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Trip chaining and car use: a case study of Cambourne, Cambridgeshire

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Being a dissertation submitted to the Faculty of the Built Environment as part of the requirements for the award of MSc Transport and City Planning at University College London:

I declare that this dissertation is entirely my own work and that ideas, data and images, as well as direct quotations, drawn from elsewhere are identified and referenced.

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1 Abstract

This dissertation investigates whether the inclusion of car-dependent trips alongside non-car-dependent trips in trip chains results in additional car use. The study uses the results of questionnaires regarding trip chaining practices, car use for specific trip purposes and reasons for choosing the car over alternative modes or considering there to be no alternative that were distributed among residents in the Cambridgeshire town of Cambourne. The results are analysed using descriptive statistics and indicate that the involvement of car-dependent trips in trip chains with non-car-dependent trips only produces a relatively small amount of additional car use, rather than a significant level. This is likely due to a significant proportion of single-purpose trips, whether considered car-dependent or not, already being undertaken by car. It is suggested that this is a consequence of Cambourne residents constructing car-dependent lifestyles that can only be maintained through the convenience offered by the car, of which trip chaining is a contributor. Policy measures that allow public and active transport to provide a comparable level of convenience, such as prioritising pedestrians and cyclists within developments, ensuring that all major travel destinations are adequately served by public transport and integrating transport and land use planning, are proposed as means to facilitate a mode shift away from the car.

2 INTRODUCTION

High levels of car use are a major source of concern regarding new developments in the UK, despite recent efforts to include infrastructure for alternative modes, especially active transport (Transport for New Homes, 2018). One possible explanation for this apparent entrenchment of car use is that car-dependent trips and activities are causing trips that could be made by alternative modes to be undertaken by car when both are combined in trip chains. In this concept, a car-dependent trip is one which, for one or more specific reasons, cannot be easily made by another mode. For example, a trip may be car-dependent if it requires transporting items that are too difficult to carry on active or public transport. Trip chaining is where two or more trip purposes and destinations are combined into a single trip 'tour'. In this way it can be understood how the presence of a car-dependent trip in a trip tour with other, non-car-dependent trips can result in additional car use.

While existing research has examined car dependency, car-dependent trip purposes and trip chaining, no previous studies have analysed how these concepts interact. This dissertation will investigate whether the inclusion of car-dependent trips with non-car-dependent trips in trip chains results in significant additional car use, using the development of Cambourne as a case study. This will be achieved by examining four research objectives: whether trip chaining using a car is a common behaviour; whether trip chaining contributes to a preference for the car over other modes compared to single-purpose trips; whether there are any specific activities, destinations, or trip purposes that are more frequently incorporated into trip chains and whether they are more conducive to car use; and what the findings entail for planning new residential developments in the UK as well as for transport and development planning in general; along with any other interesting findings. The intention is that this study will help fill a gap in the existing research regarding the impacts of combining car-dependent trips with non-car-dependent trips in trip chains in terms of additional car use.

Initially, this dissertation will review and analyse the existing literature on car dependency, car-dependent trip purposes and trip chaining (Section 3). Next, in Section 4, the research methodology will be set out, including research objectives, sampling methods, background information on the case study location, and data processing and analysis methods. Section 5 will discuss the representativeness of the sample and any related issues. The results of the study will be discussed and analysed in Section 6, while Section 7 will draw conclusions and suggest further research topics.

3 LITERATURE REVIEW

3.1 CAR DEPENDENCE

The concept of 'car dependence' was first introduced by Newman & Kenworthy (1989). In that work, they considered the development of car dependence as a consequence of the urban form. Litman (2002, p. 1) similarly defines 'automobile dependency' as 'high levels of per capita automobile travel, automobile oriented land use patterns, and reduced transport alternatives'. However, both definitions have been criticised as they equate car dependence with car ownership and car use, and ignore factors other than urban form which foster car dependence (Gorham, 2002). This lack of a consistent definition is illustrated by Table 2.1 in Jones (2011).

Several papers have distinguished between these different definitions of car dependence. Stradling (2003), Mattioli et al. (2016) and Gorham (2002) each identified three different forms of car dependence. Stradling (2003) identified car-dependent trips, car-dependent places and car-dependent persons and lifestyles, while Mattioli et al. (2016) introduced three 'understandings' of car dependence, which comprised *micro*- (car dependence influenced by the individuals themselves), *macro*- (influenced by society and/or the built environment) and *meso*-level dependence (influenced by particular journeys, activities or practices). Gorham's (2002) classification fits reasonably well with both Stradling's and Mattioli et al.'s definitions, with physical / environmental dependence comparable to car-dependent places and macro-level dependence, psycho-social dependence corresponding to car-dependent persons and lifestyles and micro-level dependence, and circumstantial dependence equivalent to car-dependent trips and meso-level dependence.

While such categorisations of car dependence are useful considering the different factors involved, they still represent a simplification of the phenomenon. The reasons why car use has become so embedded in many societies are likely to be a combination of factors situated in each of the different categories. The urban form of a particular location may favour driving, but if an individual does not like driving and/or the journey can be made by another mode, then they could easily decide against driving. Similarly, in a transit-oriented development, a person may prefer driving to any other mode and/or may be making a journey that is difficult to undertake without a car and, as a result, choose to drive. Brindle (2003) identified that car dependence and the decision to drive are 'affected as much by the way people use a place, as by the attributes of the place itself' (Ibid., p. 66).

A key aspect in people's increasing dependence on cars is its 'convenience' (Buys & Miller, 2011; Anable & Gatersleben, 2005). This is embodied by the concepts of 'ubiquitous mobility' (Brindle, 2003, p. 65) and 'hypermobility' (Adams, 2000), whereby individuals and households develop lifestyles that require the constant availability of mobility. The constraints of distance for active transport and timetables and limited destination choice for public transport mean that only the car is capable of providing the required mobility and convenience.

Hence, the attributes of 'flexibility' (Kent, 2014; Goodwin, 1995), 'independence' (RAC Foundation, 1995) and 'freedom' (Handy et al., 2005) are frequently associated with the car.

Several factors linked to higher levels of car use could be considered to contribute to the perception of convenience surrounding the car. As would be anticipated, possessing a driving license (Xianyu, 2013) and having a greater number of cars available per adult in a household (Carse et al., 2013; Vega & Reynolds-Feighan, 2008) are associated with a greater propensity to drive, as easier access to a car makes it a more convenient and attractive mode. Similarly, the availability of easy / free parking at a destination has been correlated with a higher likelihood to choose the car (Carse et al., 2013; Islam & Habib, 2012; Handy & Clifton, 2001).

