CHAPTER TWO:

IDEAS OF NODE AND PLACE IN THE CHANGING ROLES
OF RAILWAY TERMINI IN CITIES,
THE HISTORICAL AND LITERATURE REVIEW

This chapter aims to clarify and substantiate the problem definition of the railway terminus area redevelopment process by reviewing the node-place concept in the context of both the history of railway termini and the current state of knowledge in the study of the morphology and performance of railway station areas.   The chapter is structured into two main parts. The first is a historical review of how railway termini have changed their roles since they were sited at the edge of cities until the present, when they find themselves surrounded by densely built up areas and are the central element in urban regeneration programmes across Europe. The review focuses on why it is necessary to create places out of transport nodes like railway termini, and examines how the termini have paradoxically gained an increasing role as nodes over time but have often caused scars and urban blight witihn cities. In order to clarify the scope of most railway terminus area redevelopment projects that have happened recently, at the end of the historical review the evolution of railway termini, as well as their development potential, is summarised as a chronological node-place diagrammatic framework. The first part ends with a review of some recent railway station projects across Europe, in which the redevelopment, intended to unite the termini and their related structures with the urban surroundings and hence to turn the whole into a vibrant place, has achieved different outcomes. This thesis thus argues that the redevelopment process is far more complicated and requires more understanding of urban morphology and its implications for the performance of railway station areas than the overarching strategic planning and management frameworks as proposed by Bertolini and Spit (1998).

The second part discusses the works of authors involved with the morphological study of urban places, focusing on the importance of the relationship between the local urban areas and their wider surroundings as well as those who empirically examine pedestrian movement patterns associated with these urban spatial properties.   A technical introduction to Space syntax presents it as a major tool that purports to offer the description, quantification and interpretation of the spatial configuration of railway terminus areas, in addition to the related theoretical elements presented previously in section 1.3. Finally, its previous application in the study of transport related projects, mostly railway stations and their urban redevelopment, are reviewed.

2.1:   CHANGING ROLES OF RAILWAY TERMINI IN CITIES

In Europe railway stations have a long history, encompassing 170 years. This history can be divided into three phases coinciding with developments in the history of transport. The first phase began around the first half of the 19th century when the steam railways were born in Britain. While they were seen as the most advanced technological achievement in public transportation since the era of stagecoaches and horse-drawn omnibuses[1], terminus stations at this earliest stage were usually placed at a respectful distance from the edge of the city. Later, in the mid 19th century, many European cities had spread in reaction to the expansion of railway networks soon after the 'Railway Mania'[2], which happened in Britain during the 1840s.   The railway termini's surroundings had begun to be built-up, but the stations were still kept more or less at the city's edge.

The second phase started at the very beginning of the 20th century when the transport revolution was continued with the electrification of the railway system, which also brought about the innovation of the underground rail network and tramways.   The introduction of the petrol engine gave rise to the public bus system and private automobiles which almost displaced the railway as the major transport mode for urban dwellers after the mid 20th century. Most termini were left underused and some were later shut down or demolished during the World Wars. From the mid 20th century on, most newly built stations employed the Modernist architectural language, leaving out their ornamentation and bringing function and efficiency to the forefront.   Cities, having expanded rapidly to a greater degree than in the previous century, now far enveloped the railway termini.

The third phase marks the return of the railways beginning around the 1980s, when people started to realise that the railway and the automobile could offer a complementary and integrated service. Rail travel has been revived as an alternative for daily commuting use to help solve the increasing traffic problem in cities. Additionally, the economic boom and the deteriorating condition of railway termini and their attached neighbourhoods, now located in strategic sites at the centre of

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[1]   Horse-drawn omnibuses and stagecoaches are large vehicles with rooftop seats drawn by horses. They had been used popularly as a major form of transport in London during the early 19th century (*Pollins, 1964*). The word *'omnibuses'* derives from the Parisian practice to identify them as the buses for *'all'* people (*Clout, 1999*).

[2]   The Railway Mania of the 1840s is the era when several railway companies produced many competing schemes for railway access to the heart of London and created an entanglement of railway lines all around the edge of the city, (*Gerondeau, 1997*). By 1846, the Royal Commission recommended that no further railway lines should be built in central London except the extensions of the existing ones (*Clout, 1999*).

cities, has returned the focus of economic interest and urban revitalisation to the station locations. The role of railway termini can be seen to change according to each historical phase.

2.1.1 THE FIRST PHASE:

The arrival of railways and the grand termini as the gateway to cities.

The history of railways began when the first exclusive steam railway was opened for passengers in Britain in 1830 between Liverpool and Manchester, shortly after the earlier Stockton-Darlington goods line. After Britain, Perkin (1970) notes that Belgium was the second nation to have tracks laid (by 1844), followed by France in 1848. By contrast, the United States' first through railroad from the Atlantic coast to the Great Lakes was not completed until 1851, by which time Britain had over six thousand miles of railroad. During that time, the railways were the only major mass transit that could daily bring a large number of people from far away into and out of the cities. Railway termini, as the end of line stations, were sited at the edge of cities where people had to take horse-drawn carriages to continue their journeys within the urban areas.

The earliest railway termini were only single use buildings, as they did not incorporate any facilities other than roofed-over waiting platforms. The buildings were constructed quickly using simple wooden structures. Harry Holland writes in Travellers' Architecture (1971) that the stereotype of the 1830 railway termini was a simple station building placed across the lines at their ends, with extending wings along either side of the tracks. He also notes that the first station of all was the 1830 'Liverpool Road' station in Manchester, built modestly as 'a five-bay house of two storeys'. Less than a decade later, when railway-building had become increasingly prolific, termini were designed in a grand style symbolising triumphal gates of entry into the city; the first monuments of the railway era. The first truely 'grand' station architecture of all was created in 1838, a year after the London-Birmingham Railway, the world's first trunk system, reached London Euston Station where Phillip Hardwick completed his famous Doric arch (Figure 2.1a   ). This arch was built in a then empty field of North London in the style of a Greek temple to symbolise the city's gateway. However, the terminus arches were used only as representations to mark the boundary of the cities and stood alone from the iron train shed structures at their rear. Besides Euston Station, another example can be seen in the drawing of the Chemin de fer de la

Belgique, whose grand arch only stood as a symbol of the gateway to Paris but had no relation with the design of the actual two storey train sheds behind it (Figure 2.1b   ).

Railway termini began to have more enclosed internal spaces accommodating retail and catering facilities around a decade after. In 1849, London Euston Station again was the first terminus which incorporated the great hall; the first enclosed waiting room for rail passengers for the benefit protection from the weather. Sheppard (1996) notes that Euston was also the first station with refreshment rooms built in the space separated from the train sheds, a feature later imitated at several other stations. He also notes that the station designers at this time employed more varied architectural styles to cope with the increasing volume and more complicated internal spaces, as well as to enhance the romance and experience of their bustling activities. Railway termini, during the mid 19th century, had a wide range of architectural styles from throughout the history of architecture, exhibiting the variations of Classical and Italianate Style from late Regency and Victorian, to the Edwardian period[3]. Examples are Union Station in Washington D.C., in the square form of a Roman basilica (Figure 2.2a   ) and Paris' original Gare d'Orsay, structured and highly decorated in the Neo-classical style (Figure 2.2b   ). Some used an eclectic combination such as Antwerp's Central Station (Figure 2.2c   ).

However, whatever the architectural features, it appears that railway termini then began to provide more areas for non-transport related facilities inside their concourses. Pollins (1964) notes that the station concourse spaces during that time often combined all booking facilities and waiting rooms, including other public functions such as restaurants and meeting rooms in the principal buildings, placed between the end of the tracks and the street. Additionally, it was not only the concourse trading but also the railway hotels that created dynamism at the early termini. The great mainline termini often attracted quite regal and elaborate hotels, which generated a lively atmosphere throughout the day and night. The railway hotel, as recorded in the London Encyclopaedia by Weinreb and Hibbert (1998), had in fact evolved from places for transferring and lodging facilities for long-distance horse-drawn carriage travellers to places where both travellers and local people could come to restaurants and bars to enjoy themselves.

In London, the hotels were built by the Railway Companies and at first catered chiefly for long distant travellers, but later also provided services for shorter distance

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[3]   *Holland, 1971, Stewart, 1995, Parissien, 1997*

commuters. The vogue for placing hotels across the front of railway termini had been initially established at London's Paddington, Cannon Street and Charing Cross Stations. Holland (1971) notes that the vitality of terminus concourses and hotel public rooms was often conjoined. It thus appears that the role of railway termini during this first phase had changed from the mere representation of city gateways to the additional role as local centres where travellers as well as local people converged. John Dethier (In Parissien, 1997) noted in his exhibition catalogue; Les Temps des Gares of 1978 that the concourse of great termini in the early days represented 'a veritable microcosm of industrial society, a public place where all social classes rub shoulders'. The bustling atmosphere in the early day railway termini, where different types of people came for varied purposes is illustrated in a painting by William Powell Frith shown in Figure 2.3   .

However, despite their grand appearance and animated internal environment, railway termini were kept at the city edges and had no relationship with the surroundings except to their fronts. Parissien (1997) noted that people often built gates around them and the reason for such grand and ornamented architecture was in fact to 'sugar-coat' the railway industry, as people at that time regarded it negatively as a pollutant to the neighbourhood and alien to their common experience. No matter how convenient railway services were, Kellet (1969) argues, trains, spewing fire and smoke, goods-yards, tracks, and deafening noise were difficult to assimilate for people at that time. Benjamin Rees Davies' 1841 Map of London clearly shows how the termini were being kept at a discreet distance on the outer perimeter. The British government at that time was worried that the increased travelling activities would upset the inner city's traffic and environment (Barker and Jackson, 1990). Railway termini in the early days can therefore be characterised as isolated end-of-line stations with enclosed but vibrant internal environments located at the edge of cities.

2.1.2   THE SECOND PHASE:
The modern railway termini amidst the blighted urban settings.

An important factor that triggered the dramatic change of the railway termini's role in cities is the transport revolution in Britain, which occurred in the early 20th century, during which the steam railways were electrified and the first underground rail network was constructed. Holland (1971) notes that the untidiness and discomfort of the existing railway stations, built to serve steam-driven locomotives, caused trouble and inefficiency for the electrified railway system. There were countless station

closures and demolitions in Britain, France and elsewhere as these stations became neither functional nor efficient enough for the modern requirements. Most railway terminus structures were adjusted or expanded at this time to cope with the new technological requirements and to connect with the network of underground train, trams and buses, thereby becoming major transport interchanges in cities.

However, the dramatic change among railway termini in Europe came as a result of the extensive rebuilding to replace structures that were damaged or destroyed during both World Wars[4]. According to Pollins (1964), Holland (1971) and Parissien (1997), railway companies in Europe began to commission stations inspired by Modernist design and theory, corresponding with the general optimism and desire for innovation of the post war economy. This trend is first detected in the structures of railway stations in Italy, Germany and the Netherlands during the 1930s. Generally, the buildings tended to eliminate the compromises of the past, particularly in relation to the historicist architectural vocabulary and the dramatically antithetical qualities of the arched train shed. The newly built railway termini expressed utility rather than the ritual space of the city gateway as they were previously conceived. Most of them, however, still did not provide much commercial or catering facilities.

The most notable immediate post-war terminus is the rebuilding in 1937 of the 1870's Rome Terminus using a new glazing box design. Other station rehabilitation projects provided a new type of clean architectural form; glass-box like station buildings with the use of standardized and low maintenance materials and the abandoning of long span arch train sheds. Three outstanding examples are Florence's Santa Maria Novella (1933), Le Harve Ville in France (1933) and Amsterdam's Amstel Station (1939).

