044
The spatial character of London’s railway terminus neighbourhoods

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Abstract
The railways constructed during the mid to late 19th century have given London more individual terminals than any other city in the world. As substantial interventions into the city’s street network, the construction of stations and their related infrastructure created new spatial relationships with surrounding neighbourhoods. The relationships between the largest stations, the terminals, and their host areas developed over a period of 175 years, from the 19th century, but these stations still dominate their neighbourhoods today.

Previous research into London’s railway terminals, and the development of stations around the world, has focused on the direct functions of a station, as connectors and transport hubs. However, the network influence of station buildings and of the railway infrastructure that passes through large areas of the city behind stations has received limited research attention. Station neighbourhoods are frequently discussed only in terms of their redevelopment potential, in relation to railway improvements.

This paper analyses the neighbourhoods of two terminals – Euston and Waterloo - as case studies, representing the two different types of approach structure typical of London, and investigates the spatial relationship they have developed with their neighbourhoods. A combination of spatial analysis techniques is used to assess the configuration of areas around both stations during two time periods – the late 19th century and today. The aim is to assess the spatial character of these sample areas, and investigate the extent to which they have changed over time. This allows the hypotheses to be tested that long-term spatial outcomes arise from the insertion of railway terminals into existing urban fabric, and that these outcomes differ according to the nature of these insertions. It aims to generate more detailed knowledge about the spatial role of the terminus in London, and its influence on urban form, particularly in more overlooked areas behind railway terminals.

Keywords:
Railway stations, transport, London, infrastructure, development, space syntax. 
1. Introduction

Research examining the neighbourhoods of city centre railway stations is limited. An international body of research addresses station improvement, expansion and upgrade, and the redevelopment of the industrial areas that frequently adjoined stations. However, it concentrates almost entirely on the functioning of stations themselves, both as transport hubs and increasingly as retail centres, and on uplift in land values associated with “transport-adjacent development” on land adjoining railway company property (Peters & Novy, 2012a, p.13).

Fewer studies have taken the wider urban areas surrounding stations as their subjects. Bertolini’s “node and place” approach (Bertolini, 1996; Bertolini and Spit, 1998) recognises the dichotomy, and the potential conflict, between the role of the station as a “node” for journeys to elsewhere and also as a dominant structures located in its own “place”. He identifies “two types of station neighbourhood...: that on the ‘right’ and that on the ‘wrong’ side of the tracks” (Bertolini, 1996 p.332), the latter often the areas behind a railway terminals, divided from the economic activity of the city centre by ‘disruptive’ railway lines.

However, the ‘place’ aspect of railway terminals is mainly discussed by Bertolini in terms of the redevelopment challenge it presents. He acknowledges that these places are as complex and heterogeneous as any in the city, but he and other researchers represent them as sites that nevertheless require change. A research gap is left by the failure to assess the particular character and value of the substantial areas of cities crossed by railway infrastructure, particularly those located behind railway terminals on the “wrong side of the tracks”. This commonly used expression contains the clear assumption that railways divide and define places, socially, economically and culturally, creating poverty, disadvantage and undesirability in their immediate surroundings, and that this is a spatial effect. Researching the configuration of railway neighbourhoods is therefore the logical way to understand whether this assumption is based on reality, and to characterise the nature and extent of any spatial railway impact.

An analysis of the relationship between stations and the neighbourhoods they occupy is particularly relevant to understanding the urban form and spatial configuration of London. Eighteen separate stations are categorised as “London Terminals”, of which only four are also through stations. London therefore has fourteen stations where all train services terminate and all passengers disembark. No other world city has as even half the number of terminals found in London, and many have none. The presence of a uniquely large number of terminals is likely to have had a particular influence on the form and development of London over time, and on the places that play host to railway infrastructure.

