Active travel patterns and neighbourhood accessibility

Summary findings of the Solutions Neighbourhood Survey (WP12)

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Overview and context

The original title of this research - work package 12 of the SOLUTIONS programme - was *Neighbourhood accessibility and social inclusion*. Its aim was to answer three questions about which current knowledge was minimal (Handy 2005, Barton and Hills 2005):

- To what extent do outer city residents use local shops and services?
- To what extent do people travel to these destinations on foot or by bike?
- What, if any, is the influence of spatial planning and layout on these behaviours?

The study involved a household survey in 12 suburban and exurban localities in four different city regions: Cambridge, Newcastle, London and Bristol. Eight of the survey areas coincided with local study areas for the main SOLUTIONS project. The survey areas are widely varied in social composition and spatial character, so that together they give a reasonably balanced picture of suburban England. The results reveal some similarities of behaviour between survey areas but also a surprising degree of variation - leading to the conclusion that it is essential to treat each place on its own merits.

The research was designed so as to contribute useful information to the broader SOLUTIONS programme - the survey areas were chosen with this in mind, negotiated with local authority and academic partners. The research was also designed to throw light on the important general issues of social inclusion, healthy lifestyles and greenhouse emissions.

Social inclusion is relevant in terms of levels of accessibility and supportive social networks. Less mobile groups may be effectively disenfranchised by poor access to local facilities. The absence of local facilities within walking distance may in turn affect the strength of local community ties and consequent mental well-being. This question is also being explored by PhD research funded by EPSRC and linked to SOLUTIONS (Calve Blanco 2010).

A healthy lifestyle - particularly ‘active travel’ (i.e. walking or cycling to reach a destination) - is recognised as critical to the issue of obesity and its associated health problems (Butland 2007). The research reported here throws light on the degree to which the presence of local facilities affects the level of active travel, and whether spatial planning has a role in combating obesity.

Turning to climate change, transport is major contributor to carbon dioxide emissions, and its share of total UK emissions has been steadily rising, now standing at 28% (DEFRA 2008). This research captures nearly half (46%) of total trips - though a much smaller proportion
of total travel distance - and therefore provides evidence of the degree to which neighbourhood accessibility is a factor in carbon emissions. It also provides the basis for reviewing assumptions about modal split for local trips within large transport/land use models which predict overall emission levels.

The theoretical framework for the research is provided by two areas of literature. The first, from the transport field, is concerned with travel behaviour and the significance of urban form. The second, from public health, is concerned with the factors that influence levels of physical activity. See Barton and Hills 2005 on the SOLUTIONS website for a review of this literature.

The potential practical value of this research is already (2009) evident. The patterns of behaviour surveyed here systematically for the first time in the UK, provide valuable data for policy makers. They assist planners to devise realistic accessibility criteria. Plans often include such criteria in order to guide new development into locations that encourage active travel to local facilities by the majority of the population. Evidence from this study is to be incorporated into the second edition of a widely used practice guide, which will be available early in 2010 (Barton et al 2010).

The aims and issues outlined above are revisited at the end of the paper, in the conclusions.
Introduction

It is a while since neighbourhoods were declared dead (Webber 1964, Dennis 1968) or ‘phantasmagoric’ (Giddens 1990). Recent concerns about the impact that the apparent decline of neighbourhoods has had on public health, social exclusion and the environment, have raised the cause of neighbourhoods in the policy debate once more. A clearer understanding of how different people behave within their neighbourhoods, in terms of the decisions they make, the distances they travel, the facilities they use and their attitudes about their environment can help inform the debate. Key to any such discussion, though, is a functional definition of ‘neighbourhood’. Barton and Hills (2005) suggestion that a neighbourhood is a local service catchment area, where facilities are accessible by non-motorized means and where users can satisfy some of their needs is simple and effective, and will be used in this discussion.

This paper will consider the factors that influence modal choices. They could be demographic, that there is something about who you are - that influences your decisions, or they could be environmental - that the nature of the place in which modal choices are made influences your decisions, finally, your attitudes about your neighbourhood, the environment and travel may influence your choices. It is certain, that in reality there is a complex interaction between all these factors. The discussion will focus on the levels of active travel that seem to be related a set of variables based on the three factors presented above. Table 1 summarizes the variables that will be examined as components of each of the factors. The report will be structured according to these factors.

Table 1: Summary of factors, components and measures

<table>
<thead>
<tr>
<th>Factor</th>
<th>Component</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographic</td>
<td>Age</td>
<td>Cross tabulation of self-reported demographic classification by modal choice per trip undertaken</td>
</tr>
<tr>
<td></td>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Income</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Car ownership</td>
<td></td>
</tr>
<tr>
<td>Environmental</td>
<td>Locational</td>
<td>Levels of active travel based on location</td>
</tr>
<tr>
<td></td>
<td>Neighbourhood type</td>
<td>Levels of active travel based on neighbourhood type</td>
</tr>
<tr>
<td></td>
<td>Trip purpose</td>
<td>Levels of active travel based on trip purpose</td>
</tr>
<tr>
<td>Attitudinal</td>
<td>Reasons for walking and cycling</td>
<td>Reported levels of agreement and disagreement with a selection of statements</td>
</tr>
<tr>
<td></td>
<td>Deterrents to walking and cycling</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Importance of walkability</td>
<td></td>
</tr>
</tbody>
</table>
The investigation was driven by a lack of empirical evidence relating to how much and how far people walk and cycle to local facilities. It assumes access to facilities to be a basic need, and examines the effect of the car-based neighbourhood legacy has on determining levels of active travel.

There is consensus in the literature that environments influence levels of physical activity (Handy et al 2005, Anand 2006, Lee and Moudon 2008, Brown et al 2008), although the level of influence is still contested. The need to create environments that foster physical activity is not contested - particularly in the light of the obesity epidemic that exists in much of the developed world. Rodriguez et al (2006) suggest that over and above the health benefits of active travel, making such trips could have a further positive impact of social cohesion and community support. They emphasise the importance of utilitarian trips - to local shops and services - of being particularly significant in this regard. This finding is supported by Brown et al (2008), who found that intra-neighbourhood utilitarian physical activity trips were associated with lower body mass index.

Lee and Moudon (2008) investigated the relationship between neighbourhood design and physical activity. Their study included consideration of demographic variables, attitudinal variables, and, what they describe as ‘objectively measured environmental variables’ - a series of spatial descriptors of the environment derived using GIS. They found that the most important determinants of physical activity in a neighbourhood (defined by them as a 1km buffer from the respondents homes) were the presence, in the neighbourhood, of local convenience stores and post offices, proximity to a local cluster of facilities (food stores, restaurants and retail outlets), and the absence of superstores, what they describe as a ‘big box retail store’.

Lake and Townshend (2006) suggest that the factors that correlate with the propensity to undertake physical activity are high residential densities, a land-use mix - including local shops, services and schools, presence of pavements and footpaths, attractive environment and perceptions of safety. They note that modern suburban neighbourhoods do not contain many of these factors.

This report does not present a full set of results from the survey undertaken. A selection of relevant data is presented in the various sections, at different levels of aggregation, which will be explained in each section. The results are presented as a description of reported behavior - at this point, the analysis has not included any multivariate analyses. However, a number of valid inferences can, and will, be made from the data as presented. These will be considered in the light of the literature presented above.
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

Table 2 shows the characteristics of the twelve case study areas according to home and car ownership, as well as the deprivation rank based of the 2004 Index of Multiple Deprivation data. It can be seen that there is a wide variety of neighbourhoods represented. Home ownership levels vary from 57% to 96%; car ownership also from 57% to 96%; levels of deprivation from across the spectrum. While some neighbourhoods are characterized by relative poverty or wealth (compare Barking and Bradley Stoke) others have considerable social diversity.

Table 2: Case study area characteristics

<table>
<thead>
<tr>
<th>Neighbourhood</th>
<th>City</th>
<th>Home ownership (%)</th>
<th>No car households (%)</th>
<th>Deprivation rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bradley Stoke</td>
<td>Bristol</td>
<td>82</td>
<td>4</td>
<td>30,457 to 31,951</td>
</tr>
<tr>
<td>Filton Avenue</td>
<td>Bristol</td>
<td>59</td>
<td>29</td>
<td>5,408 to 21,304</td>
</tr>
<tr>
<td>Thornbury</td>
<td>Bristol</td>
<td>83</td>
<td>13</td>
<td>13,499 to 32,404</td>
</tr>
<tr>
<td>Bar Hill</td>
<td>Cambridge</td>
<td>88</td>
<td>10</td>
<td>27,652 to 31,095</td>
</tr>
<tr>
<td>Cherry Hinton</td>
<td>Cambridge</td>
<td>66</td>
<td>20</td>
<td>12,397 to 31,072</td>
</tr>
<tr>
<td>Trumpington</td>
<td>Cambridge</td>
<td>62</td>
<td>25</td>
<td>23,774 to 31,604</td>
</tr>
<tr>
<td>Barking</td>
<td>London</td>
<td>57</td>
<td>43</td>
<td>5,050 to 10,279</td>
</tr>
<tr>
<td>Broxbourne</td>
<td>London</td>
<td>83</td>
<td>13</td>
<td>8,487 to 27,628</td>
</tr>
<tr>
<td>Harrow</td>
<td>London</td>
<td>66</td>
<td>28</td>
<td>7,487 to 28,356</td>
</tr>
<tr>
<td>Backworth &amp; Shiremoor</td>
<td>Newcastle</td>
<td>47</td>
<td>11</td>
<td>5,080 to 15,826</td>
</tr>
<tr>
<td>Cramlington</td>
<td>Newcastle</td>
<td>74</td>
<td>13</td>
<td>4,924 to 30,928</td>
</tr>
<tr>
<td>Great Park</td>
<td>Newcastle</td>
<td>96</td>
<td>16</td>
<td>28,837 to 31,794</td>
</tr>
</tbody>
</table>

Each study area is characterised below, and key demographic and attitudinal responses from the questionnaires are presented. Note that the respondent symbol in the maps of the study areas usually refer to multiple respondents.

