POTENTIAL FOR CARFREE DEVELOPMENT IN THE UK

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Abstract

This paper aims: to propose a definition and typology of carfree development, to assess the benefits and problems associated with it, to assess the potential demand for 'European style' carfree housing in the UK and the circumstances under which it might be feasible in the UK.

Through a review of the literature and study visits to European carfree areas, 3 types of carfree development were identified: the Vauban model, Limited Access model and pedestrianised city centres with substantial residential populations. The study visits supported the claims that carfree developments help to reduce problems created by concentrations of traffic in urban areas. They facilitate active travel and independent play amongst children. Their main problems relate to parking management, although increasing controls in surrounding areas were helping to address this.

To assess potential demand in the UK, two surveys were conducted: an online national survey aimed at members of environmental and cycling groups and a postal survey in Camden, London, followed by qualitative telephone interviews with a subset from both surveys. The findings revealed that potential demand for carfree housing is concentrated amongst 'Carfree Choosers' – people who currently live without cars by choice. These are mainly found in the inner areas of larger cities, where the greatest potential for carfree development exists. Some potential may also exist in suburban or exurban centres, where these are well served by multiple public transport connections, including rail.

1. Introduction

Carfree development is a relatively recent response to long-standing concerns about the effects of motor vehicles on the urban environment. Until the Second World War, in the UK, as in most of Western Europe, the growth and spatial pattern of settlements were constrained by the need of most people to travel by public transport or non-motorised means. The rise in car ownership in Britain, which began after the end of rationing in the 1950s, has continued almost without interruption until the present day. As the growth has continued, the car and motor traffic have been blamed for: consuming land in a way which damages the fabric of cities (Crawford 2000), weakening community cohesion (Appleyard, Lintell 1972), removing local choice and destroying local services (Sloman 2006), causing the social exclusion of groups unable to drive (ODPM 2003), restricting the freedom of children (Timperio, Crawford et al. 2004), worsening air pollution (RCEP 2007), climate change (CfIT 2005) and obesity (Frank, Andresen et al. 2004) to list just some of the negative externalities which research has identified. The proposition that increasing car ownership and use creates particular problems in urban areas has been largely accepted, although no such consensus exists on the appropriate policy responses.

Amongst the many proposals advanced to address these problems some have advocated carfree development (Crawford 2000, Reutter 1996), although it has occupied a relatively

marginal place in this debate so far. Since its beginnings in Germany in the early 1990s, several examples have been built across Northern Europe, six of which were visited during the course of this research. Amongst the limited body of existing literature, previous writers have struggled with definitions. In the UK the term 'car free'[1] housing is frequently used to mean housing with no allocated parking, usually on conventional streets open to traffic. European carfree developments usually incorporate some parking on the periphery of a residential area free from traffic.

Section 2 to 4 of this paper will review the literature on carfree development, and carfree living in the UK. Section 5 will propose a typology encompassing the different forms of carfree development found across North-western Europe, and a new definition for the UK based on this. Section 6 will find support for some of the claims made about the potential benefits (and also some problems) of carfree developments. Sections 7 to 9 will assess, through primary research, the potential demand for 'European style' carfree housing in the UK. The final section will assess the policy implications of the findings.

2. Carfree Developments in Europe

The broadest study of European carfree developments was conducted by Scheurer (2001) who surveyed five in Freiburg, Hamburg, Vienna, Amsterdam and Edinburgh and also discussed ongoing projects in Hamburg and Cologne. Apart from Slateford Green in Edinburgh, all allowed some peripheral parking, which enabled between 8% and 54% of the households to continue owning cars. Car use was lower, varying between 5% and 16% of trips (excluding one very small development with higher use). The residents were generally characterised by high levels of environmental awareness, high numbers of children and service sector professional employment. Five of the developments surveyed by Scheurer were visited during the course of this study, including Vauban, the largest, with over 5,000 residents in around 2,000 dwellings, mainly flats.

