

# A spatio-temporal study of fringe belts and urban green spaces in Birmingham, UK

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**Abstract.** *This paper examines the historical land-use development of part of an Edwardian fringe belt with particular reference to green space. It is based on detailed research on fluctuations in urban development patterns within a small area in Birmingham, UK. Comparisons are made between fringe-belt sites and residential areas over the past 100 years. The main findings are about changes over time in types of surface, especially in the relative amounts of hard and soft surface.*

*Keywords: fringe belt, green space, urban morphology, residential areas, Birmingham*

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Cities have tended to be treated by ecologists as essentially physical entities unconnected to the concerns of historical geographers. In contrast, urban morphologists have tended to focus on how urban physical expressions of culture have changed over time: such an approach has stimulated research on the characteristics and planning of the form of cities that has been largely divorced from concerns about ecosystem services. This is somewhat paradoxical in light of the significant areas of most cities that are vegetated and the increasing evidence of the value to society of these green spaces (Kazmierczak, 2013; Whitehand and Morton, 2004). The importance of green spaces within fringe belts is an especially noteworthy feature and is the focus of attention in this paper.

There are two main aims. The first is to introduce the historical backgrounds and land-use changes of a number of individual fringe-belt sites. The second is to present and discuss maps of the types of surface, notably soft and hard surfaces, on the sites. A particular concern in this respect is changes of green space

distribution over time, including variations over time and space in the pace of change.

There are two main types of change. The first relates to changes in the form of urban ecosystems, especially those relating to how trees, grass and water have changed. These are essentially changes in the soft-surface canopy. The second is the connection of ecosystems to human attributes. Many of the outcomes relate to hard-surface changes. These require consideration in various respects, including for their heritage value.

In the case of each site in the area of southwest Birmingham, UK selected for study, the following aspects are considered: first, the main visual (or landscape) characteristics of the site, particularly viewed historically; secondly, the types of changing green space distribution (including types of vegetation and the distinction between hard and soft surfaces) from 1915 to 2015. The main sources used to ascertain physical changes to sites were Ordnance Survey plans, aerial photographs and satellite images. The factors underlying the changes are explored, including changes

of land use related to the planning system, and changes of ownership and site occupation.

### **The fringe-belt concept and fluctuations in urban growth**

Fringe belts were first identified by Louis (1936), particularly with regard to their relationship to former fortification zones around cities. The fringe-belt concept was subsequently developed in much greater depth and breadth by Conzen (1960). The majority of research has been on fringe belts that developed spontaneously in association with various obstacles to urban growth, both over space and time. The most notable of these have been major lengthy slumps in housebuilding activity (Barke, 1974, 1976; Whitehand, 1967, 1972a, b).

Fringe belts have become recognized over recent decades as zones of predominantly extensive land use that have formed at the fringe of an urban area during a period of very slow outward residential growth (Whitehand and Morton, 2003, p. 819). A fringe belt has tended to form when the demand for land by housebuilders has been very low and land has been relatively cheap (Whitehand, 1994). A fringe belt tends to be heterogeneous in its plan, building structures, and land utilization (Whitehand and Morton, 2003, p. 819). Institutions, public utilities, recreational areas and allotment gardens are characteristic of its varied land uses. It is very different in character from a residential area – different both in its buildings and in its spaces. When residential growth resumes, the fringe belt becomes embedded (Larkham and Jones, 1991; Whitehand and Morton, 2003). House builders at this point tend to acquire sites beyond the fringe belt rather than develop sites within it. The fringe belt becomes a potentially significant consideration in planning (Hopkins, 2012).

Urban transformation and growth are in many areas creating major problems for the comprehension and management of urban landscapes (Adams *et al.*, 2015). Urban morphology provides a significant part of the

groundwork for meeting these challenges. The fringe-belt concept provides a framework for explaining the physical structure and historical development of urban landscapes (Conzen *et al.*, 2012).