3.2 Car-dependent trip purposes

Environmental, circumstantial and attitudinal attributes, whether on their own or in combination, have given rise to a number of car-dependent trip purposes. Gorham (2002) uses the example of the freelance double bassist, who requires the instrument for their work and has to travel to multiple destinations, to illustrate the concept of a car-dependent trip purpose. Mattioli et al. (2016) argues that journeys or activities requiring bulky or difficult-to-carry items, such as a double bass, become car-dependent as they make use of the 'cargo function' of the car.

Other trip purposes that utilise the cargo function of the car are shopping (both regular food / household shopping and more occasional trips for items such as furniture or appliances) and sports and other leisure activities (which may require specific equipment). The weight of shopping has been found to be a reason why households drive to the shops instead of walking (Mackett, 2003; Handy & Clifton, 2001; Goodwin, 1995). The propensity to drive for shopping trips, however, was found to vary depending on sociodemographic and neighbourhood characteristics (Carse et al., 2013; Handy & Clifton, 2001). Regarding sporting activities, Mattioli et al. (2016) found that the type of sport, as well as the location and the equipment required, impacted on mode choice. In a study of children's travel to extracurricular activities in Norway, Hjorthol & Fyhri (2009) also concluded that location was important, as a large majority of children were driven when the travel distance exceeded 2 km and over half of sports activities were situated over 3 km from the family home. This demonstrates how environmental (the location of the activity in relation to home) and circumstantial (the equipment needed for the activity) attributes can combine to make a trip car-dependent.

Significant attention has been awarded to the growing mode share of the car for the school run (Kelly & Fu, 2014; Faulkner et al., 2010; Hjorthol & Fyhri, 2009). One factor in this is parents' preference for escorting their children (Mattioli et al., 2016; Mackett, 2003), primarily due to concerns about road safety and fears of abduction or 'stranger danger' (Westman et al., 2017; Faulkner et al., 2010; Hjorthol & Fyhri, 2009). As a result, there is a

noticeable shift in the mode choice for the school run depending on the age of the child, with older children less likely than younger children to be driven to school as parents are more confident in their ability to safely travel to school unaccompanied (Westman et al., 2017; Van Ristell et al., 2013; Faulkner et al., 2010). 'Convenience' has been found to be a significant factor, with Westman et al. (2017) determining that parents who valued 'social convenience', the combination of travelling in the same general direction as the school and being able to accompany their children, were more likely to drive. Similarly, Faulkner et al. (2010) found that both parents who walked their children and parents who drove their children to school regarded their chosen mode as being the easiest and most convenient, while McDonald & Aalborg (2009) found that 75% of parents cited 'convenience' as a reason for driving.

3.3 Trip chaining

Another factor that adds to the convenience of the car is the practice of trip chaining. Trip chaining is the practice by which multiple destinations / trip purposes are served during one travel episode (Figure 3.1). Adler & Ben-Akiva (1979) considered trip chains to consist of 'sojourns', a visit to a place remote from home for the purpose of one or more activities; 'trip links', journeys between different sojourns or between a sojourn and home; and 'trip tours', a consecutive series of trip links and sojourns beginning and ending at home (Ibid., p. 234-244). However, to better align with the terminology used in Section 3.2, and account for the fact that trip tours may not necessarily begin and end at the same location, the following definitions are used in this dissertation:

Journey: A travel episode of any structure.

Trip: A journey with no intermediate stops.

Trip purpose: The reason for making a trip.

Trip chain / trip tour: The combination of two or more trips in one travel episode.

Single-purpose trip: A trip which is undertaken separately to other trips or trip chains.

The additional convenience, or, in economic terms, utility, offered by trip chaining is primarily in the time savings in reducing the overall distance travelled by removing one or more return trips home. Another benefit is the reduction in the financial costs through lower fares or fuel use. In addition to the travel times and costs, Adler & Ben-Akiva (1979) include 'the "scheduling convenience" of the travel pattern', 'the attributes of the chosen destinations' and 'the socioeconomic characteristics of the households' as attributes that contribute to the utility of a particular trip chain or transport mode (Ibid., p. 256). Another attribute that must be considered is the reason for travelling itself, as this can significantly impact on the utility of both a trip chain and a transport

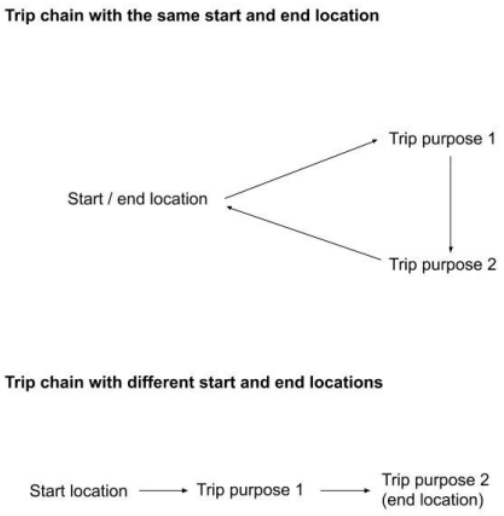

Figure 3.1: *Examples of trip chains*

mode. A potential result of the greater utility of trip chaining is that a car-dependent journey or activity is included. Since there is greater utility in maintaining the same mode, the remaining trips in the trip chain are most likely also undertaken by car. As a result, trip chaining has been identified as a barrier to achieving modal shifts (Hensher & Reyes, 2000, p. 342). Evidence of a strong relationship between undertaking complex trip chains and choosing to drive supports this (Ye et al., 2007; Wallace et al., 2000; Strathman & Dueker, 1995).

Research has indicated that the presence of children increases both the propensity to undertake trip chains and the likelihood to use the car. Hensher & Reyes (2000) posited that tending to children's needs, for example childcare, the school run and extracurricular activities, has resulted in trip chains becoming increasingly complex, making the car a more attractive mode. The presence of children in a household was also found to encourage the formation of complex trip chains undertaken by car (Xianyu, 2013; Hensher & Reyes, 2000; Wallace et al., 2000). Westman et al.'s (2017) concept of 'social convenience' suggests that a significant number of parents now incorporate the school run into the work commute. Meanwhile, Faulkner et al. (2010) found that extracurricular activities were included in trips chains with travel to/from school among parents who used non-active travel modes on the school run.

