for their distinctive locations and layouts, leading to a situation in which the termini now exist as an ellipse bounding the inner London area. The review uncovers the logic behind the siting and layout of each terminus, which has subsequently affected the evolution of its urban setting. The second section presents the figure and ground study of all London's terminus areas in three successive historical periods; in the early 19th century, before the termini were built, toward the end of that century during the period of urban consolidation, and finally at present time. In some station locations, where redevelopment projects are in progress, their future urban physical patterns will also be analysed. The last section will discuss this ongoing relationship between the terminus structures and their evolving urban settings as well as how the present figure-ground pattern of each area relates to its current urban condition.

4.1: DEVELOPMENT OF LONDON'S MAINLINE RAILWAY TERMINI: A Historical Review

This first section addresses the historical development of London's mainline railways and their terminus stations since the early 19th century. Its objective is to investigate how the termini became embedded in the city structure as a consequence of their initial siting and layout by the railway companies. The development of London's railways will first be reviewed to establish a broad picture of how the rail infrastructures were imposed upon the city. This will contextualise the development sequence of London's railway termini, their different locations in the city and strategies chosen, before introducing a summary of the relationship between the termini and the city's super-grid.

4.1.1 An overview on the development of London's railways

Seaman (1973) notes that the history of London's railways begun in the mid 19th century with lines approaching from all directions to what was then effectively the city's edge (Figure 4.1a). Not until almost half a century later were they rapidly connected by more suburban lines to accommodate expanding suburban settlements and goods transportation (Figure 4.1b). However, the central core of London was still left free from over-ground railway lines (Figure 4.1c), only to be covered by the fine mesh of the underground network in the early 20th century (Figure 4.1d). The underground network interconnected all central mainline railway termini in order to relieve the traffic congestion of the urban core. In Figure 4.2 , Holland (1971) illustrates that the railway stations built at the end of London's mainline railways seem to describe the form of a roughly elliptical ring at the edge of inner city. Paddington, Marylebone, Euston, St.Pancras, King's Cross, Liverpool Street and Fenchurch Street Stations are upon the northern perimeter, while the southern perimeter is linked by Victoria, Waterloo and London Bridge Stations. Charing Cross and Cannon Street Stations were placed a little deeper into the ring at its southeastern corner.

Three London maps by Barker and Robbins (1974), shown in Figure 4.3 , depict how periods of urban growth related to successive periods of extensive railway development during the mid 19th to the mid 20th centuries. They clearly show that the location of railway lines and their stations were not arranged from the very beginning in accordance with any predetermined urban plan. On the contrary, it was the railway

lines themselves that directed the corridors of outward urban growth. Barker and Jackson wrote in their book, London: 2000 years of city and its people (1974) that London's railways both served existing places but mostly created new communities. For example, the North Kent line was approved by a parliamentary committee in 1846 because it believed a large number of houses would be encouraged. The Railway Town consisted of eight hundred residences beyond Wimbledon and Raynes Park, built after the opening of Kingston-on-Railway Station. Other evidence of new London suburbs built following the railway lines are described in several books including Wilcox and Richard's London: the Heartless City (1977), Inwood's A History of London (1998), and several others. This relatively unplanned development remained common only until 1933 when the London Transport Board initiated integrated planning and expansion for all London's railways (Pawley and Paoletti, 2000).

Jackson (1969) notes that the siting and layout of London's mainline railways and their termini were a result of individual railway companies' selections, with the technicalities of the railway's operation primarily in mind, the relation of the termini to their urban context being very much an after thought. Due to the financial constraints of the railway companies, they tried to ameliorate the disturbance caused by railway construction to the existing neighbourhoods as much as possible. This was to minimise the costs of demolition of housing and compensation along the construction path as well as to avoid the unnecessary technical costs of too many level crossings (Perkin, 1970). Nevertheless, the construction of some of London's railway lines caused extensive demolition to densely built-up areas in several locations.

4.1.2 The development sequence of London's mainline railway termini in the city fabric

4.1.2a The first terminus

The arrival of London's first railway line to London Bridge is illustrated in Cross's New Map of 1835 (Figure 4.4). It was the London and Greenwich Railway, the first conventional line reaching the city from the Southeast. The line opened between London Bridge and Deptford, built on a straight diagonal line with four miles of elevated viaducts across a highly developed area of Southwark and Southeast London. The raised level viaducts crossed over several roads and drainage ditches, including the Grand Surrey Canal and Deptford Creek (Course In Clayton, 1964). London's area at that time was approximately limited to the boundaries of Regent's Canal, Edgeware

Road and Vauxhall Bridge to the north of the Thames, and Lambeth, Newington, Walworth, Southwark and Bermondsey to the South with a population of one million (focus on London 98, 1998). Clout (1999) notes that at that time the countryside was still visible at the city's edge.

4.1.2b Railway Mania; series of termini are built up to the city's edge

London in the mid 19th century, shown in Benjamin Rees Davies' Exhibition Map of 1851 (Figure 4.5), had just gone through 'Railway Mania', a period of extensive railway construction that lasted from 1844 to 1847. Although London had not expanded greatly from the period when its first railway line was built sixteen years earlier, during this time eight more termini were built, both at the city's edge and within its already built-up areas. The London termini constructed during this period are Euston Station (1837), Paddington Station (1838), Shoreditch Station (1840, later renamed Bishopsgate in 1846) and Fenchurch Street Station (1841). The lines approaching Euston and Paddington Stations were laid out on more or less ground level because they were built on the edge of built-up areas. Paddington Station was the terminus of the Great Western Railways, coming into the city from the northwest through clay cuttings alongside the canal. The area was then mostly vacant and considered the very western edge of London. The lines leading to Bishopsgate Station and Fenchurch Street Station ran on viaducts of brick arches crossing through dense settlements.

In the south, where property was neither fashionable nor valuable, after London Bridge Station, Waterloo Station was built right up to the bank of the river Thames in 1848. The terminus ended the London & Southampton line, extended from Nine Elms Station which was built ten years earlier at Nine Elms Lane, just south of Vauxhall Bridge. Passing through the built-up areas of Lambeth and Vauxhall, the 1.75 mile line to Waterloo Station was built on brick viaducts. Another minor terminus, Bricklayers Arms Station, was constructed relatively nearby at the south of London Bridge Station in 1844 to relieve its cramped condition (Jackson, 1969). The extensive railway development then greatly accelerated the city's expansion, especially from 1849 onwards as the railway companies began to encourage people to live away from the city by offering extraordinary fare concessions (Collins, 1964).

The most recent terminus shown in the 1851 map is King's Cross Station. It was built in 1851 as the terminus for Great Northern Railways. Its approach lines were driven

under the Regent's Canal through the Gas Works Tunnel just before reaching the terminus. King's Cross Station was respectfully built on the frontier limit set up by the Royal Commission on Railway termini in 1846. The Commissioners, reporting on railway termini within or in the immediate vicinity of London's metropolis, ruled against schemes bringing railway lines into the heart of London. The main objection was the prospect of large number of travelers that railways would have brought into the central area if more termini were allowed to built, and the effects that this would have on congestion levels in the city's centre. They set up a restricted area bounded by The Edgeware Road, Marylebone Road, Euston Road, Pentovile Road, City Road, Finsbury Square, Bishopsgate, Gracechurch Street, London Bridge, Borough High Street, Borough Road, Lambeth Road, Albert Embankment, Vauxhall Bridge, Vauxhall Bridge Road, Grosvenor Place and Park Lane, to limit the invasion by more railway construction (Perkin, 1970).

The next map of London depicts the city in 1905 (Figure 4.6). It shows two more termini that were built in accordance with the Royal Commission's restricted central area. St.Pancras Station (1868) and Marylebone Station (1899) were built to the north of the frontier limit. St.Pancras Station was the terminus of the Midland line which approached at ground level from the south of Camden Square, through the 'slums' of Agar Town and finally crossed over the Canal and the Fleet River. This necessitated the platforms and the terminus to be twenty feet higher than the level of Euston Road to its front. Marylebone Station's approach lines were built in a combination of underground tunnels, covered ways, and open areas, finally bridging over Regent's Canal before following a gradient to the street level where the terminus was located.

4.1.2c Invasion to the city centre at last

However, Broad Street Station (1865) and Liverpool Street Station (1874) were exceptions to the 1846 frontier limit. The projects within central London were specially allowed by the 1863 Committee but on the condition that the approach lines would be below street level in order to avoid additional land acquisition. The lines were intended to bring suburban traffic in from the north and the east, while the existing Bishopsgate Station was converted into a goods station. Despite the low-level approach, the construction of the Great Eastern Railway to Liverpool Street Station necessitated the demolition of 450 tenement dwellings and consequently squeezed the former inhabitants into adjacent streets, worsening the capital's poorest and most unpleasant quarter (Jackson, 1969).

On the south side of the river the Royal Commission allowed greater freedom to railway construction because of the lower property values, and the fewer main roads to be crossed in the less trafficked street system of the south. Following London Bridge Station a couple of decades earlier, the Brighton & South Coast Railways also managed to construct their West End terminus at Victoria Station in 1860. Its precise location was determined by the road bridge and Southwark Water Works immediately to the east. The bridge which carried the line across the river was the first railway bridge across the river Thames in London. The line beyond the bridge descended steeply to the level of the Grosvenor Canal before reaching the terminus, built on the vacant site of the canal basin at the western end of Victoria Street. The approaching rail line was mostly covered by a glazed roof in order to be invisible as much as possible to the newly-laid-out Belgravia and Pimlico neighbourhoods a few hundred metres away from Buckingham Palace, which belonged to aristocratic and influential landowners (Jackson, 1969). The 1846 ‘forbidden zone’ was also invaded by two more termini at the north bank of the river, Charing Cross Station (1864) and Cannon Street Station (1866). Both occupied bridgehead positions and were constructed without extensive demolition to existing property.

The communication between the capital’s mainline railway termini was achieved in 1863 by the Metropolitan Railway, an 'inner circuit' link located just north of the river. To avoid traffic disruption in central London, it was decided to build underground and so the Metropolitan Line became the world's first underground railway. The line at first linked only Paddington and King's Cross Stations. By 1913, a completely circuitous communication link with all other termini (except Fenchurch Street Station) was achieved with the electrified ‘tube’ railways, as well as by motor buses and taxicabs which were common by the early 1900s (Jackson, 1969).

Figure 4.7 shows all twelve of London's mainline railway termini, now standing amid the city's densely built-up areas, each of which has changed greatly from its initial structure at the time of the siting and layout in the 19th century. London has expanded enormously from the time of the first railway intervention. Besides the City, it now includes 32 Boroughs covering over 600 square miles with a population of approximately eight million (focus on London 98, 1998).

4.1.3 The relationship between London's termini and the city's global structure

Figure 4.8 illustrates how each of London's railway termini relates to the city's supergrid drawn from the network of trunk and main roads on the 1999 Ordnance Survey Map. The map displays the predominantly ground level termini and approach lines in yellow, the elevated ones built on viaducts in blue and the sections of the mainline railways constructed below ground in brown. It is clearly shown that the northern termini; Paddington, Marylebone, Euston, King's Cross and St.Pancras Stations, are all ground level termini located along the perimeter of Marylebone and Euston Roads, which appear to form the northern part of the supergrid. From the historical review, all of these stations were initially constructed on approximately ground level since the sites were only moderately built up at the time the railways arrived, with the exception of St.Pancras Station.

The elevated London termini built on brick viaducts; Charing Cross, Waterloo, Cannon Street, London Bridge and Fenchurch Street Stations, are grouped to the south side, scattered along both banks of the river Thames in a less orderly arrangement than the northern perimeter. They are linked with one another by elevated railway viaducts, including the Thameslink route via Blackfriars through-station which connects northwards to King's Cross Station. Only Fenchurch Street Station stands isolated away to the east. It is clear that all elevated railway termini in the south appear to reach deeper into the inner urban area. Historically, this is because London's Southwest area had less valuable properties and restrictive planning regulations than the other sites. However, as the area was densely built-up before these termini were constructed, building on viaducts was conceived as a way to avoid the extensive cost of demolition along the construction paths.

Victoria and Liverpool Street Stations are the only two ground level termini which also break into the core area. For both, construction was allowed within the 1846 Royal Commission's central forbidden zone, and as the construction site of Victoria Station was then still vacant, the terminus was able to be located at ground level. However, its structure was largely covered due to the sensitive urban surroundings. On the far side of the city Liverpool Street Station was not as fortunate. Building through a densely built-up area forced the terminus and its railway lines to be built below ground level.

It also appears that London's railway termini always locate themselves next to at least one or more main streets, with the exception of Euston, Marylebone and Paddington

Stations. These termini were set back from, but still within easy reach of, the main grid. Marylebone Station is on Melcombe street, a more local route in the area and only a block away from the main street, Marylebone road. Euston and Paddington Stations can be accessed from the main roads to their fronts, Euston Road and Praed Street respectively, but Euston Station is set back behind Euston Square Garden and a bus station, while Paddington Station is located behind the Great Western Hotel.

Despite several entry points from the surrounding streets, the station's main frontage, which is usually marked by a grand gateway, is always opposite the approach lines from the perspective of passengers alighting from trains and moving toward the city. Most of London's mainline railway termini appear to have their frontages aligned along main streets except Liverpool Street and London Bridge Stations. Liverpool Street Station has its frontage on Liverpool Street, a smaller road compared to Bishopsgate Street flanking its east side. London Bridge Station turns its side to Tooley Street, the main street in the area. However, some termini such as Waterloo and London Bridge Station have networks of railway lines passing along their frontages.

The different locations and layouts as well as the geographical characteristics of all termini have made the areas distinctive from one another. How this affected the evolution of their local urban surroundings will be discussed in the next section.

4.2: THE CHANGING MORPHOLOGY OF LONDON'S RAILWAY TERMINUS AREAS

The study in this section focuses on a more local scale by examining the evolution of the urban physical pattern in each of London's railway terminus areas. As demonstrated by the previous historical review, London termini have different siting and layouts according to availability of land for the railway companies and the conditions of the existing areas. In such distinctive circumstances at each station location the next question is, how have the terminus structures, including the station buildings, their approach lines, goods sheds, marshalling yards, etc., affected the urban physical pattern of their surroundings and vice versa throughout their history?