Although sometimes described as carfree (*autofrei*) many Vauban residents resist the term: Freiburg City Council describes most of the district as *stellplatzfrei* literally 'free from parking spaces'. Vehicles are allowed down the *stellplatzfrei* streets at walking pace to pick up and deliver but not to park. Residents must sign an annual declaration of car ownership with car owners obliged to purchase a space in peripheral multi-storey car parks. The planned parking capacity was 0.5 per dwelling. Scheurer and Nobis (2003) found just over half of households owned a car, but today, many of the parking spaces are unused. Nobis (2003), found that 57% of the households without cars had given them up on moving there, although she did not explore the reasons for this. The cost of the parking spaces (€ 17,500 in 2006, plus a monthly fee) provides one explanation, but some residents retain ownership of spaces for visitors or re-sale reasons, although they do not own a car themselves.

The other recent developments described as carfree elsewhere in Europe are smaller. Four others visited in: Hamburg (two), Cologne and Amsterdam varied from 64 to 600 dwellings. All were built at relatively high densities: all flats in Amsterdam and Hamburg, mainly flats with some terraced houses in Cologne. They all have less peripheral parking than Vauban – ratios varying from 0.15 to 0.23 – and varying arrangements to physically control the access of motor vehicles to the residential areas. In some of the smaller developments, vehicles are able to park close to the building entrances. In some of the others, such as Stellwerk 60 in Cologne, managing organisations control exceptional access to the site. This may be termed the 'Limited Access' model of carfree development

[1] Although the spelling of the terms is often inconsistent, UK documents tend to separate (car free) or hyphenate (car-free) the adjective. The spelling 'carfree' is used in this paper to differentiate the European style of development.

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All of the above analysis refers to new developments. A literature search failed to produce any examples of the removal of cars and vehicular access to a comparable extent from existing residential areas. Many cities in Europe, including the UK, have pedestrianised city, town and district centres. Although some include some residential properties, most are mainly commercial in nature and the focus of the literature on pedestrianisation mainly reflects this. One exception is the centre of Groningen in the Netherlands (Tsubohara 2007, Ligtermoet 2006) with 16,551 residents (Gemeente Groningen 2008), which was also visited.

In 1977 the City Council decided – despite initial opposition from retail businesses – to divide the centre into four segments, effectively closing it to through traffic. Since then, the process has been progressively extended (with the support of businesses in recent years). Today roughly half of the centre is entirely pedestrianised. These streets are mainly commercial in nature but do have some residents. In some streets, cars are allowed at limited times: there are no through routes for private motor vehicles. Car ownership in the centre is 28.7 per 100 residents (Gemeente Groningen 2008). There are just 2,560 parking spaces for the residents.

Figure 1 *stellplatzfrei* street, Vauban, Freiburg

Figure 2 Access to Stellwerk 60, Cologne

3. Carfree and Car Dependent Development in the UK

Unlike some of the other European countries, national planning policy in the UK has been relatively favourable to carfree development, although the definition of 'car free [1]' is generally the limited one of no allocated parking. There has been one recent exception to this. In 2007 the UK Government announced a programme to build up to ten 'eco-towns': smaller new settlements of between 5,000 and 10,000 dwellings (DCLG 2007). The transport guidance for the eco-towns aims to "equal or better the share of sustainable modes achieved in the most sustainable European communities" (TCPA, DCLG 2008). It recommends that carfree areas (defined in a similar way to Section 5, following input from the author of this paper) should form "a substantial proportion" of each eco-town.

All of the recent European examples have been built within existing cities, which raises questions about whether the concept can be transferred to smaller new developments. Smaller ex-urban developments, including some which were purportedly designed with sustainable transport objectives, have some of the highest levels of car ownership and use in the UK. Five recently-built urban extensions (to Bristol, Milton Keynes, Braintree, Bracknell

and Luton) were examined using census data, along with two research studies of Poundbury (Becker 2006) and Cambourne (Platt 2008). These examples showed between 92% and 98% of households owning cars, with cars accounting for between 71% and 83% of trips. The census analysis showed that demographic differences (more home owners and employees, fewer single people, pensioners and students) accounted for some but not all of the higher than average car ownership of the five urban extensions: within each demographic category, car ownership was still higher than average. These findings illustrate the scale of the transport challenge for eco-towns and other attempts to build sustainably in ex-urban locations.