Gender has a noticeable impact on trip chaining behaviour, with women undertaking both more trip chains and more complex trip chains than men (Xianyu, 2013; Islam & Habib, 2012; Wallace et al., 2000; Bianco & Lawson, 1998; Strathman et al., 1994). One reason posited for this difference was the inclusion of the school

run in the commute to work. McGuckin et al. (2005) found that, in households where both parents worked and had to undertake the school run, the mother was more likely to incorporate the journey into the commute. Similarly, Bianco & Lawson (1998) determined that over 60% of trips to drop off a child were made by women. The differences in trip chain practices between men and women may also be due to women's greater tendency to undertake other activities, such as shopping, running errands or keeping appointments (Ibid., p. 131).

Household structure has been found to have a significant impact on trip chaining behaviour. Larger households tend to undertake simpler trip chains, potentially because larger households can distribute non-work trips efficiently among the members of the household (Ye et al., 2007; Hensher & Reyes, 2000), or the greater variety of destinations makes chaining harder (Wallace et al., 2000). Similarly, Islam & Habib (2012) discovered that households with a greater number of adults made simpler work and non-work trip chains. However, for household size in general, they found differences between work and non-work chains, with larger households more likely to make simple non-work chains, but more complex work-based chains. This discrepancy may be because of families combining the school run with their commutes.

However, as has been demonstrated, both trip chains and trip purposes incorporated into trip chains, such as the school run or shopping, are often very car-dependent. Therefore, their increasing involvement in trip chains raises concerns that other trip purposes within those trip chains, which could be made by public or active transport, are being made by car to facilitate the car-dependent trip. In other words, a small level of car dependence could result in significant extra car use, with many journeys that could be made by more sustainable means being completed by car due to the convenience of trip chaining. As a result, strategies to reduce car use by targeting particular journeys, such as commuting, may not be as effective as anticipated, since they fail to account for someone's total travel behaviour. Hence, it is important to determine whether car-dependent trip purposes, when included in trip chains, result in individuals choosing to drive over available alternative modes. If this is the case, then sustainable travel strategies should focus on the whole travel lifestyles of people and enable them to undertake not just single trip purposes by sustainable modes, but a whole series of trips in a trip chain.

4 Research methodology

4.1 Research objectives

To investigate whether car-dependent trip purposes combined with non-car-dependent trip purposes in trip chains result in significant additional car use, four research objectives were drawn up.

1. Is trip chaining using a car a common behaviour?
2. Does trip chaining contribute to a preference for the car over other modes compared to single-purpose trips?
3. Are there specific activities, destinations or trip purposes that are more frequently incorporated into trip chains, and are they more conducive to car use?
4. What do the findings entail for the planning of new residential developments in the UK and transport and development planning in general?

4.2 Methodology

For the first three objectives, it was decided that the most appropriate method of investigation would be to undertake a survey of a sample using a questionnaire. For the fourth objective, analysis of the findings from the questionnaire and a review of the relevant academic literature was regarded as the best method.

It was decided that the objectives would be examined using a case study, with the sample being drawn from a small geographic area. It was felt that this would reduce the impact of factors, such as typology and level of public transport provision, which were not being investigated but could potentially have a significant effect on trip chaining behaviour and mode choice.

The questionnaire was structured in three distinct sections: the first concerned the frequency and mode choice for several trip chains that were considered common, the second focused on the use of cars for the single-purpose trips that formed the trip chains in the first section, while the third collected background information that had been found to have a significant effect on trip chain participation and car use in past research. Similarly, the choices of trip chains, single-purpose trips and reasons for choosing the car over the alternative(s) or perceiving there to be no alternative that were included in the questionnaire were also based on the findings of previous research. The trip chains investigated are listed in Table 4.1, along with the corresponding reference letters used elsewhere in the dissertation. The questionnaire used in the survey is included in Appendix B.

The purpose behind the separate 'trip chain' and 'car use' sections was to examine whether respondents' travel behaviour differed for particular trip purposes depending on whether it was undertaken as part of a trip chain or as a single-purpose trip. If a respondent stated that, for a car-based trip chain, one trip purpose was undertaken by car and had no reasonable alternative and the other was not always undertaken by car when undertaken as single-purpose trips, then it follows that the presence of the former trip purpose in the trip chain resulted in the latter being made by car instead of the alternative. The questions on the reasons behind choosing the car over alternative modes or the perception that there isn't a reasonable alternative would indicate which factors were

Reference letter	Trip chain description
A	School run undertaken on the commute to work
B	School run undertaken on the commute from work
C	Food / household shopping undertaken on the commute to work
D	Food / household shopping undertaken on the commute from work
E	Taking children to/from after-school / extracurricular activities while on the commute from work
F	Food / household shopping undertaken on the school run
G	Food / household shopping undertaken while taking children to/from after-school / extracurricular activities
H	Going to/from playing sports or the gym on the commute to work
I	Going to/from playing sports or the gym on the commute from work
J	Food / household shopping undertaken while going to/from playing sports or the gym
K	Food / household shopping undertaken while visiting family / friends

Table 4.1: *Trip chains investigated and their respective reference letters*

most significant in a respondent's decision-making process. These would enable policies and initiatives to be developed such that active and public transport modes were considered as feasible for trip chaining as the car.

The method chosen for undertaking the survey was face-to-face surveying, as it was anticipated this method would elicit a greater response rate. Also, the relative complexity of the questionnaire meant that it would be beneficial to have the researcher present to provide clarification on any issues raised by a participant. Since the survey was being undertaken within a case study area, the issues around the resource intensity and logistics associated with face-to-face surveying were considered to be less significant and offset by the expected increased response rate.

After carrying out a pilot survey, some additional options for reasons why the car was chosen over the alternative(s) or why there was perceived to be no alternative to the car were added to the questionnaire, along with additional responses for employment status and household structure. To increase the potential sample size, it was decided to create an online version and a 'take-away' version that could be returned to a designated collection box. It was felt that this would increase responses from individuals with busy schedules, who were unable to complete a questionnaire in situ.