Note that in the following area maps, each dot represents one post code surveyed, and may include several households.
Bradley Stoke lies on the ‘northern fringe’ of Bristol, within the boundary of South Gloucestershire District Council. Most of the housing in Bradley Stoke was constructed in the 1980s and 1990s. It is one of the least deprived areas in the country - all lower output areas are ranked above 30,000 in the 2004 index of deprivation. It has high levels of home ownership, a very small number of social rented dwellings, and very high car ownership. Bradley Stoke is dominated by residential ‘pods’ of development hanging off the distributor road system. It is ill adapted to public transport, and pedestrian routes are often very indirect. The level of local facilities is poor.

There were 134 respondents in Bradley Stoke. Almost 93 percent own their own home. Less than one percent lives in council houses, and the balance rent from private landlords. Just under two thirds of the respondents live in households that have an income higher that £30,000. This is about ten percent higher than the same statistic for the whole sample. It is, however, very close to the result for the group New Suburbs of which Bradley Stoke is a member. Fifty-six percent of households have two or more cars, ten percent higher than the result for Bristol as a whole, but slightly less than the result across all new suburbs. Only 9% of household do not own a motor vehicle, the lowest result across the entire sample. Three percent of respondent households have more than two children. Bradley Stoke has the lowest proportion of respondents with no children (just under 62%). It is the third least racially diverse study area, with more than 96% of the respondents identifying themselves as white. This is similar to the result for new suburbs, but about 4% higher than across the whole sample.

Few respondents in Bradley Stoke agreed with the statement that bus services to local services or main centres were good (only 11% and 25% respectively). Only three percent of respondents felt unsafe during the day. Two-thirds of respondents felt that local shops
were within easy walking distance of their homes. A similar proportion indicated a preference to shop at local stores, although only a third indicated that proximity to local service had been a motivating factor in purchasing their home. High levels of disagreement with the statements relating to the walking environment, that the quality of pavements and busy roads were a deterrent to walking, were found. Just over 40% of respondents cited exercise as the main reason for walking or cycling; only 23% agreed that meeting people was a reason for such choices.

**Filton Avenue - Bristol**

Filton Avenue contains many 1930s and 1950s houses, with some Victorian terraces. In terms of deprivation, it is a mixed area. Some areas within Filton Avenue are very deprived, while others appear much lower in the 2004 rank of deprivation. It has higher than average social rented dwellings, and low levels of car ownership. The general form of Filton Avenue is that of grid-based linear development, with Filton Avenue itself providing an intermittent, low-key, high street function and a frequent bus service. The main retail centers (including superstores), are outside the study area. Since 2004, a regeneration scheme has seen much of the old council housing stock replaced with new housing - both private and social rented.

There were 141 respondents in Filton Avenue. Filton Avenue has the most racially diverse set of respondents in Bristol, with almost 7% from BME populations. Almost 28% of respondent households do not own a car - this is second only to Barking across the entire sample; 52% own two or more cars. Fifty-six percent of respondent households earn less than £30,000, compared with 36% in Bradley Stoke and 48% in Thornbury, the other Bristol case study areas. Across the whole survey the result is 47%. Filton Avenue also has the highest percentage of council tenant respondent households in Bristol at 11%. This is one
percent higher than the average across the sample. Eighty-five percent of respondents own their own home.

Filton Avenue is classified as an Old Suburb. Only 21% of respondents felt that their neighbourhood was attractive, compared with 66% in Bradley Stoke and 82% in Thornbury. Sixteen percent felt unsafe during the day. Bus services to local facilities were agreed to be good by 37% of respondents, while 53% felt services to main centers were good. Few respondents (= 15%) felt that the physical walking environment made it difficult for them to walk to local services. Ninety percent felt that local shops were within easy walking distance. The most frequently agreed with reason for walking was to meet people (36%), saving money and environmental considerations were each listed as the main reason for active travel choices by 33% of respondents. Only just over half of respondents (52%) felt that their local stores met most of their requirements, with slightly less (45%), stating a preference for shopping locally. Forty-nine percent of respondents had chosen their homes because of their proximity to local services.

**Thornbury - Bristol**

Thornbury is an exurban market town that lies to the north of Bristol, in prime commuter belt. It combines housing from the 1970s, 1980s and 1990s with a much older town centre. It has no very deprived areas, and has some areas that are among the least deprived in the country. Socially it is quite mixed, though those from higher occupational groups are slightly over-represented. There are very high levels of owner occupation, and high levels of car ownership in Thornbury. Spatially, it has the character of a large neighbourhood cell, with the town centre and the main superstore in separate locations at the edge of the residential area. Walking routes are more direct than in Bradley Stoke, but less so than Filton Avenue.
One-hundred and sixty households responded in this area. In Thornbury, a Bristol commuter town, 52% of respondent household incomes were over £30,000, very similar to the proportion across the whole sample (52%). Eighty-five percent of respondents owned their own home, 10% rented from the council and the remainder rented from private landlords. Less than 1% of the respondents identified themselves as belonging to a BME racial group; the average across the whole sample is 7.3%. Thornbury has the third highest incidence of no car households at 22%, almost seven percent higher than for commuter town respondents across the whole sample.

In Thornbury, unlike the other two Bristol case studies, people are more satisfied with the bus service to local facilities than to main centers. Eighty-two percent of respondents felt that their neighborhood was attractive, and fear of crime is very low (3%). The quality of the walking environment is not regarded as a deterrent to active travel, only 10% of respondents agreeing with these statements. Saving money is the least agreed with reason for walking or cycling (26%); environmental reasons are cited by 39%; and, 33% walk or cycle to meet people. Seventy-nine percent of respondents prefer to shop at their local facilities, but only 60% felt that these facilities provided most of what they need. Less than half of the respondents were influenced by proximity to local services when choosing their house.

**Bar Hill - Cambridge**

Bar Hill is a modern exurban commuter development that lies to the north west of Cambridge. It has housing built in the 1980s and 1990s. There is absence of deprivation in Bar Hill, with each area comprising Bar Hill scoring very low on deprivation statistics. It has a very low proportion of retired people, very high levels of home ownership, and low levels of social and private rented accommodation. It has high levels of car ownership. The level of local facilities is much better than most exurban developments, partly due to the presence of a major superstore, which attracts from a wider area. The physical pattern is that of a neighbourhood cell, with vehicle circulation being on the cul-de-sac model but separate pedestrian connections giving fair permeability.
Of the 125 respondent households in Bar Hill fifty-two percent had an income over £30,000, similar to the 53% across the whole survey. Only 2.4% of the respondents identified themselves as belonging to a BME population group. Home ownership is just under 90%; only just over 3% of respondents are council tenants, the second lowest proportion in the sample. Across the Cambridge study areas home ownership is over 75%. Over 50% of respondent households own two or more cars, about 5% higher than across the sample and almost 10% higher than the proportion for the whole of Cambridge.

Seventy-eight percent of respondents indicated a preference to shop at local facilities and 80% agreed that local facilities provided most of what they needed. Local facilities were regarded as being within an easy walking distance by 96% of respondents. Neither busy roads nor the quality of pavements were significant detractors from active travel, only 2% and 10% respectively agreeing that they influenced their choice. Local bus services were regarded as good by 40% of respondents, while just over 70% felt that services to main centers were good. Fear of crime is low at 3% of respondents. Forty-seven percent of respondents agreed that their neighbourhood was attractive; 39% neither agreed not disagreed. Environmental reasons are most commonly cited for choosing active travel modes (52%), followed by to meet people (48%) and then to save money (42%).