2. Context

   i) Railway stations and spatial networks

It can be hypothesised that the neighbourhoods surrounding London’s rail terminals have developed distinct spatial characteristics, influenced by presence of railway infrastructure and the effect of stations on the street network. Limited work has been done to identify these effects, and their manifestation in areas behind railway terminals has been assumed to be negative. The negative consequences resulting from barriers created by railway lines, with limited crossing points, have been described by researchers as “blight” (Hillier et al., 1993; Pak sukcharern, 2003). The term “blight” implies a place where nothing can flourish or grow, specifically where movement is drastically reduced by network interruptions. A grid structure, according to Hillier et al., generates

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“natural movement” of people within a city (Hillier et al., 1993, p.32), and barriers within the grid cause disruption to these movement patterns.

The conclusion that “blight” is the consequence for street networks cut through by railway lines needs to be questioned. It is important to understand whether this is indeed the case; how blight it is manifested; whether it is partial or universal; whether it differs according to the type of station and structure; and whether effects other than “blight” can be observed. It is also necessary to assess whether this effect has changed over time, using long timescales to track developments that began with the construction of the first London terminus at Euston in 1837, and continue today. The term “blight” in itself implies a long-term process, implying the need to study a railway neighbourhood’s transformation over time.

The areas behind stations have been frequently stereotyped, associated from the 19th to the 21st centuries with disreputable, illicit or illegal activity such as drug use (Hartnoll and Rhodes, 2002), prostitution (Ashworth et al., 1998) and cruising (Bell 2001), and consequently with fear of crime (Uzzell & Brown, 2007, Cozens et al., 2004, Atkins 1988), and therefore seen as problem areas in need of remedial action. This reputation has helped to rationalise what Docherty describes as “a ‘cleaning up’ or a ‘sanitisation’” (Docherty, 2000). Planning and development tend to focus on the station itself as both the de facto centre and the driving rationale for its surrounding area, which has required such railway neighbourhoods to be represented as problems to be solved. However, the nature and extent of any problem cannot be understood without a detailed picture of the spatial consequences of the inherent disconnection of areas to the side of and behind stations.

ii) A research approach for London

London’s terminus stations connect with surrounding street networks and other forms of public transport in a variety of different ways. Lines that approach stations above ground create inaccessible areas where railway tracks enter the station, inevitably forming barriers which can only be crossed where access is provided. However, these approach routes take very different forms, ranging from cuttings and tunnels to embankments and viaducts.

![Figure 1: Central London Railway Terminals and Infrastructure (© OpenStreetMap contributors and the GIS user community, ESRI.](image_url)](image_url)

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Figure 1 illustrates the extent to which railway infrastructure forms a network of structures and spaces that encircle central London. The boundaries of central London were established in 1846 by the railway exclusion zone set up by Royal Commission that largely restricted railway terminals to the edges of what was then the built-up city (Hoyle 1982). These boundaries are still in place today, and the railway map of London demonstrates clearly the contrast between the central areas, untouched by railway lines, and the periphery, extensively occupied by railway cuttings, embankments, viaducts, bridges, junctions, sidings and service yards. There is, however, a difference between the forms of railway structures found in the north and west of London – largely cuttings or lines running at grade - and in south and east London where, because both of wetter ground and the decision to bridge existing streets, viaducts dominate. The railway viaducts in south and east London form the largest built structures in the city, with more than 10 miles of viaduct south of the Thames alone.

Unlike through stations, railway terminals have distinct front and back areas. They are designed to provide a gateway to the city, and passenger access and egress is therefore orientated almost entirely towards streets addressing the station frontage, leading to the city centre. The main research into the effects of this form in London is Hillier et al.’s assessment of the urban configuration surrounding King’s Cross Station (Hillier et al., 1993) which identified a pattern of pedestrian movement levels that fall sharply only a single block from the direct entrance routes to the stations in their study. They describe this phenomenon as a “negative attractor” effect, in which stations create large blockages despite themselves being “point attractors” (Hillier et al., 1993, p.50). In other words a station sucks people into its buildings and out of surrounding streets, channelling their movement on to routes leading directly to and from station entrances and exits. The concentration of movement along these routes is matched by a corresponding lack of movement on nearby streets that lie away from direct routes to stations.