The Transport Revolution also brought about the invention of petrol vehicles that marked the beginning of combined road and air transportation and led to the decline of rail travel shortly after the mid 20th century. Some railway termini were consequently left underused and later demolished. According to the Beeching Report, 3,539 railway stations had been closed in Britain alone between 1963 and 1977 (Parissien, 1997). Some that functioned as transit interchanges were refurbished or rebuilt in keeping with the modern image of airport design. This was another factor that forced the newly built railway termini at the time to accept the sober Modernist architectural features. The prime example is London's Euston Station. Its first grand

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[4]   Some large railway termini such as *Gare de l'Est* and *Gare Montparnasse* in Paris, and *Paddington Station* in London, etc. were the prime targets for bombings during both World Wars as they had served as both the distribution centres for troops and war material and the gathering point for returning soldiers (*Parissien, 1997*).

station structure was pulled down in 1962, and rebuilt as a new modernist building, completed in 1968. Holland (1971) notes that the concept proposed for the rebuilding of Euston Station by British Railways was to create a more efficient terminus space drawing on modern idioms such as airport design in order to present train travel as an exciting and competitive means of transportation.

Due to the economic decline resulting from the World Wars during the first half of the century and continuing until around the 1970s, the existing retail and catering facilities inside the termini such as shops, restaurants, and bars that had attracted both travelers as well as local people in the past century had diminished to a residual level in order to keep operation and maintenance costs low. The termini had then become principally the changeover points between surface and underground transport networks. Their role as local centres had been undermined.

Apart from the absence of the vibrant mixed-use internal environment the termini had once enjoyed in the 19th century, their urban surroundings also lacked vitality. By the 1920s, major European cities such as London, Paris, Berlin, Budapest, Hamburg, and Glasgow had expanded beyond their gateway locations once marked by the termini due to the expansion of suburban railway lines, underground train networks and bus lines. The existing railway termini grew from gates at urban fringes to the status of gates in the very heart of the city. Furthermore, the stations newly constructed during this time were also constricted within the cityscape.   Parissien (1997) notes that although people no longer strongly opposed the railways as they had in the previous century, the railway areas continued to be walled off from the growing communities for safety reasons and were hardly noticed. However, the terminus infrastructure had rapidly grown from a single railway line to an unwieldy and highly complex network branching to various related facilities such as marshalling areas, goods yards, goods transfer areas, workshops and maintenance posts, passing places, shunting yards and points, depots, power stations and other operational facilities.   These railway complexes could only be crossed at irregular points, thus making the terminus settings major fault-lines in cities, with significant characteristics to both front and rear. Cities which expanded and grew beyond the railway lines became divided into fragmented parts and the difficulty of communication over the barrier of railway structures caused a great deal of inconvenience. The origins of the deterioration and decay in the terminus neighbourhoods can be found in this development. Examples such as London's King Cross Station area, the largest brown field site in Europe (Figure   2.4a), the blighted district of Seine-Rive-Gauche located next to Gare d'Austerlitz in Paris (Figure   2.4b), the disparate and divided neighbourhood of

Gundelingen near Basel's Central Station in Switzerland (Figure 2.4c), Stuttgart's Station Quarter (Figure 2.4d) and Frankfurt Am Main Station Quarter (Figure 2.4e) in Germany and many more, have all presented degenerated urban conditions in the heart of major European cities[5].

It thus appears that although most railway termini, from the beginning of the 20th century to around the 1970s, had become significant transport nodes where several transport modes interconnected, their bustling internal environment had been lost. Similarly at an urban scale, the terminus buildings and their related structures were girdled by blighted neighbourhoods and remained segregated from the urban fabric.

2.1.3 THE THIRD PHASE:

The return of the railways era and the extensive plan for the terminus area redevelopment.

The third phase of terminus development can be characterised as being from the early 1970s until the early 1980s. Due to the increasing road traffic congestion problems, the railways were 'rediscovered' as once again the fastest and cheapest land transport mode linking the hearts of cities to the regional and continental scale. Since that time, the railways have been included along with other transport modes in the traffic planning policies for major European cities (Bertolini and Spit, 1998). The role of railway stations, especially the inner city termini, as transport interchanges was also reinforced as their interconnections with other modes of transportation, such as underground and high speed trains, bus, private car, bicycle and sometimes also with water or air transport, has been encouraged. They have become local, regional and in some cases, continental nodes of the transport network.

The period of the railway station revival arguably began earlier, in fact begun during the second phase identified above, since the movement towards these changes can be traced back to the post war period. Stewart (1995) and Parissien (1997) note that the demolition of so many first rate buildings during the 1960s due to the dominance of road transportation led to adverse reaction to such a sweeping policy. During the 1970s there emerged a serious conservation movement in an effort to save and upgrade existing or abandoned stations built over the preceeding 150 years and by the 1980s, when the railway was included as a crucial element in transport planning, hundreds of

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[5]   *Agences des Gares, 1998, Bertolini and Spit, 1997, 1998, Powell, 2000.*

stations had been sensitively modernised or adapted to meet different needs without impairing their characters. Several existing termini in London such as Cannon Street, Charing Cross, Liverpool Street, Victoria and Waterloo Stations were all redeveloped by the 1980s to keep terminus features in line with the increasing rail. For the most recently constructed termini, advanced railway technology has been complemented by high technological design.   Examples of the late 20th century stations are the international terminus at London's Waterloo Station, Amsterdam's Sloterdijk Station in the Netherlands, Lyon Airport Station and Chessy-Marne-la-Vallee TGV Station   in France, Bilbao Abando Station in Spain, and Taichung TGV Station in Korea (Figure 2.5a-f). The spatial and dramatic qualities of the element previously forgotten or denied, the arched train shed, have been revived by employing the latest technology to make it a design feature. The old railway termini that have survived as well as those newly built now have a strong role in cities as the places where people opt to use rail travel as an alternative mode from road travel.

Station trading, which largely increased during the late 1970s, accelerated around the mid 1980s. The investment in commercial units responded to an increased awareness of the station's operating costs and was accompanied by a reorganisation of the profile of facilities. Increasing numbers of specialist shops have become crucial development elements in the refurbishment of the existing railway termini and the construction of new ones. Hill (1995) notes that the growing fashion for fast food, which is well suited to travel-based retailing, has replaced the old refreshment rooms and the increased retail shopping also attracts shoppers from beyond the station.   Previously unthinkable facilities such as restaurants, cinemas, business centres, exhibition spaces, conference rooms, performance stages, health clubs, banks, and child care centres are now located inside railway stations and especially principal termini. In Germany's Dusseldorf Station and London's Paddington Station, food markets open to anyone have been established. Some Japanese stations even offer facilities such as libraries and hot springs. It seems that the strategy of the station's operators to make profit on renting out the spaces inside railway termini has brought back their mixed use internal environment aiming to serve not only rail travellers but also local people.

On an urban scale, there has been serious attention given to including railway station areas in urban restructuring programmes in recognition of their deteriorating urban condition that has developed since the beginning of the 20th century. Furthermore, Bertolini and Spit (1998) point out that as the economic profile of countries such as Britain has increasingly shifted towards service and consumption orientated activities, the majority of railway infrastructures across Europe have become outdated and even

superfluous, in part because of the decline of industrial production which was closely interwoven with the railways. This has left the enormous railway lands, strategically placed at the centre of urban areas and well connected to transport facilities, immediately available for potential redevelopment. The revival of rail transportation also brought about the construction of a high speed train network (HST) between European metropolises. This not only lifted railway development to a higher level but also made the stations selected as stops on the HST superb targets for potential development. Examples are; London's King's Cross and St. Pancras Station areas in Britain, Euralille in France, Utrecht Centrum and Zuidas Stations in The Netherlands, Stockholm Central Station in Sweden, Basel Euro Ville and Zentrum Zurich Nord in Switzerland, Berlin Haufbanhof and Frankfurt Am Main in Germany.

As stated in Chapter One, Bertolini and Spit (1998) summarised the conceptual framework for railway station area redevelopment in terms of the two categories 'node of transport network' and 'place in the city'. According to their extensive review of recent projects in Europe, they argue that redevelopment mainly aims to improve the interconnection of various means of transport at urban railway termini and to revitalise the vacant railway lands and blighted neighbourhoods, overcoming the separation of the termini structures from the surrounding grid. There are hundreds of railway station related urban redevelopment projects currently ongoing within European cities, ranging from small developments to extensive projects including several million square metre components of mixed-use space. From the ninety projects listed in Appendix C   [6], it appears that only some of them have already been completely developed, some are being implemented and some will take decades to be concluded. One large scale example is Liverpool Street Station in London. Although the rail use has never appeared to be very much in decline in Britain, and the urban regeneration scheme was not the project's initial emphasis (Bertolini and Spit, 1998), the property market cycle in the 1980s has helped transform the existing mainline terminus and its surroundings in the heart of London into the vibrant and successful Broadgate Complex.

Some other bold initiatives include the following; the reclaimed lands over Frankfurt's Central Station   and its major freight station a few blocks away will be transformed to be a mixed use district called Frankfurt 21. The project consists of new linear parks, offices and housing (Figure 2.6a   ). The Stuttgart Station Quarter will be linked with the new HST system and redeveloped as a new city district consisting of a complex of

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[6]   **Appendix C** lists 90 surveyed railway station related projects.

offices and residential uses. A linear park will be created over the tracks and marshalling yard (Figure 2.6b   ). The Euralille project was originated as a new city district and a business centre located in the triangular site between the old terminus, later renamed Lille Flandres, and the new TGV line station; Lille Europe (Figure 2.6c). The blighted 19th century railway hinterlands of Gare d'Austerlitz in eastern Paris or Seine Rive-Gauche   have been turned into a cultural park; Parc de Bercy with residential units and the national library, La Bibliotheque Nationale de France. The project is intended to be the spearhead for urban regeneration of the surrounding areas (Figure 2.6d   ). There is also a plan to reconstruct and transform Bilbao's Abando Station in Spain to be a major transport interchange with a mixed use development carefully integrated with the urban surroundings (Figure   2.6e).   Finally, the Paddington Basin Development, now the largest urban regeneration site in London, where a mixed use district of commercial, office and residential areas including leisure and community spaces is currently under construction in the areas north and south of Paddington Basin. The site is next to Paddington Station which has recently been refurbished and connected with high speed rail link to Heathrow Airport (Figure 2.6f).

According to Bertolini and Spit (1998), most long term redevelopment plans not only aim to revitalise the wastelands located next to the station buildings but also tend to propose the new mixed use districts centred around the railway termini as the 'catalyst' for further urban development. The redevelopment scope mostly covers the station buildings and their urban settings including the railway wastelands, and/or the air rights above the stations and railway lines. The intention is to eliminate the urban incision caused by these elements by introducing new uses into the scars themselves and turning them into the linkages between both sides of the tracks. The railway station locations are thus proposed as potential local centres through these large scale and phased redevelopment plans.

For such large scale redevelopment of the whole terminus location typical strategies might include the use of vertically stratified structures such as stations on bridges, stations below elevated tracks or underground stations, and using air rights above the tracks for development. The Japanese are credited with having invented the idea of a multi-level station complex (Stewart, 1995). The schemes for Berlin Lehrter Bahnhof Station, China's Kowloon Station, London's Liverpool Street and Paddington Stations (Figure   2.7a-d) are prime examples of how the stations and rail tracks can be integrated within a multi-level complex of other transportation networks, commercial uses, hotels and residential facilities, achieved with the most advanced construction

technology to produce an animated environment. It appears that the concept of multi-level spatial connection has been widely used to create the efficient coexistence of transport infrastructures and pedestrian circulation. The concept is used to create not only a more animated environment within the station complex but also a continuously utilised urban space overcoming the natural tendency for the terminus structure to fragment the local area and disrupt pedestrian networks.

