Neighbourhood accessibility and active travel

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Abstract

Neighbourhoods are advocated in UK policy in order to foster social capital, combat obesity and reduce transport greenhouse emissions. The new agenda of localism reinforces this move. Yet travel behaviour trends, and the continuing decline of local facilities, are working in the opposite direction. A review of earlier research points to gaps in our empirical knowledge and uncertainties about the degree to which spatial policy can influence behaviour and 'create' viable neighbourhoods. This paper examines the pattern of access to local facilities, and the factors which influence it, reporting on the results of a household survey in twelve suburban and exurban localities in four English cities. The focus is particularly on modal choice, comparing the behaviour of different social groups in different situations. The findings point to the danger of assuming all communities and places are alike. The degree of local use of facilities, and the level of active travel to get to them, varies widely by type of facility, social group, location and character of place. Attitudes stated by respondents are a poor predictor of behaviour, but cultural attitudes of whole communities are important. Implications for planning policy are drawn out.

Introduction

Neighbourhoods are the flavour of the times, advocated by politicians and campaigners as means of combating environmental and social ills. But there is some equivocation over the degree to which locality still matters. While residents generally feel that they live in a neighbourhood (albeit ill-defined – Minnery 2009), some commentators have long anticipated the imminent death of neighbourhoods in the face of high mobility and the telecommunications revolution (Webber 1964, Dennis 1968), and consider our persistence in alluding to them largely nostalgic (Giddens 1990). The rapid decline of many neighbourhood facilities over the past generation gives some credence to this view: local food stores, post offices, banks, clubs, pubs, cottage hospitals and filling stations have vanished from many areas (NEF 2003). Despite recent reversal of some of these trends, (Competition Commission 2008) the European Environment Agency (EEA 2009a) reports that people are generally living less local lives, relying on larger, more distant facilities, normally accessed by car, especially in the peripheral areas of towns and cities where lower density, use-segregated, car-based

patterns of development ('urban sprawl') predominate. These trends come with an environmental and health cost - including high use of energy resources and land, additional greenhouse emissions, unhealthy air and noise pollution, increases in allergic reactions and lifestyle related diseases including cardiovascular disorders linked to obesity, physical inactivity or stress (EEA 2009a,b).

While causal relationships in complex urban systems are notoriously difficult to disentangle (Brownson et al 2009, Dempsey 2008, Giles-Corti et al 2007) official policies have reacted to these concerns, seeking to counteract the trends. The revival of neighbourhoods is held up as a necessary part of a sustainable future (European Commission 1990, DETR 1998, Social Exclusion Unit 2000, ODPM 2005). The UK coalition government's localism agenda, advocating 'neighbourhood plans', and charitable trusts promoting health, have further reinforced this move (Cavill 2007, CLG 2010, CRESR 2010). The benefits of neighbourhood renaissance would, it is held, be increased accessibility to key services for all (reducing social exclusion), better physical and mental health (Corburn 2005, Rao et al 2011) and reduced carbon emissions. Concern over climate change has been the key driver since the early 1990s, but recently the issue of obesity – linked to both higher mortality and health inequalities - has given added impetus (NICE 2008). Strategies to combat obesity highlight the importance of active travel as a means of increasing levels of physical activity, especially in lower socio-economic groups who typically get much of their exercise through incidental physical activity (Frank et al 2006, Feng et al 2009, Foresight 2007, McDonald et al 2011, Whitlock et al 2009). Active travel to nearby facilities also has potential for positive impact on social networks, with benefits to self-reported mental well-being (Calve Blanco 2010). The revival of neighbourhoods would thus, it is believed, combat the problems of isolation, inactivity and poor facility access which contribute to health inequalities.

While the potential benefits are clear, the practicalities of achieving re-localization are more problematic. The UK government has pursued planning policies of higher residential densities and the concentration of new housing on brownfield sites, as means of urban regeneration, with the intention of achieving the critical mass of population needed to support local services (ODPM 2009). These policies, though, do not of themselves necessarily deliver neighbourhood revival, as studies in London have shown (Williams 2003, Barton et al 2010b). A complementary approach is that of accessibility criteria. The Department for Transport requires the level of access to public transport to be assessed within Local Transport Plans. Many local authorities use the distance of 800 metres as an indication of walkable distance to local shopping centres, following the lead of the GLA (Llewelyn Davies 1998). Other guides recommend standards for a wide range of local facilities (for example, Barton et al 2010a). The quality of the empirical evidence for these standards is varied, often more

hunch than firm knowledge. This paper hopes to illuminate the reality of active travel across England, its extent and local variety.

Previous studies of active travel and neighbourhood accessibility

Clearly the policy of neighbourhood revival rests on the critical assumption that long term trends of decline can be reversed. Can developers, planners and designers, through reshaping the physical environment, alter user behaviour? In academic (as opposed to policy) discourse this is a contested matter. As a part of the SOLUTIONS research programme we undertook a systematic review of the literature on active travel and local facilities, very recently updated (Millar and Barton 2011). Studies have found complex links between neighbourhood characteristics, activity and travel behaviour (Aditjandra 2007, Forsyth et al 2008 and 2009). Some studies suggest land use patterns, particularly in terms of density and land use mix, have only a marginal impact on travel choice (Boarnet and Sarmiento 1998), and have inconsistent association with health because of social variations (McDonald et al 2011). Nevertheless there is a growing consensus that residents in more walkable neighbourhoods (with traditional or neo-traditional form) do undertake more active travel compared with those in modern cul-de-sac layouts (Handy 2005, Saelens 2003, Frank et al 2006, Pickora et al 2005, Furguson and Woods 2010).

Many of the studies try to tease out the relative importance of social and environmental characteristics in determining behaviour through multiple regression. Necessarily they select specific indicators, thought to be significant. In terms of the environment, common variables are residential density, mixed use, traditional and 'modern' layouts. The conclusions drawn have only limited resonance because of the focus on one or two facets only and the lack of a rounded view of place (Barton and Hills 2005). More detailed attempts to characterise the environment have attempted to itemise each aspect and assess them separately (e.g. Pickora et al 2003). However, reducing the number of factors studied inevitably tends to reduce the representation of complexity in the real world (Handy 2005).

Lee and Moudon (2008) investigated the relationship between levels of physical activity and demographic, attitudinal and neighbourhood design variables. They found the most significant determinant of physical activity in a locality was the existence of neighbourhood facilities (a local centre, convenience store, post office). Winter and Farthing (1997) highlight the degree to which behaviour varies depending on the nature of the facility. When present within a given estate, supermarkets, secondary schools and newsagents, for example, are used by most people in preference to more distant options. By contrast local dentists, churches and leisure facilities are used by a small minority of people on the estate. The propensity to walk to facilities also varies

hugely, with almost all users walking to local play spaces and parks, but few to supermarkets. Winter and Farthing's study is a helpful UK precursor to the current research, but is limited by relying on a narrow subset of localities, imprecision on distances, and no analysis of urban form issues such as location, density and shape.

There remains, therefore, a surprising dearth of evidence on exactly how people behave in accessing local facilities, and the factors that might explain that behaviour. We lack adequate knowledge about how far people travel to get to different facilities, what mode they use, how far they choose to walk, how that varies between social groups, how it varies between different places. More broadly, we do not really know to what extent people are still using local facilities, and therefore whether the demise of the neighbourhood is reality or myth. There is also uncertainty about the degree to which variations in behaviour are accounted for by self-selection – households selecting locations to suit their modal preferences. Policy-makers are necessarily relying on relatively untested assumptions about the efficacy of neighbourhood planning in shifting user behaviour and tackling the big issues of climate change, obesity and inequality.

Research design

The study is about neighbourhood accessibility and active travel to local facilities. The focus, as part of SOLUTIONS, is on English suburban and exurban areas which account on some estimates for 85% of the population (Echenique 2010). In this context *local* is not defined by set distance threshold (as in some of the studies above) but in terms of function: the non-work facilities that might well be judged as important to daily life, rather than the occasional trip, thus for example convenience retail outlets, but not durable outlets. Some of those facilities are essential for some or all households (schools, food shops), others are discretionary (pubs, parks, play grounds). We make an explicit assumption that good accessibility to local facilities, especially by active means, is desirable for health, social inclusion and environmental sustainability reasons. Neighbourhoods in this context are not defined as fixed, bounded units, but as catchment areas for local facilities (Barton 2000).

The main aim of this paper is to reveal the current pattern of use of local facilities in outer urban areas so as to inform policy-makers and policy-analysts. The research identifies:

- the degree to which local facilities are used
- how far users travel to access them
- what mode of transport they choose
- how far people walk to access facilities
- how this behaviour varies between social groups

- how it varies between different places

A second aim is to throw light on the question of whether, through public policy and neighbourhood planning, accessibility could be improved, social inclusion and physical activity promoted, and neighbourhoods revived. This is a huge question, involving an understanding of the determinants of residents' and market behaviour and of state and community powers to influence that behaviour. The evidence presented here contributes to the data and understanding of this complex issue.

However, it is important at the outset to have a clear view of the complex relationship of independent and dependent variables. The logic model (figure 1) sets out the relationship between the various factors that influence the user behaviour. It draws on ecological theories that view behaviour as a result of the interaction of personal, social, cultural and environmental factors. Four sets of factors are distinguished: the population characteristics; the type, scale, and location of the facilities; the nature of the place (or neighbourhood); and cultural/attitudinal characteristics of the people. The research is distinctive in exploring all of these factors.

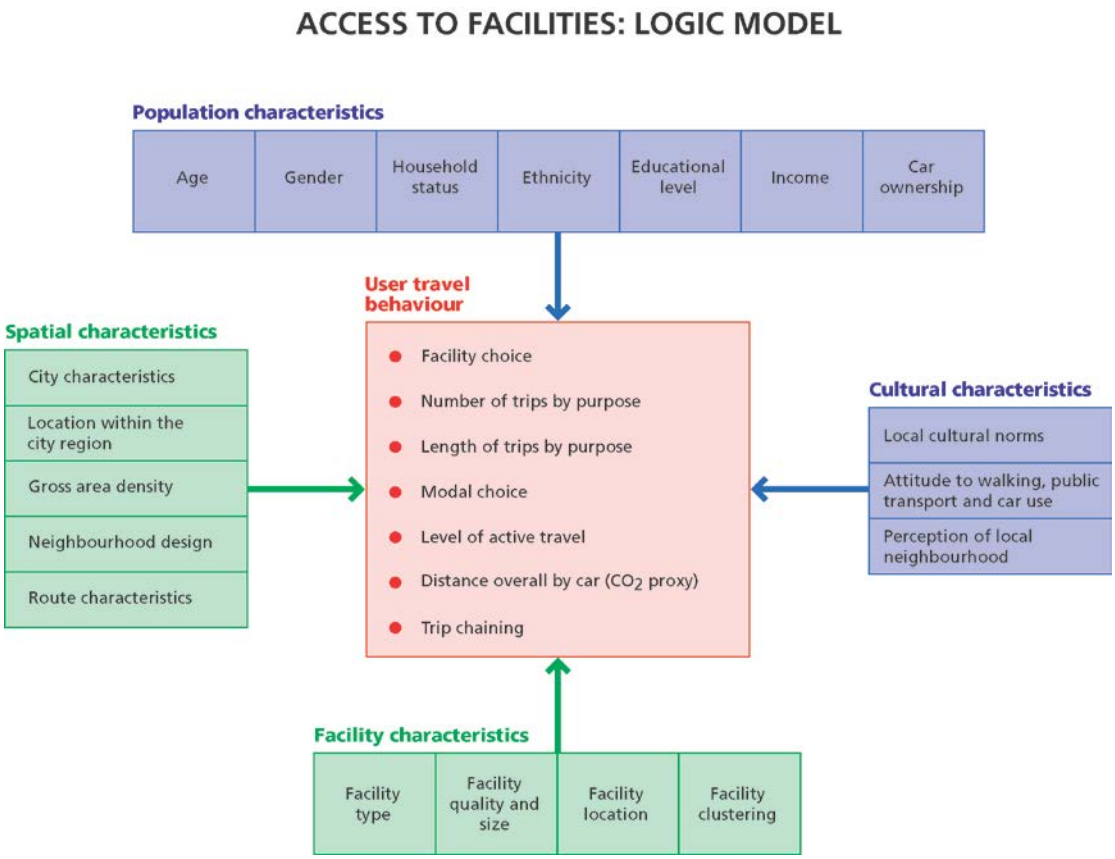

Figure 1: Access to local facilities - logic model

A postal household survey, piloted in Bristol, was carried out in 2007 in twelve localities in four English city regions, London, Newcastle, Cambridge and Bristol. The questionnaire asked for

information about destinations and trips in relation to all food outlets, other local services, schools and leisure activities. Based on a physical survey the questions specified as many facilities as possible by name to ease subsequent spatial analysis. 5959 questionnaires were sent out in the twelve neighbourhoods, and 1619 received, an average response rate of 27.2%, with at least 100 from each place.