4.3 Case study location and sampling

The selected case study location was the Cambridgeshire town of Cambourne (Figures 4.1 and 4.2). Cambourne is a large, mainly residential development with an approximate population of 12,000 (Cambourne Parish Council, 2019). Construction began in 1998, with the first homes being occupied in 1999 (Cambridgeshire Live, 2018). In the planning and construction of Cambourne, efforts were made to enable residents to travel easily

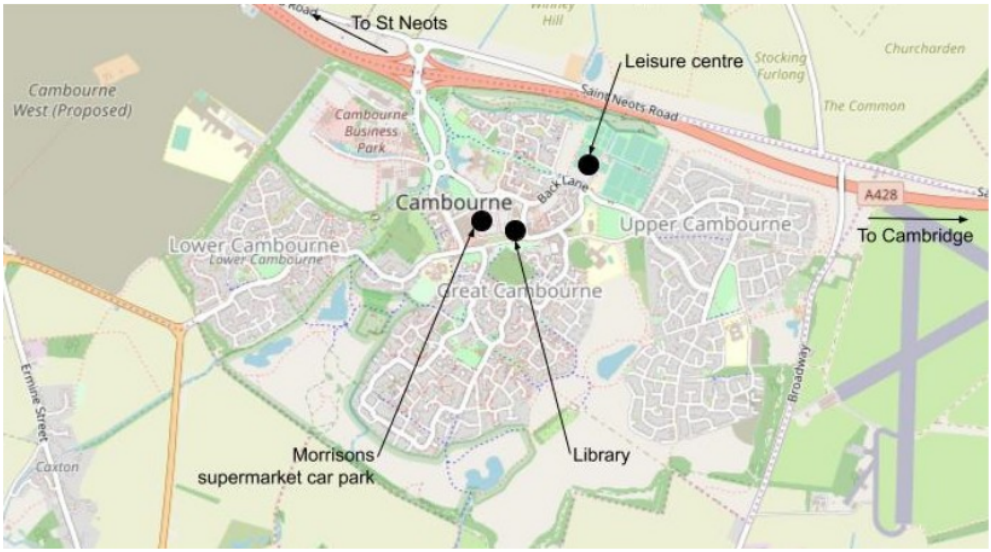

Figure 4.1: *Map of Cambourne. Map © OpenStreetMap contributors, data available under an Open Database License.*

around the town on foot or by bicycle. The residential areas were 'designed to be highly permeable by foot' with paths routed along desire lines, resulting in the 'vast majority' of residents being within a 15 minute walk of the town centre (RPS, 2007, p. 5). Cycle routes both alongside and segregated from roads have been provided, with much of the development within a five minute cycle journey of the centre (Ibid.). A regular bus service (approximately every 20 minutes between 0600 and 2300 on weekdays) connects Cambourne to Cambridge, the main local employment centre (Stagecoach, 2019a). Other bus routes serving Cambourne include an hourly service to Cambridge via local villages and infrequent services to Addenbrooke's Hospital and Huntingdon (Stagecoach, 2019b; Whippet Coaches, 2019). However, based on method of travel to work data from the 2011 census, Cambourne is a car-dependent development in terms of commuting, with nearly three-quarters of journeys to work made using a car (ONS, 2011).

The fact that Cambourne appears to be car-dependent, despite measures to encourage walking, cycling and public transport, indicates that simply providing an alternative mode to the car does not result in a modal shift. It may be the case that wider transport practices and lifestyle, such as the participation in trip chains, may inhibit the transfer to alternative modes, especially if one or more journeys within a trip chain are perceived as requiring the car. For example, a Cambourne resident who works in Cambridge and undertakes the school run whilst on the commute may select the car over the bus to work if they consider the latter to be comparatively unfeasible for taking their children to/from school. Hence, Cambourne is regarded as an excellent case study location in assessing whether trip chaining is a cause of excess car use.

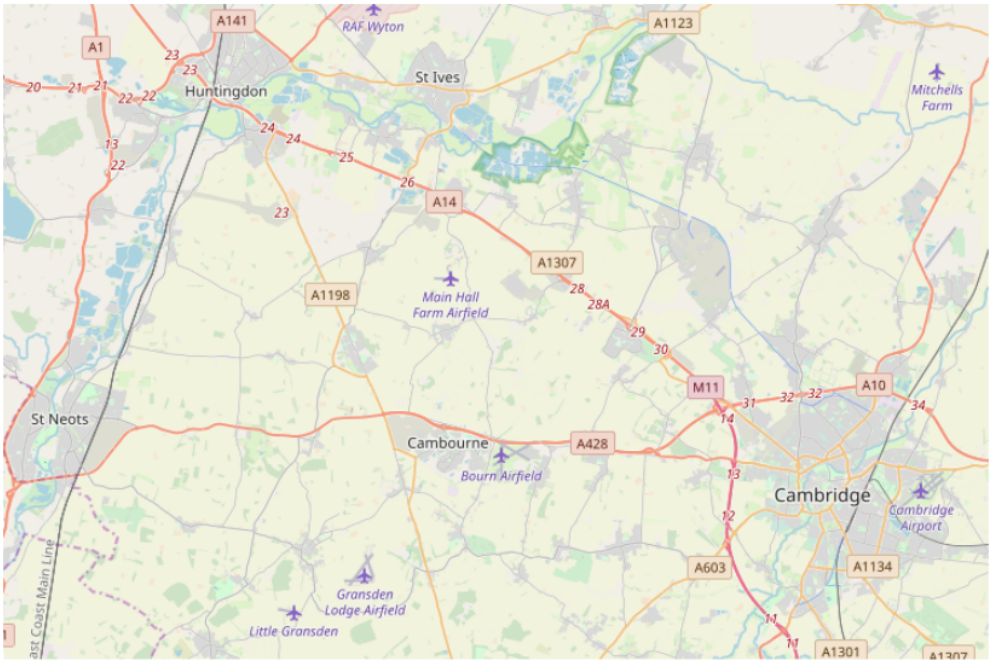

Figure 4.2: *Map of Cambourne and the wider area. Map © OpenStreetMap contributors, data available under an Open Database License.*

The sample was obtained through random sampling. This was undertaken by distributing questionnaires at the leisure centre and library in Cambourne at different times of day and across all days of the week to capture residents with different daily and weekly schedules and, therefore, different travel patterns and behaviours.

4.4 Data processing and analysis

The data obtained from the questionnaires were processed using SPSS Statistics and analysed using descriptive statistics. The descriptive statistics utilised were the percentages of respondents / responses obtained from the questionnaires. Crosstabulations were used to analyse the relationship between particular variables.

5 Survey sample

Overall, 97 questionnaires were regarded as being sufficiently complete. Tables A.1 to A.9 detail various different sociodemographic characteristics of the sample. As well as in some cases being used to explore the impacts of different sociodemographic characteristics on trip chaining behaviour and car use, the data were also used to assess the quality of the sample.

The gender split of the sample (Table A.1) is good, being almost even. The age characteristics (Table A.2) are significantly more concentrated in the 36–45 and 26–35 ranges, however this is comparable to the age structure for Cambourne (ONS, 2011). The household structures of the sample (Table A.3) also have categories with a much greater number of responses: 'Couple without children' and 'Couple with primary school children'. Again, this is similar to the structural profile of households in Cambourne (Ibid.).