It is clear that the role of railway termini as transport nodes in this current phase of development is maintained and has even become stronger in some cases. Importantly, there has been an attempt by architects and planners to integrate railway termini within their urban settings, after over one and a half centuries of their segregation (corresponding with the first two phases). These long term plans aim principally to turn the terminus buildings and their neighbourhoods into consolidated vibrant urban places and potential local centres and spatial reorganisation appears to be the key to both the station refurbishment and the urban redevelopment processes.

2.2:   THE EVOLUTION OF RAILWAY TERMINI,
summarising as a node-place diagrammatic framework

According to the preceding historical review, railway termini have been shown to have inherited since their early days node and place characteristics. However, the synergy between the two has changed distinctively throughout their history according to how the termini have been related to other transport infrastructures as well as to the city structures in which they are embedded. To summarise how the node-place synergy in railway termini has changed, including the expected changes of recent redevelopments, Figure 2.8   illustrates an overview of the evolutionary process diagrammatically.

Figure 2.8a   depicts an archetype of the railway terminus from the 19th to the early 20th century characterised by an isolated location at the edges of the city.   It represents railway termini in their earliest years when they were kept at the city periphery, disguised from their surroundings as much as possible and not yet reinforced by other transport networks except local horse-drawn facilities to the city centre. However, their grand architecture and animated internal environment made them vibrant places and destinations in their own right as social or community centres.

Figure 2.8b   represents the railway termini from the 1920s to the 1970s when they can be seen to be isolated nodes of the transportation network located within declining

urban settings. In this second phase, when the cities grew beyond the terminus locations, railway termini had become major transit nodes as they were well interconnected with other modern modes of transport. However, their role as local meeting places was reduced due to the economic decline while their transport activities and operations were merely emphasised. On an urban scale, most termini were still segregated from their surroundings, which often became blighted, especially at the backside of the station buildings.

The third phase marks the coming back of the railway era. Figure 2.8c   depicts the railway termini that are currently to be redeveloped as node and place buildings well embedded within the urban setting. From the 1980s on, varied urban and economic factors have focused attention not only on railway termini but also on the adjacent railway lands as the object of urban regeneration programmes. Most railway termini that now locate within the urban centres have become major transport interchanges at varied scales; local, regional, and international. The terminus buildings have been refurbished to accommodate more retail and catering facilities in a multi-level environment and re-engineered to be more related to their redevelopment annex built upon the terminus structures, the railway wastelands and/or the blighted neighbourhoods as a new mixed use urban district.

Figure 2.8d   depicts the future potential of railway terminus areas as rejuvenated local centres. The newly redeveloped districts at railway termini would benefit from the efficient transport connection that encourages a large number of people to converge as well as to pass through the areas where multiple activities are provided, both inside and outside the terminus buildings. The redeveloped terminus areas would then in turn be seen as huge nodes of activity themselves that would potentially invigorate their surroundings, generating further development in the long run.

Considering both the problems and potential afforded by their configuration and strategic locations, the railway terminus areas that have acted as the 'urban barriers' can now be treated conversely as 'potential links' to the consolidated urban fabric of inner cities. This diagrammatic framework presents how the role of railway termini in cities has changed to a more integrated model with the increased merging of their structures and urban settings ending a prolong period of seclusion.

2.3:   AN OVERVIEW OF

SOME RECENT RAILWAY TERMINUS AREA REDEVELOPMENT PROJECTS

AND THEIR DISTINCTIVE NODE-PLACE SYNERGIES

Despite the distinct node-place conceptual approach that has been employed and the unequivocal scope of redevelopments, the outcomes vary dramatically and are not always successful. It appears that not every railway terminus area can be successfully turned into a place with the station building well embedded within the urban place setting, the desirable model clearly objectified by the node-place concept.   The following overview of some completed redevelopment projects, juxtaposed to the node and place diagrammatic framework, is an initial evaluation of how far they have achieved the status of 'nodes and places' in cities. Bertolini and Spit (1998) defined node and place as having two key geographical features; a node is 'a point of access for trains and, increasingly, to other transportation networks' and a place, 'a specific section of the city with a concentration of infrastructures but also with a diversified collection of buildings and open spaces' (Bertolini and Spit, 1998: 9) (Figure 2.9a-b   ). To classify approximately the degrees of node and place synergy in railway terminus areas, new diagrammatic characterisations, adapted from the Bertolini and Spit's, are presented as follows.

Some railway termini are 'isolated nodes' (Figure 2.10a   ). They function as significant transport nodes but fail to be places. Their internal spaces are single use, attracting no other station users except travellers and commuters.   The termini also have no relationship with their surroundings, which are left blighted and still mostly undeveloped.   Examples are Waterloo and Paddington Stations in London. Both termini are major transport interchanges; besides the local transit connection, the first has the international rail link to the mainland Europe and the latter the rail link to Heathrow airport.   Although both termini have been recently refurbished to accommodate a good amount of retail and catering facilities, it appears that they are heavily used only by commuters and travelers, especially during the peak hours of the day, and do not attract a good level of non-passenger users compared to other London termini[7]. Due to the level difference between the station concourses and their surrounding streets, both termini do not relate well to their urban settings, which are still largely blighted and undeveloped, especially to their rears as previously reviewed in section 1.1. These termini can thus be seen as isolated nodes lacking the vibrant internal environment as well as the relationship with the city.

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[7]   According to the Railtrack's Key Station User Statistics, recorded in March 1999, *Waterloo Station* has 13% of non-passenger station users while *Paddington Station* has only 9%. Examples of other termini are Liverpool Street Station: 40%, Charing Cross Station: 20%. Euston and Victoria Station: 18% and King's Cross Station: 16%. The statistics of all eight London's railway termini owned by the Railtrack can be found in **Appendix D**.

There are railway termini that have turned out to be 'isolated nodes and places' (Figure 2.10b   ). These stations are efficient transport nodes and places in their own right. Their internal spaces are vibrant, with mixed activities shared by mixed types of people. However, their surroundings do not share the same vitality as the interiors and are left blighted or largely undeveloped.   Examples are Euston Station in London and Grand Central Station in New York. Euston Station has a good mix of transport and non-transport facilities although an early pilot study revealed that all activities are rather chaotically overlapped (Paksukcharern, 1998). Although the terminus is rather hidden away from Euston Road at the front, it is well connected with its side streets, Eversholt and Melton Streets, while the neighbourhoods at its sides and back are still largely undeveloped.   New York's Grand Central Station, restored in 1990, has a terminus concourse that is praised for its thriving interior space serving daily half a million travelers, as well as city dwellers who only come for shopping or just meeting people (Dietz, 1999). It is located among Manhattan's mono-functional high-rise office blocks.

Some railway termini function as 'nodes within place settings' (Figure 2.10c   ). They are merely transport nodes with their interior spaces mainly used by travelers and commuters. The termini are rather enclosed and segregated from their surroundings, which are coincidentally vibrant mixed use neighbourhoods. Examples are Fenchurch Street and Cannon Street Stations in London, and Lille Flandres Station in the French city of Lille. The first two termini are mainly used by rail passengers during peak hours of the day while left almost vacant at most other times. They are located among the mixed office, retail and commercial areas in the City of London but due to the level difference, the station concourses are very little exposed to their surroundings. Lille Flandres   is a railway terminus mainly serving the regional train network.   The initiative of the Channel Tunnel and North-European HST network brought about the construction of Gare Lille Europe, located close to Lille Flandres   and the Centre Euralille, a mixed use district consisting of offices, housing, commercial, education, conference, hotel and other cultural facilities, situated on the triangular vacant site between these two stations. However, Lille Flandres does not share the same vitality of its development annex as the new complex was built adjacent to the terminus but not well connected to it[8]. These termini thus act as transport nodes amidst their vibrant urban surroundings, but they do not integrate with each that environment.

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[8]   See fieldwork note on Euralille Project in C.2.1 in Appendix C.

The most significant and successful type of all are the railway termini that are 'nodes and places located within the place settings' (Figure 2.10d). These termini are efficient transport nodes with bustling internal spaces that attract mixed types of people, both passengers and non-passengers, into the stations. They also relate well to their vibrant urban surroundings as integrated indoor and outdoor places in the city. Examples are London's Liverpool Street Station, Paris' Gare Montparnasse and Stockholm's Central West Station. The termini are well interconnected with several modes of transport and are places in their own right. They all provide indoor urban spaces where people meet, shop, drink, eat, and their vivid internal environments are also well-linked to the external mixed use development annex, which in all cases includes well-used public squares and/or parks.

Some railway termini have been totally transformed to serve other completely different building functions. This is the last type of all: railway termini that have turned into 'isolated places ' (Figure 2.10e   ). They are either well or very poorly related to their surroundings and they no longer function either as railway stations or as any other transport purpose. Examples are Gare d'Orsay Station in Paris, now turned into an art museum, Bath's Neo-classical Green Park Station in Britain, now a supermarket, St.Louis' Union Station in the United States, now a cultural centre, Strasbourg's Imperial Terminus, now a public market, and Nebraska's Brunswick and Lincoln Stations, both commercial banks. Although these great termini were not completely demolished, their role as transport nodes has been discarded. Some of them may still attract a large number of people and become destinations in their own right, but in other roles of building function, not railway stations. Besides the terminus buildings, some former railway structures have also been revived to suit modern needs without any relation to travelling purposes such as the unused railway viaducts in the 12th District of Paris near the Paris Opera House. They were transformed into the famous Viaduc-des-Arts, where a promenade of galleries and workshops for the artists working at the Opera House was constructed with a public park on its rooftop.

The review suggests that the factor that classifies a railway terminus as a successful node is the degree to which it efficiently connects with the transport network, while a successful vibrant urban place, the degree to which it connects well with the surrounding area. The degree of non-transport related facilities the termini provide is also important, though not the main factor. This is clearly highlighted in the difference between the first and the second groups identified above. The termini that accommodate a considerable amount of retail and catering facilities but are largely segregated from their surroundings such as Waterloo and Paddington Stations   in

London, still fail to be places as they are unable to attract a large number of users other than rail passengers. They are understood only as isolated transport nodes. On the other hand, London's Euston Station and New York's Grand Central Station, which also provide various trading and urban facilities but are more related to their surroundings, have a more vibrant internal environment well-used by both rail passengers as well as urban dwellers. Along with the third and the fourth groups, all termini in these groups (two to four) locate in vibrant place settings. However, the difference between them is that the ones that have their internal spaces well connected to their surroundings, such as London's Liverpool Street Station, Paris' Gare Montparnasse and Stockholm's Central West Station, have a more vibrant interior space well-used by different types of people. This is distinct from those that are segregated from their settings such, as London's Fenchurch Street and Cannon Street Stations, and Lille Flandres Station.

Assessing the review, it seems that attempting to create the railway terminus areas as both nodes in the transportation network and places in the city is more complicated than Bertolini and Spit's overarching conceptual framework would suggest. Considering only the concentration of infrastructures and the diversification of functions and activities provided by designers and planners both inside and outside the terminus buildings cannot guarantee the success of the projects.   The successful examples such as Liverpool Street Station in London, Gare Montparnasse in Paris or the less successful examples such as London Euston Station and New York's Grand Central Station, suggest that the spatial relationship between railway termini and their urban settings might play the key role in the process of converting nodes into places.