Responses were captured in SPSS. Dwellings and facilities were located to post code centres on GIS, and actual trip distances estimated using the Ordnance Survey Meridian (OSM) dataset. In the vast majority of cases the facilities used were successfully identified in advance – with the significant exception of leisure destinations. Generally estimated distances were accurate to within about 100m. However, in some areas unknown errors may have occurred due to poor respondent identification of unlisted facilities, and the absence of some purely pedestrian links from the OSM networks. The results enabled the calculation of two important indicators: the overall level of active travel for the relevant purposes (as an indicator of healthy physical activity) and the total distance travelled by car (as a crude proxy for fossil fuel use and transport carbon emissions).

A comparison by trip purpose of our results with those of the National Travel Survey (NTS) (DfT 2005) give grounds for confidence in the quality of our sampling method and assumptions. There is good frequency comparability for education, shopping and leisure trips. Our survey did not include any work-related trips and only a minority of personal business trips, so overall the SOLUTIONS findings relate to 46% of total trips as identified by the NTS – a substantial proportion.

Besides revealing the patterns of facility use and related travel behaviour by social group and place, the questionnaire included attitudinal and perception questions (using a Likert scale), supplemented by focus group discussions in each locality allowing some insight into the theories of behaviour in urban areas (Koger 2010) by comparing stated attitudes and actual behaviour.

The case study areas

Twelve case study areas were selected based on the following three criteria:

- A range of social structures and conditions
- Variety of neighbourhood form and location
- Expressed preferences of SOLUTIONS local authority partners

The twelve localities represent a reasonable cross section of suburban and commuter localities. Table 1 distinguishes four locational categories, three types of local urban form, and levels of gross density, permitting interesting comparisons. The table specifies population characteristics in terms

of income, home and car ownership, and the 2004 Index of Multiple Deprivation rank (1 being the most deprived area and 32,482 being the least deprived). Home ownership levels vary from 47% to 96%, car ownership varies from 57% to 96%, and deprivation ranks are similarly varied. While some neighbourhoods are characterized by relative poverty or wealth (compare Barking and Bradley Stoke) others have considerable internal diversity.

Table 1: Location, names and characteristics of the case study areas

City	Neighbour-hood	Location	Reference	Density[1]	Form[2]	Average income (£)	Home ownership (%)	No car households (%)	Most usual number of cars per household	Deprivation rank
Bristol	Bradley Stoke	Recent outer suburb	***Brist - new***	Medium	Use-segregated pods	39,000	82	4	2	30,457 to 31,951
Bristol	Filton Avenue	Older suburb	***Brist - old***	Low-medium	Traditional / linear	30,000	59	29	2	2,776 to 26,674
Bristol	Thornbury	Satellite town	***Brist - satellite***	Low	Neighbourhood cell	37,000	83	13	2	13,499 to 32,404
Cambridge	Bar Hill	Satellite town	***Cam - satellite***	Low	Neighbourhood cell	33,000	88	10	1	27,652 to 31,095
Cambridge	Cherry Hinton	Mixed urban edge	***Cam – edge 1***	Medium	Neighbourhood cell	32,000	66	20	1	12,397 to 31,072
Cambridge	Trumpington	Mixed urban edge	***Cam – edge 2***	Low	Neighbourhood cell	37,000	62	25	1	21,023 to 21,674
London	Barking	Older suburb	***Lond – old 1***	High	Traditional / linear	28,000	57	43	1	2,204 to 10,535
London	Broxbourne	Recent outer suburb	***Lond - new***	Low	Use-segregated pods	45,000	83	13	2	12,541 to 26,864
London	Harrow	Older suburb	***Lond – old 2***	Medium	Traditional/ linear	41,000	66	28	2	7,487 to 28,356
Newcastle	Backworth & Shiremoor	Mixed urban edge	***Newc - edge***	Low	Use-segregated pods	28,000	47	11	1	4,348 to 15,826
Newcastle	Cramlington	Satellite town	***Newc - satellite***	Low-medium	Use-segregated pods	36,000	74	13	2	4,924 to 30,928
Newcastle	Great Park	Recent outer suburb	***Newc - new***	Low-medium	Use-segregated pods	43,000	96	16	2	12,331 to 31,794

*Note 1: **Density** is based on the surveyed census output area (population between 250 and 375 normally), quite tightly drawn around the housing areas. The density ranges are as follows: low = 17-22ppha; low medium = 31-35ppha; medium = 42-51ppha; high = 71ppha.*

*Note 2: **Form** is a broad indication only. None of the localities has a simple structure. Areas dominated by 'pods' have hierarchical road systems and cul-de-sac layouts; 'cell' neighbourhoods are relatively distinct and compact; 'linear' areas are part of the urban continuum, with shops along main roads.*
Note 3: population data sourced from the 2001 UK Census

Figure 2 illustrates one of the twelve survey areas, showing the location of facilities and the extent of questionnaire distribution. Addresses were randomly selected by computer from Council lists. The map identifies every selected postcode – some postcodes representing more than one respondent. Distances were measured along streets and footpaths.

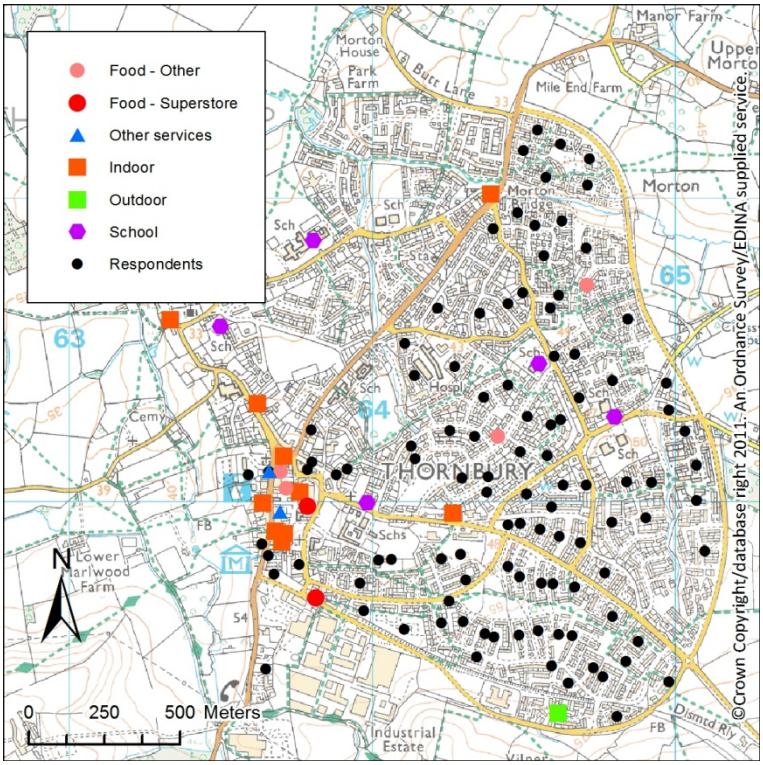

Figure 2: Example of a study area, Thornbury – near Bristol

Further details about the survey areas are available on www.suburbansolutions.ac.uk

Overall Results: the general pattern by trip purpose

The results of the survey will be presented first in an aggregate form, revealing broad patterns from all twelve study areas and their respondents. Disaggregated results then follow.

The total number and frequency of trips to different destinations are shown in Figure 3. They clearly show the importance of the superstore as a trip generator. Well over 90% of respondents make regular trips to the superstore, with the average frequency being twice a week. Focus group discussions in all the study areas highlighted the significance of superstores for planned or unplanned social contact. The frequency of trips for outdoor and indoor recreation is similar, but only 25% of the respondent households undertake trips for outdoor recreation, and 50% for indoor recreation, representing comparably low levels of participation, especially for outdoor recreation which includes parks, playgrounds and walking for pleasure as well as organized sports.

Trips to newsagents and other food stores occur weekly on average. Trips to other facilities cluster around an average frequency of once a fortnight. All these facilities are visited by a substantial majority of households, for example post offices around 80% and other food shops 85%.

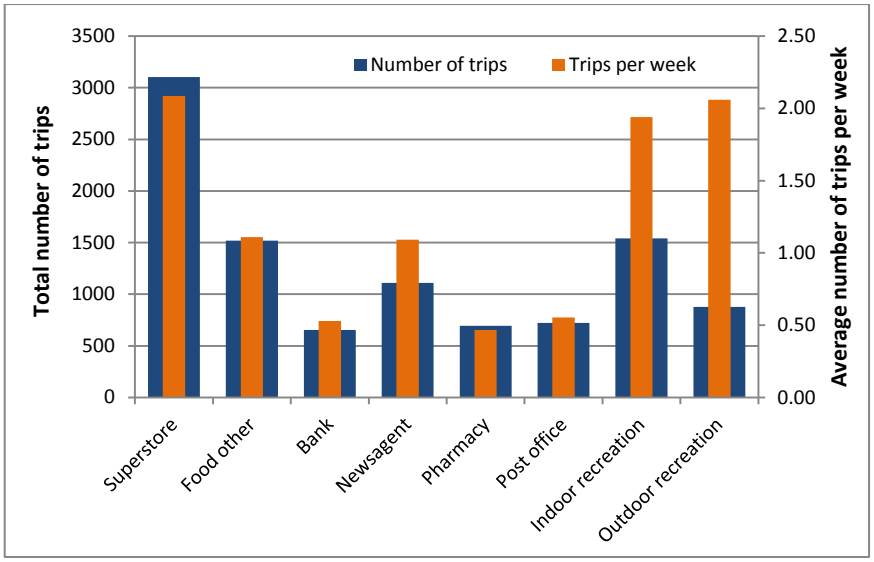

Figure 3: The total trips and average number of trips per week by users of each type of facility

Figure 4 shows the range of trip length by trip purpose. The threshold distances of 800 and 1600 metres have been chosen not only because they have a simple resonance (half mile, one mile) but because they have significance in terms of modal choice (see later). At 800m about two thirds of trips, and at 1600m about one third of trips, are by active means. The median distance to most facilities is between 1600m and 2000m (for all trips it is just over 1700m), beyond walking distance for the majority of respondents. Superstores are the least local: only 43% dwellings within the 1600m threshold. The exception to the rule is the 'other food' category: used relatively frequently, a median distance of 1000m and over 80% within 1600m, suggesting general availability and use within the walkable neighbourhood catchment.

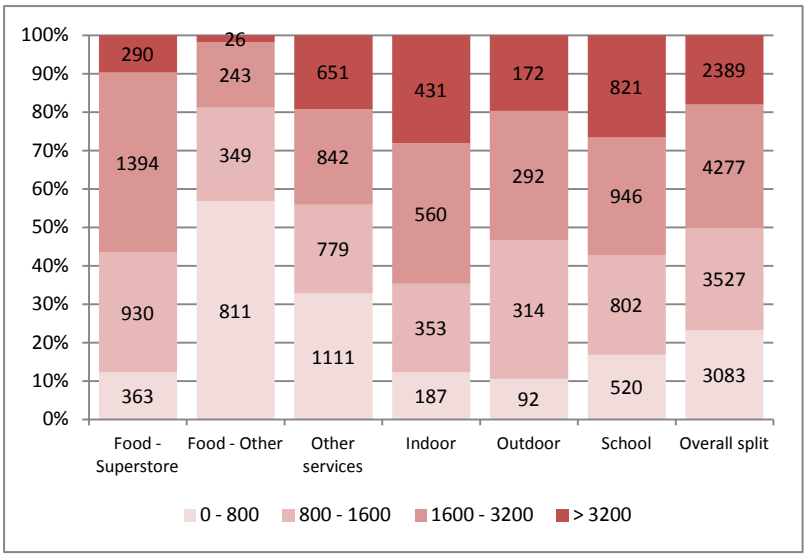

Figure 4: Trip distance bands by facility type (n=13676)

The distance people travel to access local facilities – often in excess of 1600m (1 mile) – may be due to the absence of facilities or the exercise of consumer choice. The research provides good data to discriminate between these options, finding variations between trip purposes. Almost all households (96%) did 'most' of their food shopping in superstores. Nine of the twelve localities have a nearby superstore, and in all but one instance the closest superstore is also the dominant one – sometimes capturing almost all trade. The one exception was where a new, closer store had not (yet?) managed to supplant traditional loyalties to an older, more distant store. People also normally choose the closest 'other food' stores. In neighbourhoods where there are not many close by, the number of households making 'other food' trips is low.