One of the main issues regarding the sample is that it can only be considered typical for Cambourne or another location with a similar built environment, typology, location relative to other settlements, and sociodemographics. Another issue is that the main sampling method, distributing questionnaires in person at a small number of local amenities, may not have adequately reached all major sociodemographic groups in Cambourne. This is because not all sociodemographic groups may visit these locations and particular people are more likely to agree to participate in a survey than others (Billiet & Matsuo, 2012). With more time and resources, the former could be addressed by using a sampling method that reaches a wider pool of people, such as mail surveys, telephone surveys or online surveys that are advertised across the sampling area. The latter issue is somewhat harder to address, but could be mitigated by targeting areas or sociodemographic groups with higher non-response rates once the initial surveys are complete.

6 Results and analysis

6.1 Is trip chaining using a car a common behaviour?

The findings from the survey indicate that, in Cambourne, trip chaining using a car is a common behaviour, although the frequency at which trip chains are undertaken and the number of people who undertake them varies depending on the trip chain (Table A.11). Although most trip chains featured in the survey were not undertaken by a majority of the sample, there were three trip chains that were: D, J and K.

It is clear that a household's or individual's circumstances affect trip chaining behaviour. It is these circumstances that are responsible for the different participation levels across the trip chains. Relatively few respondents undertake A or B, which is understandable, as most respondents do not have school-age children (Table A.3). Similarly, is it not surprising that the three trip chains which are undertaken by majorities of respondents contain food / household shopping, which is a trip purpose that all households will need to undertake regularly. Similarly, visiting family / friends is a trip purpose that isn't restricted to a particular subset of individuals or households and, therefore, most people have the ability to combine it with other trips, in this case food / household shopping. One consequence of this is that households with school-age children undertake more trip chains, agreeing with the findings of Westman et al. (2017), Xianyu (2013), Faulkner et al. (2010), Hensher &

Reyes (2000) and Wallace et al. (2000).

Also, the trip purposes within a trip chain can affect behaviour. Table A.11 provides evidence that trip chain frequency increases if a trip chain contains individual trips which tend to be undertaken more often. Most respondents who undertake the school run while commuting do so very frequently (i.e. 'daily' or 'several times a week'), similar to the frequency one would expect for someone undertaking the school run or the commute as single-purpose trips. Similarly, trip chains containing food / household shopping, taking children to/from after-school / extracurricular activities and going to/from playing sports or the gym, activities that tend to be undertaken regularly but not every day, are mainly carried out 'several times a week', 'once a week' or '2–3 times a month'. Trip chain K is generally undertaken the least often. This is likely because, for many people, visiting family or friends is an occasional rather than regular trip, especially as it may involve travelling a significant distance.

Table A.13 clearly demonstrates that, in Cambourne, there is a preference for using the car to undertake trip chains. For all of the trip chains investigated, a majority of respondents who undertook them drove. There was, however, some variation in how dominant the car was as the chosen mode for a trip chain. Trip chain E had the highest car use with almost nine in ten respondents driving. This is likely to be a result of both constituent trips being primarily undertaken by car when undertaken separately (Table A.15). Meanwhile, only slightly more than six in ten respondents drove for trip chains H or J. Again, this may be related to the fact that both food / household shopping and going to/from playing sports or the gym, while still mainly being undertaken by car when single-purpose trips (Table A.15), are less car-dominant than taking children to/from after-school/extracurricular activities and commuting. As demonstrated by Hjorthol & Fyhri (2009), after-school / extracurricular activities may take place some distance away from either the home or place of work, favouring car use, while in Cambourne, the leisure centre and supermarket are in close proximity, making walking and cycling more attractive. Also, individuals who live and work in Cambourne would find it easy to visit the leisure centre on the way into work.

6.2 Does trip chaining contribute to a preference for the car over other modes compared to single-purpose trips?

Comparing Tables A.13 and A.15, it seems that trip chaining does result in a preference for the car over other modes when compared to single-purpose trips. However, it is only a slight preference. For all except one of the single-purpose trips, the majority of respondents said they always used the car for the whole journey. In all six cases, the vast majority of respondents either always drove for the whole journey or alternated between the car and one or more other modes. Hence, the preference among the sample for using the car to undertake trip

chains appears to be primarily due to a preference for the car in general, regardless of whether they are trip chaining. This indicates that, in Cambourne, trip chaining only causes a small amount of additional car use.

A logical mechanism for the slightly higher car use for trip chains is that it causes some of the respondents who alternate between the car and other modes for a single-purpose trip to choose the car when trip chaining. This is supported by additional reasons given by respondents for choosing the car over reasonable alternatives ('Other' in Table A.20), such as 'going somewhere straight from school', '[I] use the car on working days as [I] have to go straight from school', 'I trip chain school runs with [the] work commute or shopping', 'easy to park at supermarket on [the] way home from elsewhere, so not usually a special trip' and 'en route from say a day out'. Table A.20 also shows that many respondents choose the car over alternatives because it provides a 'quicker journey', is 'more convenient' or offers 'flexibility', supporting Adler & Ben-Akiva's (1979) conclusion that trip chaining reduces travel times and increases 'scheduling convenience'.

6.3 Are there specific activities, destinations or trip purposes that are more frequently incorporated into trip chains, and are they more conducive to car use?

The fact that all three trip chains which are undertaken by a majority of the sample—D, J and K—involve food / household shopping suggests that most people find it easy to incorporate into a chain. One possible explanation is that many shopping trips require the 'cargo function' of the car, as described by Mattioli et al. (2016), and, therefore, it makes sense to combine it with another journey that already utilises the car. This is supported by the high response numbers for 'difficulty in transporting equipment / items' in Tables A.20 and A.21. Another reason is that food / household shopping may be a relatively simple trip to combine with one or more other trips made by car. Shopping is not usually subject to strict time constraints and supermarkets tend to have large free or inexpensive car parks strategically positioned in relation to the main road network. Regarding Cambourne, the main supermarket is located in the centre of the development with a large, free car park (Figure 4.1). For any journey beyond Cambourne, someone would only have to make a small detour to add a shopping trip.

As discussed in Section 6.2, most respondents used the car at least some of the time to undertake single-purpose trips. As a result, it can be argued that all six trip purposes are conducive to car use for Cambourne residents. Interestingly, the school run and food / household shopping, trip purposes identified in previous research as being car-dependent, were less car-dominant than commuting and visiting family / friends (Table A.15). This suggests that, in the context of Cambourne, commuting and visiting family / friends are trip purposes which are more car-dependent. This is supported by the respondents' perceptions of whether there was a reasonable alternative mode of transport to the car (Table A.17). A majority of respondents for both the commute and

visiting family / friends did not perceive there to be a reasonable alternative, unlike the school run, where nearly three-quarters felt there was a reasonable alternative. This indicates that, in the Cambourne area, it is the presence of the commute or visiting family / friends which dictates car use in trip chains in which they are present.

