CHAPTER FIVE:

THE SPATIAL CONFIGURATION OF LONDON'S RAILWAY TERMINUS AREAS

The previous chapter suggested that the morphological study of the physical pattern of London's terminus areas does not fully capture the underlying mechanism relating to their blighted, or indeed, vital conditions. It is not how the terminus structures disrupt the continuity of the urban figural pattern but the urban grid that is critical. This chapter, therefore, turns to a more precise examination of the spatial grid structure in the terminus areas. Using Hillier's configurational analysis, the study focuses on how the terminus structures currently affect the urban grid in their settings. This is to examine in detail how well each terminus, including its internal space and external structures, embeds in the surrounding spatial network. To complement the previous findings on the relationship between the figure and ground pattern and the current urban condition of the terminus areas, this chapter also examines how such a relationship reflects in their spatial configuration. The main objective of this chapter is to distinguish the consistencies found in the spatial characteristics that relate to vibrant as well as blighted urban conditions in the terminus areas.

This chapter is structured into three main sections. The first section begins with a series of theoretical propositions regarding the spatial relationship between the terminus structures and the urban grid network and its effect on space uses as well as potential redevelopment. The programme of study derived from the propositions is then described. The second section presents a series of configurational analyses which will be carried out in three parts. The first part examines the location of all railway termini in the global as well as local spatial structures of London as a whole. Focusing on a more local context at each station, the second study is a case by case review of the spatial characteristics of London's terminus areas and the relationship to their urban physical patterns and current conditions. The third part analyses the spatial embedding of the stations' internal space in their urban contexts. Space Syntax methodologies used for the spatial representations and measures are elaborated at the beginning of each analysis. All findings will be discussed and commented upon in the final section.

5.1: RAILWAY TERMINI AND THE SPATIAL STRUCTURE OF THEIR URBAN SETTINGS

The 'local-to-global' effects and the 'global-to-local' redevelopment process.

According to Hillier, the way in which the urban grids evolve is accounted for to a great extent by the fundamental mechanism of natural movement, which is the proportion of movement determined by the architecture of the grids itself (Hillier et al 1993). A dynamic relation between the evolving urban grid, its natural movement patterns and the developing pattern of land use develops over time. This process ensures that urban grids evolve not only to optimize patterns of mutual accessibility, but also to optimize the usefulness of the by-product of movement from place to place - that is, the spaces that must be passed through on journeys from all origins to all destinations. Spaces that become the busy focuses of urban life are most likely to be accessible for both to-movement and through-movement. Through the 'movement economy' process, land use and building density, which follow scales of movement in the grid, adapt to and multiply the movement economy effects, creating vital environments of mixed urban activities (Hillier, 1996b).

London's railway termini have obstructed the urban fabrics in a variety of ways demonstrated in the historical review and the figure and ground study presented in Chapter Four. The discontinuity of urban grids, according to Hillier, crucially means that the natural movement process is disrupted. Thus, the effects that the terminus structures and their urban surroundings have had upon each other over time can be seen as a result of the dynamic relation between natural movement and the grid evolution, optimizing the pattern of accessibility in the local area. In other words, since the railway structures were imposed onto either vacant or already built up sites, the urban grids subsequently evolved to regain accessibility within the whole system. The grids grew around the terminus structures while new routes have been built to cross over or under them at some specific points. However, given the different locations in the city and the distinctive layouts of the terminus structures, the process has generated unequal successes and some terminus structures still remain as strong barriers to the urban grid network.

Two propositions are developed in this chapter as an attempt to clarify this relational mechanism effected through the spatial configuration of London's terminus areas after their long evolution. The first proposition is that the ways in which the terminus structures disrupt the natural movement process by obstructing urban grid networks, are the critical factors that causes 'disurbanity' in both their urban surroundings as well as their internal spaces. Following the principles of 'contiguity' and 'linearity' of the 'partitioning theory' (Hillier, 1996a), the obstruction of the grid by railway termini, which generally are composed of structures of linearly contiguous arrangement, creates 'deep spaces' in relation to the urban spatial configuration as a whole. The more contiguous railway infrastructure interrupts grid structure, the more depth their adjacent spaces are likely to gain, as the obstruction undermines their connections to the whole system, causing people to go through more intervening spaces to get from one side of the railway area to the other.

This relational 'depth gain' is a 'local-to-global' effect (Hillier, 1996a). If the city is seen as a continuous network of movement, the disconnection of individual local grids has quite specific global effects on the whole spatial network. In a variety of ways the terminus structures located in different parts of the city may obstruct some strategic spatially integrated routes, thereby turning either parts or the whole of their locality into 'deep spaces', where the areas are very much segregated from their larger urban systems. Alternatively, they may totally seclude some sites and turn them into 'blind spaces', where there is no accessibility from the adjacent areas at all. These two types of urban enclaves are thus determined by the location of the termini in the city as well as their initial siting and layout that determines the degree of their spatial intervention in the urban grid.

Urban enclaves are, by definition, destinations that are not available for natural movement. They are discontinuities in the urban grid, comparable in their effects with the physical dispersion and incoherence of the urban fabric. The lack of natural movement crucially means the disruption of the movement economy process which is the underlying mechanism for developing urban vitality. Without the natural 'through movement', the existing land uses that depend on passing trade such as retail, commercial and business uses cannot survive. As there is no destination in the areas, it means that there is also no 'to movement'. This subsequently multiplies its negative effect as no new land uses will be attracted into the areas and the movement level will continue to be depressed. The terminus areas thus become blighted and deserted of pedestrian activity, mostly containing existing older building structures that remain in state of deterioration through disuse.

Through the current redevelopment trend (reviewed earlier in Section 2.1.3, Chapter 2) the internal spaces of railway termini have now become important public spaces in the city. Not only that they are now considered as a continuous part of the urban spatial structures, but as a centre of the nodes, they are also a key to the success of the whole redevelopment areas. Following the same principle as above, if the terminus buildings obstruct the urban grid instead of being a part of it, their internal spaces will be segregated and become 'deep spaces' and 'urban enclaves' themselves.

If this proposition, that is based on Hillier's ideas of natural movement and the movement economy, is right, it can be proposed that the urban blight and vitality of the terminus areas is in fact spatially related. The pattern of spatial grid configuration can then be used to explain the current urban condition of each terminus area, as well as the potential of undeveloped and currently-identified redevelopment sites. One would predict vibrant station areas would have continuous urban grid networks with strongly inter-related spatial structures of both integrated and segregated lines located next to each other, functioning as naturally busy and quiet streets. Such a mixture of more integrating and less integrating lines, determined by how the local grid is married into its global structure, then attract different land uses according to scales of movement and in turn create varied degrees of the 'multiplier effect', drawing more movement and further land uses into the area. This positive feedback loop, built on the relationship between the grid structure and movement, creates the familiar but hard to explain 'urban buzz' - the characteristic of urban places in the city.

The second proposition concerns the urban redevelopment at the terminus locations. Following on the same principles that underlie a good urban space, it is argued that the success of the station area redevelopment projects is critically determined by two related spatial factors. Firstly, the global spatial potential of the urban grids within the development sites should be utilised in order to draw integration into them. This is to ensure that the terminus spaces as well as their surrounding grids are well embedded in their settings and interconnected by an urban grid of mixed integration values. Secondly, as a consequence of the first factor, this also means that the urban enclaves in the terminus areas should be eliminated. The redevelopment should reconnect the local grids, previously discontinued by the terminus structures, in a way that they also become integrated parts of their larger urban networks.

Thus, it can be argued that the blighted terminus areas, caused by the 'local-to-global' urban spatial effect, should be re-integrated into their surroundings through the reverse 'global-to-local' spatial process. This is to suggest that not only the local grid networks on both sides of the railway structures should be reconnected, so there will be more direct relations for people to move across the area in general, but the new connections should also utilise their global spatial potentials so that they draw different scales of movement into the station areas. The is to ensure the revival of natural movement, bringing about the movement economy process to revitalise the station areas from their blighted condition as well as to create the multi-use internal station environment that attracts multiple user types.

This also means that all station locations have different development potentials depending on their global spatial structures. Some terminus areas may not be development areas at all as they are limited either spatially or topographically. Their existing grid network may provide no potential to draw any integration into the sites. Some terminus buildings may also have some spatial restrictions to their internal spaces being integrated as a continuous part of their spatial settings, particularly due to level differences between their concourse spaces and the surrounding streets. The spatial embedding of the internal spaces and external structures of railway termini is thus believed to be the key to ensure the success of the terminus area redevelopment programmes.

5.2: PROGRAMME OF STUDY

According to both propositions elaborated in the preceding section, the spatial configuration of London's railway terminus areas will be explored through three main types of investigation. The first two studies focus on the graphic representation of space, referred to as the axial line analysis, while the third uses numerical data.

The first two analyses depict axial models of London including its mainline railway terminus areas in the form of 'core maps' in which lines are coloured in accordance with their integration values, with the intention of giving an immediate and intuitive illustration of the urban spatial patterns. The first analysis, presented in Section 5.3.1, investigates the location of each terminus in relation to the spatial structure of London. Its main aim is to illustrate how each terminus embeds within both the global as well as local core grid structures of the city.

Secondly, in Section 5.3.2, the analysis focuses on how the spatial network is locally drawn together in and around each terminus building and its related structures. The axial break up map, covering the catchment area of each terminus, is extracted from the large-scale axial map of London. The station's internal space is added and then the map reprocessed. These local axial maps are then enlarged to illustrate more clearly how the terminus structures affect the spatial structure of their immediate urban grids. This is to examine how both the internal space and external structure of each terminus embeds within the urban grid system. The spatial characteristics of each terminus area will also be reviewed in relation to its current urban condition and urban physical pattern. For the Paddington Station area, the only mainline railway terminus area in London where an urban redevelopment plan is settled and being implemented, its prospective spatial configuration will also be analysed.

Thirdly, the analysis addresses the strategic position of the terminus buildings in their local surroundings, referred to as the 'embedding analysis'. Summarising the key development potential of each terminus area, Section 5.3.3 addresses how the internal spaces of all London's termini embed in their spatial contexts, examined statistically. Using the numerical data derived from the preceding axial analysis, this embedding study compares the global as well as local integration values of axial lines within each station's modelling area to the lines within its internal space.

5.3: THE SPATIAL MORPHOLOGICAL ANALYSES

The three types of study referred earlier: the axial analyses, both city and local scales, and the spatial embedding analysis, will now be presented in three main sections.

5.3.1 AXIAL ANALYSIS: the location of mainline railway termini within the spatial structure of London

In order to examine the location of all mainline railway termini in the inner London area, the axial representation of the majority of central London is presented in Figure 5.1. The map covers the fewest and longest lines of sight and access (axial lines) that pass through all circulation routes within the North and South Circular roads and west of the Lea Valley[1]. It represents all street segments open to pedestrian movement within the area by using some 16,000 lines and 50,000 links (Penn et al, 1998). The position of all twelve termini in the map is specified in white. Figure 5.2 represents the global integration map or 'radius-n' analysis (the logged version[2]) of the axial

1 The axial break-up is based on Hillier (1995) with information supplied by the Ordinance Survey Map 1:10,000, 1991 edition.

2 The logarithm of axial analysis is applied to normalise the distribution of integration values. It is often found that the distribution of integrated lines is not even in a large urban spatial system because there is a tendency that the system has a more number of segregated lines than the integrated ones. The logged version of axial integration map will properly show all strategic lines in the system.

model of London. The axial analysis, the syntactic measure described earlier in Section 2.5.2, shows the global spatial structure of London coloured from red for the 'shallowest' or most integrated lines through the spectrum to blue for the 'deepest' or most segregated lines in the area.

With a strong edge-to-centre pattern, the map picks up Oxford Street as the most integrated line in the whole system. London's termini form themselves as an elliptical ring, each facing inward to the approximate edge of the integrated 'core' area, depicted as the yellowish zone of axial lines. This core corresponds to the central commercial and retail areas of London. It is formed by highly integrated lines combined close to right angles to maximise local grid consolidation processes. Hillier (1996a) argued that this local consolidation benefits the 'in to in' movement within the core itself. The northern termini such as Marylebone, Euston, King's Cross and St.Pancras Stations appear to turn their front toward the 'rim' of the core: Euston Road, an integrated line at the northern edge of the central consolidation area. The other termini, especially the southern ones, seem to be arranged in a less orderly manner and reach deeper into the core. Paddington Station appears to reach deepest into the central consolidation. It locates the shortest distance from the most integrated line in the system; the Oxford Street-Bayswater Road alignment.

Most termini also locate along main radial routes leading from edge to centre. These radials consist of integrated lines combined linearly through open angles to form global paths across the grid which benefits 'out to in' movement and vice versa (Hillier, 1996a). In between these radials locate the development of more suburban residential districts. These linear 'spokes' and the consolidated grids that form a 'hub' create what Hillier (1996a) called the 'deformed wheel' structure in which the termini locate at roughly the conjoining points of the two spatial grid systems.

Figure 5.3 plots the logarithm of radius 3 integration. It highlights the most locally integrated lines distributed throughout the London area, many of which are local shopping streets. The map confirms the location of London's termini at the edge of the densest localised circulation in the core area. Most of them also locate along important locally integrated radials.

Significantly, the location of the mainline railway termini in relation to both the global and local spatial structure of London confirms their role as major transport nodes.

Most termini locate at the points where the distinctive linear and grid systems meet, which generally aligns to where the spatial grid structures change to benefit different scales of movement. The terminus locations are the transition points where people who travel from faraway towards the city centre, or the 'out to in' movement, shift to move locally within the urban core or the 'in to in' movement (and vice versa). The locations can thus be considered as gateways to the city centre for not only rail travellers and commuters but also other transport users. People who are oriented toward the centre along radial routes by long distance transport modes such as surface trains, coaches, buses, or cars, may likely to make their transit at the terminus locations to local modes of transport such as underground trains, buses, taxis, or bicycles in order to make short distance trips within the centre.

It is also clear from the two axial integration maps in Figure 5.2-3 that most termini, especially King's Cross and St.Pancras Stations, often incorporate an 'urban hole' at their rear, shadowing the railway lines that approach the terminus buildings and obstruct the street grids. The potential consolidation of the local grid network at London's terminus areas in order to eliminate these scars could then be seen as an expansion of the urban core itself. To reconnect the spatial grids on both sides of the railway lines would mean creating new grid connections which run on near right angles with the existing routes. This might result in generating the consolidation of axial lines around the terminus areas through the 'grid process' which may help these 'edges' gradually assimilate into part of the 'core grid' itself.

5.3.2 AXIAL ANALYSIS: London's railway terminus areas, the spatial structure and reflections on current urban condition and urban physical pattern.

In this section, the study proceeds to focus on the current spatial structure at a more local scale in and around each of London's termini, examining how both relate to each other as well as to the wider surroundings and including how their spatial characteristics relate to the area's current urban condition and physical pattern.

In order to examine the spatial configuration of London's terminus areas, the axial representation of their catchment areas is required. This is to ensure that the axial models are large enough to eliminate the 'edge effect' at the terminus areas and present an accurate distribution of their axial integration values[3]. Each modelling area covers the area within a 30 minute walking distance (approximately 1.5 miles)[4] around the terminus area, equivalent to the pedestrian catchment area of the site of interest. Each model is cut out from the large London's axial break-up map (Figure 5.1). Important changes are the addition of axial lines inside each station building including those relating to its external spaces, as well as the updating of the maps according to the current local pedestrian routes within the sites. The axial model of each station location is then recalculated by Axman to present its global integration analysis (radius-n) in order to present how the station's internal and external spaces relate to the global spatial structure of its urban setting.

The axial analyses of the catchment area of all London's terminus areas are depicted in Figure 5.4a-5.14a , with the close up view focusing on the station buildings and their immediate surroundings being illustrated alongside in Figure 5.4b-5.14b . There follows the case by case review in the same order as the previous figure and ground analysis.

5.3.2a Euston Station area

Figure 5.4a presents an axial analysis of Euston Station area and its catchment area. The model covers an area bounded by Adelaide, Leighton, North, and Mackenzie Roads in the north, Liverpool Road and St.John Street in the east, The Mall, Strand and Ludgate Hill in the south, and Wellington, Park, Gloucester Roads and Park Lane in the west. Focusing on the immediate surroundings of Euston Station, Figure 5.4b shows that the terminus locates within the integration core formed by Euston Road, the most integrating line in the system adjacent to the south of the station, a very long alignment of Camden High Street - Eversholt Street - Woburn Place - Southampton Row to the east, and Hampstead Road to the north and west. The core is strengthened by another three important integrators: Marylebone Road aligned to Euston Road in the west, and Gower Street and Tottenham Court Road to the southwest of the station.

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3 Any spatial representation that cuts out a part of a larger urban grid might suffer from 'edge effect', that is inaccuracies towards the edge of the representation. This is because these areas are close to the place where the urban grid has been cut. Thus, the modelling area has to be large enough in order to ensure that the edge effect are well removed from the site of interest.

4 From The Manual to Axman written by Nick Dalton (revised by Laura Vaughan, 1997). As discussed earlier in section 1.2 in Chapter 1, the railway station area, as suggested by Munck Mortier (*in Bertolini and Spit, 1998*), can be defined as an area within approximately five hundred metres around the station building . The pedestrian catchment area within 30 minute walk from the terminus area or 1.5 miles (2.4 km.) thus covers the area within approximately 2 miles (3 km.) around the terminus building.

The core of the area not only focuses around Euston Station but also moves south to Oxford Street, another main integrator through Tottenham Court Road, Gower Street and the Woburn Place - Southampton Row alignment. There are also several important integrators: Park Way, Pratt Street, Crowndale Road and Phoenix Road, running toward the terminus structures from the east but that do not cross over to the other side of the approaching railway lines. This leaves the spatial structure of the areas along the railway lines to the west of Camden High Street - Eversholt Street as comparatively weaker since there is no identifiable link to the core grid.

The distribution of integration to the north of Euston and Marylebone Roads is distinctive from that found to the south. To the south, the spatial structure is well-connected with a range of integrating lines developed in a grid-like pattern, defining the sub-areas of Bloomsbury and Marylebone which locate in between the north-south major integrators: Euston Road and Oxford Street. To the north, there is a combination of distinctive grid patterns on both sides of the approaching railway lines. The area between Euston and St.Pancras terminus structures has a dense and grid-like structure. The area between Euston Station's railway lines and Regent's Park is more sparse and linearly structured with most lines parallel to the tracks. However, the terminus structures do not totally obstruct the spatial network and the grids on both sides are well tied to the significant integrator: the Camden High Street - Eversholt Street - Woburn Place alignment. Thus, despite the existence of a large scale barrier like the King's Cross site to the east, the spatial grids at the station's rear are not segregated from the larger urban network. Instead, they are linked laterally to constitute the distinctive sub-areas of Camden Town, Somers Town, and Regent's Park.

Thus, it seems that although Euston's railway lines do not totally discontinue the urban grid network, they create several sub-areas with distinctive spatial characteristics to be developed alongside them. The survey on its current urban condition in Chapter One reveals that the immediate surroundings of the railway lines are 'quiet' with low to moderate levels of movement and mostly occupied by well-kept housing estates, terrace houses and private villas. The well-defined sub-areas of Camden Town and Somers Town are a vibrant commercial and residential mix with a well-used urban environment. These areas are depicted in the figure-ground map as being occupied by small scale urban solids coherently clustered alongside the railway tracks (see Figure 4.9c). To the south of Euston Road, the densely distributed grid network of Bloomsbury and Marylebone has mixed residential, retail, commercial and office land uses with a bustling environment and high levels of pedestrian activity. Clearly depicted in the figure-ground study, they have a more distinctive street-defined urban physical patterns, especially along the main integrators, in contrast with that of the quiet residential areas at the rear.

Despite being surrounded in all directions by three important integrators: Eversholt Street, Euston, and Hampstead roads, the main concourse space of Euston Station is not very well integrated with its spatial setting. The terminus building is set back several steps from its front integrator, Euston Road. The front colonnade of the station acts as a significant transitional space between Melton Street to the west and Eversholt Street to the east. However, the route only passes through the front corridor of Euston Station but not the station's main concourse space.

5.3.2b King's Cross and St.Pancras Station area

Figure 5.5a is an axial map of the modelling area of King's Cross and St.Pancras Station, showing the area bounded by Hampstead Lane and Amhurst Park in the north, Kingsland Road and Stoke Newington Road in the east, Finchley Road and Park Lane in the west, and Lambeth Road and Borough High Street in the south. The close up view of the terminus area in Figure 5.5b shows the section of Euston Road between Tottenham Court Road and King's Cross as the most integrating line in the system, bounding to the termini's frontage including that of Euston Station. To the west of the termini, the important integrators are the Eversholt Street-Southampton Row alignment, Hampstead Road, Tottenham Court Road and Gower Street. To the east, another integrator, York Way up to Copenhagen Street, is adjacent to the side of King's Cross Station which also has its sub-entrance on it. The other important integrators move further east to Pentoville Road, Upper Street, City Road and Goswell Road junction. All integrators except Euston and Pentoville Roads run north-south.

The core of the area within King's Cross and St.Pancras terminus area thus not only has a strong north-south bias, but also a bias towards the south and west. Two next integrators: Crowndale Road and Copenhagen Street run east-west but stop before approaching the edge of the railway lands, then the north-south bias takes over again. The Barnsbury section of Caledonian Road and York Way are relatively weak for such long lines, which emphasises the comparative weakness of the core to the east and north of the site.

The distribution of integration to the east and north of the site has a different character from that found to the west and south. To the east and north, there are a small number of linearly connected and branching street sections forming major routes. However, no lateral development links these routes into well-structured sub-areas. To the west and south, the core is more grid-like, defining local area core grids for Camden Town, Somers Town, and the Argyle Square areas. It is then clear that to the east and north of King's Cross and St.Pancras Stations, the core is sparse and linear, and does not construct sub-areas, while to the west and south the core is denser and more grid like, and creates distinctive sub-areas. In other words, the west and south have a property of 'grid-integration' which is a common characteristic of urban centres or sub-centres. The east and north have the more restricted 'linear integration', which is normally found in areas with a less develop urban character.