**Cherry Hinton - Cambridge**

Cherry Hinton is in the south east of Cambridge. The Cambridge City Council/South Cambridgeshire boundary cuts through Cherry Hinton, but it is part of the built up area of Cambridge. Most areas that comprise Cherry Hinton are somewhere towards the middle of the deprivation statistics for the country as a whole. While there is a larger proportion of higher occupations than the national average, it is in most ways socially reflective of England as a whole. The general form of Cherry Hinton is of a neighbourhood cell, but with
quite a linear centre, many small residential pods reducing permeability, and the main superstore at the edge of the development.

There were 136 responses received from households in Cherry Hinton. Seven percent of respondents in Cherry Hinton identify themselves as belonging to BME populations, close to the proportion across the whole sample (7.4%). Cherry Hinton has the second lowest levels of home ownership in the sample (66%) and the second highest levels of council tenancy (20%). Only 45% of respondent households had an income over £30,000, less than the 53% that characterizes the proportion for the whole sample. Only 38% of households own two or more cars, and 19% have no motor vehicle. Eighty-one percent of households have one or more cars, the same proportion as across the whole sample.

Although 74% of respondents agreed that local facilities provided most of what they needed, only 57% of respondents prefer to shop locally. Bus services to local facilities are regarded as good by 52% or respondents, while 69% felt that service to main centers were good. Fear of crime is relatively high at 7%, and only 55% of respondents felt that their neighbourhood was attractive. The quality of the pavements (15%) was a greater deterrent of the choice to walk than busy roads (5%). Most respondents that cycled did so for environmental reasons (60%), followed by to save money (46%) and finally to meet people (39%). Fifty-eight percent of respondents in Cherry Hinton were influenced by the proximity of local services when buying their home.

**Trumpington - Cambridge**

Trumpington is in the south of Cambridge, within the built up area of the city. Twentieth century suburban development has grown up around the core of an old village on a main radial. Socially it is very mixed. There are proportionately higher numbers of higher managers and professionals than nationally, but at the same time lower than average levels of home ownership. Both private and social renting are above average, while car
Ownership is below average. Physically Trumpington is traditionally linear in form, but with a tendency towards becoming a cell, with a neighbourhood centre that includes a superstore, and ‘pods’ in some areas impeding direct pedestrian routes.

In Trumpington, 47% of 133 respondents report a household income over £30,000, but over 7% have an income exceeding £80,000, significantly higher than either of the other Cambridge study areas (3.6% in Cherry Hinton, and less than 1% in Bar Hill). Home ownership is third lowest across the whole sample at 73%, and 10% lower than across the sample. Almost one quarter of the respondents are in rented accommodation (13% - council, 11% - private), compared with 16% for the whole sample. The number of households with two or more cars is about 10% lower than for the sample at 35%.

Seventeen percent of respondent households do not own a motor vehicle. BME population groups account for 6.3% of the respondents.

Only 60% or respondents felt that their local facilities provided most of what they needed, although 66% expressed a preference for shopping locally. Just under half of the respondents considered the proximity of local shops when choosing their home. Fifteen percent agreed with the statement that the quality of pavements made it awkward for them to walk to local services, while 12% agreed that busy roads were an influencing factor when choosing to walk. Twenty-two percent of respondents felt that bus services to local centres were good, compared with 64% agreeing that service to main centres were good. Fear of crime is low, with only 3% of respondents feeling scared during the day.

Sixty percent of respondents felt that their neighbourhood was attractive. Seventy-three percent of respondents cited environmental reasons as the motivating factor for using active travel modes, 46% walked or cycled to save money and 40% did so to meet other people.
Barking - London

Barking is located in East London, and is well served by transport links to central London, and there is a considerable local bus network. In the neighbourhood, there are many shops; and there is a large open market in a pedestrianized town centre. There is a superstore nearby with ample parking. Barking is the most deprived of the case study neighbourhoods. The index of deprivation scores put the case study area’s neighbourhoods in the poorest third in England. Both car and home ownership levels are lower than in any of the other neighbourhoods. The population is ethnically diverse. Housing is mixed, with some Victorian terraces, 1930s and 1950s housing, many of which have been converted to flats.

Barking is the most ethnically diverse of all the study areas, with almost a third of the respondents coming from BME population groups. It is also one of the poorest with only 38% of the respondent households earning over £30,000; over a quarter of respondent households have an income of less than £15,000. House ownership is the lowest in the sample at less than 60%; council tenancy is highest at 29%. Forty-one percent of respondent households do not own a car, more than double the average across the sample (19%). Less than 15% own more than one motor vehicle.

Just over half the 103 respondents felt that local shops provided most of what they needed, and a similar proportion expressed a preference for shopping locally. About 60% of respondents agreed that bus services were good to both local and main centers, higher than in most other case study areas. Only 21% felt that their neighbourhood was attractive, and over 40% agreed that they felt unsafe during the day - a more negative attitude towards their neighbourhood than in any other case study area. Eighty percent agreed that local shops were an easy walking distance from their how, but 26% also agreed that the condition of the pavements made using these facilities awkward. Twelve percent
were deterred from walking by busy roads. Most respondents cited environmental as the reason for walking or cycling (54%), followed by to save money (42%) and to meet people (29%). Forty percent were influenced by the proximity of local services when choosing their home.

**Broxbourne - London**

Broxbourne is located to the north of London near the M11. The case study area of Hammond Street near Cheshunt is largely 1980s housing. In the neighbourhood, there are some convenience stores, but the main food stores are two superstores (Tesco and Marks and Spencer) located just outside the case study area. There are high levels of home ownership, and not many households without a car. Index of deprivation scores show the area is mixed socially, though most areas do not show high levels of deprivation.

One-hundred and three responses were received from Broxbourne households. Respondents in Broxbourne are the wealthiest of all the study areas, with 65% having a household income over £30,000; 5% have an income over £100,000. Home ownership is the highest in the sample at 93%, and the lowest for council tenancy at less than one percent. Just under 94% of respondents identified themselves as white. Only 9% of respondent households do not own a car. Thirty-six percent have one car, and the remaining 55% own two or more cars, roughly 10% higher than across the whole sample.

In Broxbourne, 70% of respondents felt that local shops provided most of what they needed, and 60% indicated a preference for shopping locally. Perceptions of the bus services were poor, with 12% agreeing that services to local centers were good, and 20% that services to main centers were good. Fifty-eight percent felt that their neighbourhood was attractive, and 9% were fearful of crime and harassment during the day. More than half of the respondents felt that local shops were within easy walking distance, however, 25% felt that the quality of pavements preventing them from walking and 15% were
deterred by busy roads. Only a quarter of respondents considered proximity to local services when choosing their home.

**Harrow - London**

Harrow is located to the West of London. The neighbourhood is well served by several large and small supermarkets. Like Broxbourne, the index of deprivation scores show that in deprivation terms, it is mixed with some relatively deprived areas and some not so deprived. Levels of car and home ownership are lower than most of the other neighbourhoods and the area is ethnically mixed. Housing is diverse, with some older housing joined by post war development.

Twenty-seven percent of the 109 respondents in Harrow are from BME population groups, and over 9% of respondents identifying themselves as white are not from the British Isles - making it the second most ethnically diverse study area. Sixty percent of respondent households have an annual income of more than £30,000. Eighty-five percent of respondents owned their home, 7% rent from private landlords and the remaining 8% are council tenants. Car ownership is at 80% of households, with 34% owning more than one car.

Opinions of bus services are quite high, with 55% agreeing that local services were good and 61% agreeing that services to main centers were good. Sixty-eight percent of respondents felt that their local shops provided most of what they needed, and 61% preferred to shop locally. The quality of pavements deterred 18% of respondents from walking to local services, while busy roads accounted for 12%, although 76% felt that local services were within an easy walking distance. Twelve percent of respondents felt unsafe during the day, and less than half felt that their neighbourhood was attractive. Environmental reasons were the most popular reason for active travel (52%), followed by
exercise (40%), and, finally, to save money (30%). Fifty-five percent of respondents’ choice of home was influenced by proximity to local services.

**Backworth and Shiremoor - Newcastle**

Backworth and Shiremoor is a mixed urban edge neighbourhood, located to the northeast of Newcastle. It has good transport links to Newcastle, via the Metro. It has high levels of deprivation - the entire area is in the lower half of national deprivation ranks. It has low levels of home ownership but very high levels of car ownership.

Backworth and Shiremoor is the least ethnically diverse of the study areas, with over 99% of the 109 respondents identifying themselves as white. Only 40% of respondent households reported an annual income higher than £30,000, considerably lower than the 54% across the whole sample. Three quarters of respondents own their own home, 22% are council tenants (second highest level across all case study areas) with the balance renting from private landlords. Car ownership though, is higher than the average for the whole sample (81.4%), at 84%, although only 31% of households own two or more cars (45% for the whole sample).