This paper investigates the areas surrounding two London railway terminals by assessing their spatial characteristics, and asking whether these have changed over time. These research questions are addressed using a combination of spatial analysis techniques, explained below.

3. Methodology and case studies

A spatial analysis of the case study railway terminus neighbourhoods has been developed using space syntax techniques. This approach allows the movement generated by the spatial layout of a city, and in the street network surrounding terminus stations, to be analysed.

Euston Station has been chosen as a case study to investigate the spatial conditions around a terminus station that is approached by railway lines in a cutting that can be crossed only by bridges and therefore has the potential to form a physical barrier (see Figure 1). Waterloo Station has also been chosen because it is approached by railway lines carried on viaducts (see Figure 1) with more frequent crossing points under the viaduct arches. The stations both date from the early days of railway development in London, opening in 1837 and 1848 respectively. These two case studies allow the spatial influence of different types of railway infrastructure to be assessed and compared, and form part of a wider study which will look at all of London’s terminus neighbourhoods.

i) The built form of railway terminus neighbourhoods

The streets leading to the main entrances of London terminals are busy, especially during the working week, and areas in front of stations are a focus for economic activity. In contrast, streets equally close to stations but located away from direct station access routes are often comparatively empty both in terms of people, and shops and facilities. The two case studies analysed in this paper fit this template. The streets of Somers Town and the Regent’s Park Estate behind Euston are residential, social housing-dominated, as is the area of North Lambeth behind Waterloo. Both have long histories of poverty, and have experienced substantial 20th century redevelopment involving
replacement of Victorian housing and street patterns with blocks of social housing in a range of 20th century typologies (see Figure 2).

The neighbourhoods behind both stations are traversed by main railway lines that are not accessible to the public. The difference between areas in front of and behind both stations is very clear in both cases. However, the railway structures behind each station are very different. Euston is approached by main lines located in a cutting, bridged by a small number of main roads. Figure 2 shows the Hampstead Road and the Ampthill Estate, typical of the built form found behind Euston. The space between the vantage point of the photographer and the estate towers is occupied by the Euston railway approaches, crossing under the main road and creating a void space cutting through Somers Town and the Regent’s Park Estate. This space is likely to be widened further for the proposed High Speed 2 rail route, requiring demolition of one of the towers shown in the photograph above.
Figure 3 shows that the railway infrastructure behind Euston forms part of a larger system, connecting to the lines the serve King’s Cross and St. Pancras, and the Overground line serving Camden Road Station. The neighbourhood of Somers Town in particular is enclosed by large stations and their railway lines on two sides while Euston Road, running east-west in front of Euston, King’s Cross and St. Pancras Stations, is a busy multi-lane road that also forms a physical barrier. South of the railway terminals, Bloomsbury is characterised by Georgian terraces and squares and university
buildings, alongside main shopping streets and offices. This contrasts sharply with the estate streets north of Euston Road, which are predominantly residential with shops and services on a local scale, few offices, and limited numbers of visitors or commuters.

Figure 4 shows the area around Euston Station ten years before it was built. It was constructed between two existing neighbourhoods, on the last farm remaining in this part of London. Somers Town is almost complete to the east, and the area between the station site and Regent’s Park is occupied by the Cumberland Market neighbourhood and a canal basin. The construction of the
station, and of St. Pancras and King’s Cross to the east, was accompanied by an intensification of building and also of poverty in Somers Town and in the areas that came to be located behind Euston.

Figures 5 below, which shows the area behind Euston mapped by Charles Booth in his 1898 street-by-street survey of poverty in London.