2.4:   MORPHOLOGICAL AND EMPIRICAL STUDIES

   Ideas on the spatial relationship between local areas and the urban fabric and its implication on pedestrian use pattern

This section examines the approaches of authors who have focused on the morphological analysis of local urban areas, and who have investigated or discussed the spatial properties of permeability connections with the city fabric with an aim to produce successful urban places. It also includes the works of those who discuss possible implications of those spatial properties for levels of pedestrian movement. The review in the previous section argued that railway terminus areas create diverse and particular problems and distinctively express node-place synergies. The literature review in this section therefore aims to investigate all approaches which contribute to a methodology that can represent and quantify these morphological characteristics, and analyse the spatial potential of different railway terminus areas located in different parts of the city.

The importance of a network of streets being alive with pedestrian activity in developing successful urban spaces was extensively discussed by Jacobs (1961), whose works focused on urban life and design. She argued that streets, as the heart of the city, were vital because of their diversity. She advocated a lively mix of land use and building types that support and rely on a dense, varied population of uses and activities. She also stressed that particular qualities of the physical environment are integral to diversity and lively streets; for example, doors directly opening onto the street, small walkable blocks, and the opportunity for pedestrians to turn corners frequently. However, she offered no precise empirical evidence for her claim that the physical environment or urban morphological properties play a major role in supporting urban diversity and lively streets.

However, Jacobs formulated a basic premise of what constitutes a successful urban space. More specific studies, focusing on the urban regeneration of railway wastelands, have pointed out that the urban conditions of these areas was totally contrary to Jacobs' description of vibrant urban spaces. Crotti (1989), who carried out a study on 'post-industrial spaces', including industrial plants, railway areas, freight yards, port and dock areas and general markets, concluded that they are products of the de-industrialisation of the inner city areas. He argues that this de-industrialisation has caused a shift in production and activity withdrawal away from these areas, turning them into 'abandoned places'. These urban areas generated by the process of de-industrialisation in the inner cities, have also been described by

different authors as 'vacant', 'pathological and amorphous' (Rossi, 1982), 'problematic', 'degraded', 'derelict', 'obsolete', 'residual' (Smets, 1989) or are simply called 'weak areas', 'underused areas', 'empty urban spaces', and 'urban voids'   (Crotti, 1989). Besides the characterisation of their physical condition as blighted and fragmented spaces in the urban fabric, the above descriptions also reflect the empirical condition of these areas as being deserted by both people and urban facilities, or in other words, pedestrian activity and a lively mix of land use and buildings, in Jacobs' vocabulary.

Although it is quite clear that reviving pedestrian activity and urban facilities in the railway areas is the major objective of the redevelopment process, none of these authors clarify possible spatial procedures for realising this aim. Only Crotti recognised a 'homologative' criterion for the intervention in these spaces. He simply suggests to '...integrate them into the surrounding urban fabric' and that this 'integration' depends on the 'appeal' of those areas and their locations in the city (Crotti, 1989:69). Busquets (1989) also regards the re-utilisation of derelict industrial structures, including railway lands, as the updating of 'obsolete or empty spaces' in the inner city that could be done only by '...carefully inserting them into the urban fabric'. He also suggests that the combination of urban services with recreation facilities, offices and open spaces should be introduced into these vacant areas in order to improve services that are particularly needed in the existing neighbourhoods.   Bertolini and Spit (1998), whose works mainly focused on policy and planning management for the redevelopment of railway station areas in Europe, implicitly suggested from an urban design point of view that for the newly developed station complex, '...better integration between buildings, public spaces and transport infrastructure is needed.   The attractiveness and security of the open spaces must increase. And a good, short and 'natural' link to the city - or other adjoining-centre is desirable'   (Bertolini and Spit, op cit: 42).

Although the idea of embedding these specific pieces of land into their urban fabric is suggested in the works of these authors, they do not clarify how it can be acheived as a spatial process nor do they present any concrete evidence on how the concept of integration can possibly revive the areas from their desolate condition. In fact, the morphological analysis of local areas and how their locations in the city relate to their popular use are widely discussed in the studies of public squares; arguably one of the most important urban elements in the structure of cities. Unwin (1909) is one of the first authors to notice that the location of public squares in the urban fabric, that he refers to in terms of lines of traffic, is important for their performance. He argued that an urban square that successfully functions as a place where people are likely to

congregate is one located at the focal point of main traffic lines, or very close to those points, in order to avoid being underused and becoming a deleterious space. Unwin also directly emphasized the importance of the railway station's forecourt or 'the station place', a place where similarly large number of people are expected.   He suggested that it should be flanked with busy streets or located near a focal traffic point but recessed from them for the safety of passengers approaching and leaving the stations and for the benefit of people orientating themselves in the general lie of the town before leaving the station area (Unwin, opcit:: 187).   Figure 2.11a-d   illustrate the layout of three railway stations in Europe that he highlighted as examples of the station place being set back from main streets.   At the time he wrote, the railways in Britain was still in the process of electrification and the noise and the necessary bustle of railway traffic were still considered 'unsuitable'   for urban areas.   He therefore insisted that the station places should not be designed as the central squares of the city but perhaps connected with them by broad and important thoroughfares or avenues (Unwin, opcit:: 189). Although he later foresaw that this prejudice against railways would soon died out due to the probable reduction of both noise and smoke pollution, he did not reconsider the possibility of turning the station places into central places in the city, nor did he propose his design principles for any other parts of railway stations besides their frontage.

Another author whose work involves the design of successful urban space in relation to its morphoplogy is Gibberd, a historian who referred to urban squares as 'civic spaces' (Gibberd, 1967:95). He stresses the importance of their locations being close to areas with high levels of movement as an important factor for their success. However, neither Unwin nor Gibberd explicitly discuss spatial properties of public space morphology in regard to their permeability connections with the urban fabric and how they affect the level of pedestrian movement . Neither do they provide empirical evidence to support their claims. The importance of pedestrian networks in the creation of successful public spaces is discussed by Lennard and Lennard (1987, 1995) who conducted a study on traditional and modern urban spaces and presented a compilation of social functions and social experiences[9] that could be achieved by a series of design guidelines and recommendations regarding the morphological elements of public spaces. These focused on location, size, territory, street furniture, and architectural backdrops, among other factors. One of their principles suggests that public spaces

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[9]   Lennard and Lennard (1987) identified the social functions and experiences as follow: Safe and easy access for all members of the community, frequent and regular use, feeling significant and sense of belonging, enjoyableness and awareness of the moment, encouragement of curiosity, interest and exploration, meaningful and memorable experienceS, different activities, feeling at home, direct interpersonal communication with eye contact, voice and face recognition (*Lennard and Lennard, op.cit.: 1*)

should be free from vehicular traffic and well supported with a network of pedestrian streets and squares that could work as 'nodes' in cities. They drew successful examples from the old historical core of many European cities and concluded that city centre areas should be entirely pedestrianised.

Carr et al. (1995) also carried out a series of empirical studies to examine the needs of both occasional and regular users of public spaces and stressed that ease and freedom of access, freedom of action, differentiated spatial territoriality, and the ability to adapt spatially to new trends in society and ownership by the public are important factors that explain the presence of people in successful public spaces in cities. They argued that the functionality of public spaces alone does not explain their well-used environment. The important factors involved into creating successful public spaces are comfort related (food provision, shelter from the weather and adequate seating), relaxation related (vehicular traffic free zone), those related to passive engagement (the provision of entertaining activities such as urban events, both scheduled and unscheduled, vegetation and artistic elements), those relating to active engagement (the provision of features that encourage people's direct contact), and related to discovery (spatial variations that create changing vistas).

Although Lennard and Lennard and Carr et al. have begun to investigate the relationship between spatial properties of public spaces in cities and observed patterns of use, they have not examined the urban context in which these local areas are embedded. Early empirical studies aimed at providing solid evidence to predict space use patterns focusing on the urban structures themselves were carried out by Burden (1977) and Miles et al. (1978). Burden suggested that location and the relationship to the street are crucial factors that determine good levels of use for public spaces. Miles et al. also stressed the fact that visual and physical connections with the surroundings affect the use of public spaces. However, Whyte (1980, 1988) is the first influential author who focused on the idea of visual and permeable connections to the urban environment as the main factor influencing successful public spaces.

Whyte concluded from a series of studies focused on small urban spaces, mostly designed in the last 50 years, that the factors of aesthetics, decorative elements, shape, amount of space and enclosure proved not to be relevant to their performance as well-used public places. He argued that the real critical factor in a public space like a plaza is not related to the plaza itself but how the plaza constructs the relationship to the local streets (Whyte, 1980: 54). Two fundamental elements that Whyte claimed for

successful urban spaces are the density of moving people in the surrounding streets and the degree of easy access from the public squares to the surrounding streets. However, Whyte provided no quantifiable model that could examine the degree of embedding of the urban square in the urban fabric. His work mainly focused on the important relationship of spatial morphology to the performance of open public spaces without being able to quantify this relation accurately.

Hillier and his colleagues resolve this issue by proposing a precise account of how the spatial morphology of the urban grid plays a major role in the performance of urban spaces. His theory of natural movement (Hillier et al., 1993), previously introduced in section 1.3, is grounded in the space syntax theoretical framework (Hillier and Hanson, 1984). Its principles and applications will be discussed in the following section.

2.5:   SPACE SYNTAX METHODOLOGY

Space syntax theory and techniques allow for the representation, quantification, description and interpretation of the spatial configuration of all kinds of built environments, including buildings and urban settlements. The theory, proposed by Hillier and his colleagues at the Unit for Architectural Studies, University College London, allows the study of space as an independent entity that allows the correlated of spatial and social variables. The most significant contribution of space syntax is its establishment of empirical measures of how particular spaces do or do not constitute larger movement and interaction patterns, both locally and city-wide. The idea is based on the concept of configurational analysis, which represents the urban grid, or any other system of connected spaces, as a series of spaces and analyses the relation between each space and all others, ultimately addressing the whole of a complex rather than its parts.

The fundamental concept of configuration is illustrated in Figure 2.11 . The example of two adjacent cells (x and y) that have a permeability link between them (Figure 2.11a) shows that both cells have a symmetrical spatial relationship between them with reference to each other's access position. Figure 2.11b shows that when a third space (z) is added it creates at least two possible consequences. In the first case on the left, the cell 'y' can be accessed from both 'x' and 'z' cells; whereas in the second case on the right, 'y' can only be accessed from 'z' through 'x'. This relation is illustrated by the two graphs in Figure 2.11c which shows that the relation between 'x' and 'y' is

dependent on each other with respect to 'z', being symmetric in the first case and asymmetric in the second case.

The first graph shows a 'ring' relationship; whereby there is the possibility of more than one route between spaces. This introduces another important property of configuration analysis: the concept of 'distributedness' and 'non-distributedness' in addition to that of 'symmetry' and 'asymmetry'. If there is more than one non-intersecting route from 'x' to 'y', a relation is said to be 'distributed'. Thus, considering Figure 2.11b again, the first system has a 'symmetric' and 'distributed' relationship while the second one is 'asymmetric' and 'non-distributed'.

2.5.1 Spatial Representation

The characterisation of the spatial properties of the urban layout begins, in configuration analysis, with drawing on three representational techniques; 'axial lines' to represent the one-dimensional organisation of the layout; 'convex spaces', the two-dimensional organisation; and 'convex isovists'. Each addresses an aspect of how space is experienced and used by people. Axial lines are defined as the longest and fewest straight lines of visibility and permeability that cover all the open spaces of the urban area. Convex spaces are defined by polygons where no line drawn between any two points in the space goes outside it (Hillier an Hanson, 1984: 98). A convex isovist is a spatial description defined as the set of isovists visible from within a selected convex space. The three spatial elements are illustrated in Figure 2.12a-c .