The planning policies of several local authorities, particularly in London, have promoted 'car free housing' but not carfree developments as defined in this study in the inner areas of some existing cities. More recently, there have been some small developments with limited parking, again, usually in city centres, which provide some separation from traffic, so could be considered carfree. The recent redevelopment of Exeter's pedestrianised commercial centre, for example, included 120 apartments with just 23 parking spaces, and no direct vehicular access. The only British carfree development studied in the literature was Slateford Green in Edinburgh a 120-dwelling social housing development built around a private courtyard with no parking. The tenants are allocated from a general housing list, on the same basis as any other housing (personal correspondence, Fergus Allen, Dunedin Canmore, December 2005). Eastwood (2008) found, not surprisingly, some problems with overspill parking, but car use there was still very low: 10% of all trips.

4. Carfree Living in the UK

Although there is no specific evidence relating to carfree *development* in the UK, there is a significant body of evidence on carfree *living*. Car ownership remains strongly correlated with income, despite recent rises amongst lower income groups (from: DfT 2007). Single people, pensioners, tenants, students and lone parents are all disproportionately represented amongst households without cars. Car ownership is strongly associated with life stages, typically increasing with children and reducing after retirement (Chatterjee, Beecroft et al. 2001). It tends to be lower in inner urban areas, particularly in London, where public transport is better and parking more difficult.

In a study of attitudes towards driving in Scotland, Dudleston et al (2005) segmented car drivers into four, and non drivers into three clusters. Two groups are particularly relevant here. "Car sceptics" (10% of the sample) are positive non-drivers who cycle more, but interestingly use buses less, than average. They tend to be younger, with high environmental awareness and their income levels were higher than those of other, more reluctant non owners of cars. "Aspiring environmentalists" (16%) are drivers who tend to find driving stressful and are most open to modal shift, cycling and using buses more than the average. They tend to be from higher social classes, younger than the average, with more women.

From Reutter (1996) it seems the profile of non-car owners in Germany is similar to the UK, with a preponderance of older people, single people and households without children, particularly in the inner areas of larger cities. The residents of the European carfree areas are clearly very different. They appear to share some characteristics with Dudleston's 'car sceptics' and 'aspiring environmentalists': younger with high environmental awareness, cycling and walking frequently but making surprisingly little use of public transport.

This analysis suggested three factors relevant to the discussion below about potential demand for carfree housing in the UK: environmental attitudes, inner city locations and the relationship between income and car ownership.

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5. Definitions of Carfree

There are many areas of the world where people have always lived without cars, because no road access is possible, or none has been provided. The term carfree *development* implies a physical change: either new building or changes to an existing built area. There have been two recent attempts to define carfree development. Morris et al (2009) propose a typology with three categories : car-free, visually carfree and low-car. Heller (2008), includes these and two others: residents only areas, and *stellplatzfrei* following the Vauban example.

All of the proposed definitions are problematic. Including 'low car' as a form of carfree development would seem a contradiction in terms, although the distinction between low car and carfree developments is far from clear. Underlying these, and the limited UK definition of 'car free' are two different concepts i.e.:

- residential (or mixed use) areas from which vehicles are excluded, and/or
- housing where people live without owning a car

The UK definition ignores the first concept and assumes that parking restrictions will achieve the latter. Most of the European examples exhibit some element of both, although neither is absolute: exceptions are made in all the cases studies, which makes the distinction between carfree and low car developments one of judgement rather than absolute differences. This study proposes a definition and typology based on continental European practice, reflecting both concepts but recognising that there is an element of circularity in this process: the examples studied were those which have been described as carfree in the literature or by practitioners.