The model of historical fringe belts, innovation and building cycles (Whitehand, 1994) has been shown to have wide relevance. Examples of studies include those of medieval fringe belts (for example, Conzen, 1960), the fringe belts of Falkirk (Barke, 1974) and the Edwardian fringe belt of Birmingham (Scott *et al.*, 2013, pp. 12–13; Whitehand and Morton, 2003, 2004, 2006). Birmingham's Edwardian fringe belt comprises a zone marking the edge of the built-up area between about 1910 and the early 1920s.

Whitehand and Morton (2004, p. 276) identify three main characteristics of fringe belts. These are: first, a low-density road network, with few radial roads (that is, running across the fringe belt), and hence low permeability for the movement of vehicles outward from the city centre; secondly, a high proportion of large, well-vegetated plots, a good many of which contain institutional buildings, often of architectural note; thirdly, the tendency to have morphologically distinct sub-areas. These characteristics are relevant in varying degree to the understanding, appreciation and planning of urban green space.

### **The relationship between historical aspects of fringe belts and green space**

Margaritis and Kang (2016) consider both 'radial' cities (Leicester, Sheffield, Nottingham, Coventry) and 'linear' cities (Bournemouth, Southampton, Blackpool, Brighton) in terms of land use and morphological characteristics. They draw attention to great changes that took place, particularly after the Second World War, in the urban structure of most major British cities. Over much the same period, public green spaces in British cities have become more actively considered (Margaritis and Kang, 2016, p. 175).

The green spaces of fringe belts have deep historical roots in many cities and cultures

(Whitehand, 1996). These spaces are key elements within fringe belts in the separation of housing areas of different morphological characteristics. A notable example of this in British cities is the green spaces that often separate high-density areas of terraced housing of the Victorian and Edwardian periods and the semi-detached housing of the garden suburbs of the inter-war years.

In post-war Britain, green belts, which have become a major feature of planning, have certain affinities with fringe belts. However, in regard to the significance of green space, their statutory role is quite distinct. Rarely has the significance that fringe belts have for planning been considered.

### **Birmingham's Edwardian fringe belt**

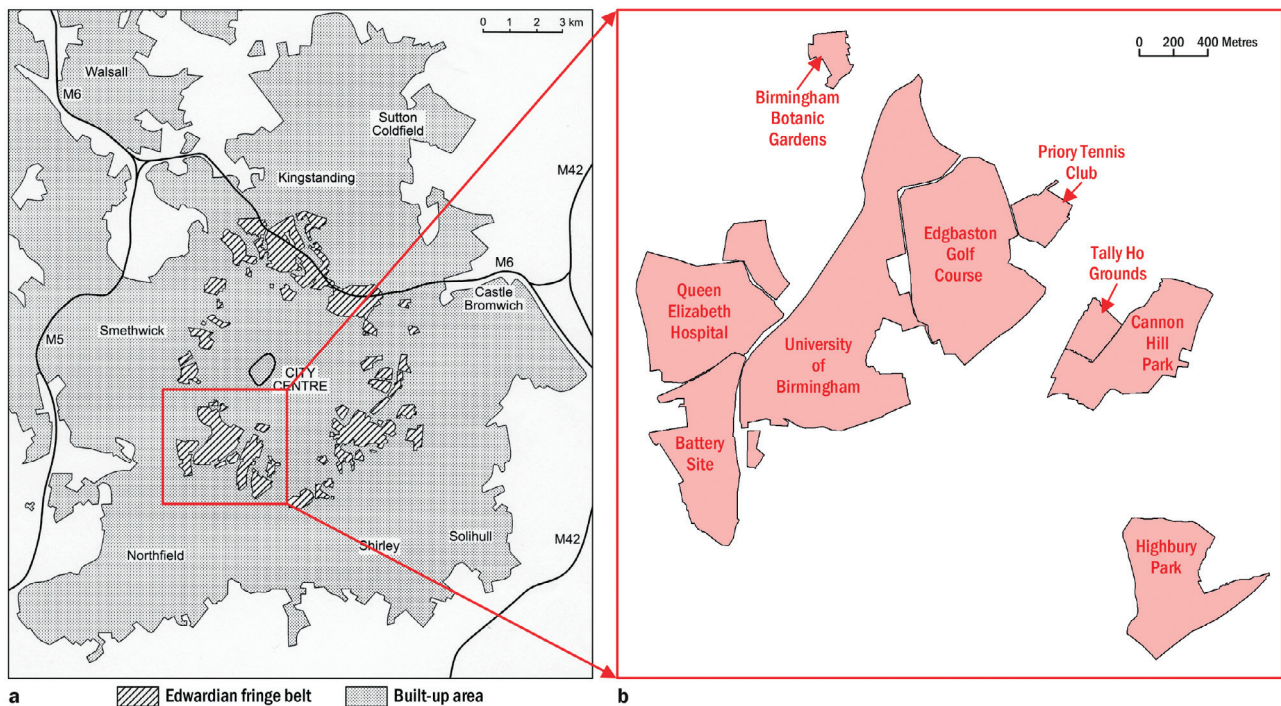
Birmingham's Edwardian fringe belt was so named because it underwent its most formative phase between the late-nineteenth century and the early 1920s, including the major slump in house building between 1910 and the early 1920s. The entire Edwardian fringe belt, including nine sites chosen for detailed study, is shown in Figure 1a. The fringe-belt sites were chosen in consideration of their representativeness of the south-western section of Birmingham's Edwardian fringe belt. Here the University of Birmingham and the Queen Elizabeth Hospital are major institutions. The Battery site includes a mixture of informal open space, vacant land, and land occupied by allotments. Representative of other major occupiers of space are Edgbaston Golf Club, two public parks (Cannon Hill Park and Highbury Park), a more specialized 'parkland' (Birmingham Botanical Gardens) and two sports clubs/playing fields (Edgbaston Priory Tennis Club and the Tally Ho Grounds).