Eighty-one percent of respondents agreed that local services were within easy walking distance but 30% were deterred from walking by busy roads and 22% were deterred by the quality of pavements. Only half of the respondents felt that local services provided most of what they needed, and only 40% expressed a preference for shopping locally. Twenty-seven percent of respondents agreed that bus services to local centers were good, rising to 44% agreeing that services to main centers were good. Ten percent were fearful of crime and harassment during the day, and only 40% felt that their neighbourhood was attractive. Forty-two percent agreed that the reason they cycled or walked was environmental, and to save money and to meet people were agreed to by 26% of respondents. Less than a third of respondents considered proximity to local services when choosing their home.
Cramlington is a relatively new commuter town located six miles north of Newcastle. It is served by a well-developed town centre, and has direct rail links with Newcastle. It is characterized by a prevalence of cul-de-sac pod-based neighbourhoods, although there are well-developed pedestrian networks, giving it reasonably high walkability. It has high levels of car and home ownership. It is socially mixed, with a wide range in levels of deprivation (the highest levels of deprivation of all study areas occurs here).

Only 1.5% of the 136 respondents in Cramlington identified themselves as belong to a BME racial group. Fifty-eight percent of households had an annual income higher than £30,000. Home ownership levels are higher than the survey average (83%) at 92%. Six percent of respondent households are council tenants and the remainder rent from private landlords. As with the other Newcastle case studies, car ownership rates are high at 88%, and 53% of respondent households having more than one car.

Eighty-two percent of respondents agreed that local shops provided most of what they needed, and 72% expressed a preference to shop locally. Eighty percent also agreed that local shops were within an easy walking distance, 20% felt that the quality of pavements deterred them from walking, but only 8% were concerned about busy roads. Fear of crime is low with only 6%, and 71% of respondents felt that their neighbourhood was attractive. Fifty-three percent of respondents considered proximity to local services when buying their home.

Great Park is an affluent new suburb situated on the northern edge of Newcastle. A major arterial road bisects the neighbourhood, providing good car based access into the city of...
Newcastle. The level of local facilities is poor. Great Park is characterized by very low levels of deprivation, very high levels of home ownership and high levels of car ownership.

One-hundred-and-sixty-four households in Great Park completed and returned a questionnaire. Ninety-seven percent of respondents identified themselves as white. Over 63% of respondent households had an annual income over £30,000, 10% higher than the survey average. Home ownership is also higher than the survey average (83%) at 96% - the highest of all the study areas. Eighty-six percent of households own a car. Multiple car ownership is also highest at 63%.

Great Park residents generally have a positive view of their location - 88% agree that their neighbourhood is attractive, less than one percent (0.6%) of respondents were fearful of crime or harassment. There seems to be relatively high levels of satisfaction with bus services - 55% agreeing that local services were good and 79% agreeing that services to main centers were good. Sixty percent felt that local services provided most of what they needed, and 63% expressed a preference to shop locally. Proximity to local services had influenced 49% of respondents choice of home.

**Methodology**

The results presented here are derived from analysis of postal questionnaires and foci determined by the results of the literature review undertaken (Barton & Hills 2005) and consultation with user groups. Local facilities included were superstores, local food shops, non-food convenience shops and services, schools, indoor and outdoor recreation. The survey also included user perceptions of their neighbourhood, as well as a number of household and demographic descriptors.
Limited data will be presented for indoor or outdoor recreation. The locations for this section of the questionnaires were left open, and it has not been possible to identify all of the locations described by respondents, resulting in lower confidence in the integrity of the GIS analysis.

It is worth noting that the research did not presuppose the spatial boundaries of the respondents ‘neighbourhood’. Although some facilities were explicitly identified in the questionnaires, open response options permitted respondents to ‘expand’ their neighbourhood according to their actual use of facilities, unconstrained by any predefined distance thresholds, or researcher expectations about the behavior of the respondents.

Questionnaires were distributed (via post) to a random sample of respondents in the twelve case study areas. The questionnaires collected information about the use of, and travel to, five categories of shops and services; food shops (supermarkets and other), selected non-food shops and services, schools, outdoor recreation and indoor recreation. Response rates were generally quite high, and are presented in Table 3.

The table also contains a descriptor of the character of each of the case study areas, showing the variety of spatial contexts. There are three commuter towns, linked to different cities; three new suburbs, also linked to different cities; three ‘mixed urban edge’ neighbourhoods, two of them in Cambridge; and three older suburbs, two of them in London. The original hope was to have a comparable set three matched in each city. This was not fully achieved because of differences in the spatial pattern of the cities and in the wishes of local authority partners. However, the four categories form a useful basis for part of the subsequent analysis.

Table 3: Response rates to the postal survey

<table>
<thead>
<tr>
<th>City</th>
<th>Neighbourhood</th>
<th>Type</th>
<th>Sent</th>
<th>Returned</th>
<th>Response rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bristol</td>
<td>Bradley Stoke</td>
<td>New suburbs</td>
<td>450</td>
<td>134</td>
<td>29.8</td>
</tr>
<tr>
<td>Bristol</td>
<td>Filton Avenue</td>
<td>Old suburbs</td>
<td>450</td>
<td>157</td>
<td>34.9</td>
</tr>
<tr>
<td>Bristol</td>
<td>Thornbury</td>
<td>Commuter towns</td>
<td>450</td>
<td>166</td>
<td>36.9</td>
</tr>
<tr>
<td>Cambridge</td>
<td>Bar Hill</td>
<td>Commuter towns</td>
<td>450</td>
<td>127</td>
<td>28.2</td>
</tr>
<tr>
<td>Cambridge</td>
<td>Cherry Hinton</td>
<td>Mixed urban edge</td>
<td>450</td>
<td>133</td>
<td>29.6</td>
</tr>
<tr>
<td>Cambridge</td>
<td>Trumpington</td>
<td>Mixed urban edge</td>
<td>450</td>
<td>132</td>
<td>29.3</td>
</tr>
<tr>
<td>London</td>
<td>Barking</td>
<td>Old suburbs</td>
<td>900</td>
<td>112</td>
<td>12.4</td>
</tr>
<tr>
<td>London</td>
<td>Broxbourne</td>
<td>New suburbs</td>
<td>450</td>
<td>135</td>
<td>30.0</td>
</tr>
<tr>
<td>London</td>
<td>Harrow</td>
<td>Old suburbs</td>
<td>550</td>
<td>112</td>
<td>20.4</td>
</tr>
<tr>
<td>Newcastle</td>
<td>Backworth &amp; Shiremoor</td>
<td>Mixed urban edge</td>
<td>450</td>
<td>114</td>
<td>25.3</td>
</tr>
<tr>
<td>Newcastle</td>
<td>Cramlington</td>
<td>Commuter towns</td>
<td>450</td>
<td>136</td>
<td>30.2</td>
</tr>
<tr>
<td>Newcastle</td>
<td>Great Park</td>
<td>New suburbs</td>
<td>450</td>
<td>161</td>
<td>35.8</td>
</tr>
<tr>
<td>Overall</td>
<td></td>
<td></td>
<td>5950</td>
<td>1619</td>
<td>27.2</td>
</tr>
</tbody>
</table>
Responses were captured in SPSS on a household (questionnaire basis). These results were disaggregated into a database of trips, with each record in the disaggregated data representing an origin-destination pair, which was linked to the questionnaire using a respondent identifier.

The postcodes for every respondent and facility were used to locate them spatially. This allowed an origin destination cost matrix to be developed using GIS. The output of this analysis was a matrix showing the distance from all origins (respondents) to all possible destinations (facilities). These results were linked back to the disaggregated data, allowing distance to be added to each recorded trip undertaken by each respondent. The distance analyses were done using the Ordnance Survey Meridian dataset. This dataset does not have coverage of pedestrian links in neighbourhoods - this is a problem with all Ordnance Survey transport network datasets. This does mean that there are probably overestimations of the walking distance for different purposes.

These distances formed the basis for exploring respondents travel behavior, for example, assessing distance thresholds at which modal choices change. Since each facility can be categorized, respondent choices can be investigated in the light of how they use various types of facilities. Respondent responses about their modal choice were classified into three types, personal motorized - including cars, taxis, motorbikes and park-and-ride responses, non-motorized - including walking and cycling, and public transport - including bus and rail transport.

Respondents indicated the frequency at which they undertook certain trips, daily, twice weekly, weekly, fortnightly, monthly, or less than once a month. These descriptors were transformed into a numeric value, measuring trips per week that could be used to calculate meaningful aggregated measures about trip distance; for example, a shopping trip occurring once a week was assigned a weighting of one, while a school trip would be assigned a weighting of five. Figure 1 compares the results with those of the National Travel Survey.
Figure 1: Comparison of Solutions results and the National Travel Survey

The results are comparable for education, shopping and leisure. The best test of the efficacy of the methods used relates to education trips. The survey captured all nursery, primary and secondary education trips. The similarity with NTS results gives grounds for confidence that the method was reasonably accurate, especially in view of the fact that the SOLUTIONS sample did not claim to be representative of the whole UK population. The slightly fewer shopping trips is partly accounted for by the exclusion of durable shopping from the survey. The marked difference in ‘other personal business’ is due to the exclusion of most such trips from the survey. The same applies to work-related trips, which were not included at all.