![Figure 5: Euston and surroundings, Booth Map 1898](image)

The map provides a detailed picture of the station area immediately after the completion of London’s main terminals, when the railway system was fully established. The streets behind Euston...
are home to significant poverty, found particularly in back streets and alleys behind wealthier streets and in the areas behind the station. Somers Town and street close to the station have the largest number of streets coloured black and dark blue, indicative of the worst poverty, including streets known as “Little Hell”\(^2\) and described as “the very home of squalor”.\(^3\) Drummond Street was the main road crossing immediately in front of the station, with hotels and pubs used by travellers in the section closest to Euston.

Figure 6 is an aerial view of Waterloo Station and its neighbourhood. It shows the size of the station and its viaducts in comparison to surrounding buildings, dwarfing even the Houses of Parliament on the left of the picture. It is also apparent that the railway structures separate riverside areas from the streets to the east of the lines.

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\(^2\) Booth (1902-03) B356 p.109
\(^3\) Booth (1902-03) B356 p.126
Figure 7 shows the railway infrastructure in the area and reveals how extensive it is, crossing the entire mapped area with a complex network of viaducts. The built form changes noticeably either side of the viaducts. To the north and west of the station, between the railway and the River Thames, there are large public institutions, including St. Thomas’s Hospital and the South Bank cultural venues, and headquarter offices. The area is almost always busy. To the east of Waterloo are
smaller shopping streets, and estates of social housing. The viaducts themselves house many different business functions, from offices and theatres closer to the South Bank, to a small number of industrial uses behind Waterloo.

Figure 8: Waterloo area, Greenwood Map 182 © Motco Enterprises Limited, www.motco.com

Figure 8 shows the site of Waterloo Station in 1827, 21 years before it was constructed. The area is already extensively developed with much of the building relatively recent, covering what was previously a marsh. It shows why viaducts were used to carry railway lines across an already complex
street network. Nevertheless, a number of streets shown on this map were demolished for the station and its lines, introducing an entirely new element into the urban form. The main street running through the area, Lambeth Marsh (later Lower Marsh) became less prominent and, once the station was built, it was superseded by streets between the river and the station.

Figure 9: Waterloo and surroundings, Booth Map 1898

Figure 9 shows Charles Booth’s map of the Waterloo area, which he describes as a place where people both live and work, in contrast to the business districts immediately north of the Thames. While larger streets are “respectable“, streets all around Waterloo are dominated by prostitution,
both behind the station and on either side, for example in York Road. There are pockets of extreme poverty to be found behind the station and close to the river. Lower Marsh, then a busy market street, was the focus of activity behind Waterloo.

ii) Spatial analysis approach

To assess spatial characteristics and change over time at Euston and Waterloo, space syntax analysis was carried out. A space syntax segment map of the contemporary inner London street network (2014) was drawn for the purpose, covering a 64 km² area. Ordnance Survey (OS) road centre line data were converted into segments, errors corrected and missing information added, and the new map analysed using depthmapX². The London road network was mapped within natural boundaries equating to the River Lea Valley, the South Circular Road, the North Circular Road, and the A504 – equivalent to Transport for London Travel Zones 1 and 2.

Spatial analysis was also carried out using historical maps of London: Ordnance Survey County Series 1:2,500 maps, sheets published during the 1880s. Segment maps were drawn by hand. The 1880s were chosen for analysis because by this time the railways were well established in London, with terminals such as Euston and Waterloo forty to fifty years old, and the rail network as it exists today substantially complete. The London road network in the 1880s was mapped to the full extent of the continuously built-up city, which fell within the boundaries of the 2014 London segment map.

Segment maps were selected because they allow a more detailed analysis of the way movement networks are used, particularly by representing local variations between different sections of long streets (Turner 2007), such as those found at both stations.

iii) Segment numbers and length

The 1880s and 2014 Inner London street networks show significant differences in character. The average segment length in the 1880s was 60 metres; by 2014 it had increased to 74 metres, a factor of 1.2. This overall change in the nature of the street network reflects the adaptation of the street network for car travel over the intervening period, but also the disappearance of many of the alleys, back yards and courts that characterised the Victorian city.