The **three types** of carfree development described above were:

- Vauban model
- Limited Access model
- Pedestrianised centres with residential population

A **definition** encompassing these three types would need to identify the key elements shared by all three but not by other forms of development. There are three factors which, though not unusual in themselves, are combined in all three models.

Carfree developments are residential or mixed use developments which:

- Normally provide a traffic free immediate environment, and:
- Are designed to facilitate movement by non-car means, and:
- Offer no parking or limited parking separated from the residences.

The term 'traffic free' is qualified to reflect the observations about Vauban. The parking separation and particularly the 'traffic free' criteria imply a certain scale to be meaningful. This scale would vary according to specific local circumstances; so again, judgement would need to be exercised.

6. Benefits and Problems of Carfree Development

Studies of European carfree developments provides some evidence that they do help to address some of the problems mentioned earlier, although there are some gaps (in respect of ultimate outcomes, such as health, for example) which would justify further research. All of the studies found low levels of car ownership and use and several found evidence that this represented a change for these households. Scheurer found proportions varying from 10% to 62% of households had reduced their car ownership since moving to the carfree developments. Ornetzeder et al (2008) found 50% of male and 30% of female residents had previously owned a car, in Vienna's Florisdorf development, where no parking is provided (only one resident admitted to continuing to own car contrary to the rules of the scheme).

41% of respondents said they were "using the bicycle much more than before". It is of course, possible that other factors influenced these changes: most of the carfree developments are in accessible urban locations. None of the three studies appear to have explored how they compared in this respect to the respondents' previous homes.

Ornetzeder et al found residents of the carfree development had a lower overall carbon footprint than those of a reference settlement nearby. They also found residents of the carfree project had more friends and acquaintances within the settlement. than those of a reference settlement nearby. Nützel (1993) found that children were allowed to play out on the carfree streets of Nuremberg-Langwasser at a younger age than on conventional streets nearby. This was consistent with the observations of considerable autonomy for young children in the developments visited during this study.

The main problems of carfree developments identified by several of the studies, and interviews with stakeholders during this research related to parking and the control of vehicular access. Where parking was already controlled in the surrounding area, as in GWL Terrein, parking management did not appear to pose any particular problems. In Cologne, controls were being extended to surrounding streets to address a perceived problem of overspill parking. Around Vauban, which borders a lower density suburban area without controls, overspill parking remained a perceived problem.

7. Potential Demand in the UK

Having established a definition, and found support for at least some of the benefits claimed, the study then posed the question: could the concept be expanded in the UK? This question would depend upon a number of factors relating to: potential demand for carfree housing, potential supply and public policy. There are research gaps in all of these areas – too many for one study to address. Two formal interviews and several informal discussions with developers suggested that scepticism about potential demand for carfree housing amongst private buyers is a significant barrier to carfree development in the UK. It was decided to focus on potential demand: who are the people **who might be attracted to live in carfree developments and under what circumstances?**

The literature on European carfree developments provides a range of information about the characteristics – demographic, economic, behavioural and attitudinal – of their residents. These show certain patterns, as discussed above, but none of these factors, individually or in combination, were unique to residents of carfree developments.

If the potential market cannot be directly identified by observable characteristics, the question may be considered from a different perspective: do any observable characteristics act as pre-requisites for moving to a carfree development? A defining feature of carfree developments is that a large majority of residents do not – and would be unable to – own cars. With the exception of Slateford Green, most residents have consciously chosen, for whatever reason, to move to a development regarded as a departure from normal practice; some of them have given up car ownership to do so. This suggests two principal groups amongst whom potential demand may be found:

Carfree Choosers: people who currently live without a car by choice

Carfree Possibles: people who currently own a car but would be willing, and able, to give it up under certain circumstances