By contrast users of indoor and outdoor leisure facilities are more discriminating, often choosing more distant options, reflecting their specialist nature or attractiveness, and people being willing and able to access them.

Overall, active travel (walking and cycling) accounts for just under 50% of total trips – as does personal motorised transport (cars, vans, motorbikes, taxis), with public transport relatively unimportant (figure 5). Travel to superstores is dominated by personal motorized transport – with over three quarters of trips. By comparison travel to 'other food' shops and to outdoor recreation facilities is predominantly by active means.

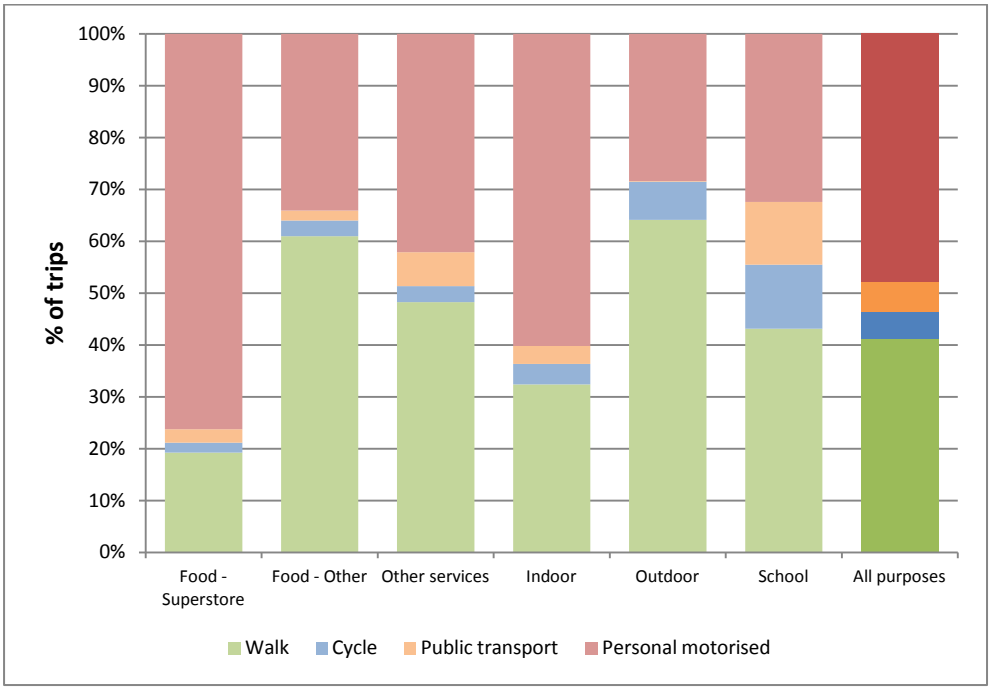

Figure 5: Modal split to different facility types
Note: statistical significance is high at 0.00; Cramer's V is 0.223 and Chi squared is 1210

The proportion of active travel to superstores decays very fast with distance, with the 50% threshold around 500m. For school and outdoor recreation trips, however, the 50% threshold is around 2,500m. Other trips – 'other food', services and indoor recreation/leisure – are in between and all similar in profile, with the 50% threshold around 1200m.

Figure 6 amalgamates all trip purposes and shows a clear relationship between distance and modal choice. At distances shorter than 400m 90% of trips are by active travel, falling to 50% at 1200m (about a 15 minute walk), and less than a third of trips at 1600m. The proportion of trips made using public transport, is consistently small, but increases with distance.

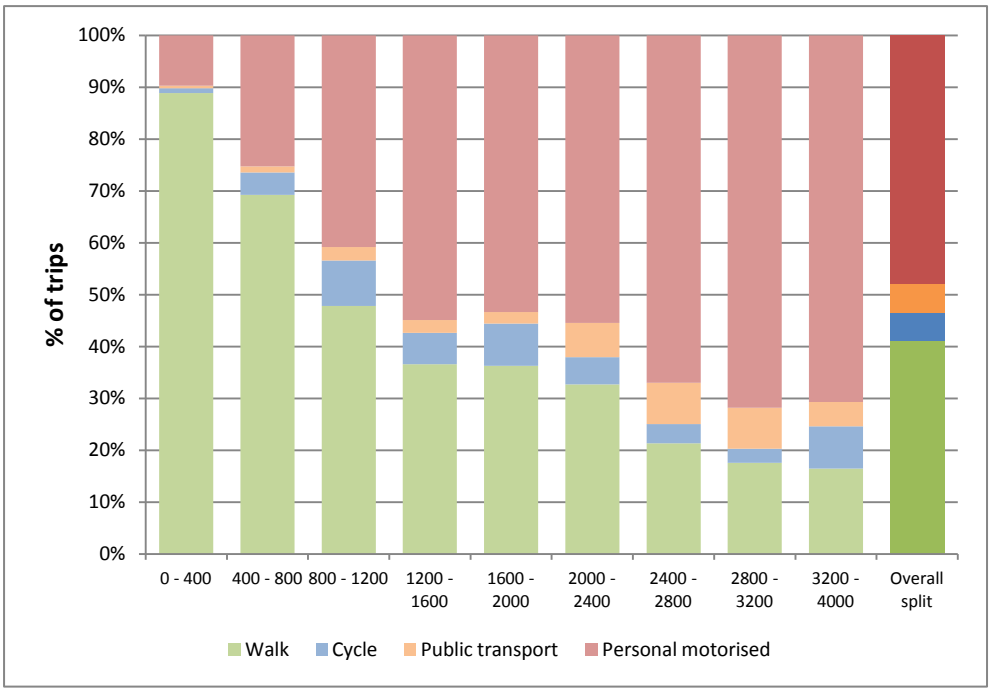

Figure 6: Modal choice by distance for all trips
Note: statistical significance is high at 0.00; Cramer's V is 0.322 and Chi squared is 2515

Figure 7 generalises from the travel distance decay data. It takes active travel proportion by distance and evens out the curve through regression. The three purposes illustrated have been selected because they illustrate contrasting behaviour patterns. The non-superstore food curve is similar to the 'other services' curve and the average of all trips. It shows a quite rapid decline in the active traveller proportion down to a 50% mark at 1250m, then a gradual levelling so that the 25% mark is at 3,250m, before a decline to zero at 5,000m. This pattern supports Lee and Moudon's (2008) notion that there are two main kinds of active travellers – those willing to walk only a very modest distance, and those willing to walk much further – the sedentary and the active types. However, the superstore curve suggests that for this purpose we are almost all in the sedentary camp, while the

minority who participate in outdoor recreation (rather similar to the school trips), fall into the active travel category. It is very clear that different types of destination lead to different travel behaviour. It can be argued that there are three archetypical patterns of travel behaviour to facilities.

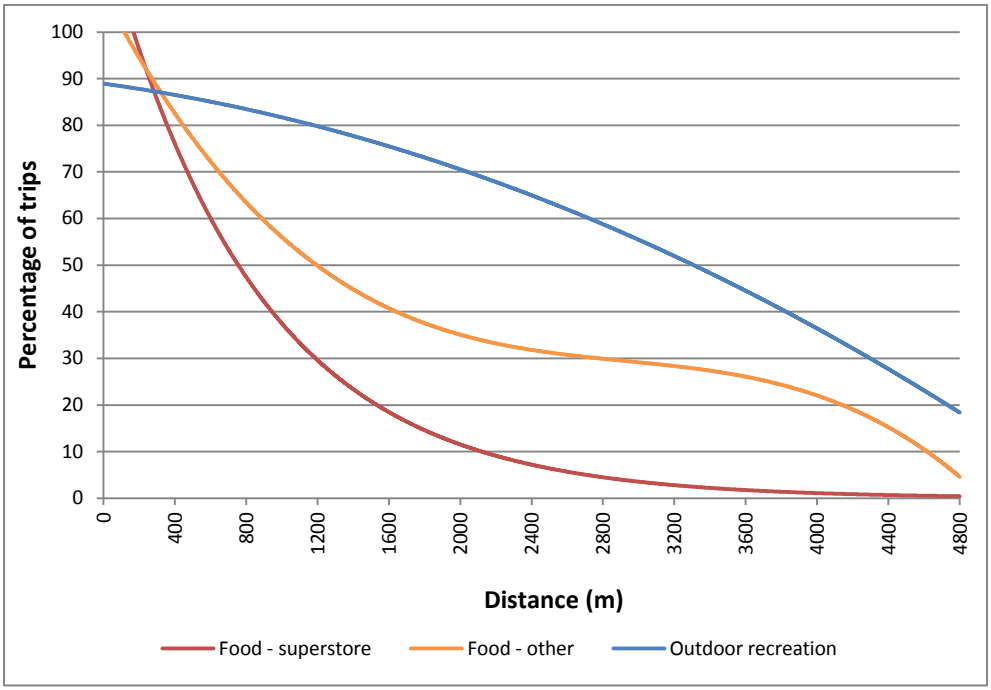

Figure 7: Regression lines of active travel distance decay for selected trip purposes

The question arises as to what this evidence shows about the nature of neighbourhoods in the twenty first century. The messages are mixed. Households travel outside the locality for many purposes that might be considered 'local'. The mean travel distance for all purposes was 2400m, the median 1700m, and – with the exception of 'other food shops' – the majority of trips for each purpose was over 1600m (1 mile). Recreational trips are often much longer. If 1600m is taken as a 'walkable' threshold, then localities do not generally provide the 'local' services people use.

However, local food shops, if present, are well frequented, often by foot; and the *closest* superstore (while often beyond 1500m) is used by a substantial majority in preference to others, and visited like a corner shop, twice a week on average. It is apparent that superstore accessibility is generally more important than brand loyalty (or perhaps helps define it). Focus groups (self-selected from the respondents) also emphasized that they considered that they belonged to a neighbourhood or local community, and stressed the significance of the superstore in their social contacts. Thus the neighbourhood, in the catchment sense defined earlier, is not dead, but more dispersed than the conventional image, with tentacles stretching out and entangled with the town around, part of the urban continuum.

What is striking is the degree to which people in outer suburban areas do still walk. Contrary to popular myth, not everyone relies on the car, even for access to the superstore. Some people (schoolchildren and recreationally active people), walk significantly beyond the 'local' and many are willing to walk two kilometres or more to 'local' neighbourhood facilities. The question arises as to whether the habit of active travel applies to particular social groups more than others.

Analysis of demographic variables

This section gives an overview of how modal choice relates to key demographic variables. The literature review showed there has been little research differentiating between groups who may be systematically advantaged or disadvantaged by the pattern of facility availability. An exception is the distinction made by some researchers between sedentary and active groups, discussed above. Table 2 shows some key demographic variables that might help explain behavioural differences. The measures here relate to statistical significance and consistency or strength of relationship, not to the size of the relationship. Note the very high significance of age, income and car ownership, but low significance of gender.

Table 2: Demographic variables in relation to modal choice, in strength order

Variable	(Cramer's V)	Significance	Effect size
Age	0.203	p < 0.000	Medium
Income	0.184	P < 0.000	Small
Car ownership	0.096	p < 0.000	Small
Ethnicity	0.034	p < 0.001	Small
Educational level	0.030	p < 0.003	Small
Tenure	0.021	P < 0.065	Small
Gender		P < 0.323	None

It is apparent from figure 8 that age is not a critical determinant of the general pattern of modal choice, despite the consistency of the relationship. The 50-64 group use cars most, while the oldest group (75+) use cars least. While the over 75s walk more, the distances are shorter than other groups. There are interesting variations in the use of the minor modes: the 50-64 age group cycles more than the two youngest and the two oldest groups. Public transport exhibits a different pattern, with the 17-24 age group relying on it more than all the other age groups; use is lowest in the 25-34 age group while levels of public transport use are similar across the oldest three age groupings.