It is clear that the terminus structures and their adjacent railway lands completely disrupt the continuity of the urban grids, causing a large void in the spatial grid network. This void is surrounded by several enclaves of post-war public as well as private housing estates such as Argar Grove Estate, Maiden Lane Estate, Bemerton Estate, etc. As depicted in the previous figure-ground study (Figure 4.10c), these enclaves can be seen as fragmented urban figural patterns at the edge of the King's Cross railway lands, alienated from their surrounding urban fabrics. The grids run north-south parallel to the barrier without any west-east important integrators being drawn through the site. This prevents the adjacent spaces forming as identifiable sub-areas. The spatial patterns around the void are not interrelated and coherent with one another.

According to the initial condition survey, the well-defined sub-areas to the west and south of the termini around Camden Town, Somers Town, King's Cross Estate and Bloomsbury are vibrant with mixed retail, commercial and residential uses and pedestrian activities. The sparse and linear spatial grids to the east and north which are mostly occupied by old industrial buildings as well as old and new housing estates along Copenhagen Street and the Barnsbury and Argar Grove areas are very much quieter and the environment is rather more blighted. Within the lacuna of the spatial grid network at the centre of the King's Cross site, the area which appears to be extremely blighted and mostly occupied by dilapidated warehouses and industrial buildings, is left vacant most of the time. It also has a high record of illicit activities.

The internal space of King's Cross Station appears to be better integrated with the surrounding grids than that of St.Pancras Station which is elevated on a higher level and can be approached only from its street frontage through a ramp or steps. The lines drawn inside the termini from Euston Road, the most integrating line in the system, through their entrances are well integrated. However, it appears that the internal space of both King's Cross and St.Pancras simply clings to the main integrator and does not establish any significant link with the urban grid.

5.3.2c Liverpool Street Station area

An axial map of the catchment area of Liverpool Street Station presented in Figure 5.6a models the site bounded by Balls Pond and Graham Roads in the north, Mare, Cambridge Heath and Jubilee Streets in the east, Essex Road, Farringdon Street and Blackfriars Road in the west, and New Kent Road, Abbey Street and Jamaica Road in the south. The map shows that there are three main integrating alignments running from the north and northeast toward the south. They are City - Moorgate Roads, Shoreditch High Street - Bishopgate Road - Gracechurch Street and Mile End - Whitechapel Roads. These three integrators run toward the intersection of several other integrators: the Prince's Street - King William's Street alignment, the Victoria - Threadneedle Street alignment, Cornhill, Lombard, and Cheapside Streets which form the core grid in the City of London area to the south of the map.

Figure 5.6b depicts the immediate surroundings of Liverpool Street Station. There are several east-west integrators that run across the three main north-south integrating alignments, creating a densely grid-like area around Liverpool Street Station. To the north of the station, Old Street, Leonard / Great Eastern Streets and Worship Street are three important integrators that connect City Road in the west with Shoreditch High Street in the east. Another two east-west integrators: Eldon Street and London Wall - Camomile Street, run to the south side of the station. Eldon Street also aligns with Broadgate Arcade, the internal route which runs through the station's main concourse hall all the way to Bishopsgate Road to the east. The alignment which consists of external-internal routes acts as an important linkage between the two major north-south integrators.

The distribution of integration around the terminus building is dense and grid-like with lateral development as identifiable sub-areas. Bishopsgate Road appears to be where the two grid patterns meet. To the west, where the terminus building is located, the street grids are relatively more dense and more integrated than those of the east. The area has inter-related lines of mixed integration forming the well-defined sub-areas of Shoreditch, Broadgate and Bank. The area to the east is more sparse but still maintains its grid-integration characteristic, forming an identifiable sub-area of

Spitalfields. The grids appear to shift down from west to east to meet at more or less right angles with the Whitechapel - Mile End Road alignment.

The Broadgate Complex development attached to the west and north of the terminus building is well-structured within the boundary of main integrated grids: Worship Street to the north, City Road to the west, the Eldon Street - Broadgate Arcade alignment to the south and Bishopsgate Road to the east. Furthermore, the development is able to draw integration into the station's main concourse hall from Eldon Street, as well as some potential routes in its surroundings which are extended into the site creating the well-integrated new development area. From the south, the integrated line from Blomfield Street is drawn into the site through Broadgate Circle to meet with the line extended from Sun Street coming from the west. The line extended from Old Broad Street at the southwest corner of the station becomes a strong line of north-south integration that runs up the west side of the Liverpool Street Station railway tracks. From the north, the lines from Clifton Street and Appold Street are also drawn into Finsbury Square, one of the three newly created public squares in the development complex. At Exchange Square, sited over the approach lines to the north of the terminus, there are also several lines of sight and access that are drawn from the surrounding grid networks such as from Earl Street, Primrose Street and Bishopsgate Road (through Exchange Arcade).

It thus appears that the new development complex is well-connected and fits naturally into the surrounding grids. The station building and its approach railway lines not only allow the continuity of the spatial grid network, but they also bring about several new significant connections between the urban grids on both sides of the railway structures that were once separated. Although the tracks at the north-east still apparently cause a gap in the spatial network, their adjacent spaces are well integrated as an integral part of their own sub-areas.

These spatial characteristics correspond well with the vibrant and mixed use environment evidenced in and around Liverpool Street Station. The Broadgate complex, with its three new public squares including several new developing sites in the station vicinity which form a dense and well coherent urban physical pattern, enjoys high levels of pedestrian activities, both transport and non-transport related. According to the survey, although the residential areas further down the tracks around Sclater and Quaker Streets are slightly blighted, they are bustling with Bangladeshi's communal and commercial activities. It shows in the axial map that these spaces are not segregated or urban enclaves but well-connected with their surrounding street networks.

5.3.2d Fenchurch Street Station area

Figure 5.7a depicts the modelling area of Fenchurch Street Station which is bounded by Old Street and Old Bethnal Green Road in the north, Cambridge Heath and Jubilee Street in the east, Borough Road, Long Lane and Jamaica Road in the south, and Farringdon Street, Blackfriars Bridge and Blackfriars Road in the west. The axial analysis picks up the Fenchurch Street - Aldgate High Street - Whitechapel Road alignment as the most integrating line in the system. The line runs southward to the core formed by the intersection of integrated lines representing the City of London area. Fenchurch Street Station locates to the east of this core, only one step away from the main integrating alignment.

Apart from the main integrator, there are three other important but less integrated alignments that link radially from the north of the intersecting core grid. They are Gracechurch Street - Bishopsgate Road, Moorgate - City Roads and the Tower Hill - Royal Mint - Cable Street alighnment. The first two connect the City to Shoreditch area in the north and the last links eastward from the Tower of London to Limehouse. Shown in the close up view of Fenchurch Street Station's immediate surroundings (Figure 5.7b), these four integrating radials are linked with one another by several other integrators, picked up in yellow lines, forming a series of rings enclosing the City of London area. The rings consist of London Wall - Camomile - Minories Streets, Eldon - Broadgate Arcade - Hounditch Street, Middlesex - Mansell Streets - Tower Bridge Road, Great Eastern - Mansell Streets and Vallance - New - Cannon Street Roads.

The distribution of integration around the terminus structures conforms to this radial ring structure. To the south of Fenchurch Street, the grids run north-south at more or less right angles with the elevated railway viaducts and underpass them to meet with the east-west integrating alignment: Tower Hill - Royal Mint - Cable Streets, bounded to the north of the Tower of London. The terminus structures embed well in the spatial grid structure with a lateral development linking the main integrators into a dense and interrelated sub-area of Whitechapel.

Due to its small size and elevated structure, Fenchurch Street Station is almost unnoticed from its surrounding street grids. The terminus structures cause very little effect to the spatial structure. Crutch Friars, Minories, Mansell and Leeman Streets are important integrators that underpass the viaducts, linking the main integrating Fenchurch Street - Whitechapel Road alignment with the Tower of London and St.Katherine's Dock to the south of the terminus. These underpass routes attract retail and commercial development at the ground level space of most office buildings that are densely clustered in the area, creating vibrant and mixed use environments shared by office workers, shoppers and tourists. Some streets parallel to the viaduct such as Crosswall, Prescott, Royal Mint and Cable Streets are also well connected and have good levels of pedestrian activity. According to its current figure-ground map (Figure 4.12), Fenchurch Street Station almost disappears among the dense and coherent urban physical pattern. Only the area further down the railway lines has a more sparse and smaller urban block pattern with a more apparent urban gap. The area is partly fenced off from the railway viaducts and is mostly occupied by residential blocks. It is revealed in the axial map that although the grid network at the station's rear far down the railway arches is highly integrated, it has a less dense spatial pattern with fewer underpassing routes. This is in fact caused by several pockets of waste areas associated with some railway arches.

Although the external structures of Fenchurch Street Station are well embedded within the spatial grid structure, apparently its internal space is not very well integrated. Despite being surrounded by several integrators, the spatial connection between its internal and surrounding street spaces is complicated due to the level difference. The development of office complexes around and above the terminus structures as well as the construction of an additional station entrance incorporated with the office building's ground level space on Cooper's Road do not enhance the integration of the terminus building. Fenchurch Street Station appears to be segregated and does not create any important connection within the urban grid network.

5.3.2e London Bridge Station area

The axial analysis of the catchment area of London Bridge Station area (Figure 5.8a) covers the site bounded by Beech, Sun, Primrose and Lamb Streets in the north, Jubilee Street, Wall Glamis, Brunell and Lower Roads in the east, Black Prince Road, East Street, Lynton and Hawkstone Roads in the south, and Waterloo Bridge, York, Lambeth Palace Roads in the west. It depicts Cannon Street as the major integrator running east-west across the intersecting core grid of the City of London area. The core moves south across the Thames through two north-south important integrators: Blackfriars Bridge -

Blackfriars Road and London Bridge - Borough High Street alignments. The latter bounds to the front side of London Bridge Station and also branches off to another important integrator, Tooley Street, which runs parallel to the north side of railway viaduct structure.

Another two integrating alignments linking from the City across the Thames are Southwark Bridge - Southwark Bridge Road and the Tower Bridge - Tower Bridge Road alignments. These four north-south alignments are inter-connected by several east-west integrators, forming a dense and inter-related grid integration system around Cannon Street and London Bridge Stations' railway structures. Shown in the close up view in Figure 5.8b , the Borough High Street - Newington Causeway alignment appears to be the most important north-south core that draws several other integrators toward it. Apart from Tooley Street, other important lines that are drawn toward Borough High Street from the east are St.Thomas, Newcomen Streets, Long Lane, Great Dover, Trinity Streets, and Harper Road. From the west, they are Southwark, Union, Suffolk Streets and Borough Road. These grids form a 'deformed wheel' like structure where several radial lines link the central core with the outer ring integrators, formed by Blackfriars, London, New Kent, and Tower Bridge Roads.

The distribution of urban grids to the north of London Bridge Station is limited by the Thames. However, the construction of GLC Headquarters which incorporates new public spaces and the ongoing office and residential complex in the riverside area draws integration from Tooley Street. The area begins to have a prospective lateral development northward to the riverside. To the west of Borough High Street, despite the existence of the complex railway structures, the urban grid development is well-structured into sub-areas of Southwark and Borough. To the south and east of the station, although the cores are more sparse and linear, the approach railway lines still allow the grids to continue through some of their arches. However, it appears that the grid networks around the viaduct structures both at the front and rear are relatively less dense than their surroundings as they are often attached with gaps of various sizes. These gaps represent vacant pocket areas being left out between the railway arches and the existing grids. Some of them have been fenced off and turned into private parking garages. However, the terminus structures appear to embed well and become a focal point in the local core grid as they are criss-crossed and surrounded by several important integrators.

It is thus clear that although the terminus structures are large in size and seen as causing a large gap in its figure-ground pattern as depicted in Figure 4.13c , they do not cause any severe obstruction to the spatial grid network. The major street grids such as Southwark Bridge Road, Southwark Street, Borough High Street, Bermondsey Street and Tower Bridge Road, all underpass well the railway viaducts. The areas to the north and south of the approach railway tracks are also connected by several other minor grids: Joiner, Stainer, Weston Streets linking Tooley and St.Thomas Streets through viaduct tunnels.

Although the preceding figure-ground analysis of London Bridge Station area depicts the extensive urban scar caused by the railway structures, the station's surroundings enjoy good levels of pedestrian activities according to the current urban condition survey. However, these well used streets are adjacent to some small blighted and inaccessible areas such as those along St.Thomas and Tooley Streets far down the railway lines including the areas adjacent to the viaducts just before reaching Tower Bridge Road. The dense and coherent urban physical pattern and well-defined spatial grid network of the area to the west of Borough High Street is the location for the bustling Borough Market, which includes retail, office, and residential uses. The areas to the south and west where the grids are more sparse are quieter and occupied by a hospital complex, residential flats and housing estates. The integrators such as Tooley, St.Thomas, and Bermondsey Streets are much more busy with street level retail uses as well as offices, art studios, workshop, and small warehouse spaces.

The internal space of London Bridge Station appears to be simply an extension of its adjacent integrators. It does not establish a significant link within its local urban context. The level difference between the concourse and the street spaces complicates their connection with each other. The terminus building is set back from its front integrator: Borough High Street and can only be approached through a large ramp at the front, a pedestrian bridge from St.Thomas Street, and escalators from Joiner Street that passes underneath its concourse space.

5.3.2f Cannon Street Station area

The axial analysis of the modeling area around Cannon Street Station shown in Figure 5.9a covers the site bounded by Guilford, Calthrope and Spencer Streets, Murray Grove, and Hackney Road in the north, Cambridge Heath Road and Jubilee Street in the east, New Kent, Spa, and Jamaica Roads in the south, and Southampton Row, Kingsway, Waterloo Bridge and Waterloo Road in the west.

Figure 5.9b depicts the close-up view of Cannon Street Station area. The St.Paul's Churchyard Lane - Cannon Street alignment to the front of the terminus is picked up as the most integrating line in the system. The route runs east-west across the intersecting core grid formed by several important integrators: Cheapside, Queen Victoria, King William's, Lombard, Cornhill, Threadneedle and Prince's Streets. To the south of the core, there is also another integrator, Upper and Lower Thames Streets, running east-west and underpassing the railway viaducts. The core is linked outward by several integrating radial routes. To the north, the important radials are the Fenchurch Street - Whitechapel Road alignment, Bishopsgate Road, and the Moorgate - City Road alignment. To the south, London Bridge is the main integrator linking Cannon Street to London Bridge Station. Other radial alignments are Fleet Street-Ludgate Hill and Holborn Viaduct - Newgate Street in the west, Gosswell Road - Aldersgate Street in the north, and Southwark Bridge - Southwark Road in the south.

The core is also bounded by two long integrating alignments that run north-south across the Thames. Farringdon Road - Farringdon Street - Blackfriars Bridge - Blackfriars Road lies to the west while Tower Bridge - Tower Bridge Road lies to the east. Apart from the radial routes linking the integrating core grid outward, there are also several west-east integrators that form a series of rings encircling the core in the north. The core, then, has a stronger bias towards the north than the south of the City as the Thames acts as a barrier, obstructing the distribution of integration to the south side.

The core is distributed by major integrators. To the south of the intersection, minor street grids appear to run north-south, parallel to Cannon Street Station's buildings. The surrounding areas of the core are also dense and grid like with sub-areas well-structured within the main grid network. Cannon Street Station, bounded on all sides by important integrators, fits well into the grid network. However, there is no lateral development of the street grid towards the Thames. The area is occupied by large office buildings and mostly closed to public accessibility. The railway viaduct structure, which carries the railway approach lines immediately across the Thames, causes no obstruction to the street grids. Its high-level structure, as well as this topographical advantage, makes Cannon Street Station a terminus without an associated 'railway land' area to the rear.

The dense and well-structured spatial grid network of Cannon Street Station area well reflects its bustling environment which is mostly occupied by office and retail uses. Most office buildings on Cannon Street, the main integrator in the area, have ground floor retail uses that create a good level of street activity. The preceding figure-ground study of the area (Figure 4.14c) also shows a dense and coherent urban figural pattern of edge-defined building blocks. There is no sign of urban blight in the area of Cannon Street Station.

The internal space of Cannon Street Station does not draw integration from its surrounding major grids. Although the station building fits well within the urban block, it does not provide any significant connection within the spatial grid network and the internal space itself is not well integrated with the surroundings. People need to climb steps to the station's foyer which is slightly higher than the street level before climbing again to enter the main concourse space. This level difference complicates the spatial connection between the inside and outside spaces.

5.3.2g Waterloo Station area

The modeling area of Waterloo Station, shown in Figure 5.10a , covers the site bounded by Mansell, Middlesex, and Great Eastern streets, and the Theobalds Road - Clerkenwell Road - Old Street alignment in the north, Piccadilly, Grosvenor Place, Vauxhall Bridge Road, and Vauxhall Bridge in the west, Harleyford Road and John Ruskin Street in the south, and Walworth Road, Browning Street, Tower Bridge Road, and Tower Bridge in the east. Figure 5.10b shows that the New Bridge Street - Blackfriars Bridge - Blackfriars Road alignment is the most integrating line in the system, connecting Lambeth on the south to Farringdon to the north of the river. The core focuses on the east of Waterloo Station at St.George's Circus, where several integrators such as Westminster Bridge Road, Borough, Lambeth, London and Waterloo Roads intersect.

From the core, there are three important radial integrators running westward, passing Waterloo Station and its approach railway lines to connect with three river bridges. The first one, Waterloo Road, bounds the north of the station but is blocked from its frontage by the viaduct structure carrying the railway lines from Charing Cross to Waterloo East Station. The other two are the Westminster Bridge Road - St.George's Road alignment and Lambeth Road connecting to Westminster Bridge and Lambeth Bridge respectively. There are also several curvilinear alignments running parallel to the bend of the river, crossing at more or less right angles with the aforementioned radial integrators. Albert Embankment and The Queen's Walk is a riverside promenade flanking the western and northern edge of the station area. York Road - Stamford Street bounds the west of the station. Lambeth Palace Road - Upper marsh - Lower March - The Cut including Hercules Road - Baylis Road and Morley Street are all paralleled to the east side of the station. These radials and curvilinear alignments, including the main integrator Blackfriars Road, form a major grid framework in the terminus area.

The spatial core is bias toward the north and east sides of the terminus building. Their distribution of integration also has a different character from that found to the south and west. To the north and east, the grids are denser and more interconnected. The grid in the east side is well integrated and laterally developed from the intersecting core grid. To the northeast, the grid network in the Southbank area becomes more spatially complicated as most of its pedestrian network includes both ground and above ground level interconnection.

To the south, although the terminus building and its approach railway lines do not completely discontinue the spatial grid network, some large properties located to the west such as Lambeth Palace, St.Thomas Hospital, and a hotel and aquarium (the former County Hall), act as a spatial barrier preventing the grids developing towards the riverside area. The spatial structure thus appears more sparse because of these rather enclosed properties as well as some small pockets of waste areas. These waste spaces are often fenced off and inaccessible from their nearby streets such as those along Lambeth Palace Road, Carlisle Lane, and Hercules Road. Most of them are related to railway arches that have been blocked up. The condition survey reveals that although the streets at the station's rear are constantly used by pedestrians, their urban environment is rather blighted because of these pocket of waste areas adjacent to the railway lines. The council estates along Carlisle Lane and Hercules Road, the two paralleled routes along the railway tracks are quieter but still have a moderate level of pedestrian use. According to its current figure-ground map (Figure 4.15c), the rear of Waterloo Station appears to be a combination of gaps of various sizes as well as a fragmented figural pattern mostly associated with the viaduct structures.

The condition survey also shows that Mepham Street, the route immediately adjacent to the station's frontage, is not as busy as the fronting roads of the other termini. The spatial map clearly depicts that the viaducts carrying railway lines to Waterloo East from Charing Cross Station segregates the Waterloo terminus from its frontal integrator, Waterloo Road. The ramp that serves as an entrance to the station's east side is also quiet during the day compared to the spatially integrated Lower Marsh Road where a morning street market is located. The busy market street is well connected to nearby local shopping streets such as Baylis Road and the Cut including the bustling Waterloo Road and Westminster Bridge Road, bounding the front and back of the station building respectively. Located within two main integrators: Stamford Street and the Cut, the area to the north of the terminus is well-structured and mostly occupied by residential, retail and office uses. The railway viaducts that pass through the area are well embedded and leave no trace as a barrier to the spatial network. The figure-ground pattern in the area reveals a more coherent and edge-defined urban block pattern. The area has moderate levels of pedestrian activity but is heavily used during peak hours by office workers walking between Waterloo Station and Blackfriars Road.

The internal space of Waterloo Station is apparently segregated from its surrounding spatial network. This is again due to the level difference between the elevated station's concourse and its surrounding streets. The spatial complication is made worse by the taxi ramp and drop off area immediately to the north and east of the terminus. The internal space is depicted as a segregated island, surrounded by several integrators but not well connected to any of them.

5.3.2h Charing Cross Station area

An axial map of the modeling area around Charing Cross Station shown in Figure 5.11a covers the site bounded by Marylebone and Euston Roads in the north, Farringdon Road, Blackfriars Bridge, and Blackfriars Road in the east, Marylebone High Street, Park Lane, Constitution Hill, and Buckingham Gate in the west, and Horseferry Road, Lambeth Bridge, and Lambeth Road in the south. Oxford Street - New Oxford Street - High Holborn, a long and straight alignment, is picked up as the strongest integrator. The next important line is a north-south integrator, Kingsway, connecting Bloomsbury to Aldwych. These two major integrators locate outside the station area to the north and east respectively.