There are considerable differences between the sites. The most marked of these are between the adjacent sites of Edgbaston Golf Club and the University of Birmingham. Such differences are to some extent inherent in the nature of the land uses involved. Aspects particularly evident in recent years in the case of the University of Birmingham were not just

its expansion into adjacent sites, including a tennis club and many adjacent Edwardian residences set in very large gardens, but also its incorporation of entirely separate sites, including green spaces for sport many miles distant at the present urban fringe. There was also much wider activity by the University in the south Birmingham land- and property-market and the spread of the University's influence into neighbouring sites where it has not become a landowner but its students occupy purpose-built accommodation run by other organizations. It would seem likely that such city-scale activity has in recent decades become characteristic of major institutions elsewhere. One might speculate that certain types of fringe-belt activity have intensified use and loss of soft surface 'built in' (that is, vigorous expansion is planned).

The fact that built forms tend to conform to morphological periods is well known. Less evident hitherto has been awareness of the conformity of the amount and nature of green space to the same sequence of morphological periods generally associated with built forms. The University of Birmingham is an example. On the original 10 ha site alone there are survivals today, albeit changed to varying degree, of green spaces characteristic of the Edwardian and inter-war morphological periods. These were followed by morphological periods when only minimal amounts of green space were incorporated: the late 1950s and 1960s, when the first ring road and tower blocks were constructed, followed by the most recent periods of first repletion by individual structures and then redevelopment.

Strongly related to the incidence of green space over time is the degree of formality with which green space has been configured. Again this has hitherto received little attention by urban morphologists. A number of significant considerations emerge from the sample sites investigated. The Priory Tennis Club and the Tally Ho Grounds were constrained by the straight boundaries of their sports areas. In the case of the University, its acquisition of both a country house park and later several large Edwardian residences were the basis for maintenance of essentially informal green



**Figure 1. a) Birmingham's Edwardian fringe belt in relation to the built-up area of Birmingham in 1995. b) Boundaries of 9 fringe-belt sites in Birmingham in 2015. Sources: Cities Revealed: high-resolution aerial photographic database, surveyed 4 May 1995, GeoInformation Group, Cambridge; OS plans surveyed in 2015; Google Earth Image, 2015.**

spaces on the sites derived from these earlier land uses, including an ornamental lake in the case of the former. However, the green spaces of the former country house park have been increasingly subject to reductions in their designed informality as pressure has built up for the adding of further buildings for student accommodation. As on the main campus, where pressure has increased for conversion of playing fields for car parking, designed green-space informality has been reduced over time (Whitehand, 1991).