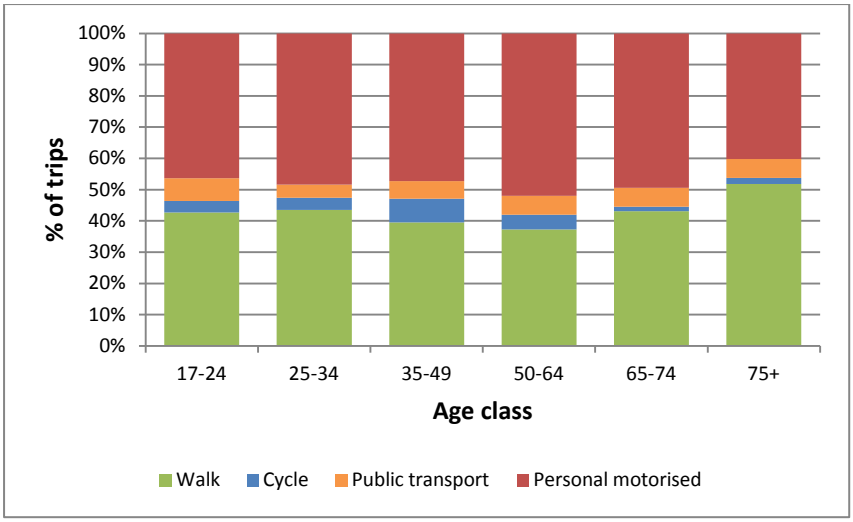

Figure 8: Modal choice across all trips by age class

Modal choice is surprisingly similar in relation to some key social variables. Gender choices are almost identical. Household size (in terms of number of adults) is also not a factor. Educational attainment and ethnicity show a slightly stronger relationship, but the impact is likely masked by more important issues of income and car ownership.

Low income appears a key determinant of travel for some households (figure 9). When the annual household income is less than £20,000 more than half of trips are by non-motorized means, when less than £10,000 over two thirds are non-motorised, and there is relatively heavy dependence on public transport. For households with medium to high incomes, however, there is surprisingly little variety of behaviour, with active travel around 40-46% of trips, and no clear trend with income levels.

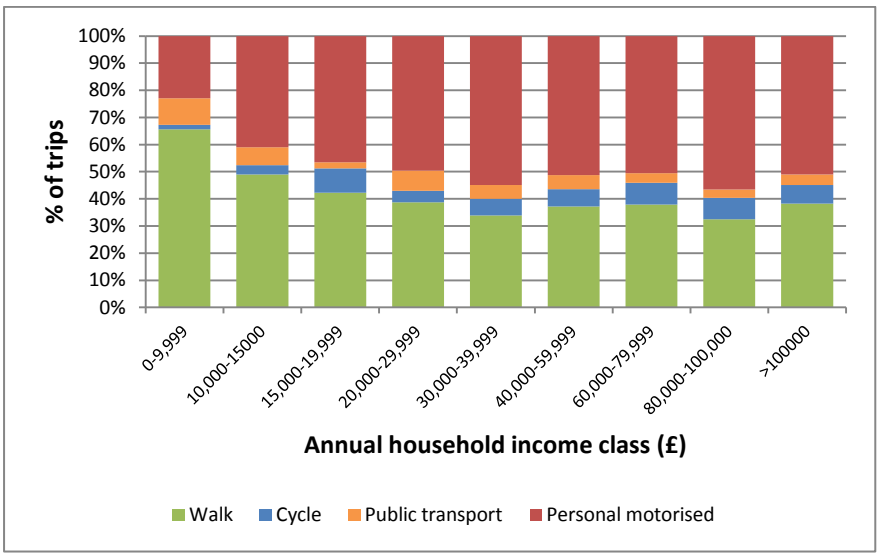

Figure 9: Modal choice across all trips by household income band

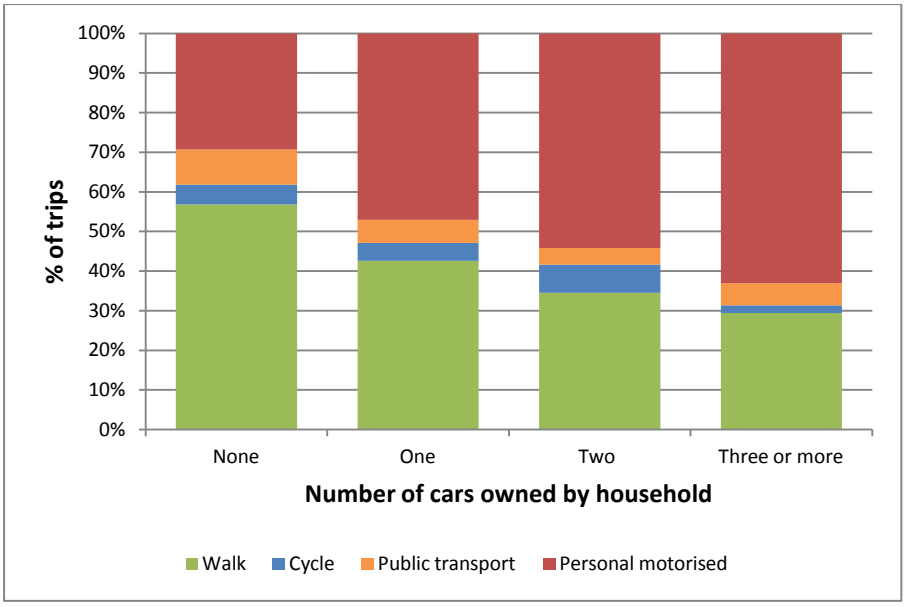

Figure 10: Modal choice across all trips by car ownership levels

Figure 10 confirms that car availability associates with increasing car usage. However, respondents with no cars still used personal motorized modes of transport for a significant number of trips (29%), sharing with others, perhaps reflecting the inconvenience of many facilities in outer areas. While car ownership levels are predictably related to income, there are multiple car owners even at the lowest incomes, and car-free households in every income group up to £60,000.

In summary, it is important to note that the analysis here is limited to only one aspect of local travel – modal choice. In that regard the most important determinant is car ownership. However, non-car owners are more reliant on car use than might be expected. At low income levels active travel is more common, while at medium and high income levels there is little variation in modal choice. Age is a factor, with middle aged respondents more car dependent, young and old more reliant on walking and public transport, but the variations are modest. However, all the preceding analysis relates to data aggregated across all study areas, whereas substantial differences were in fact found between the study areas.

Findings disaggregated by study area

Aggregating data loses important local detail. The twelve neighbourhoods have different spatial characteristics and the analysis shows huge variations between them. The proportion of active walking/cycling trips varies by over 200%, ranging from 29 to 64% of total trips. Public transport varies from 1% to 18%. Car use varies from 32% to 79%. It is immediately apparent, therefore, that places and communities vary to a degree which makes generalizations based on average figures potentially very misleading for any particular locality.

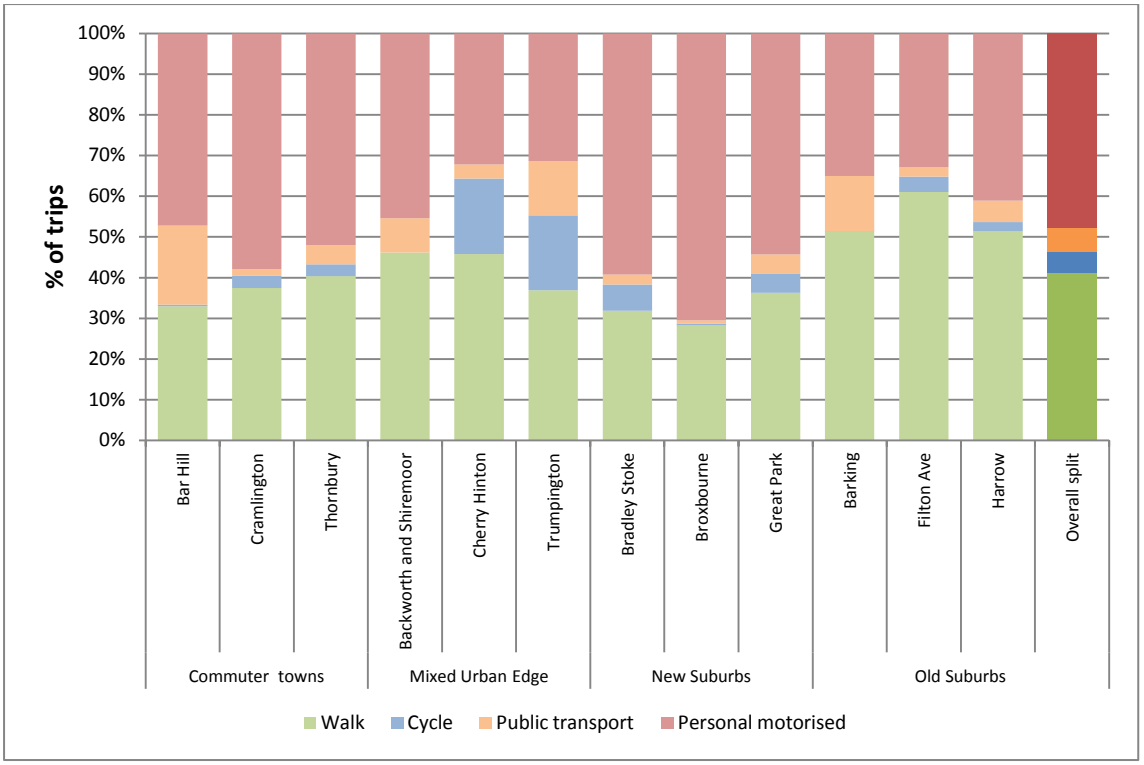

Figure 11: Modal split in case study areas, by locational type
Note: statistical significance is high at 0.00; Cramer's V is 0.241, and Chi squared is 1408

Figure 11 shows that the new suburbs and commuter settlements are generally more car dependent than the mixed urban edge areas and the older suburbs. There are three localities with very high car use: Broxbourne, Bradley Stoke and Cramlington. While appearing different from each other (unplanned suburban sprawl, planned urban extension and planned new town) they all share a modern car-based cul-de-sac layout with segregated land uses. By comparison three localities have high levels of active travel and modest car use: Cherry Hinton, Trumpington and Filton Avenue. The first two are peripheral neighbourhoods of Cambridge with mixed-age development and broadly cell-type layouts while the third is a mid 20th century area with a traditional linear pattern. Three other suburbs have above average public transport use: Barking , Harrow and Bar Hill. The first two benefit from the quality of services (including public transport) in London, but the third is very different: a commuter exurb with good bus connection to a commercially dominant Cambridge centre. The remaining study areas of Backworth and Great Park fill intermediate positions.

The modal breakdown reflects the diversity of local area factors: the accessibility of facilities that people use; the qualities of the routes available (e.g. are they perceived as safe and convenient for active travel); the socio-economic characteristics of the population; the local culture and behavioural norms. The variations above can for the most part be explained by their spatial and social

characteristics combined with qualitative insights from focus groups of respondents held in each area. In evaluating the results, the *number* of trips is significant as well as the mode. In this respect all of the neighbourhoods have generally comparable trip numbers per household except for Bar Hill, which had very substantially fewer. The main reasons for this are the high multi-purpose use of one major superstore within the exurb and an unexplained paucity of recreational trips.

Figure 12 shows the average trip distance by city and case study areas, and shows the average distance (km) travelled by car per respondent per week in each case study area – for all facility types. The solid line indicates the sample average trip distance, and the dashed line the sample median trip distance. In this analysis the study areas are grouped by city region, to test the theory that behaviour is locally culturally/environmentally influenced.