A close-up view of Charing Cross Station area in Figure 5.11b depicts the Strand as the important integrator to the north of the terminus building. This east-west integrator also serves as the main approach route to the station's front entrance. It is linked with the main integrator, the Oxford Street - High Holborn alignment, in the north through the two important north-south lines: the St.Martin Lane - Monmouth Street - Shaftesbury Avenue alignment and the Endell Street - Bow Street - Lancaster Place alignment. The latter maintains its strong integration value through to Waterloo Bridge connecting to the Waterloo Station's frontage across the Thames. The Piccadilly

- Long Acre alignment is another strong east-west integrator located about half way between Oxford Street and Charing Cross Station. It is linked northwards to Oxford Street through several other north-south integrators such as New Bond Street, Regent Street, and Charing Cross Road.

The integration to the north and east of the station site is thus densely distributed within these highly integrated grids. The areas have a spatial characteristic of grid-integration and are well-structured into distinctive sub-areas of Soho and Holborn. To the west of the station site is the St.James's Square area whose grids are well-connected with Piccadilly located to its north. To the south of the Strand within the immediate surrounding of Charing Cross Station, integration is distributed primarily from the Strand itself. There are several routes linking the station's front integrator to the Victoria Embankment at the riverside. The important ones are Villiers and Craven Streets and Northumberland Avenue, all running paralleled to the railway viaducts. Villiers Street provides another sub-entrance to the terminus and is also the major approach route to Embankment Underground Station and on towards the riverside area.

It is clear from the axial map that Charing Cross Station and its approaching railway lines have very little effect upon its spatial setting. Not only is the whole structure elevated on viaducts and located just beyond the river bank so there is no 'rear area', but the terminus building also takes up only a small space and appears to fit well within the grid network. The railway lines allow several routes to underpass them such as Craven's Passage, Embankment Place, and Victoria Embankment. The first two are mainly for pedestrian links and are flanked with retail shops constructed under the viaduct structure. The grid structure of the station's immediate setting is well connected to the Strand and Victoria Embankment, the two east-west alignments bounding the front and rear sides of the terminus respectively.

This well-connected and dense spatial grid characteristic throughout the station area corresponds with the vibrant urban condition and good levels of pedestrian activity within the station area found in the initial survey. The figure and ground study (Figure 4.16c) also revealed the cluster of coherently edge-defined urban blocks around the terminus building without any sign of physical disruption caused by the railway structures. In addition to this, the axial map also shows that they do not interrupt the spatial grid network either.

However, the internal space of Charing Cross Station appears to be rather segregated from its spatial surroundings. The station is accessible from the street level only through its front entrances. The side entrances from Villiers Street are via steps and escalators. The internal lines do not establish any significant link within the urban network but are rather extensions from the Strand, its front integrator.

5.3.2i Victoria Station area

Figure 5.12a is an axial modeling of Victoria Station. It is bounded by Bayswater Road and Oxford Street in the north, Kingsway, Waterloo Bridge, Baylis Road, and Kennington Road in the east, Culvert Road, Prairie Street, Thackeray Road and Clapham Road in the south, and Exhibition Road, Cromwell Place, and Albert Bridge Road in the west. Figure 5.12b is a close up view showing the terminus area that is bounded by several major integrators that link-up as a continuous circular ring. The most integrating line is the Sloane - Lower Sloane Street alignment located to the west of the station area. To its north end, it links eastward to the core formed by the intersection of three important integrators: Knightsbridge, Piccadilly, and Constitution Hill. To its south end, the ring continues eastward to three more integrators consisting of Chelsea Bridge Road, Grosvenor Road, and Millbank.

From this outer ring of integrators, there are several important lines linking inward to Victoria Station. From the west, Upper-Lower Belgrave Street runs from the north side of Belgrave Square toward the northwest corner of Victoria Station. From the south all the way up to the north, the Ebury Bridge Road - Buckingham Palace Road alignment is bounded along the west side of the station structure, connecting Chelsea Bridge Road to Buckingham Palace Gate. To the east the Vauxhall Bridge Road - Vauxhall Bridge alignment runs from the east side of the terminus to Kennington across the Thames.

The overall distribution of integration around the terminus building is more dense and grid like. The spatial grids to the east and west are highly integrated, constituting well-structured areas of Belgravia and Pimlico respectively. Both areas are well connected with each other through several railway embankment bridges such as Eccleston, Elizabeth, and Ebury Bridges. The area to the northeast of the station is well-structured by a dense and radial-like grid network which constitutes the sub-area of Westminster. To the south far along the railway lines, there appears to be several voids in the spatial grid network associated with the railway lines. These voids are occupied by old goods depot and its railway lines, the Chelsea Barracks, Ranelagh Garden, and the Chelsea Royal Hospital. However, they are bounded on all sides by highly integrated routes.

The axial map clearly shows that Victoria Station and its related railway structure fit well within their spatial setting. Its approach lines allow several routes to cross over them. However, the bulky volume of the terminus building itself obstructs the spatial continuity, causing the grid to adjust around the building. This is also evident in its figure-ground study (Figure 4.17c). The rear area of the station along both sides of the railway lines, has a more coherent and grid-like urban physical pattern while at the front, the pattern appears to be deviated around the terminus building. However, the overall spatial grid network around the station building is relatively dense and well integrated which is also reflected in the dense and coherent urban physical pattern.

It was noted in the initial survey that Victoria Station is locate among a bustling mixed use area, especially to the station's front. Although the rear is very much quieter due to its residential landuse, the area is relatively well-used by pedestrians. Only some areas alongside the railway tracks beyond the Ebury Bridge - Sutherland Street alignment are rather blighted. These areas are largely occupied by council flats, Peabody housing estates located at the rear side of Lister Hospital and next to the old railway tracks and train depots. The properties turn their back against the railway embankment thus are only accessible through their front. Their rear is flanked by the gaps evidenced in the axial map. The figure-ground map revealed that the area incorporates a field of fragmented figural blocks.

Although the internal space of Victoria Station has several connections with its surrounding streets, it does not establish any significant link within the local grid network. Only to the north of the terminus building where the integration is drawn into its internal space from the intersection of Victoria Street, Vauxhall Bridge Road and Carlisle Place. The station building thus imposes itself as an enclosed space within integrated surroundings such that its spatial potential is not fully utilised. The new office and commercial redevelopment complex at Victoria Place flanking the west of the railway tracks does not provide any new spatial connection to the neighbourhoods alongside the tracks.

5.3.2j Paddington Station area

Figure 5.13a depicts the modeling area of Paddington Station before its redevelopment. The area is bounded by Harvist, Brondesbury, and Belsize Roads in the north, Albany, Great Portland, and Regent Streets in the east, Cromwell and Brompton Roads, Knightsbridge and Piccadilly in the south, and Ladbroke Grove and Camden Hill Road in the west. Figure 5.13b is a close up view around Paddington Station showing the terminus area located within the local grid network that is bounded by the two highest integrating lines: Edgeware Road to the east and the Bayswater Road - Oxford Street alignment to the south.

There are several minor integrators that run toward the two major integrators all along their length at more or less right angles. The important ones that link inward to the station area are Clifton Gardens, Bloomfield Road, Maida Avenue and Harrow Road, all running toward the north side of the terminus. Praed Street, Star Street, Sussex Gardens, and Kendal Street link from Edgeware Road toward the station's front side, while Gloucester, Westbourne, Lancaster, and Stanhope Terraces, run from Bayswater Road toward the front and west sides. These lines are densely intersected with other minor lines, creating an integrated spatial grid at the station's front. The spatial core within Paddington Station area is thus biased towards its south side. In the north, all integrators stop before approaching the railway lands. Westbourne Terrace is the only integrator that crosses over the railway lines then underpasses the Westway, connecting to the Warwick Estate in the northwest.

The distribution of integration to the north of the terminus has a different character from that found to the other sides. To the east, south, and west, the spatial grids are densely inter-connected and more grid-like defining the sub-areas of Bayswater and Lancaster Gate. To the north of the Westway, the grid is more sparse without any lateral development of well-defined sub-areas. The area is occupied by council flats and estates with some terraced houses located around the Little Venice area. The area along the Canal Basin in-between the Westway and the terminus structures is occupied by Paddington Goods yard and railway lands. They are depicted in the axial map as the urban enclaves without any significant link to the surrounding integrators that cause the discontinuities in the spatial grid network.

It is thus clear that Paddington Station's structures and railway lands significantly disrupt the continuity of the urban fabric, causing a series of voids in the spatial as well as the physical patterns as shown in its axial and figure-ground studies respectively (see also Figure 4.18c). Although the approach railway lines still allow several routes to cross over them such as Bishop's Bridge Road, Westbourne Terrace, and Lord Hills Bridge, the spatial grid patterns on both sides of the station structures are incoherent and largely discontinued. Similar disruption was also depicted in the current figure-ground pattern. The urban condition survey also reflects the contrasting characteristics of a vibrant front and blighted rear at Paddington Station. Pedestrian activities are clustered along Praed Street and the area to its south, while the vacant site at the back is largely occupied by dilapidated warehouses and is deserted of pedestrians at most times of the day.

Although the internal space of Paddington Station has recently been refurbished with additional retail spaces created along with the new Heathrow Airport check-in facilities, the axial map reveals that it still appears to be very much segregated from its local surrounding. The terminus building does not have a direct access from its front integrator, Praed Street, since its main entrance is hidden behind the railway hotel (Hilton, London Paddington). Furthermore, it does not establish any significant link with its spatial setting nor does it utilise the spatial potential of its local integrators to draw more integration into the terminus building.

Paddington Station area after the Paddington Basin Development

The prospective axial map of Paddington Station's modeling area after the Paddington Basin redevelopment is depicted in Figure 5.13c with a view focusing on the terminus area shown in Figure 5.13d [5]. The map shows that the redevelopment consists of two main parts. Both fit into the areas formerly occupied by the urban enclaves that were once attached to the north of the station structures. The first part is embedded into the former Paddington Goods yard to the northwest of the terminus, and the second part, alongside the Canal Basin to the rear of St.Mary's Hospital. The internal space of Paddington Station is also enhanced as a significant linkage to the new canalside development complex.

The axial map also shows that the urban intervention at Paddington Basin in general does not significantly affect the spatial structure of the existing area. Compared to the axial map of the area before the redevelopment (Figure 5.13b), the intervention does not shift or undermine the integration core nor does it utilise the spatial potential of

5 The prospective axial map of Paddington Station area is adjusted by taking into account the latest redevelopment scheme for both the station's interior space and the Paddington Basin area. The layout plan of the new Basin area as it is now under construction is from the Paddington Regeneration Partnership (PRP) in 2001. The latest refurbished plan of Paddington Station is the property of Railtrack's design team, also from 2001.

the site to draw integration into itself. It appears that the redevelopment site as well as the terminus building are still rather segregated despite being bounded by several integrators. The spatial structure of the site itself is internally complex with too many lines breaking away from the surrounding main grids and without being well-structured as a distinctive sub-area. The intervening grids are also not coherent with their surrounding spatial pattern and most importantly, do not establish any new connection between the areas on both sides of the terminus structures as well as the Westway. The areas alongside the approaching railway lines are still largely discontinuous from one another. The Westway itself also makes it difficult for the spatial grids of the development site to effectively link with those of the residential neighbourhoods in the north.

The closer view of the spatial structure of the Paddington Basin Development site itself, depicted in Figure 5.13e , shows the distribution of global integration within the area in log version (Log.int-N). This is to see a clearer picture of how the redevelopment site relates to its surrounding grids by highlighting all strategic lines in the area. The map shows that the external lines that are drawn into the site are often either blocked or break down into unaligned spatial grids. This undermines the development of the main internal routes that would also function as the major connections between the complex and its surroundings. From the south side, London Street, Norfolk Place, Southwick Street, and Sale Place are the routes that are drawn from the station's front area into the station building as well as the canal-side St.Mary's Hospital complex. Only Sale Place is unblocked and drawn across the canal basin to as far as the public plaza at the British Waterways office complex. However, the line is not spatially established as an important entry route into the site according to the axial representation. The extension of the line from London Street ends up inside the terminus building at Platform 10-11, while the one from Norfolk Place is extended into St.Mary's Hospital complex, ending at South Wharf Road. Both routes do not lead to any important space of the development such as the square, plaza, riverside promenade, or the complex on the other side of the canal basin of which they could establish themselves as the significant links from the site to Praed Street, the important integrator bounded to its front.

Another entry route from the intersection of two major integrators, Praed Street and Edgeware Road, is also broken up by the West End Quay office complex before getting aligned with the canal-side promenade which links all the way through to the Paddington Goods yard site. Again, this route could have been created as a major central axis that would directly link the development complex to the important intersection if it is unblocked and aligned with Chapel Street, another integrator that runs toward the intersection from the east.

From the northeast, the opportunity to draw integration into the site from the two integrators: Marylebone Road and Bell Street, is also undermined by the blockade of two development elements, the Hilton Metropole Hotel and the British Waterways office complex, that flank the northeast corner of the site. The existing school area also acts as a barrier that prevents the site being more open to its northern neighbourhood. The spatial structure within this northern office - commercial - residential complex is also complicated with lines breaking up into short and unaligned spatial grids and without any significant link across the Canal Basin to the St.Mary's Hospital Complex in the south. The four bridges that connect both canal-side areas are also not aligned with the major routes.

Three office buildings will be developed above platforms 12-15 and their podium structure will be created as a transition space between the terminus's interior space and the canal-side development complex. However, due to the level difference of approximately six metres, people on the platform level can only access the canal-side level by escalators from the foyer at the end of the station's platforms. This level difference prevents the direct link of sight and access between the station's internal space and the canal-side complex. Due to the spatial complication of this linkage, the axial representation reveals that the connecting route is rather segregated from the complex as well as from the system as a whole.

Paddington Goods yard and the St.George development which consists of office, residential, commercial and leisure activities, is constructed in the space between the approaching railway lines and the Westway. Due to the level difference with Bishop's Bridge Road, the complex has its main pedestrian entrances only from the canal-side promenade. Because of this limited access, the spatial structure of the complex is not very well integrated with its surroundings, especially to the south across the terminus structures.

It thus appears that due to the topographical disadvantages of the site, the existing transport infrastructures and the spatial complication of the redevelopment plan itself, the Paddington Basin project is unable to eliminate the spatial barrier caused by the terminus structures nor does it reconnect the neighbourhoods alongside them. More importantly, the new complex is not developed into a well-defined sub-area that is well integrated with both the terminus building and its local surroundings.

5.3.2k Marylebone Station area

Figure 5.14a depicts an axial map of Marylebone Station's modeling area which is bounded by Belsize and Adelaide Roads in the north, Albany Street and Tottenham Court Road in the east, Kensington Road, Knightsbridge, and Piccadilly in the south, and Fernhead, Great Western, and Ledbury Roads in the west. Figure 5.14b focuses on the terminus area and its immediate surroundings. It depicts Edgeware Road to the west side of the station area as the most integrating line in the system. The Bayswater Road - Oxford Street alignment is the next highest integrator intersecting with Edgeware Road at the northeast corner of Hyde Park. To the south of the terminus, Marylebone Road is another important integrator that runs east-west across the station's front area. It intersects with another two integrators, Gloucester Terrace and Baker Street, running north-south paralleled to the east side of the terminus from the western boundary of Regent's Park towards Mayfair. To the west, there are several integrators, St.John's Wood Road, Frampton Street, Church Street, the Broadley Street - Broadley Terrace alignment, running east-west from Edgeware Road toward the terminus structures. Only St.John's Wood Road crosses over the railway and leads to the northwest corner of Regent's Park while the others stop before approaching the railway lands.

The core of the terminus area is thus biased towards the south of the station building where Marylebone Road intersects with Edgeware Road, Gloucester Terrace, and Baker Street. To the west and north, the core is comparatively weak as the integrators do not establish any significant link with one another. They also end at the boundary of the housing estates adjacent to the railway lines.

The distribution of integration to the north of Marylebone Station has a different character from that found to the other sides. To the east, south, and west, the spatial networks are dense and grid-like with minor street grids being laterally developed from the major ones. The north or the rear side of the terminus building has a more sparse grid network with segregated lines representing the housing estates located adjacent to the railway lines. It is depicted in the axial map as an urban enclave where there is no public accessible route into the site. The grid to the northeast has a more restricted line integration with only two north-south routes, Park Road and Regent's Park Outer Circle, running paralleled to the terminus structures.

It is thus clear that Marylebone Station's structures limit the continuity as well as the potential development of the urban grid in the station area. The adjacent housing estates also prevent the grid from developing across the railway lines. They are crossed only at Rossmore, Lodge, and St.John's Wood Roads. The recent office and residential redevelopment projects along Harewood Avenue as well as Park Road to the west and east sides of the terminus respectively, were only constructed alongside the railway embankments. They do not establish a spatial link across the terminus structures that would beneficially reconnect the grids on either sides. The previous figure-ground study (Figure 4.19c) revealed the linear void caused by the railway lines with fragmented figural blocks of housing and flats being attached to them especially to the northwest side. The areas on the other sides of the terminus where dense spatial grids are evident also show dense and coherent urban physical patterns.

The initial urban condition survey of Marylebone Station area reveals the busy front and comparatively blighted rear areas. The station's front where retail shops, offices, a hotel, and terrace houses are located, is moderately used by pedestrians. However, the area can be very much quieter outside the station's morning and evening peak periods compared to the busy Marylebone Road. The rear, where some parts of the housing estates are left in a blighted state, has low levels of use during the daytime.

The internal space of Marylebone Station appears to be segregated from its surrounding grids. The terminus is set back from Marylebone Road, the main integrator located to its front. Although the interior space provides an additional shortcut from Melcombe Street to Harewood Avenue, to its front and west respectively, the internal lines are not well integrated within the spatial network as a whole.

Summarising, it has been suggested that the way in which the internal space and external structures of London's termini fit into their urban context is manifested through the spatial configuration of their urban setting. The case by case axial analysis of the terminus areas can be summed up as follows:

* All London's railway termini except Paddington Station are bounded by at least one important integrator or integrating alignment. Charing Cross is the only terminus that has only one integrator: the Strand, to its front. Only King's Cross and St.Pancras Stations have integrators bounding both of their front and sides while the others are surrounded in almost all directions by important lines. However, Euston, Waterloo, Fenchurch Street, and Marylebone Station buildings appear to set back from their front integrator while the others are immediately adjacent to theirs. Paddington Station is the only terminus that is not immediately bounded by any integrator. It is

located in the local grid network framed by two intersecting integrators: Bayswater and Edgeware Roads. Liverpool Street and Euston are the only two termini where an alignment from one of their surrounding streets: Eldon and Drummond respectively, runs across their internal space. These lines establish a direct link between the grid network on both sides of the station buildings. However, only the Eldon Street alignment which crosses all the way through Liverpool Street Station's main concourse space is spatially integrated. The Drummond Street alignment is not an integrator. It passes only through Euston Station's front colonnades which is not the main part of its concourse hall. Victoria, King's Cross, and London Bridge Stations have some important integrators extending from their surrounding grids into their main concourse space but never cutting across it. However, these integrating lines that are simply extended into the terminus buildings make their internal space generally become more integrated with their spatial context, than those that are flanked or set back from their significant lines. According to the axial representation, Liverpool Street, Euston, Victoria, King's Cross, and London Bridge Stations thus appear to have a relatively more integrated internal space than that of Cannon Street, Charing Cross, Waterloo, Fenchurch Street, and Marylebone Stations. Paddington Station has a very segregated internal space even after the area redevelopment. However, to confirm the outcome of the axial analysis, a more detailed numerical analysis of the stations' spatial embedding will be presented in the next section (Section 5.3.3).

* The degree to which the terminus structures obstruct the urban grids largely determines the existence of sub-areas around them. These sub-areas have their own spatial characteristics which do not necessarily relate and cohere with one another. Most of London's terminus areas consist of several sub-areas located around the stations, especially along both sides of their approach railway lines. This apparently occurs especially in the cases where the terminus structures were originally imposed onto either vacant or slightly built-up sites. The urban grids have separately evolved around the structures. Examples can clearly be seen in King's Cross-St.Pancras, Marylebone, and Paddington Station areas. The first two cases are ground and the last, below-ground level termini which have only a few connecting routes across their railway lines. Their terminus structures are also accompanied with large urban voids representing vacant railway lands and urban enclaves. The axial representation of their immediate surroundings shows a combination of spatial characteristics, distinctive in terms of the grid formation and direction as well as the distribution of integration. Importantly, these sub-areas are rather separated from one another without any major interconnecting grid network.

Cases like Fenchurch Street, London Bridge, and Waterloo Station areas also appear to consist of several surrounding sub-areas. However, they are tied together by important integrators that generally work as a main spatial grid framework for the entire area. Although these high-level terminus structures appear to incorporate some small urban voids especially around the blocked railway arches and, in the case of Waterloo also some large enclosed properties, they still allow several important crossing routes that tie together the sub-areas on both sides of the railway viaducts.

The spatial structure of Victoria and Liverpool Street Station areas are coherent and interconnected throughout. The stations' surrounding grid network appears to be rather unified. Both termini are approached by low-level railway lines with several cross-over integrating lines. However, the axial analysis of Victoria Station area reveals that the bulky volume of the terminus causes the grids to deviate around it. This creates several sub-areas around the station's front whose spatial patterns are distinctive from those of its rear. In the case of Euston Station, although its railway lines apparently cause most grids to stop before crossing them, the two major integrators, the Camden High Street - Eversholt Street alignment and Hampstead Road, form the major grid network that allows some minor grids to develop laterally into sub-areas. The small and elevated termini located just beyond the river such as Charing Cross and Cannon Street Stations, are the exceptions. Their structures impose very little effect upon the continuity of the spatial grid networks. These two station areas thus appear to have a coherent and interconnecting spatial pattern throughout.

* The distribution of the spatial grid network at the front and rear sides of some of London's termini are very distinctive from each other. Examples are again King's Cross-St.Pancras, Paddington, and Marylebone Station areas. The grid structure at the front of these termini is much more intensified and integrated with a better spatial scale of mixed integration values. They have a characteristic of 'grid-integration' whereby the spatial network is grid-like and well-structured into distinctive sub-areas. The rear side has a 'line-integration' structure whereby the distribution is more linear and sparse. In the case of King's Cross and Marylebone, the rear also exhibits urban enclaves or 'deep spaces' where local grids are segregated as a defined chunk. These lines represent the housing estates located at the edge of the railway lands. In all three cases, the spatial maps also reveal large holes or 'blind spaces' where no publicly accessible route is found in the areas adjacent to the railway lines. In case of Euston Station, the spatial patterns of its front and rear are also very much distinctive from each other. Similar to the aforementioned three terminus areas, Euston Station's front area also has the spatial characteristics of the grid-integration

network while its rear, the line-integration. However, the area does not incorporate any large urban hole that severely disconnects the urban grid network as those of the former three terminus structures do.