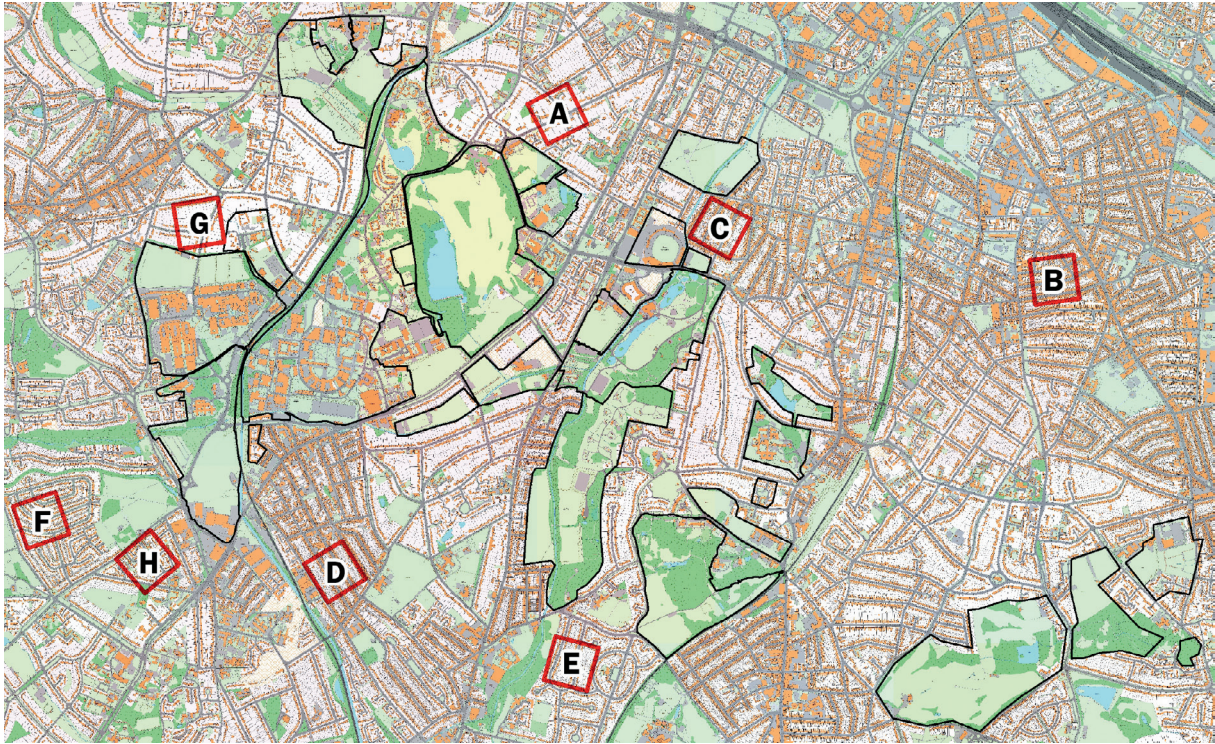
Where designed informal green space has survived to some extent, as for example in Edgbaston Golf Course, Highbury Park and Birmingham Botanical Gardens, conservation has in recent years been a factor, particularly where the work of noteworthy landscape architects has been involved. The survival of green space with a significant natural history, as in a very small part of the Battery site, is rare.

Just as the function of urban green infrastructure is highly dependent on its

built-environment setting, it is evident from the consideration of fringe belts so far, both in more general terms and in the consideration of individual sites, that to understand the significance of fringe belts within the wider urban structure entails examination of that wider framework, especially its physical composition. The most extensive part of that framework is its residential areas, and it is to these that the next section is devoted.