4.2.1 Method and scope of study

Rossi (1982) argued that the study of an urban pattern over time reveals how certain phenomena clarify the structure and order of urban space in one period of time,

linking it to another. In order to examine if there is any common physical structure and order to London's terminus areas that would potentially explain their diverse vibrant or blighted conditions, a 'figure and ground study' will be used. The method represents public spaces in an urban area as a two dimensional field of urban blocks; land covered by buildings, 'figure', and open voids, 'ground'. Both elements are called by Rowe and Koetter (1978) and Krier (1979) the 'urban fabric' whose transformation will reveal how an area has evolved. Transik (1986) argued that the transformation can be traced by examining the changing relationship between these two fundamental elements; how the figure and ground are added, subtracted, or altered in their physical geometry and subsequently affect change in the overall pattern. The transformation are approached through a two dimensional abstraction in plan view, focusing on size, pattern and orientation. The figure and ground study in this chapter will focus on how the terminus structures have taken part in the transformation of their urban settings and vice versa in successive periods of time.

As already discussed in Section 1.2, the area of the figure and ground study will be delimited by the boundary around each station building within a walkable radius of five hundred metres, or a 'ten-minute walk', with further case-specific justification according to local topography, such as the major street grids or the river. St.Pancras and King's Cross Station areas will be examined as a single area, since not only are they located adjacent to one another and share an Underground train platform, but the areas to their rear are also largely incorporated into one vast and vacant piece of land.

In order to trace out the urban pattern of each terminus area in three important periods of their history, the figure and ground study in this chapter will be based on the London maps of three successive periods, 1835, 1888 and 1995. According to the historical review of London's railways in Section 4.2.2, the beginning of the railway era was in 1836 when the first line reached London Bridge at the city's edge from the southeast. The 1835 figure and ground maps represent what all terminus areas in London were like prior to the arrival of the railway structures.

The second set of maps represent the terminus areas in 1888, which was almost the end of the first century of London's railways and several decades after the period of Railway Mania (1844-1847). Most of the termini, except Marylebone Station (1899), were already built and their urban settings had mostly been developed. The 1888 maps depict most terminus structures in their original forms being surrounded by densely built up urban areas. This is just before the period of dramatic change that occurred by the end of 19th century when the railways were electrified and many

termini demolished and extensively reconstructed in order to cope with the new railway operating system. The elimination of steam also meant new opportunities for the development of the railway properties. The 1888 maps then represent the beginning of the decline of London's railways when they were considered increasingly redundant, to be later largely replaced by road and air transportation in the early 20th century which subsequently brought about the great transformation of London terminus areas. It also coincides with the period of urban deterioration as well as the extensive clearance of London's slum areas.

The third set of figure and ground maps from 1995 represent the areas' urban pattern at the present time. Not only is this the period after such dramatic change occurred in the early 20th century but it is also post-dates several other important events that have affected London's urban fabric such as the wartime devastation (1940s), the post-war rebuilding programmes (1950s onward) and especially the big leap of urban redevelopment as a consequence of the years of the Big Bang in 1985-1986 which also marked the return of London's railways. Additionally, the prospective figure and ground urban pattern of those areas where redevelopment is currently underway will also be examined. These include the office and commercial development at London Bridge and Waterloo Stations, the hotel and commercial development at Victoria Station, the ongoing phase of Broadgate Complex Development at Liverpool Street Station and the ongoing Paddington Basin Development at Paddington Station.

The three maps selected are Cross's 1835 New Plan of London, Bacon's 1888 New Large-Scale Ordnance Atlas of London and Suburbs and The 1995 Ordnance Survey Map of Greater London. Building coverage in the areas that are depicted as 'figure' are colored in black and exterior spaces in white representing the 'ground'. As Cross's and Bacon's London maps do not produce areal surveys of as great a precision and detail as the Ordnance Survey map, the comparison of figure and ground patterns tracing from these three maps will focus only on their general transformation, not on the precise geometrical scale of the figure and ground elements.

The study will also be accompanied by a historical overview of the terminus areas briefly addressing social, economic and other development factors related to their evolution including the review of ongoing or prospective redevelopment projects that would effect their urban physical patterns in the future.

4.2.2 The figure and ground study of London's railway terminus areas

The local maps and their figure and ground study of all London's eleven railway termini are illustrated in Figures 4.9 - 4.19 , starting from Euston Station, the first terminus built in the city, then following in clockwise direction Holland's 'elliptical ring' of termini, previously shown in Figure 4.2, from King's Cross and St.Pancras, Liverpool Street to Fenchurch Street, London Bridge, Cannon Street, Waterloo, Charing Cross, Victoria, Paddington and finally, Marylebone Station areas.

4.2.2a Euston Station area

The 1835 figure and group map of Euston Station area (Figure 4.9a) depicts a sparse field of building blocks with the vast vacant space of Euston Grove in the Somers Town area before the arrival of Euston Station two years later. Apparently, the urban pattern which was overlaid diagonally from the outset has been maintained until the present day. At the time, New Road, later named Euston Road, that ran across the east-west axis to the south of the station's site, was already well constituted by buildings and crossed with one large rectangular square. The standard urban blocks in the area were small terraced town houses, established primarily in a network of streets and squares. Some residential blocks in the Bedford estates at the south side of New Road had been laid out since 1770s.

The 1888 figure and ground map shows the initial structure of Euston Station in blue (Figure 4.9b). The original terminus, built in 1837, is relatively small compared to the current one. The area had by then been completely developed and throughout its building coverage became relatively more dense. The urban fabric consisted of edge-defined building blocks of predominantly terraced houses built during the 1850s with open squares of various shapes. Some were semicircular, such as the squares at Mornington Crescent. These voids generally appeared to be 'figural' as they were carved out of the urban solids. The area was inhabited a cross-section of London society, from the most moneyed to the most deprived (Jackson, 1969). The station's approach lines demarcated a diagonal linear gap in the northern neighbourhood. However, the gap was quite narrow and the continuity of the urban grid on both sides of the tracks was still maintained. The areas along Euston Road, Drummond Street and the railway yards were constituted by large blocks of office buildings built from 1881 onward. The area at the south of Euston Road had become more concentrated than that to the north by large blocks of several campus buildings. These are University College (1826), University Hospital (1828) and its medical school (1830s) (Jackson, 1969).

The overall ensemble of urban figures appears to be looser at present especially around the station's rear, as depicted in the 1995 figure and ground map (Figure 4.9c). The edge-defined blocks along both sides of the tracks, seen in the previous map, have now been replaced by smaller blocks of free-standing council flats and other housing scattered in the landscape. Only some street-defined building blocks with carved out open squares have survived such as those in Clarendon Grove (1894) and Churchway area (1895). New flats were constructed as a compensatory provision for people who whose dwellings were demolished by the incursion of rail lines in existing residential areas here and elsewhere. Some council houses were built during the post war period (Jackson, 1969). The rebuilt Euston terminus is now seen as a distinctively large figural block standing out from its surroundings. The linear urban void caused by the railway lines has become wider and the urban fabrics alongside them appear to be separated into two sides. However, they are densely distributed and coherent with each other. The station's frontage along Euston Road and beyond are still well constituted by large office blocks. The Bloomsbury area in the south has not changed very significantly. It still has been occupied by the edge-defined building blocks of university, hospital and residential buildings. Euston Station area has no plan for any large scale station related urban development[1].

4.2.2b King's Cross and St.Pancras Station area

Located between the City and the West End, before the arrival of King's Cross and St.Pancras Stations the area was considered a London suburb. Its 1835 figure and ground map shows the terminus area still to be a vast and vacant space sparsely filled by small building blocks (Figure 4.10a). These were medieval parishes, churches, pubs, and industries of various kinds such as brick, tile and gas companies (Askew In Greed, 1996). The urban fabric generally consisted of a field of building blocks laid coherently along Euston Road, the area's major east-west axis, and along the intersection of Euston, Gray's Inn, King's Cross, Pentonville, Caledonian Road and York Way. The built up area was defined by Grand Union Canal at the north side dissecting the area since the 1820s (Thorne, 1997).

[1] As Euston Station area is in one of the building height control areas, known as *'the St.Paul Height'*, to ensure that the dome of St.Paul's Cathedral remains visible from Primrose Hill, the vertical building development using air rights above the railways is limited and thus considered financially infeasible. The source of information is a private interview with Clive Brandon, the Railtrack's chief architect on January 2000 at the Podium Building, the Railtrack House at Euston Station.

The site of King's Cross Station itself was initially occupied by small building blocks belonging to the London Small Pox Hospital, while the site of St.Pancras Station was previously occupied by blocks of family housing built in 1848 to accommodate working class people once crammed into the city centre. This accommodation was among the first blocks of family flats ever built in London (Jackson, 1969). The 1888 map (Figure 4.10b) shows King's Cross and St.Pancras Stations having been imposed onto the area in 1851 and 1868 respectively. Both lie to the north of the Euston Road which was then considered the limit decreed by the government to prevent more termini reaching further south into the centre of London, as previously discussed in Section 4.2.2b. At the time when both termini were built, the area had already been built up. The railway construction then necessitated the demolition of many industries in the area, including the whole community of small tenements of Agar Town (Jackson, 1969).

It was the organisation of complex rail lines reaching both termini and the east-west crossing of the north London line that formed the large triangular open void of approximately sixty acres, clearly shown in both figure-ground maps of the last two periods. The large void is also crossed by the Regent's Canal (seen in the original maps) and filled with some urban blocks belonged to railway related industries. The northern part of the site contained a rail depot for goods interchanging and packing and other uses including warehouses, the Granary, the German Gymnasium, the workhouse hospital and the gas holders built since the 1880s (Davis, 1997). The void has completely disrupted the urban fabric on both sides.

In the 1995 figure and ground map (Figure 4.10c), although the void is still large and in evidence, its edge has become more diffuse and invaded by other urban blocks. Some small blocks of residential flats have been built, especially in the north around Agar Grove, Caledonian Road and Barnsbury, replacing the unused parts of the railway lines and goods depot. The rail depot at the centre of the void was replaced by a larger block of concrete batching works and some storage spaces (Thorne, 1997). Designated as a conservation area dominated by the Grade I listed stations and old warehouse blocks, parts of the southern area of the site have remained almost unchanged. Similarly to Euston Station area, the overall urban figural pattern at both sides of the King's Cross-St.Pancras railway land appears to have loosened and been occupied by more fragmented and smaller urban blocks. These are principally council flats and houses constructed during the post war period in the areas of Camden Town, Somers Town and Pentonville. At the west side of St.Pancras Station, the vacant site formerly occupied only by the Somers Town's goods depot has been replaced by the new British Library finished in 1999.

Only the neighbourhoods to the front of both termini located to the south of Euston Road appear to maintain more or less the same urban density and pattern. However, since 1995 the large housing redevelopment by King's Cross Estate Action has begun in the area bounded by Euston Road, Judd Street, Tavistock Place and Gray's Inn Road (Crook, 1996). The area is now occupied by more loosely packed residential blocks.

There have been several masterplans to redevelop the King's Cross railway land since the 1980s. Their prime objective is to integrate the Channel Tunnel Rail Link (CTRL) interchange which is an international rail transport network with associated urban redevelopment intended to promote local benefits. The project is now on hold as the CTRL deal has not yet been finalised, despite several detailed implementation plans put forward by different parties[2]. However, the schemes were finally held back as they were criticised for being an office-led development rather than a mixed-use project to address the needs of local people (Bertolini and Spit, 1998). The development consortiums finally appointed King's Cross Partnership (KCP) as the main working group, mostly consisting of local authorities. Their aim was to formulate a strategic framework for the redevelopment relating to the local and regional urban and transportation issues rather than to conceive of a rigid masterplan as in the past. The process is planned to take until after 2004 so there is still no finalised scheme for the King's Cross railway land redevelopment and the site remains the largest urban void in the city.

4.2.2c Liverpool Street Station area

The existing site of Liverpool Street Station shown in the 1835 figure and ground map (Figure 4.11a) had already been densely built up with street-defined urban blocks. The grid pattern of the area had continuously evolved from the junction of the important Roman roads of Old Street and Kingsland Road located north of the terminus area (Hawkes and Harrison, 2000). The main thoroughfare cutting the area in half is Bishopsgate, linking north-south from Kingsland Road to the City. The terminus area

[2] They include the redevelopment schemes independently established by King's Cross Railway Lands Group (KXRLG), King's Cross Team (KXT) and London Regeneration Consortium (LRC). More details of the development schemes for King's Cross Railway Lands can be found in; Bertolini and Spit (1998), ***Cities on Rails***, Crook, (1996), ***Change at King's Cross, King's Cross Estate Action***, A Vision for London Report, (1997), ***King's Cross: past, Present and Future***. LRC proposed a masterplan designed by Foster and Partners with the support of British Rail, the developers and minority landowners in July 1990, and in collaboration with Space Syntax Laboratory, University College London. The detail Space Syntax study can be found in, Hillier et al. (1988), *The Other Side of the Tracks, The King's Cross railway lands site in its urban context*, Hillier et al. (1992), *The Kings Cross Project, a study of passenger behaviour*, Space Syntax Laboratory (1997b), *King's Cross - St.Pancras, report on pedestrian movement studies and review of current design proposals*, Space Syntax Laboratory (1997c), *King's Cross, Understanding the area. Stage one.*

was where the two perpendicular sets of urban grids came together, and was generally occupied by well-to-do Georgian residential communities and was at the time considered a suburb area known as Shoreditch and Spitalfields. The communities were laid out on the existing grid network during the 17th century with few alleys and courtyards (Inwood, 1998). The area declined sharply during the Victorian age and became deprived and crime ridden neighbourhoods (Clout, 1999). The site of the terminus building itself is ten acres previously occupied by blocks of old Bethlehem Hospital.

Because the area had already been built up, the arrival of railway lines to Bishopsgate, Broad Street and Liverpool Street Station in 1846, 1865 and 1874 respectively could not avoid but demolished large numbers of buildings along the construction path. This included the City of London Theatre, gasworks and some 450 tenement dwellings housing seven thousand people. Some of these who could not afford to settle elsewhere squeezed into the adjacent streets and the area became yet more deprived (Clout, 1999). Bishopgate Station was later turned into a goods station after the later arrival of the other two termini. The 1888 figure and ground map (Figure 4.11b) shows the area had been scarred by the twisting pattern of railway tracks approaching these three termini, evidenced as a series of linear urban gaps. The widest was located to the west and north sides of Broad Street and Liverpool Street Station. The east side of Liverpool Street Station was still attached to some residential blocks, later demolished in 1890 to allow for the station extension.