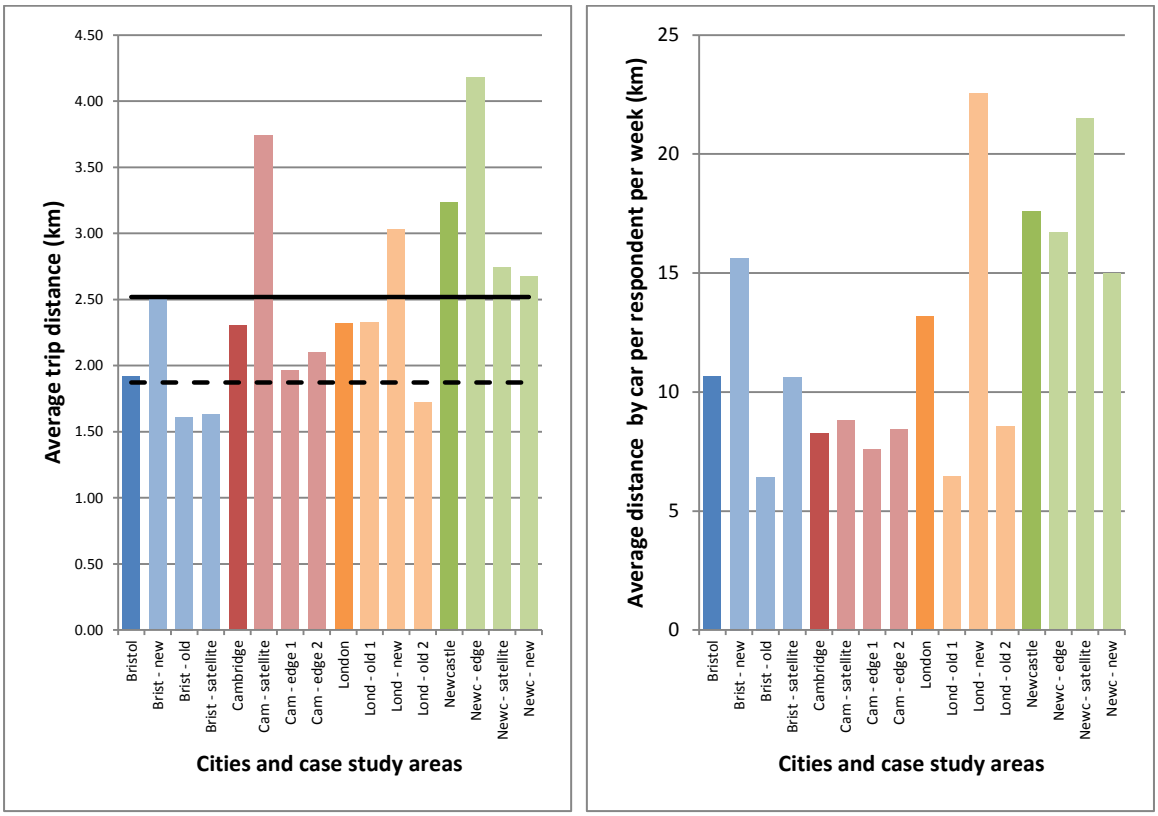

Figure 12: Average trip distance for the cities and case study areas, and total distance travelled by car for cities and case study areas

The variation in average trip distance is a proxy measure of the convenience of local facilities. By and large, as noted earlier, people use the closest available facility – apart from recreational facilities. Areas with higher car dependency generally have higher average trip distance, but this is not a universal rule. Cambridge, which has the highest proportion of active travel, is not associated with

the shortest average trip distances. Bristol has the shortest average trip distance, yet has relatively high car dependency.

The total distance travelled by car is a crude proxy for the level of carbon emissions associated with the journeys recorded in the survey. The Newcastle localities stand out for the unfortunate combination of long average distance to facilities and long distances travelled by car. The latter characteristic is shared with the two areas with highest car modal share: Broxbourne and Bradley Stoke.

From the preceding evidence it is clear that places and communities vary widely. Nevertheless, there are some shared patterns of behaviour, in terms of the propensity to walk and cycle, that suggest the existence of common cultural attitudes in particular cities. For example, behaviour is similar in Trumpington and Cherry Hinton, both 'mixed urban edge' suburbs of Cambridge. In Harrow and Barking, both older London suburbs, the distances people are prepared to walk are surprisingly similar, despite the different social and spatial character. The three survey areas in Bristol city region show broadly similar trip walking distance patterns despite locational, form and social differences. Yet Bradley Stoke is very car dependent while Filton Avenue has high levels of walking. The variation in modal choice can be explained by geography: the availability of facilities and the permeability of the route network.

The significance of the distinctive cultural/geographical characteristics of each city is illustrated by figure 13. Bristol and Cambridge show very different patterns of behaviour across all trip purposes. This appears to be due to geographical and cultural factors: Cambridge is largely flat with a tradition of cycling; Bristol is in places hilly, with no such tradition. Cambridge is immediately identifiable as a less car dependent city than Bristol – 37% as opposed to 52% and has high use of cycling – 15% overall. In Cambridge, walking and cycling together add up to 63%. Even for superstore access active travel – at almost 40% - is surprisingly high and belies the normal image of almost total car dependency. The majority (over 80%) of trips to other food stores and to schools are made on foot or by bicycle.

Figure 13: Modal choice to all facilities for Bristol and Cambridge

Attitudes to travel

The question arises as to whether the variations in behaviour between Bristol and Cambridge, which appear to represent cultural differences, reflect respondent's self-confessed attitudes. The questionnaire concentrated on attitudes to walking and cycling. Exercise was cited as an important reason for active travel by nearly 80% of respondents overall and environmental reasons by just over 65%. Across all reasons Cambridge was consistently 15-25% higher than Bristol and the other cities.

However, stated attitudes were often not reflected in behaviour. Respondents were asked about barriers to walking. The deterrents most often cited were high traffic levels and unsafe streets. Areas with the lowest levels of walking cited no more deterrence factors than the average. Areas citing most concerns about feeling unsafe and where the neighbourhood was not considered attractive were paradoxically among the more active. While overall a substantial majority (76%) felt their neighbourhood was attractive, the figure for the older suburbs fell to less than half, with the London residents in particular finding their locality unattractive. By contrast over 90% of the residents in the new suburbs thought their locality attractive. This may be partly accounted for by social differences. The new suburbs have very low levels of deprivation, while the older suburbs have socially mixed (in the case of Barking, poorer) populations. However, it is by no means as simple as that. Newcastle respondents, for example, are socially diverse in two of the three areas but rate them as being more attractive than the other cities rate theirs. Perceptions of neighbourhood attractiveness are not, on this evidence, determinants of levels of active travel.

Spatial character, density and active travel

The variation between places is clearly often related to their spatial character. Here we can only give one angle on the issues involved. Residential density has been highlighted by the literature as an important factor influencing facility accessibility and active travel (ECOTEC 1993, Frank 1995, Handy 1993, Hess 1999). But within the relatively limited density range represented by the SOLUTIONS sample – neither inner urban nor rural in character – there is no consistent relationship between density and modal choice. This is true whether we use the densities of the relevant wards and parishes (which often include some industrial, open or rural zones) or more tightly drawn areas.

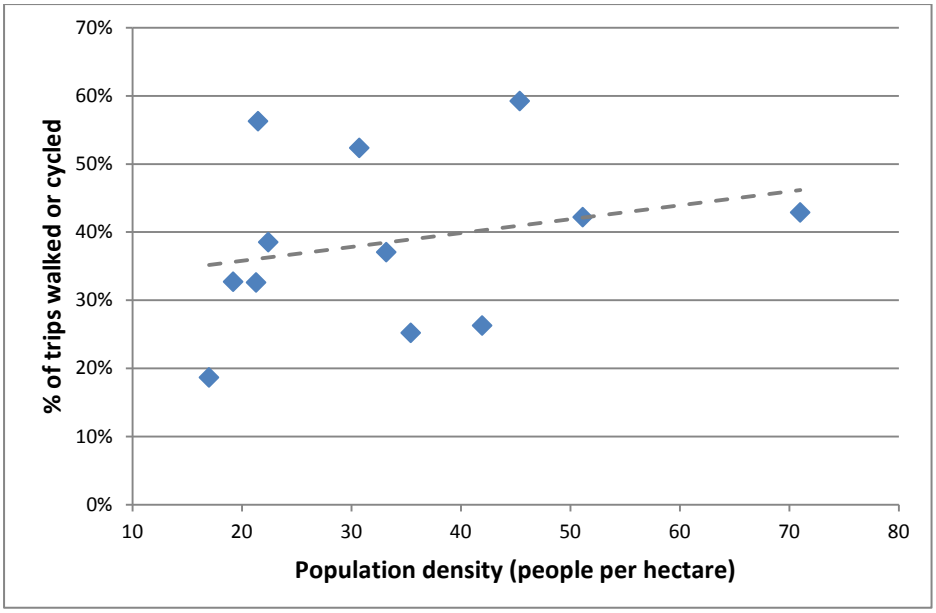

Figure 14: the relationship of density to proportion of active travel trips, for each neighbourhood

Figure 14 relates the gross population density (ppha) based on wards/parishes to the percentage of active travel trips in each neighbourhood. The density ranges from 17 to 71 ppha. From detailed analysis of the evidence, it is apparent that some communities with similar social characteristics and similar neighbourhood densities exhibit completely different patterns of behaviour. Diversity is the rule. This is not to argue that density is unimportant when looking across the whole range, but that within the suburban context other aspects of urban form, such as location, networks and use patterns, are much more significant. These other factors are touched on below.

Figure 14: Gross neighbourhood population density and active travel trips

Qualitative comparison of neighbourhoods

This discussion draws together the many above strands of analysis into more integrated pictures of active travel in the twelve neighbourhoods. It is evident that the unique social and spatial characteristics of area cannot be reduced to one or two convenient variables which explain differing behaviours. The analysis here builds on the four key determinants in the logic model - social, attitudinal, spatial and facilities – to differentiate between neighbourhoods and warn against the use of simplistic statistical averaging when planning for active travel in suburbs.

Cherry Hinton and Trumpington stand out as exemplary (by UK suburban standards) in both the proportion of walking/cycling trips to local facilities, and the median distance people are prepared to walk. The positive cultural attitude to active travel in Cambridge, especially to cycling, is clearly

distinct from other areas. These distinctive Cambridge attitudes are not easily explained by student car-lessness as few of our respondents were students. The spatial character of the city plays an important part: it is small enough for most of the city to be within cycling distance, it is flat, and planning policy has promoted walking and cycling while constraining car use through capacity constraint and parking policy. Cherry Hinton and Trumpington both benefit from local superstores, within walking distance of many residents, and – in contrast to the findings of Lee and Moudon (2008) - high levels of active travel (50% in the case of one superstore). Both areas have reasonable, though not optimal, permeability and the characteristics of a neighbourhood cell.

Filton Avenue, Harrow South and West Barking also have above average levels of active travel, in spite of being perceived as relatively unattractive. All are older suburbs embedded in their cities, with through bus routes. They are socially distinct: Barking is the poorest and most deprived area, Harrow is socially diverse, with affluent enclaves, and Filton lies between them. They have more car-free households (28-43%) than other areas. Despite having the highest population density in the study, Barking is poorly served by local facilities, with dying retail parades reflecting poverty and a declining population. Distances to effective facilities are therefore long, forcing heavy reliance on long walking trips or bus for those without cars. Nevertheless car use is higher than the Cambridge suburbs or Filton, and similar to Harrow. Harrow has more and closer facilities, easier to walk to. But neither Barking nor Harrow is optimally permeable by comparison with Filton Avenue's traditional grid structure. The facilities in Filton lie along a spine bus route. All housing is within walking distance, and catchment population has been increased by higher density redevelopment.

The common factor which the three areas share is location: a fair level of integration within the urban area, so that a wide range of facilities are not too distant. However, they contrast in local accessibility. Households without a car are well served in Filton, poorly served in Barking, signifying social exclusion of vulnerable groups, compounding issues of health inequity.

At the other end of the active travel range, in order of car dependence, are Broxbourne, Cramlington, Bradley Stoke, Backworth and Bar Hill. Bar Hill (a Cambridge exurb) is an anomaly for Cambridge in having a low walking/cycling rate. Despite relative affluence and high car ownership it also has far fewer trips than anywhere else, and an apparent aversion to recreational activities. Backworth's population is similar to Filton Avenue's, with quite high levels of deprivation and a high proportion of social housing, yet car ownership is the second highest out of the twelve. Backworth's built form is sporadic, dissected, with permeability reduced by cul-de-sac enclaves and weak provision of local facilities. Despite its social similarity to Filton its travel behaviour is very different, illustrating how the place impacts on travel choices.

Broxbourne, an area of incremental sprawl, and Cramlington, a planned settlement, are socially varied, and lie beyond the city edge. Bradley Stoke is a more recently planned owner-occupied urban extension typical of many outer estates, with no deprivation. All three share design assumptions of full motorization, with pod-based layouts that reduce permeability, compromises walkability and weakens the viability of local facilities. All three study areas have district or town centres nearby but sufficiently distant requiring most trips to be by car.

Taking the two extreme cases, Cherry Hinton and Broxbourne, both are mid/late twentieth century suburbs, both have similar deprivation profiles, both have similar gross densities, yet the availability of accessible facilities and the pattern of active travel are completely different. Cherry Hinton's residents travel actively over three times as far and three times three times the proportion of trips as Broxbourne's (three out of five compared with less than one out of five). This is due to their cultural/attitudinal differences, their contrasting locational patterns (integrated/dispersed) and long standing planning priorities.