#### **Analysis at the micro-scale of sample residential areas**

Eight sample residential areas in south-west Birmingham were selected to be, as far as practicable, representative of house types constructed in south-west Birmingham over the period of a little over 100 years between the mid-nineteenth century and the early years after the Second World War (Figure 2). Most of them are fairly close to the Edwardian



**Figure 2. Edwardian fringe-belt sites and sample residential areas in part of south-west Birmingham. Sample residential areas are representative of (A) early-Victorian detached; (B) mid-to-late Victorian terrace; (C) mainly late-Victorian and Edwardian terrace; (D) mainly Edwardian terrace; (E) inter-war council; (F) inter-war detached; (G) inter-war semi-detached; (H) mainly 1960s flats and terraces. Source: OS plans of 1995.**

fringe belt, either closer to the city centre than the Edwardian fringe belt or a little farther out. Each is 250 m by 250 m in size. In terms of the principal house types of their original construction they are early-Victorian detached, mid-to-late Victorian terrace, mainly late-Victorian and Edwardian terrace, mainly Edwardian terrace, inter-war council, inter-war semi-detached, inter-war detached, and 1960s flats and terraces. Changes over time, concentrating principally on the various types of hard and soft surface, have been analysed so as to provide the basis for comparison with the fringe-belt sites already discussed. Four cross-sections in time have been examined. The dates chosen (1915, 1945, 1995 and 2015) have been influenced principally by the availability of cartographic and photographic information. Not all sources used correspond exactly to these dates. In particular, Ordnance Survey plans surveyed just

before the 1914–18 and 1939–1945 wars have been employed. The principal source for 1945 was an aerial photograph of that date, and for 1995, it was Cities Revealed high-resolution aerial photographic database, surveyed in May 1995. The types of surface that it has been possible to identify for all four temporal cross-sections are buildings, roads/footpaths/vacant land/parking (collectively the hard surfaces) and grass and tree-covered grass (the soft surfaces).

### **Fringe-belt sites and residential areas**

Despite the fact that fringe-belt studies have generally made a fundamental distinction between fringe belts and residential accretion, comparative examinations of the physical forms of these two types of urban areas have been relatively rare. Direct comparison

is made here of the samples of residential areas and fringe-belt sites in south-west Birmingham. Particular consideration is given to the configuration of plots, the changing character and distribution of green space, buildings and other hard surfaces, the influence on accessibility of different street patterns and forms of plot tenure, and variations in access to the benefits to be gained from green spaces.

### *Plot patterns*

The configurations of fringe-belt sites differ greatly from the plot patterns of residential areas. The contrast between the two types of plot in terms of size and shape is arguably one of the greatest contrasts in the layouts of cities, and south-west Birmingham is no exception (Figure 2).

Within south-west Birmingham, the plots within individual sample residential areas tend to be similar in shape and size: indeed within many areas the plots are practically identical in these respects. The fringe-belt sites, in contrast, are highly variable in size and shape. In terms of their shapes over time, they tend to have changed somewhat more on average than the plots in the residential areas. This greater variability of the fringe-belt sites is to a major extent a reflection of the greater variation in the types of activity being undertaken within them, for example whether it be as containers of types of sporting activity or types of institution. It also relates to the extent to which the movements and accommodation of people need to be catered for. Heterogeneity is inherent in the very character of fringe-belt land and building uses. While it is also the case that no two houses and their gardens are identical, the range of practical possibilities for physical structures and the contents of any attached green spaces, particularly in private gardens, tend to be considerably less. Added to this source of difference there is the almost invariably significant difference between the ways in which fringe-belt sites and residential areas are maintained and, more often than not, brought into existence.