The urban pattern of the station area in 1888 was at its most dense and congested. It was the time shortly before the overcrowding due to a large number of immigrants coming into inner London areas around 1900 thus worsening the already acute urban deprivation. The map also shows the new Commercial Street diagonally cutting through the area from the northwest to the southeast crossing the rail lines as a major thoroughfare since 1845. It was initially aimed to cut right across the notorious slum areas around Wentworth Street (Inwood, 1998).

The area was heavily bombed in 1917 and 1941 and slum clearance was further carried out by the Peabody Trust during the 1920s-1930s. The area has largely been rebuilt with a modern mixed use of office, business and residential blocks. The 1995 figure and ground map (Figure 4.11c) reveals a dramatic change of urban pattern from the previous map. Now the area has a more loose urban pattern of edge-defined building blocks and figural voids. The latest map also sums up the area's physical pattern following the large scale Broadgate Complex office and commercial development of the

1980s to the north and west side of Liverpool Street Station. The site of Broad Street Station and the large gap at the station's back are now filled with more coherent urban blocks with a series of open squares which appear to integrate the urban fabric on either side of the terminus structure well with each other. Broad Street Station's former approach line which is no longer used is left as a flat-topped embankment still clearly visible as a narrow gap running northward from the former station. However, the line is elevated on a series of viaducts and does not intervene in the street grids. Nevertheless, there remains a large gap caused by the abandoned Bishopsgate Station and the rail lines approaching Liverpool Street Station from Shoreditch at the northeast corner. The urban fabric on both sides appears to be disconnected from each other.

After the completion of the Broadgate Complex's early phases (1-8) in 1990, its later phases (9-13) are now being constructed, again using the air rights above the rail lines as office, residential and commercial spaces to the north of Exchange House on Primrose Street (Figure 4.11d). There are also more office developments being constructed in the station area including the Spitalfields office and retail development and several new housing projects located around the railway embankment. Another small project called 'the Viaducts Goods Yard' is also being implemented by reclaiming the vacant space of the disused railway viaducts further down the tracks for a new retail strip, local market place and sports ground for the Bangladeshi community. The new viaduct market is located to the west of Brick Lane and aimed to be an extension from its weekend market and a new connection to Wheler Street. The location of all these new developments are plotted on the station's local area map shown in Figure 4.11e . Its figure and ground study (Figure 4.11f) reveals that the urban fabric around the terminus building becomes relatively denser throughout, but especially to its rear. The void caused by the approaching rail lines appears to be entirely overcome and the urban fabric on either side become united without any sign of the railway structures. The large void further north is also projected to be narrowed being taken up by the new market space.

4.2.2d Fenchurch Street Station area

Fenchurch Street Station was the first terminus built within the City of London. The 1835 figure and ground map (Figure 4.12a) shows evidence of an already dense urban pattern before the arrival of the terminus in 1841. The pattern was relatively coherent and established along two main thoroughfares in the area, Leadenhall and Fenchurch Street, which were among the City's widest streets at that time beside Cornhill and

Cheapside. Most urban blocks in the area were residential and industrial buildings densely packed along tiny alleys off the main streets. They were merged with a shipping quarter serving the docks and the estuary at the southern end of the plan, which was densely latticed with small streets and lanes approaching the river Thames. The largest void in the area is around the Tower of London and at St.Katherine's Docks.

As the area had already been built up, the Railway company opted to build the terminus structure on a series of elevated viaducts. The terminus building was sited just to the south of Fenchurch Street, east of Mark Lane. The railway structures had apparently very little impact on the existing urban fabric as shown in the 1888 figure-ground map (Figure 4.12b). Only a new street called Railway Place was cut to give access to the station's front entrance. The urban grid at the station's rear area had not been interrupted since it still continued beneath the viaducts. The urban pattern by that time was generally at its densest, especially in the Tower Hill and Whitechapel areas located to the north and south of the terminus. The areas had accommodated more industries and immigrants and become significantly poverty-stricken (Inwood, 1998).

The 1995 figure and ground map (Figure 4.12c) shows that Fenchurch Street station is still well assimilated and almost unnoticed in the map despite its structural expansion in 1935 and 1962. The terminus structures almost disappear under the proliferation of office buildings that sprang up in the second half of the 20th century. The station building itself was built over to provide more office spaces. The overall urban pattern in the area, especially within the City wall, has not changed very much as most of the new buildings largely replaced the existing ones retaining their same footprints. Some old blocks were only refurbished to accommodate new functional uses such as banks, insurance offices, warehouses and production houses (Cassidy In Burdett, 1994).

In the area outside the City wall, its urban pattern has become looser. Most old warehouses that survived the German bombing of the 1940s were closed down and some were either refurbished or replaced by residential uses built in smaller blocks. There is also a more apparent linear urban gap further down the railway lines which is caused by the railway viaducts being fenced off especially around Cartwright, John Fisher and Chamber Streets. The blocked viaducts have disconnected the urban fabrics on either sides. They are attached with some vacant pocket spaces or fenced off parking lots. Apparently, the areas further down the railway lines have more sparsely figural blocks which represent new housing estates.

4.2.2e London Bridge Station area

Figure 4.13a shows the 1835 figure and ground map of London Bridge Station area which is located in Borough, between Southwark and Bermondsey. The building blocks had begun to constitute along three main streets in the area; Tooley Street, running east-west parallel to the Thames with small alleys packed with industrial factories and warehouses approaching the wharves to the north; Bermondsey Street, running diagonally from the southeast corner with a series of differently sized urban blocks relating to it; and Borough High Street, the centre of business and trading in the area with small alleys inhabited by poor trade-labourers. The urban pattern in the area within these three main streets was still sparse. The areas were largely occupied by a series of pleasure gardens, entertainment resorts and spas (Davies, 1987, Hawkes and Harrison, 2000).

The first railway line to London terminated at London Bridge Station in 1834. The station was sited just to the east of Borough High Street, between Tooley and St.Thomas Street. Its approach tracks were built on a series of viaducts diagonally across the built up area. The tracks continued to run through Southwark, snaking off towards Waterloo Station before curving round onto the Cannon Street Bridge to Cannon Street Station. The tracks produced a series of linear gaps seen in the 1888 figure and ground map (Figure 4.13b) because of the large bundles of railway structures both at the front and back of the station building. As the arrival of the railways in the area brought along busy wharves and more tenements, the whole area had then become progressively more densely packed with blocks of industrial, residential and warehouse building. Its social condition had become worse due to bad drainage leading to an unpleasant smell (Inwood, 1998).

The station was rebuilt in the 1970s and later refurbished in the 1990s. It now accommodates platforms for both terminus and through station's under one roof. Its overall structure appears to be the largest building block in its surroundings as depicted in the 1995 figure and ground map (Figure 4.13c). The map also represents London Bridge Station area after the docks were closed down and parts of Bermondsey were redeveloped under the Docklands regeneration scheme. Some areas were devastated by the German bombing during the 1940s and later rebuilt as residential housings and council flats. The urban pattern has apparently become more sparse with free-standing blocks scattered in open ground rather than street-defined urban blocks. Only Guy's Hospital complex, located to the south of the terminus, has remained the same. Several old warehouses along the waterfront have been either

restored and converted into small units of accommodation, shops and restaurants such as at Butler's Wharf, or replaced by office blocks or luxury flats during the 1990s. The linear gap caused by the space taken up by the approaching rail lines has become more apparent in the 1995 map. It appears to become wider as it also includes some pocket spaces which are either vacant or fenced off for parking lots. Similar to Fenchurch Street Station area, some of London Bridge Station's railway arches have been blocked or converted into storage, garages or small businesses so the urban fabric alongside them are largely disconnected.

The drastic regeneration of London Bridge Station area was proposed by Renzo Piano in 2000 and initially due to be completed in 2006. The scheme includes the redevelopment of a new retail, office and residential complex on top of the terminus building, boasted to the be the tallest high rise structure in Europe, and the refurbishment of the station's concourse and platform areas as well as its viaduct spaces to improve the accessibility from its surrounding streets and to increase retail and other urban facilities (Figure 4.13d-e). The large vacant riverside areas resulting from the demolition of the docks is now the site of the new headquarters for the Greater London Authority, completed in 2002, and the ongoing construction of a medium rise office complex (Figure 4.13f). The prospective figure and ground pattern of London Bridge Station area in the near future, shown in Figure 4.13g , reveals the denser and more coherent urban pattern along the riverside area. The linear gaps taken up by the railway lines still cause scars in the urban fabric and become more apparent as their surroundings get denser.

4.2.2f Cannon Street Station area

The 1835 figure and ground map of the area before the arrival of Cannon Street Station (Figure 4.14a) shows the once commercial heart of London built over a maze of medieval lanes and alleys. Major market streets in the area, Newgate Street and Cheapside, run on east-west axes and fan out towards the north and the east. Bishopsgate is another main road linking from the north to the City and all the way down to London Bridge. The general urban pattern was dense with edge-defined urban blocks. The important ones were the Guildhall Complex, guild buildings and parish churches including some prestigious houses with large courtyards well embedded within the urban grid (Hanson, 1989). The urban fabric north of Cheapside was relatively more sparse and fragmented forming a random scatter of figural blocks

throughout the plan, while the southern part was cross-cut by a denser lattice of small streets and lanes close-packed with small blocks of wharves lying along the Thames.

The arrival of a new river bridge and viaducts brought in railway lines to Cannon Street Station in 1866. The 1888 figure and ground map (Figure 4.14b) shows how the terminus building and its approach lines fit well into the urban grid since its initial stage. It was sited just to the south of Cannon Street with its elevated platforms crossing over Upper Thames Street. Its elevated tracks were immediately carried away onto Cannon Street Bridge. There was no interruption to the existing street grid and the terminus structures were totally assimilated and almost unnoticed in the figure and ground map. This is due to its topographical advantage since the terminus was sited just slightly beyond the river bank. By that time, there were two more new streets, Queen Victoria Street and King William Street, cutting diagonally across the area to the north of the station. The site of Cannon Street Station then appeared to be more or less in the middle position to the south of the City's major intersection. The overall urban pattern was constituted by street-defined building blocks latticed with small alleys and lanes. Areas along the riverfront appear to be even more packed with small linear blocks of wharves than the previous map.

The 1995 figure and ground map (Figure 4.14c) depicts the terminus area in a looser pattern with larger urban blocks. As the arrival of the railways had encouraged a large proportion of the work force to take up suburban residence, Londoners became increasingly daily commuters travelling to work in the city. Most of the old building blocks have been replaced by larger blocks of banks, insurance offices, warehouses since around the end of the 19th century. The station building itself was heavily bombed in 1941 and was rebuilt in 1957, addressing also the need for longer train platforms (Jackson, 1969). The station's arch roof was removed and topped over with office space with a roof garden and the terminus building is now totally hidden under the new development. The river bank warehouses, breweries, markets such as Billingsgate, Leadenhall markets, including buildings such as Bracken House, Royal Exchange, Custom House and Fishmonger Hall, were either refurbished, rebuilt or infilled to accommodate large blocks of office buildings during the 1980s.

4.2.2g Waterloo Station area

The area of north Lambeth and Southwark before the construction of Waterloo Station had been sparsely built up, as shown in the 1835 figure and ground map (Figure 4.15a). The urban pattern was generally made up of small blocks of residential, commercial and industrial uses constituted along Waterloo Road which runs straight from Waterloo Bridge and also the other roads cut in parallel with the bend of the Thames; Bleeder, York, Baylis and Kennington Roads. The area along the riverfront at north Lambeth was occupied by small blocks of pottery industries on the open grounds of timber yards while Southwark's riverside was filled with wharves and breweries (Davies, 1987, Inwood, 1998). The large urban void located in the south is the area of Lambeth Palace built in the 12th century.

The construction of elevated viaducts carrying rail lines to Waterloo Station was completed in 1848. The construction had demolished some seven hundred houses along its path as it had tried to avoid important buildings such as Lambeth Palace, Vauxhall Garden and gasworks, and ended up crossing over twenty one roads in total (Jackson, 1969). Shown in the 1888 figure and ground map (Figure 4.15b), the linear gap taken up by the railway lines were evidenced as far north as Waterloo Road where the terminus was sited on ten acres of land over eight streets, miscellaneous hay stalls, cowyards, dungheaps and a large pond. The general urban pattern was already dense and the area was considered one of the most deprived residential neighbourhoods in London (Inwood, 1998). Although the urban fabric at both sides of the railway lines appear to be coherent with each other as the street grids could still be continued under their viaducts, the area in general was very much scarred by the viaduct structure itself. The linear gaps are evidenced at the station's rear by its approach lines and at the front by the bypass lines from Charing Cross Station.

The urban pattern of the terminus area depicted in the 1995 figure and ground map (Figure 4.15c) changes enormously from the 1888's. The area has comprehensively been replanned and redeveloped since the mid 20th century. Like other areas in inner London, it experienced overcrowding and accumulative decay toward the end of 19th century and was heavily bombed during the 1910s and the 1940s. The congested slums in the area had been cleared and replaced by council flats, governmental and office blocks. In 1951, the Southbank area, north of the terminus, became the site of the Festival of Britain and was later replaced by the Southbank cultural complex, consisting of auditoriums, concert halls and an art gallery. The river bank once lined with small wharves and industries has been redeveloped to accommodate large scale

institutional blocks such as St.Thomas Hospital and County Hall, later redeveloped as the London Aquarium. Another large scale office development is The Shell Centre, built in 1962 on the site adjacent to the terminus on York Road. The overall urban pattern along the riverside has then become looser with large urban blocks with several open spaces placed in between them.