Hillier et al. (1987b) defined axial lines as being associated with movement properties that give information concerning movement to destinations while convex spaces relate to the position where people are in the system. Hillier clearly illustrated these properties as follow:

> ' At the most elementary level, people move in line... Then if an individual stops to talk to a group of people, the group will collectively define a space in which all the people the first person can see, can see each other, and this is a mathematical definition of convexity in space... The more complex shape of the third figure defines all points in space, and therefore the potential people, that can be seen by any of the people in the convex space who can also see each other. We call this type of irregular, but well-defined, shape a 'convex isovist.''

(Hillier, 1996a: 153)

Convex and axial maps are used to describe and analyse the spatial configuration of the urban layout. Firstly, the system of open spaces is represented by the set of fattest and fewest convex spaces. Then, axial lines, constructed by the fewest and the longest lines, are drawn to cover all convex spaces of the system, such that every point in the system has both one and two-dimensional forms, as presented in Figure   2.13 , an example of the convex and axial representation of the small town of Gassin in the Var region of France.

The axial representation can be analysed as a system of syntactic relations in terms of the   two   basic   properties: symmetry-asymmetry   and   distributedness-non-distributedness. To quantify the representation of the urban grid, the axial break up is converted to an axial graph where the route intersections are defined as the nodes and the route segments are the edge. The analysis of the axial graph uses the concepts of topological relations of which depth and shallowness are the most important, not metric distances. In space syntax, the concept of depth is one of the most important relational ideas.   Hillier et al (1987b) argue that 'Depth exists wherever it is necessary to go through intervening spaces to get from one to another. Shallowness exists where relations are direct' (Hillier et.al.,1987b: 224). Depth, therefore, measures how many necessary steps from a given point are needed to go through to another given point, or in other words, how many steps each line is away from another line. The analysed axial map shows the combination of this information, giving a measure of the 'integration' of each element into the system.

There are three models of representation: axial map, convex space map and convex isovists and all are used in different forms. However, new ideas from research have been produced such as the 'all line map'   (Hillier, 1996a) and 'isovist integration analysis' (Turner and Penn, 1999). In this thesis, the first three original models, including the all line map, are used and will be discussed in detail in Chapter Three and Five.

2.5.2 Syntactic Measures

Integration is the key syntactic measure of spatial configuration. The integration value of each axial line measures its mean depth from the other lines in the system. The calculation of the mean depth of each line, which is done by comparing how deep a system is from that point with how deep or shallow it theoretically could be, gives a measure called the 'relative asymmetry' or RA. Its reciprocal value is simply called

'integration'. The highest number is the most integrated space in the system, the lowest, the least integrated.

The measure of integration[10] can be used in different ways. Radius-n (Rn) or 'global integration' measures the relative depth of each axial line to all other lines of the system. The most integrated line is the shallowest in the system, the least integrated, the deepest. This gives an important assessment of the degree of integration of a line (how few steps there are to everywhere else) and numerically measures the degree of accessibility (the degree to which a line is present on the simplest and the fewest changes of direction across the whole system) of each axial line from all the others in the system. Radius-3 (R3) or 'local integration' measures the accessibility up to three steps away (the first selected line is the first step calculated by computer software). 'Connectivity' measures the degree of intersection or one step possibilities of each line. Rn is then used to express global properties, while R3 and connectivity, the local ones.

There is also the concept of 'intelligibility,' which is a descriptive measure of whole systems. Hillier defines it 'as the degree to which what can be seen and experienced locally in the system allows the large scale system to be learnt without conscious effort' (Hillier, 1996a: 215). The intelligibility value is calculated by the degree of linear correlation between connectivity and the global integration value (Hillier and Hanson, 1984) which is presented graphically in the 'intelligibility scattergram' (Hillier, 1993). Intelligibility is a very important measure as it represents, in practical terms, a quantitative description of how the whole system can be read from its local parts. For the system that is highly intelligible, the information that people get as they move around locally provides the knowledge of how the overall spatial system is constructed.

2.5.3 Measuring lively and quiet places

Integration is currently the most crucial measure to predict levels of pedestrian movement. There have been studies carried out by the Bartlett School of Graduate Studies since the 1980s that provide evidence that space syntax methodology is an important tool not only for describing but also for quantifying the relationship between spatial configurations and the density of pedestrian movement in urban areas

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[10]   The measure of integration is processed by computer software called *'Axman',* which has been innovated and developed at the Bartlett School of Graduate Studies, University College London, written by Nick Dalton.

(to be reviewed in the next section). Comprehensive studies that involved data collection in a series of urban, suburban and housing estate areas in Greater London have been compiled with significant evidence of a good correlation between integration values of axial lines and levels of pedestrian movement (Hillier, 1986, Hillier et al., 1987a). Hillier and colleagues suggested that there are consistent syntactic measures, mainly integration and intelligibility, that express the strong determination of the density of pedestrian movement in urban areas despite the difference in morphological properties of varied urban systems. They also suggested two more points. Firstly, local facilities should not be considered as the primary factor affecting pedestrian movement patterns because they tend to be placed in suitable and favourable parts of the urban configuration. Secondly, the loss of intelligibility is strongly associated with a reduction in the predictability of patterns of movement.

The natural movement theory previously introduced in section 1.3 is based on this space syntax theoretical framework. It refers to the relationship between the spatial layout and patterns of use, understood as pedestrian occupancy and movement in space, and describes how the pedestrian movement is affected by the spatial configuration. Natural movement pattern in an urban system is primarily generated by the urban grid as pedestrians tend to follow the shortest and most direct routes. Hillier et al. (1993) argued that there will be a strong correlation between the integration values of the axial lines of the urban grid and levels of pedestrian movement, if both forms and density are more or less homogeneous and distributed throughout the system and people are allowed to move freely to and from all parts of the system. Because an active street involves pedestrian movement and flow, the space syntax measurements will identify which spaces or pathways in a settlement make themselves most readily accessible to others and thereby integrate the locality with the wider surroundings. At the same time, it devises measures to identify the spaces or pathways that make themselves less accessible to their surroundings and thereby, typically, have less street activity and are quiet.

As previously discussed in section 1.3, attractors such as shops, take advantage of the potential areas with high natural movement level, and not the other way around. It thus confirms that without understanding the structure of the urban grid configuration, it is not possible to understand either the levels of urban pedestrian movement or the distribution of the attractors.

The determination of this spatial rule on pedestrian movement and land use is important because it provides a way to understand how the presence of mixed

pedestrian activity constitutes a vibrant urban place. Hillier (1989) argues that spatial form influences '...the field of probable - though not all possible - encounter and co-presence within which we live and move: and whether or not it leads to social and interaction; this field is in itself an important sociological and psychological resource' (Hillier op cit: 13). He uses the term 'virtual community' to describe this field of potential encounters as it is grounded in a settlement's physical layout. The field is always present, though sometimes only 'latent and unrealised' (ibid.:16) and is a 'direct product of spatial design' (ibid.:13). To facilitate an active urban place, it is, then, the spatial integration of the urban structure that influences liveliness in the local area that needs to be understood.

2.5.4   Space syntax applications on transport related projects

There have been several studies that have used space syntax in design interventions to transportation buildings such as railway termini, railway stations, underground train stations, and airports. These studies aimed to assist the project designers to manage a complex set of problems regarding the configurational design of the new redevelopment areas including the organisation of diverse functions such as transport facilities, retail concourses, offices, commercial and residential buildings, and new public spaces.

Architects and planners such as Norman Foster, Richard Rogers, Terry Farrell and Zaha Hadid have consulted the Space Syntax Laboratory at University College London and have utilized space syntax and its computer modelling techniques to help design the internal and external environments of such developments.   Space syntax forecasts patterns of movement with an accuracy of approximately 75%, taking into account both 'programmed activities,' such as passengers flows to and from trains, and 'unprogrammed activities,' such as waiting, shopping, eating and other informal types of space use (Penn and Vaughan, 1995). It assists architects and planners as a powerful tool to make objective design decisions based on a clear understanding of how pedestrians behave in such transport complexes.   The aims are multiple; that the passenger and non-passenger movement can be patterned in a clear, uninterrupted way; retail shops can be placed in accordance with passing movement; new public spaces can be located in an optimal way to create well-used and lively environments as opposed to deserted and problematic ones; and office and residential buildings be located in 'natural' settings. The studies' overall aim was to ensure that transport complexes can

be successfully developed to achieve mixed-use environments, well integrated with their urban settings.

One significant and large scale study using space syntax techniques in relation to station area design was the Norman Foster's, King's Cross Masterplan and International Terminal Proposals in central London[11], carried out in 1992. The study began by constructing a configurational model of the King's Cross urban context in order to evaluate and represent the potential for the area to be integrated into its setting. Detailed observations were made for the existing pedestrian activity inside and around King's Cross and St.Pancras Stations, including inside Euston Station to provide a basis for comparison. Several hypothetical schemes were then analysed using space syntax in order to find the optimum balance between strong integration routes for public spaces and less integration for more secluded office and residential development. The final scheme proposed a new development area that is well integrated into its surrounding neighbourhoods and, although unbuilt, has had much influence on urban design practice in the UK[12].

Another significant project is the spatial design study and pedestrian movement analysis in association with Skidmore, Owings & Merrill for the Rosehaugh Company and Stanhope Properties PLC. for the first four phases of Broadgate Complex, located next to the west of Liverpool Street Station in London. Space syntax was used to assess the performance of the complex in terms of how far it had been successful in bringing life to public spaces and how far any success was due to design. Its aim was to investigate its configurational properties in order to propose how to improve the current design and to shape further development phases. The study revealed that the development area is well adapted to, and takes advantage of, the spatial structure of its surrounding area and the local pattern of natural movement. High levels of informal activity are also influenced by the availability of spaces adjacent to main movement lines. This has made Broadgate the best used public open space in and around London with generally high and continuous levels of pedestrian use throughout the day[13].

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[11]   The scheme still remains unbuilt due to the recession in the 1990s that changed the priority of the development elements from office areas to housing, small businesses and social facilities (*Bertolini and Spit, 1998*)

[12]   See more in Hillier, B. et al. (1992). *The King's Cross Porject, a study of passenger behaviour.* Unit for Architectural Studies. Bartlett School of Architecture and Planning, University College London.

[13]   See more in: Hillier, B. et al (1990). *Broadgate Spaces, Life in Public Places.* Unit for Architectural Studies. Bartlett School of Architecture and Planning, University College London.

A follow-up study was done in 1997 in the later Exchange Square Phase to the north of the terminus. Space syntax was used to diagnose the potential of the site in order to identify key routes within the urban context that could be extended into the new square with the aim of embedding it within the wider urban grid structure. Again, detailed observations were made of the existing patterns of pedestrian activity inside Liverpool Street Station in comparison with King's Cross and Euston Stations. The computer modelling tool 'Axman' calculates all routes in the area and ranges them by spectral colours from the most to the least accessible (from red, orange, yellow, green through to blue and dark blue). The model forecasts around 75-80% of the actual pedestrian movement levels and has been used throughout the design process to evaluate several possible layouts for the square, including the assessment of macro decisions, such as the primary route structure, and micro decisions such as the placement and alignment of stairs and urban furniture, providing the design team and client with rapid feedback on the pedestrian implications of their design proposals[14].

Space syntax has also been used in the development of a strategic plan for a local railway station area in Zaanstad, Amsterdam. The Laboratory was employed to examine the spatial relationship between the initial and later development areas in order to ensure an effective connection of various quarters of the town that had become disjointed and rigidly separated due to land use. The techniques of space syntax were used in conjunction with the new 'Pangea' software, a three dimensional modelling tool developed at University College London to study the relationship between building forms and energy assumption. The approach was able to forecast the effects of spatial layout on pedestrian movement patterns and demonstrated how incremental changes in the urban fabric could be made over time, eventually reuniting the fabric of the town in a masterplan in which the railway station and an extension of the existing high street have become the central focus[15].