<table>
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<tr>
<th></th>
<th>Average segment length (m)</th>
<th>Total number of segments</th>
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</tr>
<tr>
<td>2014</td>
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<td>517</td>
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<td>2014</td>
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<td>1081</td>
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</table>

Table 1: Average values for segments within inner London road network

Table 1, above shows both average segment length and total number of segments for areas around Euston and Waterloo stations. Street segments were selected within a natural boundary around each. An 800m radius circle was drawn, measured from the centre of the station buildings, to represent an area equivalent to a 10 minute walk from the station. The selection was then extended to meet the nearest main roads or other features marking the edge of an area.

In front of Euston Station, the natural boundaries are formed by larger roads within the street grid of Bloomsbury⁶. North of Euston, behind the station, the natural boundaries are more substantial:

⁴ Meridian™ 2 v1.2 Release 1 2014 Ordnance Survey © Crown copyright and database right.
⁶ From east to west Cleveland Street, Goode Street, Tottenham Court Road, Bedford Square, Montague Place, Russell Square, Calthorpe Street and Gray’s Inn Road.
Regent’s Park, the Regent’s Canal, the viaduct and embankment carrying the London Overground, and the main railway lines into St. Pancras Station. This alone highlights the contrast between the integrated, central London grid south of Euston Road, and the area behind the station, very clearly bounded on all sides by large open spaces and transport infrastructure. There has been a substantial change in segment length in the Euston area, with the average length increasing by a factor of 2.5 between the two periods while the total number of segments has reduced by a quarter.

The Waterloo Station neighbourhood was defined by selecting all segments within an 800m circle centred on the station, to represent the distance covered in a 10 minute walk, and extended to meet the area’s natural boundaries. The area is defined as much by viaducts as by main roads, but the grid of streets is more complete around the station than at Euston. Average segment length between the two periods has increased by a factor of 1.3, a lower increase than at Euston. However, the total number of segments in the area has more than halved.

Euston in particular has seen substantial change to the average length of street segments since the 1880s, more than twice the average for London. However, at Waterloo, the noticeable difference has been a much larger reduction in the number of segments, compared to Euston. These measures suggest different forms and processes of change to the street network in each place.

**iv) Choice and integration analysis – Euston Station**

The street network around Euston and Waterloo Stations was analysed using choice and integration measures, representing two different aspects of network function, weighted by segment length to normalise results. Choice calculates the shortest path from one street segment to another for every pair of segments in a system (Turner, 2005), representing the likelihood that a street segment will receive through movement as part of a route from one place to another. Integration demonstrates the ‘to-movement’ potential of a space, the likelihood that it will be visited as a destination (Hillier, 2009). Local measures of integration have been shown to be the best predictors of economic and social activity at street level (Hillier, 2002, Vaughan et al., 2005).

<table>
<thead>
<tr>
<th>Integration N</th>
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<th>Integration 800m</th>
<th>Integration 1500m</th>
<th>Integration 3000m</th>
<th>Integration 5000m</th>
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<tr>
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</table>

Table 2: Average values for segments within inner London road network

Table 2 shows average values for segments across the whole of the London road network for the 1880s and 2014. The lower of the two values in each column is shown in red, for easier comparison.

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7 These are the River Thames to the north and west, the railway viaduct approaching Blackfriars Station to the east, and Lambeth Road to the south.
Average choice values rose for the system as a whole, by a factor of 3.3. However, measure at a range of scales, the picture is more varied. Choice values fell at the largest scales - by a factor of 1.7 at 3000m and a factor of 9 at 5000m - between the two time periods, but at 800m rose by a factor of 5.4. At this more local scale, better connected routes have become available for through journeys, but at larger scales there are now more routes that are less well-connected.

However, integration values for London have fallen at every scale measured, except 3000m. System integration fell by a factor of 17 between the two periods. The fall in local scale integration values is likely to indicate a decline in the number and connectivity of streets serving as destinations for local journeys.