Waterloo terminus was extensively rebuilt and extended to accommodate more rail platforms including those of the new trans-European rail links, the Eurostar service. The voids taken up by the railway structures appear to become wider both at the front and the back sides and their attached urban solids become more fragmented due to their occupation by loose blocks of council housing and flats. Similar to Fenchurch Street and London Bridge Stations, some of the Waterloo's railway arches have been blocked or turned into garages, warehouses or storage, such as the ones along Hercules Road south of the terminus. Some were later closed down due to dampness and water leakage problems and remain a physical barrier to the urban fabric on both sides of the tracks.

There is a future refurbishment and redevelopment plan for Waterloo Station being studied by Nicholas Grimshaw[3] who designed the Waterloo International Station. The scheme is to move the currently elevated station's concourse hall down to ground level in order to improve the accessibility from its surrounding streets and to extend the length of rail platforms into the existing concourse area. A fifty five storey office building is also planned to top the station structure. However, its detailed implementing plan has not yet finalised. Additionally, the riverside Jubilee Gardens next to the London Eye to the west of Waterloo Station is now being developed by Rick Mather Architects as a new arts quarter consisting of concert halls, theatres, cinemas, an arts school and cultural organisations as well as new public squares (Figure 4.15d-e). The accessibility of pedestrian routes to and through the Southbank area will also be improved. The prospective urban pattern of Waterloo Station area shown in the latest figure and ground map (Figure 4.15f) reveals that the riverside vacant lot of Jubilees Garden is filled in while the urban scar caused by the terminus structures still remains unchanged as the Grimshaw's station redevelopment plan neither utilizes the air rights above the approach lines nor aims to reconnect the areas alongside the tracks, but takes up only the space over the existing terminus building.

[3] Source: interview with Clive Brandon, Railtrack's chief architect on 24 January 2000 and from Building Design weekly magazine, 14 January 2001.

4.2.2h Charing Cross Station area

The area before Charing Cross Station depicted in the 1835 figure and ground map (Figure 4.16a) was dominated by edge-defined urban blocks with a large open space, Trafalgar Square, constructed in 1830. The area is a junction where major streets come together such as The Strand, Whitehall, Pall Mall, Charing Cross and St.Martin's Lane. All of them had already been well constituted by urban blocks by 1835. The area along the riverfront east of The Strand and Whitehall, the two main thoroughfares cutting parallel to the sharp bend of the Thames, was largely occupied by river palaces and mansions, one of which remains, Somerset House. The other important building blocks are several governmental offices, The National Gallery, Northumberland House, Covent Garden Market and entertainment businesses such as gaming houses and theatres (Davies, 1987). The site of Charing Cross Station itself was formerly occupied by Hungerford Market located to the east of The Strand just beyond the river bank.

Similar to Cannon Street Station, Charing Cross Station, which was opened in 1864, has caused very little interruption to the existing urban grid. Depicted in the 1888 figure and ground map (Figure 4.16b), the terminus was assimilated well into the its surrounding. There was no sign of an urban scar as the terminus structures had been placed on elevated viaducts. The lines were immediately carried across the Thames on the new Hungerford Bridge, named after the former Hungerford Market. A new riverfront street, Victoria Embankment, was constructed along the bend of the Thames running underneath the Charing Cross viaducts and the relationship between the urban fabric and the river has since been disconnected. Northumberland House was also demolished in the 1870s giving way to Northumberland Avenue, another approach street to Trafalgar Square from the riverside. Leicester Square, another important open square in the area, was apparently constituted by building blocks after Charing Cross and Shaftesbury Avenue were tidied up and improved in the 1870s (Davies, 1987). By that time, the square was surrounded by dense blocks of residential use, theatres and music halls (Hawkes and Harrison, 2000). Another open void apparently seen in the map is the Covent Garden Market.

The 1995 figure and ground map (Figure 4.16c) depicts the current urban pattern of the terminus area which has not changed much during the past century. Most building blocks have only been refurbished or infilled to accommodate more offices, hotels and especially entertainment businesses since the 1930s (Hawkes and Harrison, 2000). The terminus itself has been refurbished several times including in the 1900s, from its declined condition, 1926 at its electrification, restoration in 1951 following the war

time destruction of 1914 and 1941, and finally in the 1980s, the large scale redevelopment of commercial and office spaces, Embankment Place, using air rights above the terminus building and its railway lines. Apparently, these developments have had very little effect on the station's surroundings and the overall urban pattern.

4.2.2i Victoria Station area

Belgravia as shown in the 1835 figure and ground map (Figure 4.17a) before the arrival of Victoria Station was only sparsely built up with small blocks of residential uses. Defined largely by watercourses, the area was still generally vacant, consisting of low-lying ground used for horticulture that was latticed with water channels irrigating and draining the productive fields. Natural inlet of water at the time stretched as far north as the present site of Victoria Street (Davies, 1987). Buckingham Palace Road was then the only main thoroughfare in the area connecting Buckingham Palace to the riverside in the south. The site of Victoria Station itself was still vacant and formerly occupied by the old Grosvenor Canal Basin used for conveying materials and essentials for freight transport to Belgravia and Pimlico. Several blocks of sawmills and small wharves lay along the canal bank north of Ebury bridge (Davies, 1987).

As shown in the 1888 figure and ground map (Figure 4.17b), the diagonal urban pattern became more apparent as the grid was completely filled up with edge-defined blocks of residential buildings, mostly of influential and aristocratic landowners (Davies, 1987). Some were built around open squares such as Eccleston Square and Warwick Square located to the east of the terminus. The grid had evolved from old ancient tracks designated to maximise return per acre by Thomas Cubitt (Barker and Jackson, 1990). Victoria Street was constructed in 1851 and later became a major street linking Belgravia to Whitehall and Westminster, flanked with large blocks of mansion flats, retail units, hotels and offices. Victoria Station, built later in 1860 over the existing canal, had its railway lines placed below street level. Despite a long linear gap caused by the railways, the street grid could still continue over the tracks. There were some small and fragmented residential blocks that occupied the narrow area between the tracks and Buckingham Palace / Ebury Bridge Road alignment.

The terminus was extended to accommodate its Brighton platform in 1908. Shown in the 1995 figure and ground map (Figure 4.17c), the station building now completes the vacant site once attached to its east. Although the railway lines can still be seen

as a linear gap along their route, the areas on both sides of the tracks maintain a coherently diagonal urban pattern. In the 1980s, there was a large scale office and commercial development, Victoria Place, built over the westernmost rail platforms and a part its approach lines. This is seen as a figural block at the station's back side flanking Buckingham Palace Road. However, the area's urban pattern in general remains more or less the same. Some urban voids have been filled in by more building blocks such as the Chelsea Barracks to the southwest of the terminus on the site of Ranaleigh Garden and around the cluster of streets newly created in the late 19th century such as Ashley Place, Carlisle Place and Morpeth Terrace (Barker and Jackson, 1990). Along Victoria Street, several blocks were reconstructed during the post war redevelopment to accommodate more commercial uses but the new structures were then built on more or less the existing footprints of the old blocks.

Victoria Station has a redevelopment scheme being implemented through a detailed plan by Railtrack. The plan is to develop a new hotel and commercial complex over the station's concourse space including a new office complex at its eastern frontage along Wilton Road. The bus station which is now located at the station's front side will be moved in order to give way to the new station forecourt. The new bus station will be incorporated with the newly developed office building. The prospective development spaces are marked in grey onto the 1995 map (Figure 4.17c) which shows that the area's urban physical pattern is not affected by the new construction.

4.2.2j Paddington Station area

Paddington Station area shown in the 1835 figure and ground map (Figure 4.18a) was still largely vacant. Only some residential blocks had been built up along Edgeware Road and Bayswater Road as well as the street grids located in between them. The area was still considered suburban being largely occupied by small private villas along Regent's canal and beyond.

The first stage of Paddington Station was built in 1838 as a small timber construction sited alongside the canal of Paddington Basin, its front on Praed Street. The urban grid began to form itself around the railway structures, its approach lines and a temporary station that branched off just to the north before the terminus. The 1888 figure and ground map (Figure 4.18b) shows the construction of the Brunel's ironwork station building that replaced the original one in 1854, with Great Western Hotel built at its front. The old temporary station at the north side was turned into a goods depot. The

area had been relatively built up and the urban void caused by the railway structures had become more apparent. The urban pattern of the areas alongside the void appears to be distinctive from each other. The southern part was densely built up with edge-defined rectangular blocks of terrace houses with a series of carved out squares in different shapes and sizes, all corresponding to a diagonal street grid. Some of these blocks were occupied by hotel businesses that came along with railways, especially in Bayswater. The area had also been filled in with boarding houses, privately occupied mews, Victorian residential blocks overlooking Hyde Park and a shopping mall (Clout, 1999). The northern area around Paddington Basin which was cut across by Grand Union Canal was occupied by small blocks of wharves and scattered blocks of semi-detached villas especially around Warwick Avenue. It had later become an area of poverty and the major factor of such decline was noted to be largely the influence of the railway line itself that cut into the area (Davies, 1987, Clout, 1999).

Depicted in the 1995 figure and ground map (Figure 4.18c), the Westway (A40) reinforced the urban division even more than that the railway structures and Grand Union Canal had already done during the last century. Although it was built as an elevated highway and allows the existing street grids to continue beneath its structure, the construction of The Westway largely demolished the area north of Paddington Basin and separated a large vacant piece of land, previously a goods depot, from its neighbourhoods. The gap then appears to become larger, disconnecting the urban fabric of the areas alongside the track even more severely. The slum areas around Paddington Basin and Warwick Crescent that were demolished during the 1960s have been replaced by new clusters. The urban pattern at the north side of the Westway has largely become a sparse field of free-standing blocks, while at the south side, it remains more or less unchanged. Only some blocks of terraced houses were replaced by council flats such as at Hallfield Estate along Bishopbridge Road and around Norfolk Crescent, Oxford Square and Cambridge Square.

The Paddington Basin Development, now being constructed with its first phase due to be completed in 2003, is currently the largest urban development project in London. The development area comprises the station building itself, 13 acres of Paddington Basin north of the terminus, 11 acres of Paddington Goods yard located between the rail lines and The Westway, St.Mary's Hospital area north of Praed Street and the area at the eastern end of the Canal Basin by the corner of Praed Street and Edgeware Roads. The project includes approximately 720,000 square metres of mixed use development including transport facilities, offices, residences, commercial uses, hotels, hospitals, and leisure with a series of public squares (Figure 4.18d-g). The figure and ground

study of the station area after the redevelopment, shown in Figure 4.18h , depicts that although the urban gap is largely filled in by the new development spaces, the trace of the urban barrier caused by the railway lines and The Westway cannot be eliminated. The urban fabric at the north and the south sides of the railway lands are still appear as separated and the new figural elements do not generate a coherent linkage between them.

4.2.2k Marylebone Station area

Marylebone Station (1899) is the last Victorian terminus to be built in the city. The area is attached to Regent's Park to the east and Regent's Canal along its northern parameter. The area before the construction of Marylebone Station, shown in both the 1835 and 1888 figure-ground maps (Figure 4.19a-b), had slowly filled up with blocks of terrace houses and open squares especially in the south and west, while the north was still left as a sparse field of small building blocks. Most of them were affluent villas laid out with front lawns (Davies, 1987). Generally, the urban pattern of the area before the arrival of Marylebone Station was a combination of a dense field of urban blocks with carved-out open squares and vacant ground sparsely built up with small building blocks.

The terminus was constructed in 1899 on the site of Blandford and Harewood Squares located to the west of the southwestern corner of Regent's Park. The construction of the station building which included its goods and coal depot, carriage sheds and locomotive yards, demolished not only some villas but also insanitary and overcrowded tenements, especially the filthy slums of Boston Place at the east side of the station's site (Clout, 1999). Almost five thousand working class inhabitants were evicted around Lisson Grove and placed in several medium-rise apartment blocks constructed at Wharncliffe Gardens just off St.John's Wood Road (Davies, 1987). Two new roads, Harewood Avenue and Rosemore Road were cut through the demolished property. However, the railway lines had no detrimental effects on the elegant streets of St.John's wood because they were mostly covered, although they appear to cause a linear gap at the immediate rear of the terminus building, clearly evidenced in the latest map.

The 1995 figure and ground map (Figure 4.19c) shows the urban pattern has become more loosely built up. Only the area to the south of the terminus still retains more or less the same urban pattern of street-defined urban blocks. The small blocks of villas along Grand Union Canal have been largely replaced by blocks of flats since the end of

the 19th century. Some of the early blocks have also been replaced by new residential blocks, a hospital and orphanage. The edge-defined urban solids largely appear to be replaced by more free-standing figural blocks, especially at the north of Marylebone Road and the west of the terminus around Lisson Grove. During the 1950s, much of the goods yard was sold for office and residential redevelopment (Inwood, 2000). There are now large blocks of office and residential buildings occupying the area to the west side of the terminus along Harewood Avenue. Some luxury residential blocks have also begun to be constructed along the vacant piece of land left between the tracks and Park Road. However, despite several urban redevelopment programmes, the urban fabrics along both sides of Marylebone Station's railway tracks and to the north of Grand Union Canal still appear to be loosely distributed. Their figural patterns are also incoherent with one another.

4.3: DISCUSSIONS

The figure and ground study of all London's railway terminus areas reveals striking similarities as well as great variations in the relationship between the termini structures and their surroundings. It suggests that some terminus areas have been transformed dramatically, while in other cases the changes are much smaller. The discussion in this section begins with a comparative overview of the morphologies of all London's terminus areas. It begins from the premise that the morphological variations and degree of transformation of the urban pattern reflect the ways in which the terminus structures and their urban settings have affected each other throughout their history.

Finally this will introduce a discussion of how the current urban conditions of London's terminus areas, previously introduced in the first chapter in section 1.1, are related to their present urban patterns.

4.3.1 The morphology of London's railway terminus areas: the manifestation of the mutual influence of terminus structures and their urban settings.

The previous figure-ground study suggests that there are four main characteristics which indicate how the terminus structures have affected their urban settings and vice versa. Firstly, the study shows that from the very beginning, the initial layout of the

termini was largely determined by their settings. The urban patterns of the station locations before and after the arrival of the termini (1835 and 1888) clearly show that most terminus structures were fitted into the available urban lots or laid out more or less in correspondence with the existing urban patterns in an attempt to cause the least interruption. Ground and below ground-level termini such as Euston, Victoria, and Paddington Stations were sited precisely into available vacant lots in areas which had only been sparsely built up but already had their major street grids laid out. The terminus buildings were aligned to the existing grids and their approach lines orientated to avoid the destruction of the existing urban fabric as much as possible.