Again, space syntax was approached in 1997 to study the new development proposals for King's Cross and St.Pancras Station complex and associated railway lands. The Laboratory had been appointed with the Foster and Partners-led design team as a consultant to King's Cross Partnership (KCP) for the design of a new international and regional station at St.Pancras. Previous analyses conducted in the area in the early 1990s were used to reinforce the analysis of the latest design process. Space syntax

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[14]   See More in: Space Syntax Laboratory. (1997a). *Broadgate.* Reports. 1,2,3 Bartlett School of Graduate Studies. University College London.

[15]   See more in: Stonor, T. and Major, M.D. (1996). *A Vision for Zaanstad,* Space Syntax Laboratory Report. Bartlett School of Graduate Studies. University College London.

was used to designate the routes intended to connect two main passenger concourses to ensure the ease and convenience of use for passengers. The team also proposed a new public space serving as an entrance for each terminus and a gateway to the development of the railway lands at the back of both termini. The intersection of routes between the specific terminus nodes and the large scale through-routes for local people were designed to produce a well-used public space that would also benefit related land use activities such as retail shops, hotels and a conference centre[16].

More recently a phased development of office buildings, residential apartments and retail facilities was proposed by Terry Farrell and Partners in 1997 for the Paddington Basin site, once again located next to another major transport interchange in London: Paddington Station. Space syntax was used to ensure that the site as well as the following development phases, would be well embedded within the urban context. This included the area to the west of Paddington Station designed by Nicholas Grimshaw and Partners to accommodate new public spaces and retail facilities, and the existing goods yard area to the northwest. The analysis suggested an urban layout that is well integrated with the city in a large scale with potential routes locally connecting the site with its surroundings. As a part of the study, the Space Syntax Laboratory carried out a ground-level land use survey of the terminus area that was later incorporated with the computer modeling of the area's spatial structure. The result showed a strong correspondence between the highly accessible routes and the location of retail facilties. This study has been used to optimise the location of retail shops as well as new public spaces and pedestrian and vehicular routes throughout the area[17]. However, the redevelopment scheme at Paddington Basin that is being implemented at present, its first phase of construction due to be completed in 2002, is different from the original proposal. This thesis will incorporate the results from the 1997 analysis with the spatial analysis of the new urban layout and an empirical study of current pedestrian movement to predict the pedestrian implications of the new development.

At a finer level of detail, space syntax applications have also used for the spatial design within an underground train station. The Space Syntax Laboratory was commissioned in 1993 as a consultant for the Terry Farrell-designed South Kensington Underground Station in London. The aim was to optimise the internal layout and

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[16]   See more in: Space Syntax Laboratory. (1997b). *King's Cross - St.Pancras, report on pedestrian movement studies and review of current design proposals.* and Space Syntax Laboratory. (1997c). *King's Cross, Understanding the Area. Stage One,* Bartlett School of Graduate Studies. University College London.

[17]   See more in: Space Syntax Laboratory. (1997d). *Paddinton Basin.* Bartlett School of Graduate Studies. University College London.

create potential routes of connection with the Foster and Partners' proposal for the 'Albertopolis'; the zone of cultural and educational development located next to it. The spatial analysis of the station's internal layout and a detailed observation of the existing pattern of movement and stationary use in the concourse was used by the client and the design team to highlight the constraints for future pedestrian movement of different types of people; daily commuters and users of 'Albertopolis'[18].

As well as assessing current situations and possible permanent interventions, space syntax has also been involved in a series of studies to forecast the impact of temporary construction work in pedestrian flow patterns in transport interchanges and retail buildings[19]. The first case study involved spatial analysis and observation in and around Victoria Station in London to identify the change in pedestrian movement patterns during refurbishment work. Axial analysis and visibility graph analysis (VGA)[20] were used to compare the spatial layout of the terminus building before and after the closure of some internal routes for construction work in order to assess the degree to which changes in spatial layouts can influence changes in the patterns of pedestrian movement and customer behaviour[21].

Finally, the analysis of passenger movement, security, and retail shop location has also been carried out in airports. A research study at University College London in 1997[22] sought to identify the distinction between passenger and 'greeter' activity in several international airports including Heathrow (Terminal 4) and Manchester (Terminal 2) by analysing the spatial layout of both airports using combined convex-axial models. The preliminary findings of the study confirmed that space syntax computer modeling is a powerful tool in predicting pedestrian patterns of use, which is useful to

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[18]   See more in: Space Syntax Laboratory. (1993). *Albertopolis.* Bartlett School of Graduate Studies. University College London.

[19]   This work, conducted since 2000, is part of the RaCMIT research project (standing for *Refurbishment and Consumer Movement Integration).* Space Syntax Limited acts as an industrian sponsor and a project manager working alongside with Railtrack, British Land, WS Atkins, and Laing Construction.

[20]   Visibility Graph Analysis (VGA) technique analyses visual fields from different parts of the building's layout and compares these to calculate which locations give users more visual information and which give less. The VGA map is constructed by dividing all accessible space in a building, on the basis of an accurate scale map, into a rectilinear grid of points. The computer then calculates *'visibility'* relationships between all points in the system on the same basis of configurational analysis (*Turner and Penn, 1999*).

[21]   See more in: *RACMIT: Case Study 1-Victoria Station. Report on the Space Syntax Study.* (2001) Bartlett School of Graduate Studies. University College London.

[22]   From Lemos, P. (1997). *Relieving you of the stress…along with your cash.* MSc Thesis, Bartlett School of Graduate Studies. University College London.

anticipate the demands of wayfinding and security within complex buildings where different types of people and activities converge.

These transport related space syntax studies provide a new approach to the redevelopment process of redundant and segregated urban areas where railway termini lie at their heart. It suggests that the success of such large scale redevelopment projects is related to their treatment of space and that future projects need to take an analytical approach to the relationships with the larger scale urban structure of the city rather than adopting a local and design-based approach. 'Spatial Integration' of both internal and external spaces of the railway termini with the surrounding urban context appears to be the key.

However, for all London's railway terminus areas, there is still an incomplete picture of how each functions as a node and place in the city. Although some studies were carried out at selected London termini, they provide neither an exhaustive nor conclusive analysis of the internal and external implications of pedestrian movement. Although the lesson of a successful project such as the Broadgate Complex are being applied in a growing number of major urban developments around the world (Major et al, 1998), the current development phase and the redevelopment of surrounding areas including the neighbourhoods further along the railway lines have not yet been examined in terms of their potential or how they have been affected by the terminus. Similarly, the space syntax studies of Euston and Victoria Stations   focused only on their internal layouts but not on how they are embedded in their urban contexts. King's Cross and St.Pancras Station areas have still no agreed redevelopment scheme so it remains useful to review existing potentials once again to stand as a comparative case study with all other terminus areas.

Additionally, there is a need for the re-examination of current redevelopment scheme that differ from what has previously been investigated, for example the Paddington Basin Development. The ultimate aim of this thesis is to make a comprehensive review of all London's terminus areas, including all the six termini that have never been analysed before, addressing both their internal and external spatial configurations as well as their pedestrian patterns of movement, in order to identify the spatial conditions promoting successful railway terminus development into vibrant urban places and 'live centres' in the city.

2.6: DISCUSSION AND CONCLUSIONS

From the historical review juxtaposed with Bertolini and Spit's idea of node and place, it is clear that the changing roles of railway termini are closely related to society and the innovation of transport technologies. Railway termini have become increasingly stronger transport nodes as their relationships to wider transportation networks have increased throughout their 170 year history. They have grown from small end-of-line railway stations to single-level transitional spaces, finally to become multi-level interchange complexes serving transport facilities at multiple scales. Conversely, their relationship to their urban surroundings have decreased. Their former role as vibrant urban places in cities has returned as the focus of attention only in the last two decades. Most terminus areas have been left blighted, without attempt or intention to assimilate them with the station structures or wider city, because they have been fenced off from their urban context and often regarded as a pollutant. It seems that for urban railway termini there is always the problem of creating places out of nodes and not the other way around.

The recent interest in converting termini from nodes into places can thus be seen as a response to both their uniquely positive and negative characteristics. The positive drivers are their strategic urban locations in inner city areas and their excellent transport connections, which give the areas the potential of becoming lucrative development sites. On the other hand, their negative urban conditions, characteristic of long-term problems in inner city areas, have stimulated urban designers and planners in major European cities to establish area-wide revitalisation programmes, including internal and external station spaces. The 'romance of rail travel', once celebrated through the termini's symbolic status as the city gateway and flamboyant architectural styles, is undergoing some revival. There is a deliberate allusion to former grand architectural styles, both through the revival of the arched train shed in new constructions and the refurbishment of the architecture of existing termini. Furthermore, there is renewed emphasis on rail travel as the only viable alternative solution to the growth in road traffic and railway termini are returning as the focal points of urban redevelopment plans in cities.

Although redevelopment strategies may be clear and straightforward in their presentation, the outcomes are not always so predictable or successful. The desktop review of some completed projects (presented above) reveals the distinctive degrees of node-place synergy that individual terminus complexes possess. However, only some termini were able to successfully convert this potential to become transport nodes with

vibrant mixed use internal environments which relate to and stimulate the use and vibrancy of their urban settings. According to the overview, the key factor that inhibits most redevelopments appears to be the discontinuity between their internal and external spaces as well as between the whole redevelopment area and the wider city. To be more precise, two principal elements undermine the success of the terminus areas as places in the cities. Firstly, the enclosure of the terminus buildings or the level differences between their concourses and urban settings that seclude the termini from the urban areas, and secondly the urban discontinuity caused by the obstruction of the terminus structures that has not yet been eliminated through lack of redevelopment or redevelopment that has failed to eliminate the discontinuity.

It is thus clear that the existing overarching and planning policy is unable to ensure the success of all redevelopment areas which have idiosyncratic problems and potentials. Crucially, this review suggests that not only the railway terminus area redevelopment process is a problem of a spatial kind but that the problem is also critically caused by the conflicting spatial nature of 'node' and 'place'. To function as efficient transport nodes, the termini location may become entangled with complex transport infrastructures that act as permanent urban barriers and cause difficulties for the station buildings in relating with their urban settings. At the same time, to create the new vibrant mixed use complexes uniting the termini and their urban surroundings, the areas require these same improved transport facilities which interfere spatially with that process. It is thus argued that the right balance has to be made and the process must take into account the spatial configuration of each terminus area. The critical concern is to develop appropriate strategies that connect the terminus and surrounding area to the city such that they transform themselves from blighted transport nodes into vibrant urban places, without restricting the efficiency of the transport network itself.

Clearly, how the permeability connection between the railway terminus areas and the city relates to vitality is critical. What Jacobs suggests is that the mixed types of people and dense activity that enhance the vitality of street networks can be accomplished through particularly physical qualities of the city. However, she gives no clear procedure for how the bustling people-activity phenomena relate to the spatial properties of local urban areas. The authors whose works directly addresses the urban regeneration of railway wastelands, such as Crotti, Busquets, and Bertolini and Spit, all make the limited spatial design suggestion that these areas should be carefully embedded into their urban settings, but without clarifying any morphological process or giving empirical evidence to support their assertion.

These ideas have received little attention compared to those dealing with the spatial relationship between the city and public spaces, often perceived as the more significant urban element. How the location of public spaces contributes to their successful performance was discussed by Unwin and Gibberd. Both argue that the public spaces which locate in proximity to main traffic lines with high levels of movement will be preferentially used. However, they did not discuss the morphological relations between public spaces and the city. Based on observational studies, the works of Lennard and Lennard, and Carr establish design guidelines consisting of local spatial features such as sizing, height of surrounding buildings, dimension and arrangement of street furniture. Apart from these factors, they are among the first authors who stress the importance of the pedestrian network and activity in determining the success of public spaces. However, in all cases, public spaces are seen as spatial features with no relation to their surroundings.