The surroundings of the three high level termini: London Bridge, Waterloo, and Fenchurch Street Stations have the grid-integration spatial patterns both at their front and rear. However, due to the existence of some small waste pocket spaces and large private properties (in case of Waterloo), the grid network of their rear becomes more sparse than their front. On the contrary, Liverpool Street and Victoria Stations have coherent grid-integration patterns more or less surrounding their terminus structures. Their spatial map shows a structure of densely distributed grid network of mixed integration values throughout the station areas with several important integrators crossing over the terminus structures. In the case of Liverpool Street Station, the integrating grid network also weaves through its internal space as well as the adjacent Broadgate Complex. Only in some areas further down the railway lines of both Liverpool Street and Victoria stations there is a trace of a gap in the spatial network due to the existence of undeveloped sites. However, these gaps appear to be bounded on all sides by important integrators which means the sites have got strong potential to be well integrated within the larger spatial network. Due to their rather limited rear areas, Charing Cross and Cannon Street Station areas are again the two exceptions as the spatial grid distribution is coherent throughout in spite of the existence of the terminus structures.

* Focusing on how the terminus structures affect their immediate grid structures, the axial analysis suggests that most ground and low-level approach railway lines have the most influence on the urban grids. The effects can be clearly pointed out in two various ways from the cases of King's Cross, Paddington, Marylebone and Euston Station areas. Firstly, the terminus structures tend to force the grids to deviate around them. Most axial lines close to the railway tracks often lie parallel to them. The ones that run toward the railway lands tend to stop before reaching them and are often taken over by the tracks' parallel routes. Secondly, in the extreme circumstance where the terminus structures are also accompanied by large vacant railway lands or housing estates that are segregated from the public domain, as in the cases of King's Cross, Paddington, and Marylebone Station areas, the whole barrier area tends to completely obstruct the continuity and disrupt the coherence of the urban grid pattern of their surroundings. This often causes clusters of segregated lines flanked to the edge of the railway lands as the grids are discontinued and cannot make any interconnection with the larger network. In Paddington Station area, the grid

interruption is also reinforced by the Westway (the A40). However, in the other cases of ground and low-level terminus structures like Victoria and Liverpool Street Stations, the two effects mentioned above do not occur as the terminus structures coexist with the urban grids without any significant obstruction to each other.

The high level terminus structures like Charing Cross, Cannon Street, London Bridge, Waterloo, and Fenchurch Street Stations have much less effects upon their surrounding grids. Although some railway arches which have been blocked can also cause interruption to the grid, the elevated structures do not affect the continuity of most immediate grid patterns. However, it is noted that the three high-level railway structures which were initially constructed through the densely built up areas as discussed in the historical review in Chapter Four, create oddly-shaped left-over spaces attached to the lines. Some of these small pockets, often stuck between the railway arches and the existing street grids, have been fenced off or left vacant and become blighted.

* The terminus areas which locate in the proximity of natural boundaries (the river), large enclosed properties (palace, hospital, school, etc.), or another nearby railway lands have a rather limited spatial potential to be integrated with their larger spatial network, especially if the railway structures themselves are also the spatial barriers. Clear examples are Waterloo, King's Cross, Marylebone and Paddington Station areas. Waterloo's railway viaducts at its rear are bounded to the west by Lambeth Palace, St.Thomas Hospital and the River Thames. Paddington Station area is not only cut through by the canal basin that branches off from The Grand Union Canal, but also restricted by the Westway (A40) to the north. The Grand Union Canal also passes through Marylebone and King's Cross Station areas at their north sides. The axial maps reveal that the development of the urban grids in these station areas is rather restricted due to these barriers. The rear of Charing Cross and Cannon Street Stations is also bounded by the Thames. Although the terminus structures are not the spatial barriers in their own right, the further development of their urban grids toward the riverside is apparently limited.

* Lastly, for the latest London's terminus area redevelopment plans, the axial analysis reveals that only the Broadgate Development at Liverpool Street Station area is successful in fully embedding the station's internal space and external structures into the larger spatial network. The refurbishment of its interior space as well as the redevelopment of its railway lands to accommodate an office and commercial complex with three new public plazas appear to utilise well the site's spatial potentials by

drawing integration into the new complex and especially into the station's concourse. The current spatial pattern of Liverpool Street Station area is dense with a good spatial scale of interrelated urban grids which also function as new connections for the surrounding neighbourhoods, once separated by the railway structures.

Other completed urban redevelopment projects at Fenchurch Street, Cannon Street, Charing Cross, Victoria, and Marylebone Station areas do not greatly affect the overall spatial configuration. The projects add only some new usable spaces on top of the terminus structures in the first four cases and in the vacant sites adjacent to the railway lines in the last case. The redevelopments thus offer no new spatial connection or draw any integration into the new complexes. The urban redevelopment schemes at London Bridge and Waterloo Station areas have not yet been finalised.

However, the prospective spatial configuration of Paddington Station area after the ongoing redevelopment project of Paddington Basin crucially reveals its failure to achieve what the Broadgate Complex has to enhance Liverpool Street Station area. The axial map of the new Paddington Station area shows that the new development complex is not well embedded with its spatial setting but rather adds a segregated and internally complex grid network into the area. The new development does not utilise the spatial potential of its existing grid to draw integration into the site nor is its spatial pattern coherent with the surrounding's. More importantly, the new complex is unable to eliminate the gaps in the spatial network that are caused by both railway lines and the Westway. Thus, the station's surrounding grid patterns are still segregated from one another.

The categorisation of London's railway terminus areas based on their spatial configuration in relation to their urban physical pattern and current urban condition will be summed up and discussed further in Section 5.4. This will also take into account the results of the embedding analysis of each terminus presented in the next section in order to complete the urban scale spatial study of all station areas.

5.3.3 SPATIAL ANALYSIS: the internal embedding of London's mainline railway termini

This section turns to a more precise spatial analysis, focusing on the degree to which the station buildings are integrated into their urban settings. Considering each railway terminus as a nodal point of various movement networks as well as the centre of urban redevelopment, it is argued that the successful transformation of a terminus area from node into place crucially depends on how well the station building and the urban structure correspond with each other. If the station's internal space has become an integrated part of its local as well as global spatial grid networks, or in other words, it is well embedded as a part of the highly accessible routes within the area, this also means that the urban area will benefit from the existence of the terminus building by becoming more spatially integrated.

For a quantitative measure, the analysis will turn to the ratio of the mean integration value of all axial lines in each station's modeling area to the internal lines and that without[6]. The study draws upon the spatial variables established in the preceding axial analysis (all variables are displayed in a station base spatial data table presented in Appendix F). It aims to examine the degree to which the stations' internal space enhances the integration value of their urban settings. The greater the ratio is over 1.0, the better the station building is spatially embedded in its surrounding.

Table 5.1 illustrates the mean integration values of all London's terminus modeling areas including those of Paddington Station after the area redevelopment (Paddington new). Column A and B are the mean global integration values of all terminus areas with and without their internal space respectively, and Column C and D, for those of the local integration. The 'embedding ratio' of the global integration (A against B) and that of the local integration (C against D) are shown in Columns E and F respectively.

6 The mean integration value of all axial lines in each station's spatial modeling area is calculated from the axial maps depicted in **Figure 5.4a-5.14a**. The maps include the axial lines inside the terminus buildings and the ones in relation to their surroundings. The mean integration value without the internal space is calculated from the same spatial model for each area which is reprocessed after the internal lines are excluded.

Table 5.1: Spatial embedding of eleven London's railway terminus buildings, global and local integration.

STATION	A µ.int-N w/internal space	B µ.int-N w/o internal space	C µ.int-3 w/ internal space	D µ.int-3 w/o internal space
Euston	1.4191	1.4163	2.5897	2.5907
King's Cross	1.1380	1.1360	2.6541	2.6547
Liverpool Street	1.1725	1.1378	2.4920	2.4622
Fenchurch Street	1.1984	1.2213	2.4416	2.4705
Cannon Street	1.1794	1.1786	2.4634	2.4666
London Bridge	1.1326	1.1291	2.4024	2.4017
Waterloo	1.2566	1.2556	2.5239	2.5270
Charing Cross	1.5505	1.5490	2.7056	2.7036
Victoria	1.1351	1.1328	2.5037	2.5020
Paddington	1.4230	1.4230	2.5543	2.5580
Paddington (new)	1.4487	1.4474	2.6035	2.6007
Marylebone	1.6531	1.6524	2.6566	2.6592

STATION	E=A/B Internal space Spatial Embedding (int-N)	STATION	F=C/D Internal space Spatial Embedding (int-3)
Euston	1.0019	Euston	0.9996
King's Cross	1.0017	King's Cross	0.9997
Liverpool Street	1.0304	Liverpool Street	1.0121
Fenchurch Street	0.9812	Fenchurch Street	0.9883
Cannon Street	1.0006	Cannon Street	0.9987
London Bridge	1.0030	London Bridge	1.0002
Waterloo	1.0007	Waterloo	0.9987
Charing Cross	1.0009	Charing Cross	1.0007
Victoria	1.0020	Victoria	1.0006
Paddington	1.0000	Paddington	0.9985
Paddington (new)	1.0008	Paddington (new)	1.0010
Marylebone	1.0004	Marylebone	0.9990

Table 5.2 sorts the spatial embedding data in descending order from the highest to the lowest values. Liverpool Street Station is the most spatially integrated terminus in its global as well as local grid structures, having embedding ratios of 1.0304 (int-N) and 1.0121 (int-3). The termini that have important integrators drawn into their internal spaces or those that were shown above to provides a direct link within the grid network such as London Bridge, Victoria, Euston, and King's Cross Stations are all included in the top five with embedding ratios (int-N) of 1.0030, 1.0020, 1.0019, and 1.0017 respectively. However, it is clear that the margin between the four termini and Liverpool Street Station is large which means that this station is far more integrated than the others. All other elevated terminus spaces such as Charing Cross, Waterloo, and Cannon Street including the hidden away Marylebone Station do little to increase the mean global integration of their spatial settings (1.0009, 1.0007, 1.0006, 1.0004 respectively). This confirms that these high-level termini do not embed as a significant part of their global spatial structure. Only the elevated London Bridge Station whose internal space is directly linked through a large ramp from its front integrator, Borough High Street, comes in second place after Liverpool Street Station as mentioned before. Paddington Station is not well embedded even including the adjacent basin area redevelopment as its global embedding ratio increases from 1 to only 1.0008. Fenchurch Street Station is the only terminus that has a negative effect on its global spatial network. The existence of this small elevated station building decreases the mean global integration value of its urban setting (the embedding ratio is

0.9812). It can be said that the very segregated internal space of Fenchurch Street Station is not an integral part of its global spatial grid network.

For the local embedding, it appears that all termini except Liverpool Street Station are not very well integrated. Although the new Paddington, Charing Cross, Victoria, King's Cross, and London Bridge terminus spaces improve the mean integration value of their local spatial structures (with ratios of 1.0010, 1.0007, 1.0006, 1.0002, 1.0002 respectively), the values are relatively small compared to that of the most locally embedded Liverpool Street Station (1.0121). It also appears that although Euston Station building is rather well embedded in its global spatial network, the terminus space is not integrated in its local spatial structure, turning the local embedding ratio into a negative value of 0.9996. This negative effect also occurs at Marylebone, Waterloo, Cannon Street, the existing Paddington, and Fenchurch Street Stations whose internal spaces undermine the spatial integration value of their local grid structures (the local embedding ratio of these termini are 0.9990, 0.9987, 0.9987, 0.9985, 0.9883 respectively). All include large and small ground, low-level, and high-level termini. It thus seems that how well a terminus space would become a significant part of its global as well as local spatial structures depends on more complicated spatial factors than its layout as well as level of intervention in the surrounding grids. The spatial structure of its urban setting as well as how the setting relates to its larger grid network of the city are also crucially important.

Table 5.2: Spatial embedding of eleven London's railway terminus buildings in global and local integration value descending order.

STATION	Internal space Spatial Embedding (int-N)	STATION	Internal space Spatial Embedding (int-3)
Liverpool St.	1.0304	Liverpool St.	1.0121
London Bridge	1.0030	Paddington (new)	1.0010
Victoria	1.0020	Charing Cross	1.0007
Euston	1.0019	Victoria	1.0006
King's Cross	1.0017	King's Cross	1.0002
Charing Cross	1.0009	London Bridge	1.0002
Paddington (new)	1.0008	Euston	0.9996
Waterloo	1.0007	Marylebone	0.9990
Cannon Street	1.0006	Waterloo	0.9987
Marylebone	1.0004	Cannon Street	0.9987
Paddington	1.0000	Paddington	0.9985
Fenchurch Street	0.9812	Fenchurch Street	0.9883

Table 5.3 presents a ratio of intelligibility values at each terminus area after and before its internal space is included. Intelligibility measures the ratio of the mean global integration against the mean connectivity of all axial lines in the system[7]. The values represent the degree to which people who move around locally also have an

7 While mean 'integration' is the mean depth of all axial lines to every other lines in the system, mean 'connectivity' is the mean number of their immediate connections.

awareness of how the whole area is constructed. This is to examine if the existence of the station buildings enhances the understanding of how to navigate their urban surroundings.

Liverpool Street Station again by far is the most successful London terminus, its internal space greatly improving the intelligibility of its urban setting with a ratio of 1.0767. Although London Bridge, Victoria, Marylebone, Paddington, Euston, and Waterloo Stations also improve the intelligibility of their settings with ratios slightly over 1.0, the values are all relatively small compared to that of Liverpool Street Station. On the contrary, the existence of Charing Cross, Cannon Street, the new Paddington, King's Cross, and Fenchurch Street Stations decreases the intelligibility of their urban contexts, all with a negative ratio of below 1.0. This suggests that their internal space undermines the understanding of the urban structures they embed in.

Table 5.3: Spatial embedding, intelligibility values in descending order

STATION	µ.intN / / µ.conn w / / w / o.intl (intelligibility)
Liverpool Street	1.0767
London Bridge	1.0037
Victoria	1.0036
Marylebone	1.0024
Paddington	1.0021
Euston	1.0018
Waterloo	1.0004
Charing Cross	0.9994
Cannon Street	0.9976
Paddington (new)	0.9941
King's Cross	0.9880
Fenchurch Street	0.9862

In summary, it appears that Liverpool Street Station by far has the best performance of all London's railway termini. It is the most spatially embedded terminus, both in the global and local structures of its urban context. Its internal space also improves the intelligibility of its urban setting. The analytical result also reveals that London Bridge and Victoria Stations are the next two best which enhance the global integration as well as the intelligibility of their surroundings. However, the values are relatively small compared to those of Liverpool Street. Both termini are also not very well embedded in the local structure of their urban grid network. The results crucially suggest that the degree to which the stations embed and enhance the intelligibility of their urban context do not only depend on their layout and the level of intervention in the street grids, but also their location in a larger scale grid network. Liverpool Street Station is a low-level terminus while London Bridge is an elevated structure and Victoria, a ground-level one. This analogy can be pointed out again by comparing London Bridge with Marylebone Stations. The high-level terminus that has a complex spatial arrangement such as London Bridge Station, gives higher embedding ratios and better improves the intelligibility value of its setting than the ground-level station with a much simpler layout like Marylebone Station. It is thus clear that due to the importance of the spatial continuity in urban grid networks between inside and outside the termini, how the station buildings position themselves within the spatial structures is also crucial.

5.4: DISCUSSIONS AND CONCLUSIONS

Two key points are to be discussed here. Firstly, to answer the chapter's first question: how well each London terminus, including both internal and external structures, embeds in its surrounding grid network, all findings from the syntactic analyses will be discussed in order to categorise the terminus areas into groups. This categorisation suggests similarities and distinctions in urban spatial characteristics, with the aim of establish a clear comparative review of all terminus areas for further discussion. The second part discusses the influences of the stations on their spatial setting based on the categorisation made earlier. It seeks to answer the other main question: how the relationship between the urban condition and physical pattern of the terminus areas reflects their spatial characteristics and why. Drawing on all analytical results, the chapter concludes by discussing which spatial characteristics of the railway terminus areas relate to their vibrant as well as blighted urban environment.

5.4.1 The spatial categorisation of London's railway terminus areas

Taking into account all syntactic analyses, all eleven of London's terminus areas can be categorised into four groups in respect of the degrees to which their internal space and external structures embed in the urban surroundings.

* The first category includes only Liverpool Street Station area. It is clear that Liverpool Street is the only London's railway terminus that has its internal space as well as external structures well embedded in the urban grid network. The terminus is not only bounded by important integrators in all directions, but its internal space also has three integrating lines cutting across all the way through its lower and ground level concourse spaces. The one that passes through its lower-level gallery aligns with Eldon Street, which is the station's approach integrator from the west. As a result, the

integration is directly drawn into the indoor concourse hall and this makes the connection between the inside and outside spaces become distinct. From the numerical embedding analysis, Liverpool Street Station is far more integrated globally as well as locally and improves the intelligibility value of its urban setting more than all the other London termini. Its surrounding grids are densely and coherently distributed throughout as a network of mixed integrating lines without any significant trace of disruption. The discontinuity of the grids appears only in the undeveloped area located far down the railway lines. However, the area is not segregated and still bounded by important integrators. Liverpool Street Station's approach railway lines are criss-crossed by several integrators. This interconnecting grid network is a result of its urban redevelopment in the 1980s which addresses successfully the spatial potential of the site and draws integration into the new development complex. It can then be seen that the internal space as well as external structures of Liverpool Street Station allow the surrounding spatial grids to weave through them and to well connect with the larger urban grid network of the city.

* The second group includes Euston, Victoria, Charing Cross, and Cannon Street Station areas. Although the internal space of these four termini is not well integrated according to the axial and numerical embedding analyses, their external structures fit well within their spatial surroundings. The grid structures of these four station areas in general are densely distributed throughout, though with slightly distinctive spatial characteristics between the front and rear. Euston Station, a ground level terminus, is hidden behind a series of office buildings, a bus station, a plaza, and small gardens, away from its front integrator, Euston Road. A direct spatial link between its east and west sides that cuts through the frontal part of the concourse hall is not spatially significant. Although Victoria Station is surrounded in almost all directions by several approach integrators, only one of them is drawn into one of its two concourses. The bulky volume of the terminus building appears to be more of a barrier to the urban grid than a part of it. Apart from the rather enclosed interior space, this is due to the complicated spatial arrangement of Victoria's two paralleled concourse spaces as well as the location of its entrances in relation to the surrounding grids. Charing Cross and Cannon Street are the elevated termini that can be entered from the street level only from their front. However, the spatial connection between their internal space and front integrators is made complicated by the vehicular drop-off area (in case of Charing Cross) and the high-level foyer space (in the case of Cannon Street). The embedding analysis also reveals that these four termini give insignificant values of global as well as local integration including the intelligibility measures compared to those of Liverpool Street Station in the first category.

Nevertheless, the surroundings of these four termini in general incorporate dense grid-integration networks. The terminus structures do not impose themselves as complete barriers to their spatial grid networks. Their surrounding sub-areas, especially the ones located along the approach railway lines, are tied together by some important integrators that function as a major grid framework for the sub-areas. In the case of Euston Station, although its rear is restricted to the east by the King's Cross site, the sub-areas of Camden Town, Somers Town, and Regent's Park are well interconnected by two long integrating alignments: Camden High Street - Eversholt Street - Woburn Place and Hampstead Road. Victoria Station's railway embankment is well traversed by several east-west integrators, and also flanked by Buckingham Palace Road, the main north-south integrator that connects the rear with the front areas. Only the area far down the railway lines beyond the Ebury Bridge - Sutherland Street alignment where the existing goods station is left vacant appears as a large gap in the grid network. However, the gap is flanked by several important integrators. Cannon Street and Charing Cross are the termini that have their rear restricted by the Thames. However, both areas incorporate densely distributed and continuous spatial grid networks without any sign of interruption by the railway structures.

* The third category identifies with London Bridge, Waterloo and Fenchurch Street Station areas. They are all high-level railway termini whose internal spaces are rather segregated from the surrounding grids. Although their railway viaducts do not totally obstruct the urban grid network in the areas, they are often adjoined by a series of gaps of different sizes. These gaps represent pockets of oddly-shaped land that have been left out after the terminus structures were initially constructed in already laid-out urban grid of densely built-up areas. This is made worse by the fact that some of the railway arches have been blocked or altered for other uses then left vacant or fenced off afterwards. Although the urban structure of these three terminus areas in general is well distributed with a mixed integrating grid network since the viaduct structures still allow most grids to pass through, these gaps apparently cause the grid network to become more sparse than their surroundings. In case of London Bridge and Fenchurch Street Stations, these gaps are clearly evident between their rear railway viaducts and the adjacent street grids. The gaps along Waterloo's approach viaduct structures become even more conspicuous as they are accompanied by other larger gaps, caused by enclosed properties such as Lambeth Palace and St.Thomas Hospital. The existence of these three elevated terminus buildings does not well enhance the mean global and local integration as well as intelligibility values of their spatial contexts. The axial analysis suggests that their internal space is not well integrated as a part of the surrounding grid network but rather a segregated extension of it.

* The last group consists of Paddington, Marylebone, and King's Cross Station areas. Neither internal spaces nor external structures of these termini embed well in their spatial setting. The urban grid structure of these three terminus areas is a combination of densely distributed spatial networks at the front and disruptive and segregated grids with large urban voids at the rear. The stations also have rather enclosed interior concourse spaces. Only King's Cross is immediately bounded and approached by main integrators while Marylebone and Paddington Stations are set back from theirs. King's Cross is thus the only terminus in the group that draws integration into its concourse. However, its internal space does not create a significant link within the grid network. The embedding analysis confirms that all three termini are spatially segregated as they do very little to enhance the global and local integration as well as intelligibility values of their spatial contexts.