Overall, the Solutions data represents 46% of total trips, when compared with the National Travel survey. This is significant. Variations in modal choice for these trips will have a significant impact on overall modal split. If it is the case that certain kinds of locality lead to fewer car-based trips and more active travel, irrespective of social character, then there are health and social inclusion reasons to shape neighbourhoods accordingly. The same may be true in relation to carbon emissions, but because the survey captures predominantly shorter trips the significance would be less.
Results

The results of the survey will first be presented in an aggregate form, consolidated across all twelve study areas. This reveals broad patterns in the data, and also allows, by comparison with disaggregated results, an assessment to be made of how behavior in specific areas or types of case study areas differs from the aggregated results. These differences may permit inferences to be made about the modal choices, and their drivers in the case study areas. This aggregated view of the data gives the widest sample of respondents possible, diluting any regional, neighbourhood or attitudinal influences.

Before looking the selected demographic variables, the general trends in the data will be presented. Figure 2 clearly shows the dominance of superstores as a trip generator. Although the frequency is similar to that of trips for outdoor recreation, the number of households undertaking supermarket trips represents over 90% of respondent households, while less than 25% of the respondent households undertake trips for outdoor recreation. The most frequent trips by those making them, twice weekly on average, are to superstores and recreational facilities. Trips to newsagents and other food stores can be regarded as occurring weekly. Trips to other facilities cluster around an average frequency of once a fortnight.

![Figure 2: The average number of trips per week to different types of facility per respondent](image-url)
The median trip length is an important statistic, especially in the light of the frequency data presented in figure 3. The median distance to most facilities is between 1,500m and 2,000m (the median distance for all trips taken is just over 1700m). The noteworthy exception is other food shopping, which explicitly included local food shops, such as butcheries, bakeries and grocers, and convenience stores. These are used relatively frequently, and are relatively close to the users - suggesting that local (neighbourhood) facilities are used, but that for recreation and supermarket shopping it seems people are travelling further. Comparing the median and average values suggests that there is a greater variation in the distance travelled to facilities not related to food shopping, where the difference is less than 500m. This difference is greatest in trips for recreational purposes, where it exceeds 2,500m. This may suggest a consistent tendency to shop for food at nearby facilities, be they superstores or other food stores.

![Figure 3: Trip length to different facility types](image)

One can deduce that people across all twelve case study areas exhibit similar food shopping behavior - using superstores more than conveniences stores, traveling an average distance of about 2km to superstores twice a week. Local stores are visited once week, and the distance travelled to get to them is in the region of 1,000m to 1,500m. Figure 4 presents the modal split for travel to facilities.

The results presented in figure 4 show that across all twelve case study areas, just over half of all trips are walking or cycling trips. A very small proportion of trips are made using
public transport. Travel to superstores, the most frequent trip undertaken, is dominated by personal motorized forms of transport (cars, motorbikes and taxis) - over three quarters of such trips using this modal category. The immediate comparison that can be made is to other food shops; almost two thirds of these trips are made using non-motorized modes. These trips are also shorter than trips to superstores which may suggest a willingness to walk or cycle short distances. The fact that these facilities are used less frequently than superstores, combined with the modal and distance information, may suggest how these facilities are used - as a supplement to superstores, visited on a more ad-hoc basis; with only 4% of respondents doing half or more of their shopping using local stores.

Figure 4: Modal split to different types of facilities

Findings related to demographic variables

Modal choices can be influenced by the demographic characteristics of a respondent household. The following series of graphs will present modal choice in relationship to a selection of demographic variables - age, gender, income and car ownership.

It is immediately apparent, from figure 5, that age does not seem to be strong determinant of modal choice. It is apparent from the data though, that non-motorized travel does decrease in the over-75-years age class, although not by much. Examination of
the data reveals that the average non-motorized trip distance for this age group is about a third lower than that for the full set of respondents, at just over 1km.

Figure 5: Modal split by age class

Figure 6: Modal split by gender
Similarly, figure 6 shows that there is little difference between the modal split based on gender. Contrary to popular belief, there appears to be no meaningful difference in the modal choices of men and women.

Figure 7 shows that a stronger pattern of modal choice is discernible from the income data than the age or gender data. For households with an annual income less than £20,000 more than half of trips are by non-motorized means. Above this threshold, the percentage is fairly constant, ranging between 40% and 46%. Households with an annual income less than £10,000 walk or cycle for more than two thirds of the trips they make. Less than a quarter of trips are by personal motorized modes for this income group; the rest are made using public transport (10%). Public transport use by the rest of the income classes is generally low (less than 8% of all trips).

![Figure 7: Modal split by income class](image)

The data presented in figure 8 confirms an intuitive assessment of the influence of car ownership on modal choice with the number personal motorized journeys increasing with car ownership levels. What is surprising is the proportion of trips undertaken by respondents with no cars that are made using personal motorized modes of transport (29%). This is partly the result of combining car, motorbike and taxi travel into a single category, but must be mainly explained by lift-giving and car share schemes.
Figure 8: Modal split by car ownership levels

It seems that affluence (represented here by income and car ownership) is a greater determinant of travel behavior than the more fundamental demographic characteristics of age and gender.

Figure 9 examines the influence of distance on mode choice across all study areas. There is a clear relationship between distance and mode choice. At distances shorter than 1200m (about a 15 minute walk), 50% of trips are made using non-motorized modes. More than 85% of trips 400m or shorter are made using these modes. Less than a third of trips, longer than 1600m, are made on foot or by bicycle. The proportion of trips made using public transport, is consistently small, but increases with distance.

It should be noted that all the differences identified here are statistically significant - mostly at the 0.99 or 1.00 levels. The only exception is the difference between male and female (figure 6) - which is very marginal.
Based on the patterns revealed in the preceding graphs and discussion, a number of observations can be made. These are necessarily a simplification of the complex interaction between a number of factors (known and possibly unknown) that may be determinants of modal choice. However, considered in isolation, the variables that have been examined can be ranked in order of their apparent influence of such choices:

1. Distance
2. Facility type
3. Car ownership level
4. Income (especially in lower income classes)
5. Age
6. Gender

There may however, be differences between the twelve case study areas that are significant, but are lost by examining the data in this aggregated format. The next section will examine the responses in each of the case study areas. The top two factors that this broad view examination of the data has identified as important will form the basis of the more detailed analysis that follows.
Findings by city

In this section, the differences in travel behavior are examined to see if there are systematic variations between cities. The travel characteristic to different types of facilities provide the structure of the charts below. The recreation facilities are excluded because the names of destinations used by respondents are not always identifiable on the map, particularly at longer distances. The level of consistency within cities, and difference between cities, with regard to transport choices may reveal local attitudes towards travel that are different from area to area. Note that each city includes a range of types of survey area.

Figure 10 presents the modal split for different distance thresholds to local facilities in Bristol. The first group of data labeled ‘All facilities’ represents the overall modal split by distance class for the Bristol case study areas.

![Figure 10: Modal split by distance thresholds to different facility types in Bristol](image)

Bristol shows a just above average level of car dependency - 58% all trips being made using personalized motorized modes of transport. In overall terms, there is a very rapid decline in the proportion of active travel (predominantly walking) trips until the ‘bed-rock’ level of 25-30% of active journeys is reached at 1200 metres. The rate of fall-off in the
The proportion of active travel trips varies greatly across types of facility. Active travel choice to superstores decline more rapidly than to any other type of facility, with a majority of shoppers choosing to use motorized modes beyond about 500 metres. Comparable levels to other food stores - the smaller local and convenience stores - are only reached at distances over 1000m. Over 80% of supermarket trips are motorized, while only 40% of trips of other food stores are motorized. Journeys to school show the highest levels of active travel (at just under 70%), and a perhaps surprisingly slow rate of decline with distance - it remains above 50% until a distance of 2400m, partly due to the significance of cycling. Walking and cycling trips to other services show a similar rate of decline as to other food shops.

Figure 11 presents the data for Cambridge - immediately identifiable as a less car dependent city than Bristol - 37% as opposed to 57%. The difference would be even more marked if only the two Cambridge suburbs (excluding the exurb of Bar hill)were assessed. The other distinctive feature is the relative importance of cycling - 13% overall. The proportion of trips by walking and cycling together adds up to 62%.
and cycling - at close to 40% - belies the normal image of almost total car-dependency for access to large food stores. The majority (around 80%) of trips to other food stores and schools are made on foot or by bicycle. It is interesting that in the ‘other food’ category all the trips are less than 2400 m, indicating the degree of localization of facility provision. Primary schools are also relatively local. As in Bristol, public transport use is low - only reaching significant proportions of trips in the longer distances to schools.

Figure 12 shows the modal split in London. While the general proportions of car travel and active travel are not hugely different from Bristol, it is noticeable that the distance decay slopes are less steep. In other words car use is significant even at very short distances but people will on average walk further. The other point to notice is that compared with the preceding two cities the amount of public transport use is higher, 10% of all trips being made on public transport. Travel to superstores remains dominated by personal motorized modes, at 80% of trips. The proportion of school trips (56%) that are walked or cycled is lower than in Bristol (68%) or Cambridge (81%).