The fact that Cambourne differs in terms of the most car-dependent trips compared to previous research may be due to differences between the study locations. Cambourne is a relatively small community (12,000), in a mostly rural area, with one small city (Cambridge, population 123,900 (ONS, 2011)) nearby. Meanwhile, two of the studies—Handy & Clifton (2001) in Austin, Texas; Faulkner et al. (2010) in Toronto, Ontario—were undertaken in large cities, while Van Ristell et al. (2013) used data for the whole of England, encompassing areas with very different typologies and sociodemographics. Westman et al.'s (2017) study was undertaken in a relatively rural area, but in Sweden, which may have different sociodemographics and travel requirements.

The presence of taking children to/from after-school / extracurricular activities appears to result in greater car use in trip chains, as both trip chains with the highest percentage of car use—E and G—contain this trip purpose (Table A.13). This supports the hypothesis that combining car-dependent and non-car-dependent trips in trip chains results in additional car use, as majorities of respondents that undertake it as a single-purpose trip always use the car for the whole journey and consider there to be no reasonable alternative mode (Tables A.15 and A.17). The fact that three-quarters of respondents gave 'quicker journey' as a reason for choosing the car over a reasonable alternative and over three-quarters gave 'too far to walk or cycle' as a reason for there being no alternative to the car for taking children to/from after-school / extracurricular activities supports the conclusions of Hjorthol & Fyhri (2009) that the locations for such activities are often a significant distance from the home, favouring the car as mode of choice.

The car dependence of the school run observed by Faulkner et al. (2010) and Hjorthol & Fyhri (2009) is less apparent in Cambourne, with most undertaking the trip either alternating between the car and other modes or not driving at all (Table A.15). Furthermore, a majority of those who undertake the trip perceive there to be a reasonable alternative (Table A.17). One factor that may explain this is the apparent lower priority given to safety in mode selection, with both 'safer' and 'personal safety concerns' garnering relatively few responses in Tables A.20 and A.21. This may be because Cambourne residents are less concerned with safety, as the town possesses a network of well-lit, segregated footpaths and cycle lanes. Another potential reason is that the locations where Faulkner et al.'s and Hjorthol & Fyhri's studies took place, Toronto and Norway respectively, may have substantially different built environments, sociodemographics and travel practices to Cambourne.

6.4 Further discussion of findings

Examining Table A.12, there are some noticeable differences in trip chain behaviour between men and women. For three of the trip chains involving the school run—A, B and F—women are far more likely to participate than men. This supports the findings of Bianco & Lawson (1998) and McGuckin et al. (2005) that women are more likely to undertake the school run and combine it with the work commute. The fact that most of the trip chains involving food / household shopping have comparable participation between genders does, however, disagree with Bianco & Lawson's (1998) view that differences between men's and women's trip chaining behaviour were due to women's greater tendency to undertake additional activities such as shopping. This may be because differences in men's and women's working patterns have reduced since Bianco & Lawson's (1998) study, with more women working full-time and fewer being stay-at-home parents (Roantree & Vira, 2018, Figures 2 & 11). As a result, the differences in time available for undertaking additional trips between men and women have decreased, meaning it is more efficient to distribute such trips evenly across a household.

Another clear difference in trip chaining behaviour between genders is for trip chains involving going to/from playing sports or the gym, which are far more likely to be undertaken by men. This may be because men are more likely to take part in sports or go to the gym in the first place. While the difference between male and female participation rates in physical activities does not seem large enough to support this explanation (Sport England, 2019, p. 7), the survey includes 'walking for leisure' and 'walking for travel' in its definition of physical activities (Ibid., p. 13), activities which tend to be undertaken more by women (DfT, 2018, p. 7). This suggests that the difference between men and women in sports participation or gym attendance is greater than that for physical activities as a whole, and may be similar to the differences in trip chain participation. Another possible explanation is that, since women are still more likely to work part-time or undertake a stay-at-home parent role than men, they tend to have more time available for such trips and have less need to combine it in a trip chain. However, were this to be the case, it would also be expected that trip chains C and D, undertaking food / household shopping while commuting, would have a similar difference in participation between genders.

As with trip chain participation, there are differences in mode choice for trip chains between genders (Table A.14). Men are more likely than women to drive when undertaking trip chains A and B. In the past, this may have been explained by differences in access to a car, with households having one car which was most likely used by a man to commute to work in a stereotypical 'breadwinner' role (Wachs, 1987). However, as shown in Table A.5, the vast majority of the sample have regular access to a car as a driver, so access is unlikely to be the reason. One potential explanation is that women's working patterns may allow them to walk with their child(ren) to school while going to/from work. This is supported by DfT (2018, p. 7), which states that 'women in their thirties make four times as many escort education trips than men of the same age, and walking is the most common mode

used to make these trips'. This may be because more women work part-time than men (Table A.8), enabling them to organise work around the school run. Also, there is an increasing trend for employers to offer more flexible working (Williams, 2009), allowing parents to schedule work around activities such as the school run despite working full-time. Since Bianco & Lawson's (1998) and McGuckin et al.'s (2005) finding that women are primarily responsible for undertaking the school run appears to still hold true, then many women may be taking advantage of flexible hours to walk their children to school instead of driving. However, the small number of responses for each trip chain for each gender must be considered, as one response has a significant effect on the results. Hence, the survey on trip chaining behaviour should be repeated with a larger sample before definitive conclusions are drawn. Conversely, women are more likely than men to drive when undertaking trip chains that involve going to/from playing sports or the gym. This may be due to the fact that, while women tend to walk further and more often, men tend to cycle more than women (DfT, 2018, p. 7 & 13). Although, for one trip chain—H—women are more likely to walk or cycle than men, but the small number of responses means the results are unlikely to be representative. Again, a survey with a larger sample should take place before firm conclusions are made.

There is also an interesting variation in trip chain behaviour between genders for trip chain K. Men are more likely than women to be the driver, while women are more likely to be a passenger. This may reflect the fact that some trips to visit family or friends involve the whole household, and, in some households, the default driver for such trips would be a male head of household. Again, the subset of the sample is small, so further analysis with more participants is required.