Figure 10: Euston Station – Choice 3000m (1880s). (© Crown Copyright/database right 2014. An Ordnance Survey/EDINA supplied service. ©depthmapX © 2011-2014, Tasos Varoudis)
Figures 10 and 11 show segment maps of the 1880s and 2014 street networks around Euston, analysed using choice at 3000m. Vaughan and Geddes (2014) propose that radii of 1600m-3200m have the potential to predict through journeys and emphasise the relationship of local areas to the city core. Choice has been measured at 3000m for the case studies, because the highest values for the main roads passing the front of both Euston and Waterloo are shown at this scale.
Choice values both north and south of Euston Road were lower during the 1880s than in 2014, with fewer high choice through routes. However, the basic structure of main roads is recognisable on both maps, with Euston Road still forming the principal east-west connection and Hampstead Road and Eversholt Street the main north-south roads. The station itself is much smaller than the present-day structure, which was rebuilt during the 1960s. The current station extends further south than its predecessor, severing east-west streets such as Drummond Street that formerly crossed in front of the station.

The highest choice values are found on Euston Road, the primary east-west through route connecting Euston, St. Pancras and King’s Cross Stations. Euston Station is located within a triangle of main roads, with main north-south routes also running to the east along Eversholt Street, and to the west along Hampstead Road. Almost all other streets behind the station frontage and north of Euston Road have much lower choice values, including the neighbourhoods of Cumberland Market and Somers Town. These areas contrast with Bloomsbury, where the primary street network forms a more complete grid, with both north-south and east-west routes crossing the whole area.

Figure 12: Euston Station – Integration 800m (1880s), (© Crown Copyright/database right 2014. An Ordnance Survey/EDINA supplied service. ©depthmapX © 2011-2014, Tasos Varoudis)
Figures 12 and 13 show integration in the 1880s and 2014 street network around Euston Station, measured at 800m radius. Vaughan and Geddes (2014) suggest that the optimum predictor of local journeys is choice measured at radii of 400m-800m. A scale of 800m has been chosen for both case studies, as this is the scale at which clusters of higher values emerge in segments at the front of station exits.
Integration values in the 1880s contrast with those 130 years later, which were higher both north and south of Euston Road. The latter’s role in separating neighbourhoods is not apparent in the 1880s, despite its significance as a high choice through route. High integration streets, likely to act as destinations for local journeys, are found either side of Euston as well as in front of the station, continuing into Fitzrovia and Bloomsbury. While integration values fell behind Euston, this happened much more gradually than today. Much of both the Cumberland Market and Somers Town neighbourhoods consisted of streets with lower integration values than the nearby main roads, but with higher values than those found there today. This partly reflects the substantial reconstruction of large parts of both areas, where 18th and 19th century housing was replaced with a variety of 20th century estate blocks and street layouts separating pedestrians from traffic.

South of Euston Road, the Bloomsbury grid has consistently high integration values. This contrasts sharply with the streets north of Euston Road, around the station, where integration values fall immediately in the neighbourhoods surrounding the station, remaining high only in streets adjacent to the station frontage, including a sub-centre at Drummond Street. The rebuilding of Euston Station left only a remnant of Drummond Street, to the west of Euston. Previously the main location for direct station uses, its character changed and it is now known for a distinctive selection of independent businesses, especially South Asian restaurants, used by travellers but also by local residents and workers. It is currently threatened with partial demolition for the High Speed 2 rail route showing that the extensively dismantling of the street grid north of Euston Road continues.

Euston Road appears to mark a boundary between two areas with different characteristics. To the north there is an absence of east-west routes due to the presence of Regent’s Park and Euston, St. Pancras and King’s Cross stations. For 1.3 miles north of Euston Road, no east-west route connects all the way across the area. The difference between streets in front of and behind Euston shows a spatial change between central London, south of Euston Road, where the majority of streets have high potential as destinations and therefore as locations for economic activity, and areas north of Euston Road where there is clear separation between a few highly-integrated and many more less-integrated streets.