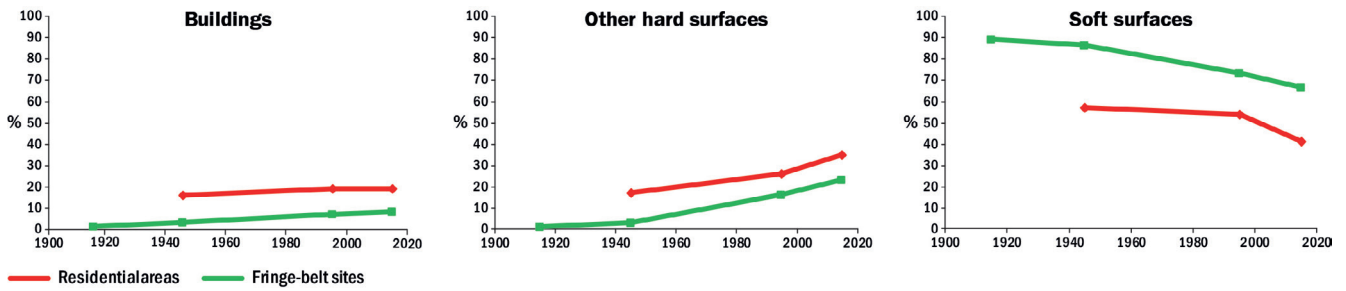
While much attention has been given to the conditions that favour the creation and continued existence of fringe belts, these belts are also different from residential areas in major ways that have, or should have, a bearing on their treatment in planning, not least in relation to their role as green spaces. Even many of the privately-owned fringe-belt sites by virtue of the extent of their frontages onto public roads tend to provide greater ecosystem services than most residential areas.

### *Types of surface*

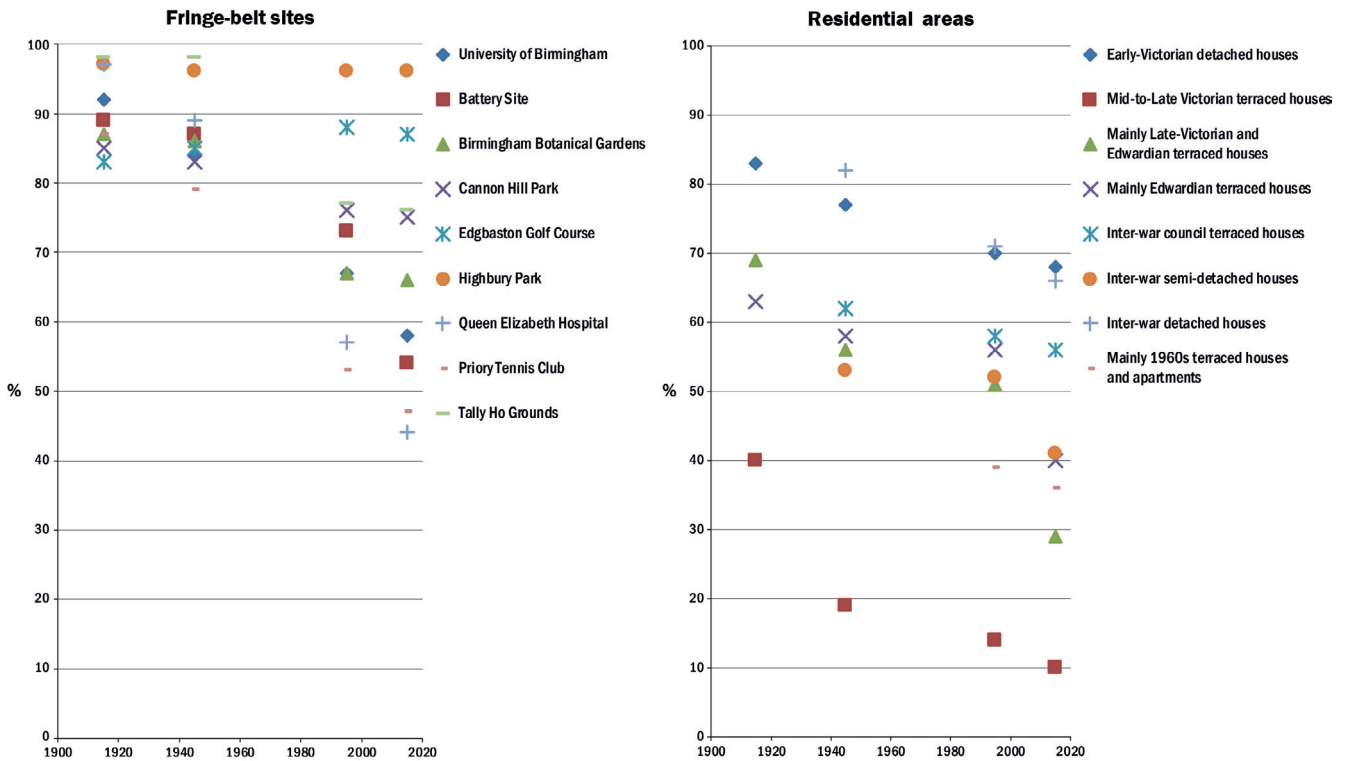
Graphs comparing the samples of fringe-belt sites and residential areas in respect of the median percentage of their areas covered by buildings, other hard surfaces and soft surfaces reveal the increasing amount of hard surface over time (Figure 3). Significant amounts of water exist only on the fringe-belt sites. However, the pressure on land, particularly related to the construction of other hard surfaces, is especially evident in the residential areas between 1995 and 2015. By far the most important component of this is the covering over of front gardens by hardstanding.