Other termini such as King's Cross and St.Pancras, Marylebone, Liverpool Street, Cannon Street and Charing Cross Stations were all fitted into the sites formerly occupied by building blocks. The construction of these terminus structures was thus naturally limited by the existing urban pattern as again they sought to avoid extensive demolition. The first three stations, all ground level termini, were built in areas that had just begun to consolidate. King's Cross and St.Pancras Stations were laid out on sites initially occupied by The London Small Pox Hospital and blocks of family housing respectively. Marylebone Station was built on the site of terraced houses and two squares. Liverpool Street Station was built below ground level in a densely built up area by fitting into the former site of The Bethlehem Hospital. Two bridgehead viaduct termini, Cannon Street and Charing Cross Stations, also appear to fit well in their existing urban settings by taking up small blocks of wharves and Hungerford Market respectively. However, the layout of the other elevated termini such as Fenchurch Street, London Bridge, and Waterloo Stations appears to respect their existing urban patterns less. This is because the construction of viaduct structures were less constrained by the urban settings and thus could be laid out more freely.

Secondly, the initial layout of the terminus structures can be shown to have enormously affected the subsequent urban consolidation around them. In the second set of figure-ground maps (1888), the terminus structures are seen to have caused disruption in the urban fabric as the areas were built up. In some areas the trace of the railway structures was evident as gaps of different sizes, permanently scarring the urban pattern. In some severe cases, the gaps appear to bisect completely their settings into two sides. Examples are ground and below-ground level termini such as King's Cross-St.Pancras and Liverpool Street Stations. Their approach lines, including other related structures, not only obstructed the continuity of urban blocks but also disconnected the street grids at the rear side of the termini. In the first case, the scar is seen as a very large gap where the entanglement of railway structures claimed a

large ground area to the north of the termini. Although the scar evident at the Liverpool Street Station area was very much smaller than the previous case, the urban pattern of both areas was apparently separated into two sides. Importantly, the patterns alongside the gaps showed no sign of continuity or coherence with each other.

However, physical scars were not conspicuous in some areas as the terminus structures had been assimilated well into their consolidated settings. Their urban patterns were dense and coherent throughout. Examples are all small elevated termini such as Cannon Street, Charing Cross, and Fenchurch Street Stations. However, the first two termini are bridgehead railway stations that were sited just beyond the Thames' bank. Thus both had very little interference with their immediate settings. Another group includes Euston, Victoria, London Bridge and Waterloo Stations. The first two termini are below-ground level stations which had several routes crossing over their approach lines while the latter two were elevated on viaducts and allowed several routes to pass under them. Although these terminus structures occupied relatively large areas that inevitably scarred their urban fabric, as apparent from the 1888 figure-ground maps, their urban patterns remained very much coherent and the overall continuity of the urban grids were still largely traceable on both sides of the scars.

It thus seems that although the scale of the terminus structures determined the size of the gaps evident in the urban patterns, the way in which the structures intervened in their topographical settings (at ground level, below ground or above ground) is the key factor that influenced the patterns of the urban fabric itself. If the structures acted as barriers to urban blocks but not to street grids, the urban pattern of their settings in general appear to remain coherent throughout despite the existence of the gaps. If the terminus structures largely interrupted the continuity of street grids, their settings often incorporated incoherent and fragmented urban patterns, especially in the areas adjacent to the gaps themselves. This suggests that spatial factors critically influenced the way in which the urban areas were consolidated around the terminus structures.

The third characteristic evident from the preceding figure and ground study is that the urban pattern of London's terminus areas following the period of consolidation determined the layout of subsequent station expansion and adjustments during the time of their technical modernisation and electrification during the early 20th century. In some areas, it also influenced the redevelopment of railway lands that suddenly became available due to the demolition of disused freight stations, goods yards and other redundant facilities. This is because all London's terminus areas had

by then been densely built up and any change related to the termini was thus totally limited by their surroundings. The 1995 set of figure-ground maps clearly show that all terminus structures have been adjusted from their original layout to varying degrees. While King's Cross, Victoria, London Bridge, Waterloo, Paddington, and Euston Station buildings were expanded into gaps once occupied by their entangled rail lines, the railway complex at Liverpool Street Station was diminished. The terminus itself was refurbished but its accompanying Broad and Bishopsgate Stations, were demolished. The other termini such as Fenchurch Street, Cannon Street, Charing Cross, and Marylebone Stations also had their structures modified but maintain more or less the same footprints as their original schemes.

At the time of their structural modernisation, Liverpool Street and Victoria Stations also utilised the air-rights above their approach lines for the development of office and commercial spaces. The additional blocks appear to assimilate well with their surroundings and some of them fit appropriately into the available urban gaps. The new additions create a series of figure and ground elements that are very much coherent with the existing urban physical patterns, especially in the case of The Broadgate Complex at Liverpool Street Station. Victoria Place, developed over Victoria Station and the western side of its approach tracks, also seems to fit well into its existing area by filling up an urban lot constituted by the major street grid. It appears that both development projects tend to eliminate the urban scars by reconnecting the areas alongside the rail tracks as well as filling in the original gaps.

Fenchurch Street, London Bridge, Cannon Street, and Charing Cross Stations had their structures modernised but still maintained their existing footprints. The office developments utilised the air rights above these terminus buildings. Some new retail spaces were constructed in their viaduct structures. The new development spaces thus fitted well into the already dense and coherent urban settings and had very little effect on their existing urban patterns. The urban development at Euston, Waterloo, Paddington and Marylebone Stations did not utilise the air rights above their terminus structures but were sited into the available urban lots attached to them. Thus, the gaps evident in their urban patterns still remain. King's Cross-St.Pancras Station area is the only area that has not yet been redeveloped. Its railway lands remain as the largest urban gap in the city. However, from all cases except King's Cross-St.Pancras Station, it can be stated that the adjustment of the terminus structures as well as their related urban development during the 20th century were largely laid out in correspondence with their surroundings. In other words, they were limited and determined by their existing urban physical patterns.

Fourthly, it is clear that the terminus structures tend to influence the evolution of their front and back surrounding areas in rather distinctive ways. At the front side of the stations, where their entrances are located, the urban physical pattern is often relatively denser and more coherent than at the rear side which is largely occupied by railway lines, goods yards or other related structures. Examples are King's Cross-St.Pancras, Paddington, and Marylebone Station areas. The current urban pattern at the back side of these termini is sparsely constituted by fragmented housing and / or apartment blocks while their front areas are densely filled with coherent, edge-defined urban blocks of commercial, office and / or residential uses with a series of figural open spaces. It is notable that these stations are ground and below ground level termini whose structures largely obstruct the continuity of urban grids. Euston and Victoria Stations also have two distinctive urban patterns evident to their front and rear. However, the sparse blocks of housing occupying the areas alongside their railway tracks appear to be coherent and compact, though in a less dense pattern than to their front area. As previously noted, although both stations are ground level terminius structures, there are several routes crossing over their approach lines.

The urban pattern of the areas around Cannon Street, Charing Cross, and Liverpool Street Station areas is relatively more dense and coherent throughout, both to their front and back areas. Again, as previously noted, these termini include structures that are well assimilated with their settings and do not totally obstruct their urban grid networks. The first two termini have been criss-crossed with several streets since the very beginning. In the case of Liverpool Street Station, the new development at The Broadgate Complex currently provides several new routes across its existing railway lines. However, the undeveloped area further down its tracks to the northeast of the station still appears to incorporate some fragmented blocks associated with the urban gap caused by the approach lines.

Waterloo and London Bridge Station areas are the exceptions. Both termini (which are also through-stations) have railway lines entangled both to their front and rears. It is apparent in their current urban patterns that there are dense as well as loose and rather fragmented urban figural blocks found at the stations' front and back areas as well. Although Waterloo and London Bridge are high-level railway stations, the preceding historical review showed that some of their viaduct spaces have been blocked or turned into small retail units or storage spaces. Thus, the elevated terminus structures have become more of a barrier to some of the street grids. The loose urban

pattern is also evidenced at the rear of Fenchurch Street Station representing the housing estates and some urban enclaves attached to the railway viaduct blockades.

Crucially, this indicates that there is a spatial implication inherent in the process that generates and transforms the urban pattern of railway terminus areas. The study suggests that the connection of urban grids in the terminus areas is the significant factor that shapes the density and coherence of their urban patterns. It is thus clear that London's termini, that were initially laid out distinctively in different locations in the city, have engineered the evolution of building densities and land use patterns through the different structuring of the urban grid that they themselves have caused. Despite several other forces related to economics and political factors, such as slum clearances, war time destruction, post war rebuilding, etc., the variations and similarities in the urban pattern of London's terminus areas are determined by the spatial intervention of the terminus structures.

It is also apparent that ongoing as well as future redevelopment projects in London's terminus areas suggest different directions in the attempt to shape the urban grid structures. Depicted in the figure-ground maps of its prospective urban pattern, the new developments at Liverpool Street Station area tend to generate a more compact and coherent urban pattern and strengthen the continuity of the street grids by patching the areas alongside the scar with several new building blocks and grid connections. The future urban pattern of Victoria, London Bridge and Waterloo Station areas after new developments reveal very little transformation from the current situation. The projects are small and piecemeal and reveal no attempt to reconnect the areas alongside the tracks, such that the urban scars still remain. In the case of Paddington Station area, where the large scale Paddington Basin Development aims for a dramatic transformation, its prospective urban physical pattern offers no suggestion as to how the two neighbourhoods located to the north and south of its railway lands could be reconnected. Reinforced by the Westway and Paddington Basin as significant urban barriers themselves, the new development elements appear to narrow the urban gap but do not generate an overall coherent urban pattern. This gives important clues that the outcome of these developments will also be very different and suggests that a more detailed study on the areas' spatial configuration is needed to confirm this.

4.3.2 The relationship between the urban pattern of London's terminus areas and their current urban conditions.

The findings from the figure-ground study validate the significant relationship between the urban pattern of the terminus areas and their urban conditions. It is clear that the three most vibrant terminus areas in London: Liverpool Street, Charing Cross and Cannon Street Station areas, where their mixed use surroundings sustain high levels of movement throughout most times of the day, share the same feature of a dense and coherent urban pattern. The current figure-ground map of these three terminus areas similarly displays a fine mesh between block patterns and individual buildings with a series of figural open voids. There is no significant trace of an urban scar caused by the terminus structures and the field of urban blocks extends continuously around the termini.

According to the survey, the areas around these three termini are filled with mixed types of activity generally shared by office workers, commuters and travelers, as well as local people. However, a lower movement level is recorded in the undeveloped part of Liverpool Street Station area where the urban gap appears still to scar its urban setting. Nevertheless, the areas alongside the gap, which are mostly occupied by dense blocks housing the Bangladeshi community, are well used by local residents. In the case of Cannon Street Station, its urban pattern apparently features large blocks of office buildings with only some finer-meshed blocks located to its eastern side. This is reflected in the flux of space use patterns, whereby the area is mainly occupied by local office workers during peak and lunchtime periods.

The current figure-ground map of these three vibrant terminus areas also reveals the coherent pattern between the mass of station buildings and their surrounding blocks. Cannon Street and Charing Cross Station buildings are relatively small and thus well assimilated with their surrounding block patterns. Although the scale of Liverpool Street Station's train shed is relatively larger and stands out from its overall pattern, the station is bounded on all sides by the new development elements of the Broadgate Complex. These elements help break down the bulky volume of the railway architecture to become more coherent with its surrounding urban blocks. This feature generates a good transition between travelling and other urban activities reflected in a good level of space use being recorded around the terminus buildings.

Euston,Victoria and Fenchurch Street Station areas have an overall vibrant atmosphere but, according to the survey, distinctive land use patterns between their busy front

and quiter rears. While the front is associated with an area of mixed office and commercial uses with a high level of movement being recorded, their approach lines are bounded by residential blocks with some small retail and business uses or small warehouses, exhibiting a relatively moderate level of movement. The urban pattern of the first two terminus areas reflects a combination of predominantly dense and edge-defined building coverage at the front and a freestanding but still connective block pattern of flats and houses at their rear. The urban pattern of Fenchurch Street Station area incorporates a compact and coherent front and side and a rather less dense area occupied by smaller blocks of apartments, housing and warehouses attached to its approach lines. However, there is an evidence of slightly blighted urban condition in the areas further down Fenchurch Street's railway lines where its viaduct arches have been fenced off and accompanied with some waste pocket spaces.

Marylebone, Paddington, and King's Cross-St.Pancras Station areas have two completely different urban patterns between their front and rear that also reflect two very distinctive urban conditions. These areas all have a busy front side contrasting with blighted surroundings to their rear. Their urban patterns clearly suggest that the coherent and densely built up front area of mixed use generates a high level of movement. The sparse field of disjointed urban blocks, mostly of residential use, poorly balanced by a vast field of open space alongside the urban scars caused by the terminus structures themselves, has a very low recorded movement levels. However, because of its small size, Marylebone Station area has a very much less blighted urban condition than the latter two station areas, which incorporate vast fields of fragmented and deserted building blocks, mostly in a state of disrepair. The rear side of these three termini are vacant most of the time. King's Cross-St.Pancras Station area, where a very large urban hole exists as a physical scar in the urban pattern, has a notable record of illicit activities.

London Bridge and Waterloo Station areas share similarly complex urban pattern and urban condition. Both termini have an entanglement of railway structures disrupting both their front and rears. The areas incorporate a similar combination of dense clusters and sparse fields of fragmented blocks around the terminus structures. Both generally consist of sub-areas with a good level of movement and vibrant atmosphere of mixed activities and those with moderate to low levels of movement, including elements of a blighted condition.