The apparent car dependence of the commute discussed in Section 6.3 provides another interesting finding when residential and workplace / education location are considered. Table A.10 shows that the most common commute is between Cambourne and Cambridge. When mode choice for the commute is examined for this group (Table A.16), it emerges that the majority always use the car for the whole journey. This is despite there being a frequent bus service operating between Cambourne and Cambridge, as mentioned in Section 4.3. Furthermore, when asked whether there is a reasonable alternative to the car for the commute, a majority responded 'no' (Table A.18). A lack of awareness of the bus alternative is unlikely, as the route and frequency of the service mean that it is highly visible to residents when travelling through Cambourne. An alternative reason is that the bus service is considered too slow to be feasible. Table A.19 demonstrates that, for a journey into Cambridge city centre, the bus is only slightly slower than driving. However, for employment areas that are neither in the centre nor on the bus route from Cambourne, such as those identified in Figure 6.1, journey times from Cambourne are significantly higher. Hence, the bus service between Cambourne and Cambridge is only a reasonable alternative if your destination is in the city centre or along the bus's route into the city. If a mode shift away from cars is to be facilitated, then public transport provision must adequately serve all major

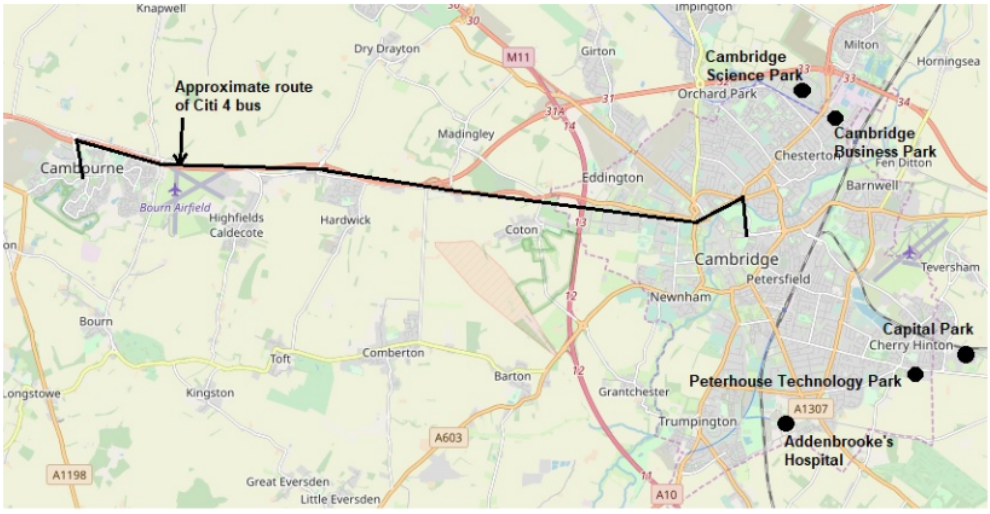

Figure 6.1: *Citi 4 bus route in relation to selected major employment areas in Cambridge. Bus route information from Stagecoach (2019a). Map © OpenStreetMap contributors, data available under an Open Database License.*

destinations, both in terms of frequency and journey time. This also illustrates the problems which arise from a lack of integrated transport and land use planning, as numerous major employment sites have been developed far from Cambridge's main transport hubs.

Since trip chaining results in only a small amount of extra car use, it seems that it is a symptom of car dependence and high levels of car use, rather than a cause of excess car use. Since most of the trip purposes that formed the surveyed trip chains are car-dominant when undertaken as single-purpose trips, then they are already car-dependent regardless of respondents' trip chaining habits. Since the car is already being used for most journeys, then it is straightforward for an individual to make a time saving by adding additional trips. As discussed previously, 'quicker journey', 'more convenient' and 'flexibility' were three of the most common reasons given for selecting the car over other modes. These are all reasons that encapsulate the convenience offered by the car, or the 'ubiquitous mobility' described by Brindle (2003, p. 65). Another reason frequently offered for choosing the car over alternatives in Table A.20 was 'weather conditions', which contributes to the image of convenience as the car provides a more comfortable journey during adverse weather conditions.

The car also offers convenience as it enables households and individuals to undertake journeys and participate in activities that would not be feasible if driving wasn't an option, as demonstrated by the high proportion of respondents giving 'no public transport to/from destination or not at time required' and 'too far to walk or cycle' as reasons for there being no reasonable alternative to the car (Table A.21). It is this aspect of convenience which is arguably the most important in terms of car dependence and car use. Households' and individuals' travel needs are dependent on the origins and destinations and the schedule of the trips undertaken, which, in turn,

are products of the household's or individual's lifestyle. Which activities an individual or a household needs or wants to do, and when and where they take place, are the key factors in dictating their travel requirements. For many trips, it is the 'attributes of the destination', as described by Adler & Ben-Akiva (1979), that determine the destination and, as a result, the travel behaviour including the mode. Activities located a significant distance apart but scheduled close timewise may necessitate a particular mode if it is the only one that can undertake the journey in the required time. Hence, the 'scheduling convenience' (Adler & Ben-Akiva, 1979) and 'ubiquitous mobility' (Brindle, 2003) offered by the car enables households and individuals to enjoy lifestyles they would not be able to otherwise. The result is that many households and individuals in Cambourne have chosen a lifestyle and combination of destinations and activities which can only be pursued using the car. Trip chaining contributes to this concept of convenience.

6.5 What do the findings entail for the planning of new residential developments in the UK and transport and development planning in general?

A finding with significant consequences for transport and development planning for both new and existing developments in the UK is that, despite investment in safer, segregated footpaths and cycleways and a frequent public transport service to the main local employment centre, many residents in Cambourne not only always drive when making trips, but also consider there to be no reasonable alternative to using the car (Tables A.15 and A.17). The fact that 'quicker journey' was frequently given as a reason for selecting the car over alternatives suggests that, despite the active travel infrastructure and bus service, the car is still considered to perform best in terms of travel time. Especially concerning is that a majority of those who commuted between Cambourne and Cambridge, served by a regular bus service, felt that there was no reasonable alternative to the car. It is evident that offering a regular public transport service along only one route into the main local employment centre, requiring anyone employed elsewhere in the city to make a lengthy interchange, is insufficient to encourage a modal shift. Public transport options must better serve people's actual travel needs and employment locations if they are to be considered competitive against driving. The proposed options for improving bus infrastructure between Cambourne and Cambridge, either dedicated on-road bus lanes or an off-road segregated route (Greater Cambridge Partnership, 2019), may help make travel times more competitive in relation to the car. Introducing peak time routes that travelled directly to major employment locations could also contribute. Going forward, more integrated land use and transport planning would help avoid situations where important destinations are poorly served by public transport. For example, planners should consider building new developments around public transport infrastructure, such as developments in the Netherlands built around purpose-built bus lanes (Transport for New Homes, 2018, p. 13). Another measure would be to make walking and cycling routes follow the most direct route between destinations, while relegating road

traffic, especially cars, to indirect, peripheral routes. It would also be beneficial to change priority at interfaces between active transport, public transport and cars, with public transport having priority over cars, cyclists having priority over both public transport and cars, and pedestrians having priority over all of them. Car use could also be tackled by addressing the requirement of the car's 'cargo function' for shopping trips. Regulating the size and location of supermarkets to create a more 'dispersed' retail pattern resulted in residents tending to use non-motorised modes for shopping trips in Freiburg, Germany (Hamiduddin, 2015). Similar measures could be implemented in the UK.