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Table 3: Average values for segments within 800m radius and natural boundaries of Euston Station

Table 3 confirms the picture shown by the two maps. Lower values are shown in red, for ease of comparison. Since the 1880s average integration values for the Euston area have fallen consistently at all scales measured, reflecting the substantial restructuring of the street network behind the station.

Average choice values for the area also fell at all scales except for 3000m, where values increased by a factor of 1.2, in contrast with the decrease at this scale across the London during the same period. The Euston area appears to have become less well connected for through journeys during the 20th century, with the exception of those at a scale that passes through the neighbourhood entirely.
v) Choice and integration analysis – Waterloo Station
Figures 14 and 15 shows choice at 3000m around Waterloo Station. Waterloo Station was rebuilt, and greatly expanded, in the 1920s. Routes with high choice values pass to the front and sides of the station - York Road to the north-west and Waterloo Road to the north-east. Waterloo Station is
enclosed between through routes radiating from St. George’s Circus to four Thames bridges, main routes into central London.

It is clear from this map that the number of street segments in the area has reduced greatly since the 19th century. The background street network located between the main routes is almost entirely unrecognisable from the 1880s, remodelled and replaced across the areas behind Waterloo and only remaining intact in areas in front of the station. However, high choice value routes are the same as those highlighted on the 2014 map. The through routes around Waterloo remain essentially unchanged, although the introduction of large roundabouts both in front of and behind the station has coincided with reduced values on main roads.
Figure 16: Waterloo Station – Integration 800m (1880s), (© Crown Copyright/database right 2014. An Ordnance Survey/EDINA supplied service. ©depthmapX © 2011-2014, Tasos Varoudis)

Figure 17: Waterloo Station – Integration 800m (2014), (© Crown Copyright/database right 2014. An Ordnance Survey/EDINA supplied service. ©depthmapX © 2011-2014, Tasos Varoudis)
Figures 16 and 17 show integration at a radius of 800m, representing ‘to-movement’. This measure highlights the same main routes at the choice measure above, but also a selection of further, smaller streets as likely destinations. The neighbourhood centre is located to the east of Waterloo, between the front of the station and Blackfriars Road. The riverfront areas to the north and west, between Waterloo Station and the Thames, despite containing large cultural and tourist attractions, is not the centre of the area for local journeys. There is a concentration of mixed uses on Lower Marsh and The Cut to the west of Waterloo. In contrast, streets immediately behind the station, closest to the railway viaduct, have lower integration values.

The focus of local integration in the 1880s is in the same area as in 2014, around the junction of The Cut, Lower Marsh and Waterloo Road. However, integration values which were high on the whole of Lower Marsh in the 1880s are now reduced, and become lower the further the road moves behind the station. The presence of the station and its structures has led to a reduced significance for Lower Marsh as destination. Like Drummond Street it is now known for small, non-mainstream independent businesses, and is very different in character to streets in front of Waterloo. Meanwhile, the street segments further behind Waterloo, closest to the viaducts, have become much less integrated over the same period. On the ground observation finds them to be characterised by land uses that are not reliant on passers-by.

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Table 4: Average values, segments within 800m radius and natural boundaries of Waterloo Station

Table 4 shows averages for all segments within the neighbourhood of Waterloo Station. They show a decline in integration values across all scales, with integration values at 800m reduced by a factor of 1.4, slightly lower than the reduction of 1.66 for London as a whole. There is also a decline in choice values in the immediate Waterloo area, with choice at 3000m reduced by a factor of 2.1, greater than the overall decrease for London. As at Euston there has been an increase in choice values over the period only at one scale, but the increase is at 1500m rather than 3000m, by a factor of 3.2.