Between 1945 and 1995, the median percentage of other hard surfaces rose only slowly in residential areas, from about 17 per cent to about 26 per cent. However, in the case of the fringe-belt sites, there was an increase from about 3 per cent to about 16 per cent. Between 1995 and 2015, the median percentage of other hard surfaces in residential areas increased from about 26 per cent to about 35 per cent. The corresponding increase in the case of fringe-belt sites was from about 16 per cent to about 23 per cent. Variability between residential areas was small by comparison with that between fringe-belt sites during both 1945–95 and 1995–2015.

Figure 4 shows the change in the percentage of soft surface for each fringe-belt site and each residential area. Of the fringe-belt sites, Highbury Park had a very slight decrease in soft surface between 1915 and 2015, and Edgbaston Golf Course actually had a slight



**Figure 3. Median percentage of area covered by different surfaces.**

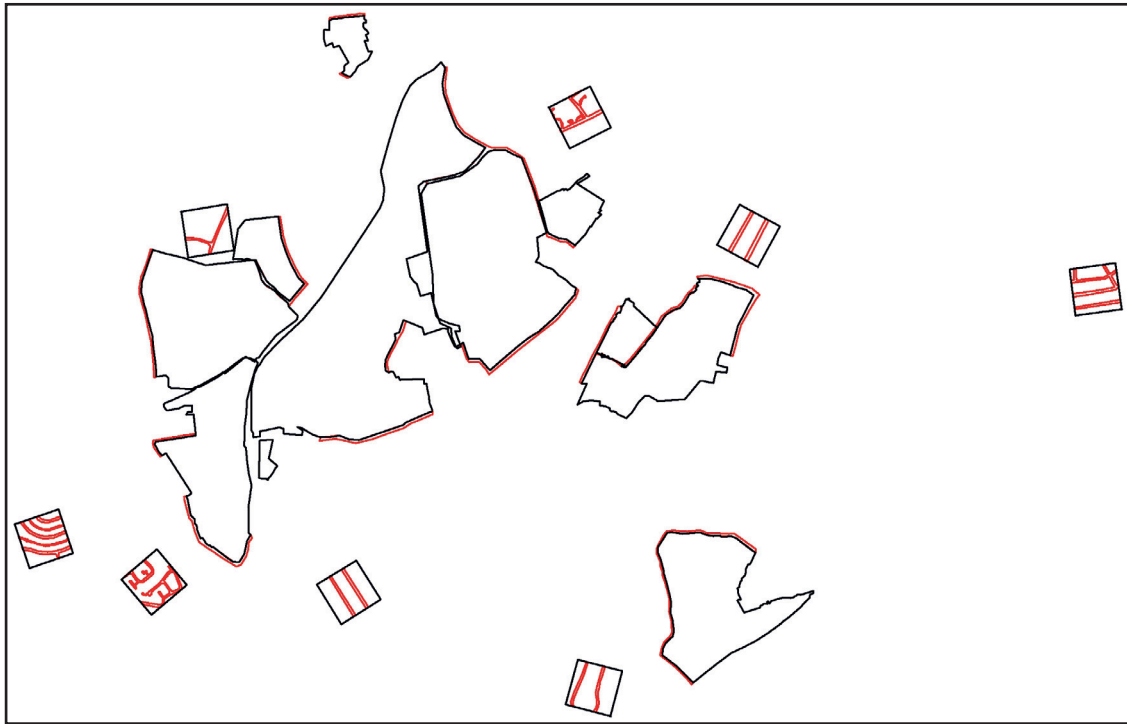


**Figure 4. Percentage of soft surfaces in fringe-belt sites and residential areas, 1915–2015. Sources: OS plans, 1915, 1945, 1995, 2015; aerial photograph, 1945; NERC image, 1995; Google Earth image, 2015.**

increase. At the other extreme, the decrease in the case of the Queen Elizabeth Hospital was from 97 per cent to 44 per cent. In the case of the residential areas the greatest decrease between 1915 and 2015 occurred in the area of mainly late-Victorian and Edwardian terraced houses (from about 69 per cent to about 29 per cent). The smallest decrease in any of the residential areas between 1945 and 2015 was in the area of inter-war council terraced houses. Before 1945, not all types of houses

are shown in Figures 3 and 4 because some types had not been built by then.

Fringe-belt sites show either little change in their amounts of soft surface (for example, Highbury Park and Edgbaston Golf Course) or accelerating loss. The pattern of loss can be described as exponential, with different time constants depending on the use of the site. Residential sites, in contrast, have roughly linear trends (all with much the same gradients) in their loss of soft surface, though starting



**Figure 5. Public roads (in red) in relation to sample fringe-belt sites and residential areas.**

their existence with smaller percentages of soft surface than the fringe-belt sites. Loss of soft surface in residential areas might therefore be seen as more predictable at least until such point as the soft surface area becomes very small.