Conclusions

At the general level, the data presented here supports some of the findings of earlier researchers. In particular, it shows the critical influence of distance on modal choice – and therefore, if we wish to promote physical activity and reduce car dependence, facilities must be available within walkable distance. It is possible that respondent bias What this study adds is more detailed UK evidence about the way in which local facilities are used, the distance people are prepared to walk to them, and the degree to which suburbs vary in terms of facilitating active travel to local facilities. We present the findings with some confidence, despite the possibility of respondent bias, given the high levels of significance, consistency with the NTS, and wide range of local behaviour.

The study highlights the fact that many English suburbs are not very walkable at all, but that where there *are* local facilities, people use them. The sheer diversity of local suburban behaviour is striking. The research demonstrates the significance of place and of travel culture.

This diversity suggests that aggregate analysis – i.e. averaging behaviour across many places and communities, looking for statistically valid generalizations and explanations – can be problematic, giving a false impression of universal truth, and in any particular case could be very misleading. There *are* significant shared patterns, but the exceptions are many, and complex. Our belief, on the basis of this research, is that it is important to view each place and community holistically, and cluster them when similarities occur.

The logic model (figure 1), while presented at the start to orientate the reader, was in fact devised as a result of the research (a post hoc rationalisation!) as we became aware of the interacting influences more fully. It is useful in that it distinguishes and emphasizes cultural factors and well as social characteristics, facility provision as well as a rounded view of urban form and design. In this paper we have not delved deep into each of these determinants, but striven to give an overview. Future papers, making full use of the rich SOLUTIONS database, will probe more specific questions, and test factor confluence. Beyond that, further research is needed to study a wider range of neighbourhoods, for example in the inner city; to investigate route and facility characteristics fully; to do longitudinal studies on the twelve neighbourhoods; to tie in health/well-being and social capital data.

In terms of practice, it is salutary to note that the suburbs created in the last 20 or 30 years exhibit high levels of car dependence, and low levels of active travel, while some of the older or more mixed age neighbourhoods are less car dependent and have high levels of active travel. There is a hiatus between the expressed purpose of policy – promoting neighbourhood vitality, social inclusion, healthy lifestyles and reduced carbon emissions – and the reality of the development and planning decisions that have shaped suburban places. The divergence in behaviour evident between neighbourhoods derives more from spatial and cultural factors than from population variation. The research suggests that higher residential density – often held up as vital to sustainability - is not the key spatial issue. Neighbourhood location, form, integration (into the town/city), permeability, and service catchment viability are all important. The research also highlights the critical significance of cultural attitudes to bike use and to what is a walkable distance; also across most places studied two loose groups are apparent, the more sedentary and the more active. Cultural variation would of course be much *more* marked if we were to compare Dutch and English populations.

There are some patterns of travel behaviour – in terms of thresholds of pedestrian accessibility – which are relatively widespread in the sample neighbourhoods and could provide starting points for policy discussion. One crude threshold is the one kilometre ‘standard’: local shops and services within this distance are likely to generate a majority of walking trips. However, as local variation is so high, local debate, surveys, spatial analysis and market research are required to define viable principles, relevant to the local community. It is to be devoutly wished that the new UK agenda of ‘localism’ encourages this sensitivity. The question is: will local communities see planning for active travel – with the concomitant benefits - as their priority?

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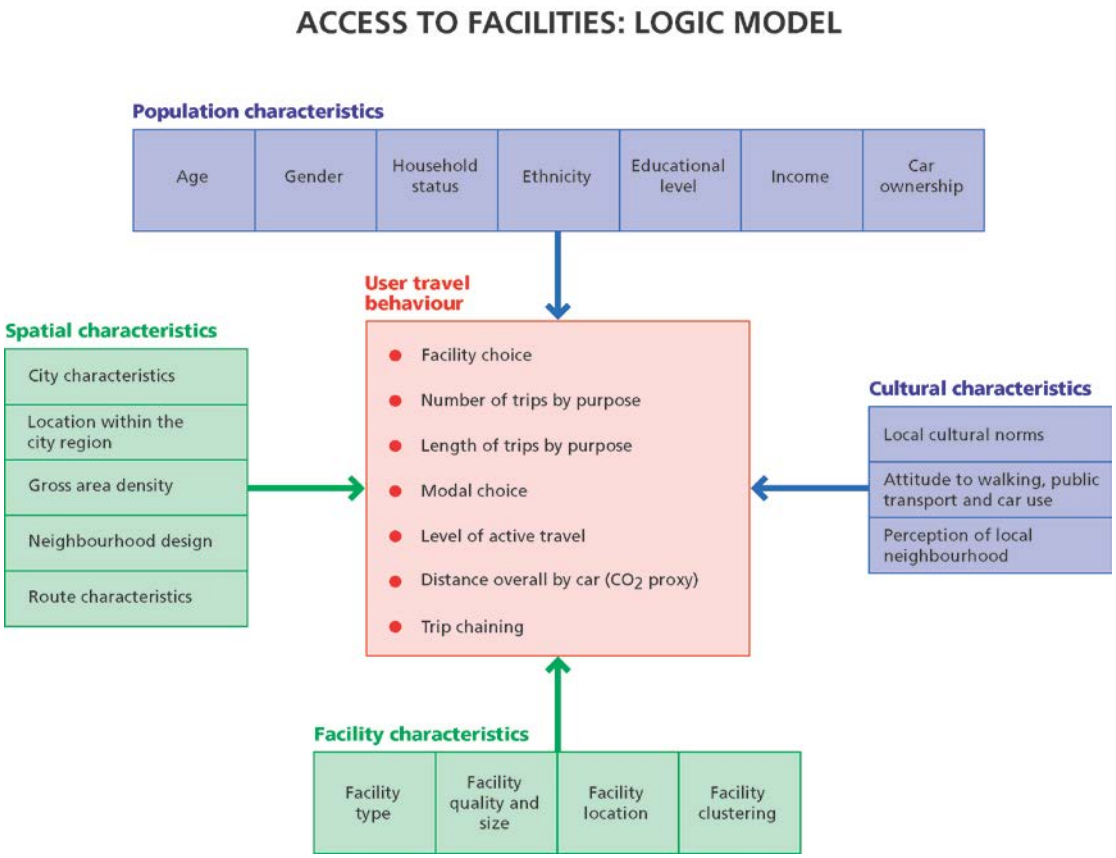
Figures:



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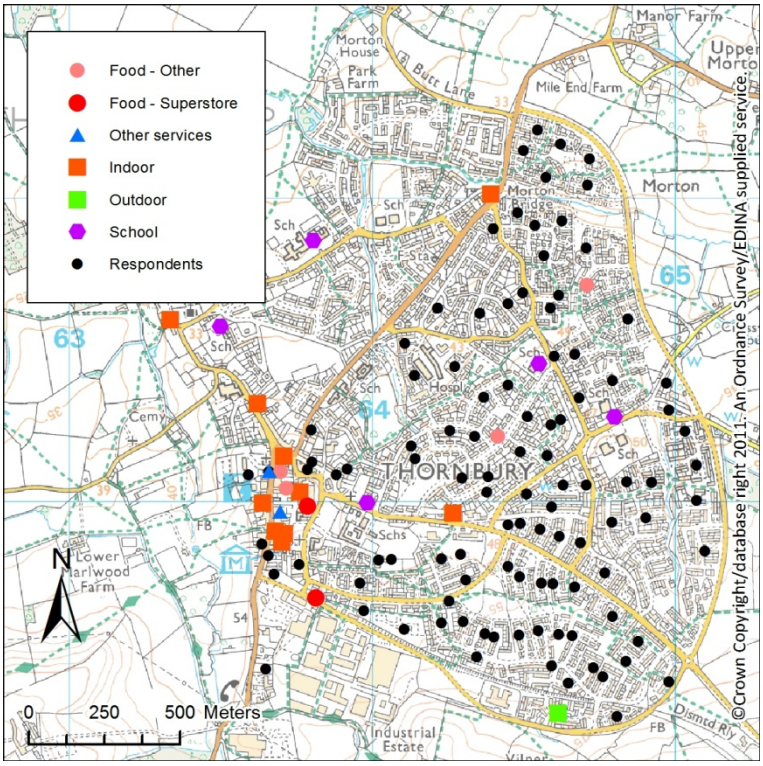

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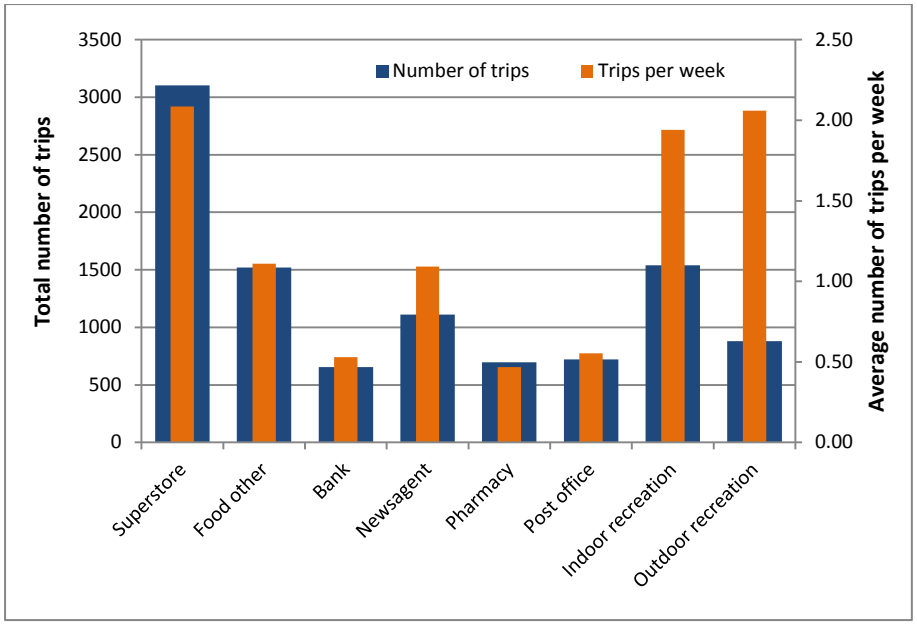

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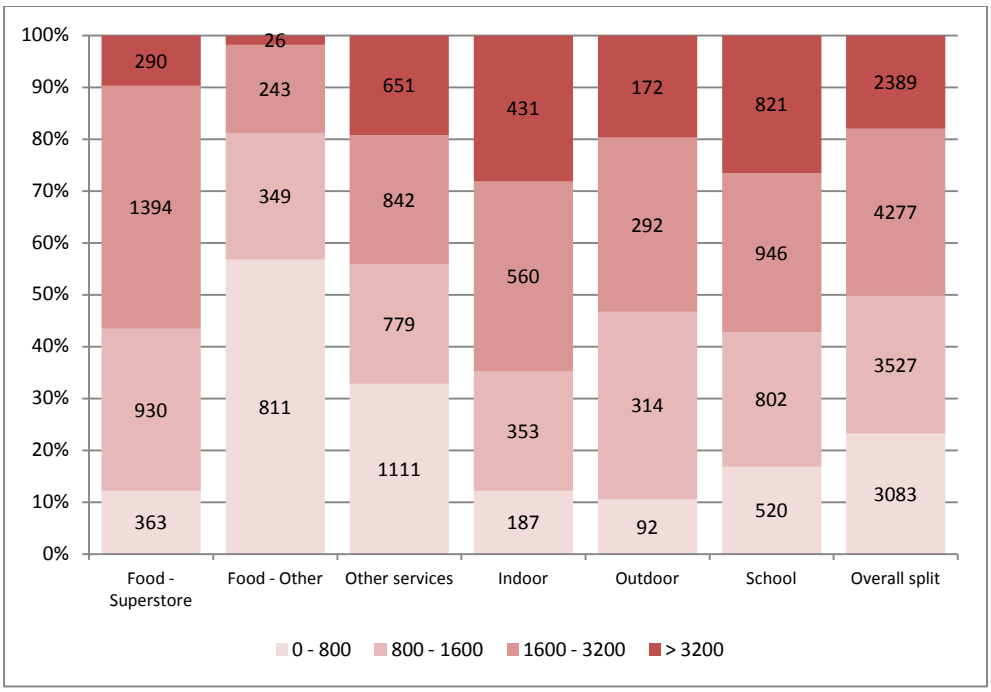