All three terminus areas consist of several sub-areas with different spatial characteristics: a combination of grid-integration and line-integration spatial networks at their front and deep and/or blind spaces, at their rear. However, unlike the station areas in the second category, the sub-areas around Paddington, Marylebone and King's Cross Stations are not well tied together by integrators that function as a major grid framework. There are several large gaps that also completely disrupt the grid networks. Although Paddington, and Marylebone Station areas do not have an extensive gap like that of King's Cross Station, they all have similarly disruptive spatial patterns at the rear. In Paddington Station area, the grid interruption is also emphasised by Paddington Basin and the Westway (the A40). These other barriers prevent the station's surrounding grids from being integrated with their larger urban network.

The terminus structures as well as the railway lands of King's Cross Station almost completely discontinue the spatial network. The adjacent urban grids that represent several sub-areas do not have any coherent spatial pattern with one another. Some consist of a chunk of segregated lines that represent the housing estates located at the outer rim of the urban hole. King's Cross Station area is thus a prime example of the railway terminus complex that acts as a permanent spatial barrier causing an extensive effect upon its surrounding grid network.

It is clear that the dense distribution of mixed grid-integration networks evidenced in and around London's railway terminus buildings, in which the grid patterns are coherent and interconnected, are determined by two main factors. First is a good degree of spatial embedding of the railway termini, both their internal spaces and external structures, in their urban context. The station's layout plan and the location of entrances are thus significant. Second is the location of the terminus areas in the city whereby their grid structure can be well interconnected with the larger urban network. This means the locations that do not have the topographical limitation or any other nearby spatial barriers. It confirms that not all London's termini are urban grid barriers and importantly, not all terminus areas have the spatial potential for further redevelopment. Thus, all railway terminus areas cannot be imposed by an overarching redevelopment plan.

As a consequence, it is also clear that the spatial categorisation of the terminus areas cannot be clearly made only on the basis of whether the stations are ground, lower-ground, or above-ground level structures but the degrees to which they obstruct the movement grid network in the areas. According to the current redevelopment projects, it also appears that not all of them achieve in re-integrating the railway termini into their contexts. Cases like Victoria, Waterloo, Marylebone, Charing Cross, Cannon Street, Fenchurch Street and especially Paddington Stations reveal that their related urban redevelopment schemes have done very little to reconnect more of the urban grids on both sides of the terminus structures. And on the same basis, Liverpool Street Station area appears to be the only successful case.

5.4.2 The spatial related urban phenomena at London's railway terminus areas

Considering the case by case review on the spatial configuration of London's terminus areas in relation to their current urban condition and figure and ground pattern in Section 5.3.2, it is made clear through the preceding categorisation that the areas with common spatial characteristics also share similar urban conditions and physical patterns. The analyses crucially imply that the spatial grid structures have indeed affected space uses and, possibly through the natural movement process as Hillier argues, also influenced subsequent land uses and building density.

Liverpool Street Station area, the only London's terminus area which consists of the dense and coherent grid-integration network interconnecting through its internal space as well as external structures, enjoys vibrant and mixed-use environment with a good degree of pedestrian activity both within and around the terminus building. The terminus structures embed well in the urban context and cause no significant trace of deep or blind spaces. The initial survey confirmed that the newly developed Broadgate

Complex as well as its surrounding neighbourhoods are well used and accommodate mixed-land use of office, retail, commercial, residential, and small scale industrial. Its figure and ground patterns representing building footprints and open spaces appear to be coherently carved out of each other. The figural plan almost reflects the actual pattern of the street network which implies that most movement channels and open grounds are constituted by buildings. Its spatially embedded internal space is also vibrant and multi-functional.

Similar vibrant urban conditions and coherent figure-ground patterns are also found to be identified with the areas around Victoria, Euston, Cannon Street, and Charing Cross Stations, the four terminus areas categorised in the second group. Despite the segregated internal spaces, their coherently distributed spatial surroundings reveal that the terminus structures embed well in the urban contexts. The dense grid-integration network at the front of all four termini is corresponded with vibrant and mixed-use urban environment. The interconnecting but less integrated grid network at the rear of Victoria and Euston Stations which is dominantly occupied by well-kept residential buildings has a quieter urban environment than the front but still maintains good levels of pedestrian space use. The topographically restricted but uninterrupting urban grids at the rear of Cannon Street and Charing Cross Stations are vibrant and busy although the areas can turn quieter during the office hours. It is also noted that all terminus buildings except Cannon Street Station have rather bustling internal environment although the axial and embedding analyses reveal that all of them are not well integrated with their spatial contexts. However, the terminus buildings can turn very much quieter during the station's off peak hours. It implies that most internal space uses might only be transport-related.

The areas around the three high-level termini in the third category: London Bridge, Fenchurch Street, and Waterloo Stations, also share strikingly similar urban conditions and figure-ground patterns. The axial analysis reveals that their elevated structures do not totally obstruct the urban grids but instead create several waste pocket areas attached to them. The areas in general consist of several sub-areas as a result of the entanglement of the railway structures, especially in the cases of London Bridge and Waterloo Stations. There is a combination of the spatially dense and well-defined areas representing the vibrant urban environment and the interconnecting but sparse grids identifying with the slightly blighted but still well-used areas. It is noted that the blighted urban condition is in fact found to be evident in the waste pocket areas and around the blocked railway viaducts. However, these small enclaves are flanked by well-used streets. It thus indicates that the blighted urban condition is not caused by the spatial grid structures but by the existence of the adjacent waste pocket spaces that are left out and fenced off from the integrated routes. These areas are inaccessible and cause the grid network to become more sparse though still maintain its interconnection. The urban physical patterns also reflect the coherent but loose figural patterns in the areas where these waste pocket spaces exist, alternating with the dense figure-ground patterns. The spatially segregated internal space of these three termini is busy only during the morning and evening rush hours.

For the last group, Paddington, Marylebone, and King's Cross-St.Pancras Station areas whose spatial structures are severely disrupted and segregated are evident of blighted and underused urban environment in various stages. The terminus areas have a combination of the grid-integration or line-integration spatial networks at the front and the urban enclaves: deep and/or blind spaces, at the rear. All of them, especially King's Cross - St.Pancras Station area, incorporate large urban holes apparently revealed in both of their urban spatial and physical patterns. The urban holes are often edged with segregated lines in the axial maps and sparse and fragmented figural blocks in the figure-ground patterns. The front of the stations is generally a busy area of mixed-land use while the rear, mostly occupied by housing estates, is extremely blighted with very low levels of pedestrian activity. Some areas are pedestrian deserted with the presence of unused buildings in dilapidated condition such as those at the rear of King's Cross-St.Pancras and Paddington Stations. All three termini are spatially segregated and, similar to all the others except Liverpool Street Station, are dominantly used by commuters and travellers. The concourse spaces can turn very quiet during the day.

In conclusion, it is clear that the urban spatial configuration of the terminus areas shows a strong relationship with their urban condition as well as figure and ground pattern. Good levels of pedestrian activity and mixed-land use are often found in the areas whose spatial structures are organised as a dense and interconnected grid-integration network, with the lateral grid development from some major integrators into well-defined sub-areas. The sub-areas often include mix integrating lines well structurally connected to the main grid framework. Well-used urban environment is also evident along important integrators of which most termini are flanked, especially at their front and sides. These areas also appear to have dense and coherent urban physical patterns of street-defined urban solids and figural voids. On the contrary, the areas of sparse and segregated urban grids with the presence of 'deep spaces' or 'blind spaces' which include lumps of segregated lines or holes in their spatial structures, are often accompanied with blighted urban conditions. Low levels of pedestrian movement, less degrees of mixed-land use and activity including building structures that are left unused or dilapidated are often evident in these areas. The figure-ground maps also show sparse and fragmented urban figural patterns which appear to be dominant by a vast area of ground.

The grid structure of the terminus areas that distinctively affects their space uses and building density as precedingly described is largely determined by two spatial related factors. First is the layout of the terminus structures themselves. Second is their location within the city structure as a whole. It was pointed out in Chapter Four that the choices of layout and siting of London's termini were primarily determined by the Railway Companies with their financial objectives in mind. The alternatives for ground, below-ground, high-level terminus structures were decided according to the existing building density and location. For almost two centuries, the railway structures have imposed themselves as the permanent barriers and often the territorial setters within the urban fabrics. This chapter reveals that the terminus structures which allow the subsequently evolved urban grids to interconnect throughout the areas in spite of their existence are the ones that have their internal spaces as well as external structures become a part of the grid networks. The layout of the terminus structures themselves is thus crucial. The location of the station entrances, the spatial connection between the internal spaces and their surrounding streets, the spatial inter-relation between the approach railway lines as well as their related structures and their surrounding grids all affect the continuity of the urban grids in the terminus areas. As the city consists of a continuous movement grid network, the station locations that also allow the surrounding grids to become the integral part of their larger urban network then have a better potential to become more integrated. This means the locations that are not restricted by natural boundary or any other urban barriers.

The analyses confirms the two propositions based on Hillier's ideas of natural movement and movement economy. Firstly, it points out that the vibrant as well as blighted urban conditions evidenced in London's railway terminus areas are in fact spatial related. Secondly, only the redevelopment schemes that take into account of the sites' spatial potential can then turn the areas into vibrant urban places. The well interconnected and integrated grid network means that pedestrian movement can flow naturally into and through the area. The movement thus attracts the movement-seeking landuses such as retail, commercial, and business uses to develop along the integrated lines. This subsequently multiplies its effect by attracting further pedestrian space uses which would benefit the development of more land uses according to Hillier's idea of movement economy. The residential land use is to be developed along the less integrated lines which attract less movement, creating a quieter urban environment. This whole process thus creates a vibrant urban environment of mixed-use and pedestrian activity within the areas. On the contrary, the interruption of the urban grid network thus undermines this mechanism as the flow of natural movement is obstructed. The lack of movement economy process thus cannot sustain the existing land use in the areas and also interrupt the development potential of more new land uses.

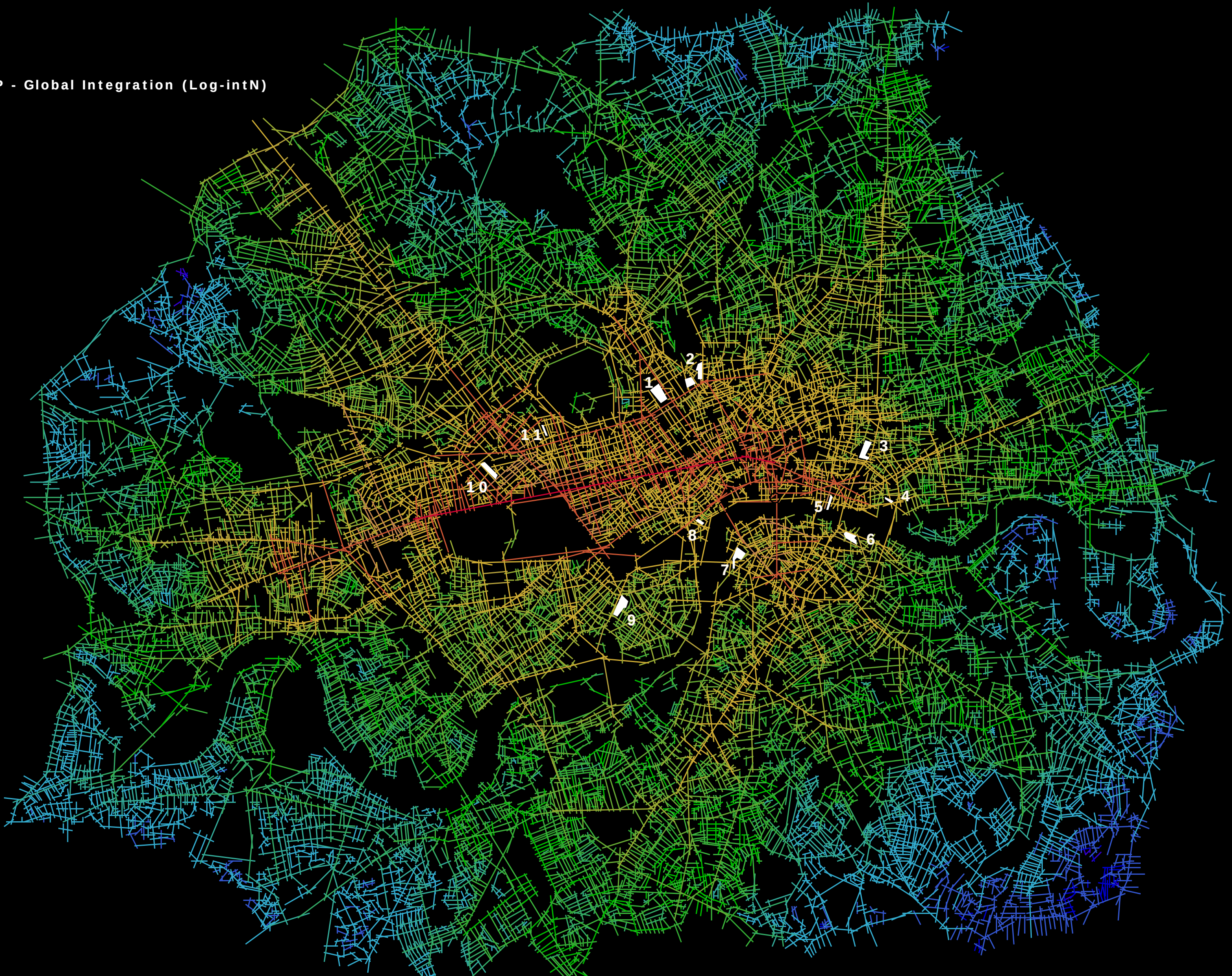
The analytical results strongly suggest that the natural movement process might have played a major role here in creating vibrant and mixed-use urban environment in some London's railway terminus areas, and the lack of it then leads to the contrast outcome in some others. The study in this chapter generally sums up the spatial characteristic of each London's terminus area and how it relates to its urban physical pattern and especially current urban condition. However, it is still unclear whether the pedestrian movement levels evidenced in the areas according to the initial survey are in fact 'grid-related' or so called the natural movement, the movement that would be sustainable throughout most times of the day, or 'station-related', whereby the fluctuation can occur during the stations' peak and non-peak periods. The next chapter aims to make a precise investigation on the natural movement level in each station area in order to substantiate the propositions based on Hillier's ideas of natural movement and movement economy in addition to this chapter. The study in Chapter Six turns to an empirical analysis of the pedestrian movement levels on all key routes around each terminus structure during different times of the day.

Figure 5.1: LONDON AXIAL MAP with the location of all mainline railway termini


Figure 5.3: LONDON AXIAL MAP - Local Integration (Log-int3)
1: Euston Station
2: King's Cross - St.Pancras Station
3: Liverpool Street Station
4: Fenchurch Street Station
5: Cannon Street Station
6: London Bridge Station
7: Waterloo Station
8: Charing Cross Station
9: Victoria Station
10: Paddington Station
11: Marylebone Station
1
2
3
4
5
6
7
8
9
10
11
London Axial Map: after Hillier, 1995.

Figure 5.2: LONDON AXIAL MAP - Global Integration (Log-intN)

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



London Axial Map: after Hillier, 1995.

Figure 5.4: EUSTON STATION AREA
Axial analysis: global integration - intN
(with the station's internal space included)

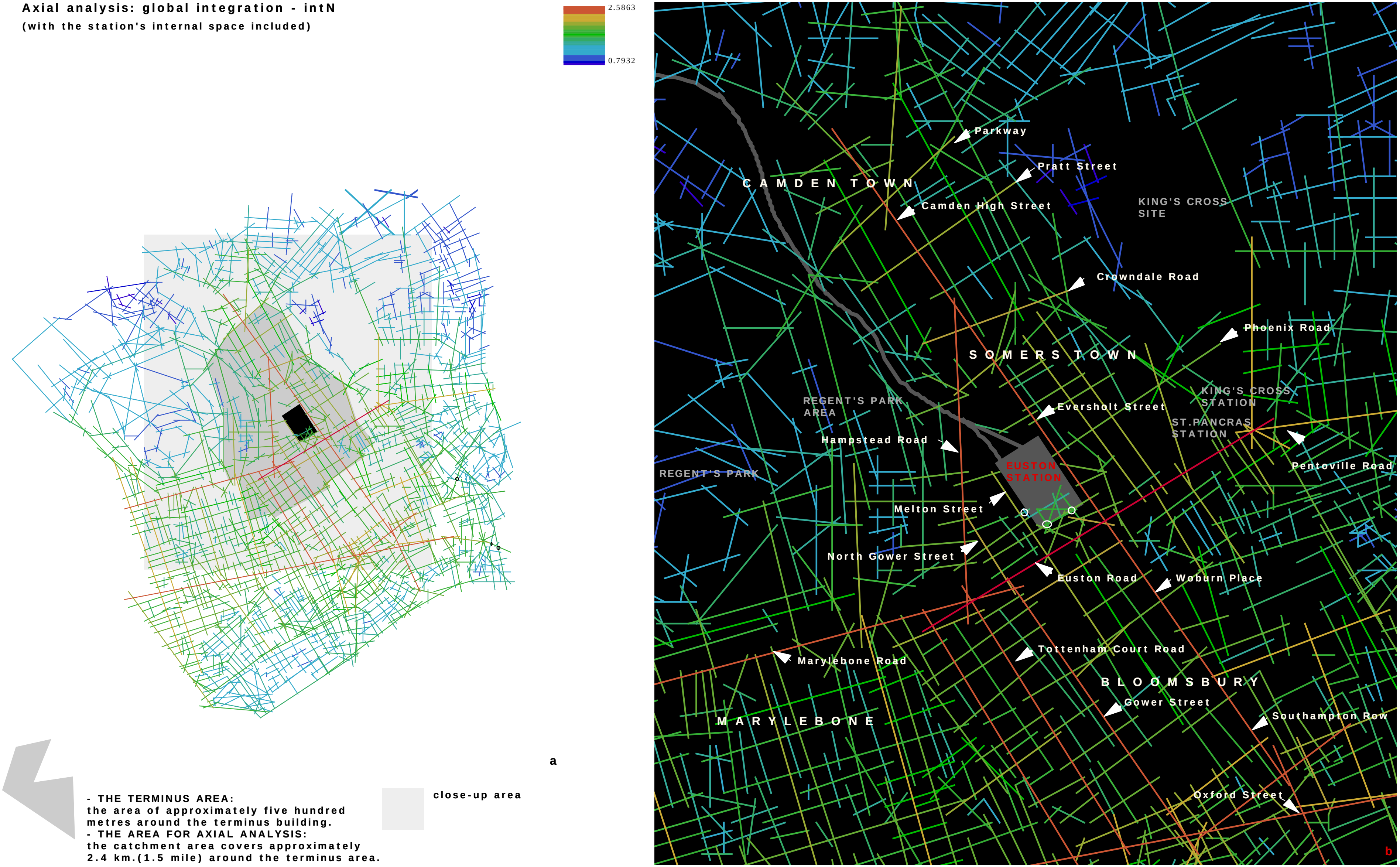
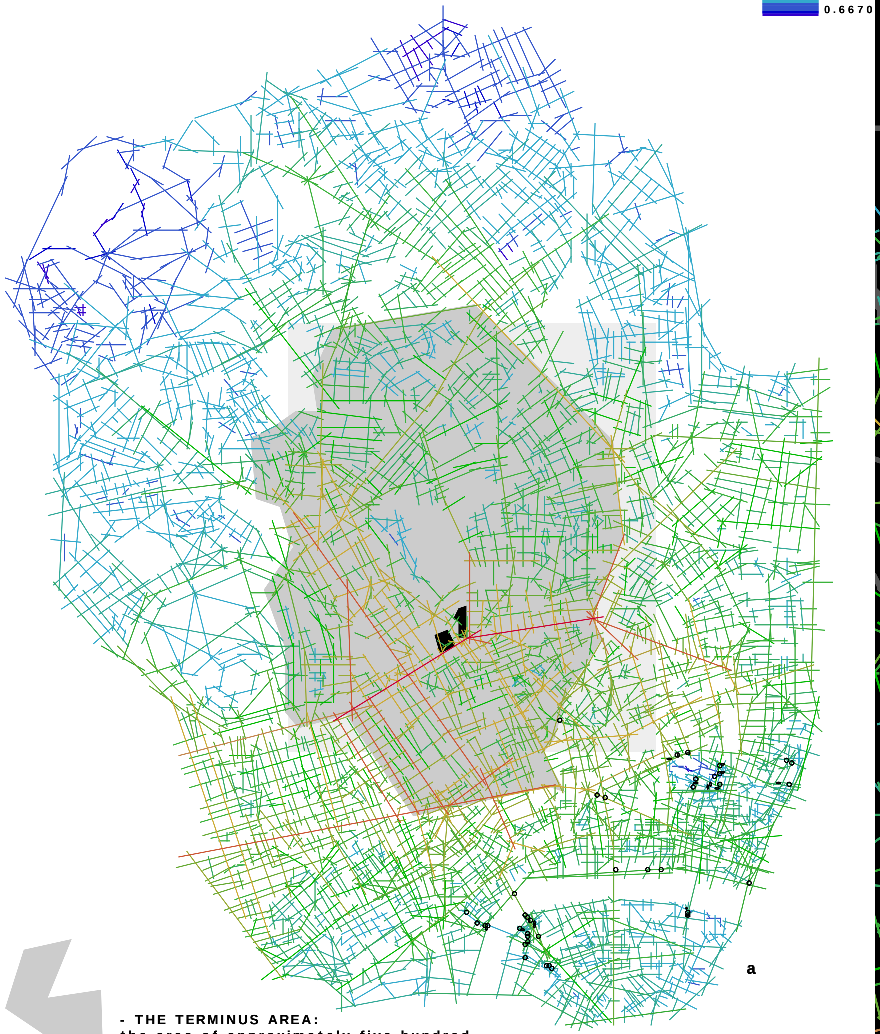
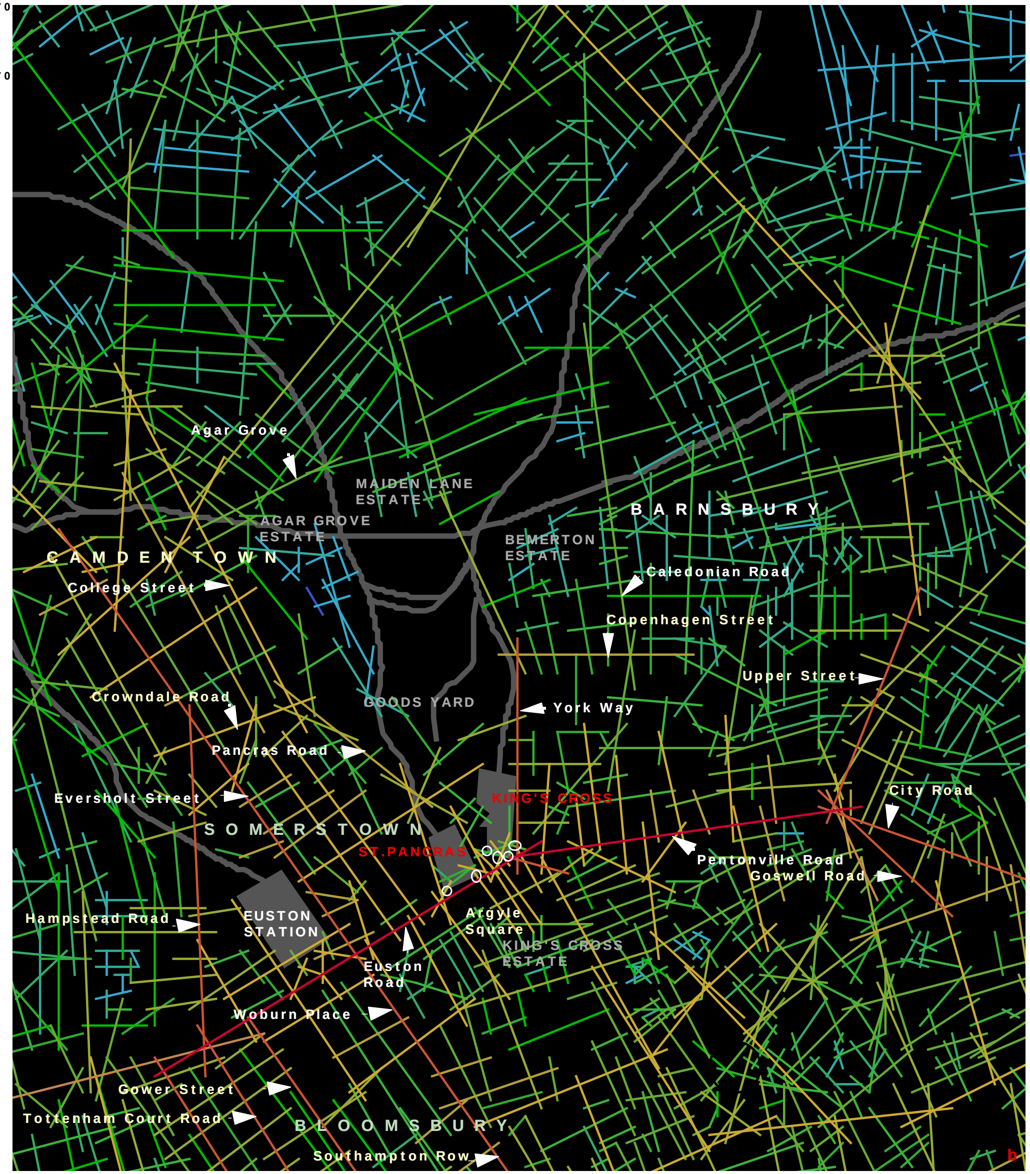