![Figure 12: Modal split by distance thresholds to different facility types in London](image)

From examining figure 13 below, Newcastle appears the most car dependent of the four cities for local trips -at 62%, and the same low proportion of non-motorised trips as London (35%). In most other respects, the pattern of trips is quite similar to Bristol, with high
levels of walking for shorter trips but quite a rapid decay with distance. Both cities have about 75% of superstore trips occurring using personal motorized modes. There are similar overall levels of public transport use. In all four cities, all school trips shorter than 400m are made on foot or by bicycle. Between 58% and 81% of all school trips are made using non-motorized modes across the four cities.

Figure 13: Modal split by distance thresholds to different facility types in Newcastle

In Newcastle and Bristol, the decay pattern for superstores, other food stores, and other services are similar, with rapid drop-off in non-motorized trips above 1200m; schools showing a markedly different pattern with proportions staying high up to distances of 2400m. In Cambridge, by contrast, similar patterns exist between trips to other food stores, other services and schools, only falling below 50% above 3200m (or two miles); and the faster uptake of non-motorized modes is limited to superstores, also at the 1200m limit. London shows a pattern somewhere between car dominated Bristol and Newcastle and active travel dominated Cambridge, largely due to the importance of public transport. The shift to motorized transport to superstores also occurs at a distance to 1200m.

The variation between cities is clearly significant, reflecting differences in scale, character, social composition and culture. But it is important not to put too much on the difference between cities, because of the variation in types of neighbourhood in each. The
next section will explore whether the age, character and location of neighbourhoods within the city region are as significant as the parent city. A later section examines each neighbourhood separately.

**Findings related to neighbourhood type**

This section will examine the same data, but based on the neighbourhood types rather than city. It will be clear from earlier descriptions that the suburban and exurban survey areas vary greatly in relation to several factors: their closeness and degree of integration with the parent city; their social composition; and their layout. The analysis below divides them into four groups: commuter towns, mixed age urban edge, new suburbs and old suburbs. Inevitably there is a degree of arbitrariness in the categories and the allocation of places to each category. Because each category represents only three areas, any generalizations needed to treated with caution. Nevertheless the results indicate very significant variations in behaviour.

![Figure 14: Modal split by distance thresholds to different facility types for commuter towns](image)

Figure 14 presents the modal split and distance thresholds for different trip purposes for commuter towns. The three towns of Thornbury, Bar Hill and Cramlington, which constitute this category, are a reasonable cross section of commuter settlements,
excluding the London region. They do not indicate behaviour in commuter villages, which often have few or no local facilities.

The general pattern shows that they are more car dependent than the SOLUTIONS average. This is accounted for largely by the relative high car use for local food and other services trips - nearly 60% and 70% respectively. Even at a distance of 800 metres only half the local food and service trips are by active travel modes. By contrast, around 75% of trips to schools are non-motorized.

![Figure 15: Modal split by distance thresholds to different facility types for mixed urban edge neighbourhoods](image)

Mixed urban edge neighbourhoods are generally less car-dependent than commuter towns, as is shown in figure 15. Sixty percent of all trips are made using non-motorized modes in comparison with only just over 30% in commuter towns. This greater reliance on walking and cycling applies to all the groups of facilities. People are prepared to walk/cycle further. The 50% distance for the four categories above, in order, are approximately 1000 metres, 2000 m, 2,800 m and 2,800 m. The three neighbourhoods in this category are, however, not particularly representative - two, Trumpington and Cherry Hinton, are from Cambridge, together with Backworth from Newcastle.
Figure 16 presents the data for new suburbs. The neighbourhoods here - Bradley Stoke, Broxbourne and Newcastle Great Park - are from three different cities and are a fair representation of late twentieth suburbs, constructed for the most part around the assumption of full car ownership. The proportion of trips made using personal motorized modes is high: at 70% slightly above the commuter towns. Only 30% of all trips are by walking or cycling. The lack of data for the first two distance classes for superstore trips reflects the lack of such facilities nearby, leading to 96% car dependence. This could contribute to the general pervasiveness of personal motorized modes, even for short distances to local facilities. This pervasiveness is evident in the lower proportion of children walking and cycling to school, especially at the longer distances - just over 50%.

Figure 17 presents the data for old suburbs. The balance of neighbourhoods in this group is not nationally representative - two in London (South Harrow and West Barking) and one in Bristol (Filton Avenue), but the findings are interesting. These suburbs are closer in behaviour to the ‘mixes urban edge’ category than the others. Less than half (44%) of the trips are by private vehicle, and just under half of all trips are made using non-motorized modes.
means. In these neighbourhoods, use of public transport is more pervasive at just under 10%. The closest level of public transport use is in commuter towns and it is only 3%.

Figure 17: Modal split by distance thresholds to different facility types for old suburbs

In other neighbourhood types, the highest proportion of public transport trips were to school, in these neighbourhoods this purpose has the lowest proportion of public transport trips. This may suggest that these neighbourhoods are well served in terms of local schools. More than half of all trips to non-superstore food stores, other services and school are non-motorized, although the levels are lower than in mixed urban edge neighbourhoods. The modal change to motorized mean to superstores is consistent at between 800m and 1200m. The modal split to other food stores and other services are very similar with a majority being non-motorized. Superstore trips are dominated by personal motorized mode (78%), as with all other aggregations, and the 50% level is around 800 metres.
Findings related to trip purpose

Figure 18 is presented in confirmation of the pattern that has become apparent regarding the modal choices to different types of facilities. The data is for the entire set of responses, so it is important to recognize that this is an average situation for English suburbs, concealing the significant divergences. It allows us to give the best estimate currently available of modal choice for these purposes. The overall proportion of trips by foot and pedal is 39%, by public transport 4%, and by private vehicle 57% (see also figure 9). The average is strongly affected by the high frequency of superstore trips – typically twice a week – and the low 22% of active travel for that purpose. The other trip purposes all have higher levels of active travel: 54% for other food trips, 44% for selected services and 67% for school trips.

Figure 18: Modal split by distance thresholds to different facility types for all areas

This chart, as those preceding, shows behaviour within certain distance bands, and therefore simplifies the evidence for ease of comparison. The SOLUTIONS GIS analysis provides a finer grain of data. Caution has to be applied in drawing conclusions where there are very few respondents within a particular distance band for a particular neighbourhood category (normally the shortest and longest). We can nevertheless say with
confidence that there are certain thresholds of distance which relate to, say, at least half of people using active travel modes. Because of the variation between neighbourhood types and cities, these suggested thresholds are shown below as a range:

- Superstore trips: the 50% threshold is 400-800 metres (600 m typical)
- Other food trips: the 50% threshold is 800-2000 metres (1000 m typical)
- Selected services: the 50% threshold is 800-2000 metres (1000 m typical)
- Schools: the 50% threshold is 1200-3000 metres (2,400 m typical)

Data regarding recreational activities, both indoor and outdoor, was collected. Due to the nature of many of the destinations, and their locations being described in quite general terms by respondents, some of these features were difficult to locate for trip distance analyses. While confidence in the results for these facility types in terms of modal choice is high, it is lower for distance travelled - except in the case of Bristol where the researchers have personal knowledge. This problem is compounded by the relatively small number of trips to such facilities. The total across all locations for indoor recreational trips (including pubs, clubs, restaurants, leisure centres), was around 1500. Half the respondents reported such trips, but each of them made on average nearly two trips a week. The results for trips to indoor recreation facilities are presented in Figure 19.
Cambridge has the highest levels of active travel (62% of trips), followed by Newcastle at 50%. It is worth noting that public transport does not feature in the responses from Bristol at all, which has the highest level of personal motorized modal dependency in the sample. Unsurprisingly, public transport is most widely used in London.

Figure 20 presents the same analysis for outdoor recreation trips. The sample (= 800 trips) is even smaller than for indoor recreation. Only 27% of the respondents reported outdoor recreation trips, but each of them took on average two trips a week. However, in all areas except Newcastle, levels of active travel are high, accounting for about almost three quarters of outdoor recreational trips in Bristol and Cambridge, and about 60% of outdoor recreation trips in London. Even in Newcastle, more than half such trips are made using active travel modes.

We may tentatively suggest 50% active travel thresholds for recreational trips:

- Indoor recreation and leisure: ranging from 1,200 - 2,800 m (1600 m typical)
- Outdoor recreation: typical threshold around 2,000 metres
Figure 20: Modal split to outdoor recreation facilities for the case study areas

Figure 21 below, presents modal split and distance thresholds by a selection of aggregations of destination types.

Figure 21: Modal split to aggregations of destination types
It is worth noting the significant difference between the modal split of superstore trips and all other aggregations. Although the specific geographies of the case study areas play a role, this does corroborate the findings of Lee and Moudon (2008), that the mere presence of a superstore may have a detrimental effect on the levels of active travel.