#### *Street patterns, accessibility and property ownership*

The streets have different alignments in the residential areas from those bordering the fringe-belt sites. For instance, the streets in the residential areas tend to follow regular patterns, rectilinear or curvilinear. However, in the case of streets bordering the fringe-belt sites their alignments are irregular, often having been strongly influenced by the pattern of rural roads that existed before urban development occurred (Figure 5).

Except for council houses, the ownership of the majority of residential plots is private and, even where it is not, access to the green space of residential gardens is generally limited to the occupiers of the houses. As the houses are

individually owned, the back gardens of the houses cannot be accessed without permission of the owners. Many fringe-belt sites in contrast are either publicly owned, notably public parks, or in some cases of private ownership, such as the University of Birmingham, effectively provide a considerable measure of access to, or at least views of, many of the green spaces. Due to the differences in ownership and accessibility, different groups of people can benefit from accessing green spaces in different ways. The green space coverage in public institutions is more open and is thus beneficial for more people.

In relation to local intra-urban accessibility, fringe belts tend to limit accessibility by vehicles, in that public roads across fringe belts tend to be much fewer than those through residential areas.

#### **Conclusion**

A detailed comparison over time of a section of fringe belt with the residential accretions on either side of it has been provided.

Birmingham's Edwardian fringe belt has for many decades been embedded within the growing urban area and has become a potentially important, but insufficiently recognized, element in planning. Although each fringe belt is a product of human culture specific to a time and place, the fringe-belt concept provides a more general frame of reference.

Of the various findings described in the paper, the most important is the contribution made to filling the major research gap between the historical development of urban form and the nature and distribution of different types of green space. Both the fringe-belt sites and the residential areas have reduced coverages of soft surfaces over the 100-year study period, but the reductions are greater in most of the residential areas. The percentages of soft surface remaining in these areas are on average substantially less than on the fringe-belt sites. However, the sample sizes examined are relatively small and similar research needs to be undertaken over larger areas and in more cities, including in different cultural areas.

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