Figure 5.5: KING'S CROSS / ST/PANCRAS STATION AREA
Axial Analysis: global integration - intN
(with the station's internal space included)

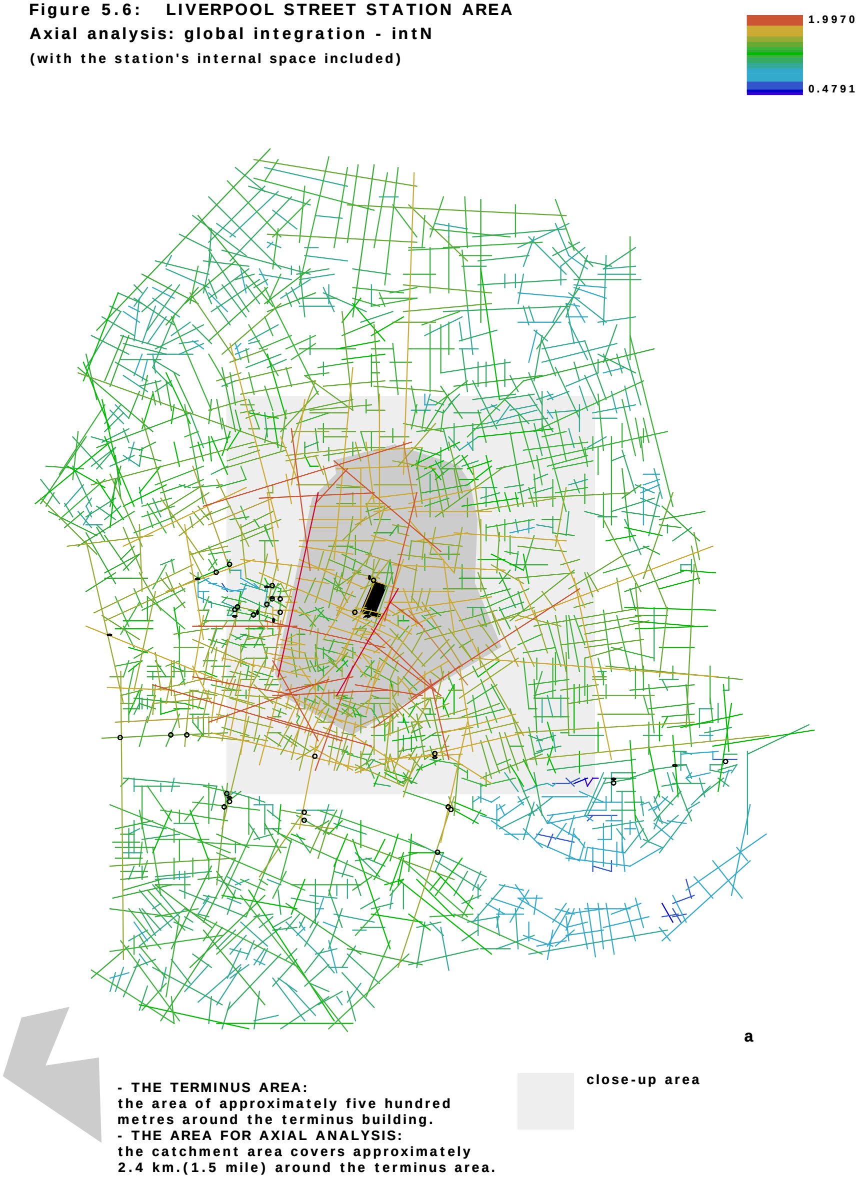




- THE TERMINUS AREA:
the area of approximately five hundred metres around the terminus building.
- THE AREA FOR AXIAL ANALYSIS:
the catchment area covers approximately 2.4 km.(1.5 mile) around the terminus area.

close-up area

Figure 5.6: LIVERPOOL STREET STATION AREA
Axial analysis: global integration - intN
(with the station's internal space included)



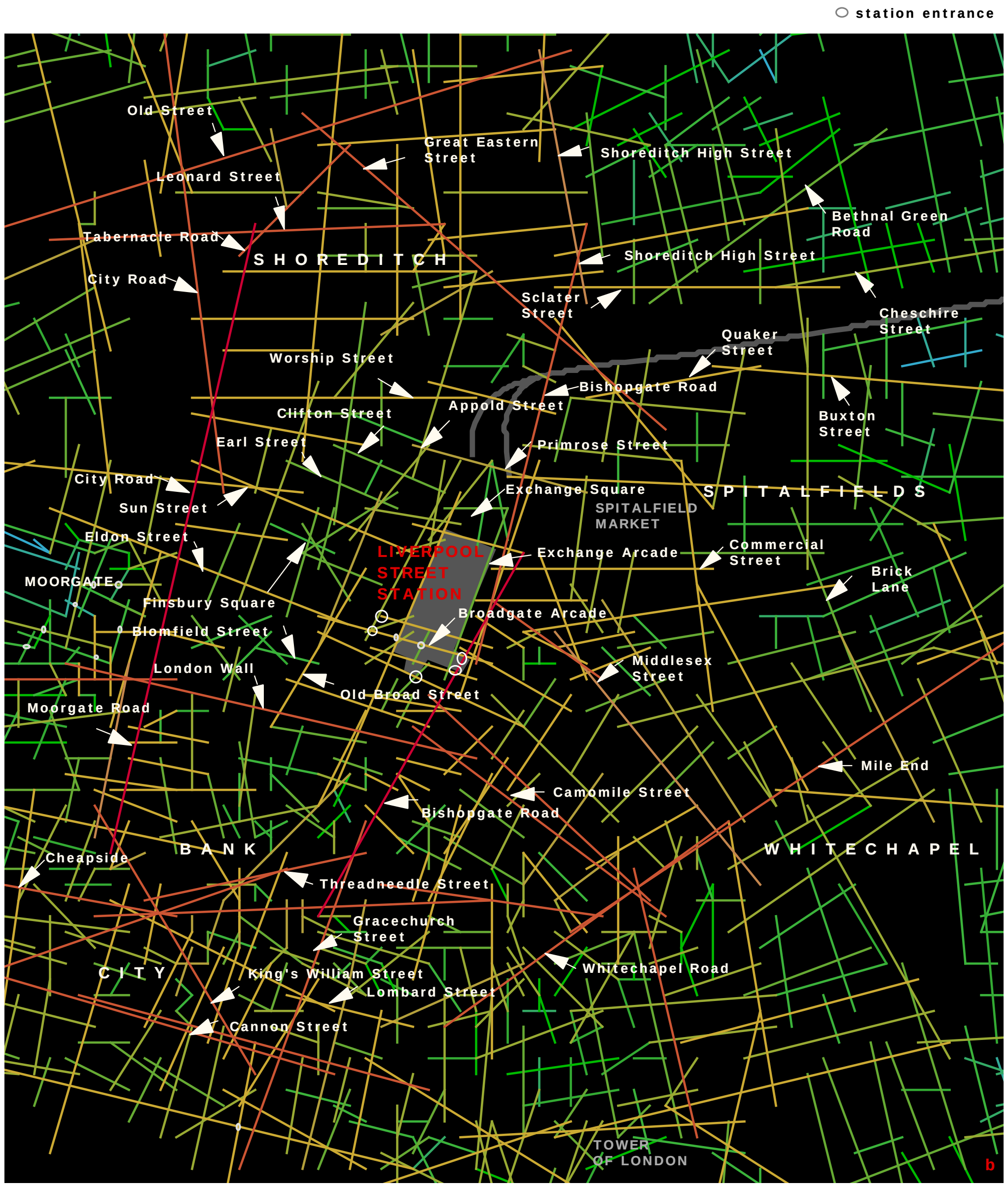
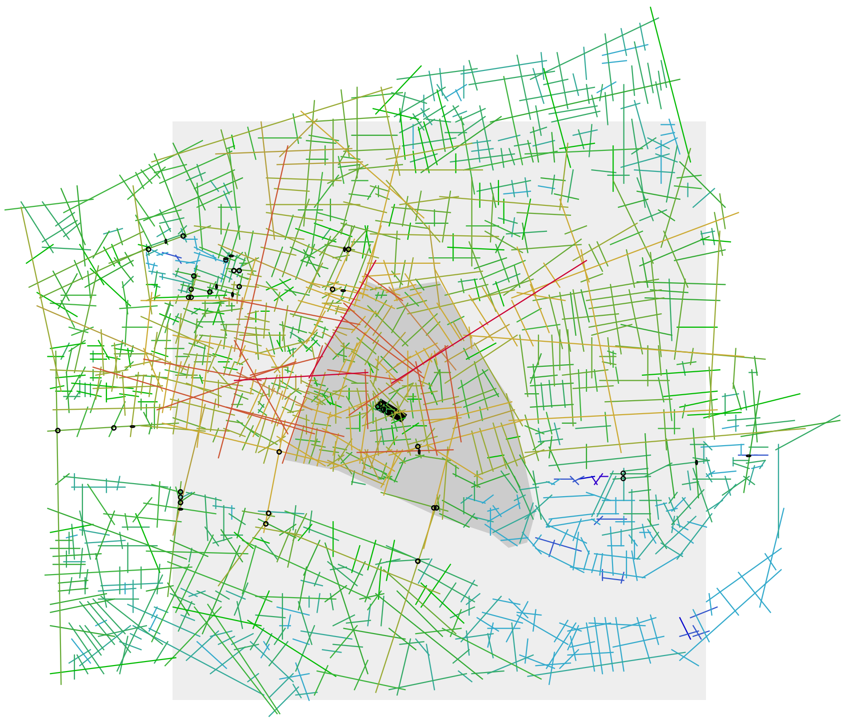
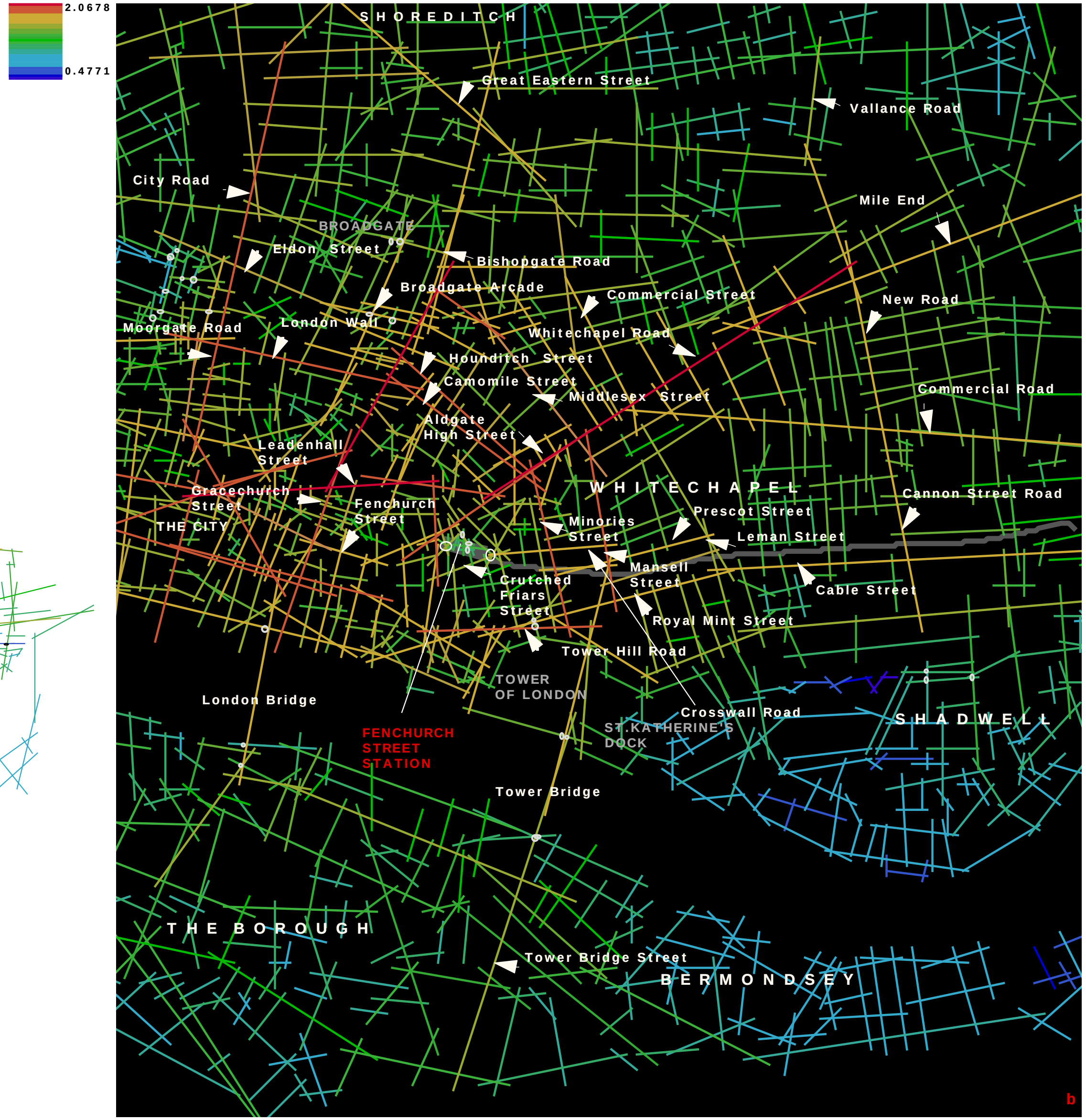


Figure 5.7: FENCHURCH STREET STATION AREA
Axial analysis: global integration - intN
(with the station's internal space included)



a

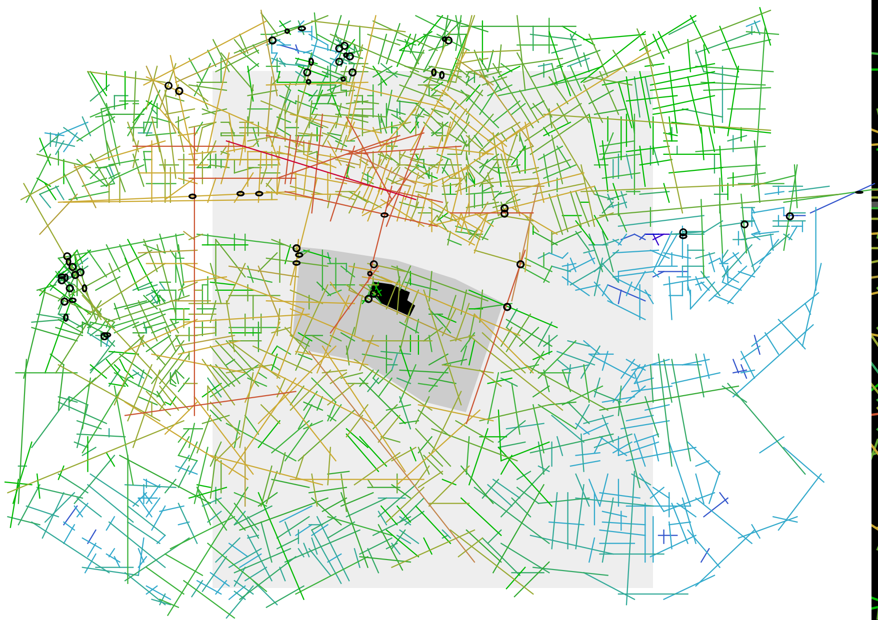


- THE TERMINUS AREA:
the area of approximately five hundred metres around the terminus building.
- THE AREA FOR AXIAL ANALYSIS:
the catchment area covers approximately 2.4 km.(1.5 mile) around the terminus area.

close-up area

Figure 5.8: LONDON BRIDGE STATION AREA
Axial analysis: global integration - intN
(with the station's internal space included)

1.8927
0.4699



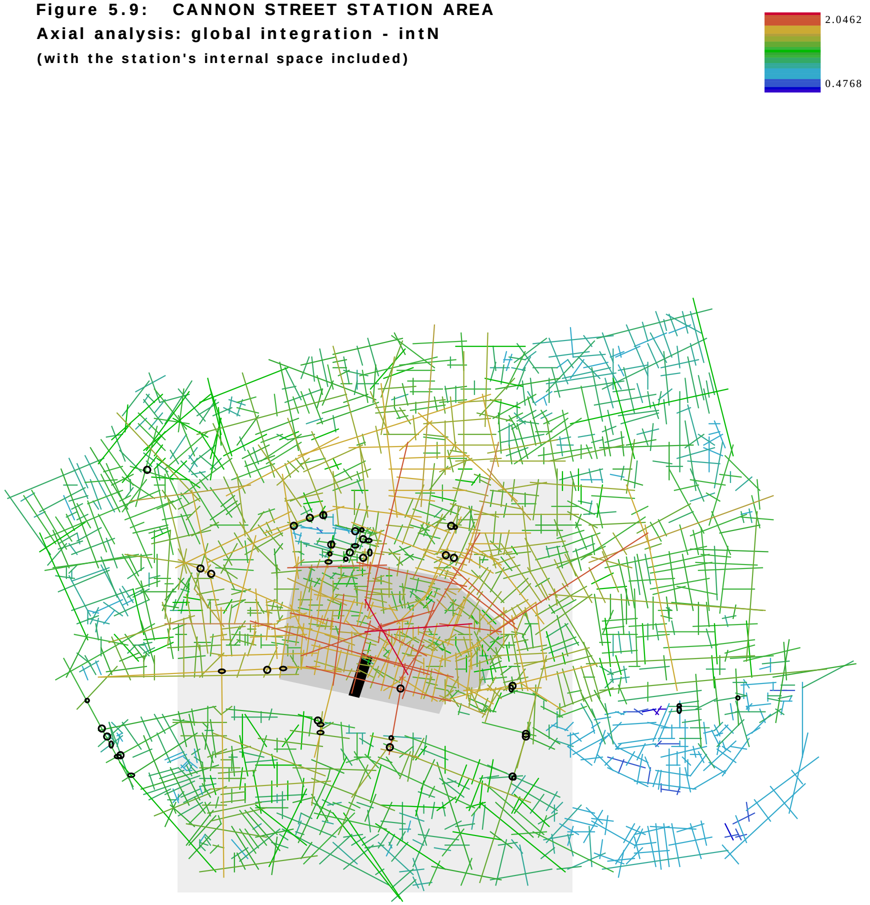
a

- **THE TERMINUS AREA:**
the area of approximately five hundred metres around the terminus building.
- **THE AREA FOR AXIAL ANALYSIS:**
the catchment area covers approximately 2.4 km.(1.5 mile) around the terminus area.