These findings potentially reflect the difference in station approach structures found at the two stations. While viaducts create a more substantial barrier close to Waterloo, they are associated with less of an impact on the integration of a wider neighbourhoods – perhaps because they are more permeable to the street network, with more crossing points under the railway lines. At Euston, the immediate streets are less separated from the station, but the cuttings appear to be associated with a larger area of lower integration.

The size of stations and station structure has increased since the 1880s, contributing to reduced local connectivity and making it harder to pass through both station areas. Reduced average integration values for the station neighbourhoods reflect increased separation between areas in front of and behind both stations, also potentially a consequence of greater railway barriers.

4. Conclusions
Analysis of the Euston and Waterloo Station neighbourhoods allows the street and space networks around the stations to be characterised, and comparisons made between the built form and spatial networks in the 1880s and 2014.

Choice metrics highlight the connected core of central London, and a sparser grid of main roads framing Euston and Waterloo. Local integration at 800m highlights “local core grids” (Hillier et al., 1993) which were strong in the 1880s and weaker by 2014. In the intervening period these grids have been eroded and disconnected, particularly in areas located behind both stations. In the streets behind both Euston and Waterloo Stations, integration values have fallen further than the average for the 800m areas around each station. The most integrated local centres are located in streets to the front of each station now, as they were in the 1880s. However, expansion of both stations has coincided with a reduction in integration values around each, meaning that areas behind both stations are less connected than they were 130 years ago.

As Euston Station has grown, connecting streets to the south of the station have been severed by the larger station structure, fragmenting the surrounding grid and creating a spatial contrast between the areas north and south of Euston Road. Enough remains of the street grid around Drummond Street to represent an integrated local sub-centre, but this too is currently scheduled for demolition during the 2020s.

At Waterloo, a grid of main streets is apparent at choice 3000m, consisting of main roads. However, integration at 800m reveals reduced likelihood of to-movement on streets behind the station, illustrated by the changed role of Lower Marsh within the local network, now a grid remnant similar to Drummond Street.

The neighbourhoods around the two stations are spatially distinct, and Hillier’s ‘negative attractor’ effect is apparent. The presence of large terminus stations in both creates apparent spatial effects, but to varying degrees. The street pattern has changed noticeably behind both stations, and remained relatively unchanged in front. Grids have been disrupted by the construction of estate blocks with the “inward-facing morphology” identified by Hanson (Hanson, 2000, p.10) and few through routes, in contrast to the dense networks of alleys present in the 1880s, particularly at Waterloo. These areas are separated from the station itself by railway lines. Comparing the two time periods highlights the extent to which neighbourhoods in front of and behind both stations have grown apart, following different development trajectories.

The spatial character of railway terminals in urban settings has been not been analysed extensively, nor over time, but it is important to do so to understand the places that have been created, and are being changed, by the presence of the railway. The roles and functions of railway stations have changed since the advent of the 21st century “Railway Renaissance” (Peters and Novy, 2012b) also described as “The Second Railway Age” (Hall and Banister, 1994). Railway stations and their surroundings have been “rediscovered as attractive sites for working, living, visiting and entertainment” (Peters and Novy, 2012b, p.6).

Railway stations are now “not considered merely as nodes, where people change from one form of transport to another, but also as places where spatial concentrations of high value activity are recognised as having a positive impact on cities” (Bruinsma et al., 2008). Station area redevelopment has become ubiquitous, particularly in Europe and the USA, where the expansion of high speed services and metros and the integration of transport services into station-based hubs, accompanied by the redevelopment of de-industrialised land, but a focus on “high value activity” implies comprehensive change for areas that have developed multiple layers and scales of activity over time, in response to their particular spatial and built character.

This analysis shows that the neighbourhoods behind the two case study railway stations have become less connected as terminals and railway lines have developed, and both are now spatially distinct from the central London areas immediately adjacent. Applying this analysis to the full set of London’s terminals will produce a complete picture of the spatial character and typologies to be found in London railway terminus neighbourhoods.
References