Whyte examines all these properties and points out that it is the adjacent streets and their respective levels of pedestrian movement that play a major role in the performance of public spaces, with good visual and permeability connections between streets and public spaces being the key factor. Nevertheless, his work did not provide a method of quantifying or predicting the likely number of users. Certainly a formal representation of space is missing in all these previous concepts. Any kind of quantification with direct implications for patterns of spatial use by people is also subjectively based, although some authors stress important properties that may contribute to the overall quality of public spaces.

In marked contrast, space syntax is a methodology that addresses a very important aspect of urban morphological analysis based on the concept of relative depth expressed by the integration value. Space syntax is used to examine an urban area through a configurational analytic process by looking at all publicly accessible spaces within that area as independent spatial entities. Through the theory of natural movement, it provides the possibility of correlating spatial variables with spatial behaviour. To be more precise, syntactic measures such as integration and intelligibility can be tested against the patterns of movement on streets. Using the idea of spatial configuration in a 'generative' capacity, space syntax methodology is then able to suggest potential design proposals of relevance to transport related urban development that ensure good levels of pedestrian use and activity, as well as explaining why some areas fail despite careful design.

Space syntax is therefore used in this research as it proves to be a methodology capable of escaping from 'attraction' based models and a deterministic approach and presents an alternative global interactive view of the relationship between patterns of space use and local urban design. Furthermore, space syntax does not preclude other informative or theoretical approaches brought to the analysis, as is the case in this research. It has to be used creatively with careful handling of the data mediated by common sense. However, its strength derives from the continuous ongoing research that feeds back new knowledge into its theoretical and methodological framework. Space syntax is therefore the main methodology used for this research for the spatial analysis of London's railway terminus areas, applied to both internal and external station spaces. The following chapters turn, therefore, to an explanation of the relevant methods of collecting data in order to correlate spatial form with human behaviour.

2.1a

2.1b

2.2a

2.2b

2.2c

2.3

Figure 2.1: 'THE CITY'S GATEWAY'

a: The Portico, Euston Station in London built in the Greek Doric Style by Phillip Harwick, 1836.
(Source: Holland, 1971. Travellers' Architecture)
b: A project drawing for the gateway at Chemin de Fer de la Belgique, Paris. Its gateway followed the lead of the Grand Arch at Euston.
(Source: Sheppard, 1996, Railway Stations, Masterpiece of Architecture)

Figure 2.2: RAILWAY TERMINI IN THE EARLY DAYS
built in variations of Classical style.

a: Union Station in Washington D.C.
The waiting room was built to resemble a Roman Basilica.
(Source: Parissien, 1997, Station to Station)

b: Gare d'orsay, Paris
The original concourse was built in Classical style.
(Source: Sheppard, 1996, Railway Stations, Masterpieces of Architecture)
c: Central Station, Antwerp
The concourse was built with a combination of Neoclassical detailings
(Source: Parissien, 1997, Station to Station)

Figure 2.3: The Railway Station

by William Powell Frith (1819-1909) depicts social interaction between the upper and middle classes in a railway station in 1862.
(Source: Parissien, 1997, Station to Station)

Figure 2.4: EXAMPLES OF MAJOR RAILWAY WASTELANDS IN EUROPE.

a: King's Cross Station area in London
(Source: Bertolini and Spit, 1998, Cities on Rail)

b: Seine Rive-Gauche area near Gare D'Austerlitz in Paris
(Source: Powell, 2000, City Transformed)

c: Basel Euroville in Basel
(Source: Bertolini and Spit, 1998, Cities on Rail)

d: Station Quarter, Avenue 21 in Stuttgart
(Source: Powell, 2000, City Transformed)

e: Station Quarter, Frankfurt 21 in Germany
(Source: Powell, 2000, City Transformed)

Figure 2.5: EXAMPLES OF THE LATE 20th CENTURY RAILWAY TERMINUS.

a: London Waterloo Station, Britain - the new extension for Eurostar train concourses
(Source: Sheppard, 1996, Railway Stations, Masterpieces of Architecture)
b: Sloterdijk Station in Amsterdam, the Netherlands
(Source: Sheppard, 1996, Railway Stations, Masterpieces of Architecture)
c: Airport Stationat Lyon, France
(Source: Sheppard, 1996, Railway Stations, Masterpieces of Architecture)

d: Gare TGV Chessy-Marne-la-Vallee, France
(Source: Agence des Gares, 1998)
e: Bilbao Station, Spain
(Source: Powell, 2000, City Transformed)
f: Taichung TGV Station, Taiwan
(Source: Agence des Gares, 1998)
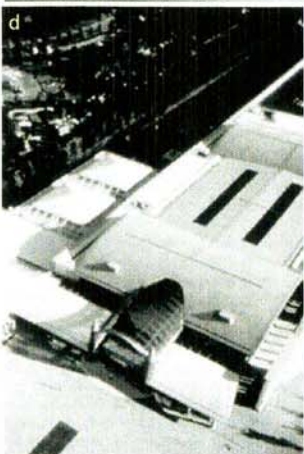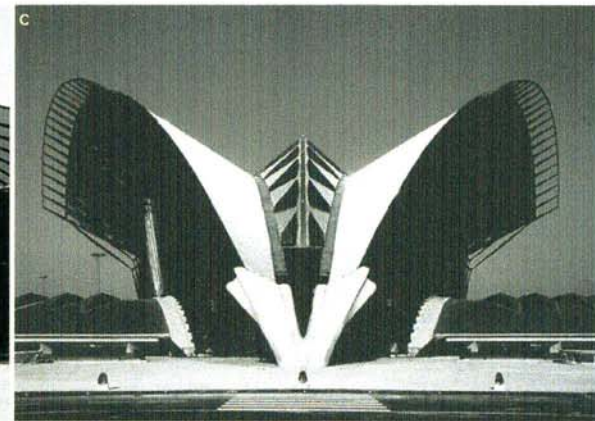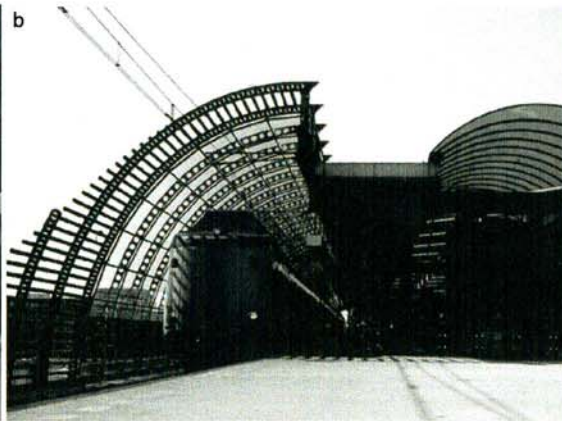
Figure 2.6: EXAMPLES OF RECENT RAILWAY TERMINUS AREA REDEVELOPMENT PROJECTS IN EUROPE

a: Frankfurt Am Main Station Quarter, Germany
(from: Powell, 2000, City Transformed)
b: Stuttgart Station Quarter, Germany
(from: Powell, 2000, City Transformed)
c: Euralille Project, France
(from: Bertolini and Spit, 1998, Cities on Rail)
d: Paris Seine Rive Gauge Project at Gare d'Austerlitz, France
(from: Powell, 2000, City Transformed)
e: Bilbao Abando Station, Spain
(from: Powell, 2000, City Transformed)
f: Paddington Basin Development, London Paddington Station, Britain
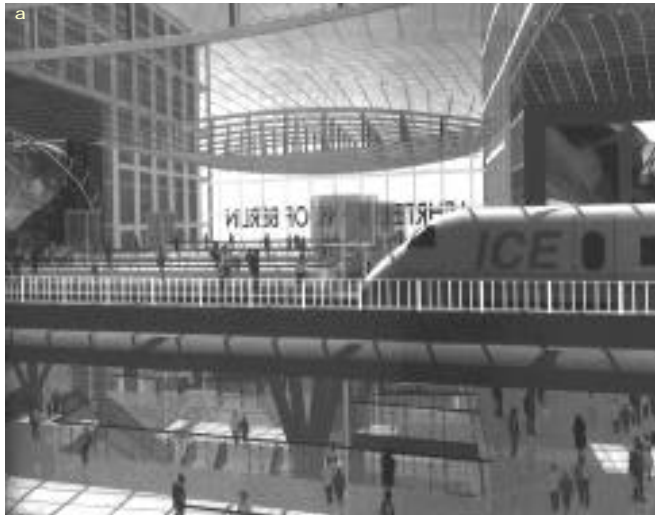(from: Pearman, The Sunday Times Newspaper, Sep.3, 2000)
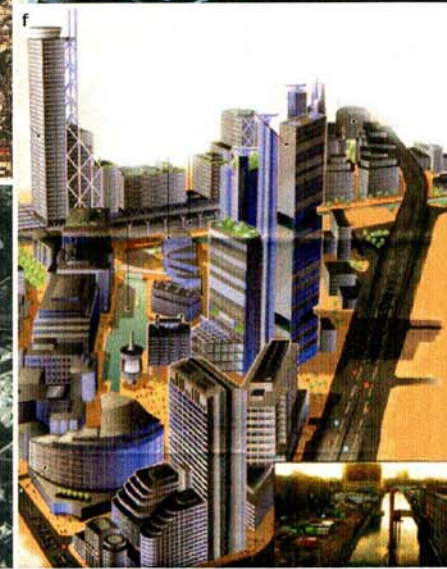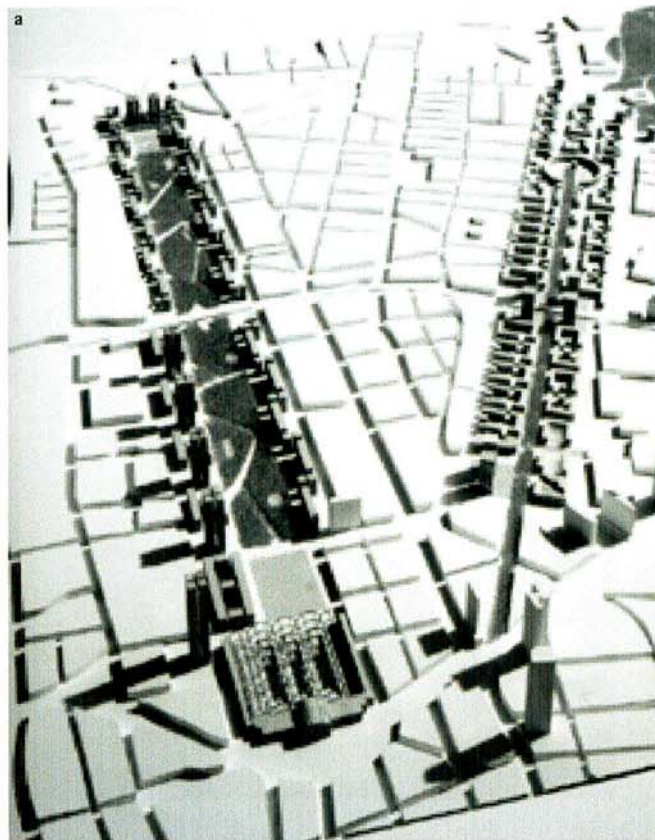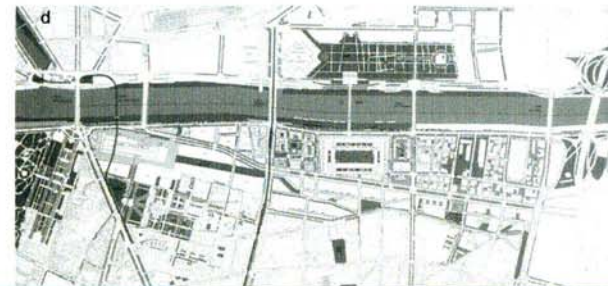
Figure 2.7: MULTI-LEVEL SPATIAL ORGANISATION has been widely used to arrange the overlapping circulation networks common in station complexes

a: Berlin's Lehter Bahnhof, Germany
The station hall with large open atrium to conduct light through the multi-level complex of train, underground train and retail activities.
(Source: The Architectural Review', January, 1999)

b: Kowloon Station, Hong Kong, China
Designed by Terry Farrell and Partners, the newly developed station with office and residential complex is a multi-level interchange where heavy rail, light rail, bus and taxi facilities meet.
(Source: Edwards, 1997, The Modern Station)

c: Broadgate Complex at London Liverpool Street Station
A new public square, Exchange Square, and a series of office buildings were built over the terminus' approach lines.

d: Paddington Basin Development at London Paddington Station
The new office - commercial complex and car parking are to be constructed over the existing railway platforms. The scheme aims to transfer a flow of passengers from the lower level station concourse to the higher level pedestrian platforms along the Canal Basin.