close-up area

station entrance

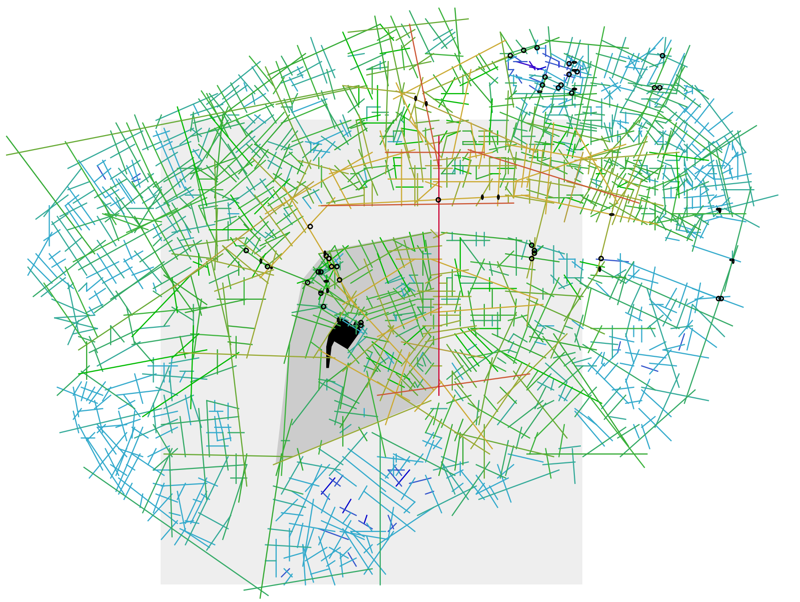
Figure 5.9: CANNON STREET STATION AREA
Axial analysis: global integration - intN
(with the station's internal space included)

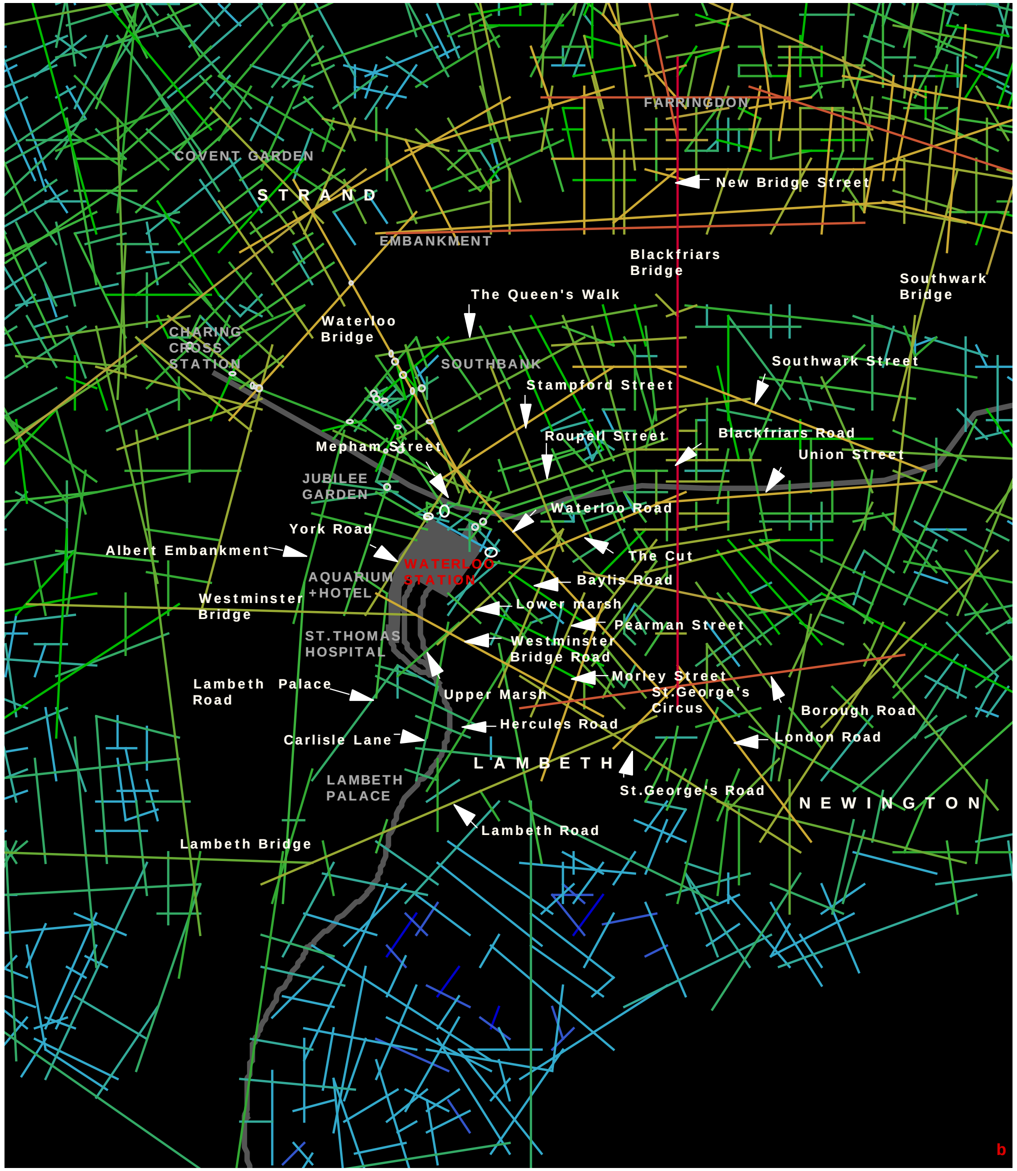


- THE TERMINUS AREA:
the area of approximately five hundred metres around the terminus building.
- THE AREA FOR AXIAL ANALYSIS:
the catchment area covers approximately 2.4 km.(1.5 mile) around the terminus area.

close-up area

Figure 5.10: WATERLOO STATION AREA
Axial analysis: global integration - intN
(with the station's internal space included)



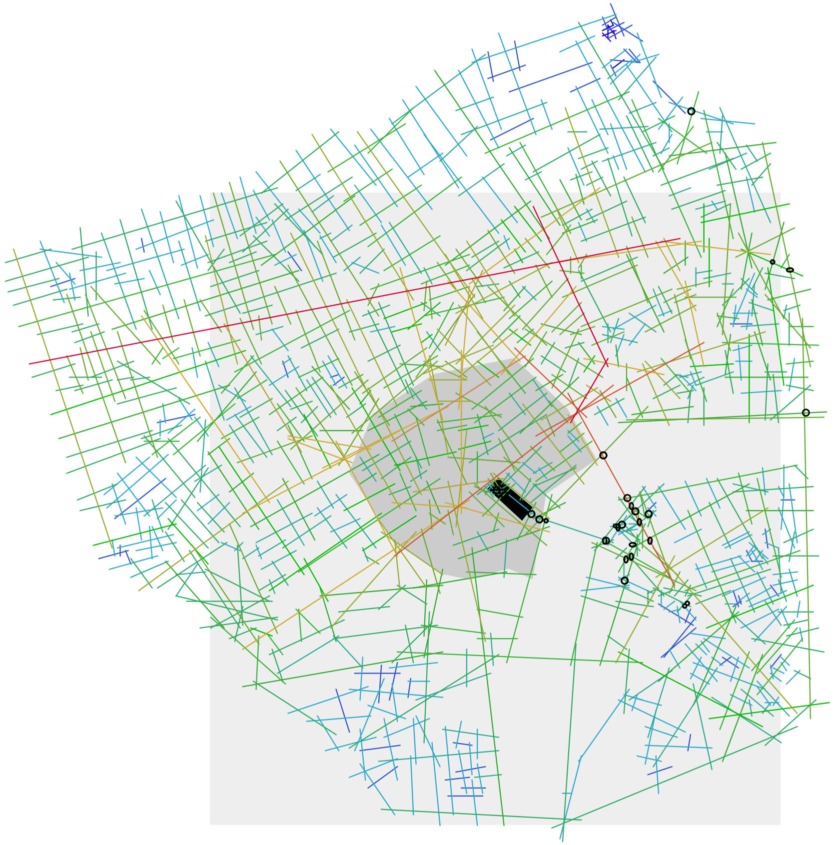


- THE TERMINUS AREA:
the area of approximately five hundred metres around the terminus building.
- THE AREA FOR AXIAL ANALYSIS:
the catchment area covers approximately 2.4 km.(1.5 mile) around the terminus area.

close-up area

Figure 5.11: CHARING CROSS STATION AREA
Axial analysis: global integration - intN
(with the station's internal space included)

2.5227
0.8808



a

- THE TERMINUS AREA:
the area of approximately five hundred metres around the terminus building.
- THE AREA FOR AXIAL ANALYSIS:
the catchment area covers approximately 2.4 km.(1.5 mile) around the terminus area.

close-up area

○ station entrance

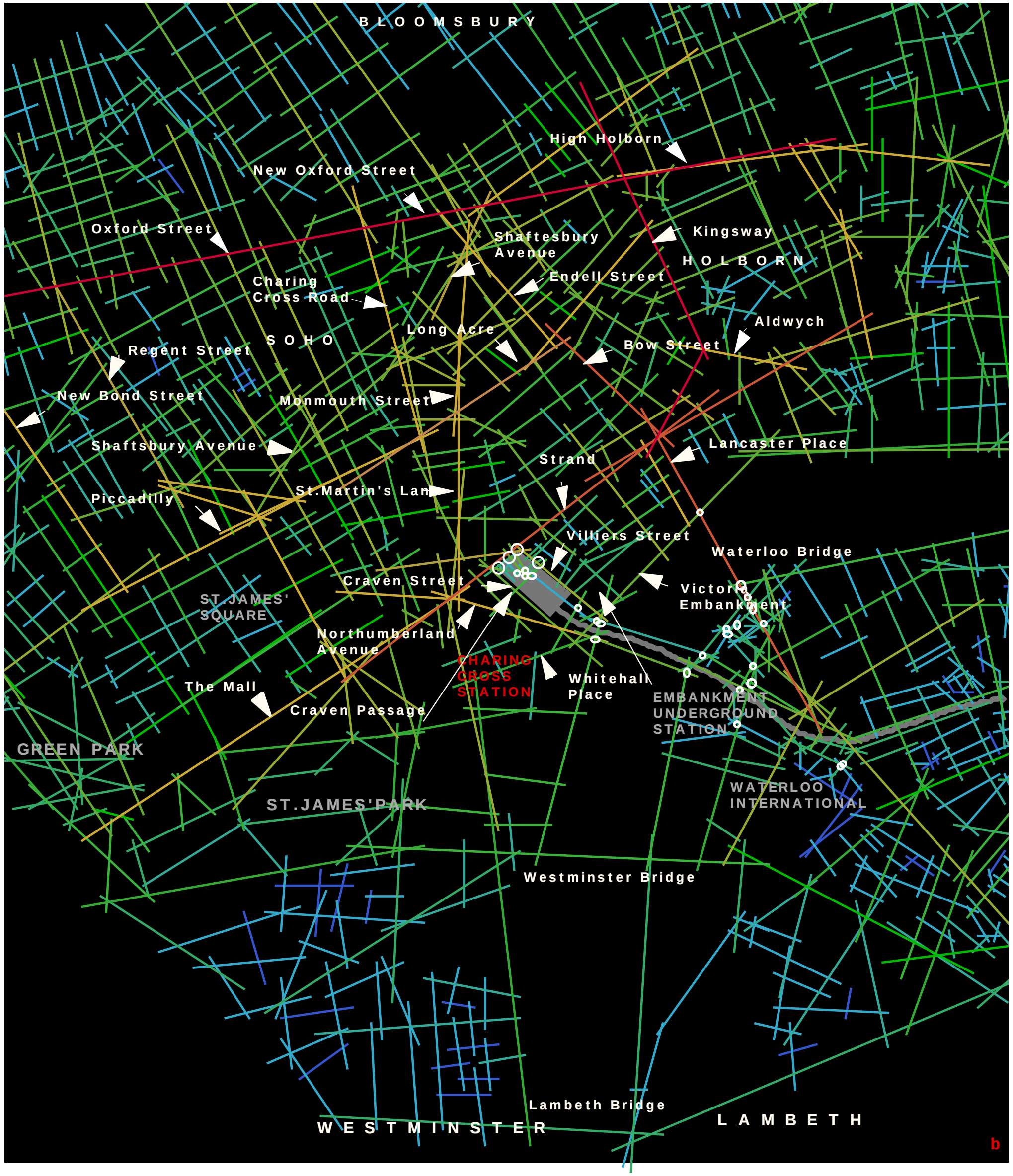
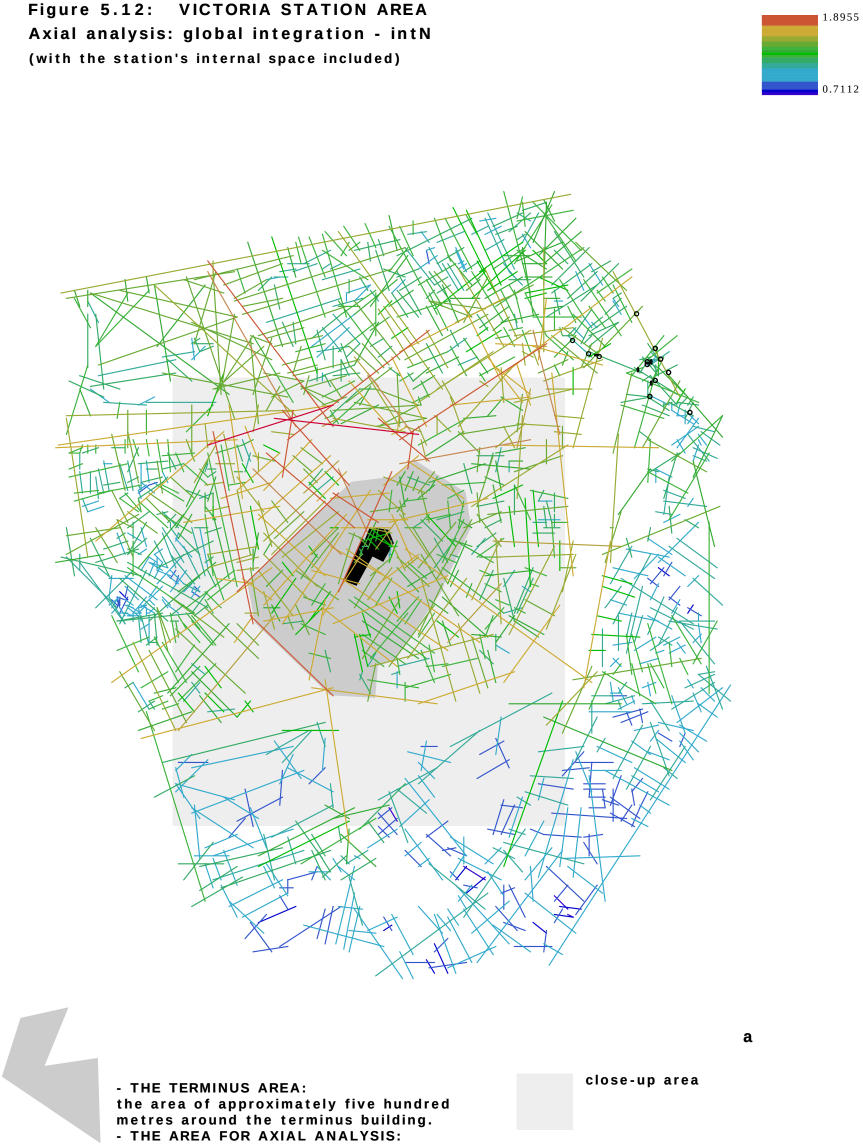


Figure 5.12: VICTORIA STATION AREA
Axial analysis: global integration - intN
(with the station's internal space included)



- THE TERMINUS AREA:
the area of approximately five hundred metres around the terminus building.
- THE AREA FOR AXIAL ANALYSIS:
the catchment area covers approximately 2.4 km.(1.5 mile) around the terminus area.

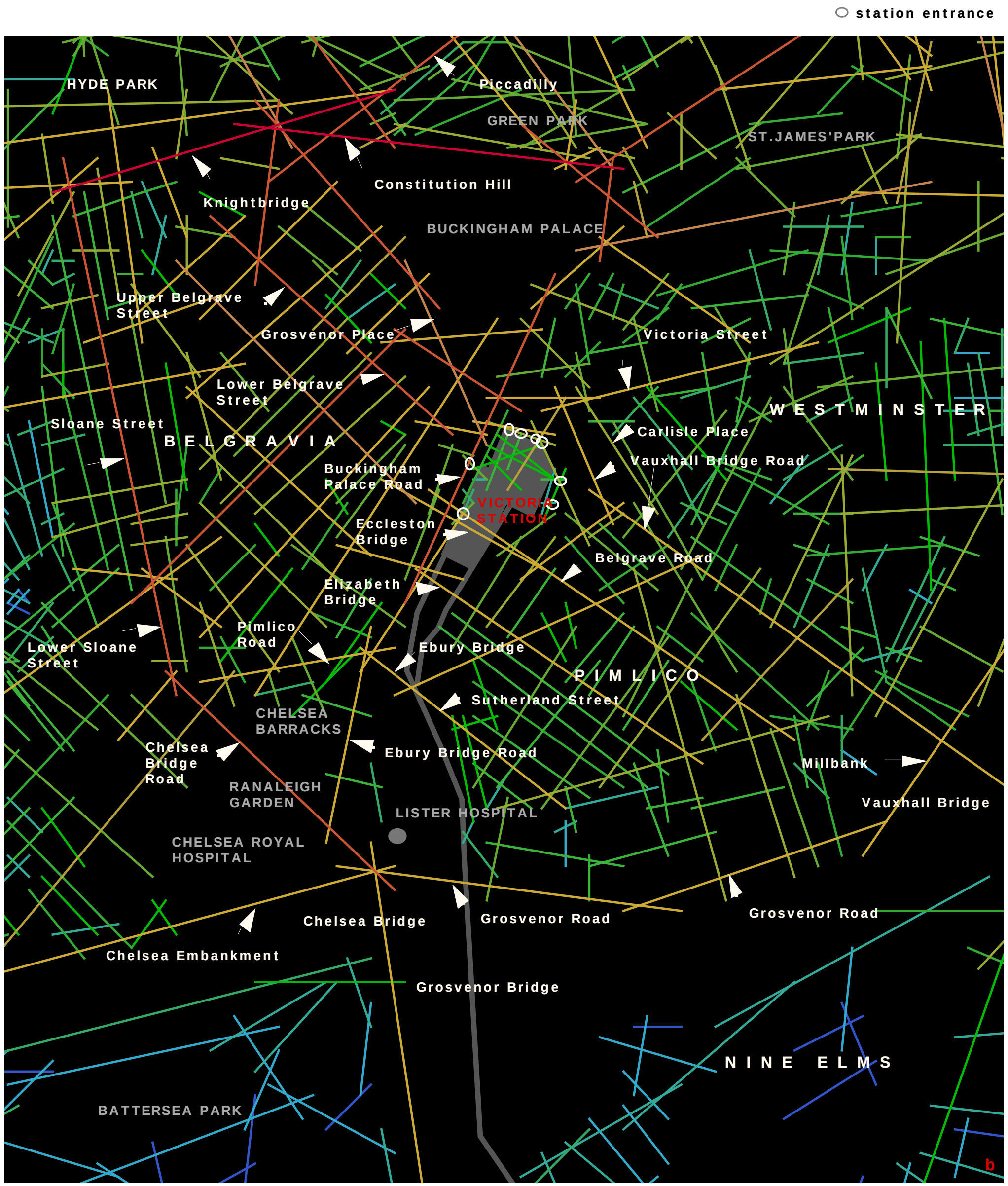
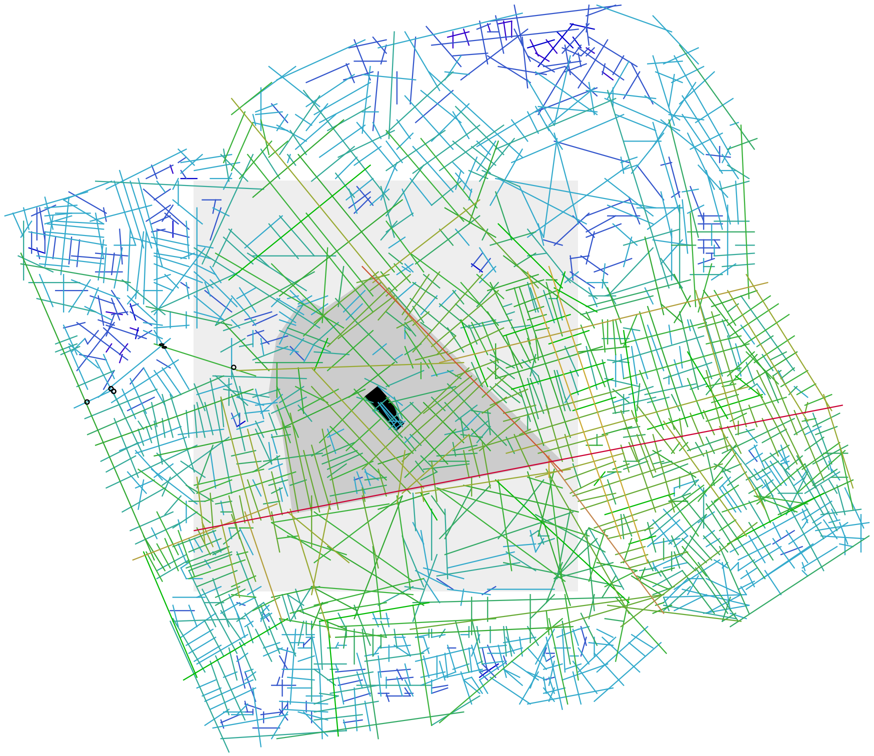