In seeking to distinguish these groups from the rest of the population, three characteristics are relevant: car ownership, attitudes towards it and (for the car owners) ability to give up car ownership. From these three characteristics, six possible groups, encompassing the entire adult population, may be defined, as shown in Table 1:

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Possible Groups		Car Owner	Desire to Change	Ability to Change
Carfree Choosers*		No	No	N/A
Carfree Possibles*		Yes	Yes#	Yes#
Other Nonowners:	{Aspiring Owners	No	Yes	Yes#
	{Constrained Nonowners	No	N/A	No
Other Owners:	{Determined Owners	Yes	No	N/A
	{Dependent Owners	Yes	N/A	No
*target groups		# under at least some circumstances		

Table 1 Possible Groups Related to Car Ownership, Desire and Ability to Change

As the study focussed on the two 'target groups' the remaining four groups were combined as shown, for the analysis. The definition of the Carfree Possibles raised a question about seriousness of intent, particularly where this might involve overcoming constraints. This was addressed by the addition of a further criterion: that the individuals had already given up car ownership in the past and subsequently reacquired a car.

Following the European evidence **it was decided to test the hypothesis that Carfree Choosers and Carfree Possibles would be more likely than the others to choose living in a carfree development.** The hypothetical nature of this question posed a methodological challenge for the study. Various methods were considered, including stated preference techniques. Such techniques suffer from various problems of bias (Kim, Pagliara et al. 2005) and ultimately offer no particular resolution to the problems of hypothetical questioning. As the aim here was not quantification of a choice, a more straightforward method was chosen, involving a first stage of questionnaire surveys, which would seek volunteers for a second stage of qualitative interviews to explore motivations and causality in more depth. To address the challenges associated with hypothetical questions, the questionnaires were structured to enable cross-referencing of questions concerning actual behaviour and future intentions – both hypothetical and more concrete.

Following Lanzendorf's (2003) concept of mobility biographies, the questionnaires were designed to provide some biographical housing and transport information, against which the responses to a hypothetical question about moving to a carfree neighbourhood could be assessed. These were followed by qualitative telephone interviews of a sub-sample from each of the surveys, aiming to elucidate the respondents interpretations' of the questions and to probe the hypothetical responses.

Resource constraints precluded a representative national survey, so it was decided to focus on populations expected to contain high concentrations of the target groups. The following surveys were conducted during 2007:

- An online national survey of members of environmental and utility cycling organisations
- A random postal survey of Bloomsbury and Kings Cross wards in Camden, London

Following the analysis above about environmental attitudes, and the importance of cycling in the European carfree areas, it was hypothesised that high proportions of the target groups would be found amongst members of the above organisations in the UK. To reflect the locational influences on car ownership, it was decided to supplement this with a geographically defined sample. Bloomsbury and Kings Cross wards were chosen as they

have some of the lowest car ownership in the country (32% and 34% of adults – 2001 Census) coupled with median household incomes above the national average and high proportions of home owners without cars (56% and 52%). It was hypothesised therefore, that these areas would contain high proportions of the Carfree Choosers in particular.

8. Survey Findings

932 people responded to the online survey. Two thirds of these came from cycling organisations, particularly the CTC (the UK cycle touring organisation), producing a sample weighted towards males (67%) and the 40--59 age group (52%). Median household income was above average: nearly £40,000 – from banded responses – compared to a national median of £27,000 (DMAG 2006). 78% were home owners – slightly above the national level. Three quarters lived in towns or cities. Single person households (16%) were under-represented. Car ownership was slightly lower than the national level (79% of respondents had a car in the household): the proportion with more than one car (32%) was significantly lower.

Although the categories relating to travel behaviour were not directly comparable with national statistics, the respondents clearly drove less than average (25% drove most days) and cycled considerably more (56% on most days) – this was true of the 'environmentalists' as well as the cycling members.