Figure 2.8 : THE NODE-PLACE DIAGRAMMATIC FRAMEWORK summarised from the historical evolution of railway termini.
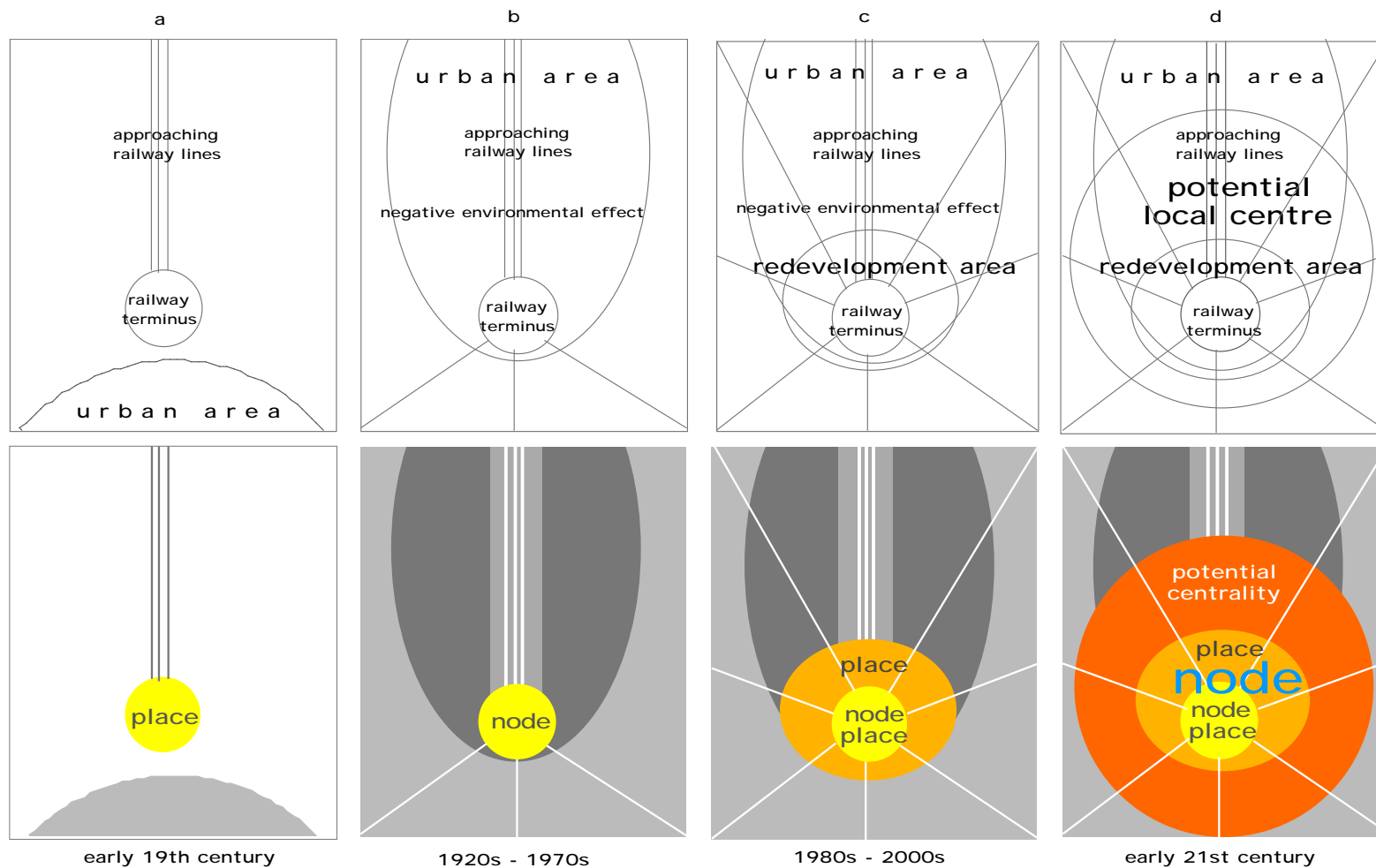
Figure 2.9: BERTOLINI AND SPIT'S IDEA OF THE RAILWAY STATION

a: Railway station as a NODE

b: Railway station as a PLACE

from: Bertolini and Spit, 1998, City on Rails.
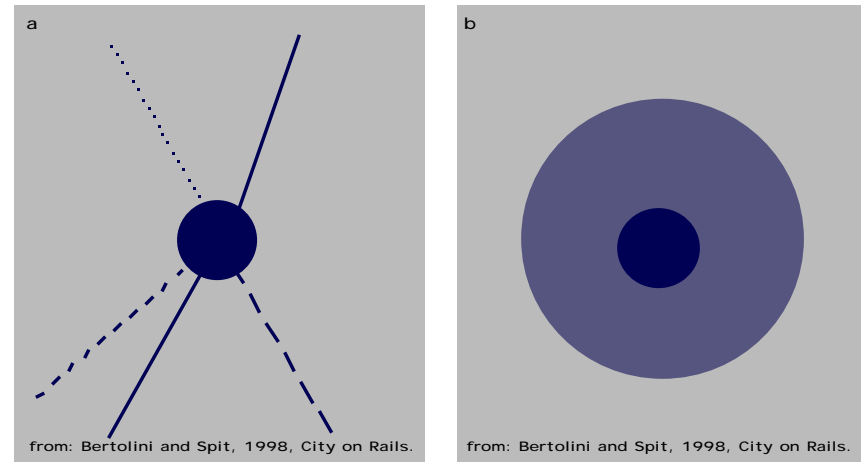
from: Bertolini and Spit, 1998, City on Rails.

Figure 2.10: VARIOUS NODE - PLACE SYNERGIES   classified according to how the railway terminus relates to the transportation network and its urban setting.
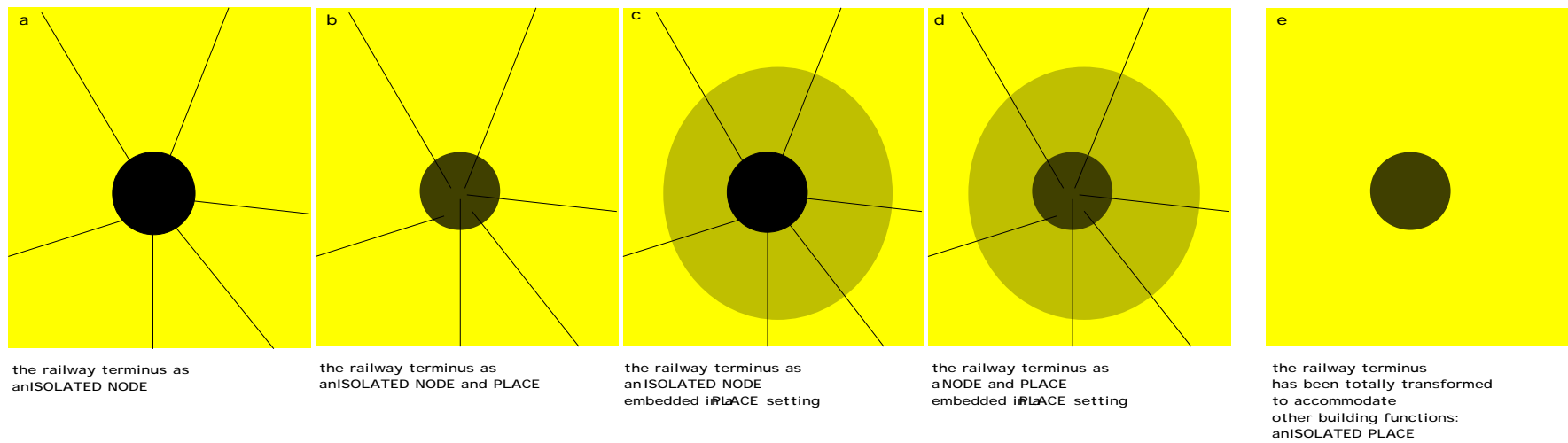

the railway terminus as
an ISOLATED NODE

the railway terminus as
an ISOLATED NODE and PLACE

the railway terminus as
an ISOLATED NODE
embedded in PLACE setting

the railway terminus as
a NODE and PLACE
embedded in PLACE setting

the railway terminus
has been totally transformed
to accommodate
other building functions:
an ISOLATED PLACE

Figure 2.11:   EXAMPLES PROPOSED BY UNWIN FOR A STATION PLACE.
(from Unwin's Town Planning in Practice, 1909)

a: Gare du Nord, Brussels.
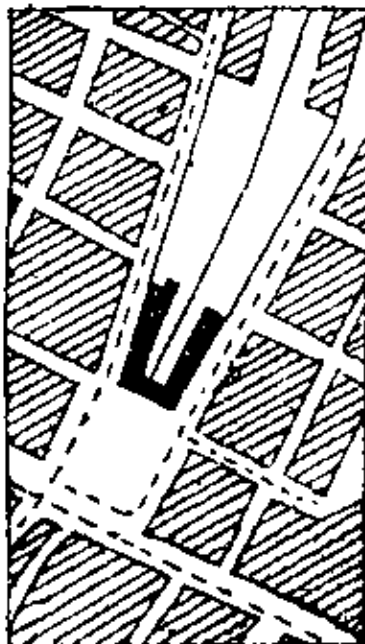
b: Central Station, Munich.
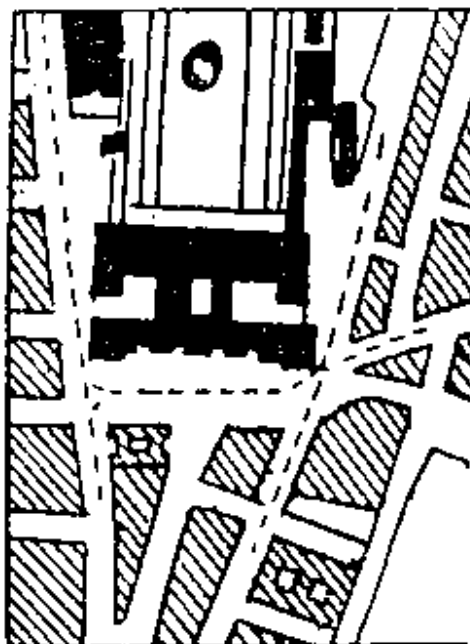
c: St.Nicholas Station, St.Petersburg.