Figure 5.13: PADDINGTON STATION AREA
Axial analysis: global integration - intN
(with the station's internal space included)

3.0007
0.8329



a

- THE TERMINUS AREA:
the area of approximately five hundred metres around the terminus building.
- THE AREA FOR AXIAL ANALYSIS:
the catchment area covers approximately 2.4 km.(1.5 mile) around the terminus area.

close-up area

station entrance

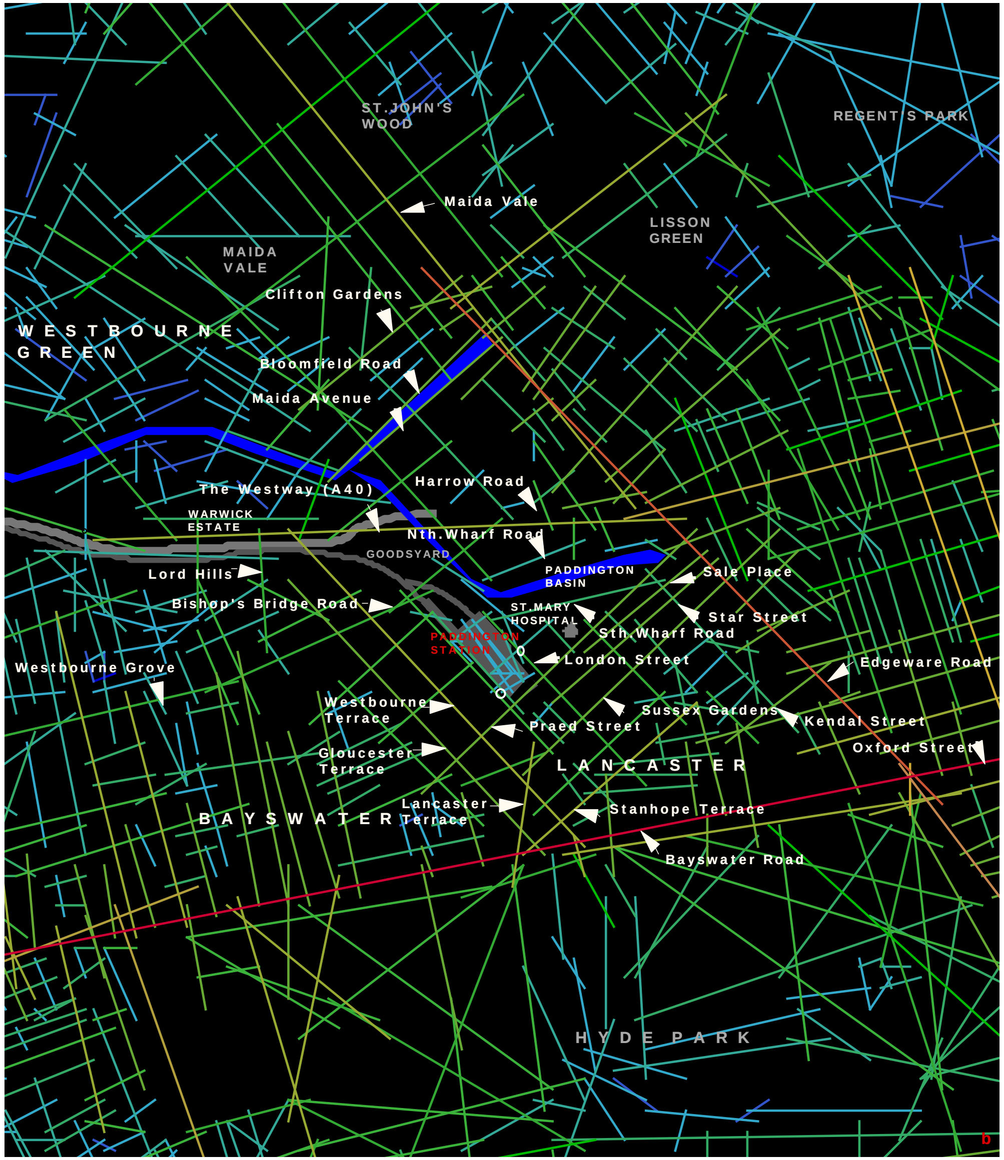
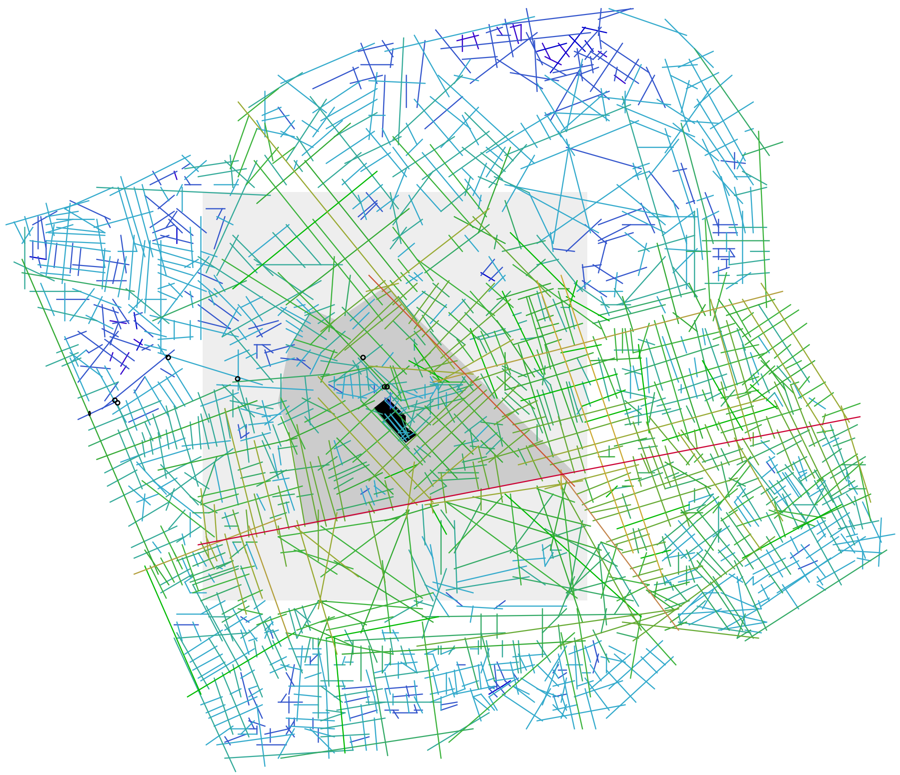


Figure 5.13c-d: PADDINGTON STATION AREA
Axial analysis: global integration - intN
(with the station's internal space included)

AFTER THE PADDINGTON BASIN REDEVELOPMENT

2.9839
0.8341

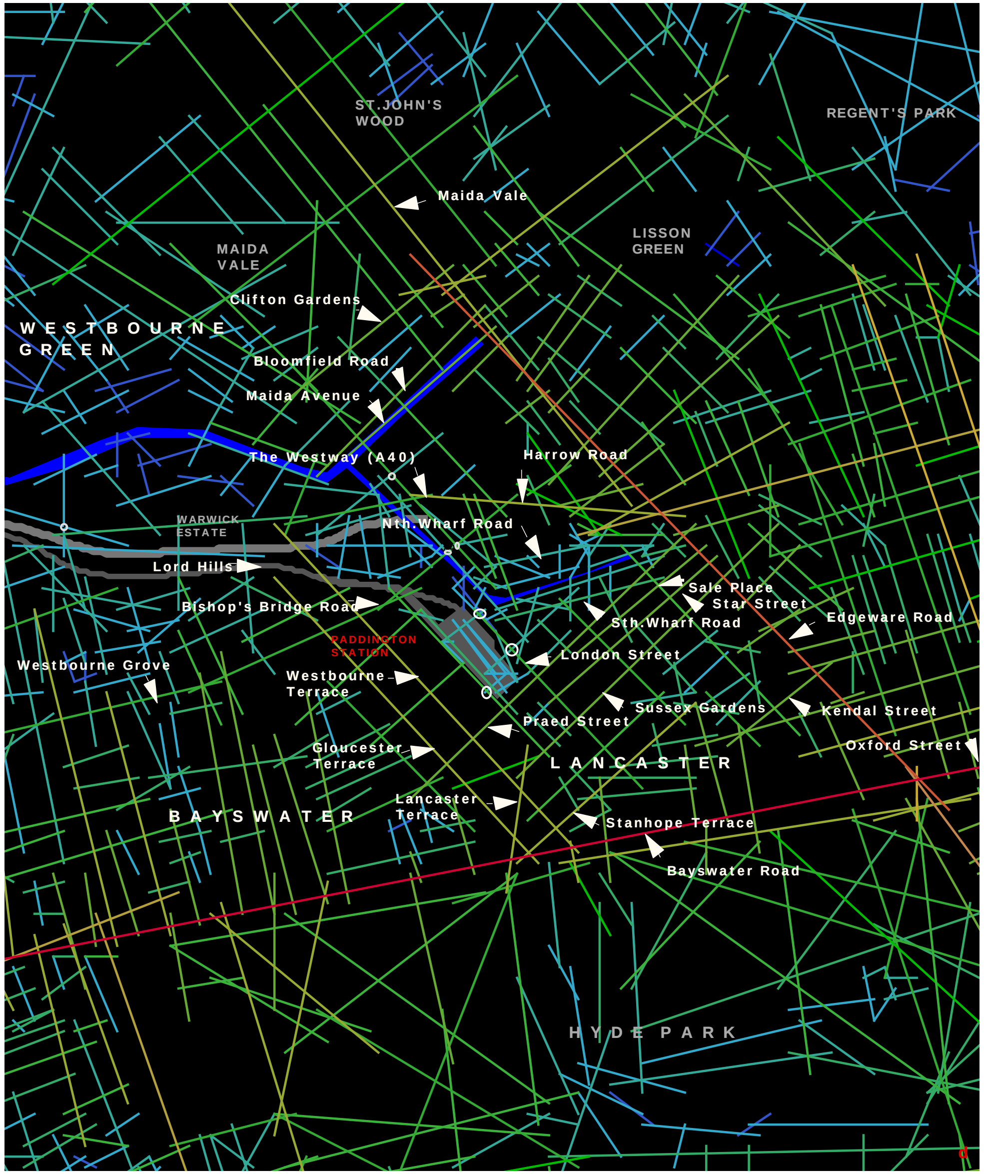


c

- THE TERMINUS AREA:
the area of approximately five hundred metres around the terminus building.
- THE AREA FOR AXIAL ANALYSIS:
the catchment area covers approximately 2.4 km.(1.5 mile) around the terminus area.

close-up area

○ station entrance



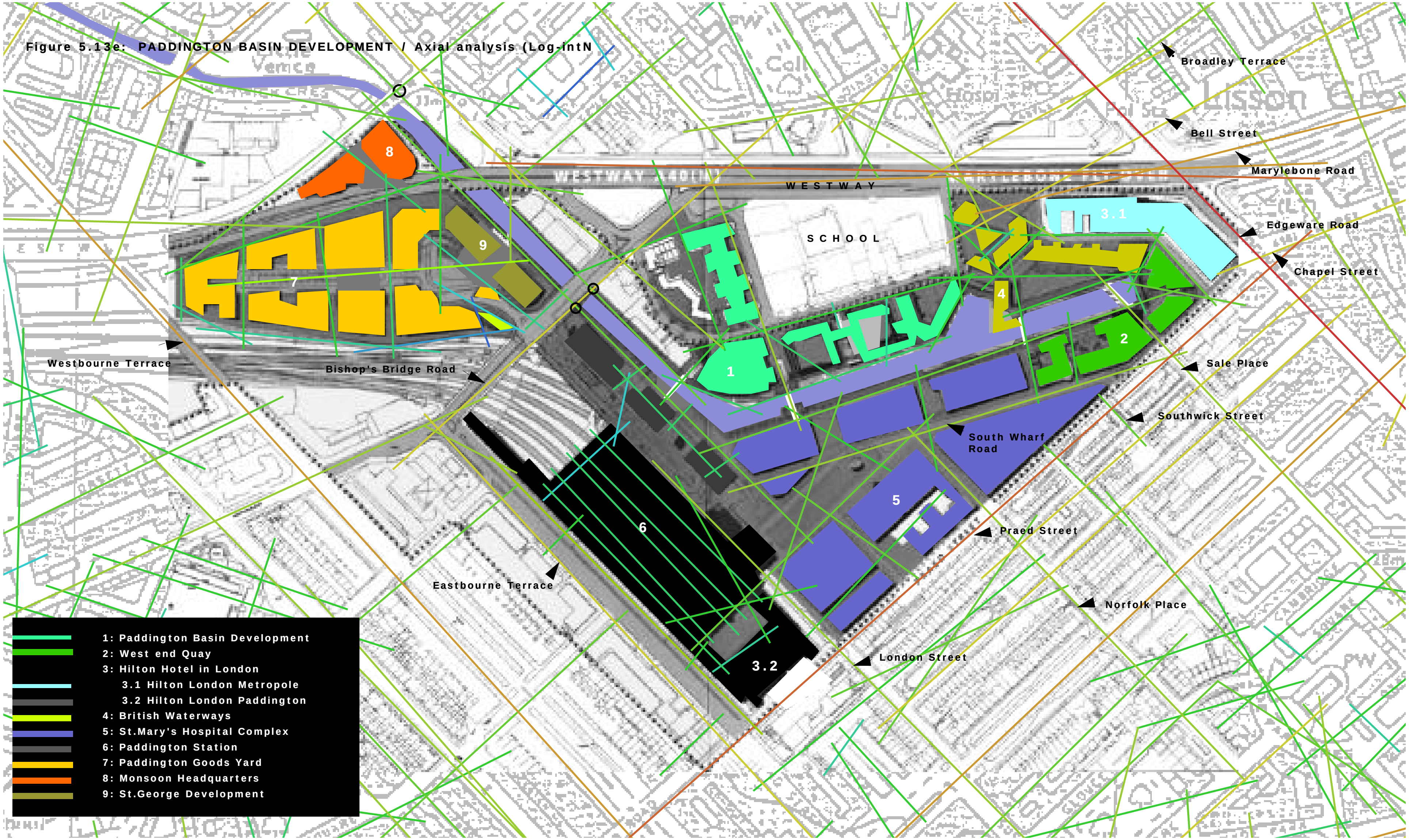
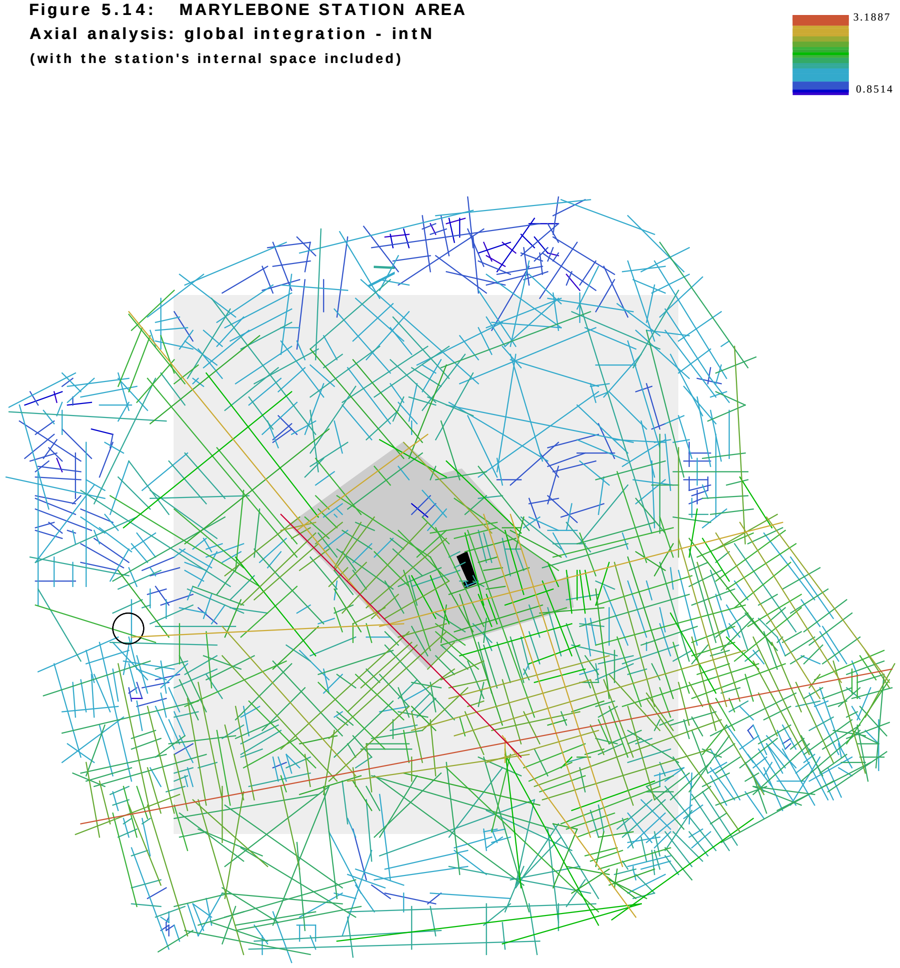
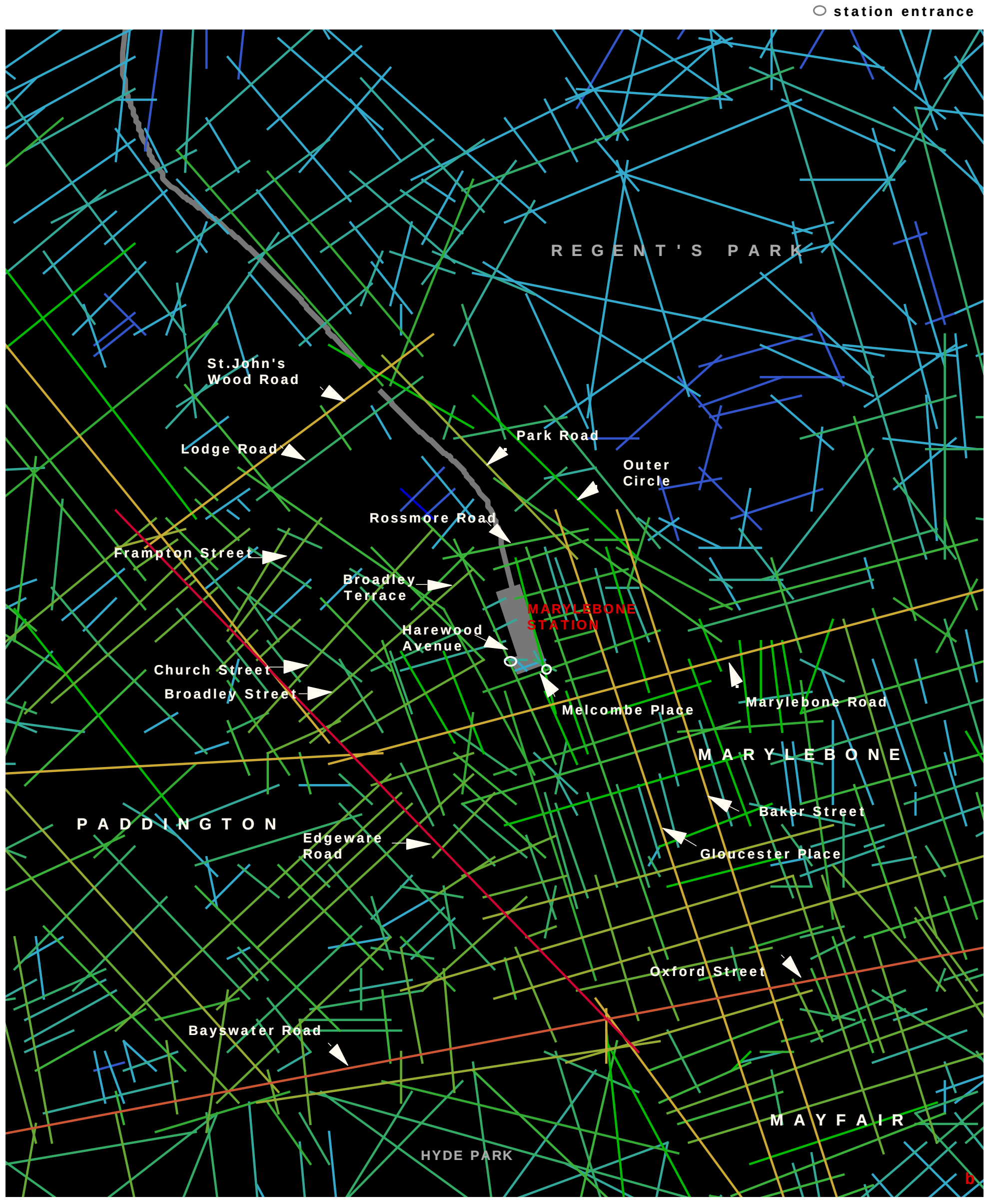


Figure 5.13e: PADDINGTON BASIN DEVELOPMENT / Axial analysis (Log-intN
Broadley Terrace
Bell Street
Marylebone Road
WESTWAY
SCHOOL
Edgeware Road
Chapel Street
Westbourne Terrace
Bishop's Bridge Road
Sale Place
Southwick Street
South Wharf Road
Praed Street
Eastbourne Terrace
Norfolk Place
London Street
1: Paddington Basin Development
2: West end Quay
3: Hilton Hotel in London
3.1 Hilton London Metropole
3.2 Hilton London Paddington
4: British Waterways
5: St.Mary's Hospital Complex
6: Paddington Station
7: Paddington Goods Yard
8: Monsoon Headquarters
9: St.George Development

Figure 5.14: MARYLEBONE STATION AREA
Axial analysis: global integration - intN
(with the station's internal space included)





- THE TERMINUS AREA:
the area of approximately five hundred metres around the terminus building.
- THE AREA FOR AXIAL ANALYSIS:
the catchment area covers approximately 2.4 km.(1.5 mile) around the terminus area.

close-up area