199 (9%) of the 2200 Camden questionnaires were returned – a low return rate typical of postal surveys in Inner London. Single person households, social tenants and the under 29s were all somewhat under-represented. In terms of gender, income (median around £30,000) and car ownership (67% without) the sample was close to the census and Greater London Authority (DMAG 2006) figures for the two wards. The pattern of low car use (6% drove most days) and high public transport use (34% used buses most days) was as expected for Inner London.

Non car-owners who ticked "I live without a car by choice" in the surveys were classified as Carfree Choosers. Drivers who ticked "I would live without a car if circumstances changed" and who had also lived without a car in the past, were classified as Carfree Possibles. Their proportions were as follows:

	Online Survey			**Camden Survey**	
Carfree Choosers	221	(25%)		104	(52%)
Carfree Possibles	212	(24%)		10	(5%)

Table 2 Proportions of Target Groups in the Two Surveys

In Camden, car ownership was low, public transport and accessibility were relatively good, so the small proportion of Carfree Possibles was expected. Comparing the two target groups with the rest of the sample was most illuminating within the online survey, where the large sample revealed more statistically significant associations (differences referred to here are significant at the 95% level unless stated otherwise). To some extent they reflected more general differences between car owners and non-car owners, although this was not always the case, particularly when considering preferences.

20 of the online respondents and 9 of the Camden respondents, including 18 Carfree Choosers and 9 Carfree Possibles, were selected for follow-up telephone interviews.

Carfree Choosers

Compared to the rest of the online sample, the Carfree Choosers were younger (51% under 40) with a higher proportion living in single person households (27%). Their self-reported incomes were slightly lower than the rest of the sample, but significantly higher than the Other Nonowners and (although comparisons of this nature are problematic) seemed similar to the general population. Fewer had children (20%); more of them were renting (38%) although most (56%) were home owners.

There were fewer statistically significant associations in the Camden survey due to its smaller sample size and greater homogeneity. Some associations (age, income, household structure) exhibited the same signs but the magnitudes were smaller and the differences were not statistically significant.

61% of the Carfree Choosers cited environmental factors as a principal reason for not owning a car. When asked about this in interview, some explained how these reasons had evolved over time. Their accounts appear consistent with Jain's (1998) hypothesis that 'going carfree' may contribute to environmental awareness.

The Carfree Choosers from the online survey rarely drove (76% never), travelled less as car passengers (72% occasionally), cycled more (64% most days) and used all forms of public transport more than the rest of the sample. In Camden the Carfree Choosers also rarely drove (78% never). Public transport use was generally high across the Camden sample, so differences were not statistically significant.

Both trains and buses appeared important for the Carfree Choosers, in different ways. From the online survey, whereas more used buses (39%) than trains (35%) regularly (most weeks or most days) the proportion who never used a bus (7%) was higher than the proportion who never used a train (3%). Compared to the Other Nonowners, they cycled more and used buses less, suggesting a degree of substitution between these two.

11 of the 19 Carfree Choosers interviewed mentioned proximity to a station as a factor in choosing where to live. Proximity to bus services was mentioned by several respondents but there was only one suggestion that this might have been a factor in deciding where to live. As most of the Carfree Choosers lived in larger urban areas, proximity to regular bus services may have been regarded as a 'given'.

91% of the online Carfree Choosers lived in towns or cities. Their attitudes to their existing neighbourhoods and towards future house moves both reflected urban preferences. They preferred to live in areas well served by public transport (60%), close to shops and services (44%) and town or city centres (36%). They were also more likely to favour living in flats or terraced houses: 95% would prefer or consider one or both.

40% of the Carfree Choosers stated that they would like to live 'near the countryside'. When followed up in the interviews, a move to a smaller town was suggested by several as one way of achieving this. Several of the Carfree Choosers recognised a conflict between this preference and the proximity and transport connections which were important to them. Some believed that they might be obliged to acquire a car later in life, for example:

> "..,if I decided to get married and have kids and move out to the suburbs – then you need a car to ferry them around..."