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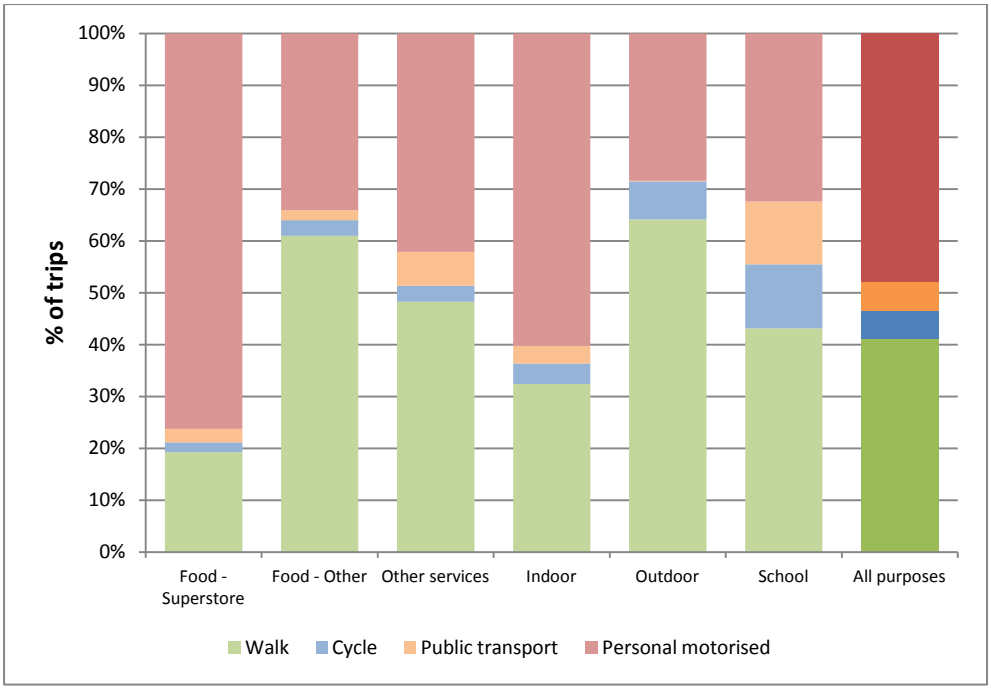

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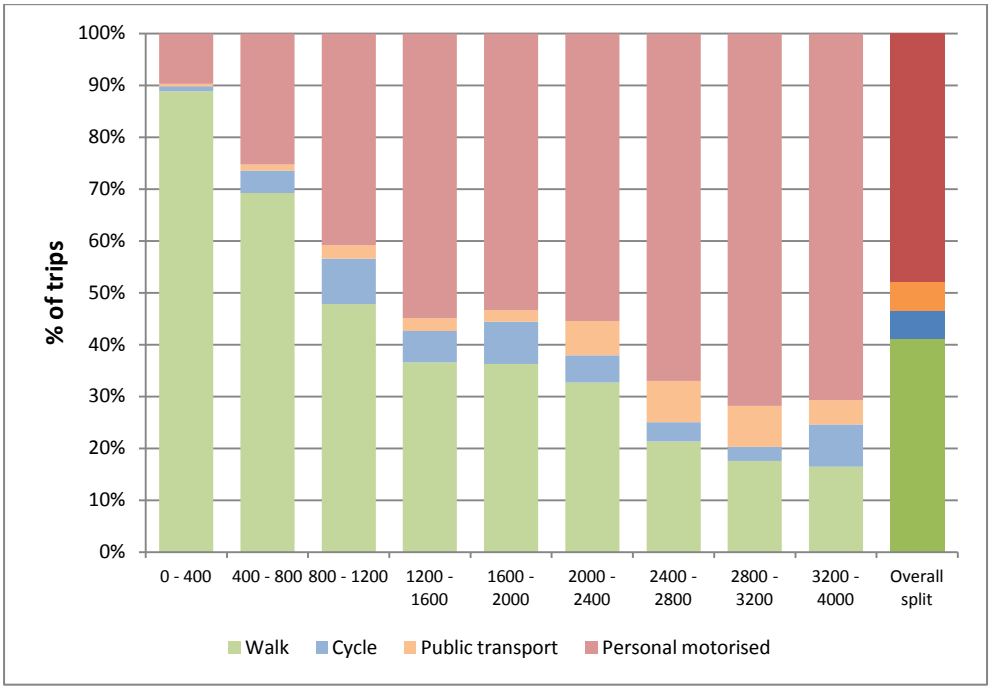

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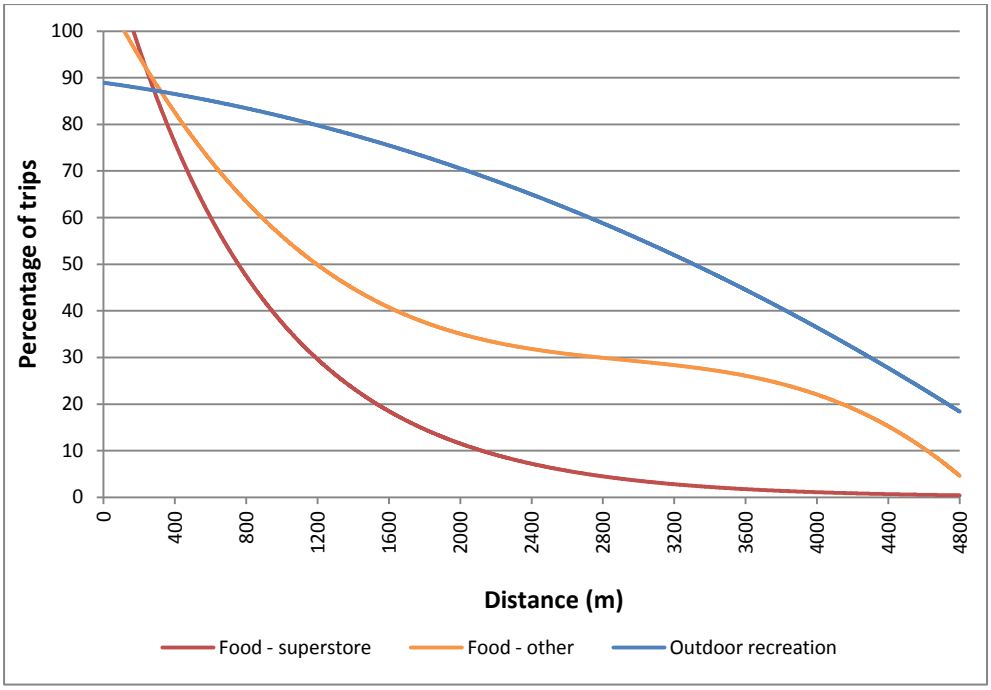

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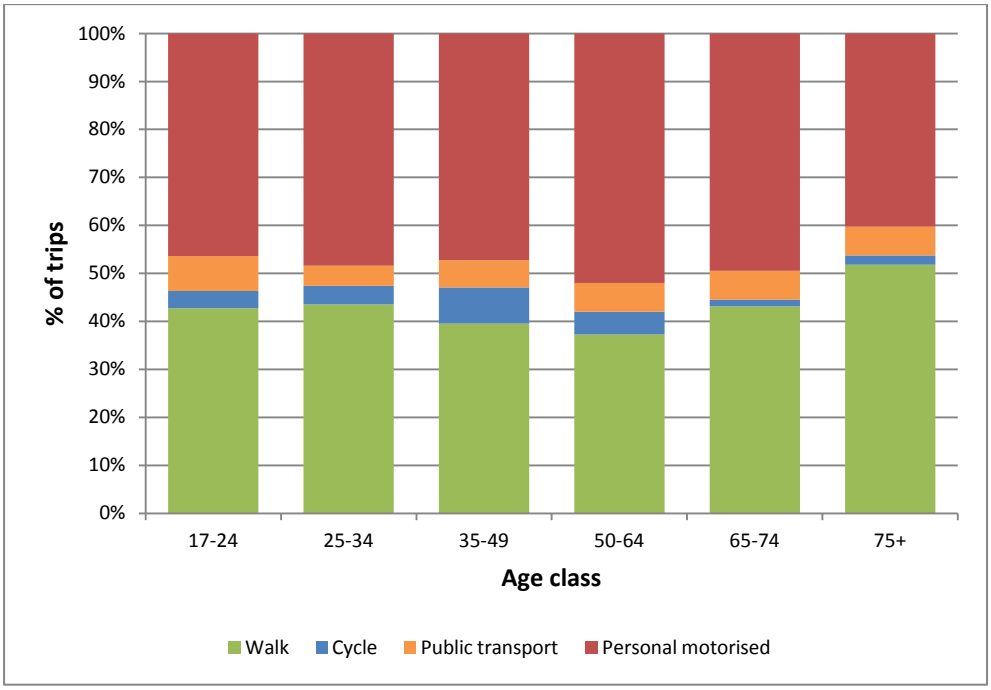

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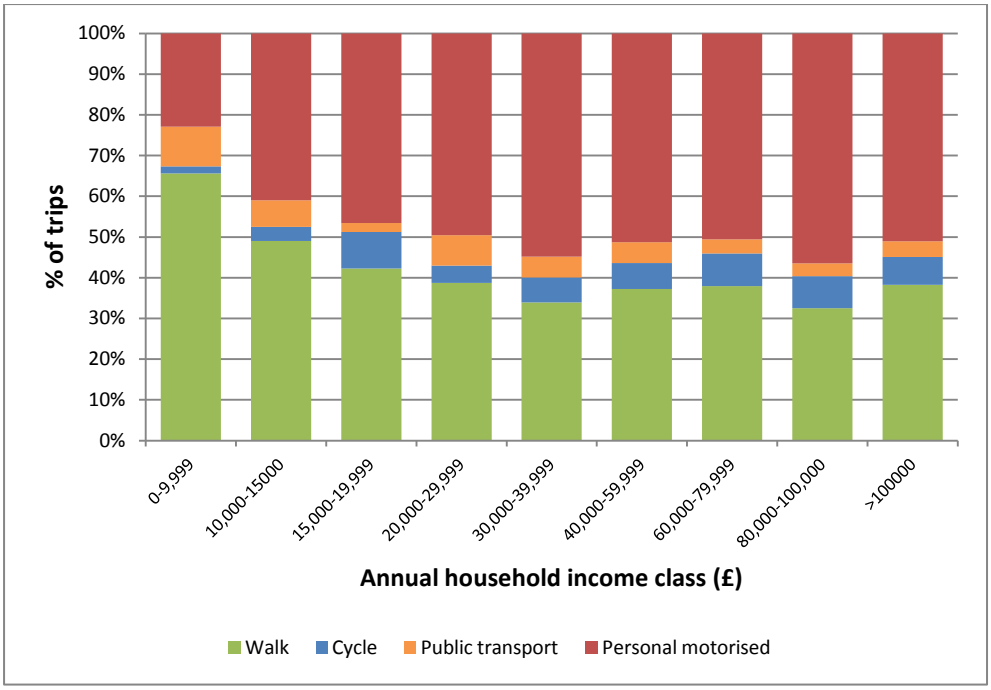

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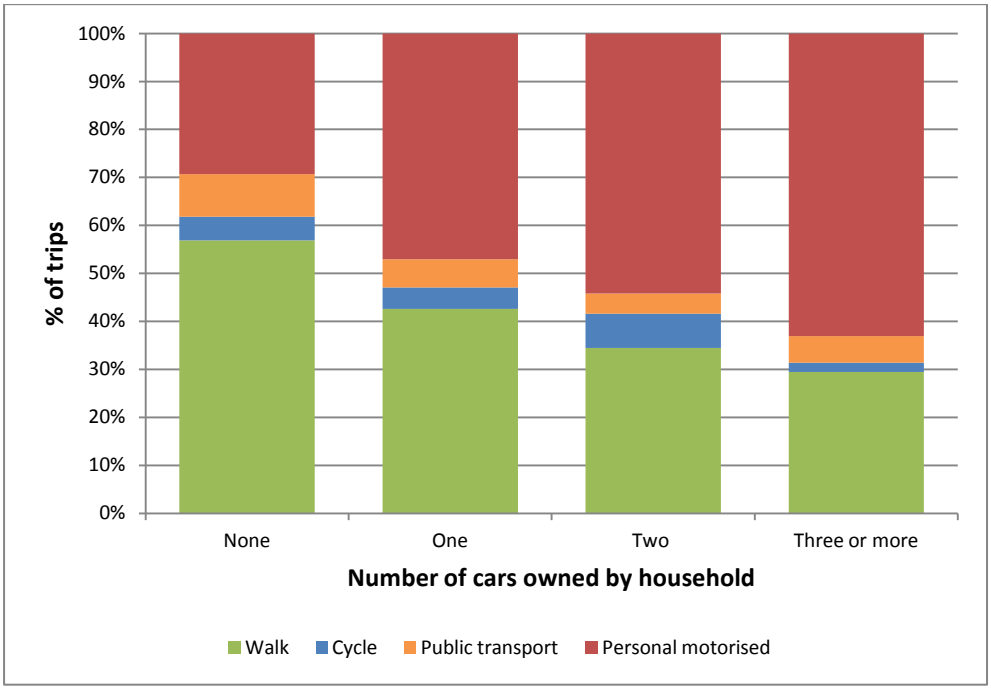