In a closer examination, London Bridge Station area, the cluster of urban blocks at the station’s front, located to the south of the terminus building, is well defined by the

urban grid. The area includes the Guy's Hospital complex, as well as office, retail, and residential blocks that well constitute with respect to Borough High Street and St.Thomas Street. This cluster is well connected to the area beyond the viaduct structures at its front. Although these viaducts to the front have caused an extensive scar in the urban physical pattern, they are well perforated by the urban grid network. The area underneath them, which is occupied by a mixed use of office, retail, warehouses, market spaces (Borough Market) and tourist attractions (the Clink Museum, Vinopolis), is very busy, bustling with mixed types of people. The riverside area to the north of Tooley Street includes several newly created and ongoing office and commercial blocks that have begun to in-fill vacant lots. These new development elements, well constituted to Tooley street, are coherent with the existing urban blocks at the opposite side of the street. High movement levels of office workers, shoppers and tourists is recorded within the area. The area to the south of the viaducts, which at first appears to be a sparse field of urban blocks, in fact incorporates a mixed use of residential, small businesses, artist's studios and small warehouses. Despite having several routes that are used as connections between the riverside area to the north and the area to the south of the tracks, it is noted that some viaduct spaces under London Bridge Station's approach lines have been blocked and in some areas, attached with several small fenced off and vacant areas. The survey reveals that these areas are blighted. The urban pattern of the viaduct structure's immediate surroundings thus appears to be sparse with some fragmented figural blocks.

Waterloo Station is not only entangled by the railway structures at its front and rear but also bounded in all directions by busy roads, junctions and ramps, which are hostile to ground level pedestrian movement. The pedestrian linkage across the junction to the front can only be accessed through an underground tunnel, while the movement routes beyond the junction to the riverside Southbank Centre is elevated on high level walkways. The terminus itself is also bounded by a taxi ramp to its north and east facade. This disruption of pedestrian movement networks in the area reflects in a record of low-level movement, despite a good combination of dense and sparse patterns of urban blocks occupied by office, retail, residential and cultural uses. According to the survey, the areas alongside its approach tracks show strong symptoms of blight. Some of their viaduct spaces are dilapidated and mostly blocked or fenced off from the street or turned into garage and storage spaces. However, there are still several underpassing routes in the rear area which are rather well used. It clearly reveals in its urban pattern that the large scar of its approaching rail lines is associated with loosely fragmented blocks of council flats and old warehouses. Similar

to Fenchurch Street and London Bridge Stations, the viaduct structure at the rear of Waterloo also incorporates several waste pocket areas.

4.4 CONCLUSIONS

In conclusion, the shaping and organisation of urban spaces around the terminus structures, reflected in the successive transformation of their urban morphologies, suggests that spatial factors are critically involved in the mechanism of area evolution. The figure-ground study reveals that the terminus structures have interrupted the continuity of the urban fabric, both building blocks and street grids, in a variety of ways designated by their initial siting and layouts. The interruption in urban figural patterns is manifested as the gaps of different sizes that scar the urban pattern, while the obstruction of street grids is often evident in the degree of fragmentation and incoherence of the urban solids adjacent to the scars themselves. It is thus clear that the way in which the terminus structures block the movement routes in their urban settings is a powerful factor that has influenced the patterns of urban development in those areas.

The research results affirm that space and society are interrelated through movement or more precisely, how movement fundamentally influences form and function in the city. The building densities and land use developments revealed in the figure-ground study and its parallel historical review suggest that the shaping and organisation of urban forms and functions in the terminus areas are critically determined by movement networks. The sparse fields of fragmented blocks of residential flats, apartments, or council houses are often found at the back of termini such as King's Cross-St.Pancras, Euston and Paddington Stations, where the movement channels are largely obstructed by the terminus structures or railway lands. The stations' front is often occupied by a dense and coherent field of office, retail and commercial uses. It suggests that society has responded to space by putting specific functions in specific locations where different levels of movement are present. The residential uses are often placed in the quiet areas, while business and commercial uses locate in busy locations.

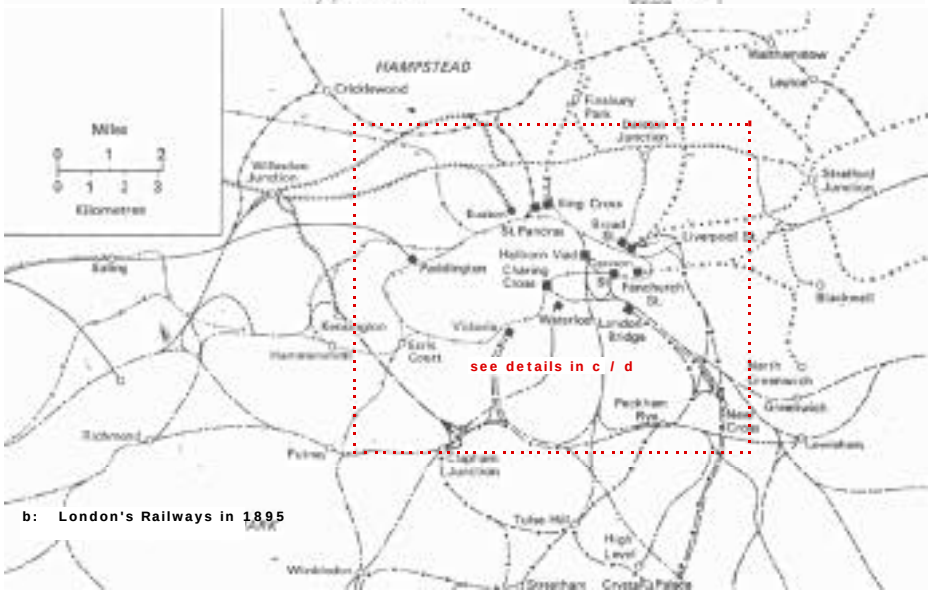
Through the same mechanism, spaces with specific forms and functions in turn generate distinctive urban dynamics that impact back on society. The detailed analysis of the relationship between the urban pattern of London's terminus areas and

their current urban conditions reveals that the degree of vitality and blight in the terminus areas are very much related to the density and coherence of their urban forms and the levels of mixed urban functions. However, the figure-ground analysis sometimes cannot capture the urban dynamics of some terminus areas, such as Waterloo and London Bridge Station areas, where their sub-areas reflect ambiguous urban patterns as a result of the involvement of complicated spatial factors.

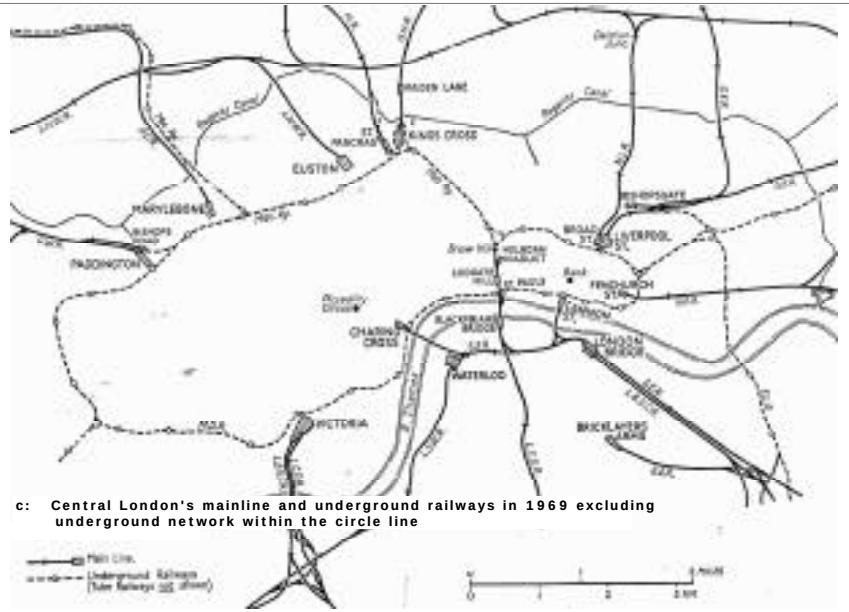
This simply suggests that a more detailed study of the spatial configuration of these areas, and its impact on movement patterns, is required. To be able to objectively transform railway terminus areas into places in the city, it is hence necessary to clarify the spatial impact the terminus structures have on their current urban settings and the relationship between the internal and external spaces of the station buildings, as well as between the terminus areas and the city, in order to design for the most appropriate spatial intervention. These are the objectives of the next chapter.

Figure 4.1: HISTORY OF LONDON RAILWAY NETWORK

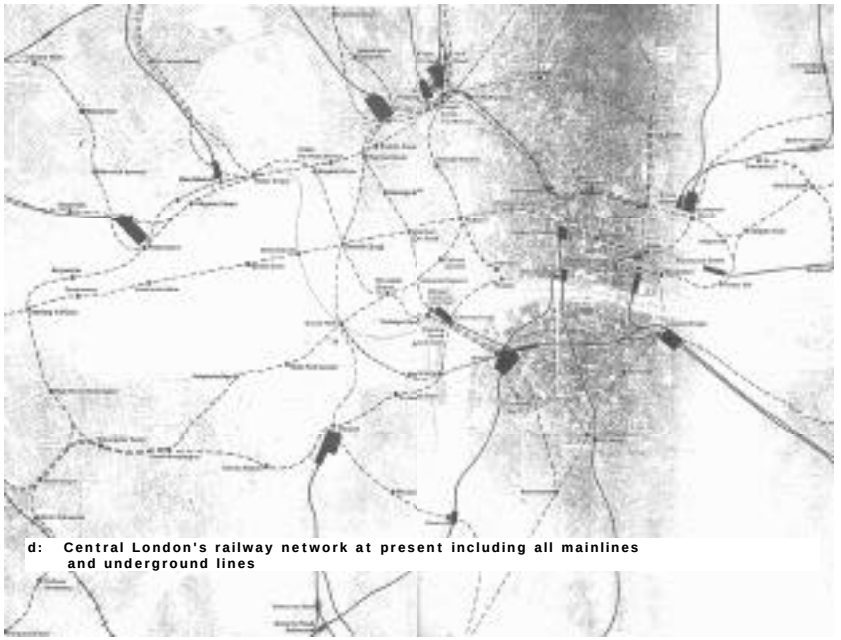
a: London's Railways in 1855



b: London's Railways in 1895

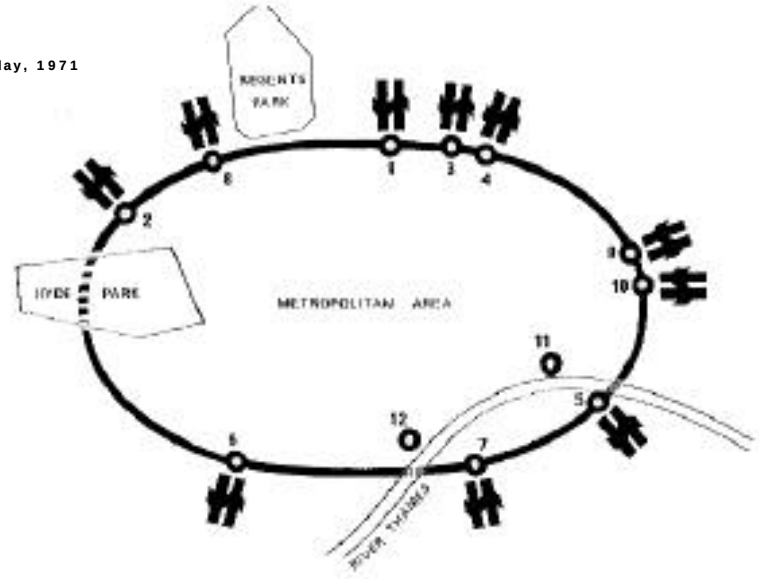


c: Central London's mainline and underground railways in 1969 excluding underground network within the circle line



d: Central London's railway network at present including all mainlines and underground lines

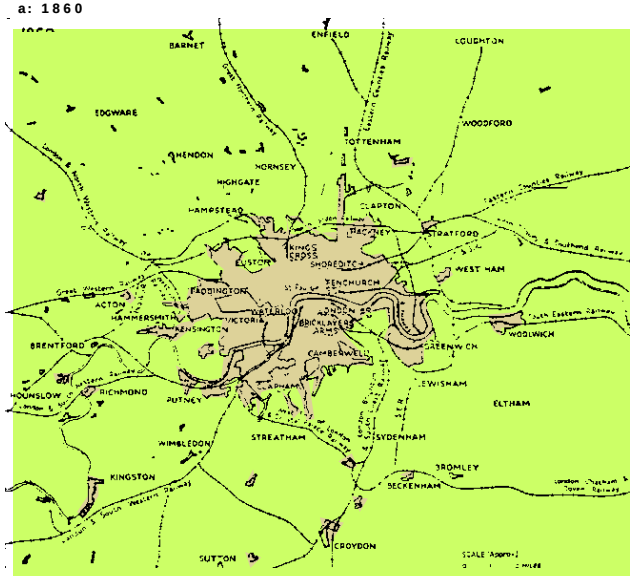
Figure 4.2: THE ELLIPTICAL RING
A diagram indicating the approximate position of mainline railway termini in relation to metropolitan London in the 19th century
from: Holland, H., Travellers' Architecture; a comprehensive account of building and design from Roman times to the present day, 1971



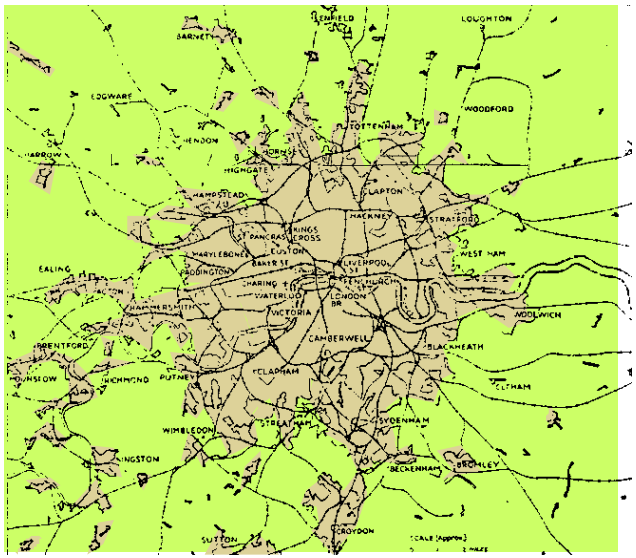
1. Euston Station
2. Paddington Station
3. St.Pancras Station
4. King's Cross Station
5. London Bridge Station
6. Victoria Station
7. Waterloo Station
8. Marylebone Station
9. Broad Street Station
10. Liverpool Street Station
11. Cannon Street Station
12. Charing Cross Station