Carfree Possibles

Compared to the Carfree Choosers, the online Carfree Possibles were: older (66% over 40), had higher incomes (66% over £30,000), were more likely to be living in a family (52%), with children (42%) and working full-time (67%). 23% of them lived in rural areas in detached (26%) or semi-detached (35%) houses, mainly (84%) as home owners.

They drove more than the Carfree Choosers (19% on most days, 43% occasionally) but less than the Other Owners (and less than the general population).

They cycled more than the Other Owners and almost as much as the Carfree Choosers (62% on most days). They used trains more (10% on most days) than the others but less than the Carfree Choosers. Their infrequent bus use (4% on most days) was not significantly different from the Other Owners. Their attitudes towards public transport were not as positive as the Carfree Choosers. Infrequent, unreliable and uncoordinated bus services, indirect routes requiring changing, and living some distance from the nearest railway station were all mentioned as reasons for continuing to own a car.

The questionnaires asked the Carfree Possibles: "what changes would be necessary for you to live without a car". The top reasons identified in the online survey were: improved public transport where I live (47%), changing circumstances of my family or spouse/partner (37%) or moving to a different place (25%). The interview explanations were generally consistent with their questionnaire responses, but none of the Carfree Possibles gave the impression that those circumstances were likely to change in the foreseeable future. Long periods of car ownership would seem to make such a decision more difficult or less attractive. But all of this group and nearly half the Carfree Choosers had changed their car ownership status at some point in their lives, generally linked to significant life changes. Some of these changes, such as having children, are associated with car acquisition; others such as moving to a new area for a new job or course of study might be associated with either acquisition or giving up a car.

Attitudes to Carfree Neighbourhoods

The questionnaires asked about future moving intentions. Those who indicated that they might move in the future were asked whether they would consider moving to a 'European style' carfree neighbourhood, if one were built in this country. The responses were:

Survey – Groups	Keen – would even move some distance	Would Consider if convenient
Online – Carfree Choosers	24%	65%
Online – Carfree Possibles	14%	70%
Online – Others	5%	54%
Camden – Carfree Choosers/Possibles	6%	48%
Camden – Others	2%	39%

Table 3 Target Group Attitudes to Carfree Neighbourhoods

In the online survey, both the Carfree Choosers and Carfree Possibles were, as hypothesised, more positive than the other groups. In the Camden survey the differences were not statistically significant.

The interviews probed the reliability of the responses to these questions. Some of the interviewees had experience of carfree areas from overseas; some had read magazine articles about them but in most cases the concept needed to be explained. The Eco-towns were mentioned to help illustrate the type of choices which might become available in the UK.

When pressed, most of the 'keen' group revealed factors particularly related to work or family which would constrain their ability to move to other places. Travel concerns did not appear

likely to prompt a move. After describing the specific constraints, the following response was typical:

> "there are so many different, other factors that come into it…if I were going for a job in a particular area of the country and there was a carfree place that was close to it, that would be a first choice to look at…it would be in that order…"

The people who had ticked "consider moving there if it were somewhere convenient" displayed a similar range of attitudes towards carfree neighbourhoods. Some were enthused by the idea. Further questioning revealed constraints mainly related to work, family and public transport connections, and a range of preferences concerning locations.

Access to rail was mentioned by several interviewees, either in terms of proximity to a station or a convenient rail link to their places of work. For the Camden respondents this typically meant good rail links into central London.

Amongst the attractions of carfree areas, phrases such as "cleaner and greener" were used several times. Some mentioned a better environment for children to play in. Another theme related to a sense of community, sometimes related to "like minded people", who were expected to move to such places.

Several of the interviewees said that a carfree area within an existing city – usually the one in which they were living – would be of more interest than an eco-town. Some had picked up on concerns in the media about the remoteness of the proposed locations and inadequacy of public transport links, and some generally preferred older areas to newly-built ones. The strength of these preferences varied, however. Several said they would consider carfree areas within eco-towns. Architecture and design, as well as public transport connections, were mentioned as factors which would influence decisions on whether to move to a newly-built area.