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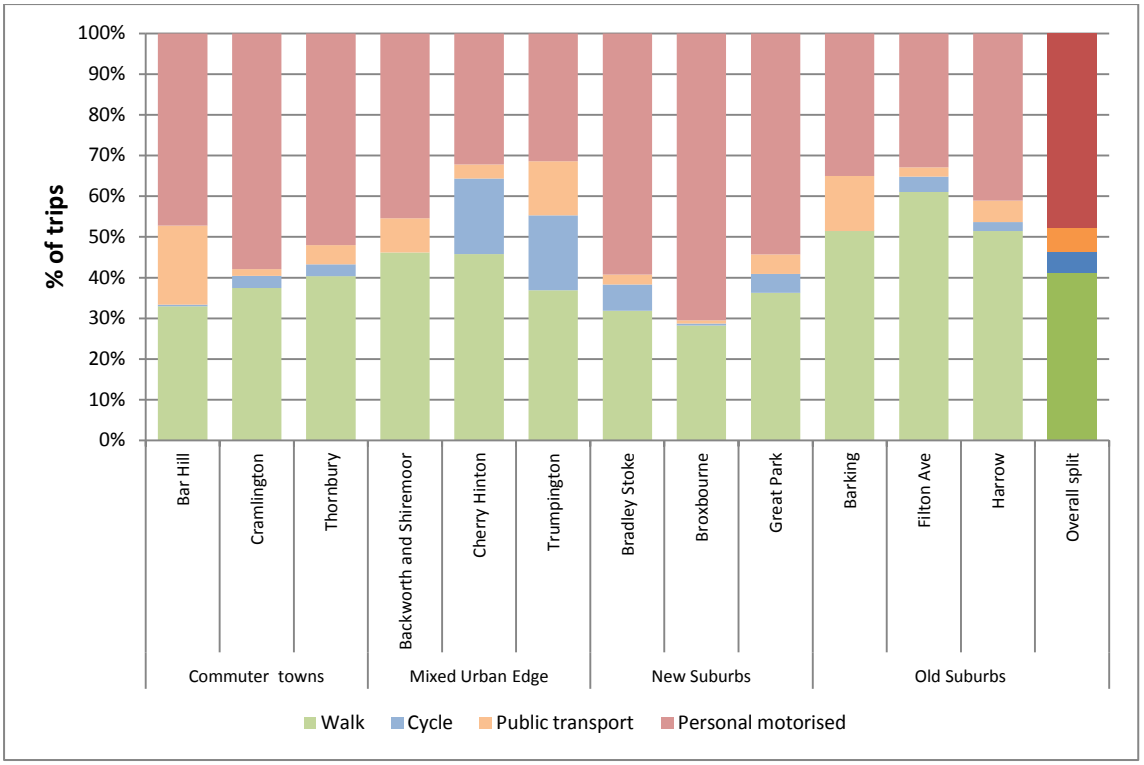

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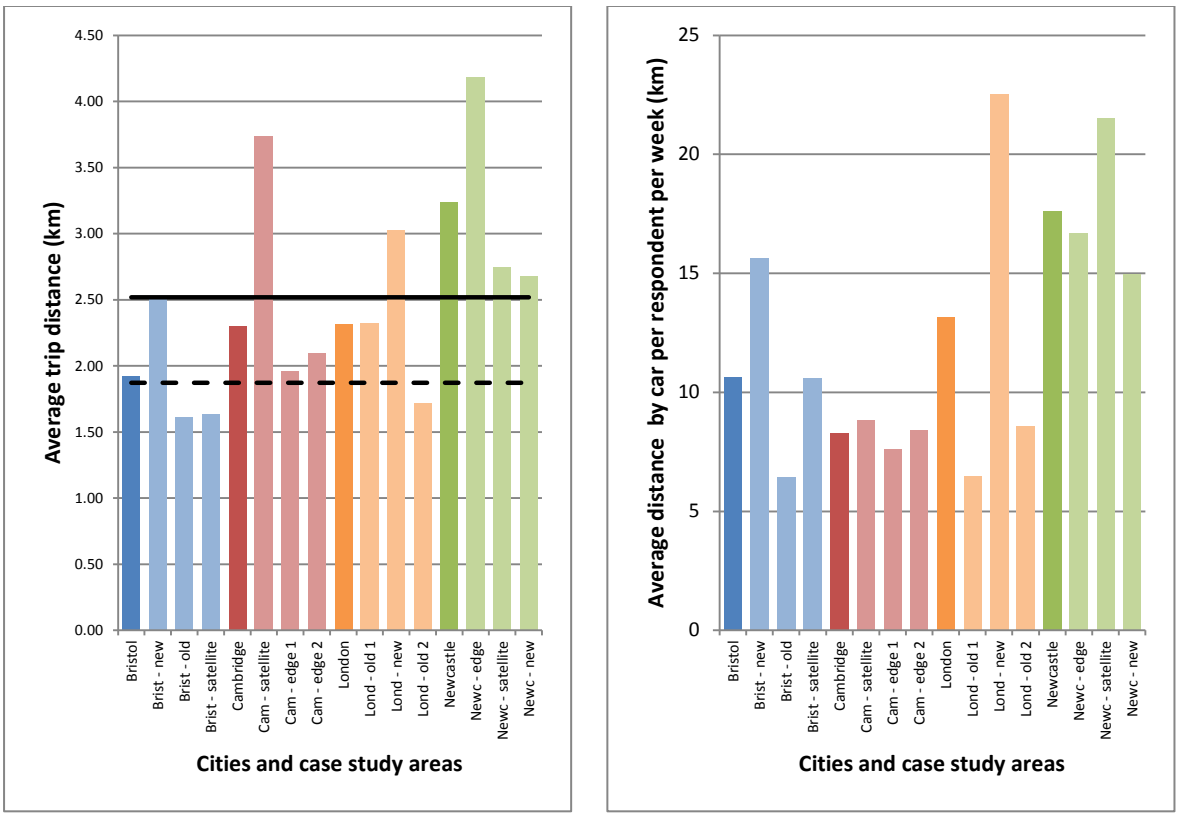

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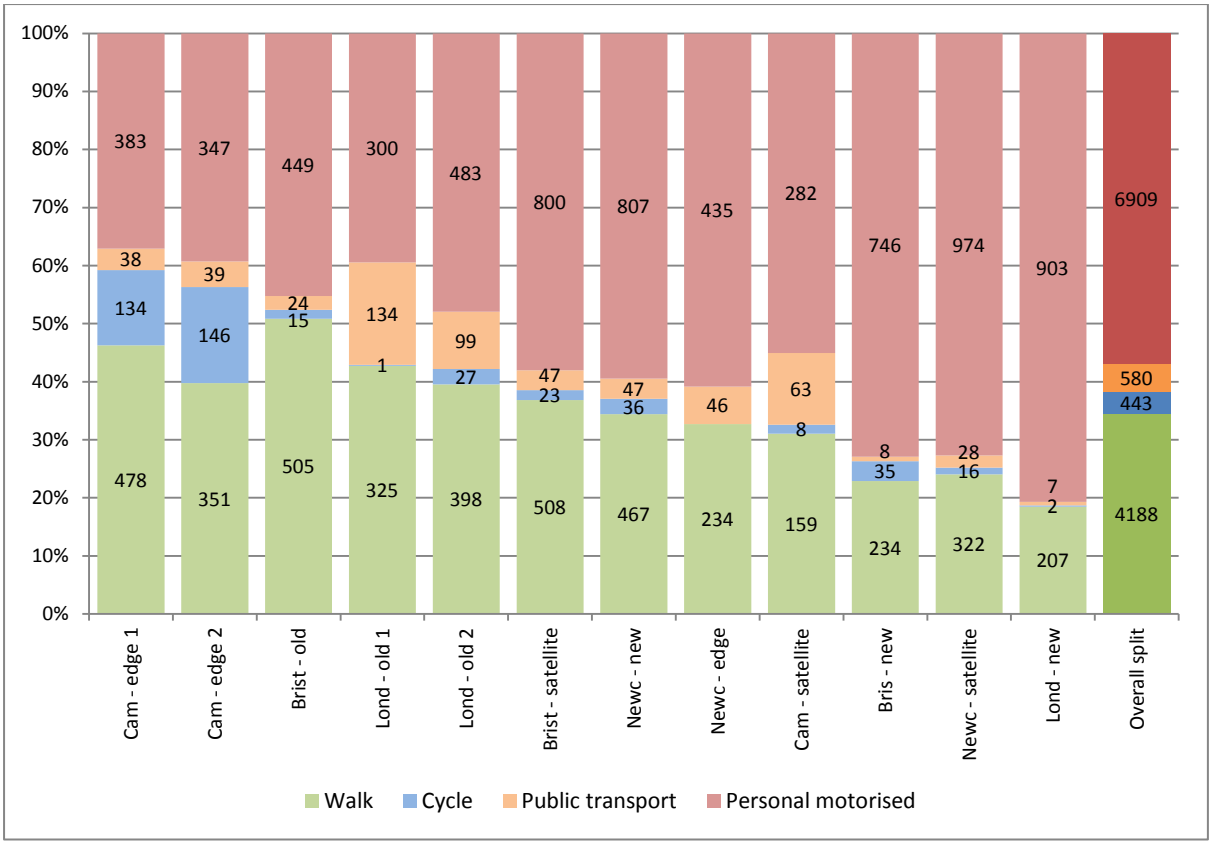

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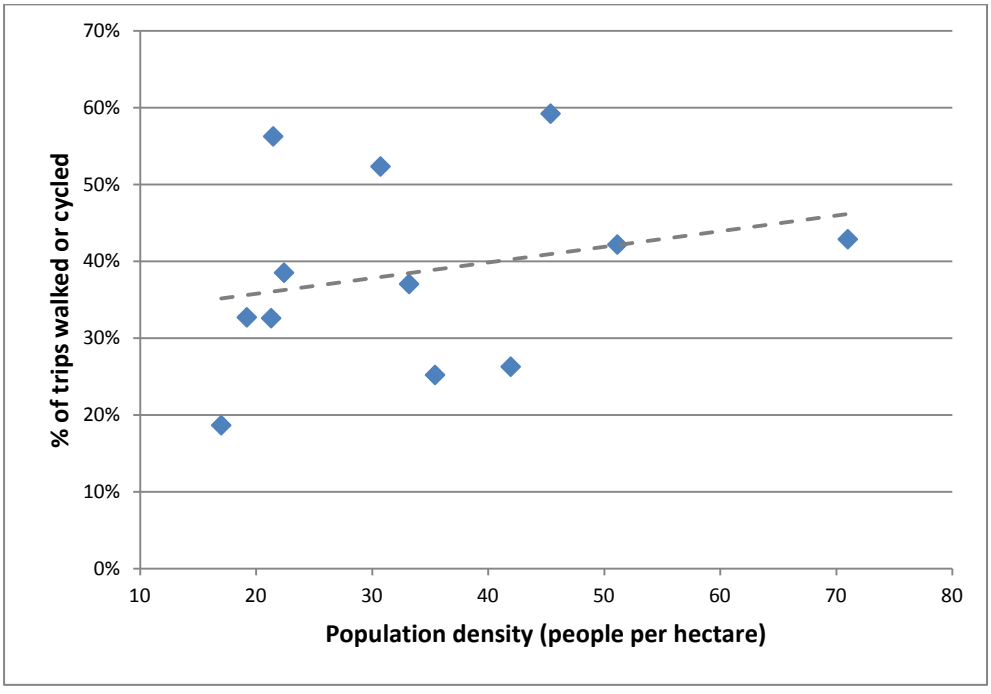

Figure 14