**Trip chaining**
People do not however, undertake only single purpose trips. Figure 22 shows the levels of trip chaining with food shopping. Trip chaining in this context is not the general practice. Only 15% of such trips are *usually or often* combined with other purposes. Contrary to common impressions, food shopping is rarely combined with a school trip - possibly influenced by the fact that many schools trips are made using non-motorized modes. Food shopping is most usually combined with other shopping (16% of food trips), followed by leisure activities and commuting to work (each accounting for 12% of combined food-shopping trips).

It is possible that respondents interpreted this question as being related to the main food shopping activities - dominated by superstores as the data has shown. Local food shopping trips, which are more likely to be combined with other purposes may not have been considered, meaning that these data could be an underestimation of the total number of trips combined with any type of food shopping.
Summary of car dependence by location, distance and trip purpose

A number of patterns have become discernible in the preceding discussion. Table 4 presents the levels of dependency on personal motorized modes of transport to different types of facilities. The context for this is the desire to reduce car dependence in order to reduce transport carbon emissions and other pollution. The table cells have been shaded from dark red (highest dependency) to pale pink (lowest dependency) for each city and neighbourhood type, to highlight patterns in the data. The mean scores are shaded in lightening shades of green based on increasing patterns of dependence on personal motorized modes of transport, with deep green being ‘best’.

Figure 22: Levels of trip combining for food shopping
Table 4: Showing levels of car dependency to different facilities by city and neighbourhood type

<table>
<thead>
<tr>
<th></th>
<th>Superstores</th>
<th>Other food</th>
<th>Other services</th>
<th>School</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bristol</strong></td>
<td>83</td>
<td>40</td>
<td>57</td>
<td>29</td>
<td>52</td>
</tr>
<tr>
<td><strong>Cambridge</strong></td>
<td>59</td>
<td>22</td>
<td>34</td>
<td>16</td>
<td>33</td>
</tr>
<tr>
<td><strong>London</strong></td>
<td>80</td>
<td>58</td>
<td>48</td>
<td>43</td>
<td>57</td>
</tr>
<tr>
<td><strong>Newcastle</strong></td>
<td>85</td>
<td>50</td>
<td>62</td>
<td>30</td>
<td>57</td>
</tr>
<tr>
<td><strong>Commuter towns</strong></td>
<td>75</td>
<td>59</td>
<td>67</td>
<td>25</td>
<td>57</td>
</tr>
<tr>
<td><strong>Mixed urban edge</strong></td>
<td>62</td>
<td>26</td>
<td>33</td>
<td>14</td>
<td>34</td>
</tr>
<tr>
<td><strong>New suburbs</strong></td>
<td>96</td>
<td>54</td>
<td>67</td>
<td>44</td>
<td>65</td>
</tr>
<tr>
<td><strong>Old suburbs</strong></td>
<td>77</td>
<td>41</td>
<td>35</td>
<td>31</td>
<td>46</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td>77</td>
<td>44</td>
<td>49</td>
<td>29</td>
<td></td>
</tr>
</tbody>
</table>

most car dependent and school trips consistently least car dependent. Overall more trips to other services are made using non-motorized modes than to other food stores - although the difference is not large.

Cambridge has much lower use of personal motorized modes of transport. In terms of neighbourhood type, the best performing neighbourhoods have been characterized as mixed urban edge. New suburbs perform worst - with almost double the proportion of motorized trips of mixed urban edge neighbourhoods. The poor overall performance of London might be surprising. However, this is explained by the very varied case study areas within the London group: in particular, the greenbelt suburb of Broxbourne has influenced this result.

**Comparing individual neighbourhoods**

One of the most striking features of the results is the degree to which each neighbourhood is unique, and the residents’ exhibit distinctive behaviours. The variations within each of the earlier categories (cities and neighbourhood types) are often greater than the difference between them. Figure 23 presents the modal split in each case study area (grouped by neighbourhood type).
Figure 23: Modal split in case study areas, by neighbourhood type

The modal breakdown reflects several related factors: the accessibility of ‘local’ 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 reference to observed spatial and social characteristics combined with qualitative insights afforded by focus groups 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 except for Bar Hill, which had very substantially fewer. The main reason for this was the high use of one major retail outlet for many purposes - a superstore within the exurb - together with an unexplained paucity of recreational trips.

Figure 22 reveals different groupings from those previously analysed. There are three localities with very high car use: Broxbourne, Bradley Stoke and Cramlington. There are three with high levels of active travel and modest levels of car dependence: Cherry Hinton, Trumpington and Filton Avenue. There are three with above average public transport use: Barking, Harrow and Bar Hill, with Barking thereby having relatively low car dependence. Thornbury, Backworth and Great Park fill intermediate positions. The
This modal analysis gains extra dimensions by examining other key variables. Figure 24 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 – all facility types have been included. The solid line indicates the sample average trip distance, and the dashed line the sample median trip distance.

The variation in average trip distance is a measure of the convenience of local facilities. By and large, from our physical survey and the results, people use the closest available facility - with the exception of recreational facilities, where there are more specific requirements. In most of the neighbourhoods, for example, residents used the closest superstore, irrespective of the brand. The notable exception was Backworth, where a more distant long-standing superstore was still preferred over a much closer new one.

It is noteworthy that areas with higher car dependency have higher average trip distance - closer examination of the type and number of local facilities in these areas may reveal
that this is the result of a lack of facilities or alternatively the use of preferred facilities further away. 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.

From the preceding evidence it is clear that places and communities vary widely. There is no hint of ‘one size fits all’. 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. Sometimes the similarity can extend across barriers of neighbourhood type. Figure 25 illustrates the three survey areas in Bristol city region. The proportion of people walking different distances follows the same general trend. (Note that the bumpy lines reflect the unique shape of the locality - for example the location of the superstore, with high car use and frequent trips, relative to the questionnaire respondents, will strongly influence the pattern). Bradley Stoke and Filton are not very different, despite one being overall very car dependent and the other with high levels of walking. In this respect, they share the same kind of attitudes to walking, in terms of in what situation to walk - shared culture perhaps. The variation in modal choice is therefore explained primarily by the geography of the locality.

Information related to trip purpose can be examined in the same way. In the graphs below, the data is presented using a three-class rolling average. Figure 26 presents the data across all case study areas. Superstore trips show the fastest decay in the proportion of trips by bicycle or walking. Other commercial trips (Food - other and Other services) follow. Recreational trips (both indoor and outdoor) show high levels of active travel. School trips are dominated by active travel, to a distance of about 1200m.
Figure 25: Comparison of the proportion of active travel by purpose in Bristol (Note: The number of responses in the shorter distance categories is small)

Figure 26: Active travel by trip purpose across all study areas
Findings related to perceptions and attitudes

The attitudinal data presented are consolidated from a 5-point Likert scale dataset. The ‘neither agree nor disagree’ responses have not been plotted, and the all levels of agreement or disagreement have been consolidated to emphasize the patterns in the data.

The reasons for walking and cycling will be examined first. Figures 27 and 28 present prevalence of agreement and disagreement with statements focused on reasons for walking or cycling. The most pervasive reason for using non-motorized modes is for exercise, showing the highest levels of agreement and the lowest levels of disagreement in all case study areas. The next most pervasive reason, which is again consistent across all cities and neighbourhood types, is for environmental reasons.

![Graph showing levels of agreement and disagreement with reasons for walking or cycling, by neighbourhood type](image)

**Figure 27: Levels of agreement and disagreement with reasons for walking or cycling, by neighbourhood type**

In old suburbs and mixed urban edge neighbourhoods, the next most prevalent reasons are, in order, to save money and to meet people. In new suburbs and commuter towns, the order of these reasons is reversed. The responses are consistent - the lowest levels of disagreement across the sample are, in order, for the exercise and environmental reasons. Highest levels of disagreement are with ‘to save money’ in all neighbourhood types, except mixed urban edge neighbourhoods, where ‘to meet people’ has slightly higher levels of disagreement.
Figure 28 shows the same data grouped by city; any differences between the data in figure 27 and that in this figure would suggest that location-based cultural and social factors might have an influence on the reasons for walking or cycling.

As in figure 27, the prevalent reason for walking or cycling is for the exercise, followed by environmental reasons across all cities. In Bristol and Newcastle, to meet other people is next, followed by to save money. In Cambridge and London, this order is reversed; in London, agreement with the reason ‘to meet people’ is particularly low.

![Figure 28: Levels of agreement and disagreement with reasons for walking or cycling, by city](image)

‘To save money’ has the highest levels of disagreement in three of the four cities. Only Cambridge differs, where ‘to meet people’ has the highest levels of disagreement. The similarity between the data presented in the preceding two graphs, suggests that although, the proportions of people using non-motorized modes of transport may differ from place to place, and by neighbourhood type, the reasons for using these modes is similar across the responses.