9. Discussion

The European studies support the main advantages claimed for carfree developments: that they reduce car use and traffic generation, and create a better local environment, particularly in dense urban areas where concentrations of cars would otherwise create a range of problems. Small examples of the Limited Access model and pedestrianised centres with some residents already exist in Britain.

The Vauban model would present some particular challenges to implementation in the UK. Legal advice suggested that the German system of annual car ownership declarations could be difficult to enforce under English law. The social pressure to respect the no-parking rule, which has exerted a variable influence in Vauban might not transfer successfully to Britain, where no-parking covenants on some housing estates have fallen into disuse over time. More conventional parking controls could provide an alternative. These would probably be more effective in the inner areas of British cities, where controls are more widespread and penalties more severe than in Freiburg. The same comment would not necessarily apply to suburban areas. Likewise, effective parking controls in surrounding areas – relevant to all three carfree models – would be easier in urban than suburban areas.

The surveys demonstrate that some potential demand does exist for housing in carfree areas, although more research would be needed to quantify this at a national level. This demand is mainly concentrated at the moment amongst Carfree Choosers living in, and preferring to remain living in, larger urban areas, although a significant minority would prefer to live closer to the countryside, possibly in smaller settlements, if these provide sufficient access to public transport and other services. The case studies and interviews provide some support for the view (though do not prove) that carfree developments can change the behaviour and attitudes of residents after they move there. Given that the target groups are

not static, this would imply that demand may be greater in the longer-term. The European evidence suggests, for example, that Carfree Choosers would be less likely to acquire a car when starting a family if they are living in a carfree development.

This analysis also implies, paradoxically, that carfree developments which provide some limited peripheral parking with charges as a disincentive may have a greater potential to change behaviour, and reduce overall car use, than developments where no parking is possible, which may only attract the most committed Carfree Choosers.

The importance of proximity to services for the Carfree Choosers would imply that successful carfree developments would need to be built at relatively high densities, as were all the European developments visited. This would be consistent with the housing and location preferences of most of the Carfree Choosers.

Within the inner areas of larger cities, walkable proximity to a mainline railway station does not appear to be essential to support carfree living. A good range of bus services connecting to a main city railway station for longer-distance travel suffices for many Carfree Choosers. Slateford Green is 1.5 miles from Edinburgh Haymarket station; walking and buses are the 'usual modes' of transport for three quarters of residents (Eastwood 2008). Elsewhere, proximity to 'good' rail connections as well as frequent bus or tram services would appear to be essential for Carfree Choosers moving out of the inner cities where most of them currently live: what constitutes a 'good enough' service is a question which this study has not addressed in detail, and would merit further research.

10. Conclusions

This study has proposed a typology and a new definition of carfree development, based on continental European practice. As this clearly differs from the UK concept of 'car free housing', another term for the latter, such as 'housing with no parking', would help to avoid confusion in practice, and in future debate in this area.

Where feasible, carfree developments offer significant benefits in respect of modal shift, reduction of traffic generation and improvements to the urban environment. The greatest potential demand for carfree housing in the UK lies within the inner areas of larger cities, which generally benefit from the best (local and long-distance) public transport connections and the greatest accessibility and services. Parking controls, which are generally needed in the area surrounding carfree developments, are more common within inner cities. Any of the three European models of carfree development could be appropriate in different circumstances, although the Vauban model presents some challenges related to parking controls.

This study provides some evidence of potential demand for carfree housing in smaller settlements or edge-of-city developments but the conditions for satisfying this demand would be more challenging. Higher density development, parking controls and investment in public transport connections, including rail, will all be necessary to support successful carfree areas within eco-towns or urban extensions. If the conditions are not likely to support a carfree development, the evidence from the recent past suggests that high levels of car ownership and use are likely to result. Thus, although carfree developments may be more difficult to support in ex-urban developments, creating the conditions to support them may be necessary if the policy aim is to significantly reduce the car dependency of such developments.

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