Figure 4.3: URBAN GROWTH AND THE DEVELOPMENT OF LONDON'S RAILWAY SYSTEM
from: Barker, T.C., Robbins, M., A History of London Transport, 1974

a: 1860



b: 1900



c: 1939

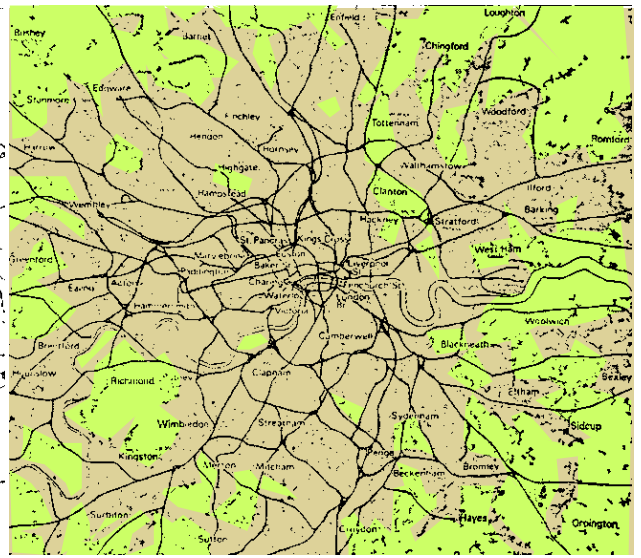
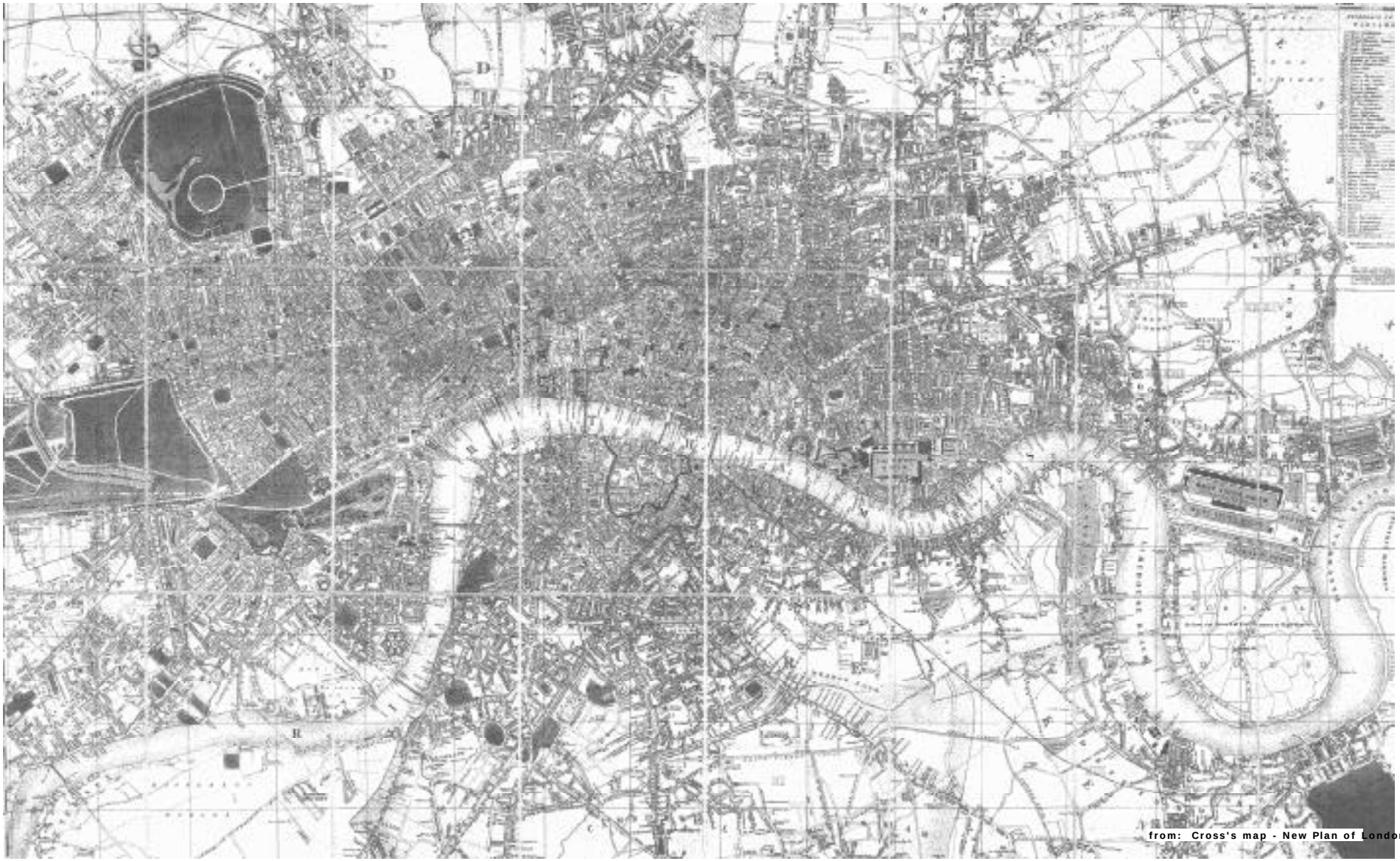


Figure 4.4 : LONDON IN 1835 - before the Railway Era



from: Cross's map - New Plan of London, 1835

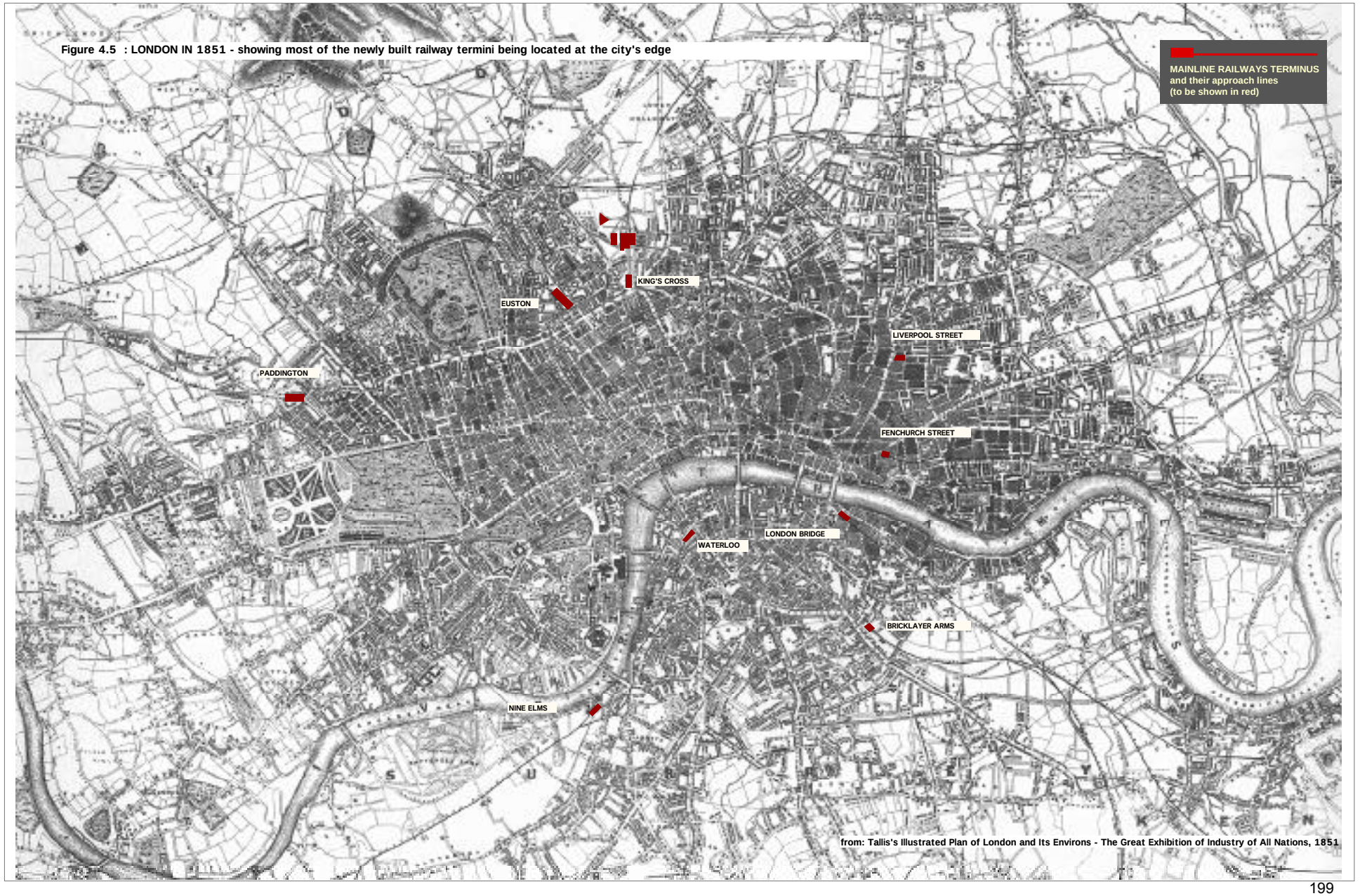
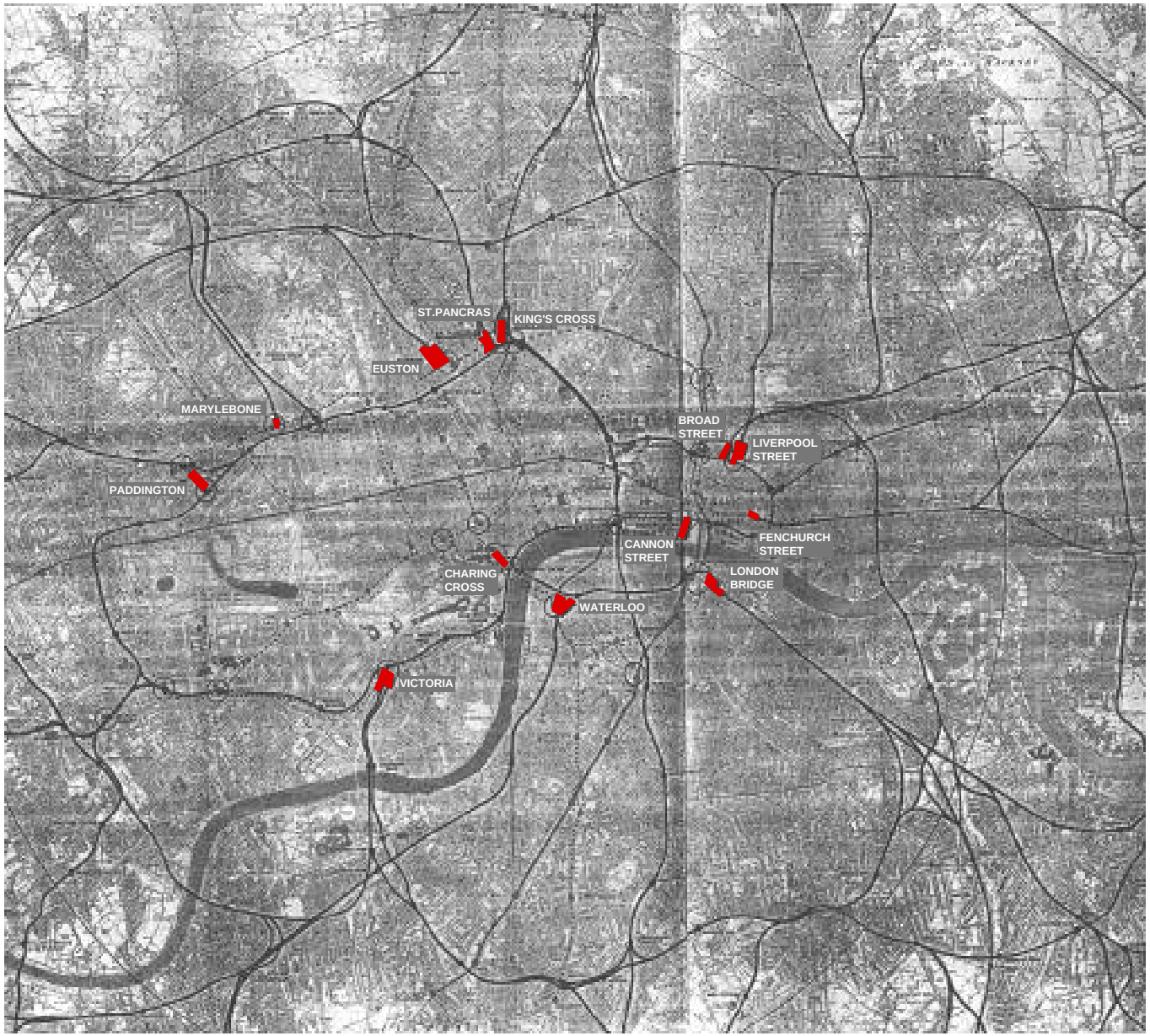


Figure 4.5 : LONDON IN 1851 - showing most of the newly built railway termini being located at the city's edge

from: Tallis's Illustrated Plan of London and Its Environs - The Great Exhibition of Industry of All Nations, 1851

Figure 4.6 : LONDON IN 1905
showing both mainline and underground railways



MAINLINE RAILWAY TERMINI
and approach lines

UNDERGROUND RAILWAYS

Figure 4.7: CENTRAL LONDON AT PRESENT
showing mainline railway termini have been assimilated into the densed urban grid and now locate at the very heart of city