It is also worth considering what the deterrents are of active travel. Figure 29 shows the levels of agreement and disagreement with statements relating to reasons for not walking or cycling. It is striking that levels of disagreement are much higher than levels of agreement - suggesting that respondents’ decisions to walk and cycle were not strongly
influenced these considerations. Although levels of agreement are low, busy roads seem more of a deterrent than considerations of safety, except in London case study areas, and in case study areas characterized as old suburbs where safety was a greater concern.

**Figure 29:** Level of agreement and disagreement with statements relating to deterrents for walking

It is interesting that the pattern revealed in figure 30, runs counter to patterns of behavior. The most car dependent cities and neighbourhood types are rated by their residents as attractive.

This probably confirms the findings in the discussion relating to demographic influences - that affluence is an important determinant of modal choice, with affluent case study areas being regarded as more attractive by residents, than deprived case study areas.
Figure 30: Levels of agreement and disagreement with the statement 'My neighbourhood is attractive' by city and neighbourhood type

Figure 31 shows responses to the statement ‘Having shops that I can easily walk to was important factor when moving house’. In all case study areas, and in both the locational and categorical groupings, being able to walk to local shops is widely agreed to be an influence on choosing where to live. It is least important to the respondents in London, but has similar level of agreement in all other cities. The highest level of disagreement is in new suburbs, which have the highest use of personal motorized modes of transport. The highest level of agreement is from respondents in commuter towns.
Respondent’s responses are consistent across the case study areas and the two aggregations methods. Exercise is the primary motivation for active travel, followed by environmental reasons. Neither busy roads nor concerns about safety seem strong determinants of active travel behavior - although the possible influence of safety concerns is higher than traffic concerns in old suburbs and in London. Neighbourhood attractiveness seems inversely related to proportions of active travel - but this simplistic interpretation does not consider that neighbourhood attractiveness is more than likely related to neighbourhood affluence - and affluence is the more important determinant of travel behavior. The data show that living in a neighbourhood with facilities in walking distance is an important consideration in determining where people choose to live.

**Conclusions**

At the general level, the data presented here supports the findings of other researchers. In particular, the influence of having facilities in a neighbourhood, within walking distance, is confirmed as a critical factor in determining active travel choices. What this study adds is detailed information 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 accessibility and car use for local facilities. Across the study areas just under a
half of all trips to local facilities were on foot or by bike. The distance at which modal choice shift to motorized mean is, perhaps higher, than expected with a distance of 1000-1200m being a recurrent distance range below which more than half of trips are non-motorized. Where there are few facilities within that distance - as in the new suburbs - active travel is much lower.

More specifically a number of conclusions can be drawn from the research:

1. **The level of use of facilities:** most households make trips to all the retail facilities recorded - both food and non food. Superstores and pharmacies were accessed by over 90% of households; smaller food stores, banks, post offices and newsagents by at least two thirds of households; indoor leisure facilities, however, were used by a bare half of households, and outdoor recreation facilities by just over a quarter.

2. **The frequency of use:** for those who used a given type of facility, the frequency of use varies widely. The average number of weekly trips to a superstore is just over two, demonstrating the importance of superstore trips in most people's lives. According to focus groups the importance relates to social contact as well as food. A similar frequency of indoor and outdoor recreational trips - twice a week - was recorded by those who participate in these pastimes. Other food stores and newsagents were visited just over once a week on average, while the other facilities were visited around once a fortnight.

3. **The distance travelled, by facility:** the median distance to facilities varies widely by facility type and place. Non-superstore food trips are associated with the shortest distances, with the median being 1000 metres, and 80% less than 1600 m or one mile. Other facilities are further, with the median distance being close to 2 km. In the case of superstores, schools and ‘other’ services the majority of trips are still less than 1600 metres (one mile). Recreational facilities, however, are often more distant, reflecting not necessarily the lack of local facilities as the as the strong element of personal choice in which facility to visit.

4. **The mode chosen, by facility:** modal choice reflects the type of facility as well as the distance travelled. Thus the level of car dependence for superstore trips is predictably high at 77%, while the other services, with much the same pattern of distance, are 48%, and outdoor recreational trips, generally longer than either, have a car dependence of only 28%. The closest facilities, non-superstore food shops, average 34% car dependence. Contrary to rumour, schools trips are not
mainly by car - 32%. Looking at mode choice from the other end, active travel (walking and cycling) accounts for half of trips overall.

5. **The significance of social and economic variables**: variations in behaviour between households can in part be explained by socio-economic variables. However, there is practically no variation between male and female respondents or between different household sizes. There is only modest variation between age groups: the level of car reliance, for example, is from 41% for the 75+ age group to 52% for the 50-64 group. Income is also of little significance, with the important exception of the lowest level: those households with less than £10,000 income are much more reliant on walking and to a lesser extent buses. The evidence points strongly to the degree to which the vast majority of households now, if they choose, have access to at least one car, and that choice is similar across gender, age and all but the lowest incomes. Car ownership does, however, have a direct and strong correlation with car use, proportional to cars per household, with 3+ car households having twice the proportion of car trips than no-car households.

6. **The significance of place**: the image of suburbia as all the same and all car-dependent is comprehensively undermined by the SOLUTIONS data. The twelve neighbourhoods studied vary hugely in local travel behaviour, by around 300%. Average trip distance for all purposes varies from 1.6 km to 4.2 km. Average distance by car per week per household varies from 6 km to 22km. The proportion of walking/cycling trips varies from 18% to 62%.

7. **Distance and modal choice**: for any given type of facility there is some consistency in terms of modal choice by distance. The overall average figures suggest two key distance thresholds: below 1 km the majority of trips are by foot or pedal - two thirds 67% of trips between 800m and 1000m are active travel, while between 1000m and 1200m the proportion falls to 46%. The other threshold is around 2,400m, with an abrupt fall-off of active travel trips from 38% down to 24% for successive distance bands. However, because modal choice does vary with journey purpose, these average figures much be treated with caution.

8. **Variations of mode by place and distance**: the propensity to walk at any given distance does vary by place, but care has to be taken in interpreting the data. The clearest difference occurs between the two neighbourhoods in Cambridge and the rest. In Cambridge the 50+% threshold of walking cycling trips occurs around 2km, while as noted the normal threshold is around 1km. The difference is accounted for
the cycling culture of Cambridge - 13% cycling trips by comparison with 2% elsewhere. Another significant difference occurs within the London group, which includes one place with the low car ownership, and another with the very high car ownership. Both have few close facilities and therefore people have to travel further, but in one place they choose to drive, while in the other there is little option for many but to walk.

9. **Consistency of mode by place and distance:** the contrasts in behaviour noted above do not apply in most of the other localities. There is a generally similar pattern of modal choice by distance. In Bristol, for example, the three neighbourhoods vary widely in locational characteristics and income levels, but the propensity to walk any given distance is much the same. The actual level of walking varies greatly, not because of different travel preferences, but because of different spatial characteristics. In one neighbourhood, with few close facilities, the level of active travel is 18%; in another, with many convenient local facilities, it is 52%.

10. **General locational explanations:** analysis of the differences between the four cities surveyed and between four different locational types do reveal some variations, though the degree to which are systematic is open to question. While the Cambridge neighbourhoods have 62% active travel, Bristol has 40%, Tyne and Wear and London have 36%. Cross-cutting by locational type there is an alarming divide: while the older suburbs and mixed urban edge localities have 56% and 62% active travel respectively, the new suburbs and commuter towns have 30% and 33% respectively. This indicates a fundamental problem - the newer places are performing much worse than the older. However, it is not as simple as that, because the variation within each category is at least as great as the variation between them. It would appear, in other words, that each place has unique characteristics - both spatial and, often, cultural - that set it apart from its fellows.

Returning to the points made at the start of this paper, the evidence gathered here does not support the contention that neighbourhoods are dead - though the degree to which they can be labeled as ‘alive’ varies by place and by the assumed definition of alive.

What is clear is that spatial variables at the neighbourhood scale, as well as certain socio-economic variables, have a major role in determining the behaviour of households. Further research is needed to validate statistically what is of most significance. This will include
analysis of key aspects of urban space such as use, density, connectivity and form. It will also require further analysis of the SOLUTIONS data to elucidate the way different facilities, including major interventions such as superstores, interact with urban form and behaviour. But even at this stage there are policy implications:

- The new suburbs created in the last 20 years exhibit high levels of car dependence, and the policy assumptions on which they are based need urgent review.

- There are common aspects of behaviour - in terms of thresholds of accessibility - which could provide starting points for policy. One crude threshold is the one kilometer standard: local shops and services within this distance are likely to generate a majority of walking trips.

- However, there are also unique aspects to the spatial, social and cultural character of each place which require understanding (preferably through survey) before local standards are set.

- The varied pattern of local travel behaviour has implications for the assumptions used in land use transport models - both the proportion of local trips for different purposes and the proportion by different modes, tied to distance thresholds.

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