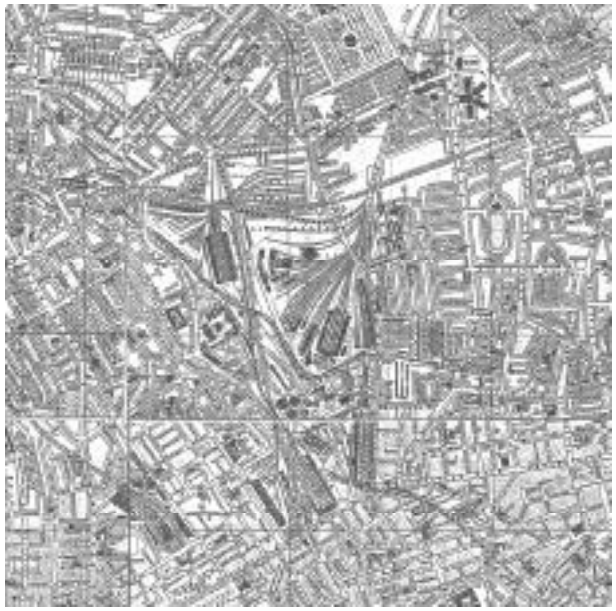
Figure 4.8 : LONDON'S MAINLINE RAILWAYS AND TERMINI IN RELATION TO THE URBAN SUPERGRID

Figure 4.9 : EUSTON STATION AREA - local maps and figure and ground maps

terminus building

Figure 4.10 : KING'S CROSS and ST.PANCRAS STATION AREA -local maps and figure and ground maps

terminus building



1835

1888

1995

Figure 4.11 : LIVERPOOL STREET STATION AREA - local maps and figure and ground maps

terminus building

Figure 4.11: LIVERPOOL STREET STATION AREA (cont.)

d: Broadgate Complex, fourteen phases of the development including Liverpool Street Station
e: Ongoing development sites around Liverpool Street Station
f: The prospective figure and ground pattern of the area after the development

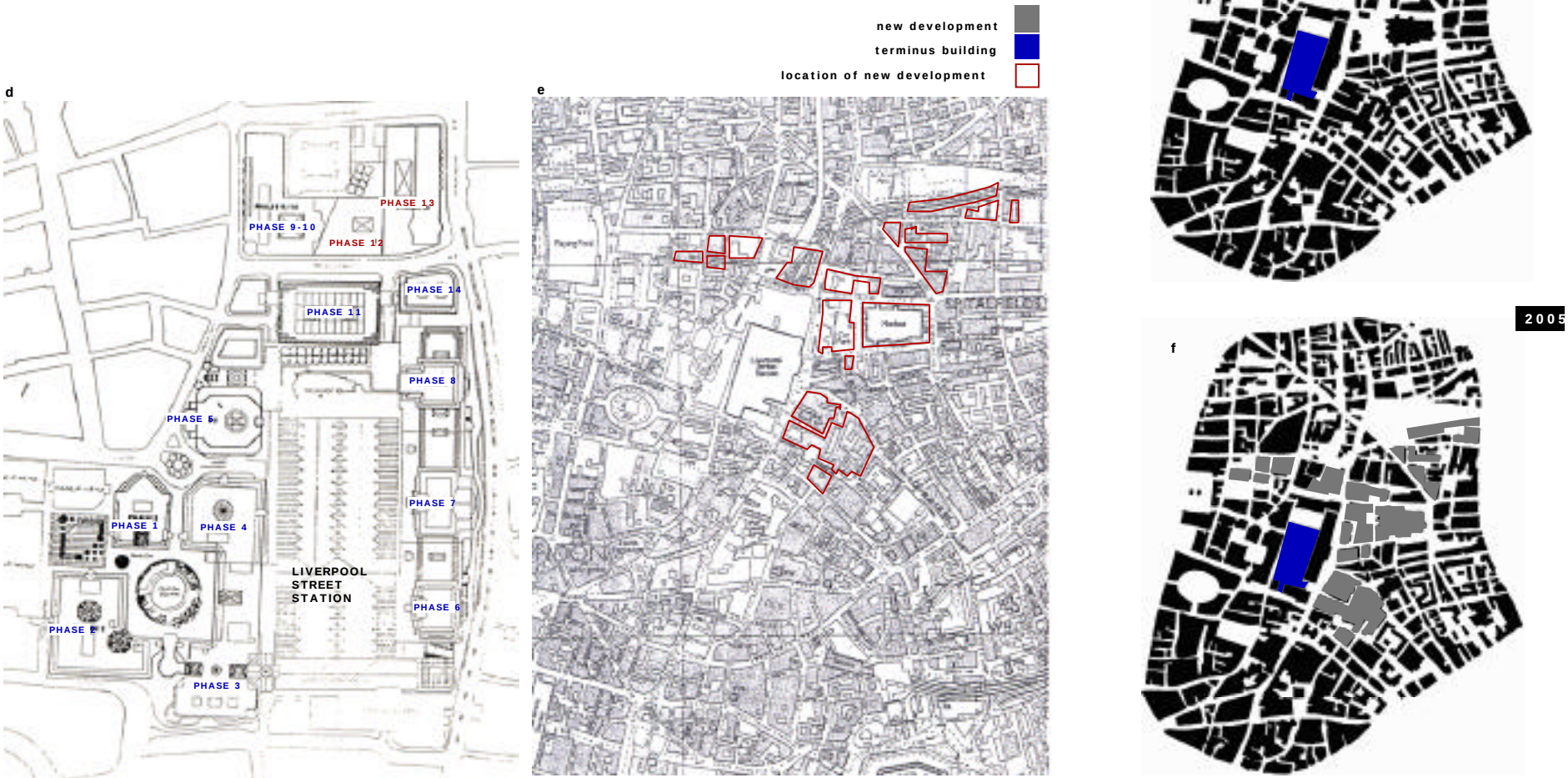


Figure 4.12 : FENCHURCH STREET STATION AREA - local maps and figure and ground maps

terminus building

1835

1888

1995

Figure 4.13 : LONDON BRIDGE STATION AREA -local maps and figure and ground maps

terminus building

1835

1888

1995

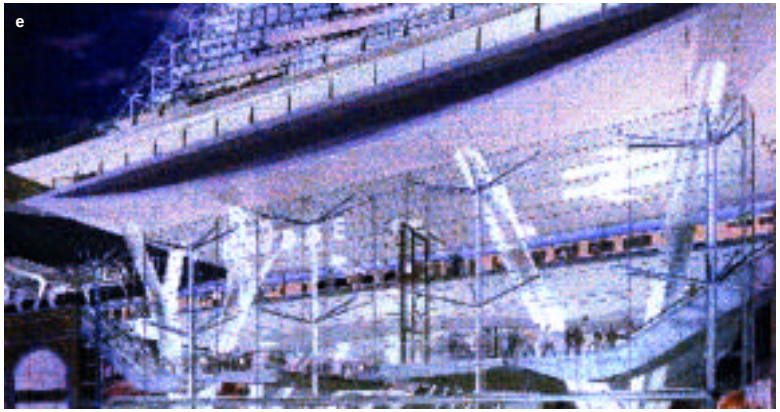


Figure 4.13 : LONDON BRIDGE STATION AREA (cont.)

d: The proposal for office and residential high-rise development at London Bridge Station by Renzo Piano.
e: The new concourse at street level on Stainer Street with access to the London Underground station and the rail platforms above it.
f: The image of Great London Authority Headquarters which is due to be completed in 2002 and the proposal for adjacent office development. All have been planned by Foster & Partners.
g: The prospective figure and ground pattern of London Bridge Station area after the redevelopment.

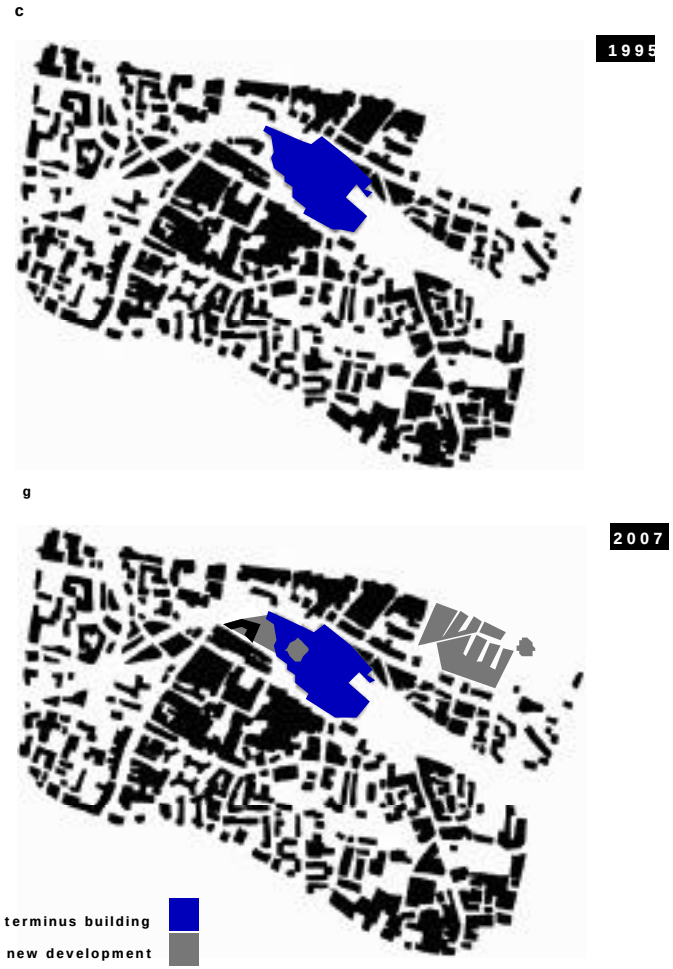


Figure 4.14 : CANNON STREET STATION AREA - local maps and figure and ground maps

terminus building

1835

1888

1995

Figure 4.15 : WATERLOO STATION AREA - local maps and figure and ground maps

terminus building

1835

1888

1995

Figure 4.15 : WATERLOO STATION AREA (cont.)

d: The new proposal for the Southbank Development by Rick Mather Architects looking from Belvedere Road
e: The bird's eye view of the Southbank Development
f: The prospective figure and ground pattern of Waterloo Station area after the station refurbishment and office development and the Southbank Development

new development terminus building

Figure 4.16 : CHARING CROSS STATION AREA - local maps and figure and ground maps

terminus building

1835

1888

1995

Figure 4.17 : VICTORIA STATION AREA - local maps and figure and ground maps

new development terminus building

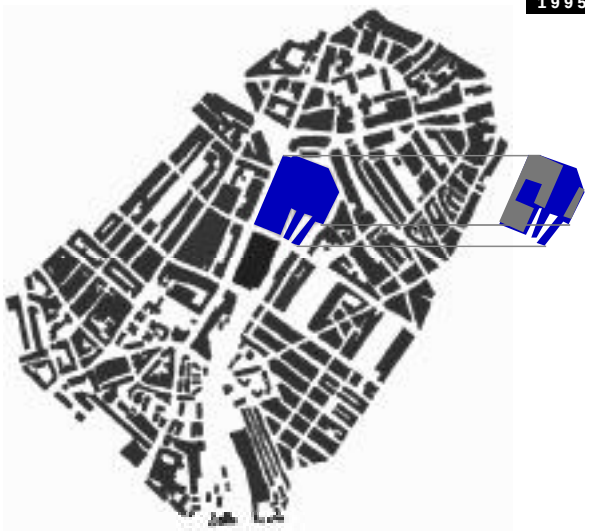


Figure 4.18 : PADDINGTON STATION AREA - local maps and figure and ground maps

terminus building

1835

1888

1995

REDEVELOPMENT PROGRAMME

1: Station refurbishment for Heathrow Express
2: Paddington Basin Development - mixed commercial, residential, office complex
3: West End Quay - complex of apartment, retails, leisures facilties.
5: Hilton Hotel London
6: British Waterway regeneration on Canal Basin
7: St.Mary's Hospital Complex development
8: Paddington Station redevelopment and Office Complex
9: Paddington Goods Yard
11: Monsoon Headquarters
12: St.George Complex of office, residential, commercial and leisure facilities.

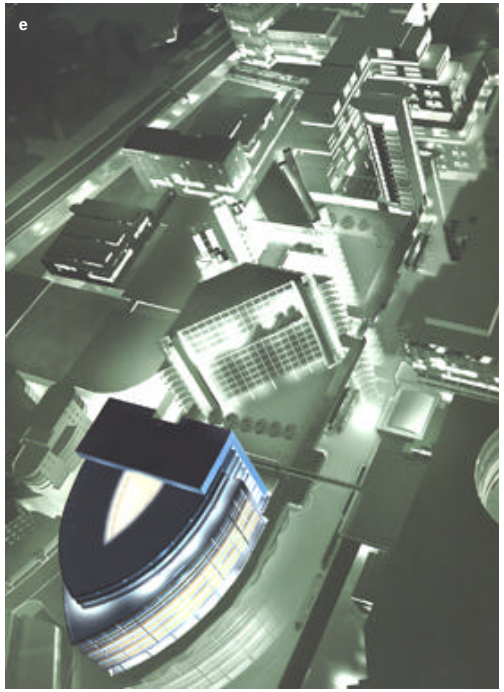


Figure 4.18 : PADDINGTON STATION AREA (cont.)

d: Paddington Basin Redevelopment Project, its scope and project components
e: The office, commercial and leisure complex development at the north of Paddington Basin with a series of new canalside public spaces.
f: Bishopbridge - Paddington Station's Goods yard development of residential, commercial and sport complex
g: Office development over Paddington Station's rail platforms 9-14
h: The prospective figure and ground pattern of Paddington Station area after the Paddington Basin Development

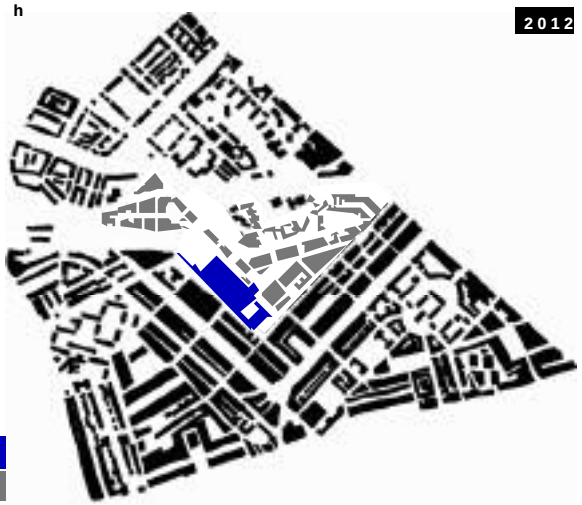


Figure 4.19 : MARYLEBONE STATION AREA - local maps and figure and ground maps

terminus building

1835

1888

1995