However, the most challenging aspect from a planner's perspective is that the lifestyles of those surveyed are car-dependent, built around the convenience or 'ubiquitous mobility' that the car offers. While this is encouraging in the sense that the issue is something the car provides rather than the car itself, there is a significant gap between the lifestyle that public and active transport are currently capable of supporting and the one that they would need to support to enable a mode shift. As discussed in Section 3, this applies to most communities, not just Cambourne. The measures mentioned previously, such as reconfiguring public transport services to better serve people's actual destinations rather than simply travelling between settlement centres and better integrated transport and land use planning, would help close this gap. Additionally, policies to reduce the convenience of the car can be implemented. These mainly concern shifting the costs associated with driving from ownership to use, as proposed by Gorham (2002, p. 113), and include road pricing and ending the provision of free and plentiful parking. However, some of these measures, especially the former, would be difficult to implement politically if it meant individuals became unable to maintain their existing lifestyles. As a result, any such policies would have to be implemented once public and active transport alternatives were sufficiently developed to replace the car.

7 Conclusions

This study has demonstrated that trip chaining using the car is a common practice for residents of Cambourne. However, it appears that trip chaining causes a relatively small amount of additional car use, as the trip purposes that comprised the studied trip chains are also often made by car when undertaken as single-purpose trips. Instead of car-dependent trips causing non-car-dependent trips to be undertaken by car when combined in trip chains, trip chaining seems more to be a symptom of a car-dependent lifestyle. Cambourne residents have organised activities and destinations such that the car is the only mode that can meet the resultant transport requirements. This supports Brindle's (2003) concept of the car's 'ubiquitous mobility' allowing people to live their desired lifestyles and, in the process, becoming highly car-dependent. Furthermore, this study indicates the importance of the 'scheduling convenience of the travel pattern' and the 'attributes of the chosen

destinations' in the utility of the mode, in this case the car, as posited by Adler & Ben-Akiva (1979).

Gender differences in trip chaining behaviour and mode choice were identified, supporting Bianco & Lawson's (1998) and McGuckin et al.'s (2005) conclusions that women are more likely to undertake the school run and combine it with the commute. However, the study did not support Bianco & Lawson's view that differences between men's and women's trip chaining habits were due to women's greater tendency to undertake shopping and similar activities, as gender participation in trip chains containing food / household shopping was similar. Men were found to be more likely to incorporate a trip to play sports or go to the gym into a trip chain than women. Men were found to be more likely to drive for trip chains involving both the school run and the commute, but less likely for trip chains involving going to/from playing sports or the gym.

The results of the study have several implications for both the planning of new residential developments in the UK and for planning in general. Instead of offering theoretical yet impractical alternatives to driving, active and public transport must provide at least the same level of convenience in terms of travel time, destinations, frequency and comfort if a modal shift away from the car is to be realised. Measures and policies that could improve the convenience offered by active and public transport include making pedestrian and cycle paths run along the most direct routes between local amenities, changing priorities at active-transport-road-transport interfaces such that pedestrians have the highest priority and cars the lowest, operating public transport services that connect all major destinations rather than just town / city centres, and integrating land use and transport planning such that employment, commercial and residential developments are not isolated from the local public transport network.

7.1 Further research areas

As discussed in Section 6, some of the trip chains and single-purpose trips were undertaken by a relatively small number of respondents, meaning the results could have been skewed by a few outliers. Hence, it would be beneficial to undertake the survey with a larger sample, perhaps specifically targeting residents who undertake the school run and take children to/from after-school / extracurricular activities. This could be done by distributing questionnaires via local schools. Also, a larger sample would also mean it would be feasible to perform significance tests on the data. As mentioned in Section 5, the results are only valid for settlements with very similar sociodemographic profiles and built environments, therefore further studies of places with very different sociodemographic profiles and built environments should be undertaken. It would also be interesting to compare trip chaining practices between places with very different mode shares, such as the UK and the Netherlands. The chosen method of distributing questionnaires, through face-to-face surveying at the local leisure centre and library, may not have reached sociodemographic groups who are less likely to visit such

locations or respond to surveys. As a result, follow-up surveys which target underrepresented sociodemographic groups should be arranged.

While the research reveals some of the factors which influence car use in Cambourne, it does not provide a clear picture of the decision-making process households or individuals undertake when choosing the car. Such a picture is necessary so that active and public transport can be adapted to provide the same convenience as the car. Hence, a travel diary study should be organised to better understand the decision-making process, with follow-up surveys assessing the relative importance of factors using a Likert scale.

Further studies examining the differences in trip chaining behaviour between genders would be beneficial. These should include investigations into why men are more likely to drive than women when undertaking trip chains involving the school run and whether differences in part-time employment or use of flexible working are a factor. The differences in car use for trip chains containing trips to play sports / go to the gym between genders could also be studied. Finally, it would be interesting to investigate why, for trip chain K, men are more likely to drive than women and women are more likely to be a passenger than men.

It would be beneficial to investigate the effectiveness of the measures suggested in Section 6.5. For example, the impact of introducing bus services that travelled directly to major employment areas on the periphery of Cambridge could be assessed by surveying Cambourne residents who work at the locations identified in Figure 6.1. Also, the feasibility of policies which shifted the cost burden for cars from ownership to use could be examined by surveying residents, along with whether providing public and active transport that offered comparable convenience to the car increased the acceptance of such policies.

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A DATA TABLES

Female	47.9%
Male	52.1%
Respondents = 96	

Table A.1: *Gender characteristics*

18–25	11.5%
26–35	24.0%
36–45	33.3%
46–55	13.5%
56–65	9.4%
>65	8.3%
Respondents = 96	

Table A.2: *Age characteristics*

Single person household	12.5%
Multiple person household (unrelated)	6.3%
Couple without children	25.0%
Couple with preschool children	6.3%
Couple with primary school children	22.9%
Couple with secondary school children	8.3%
Single parent with preschool children	1.0%
Single parent with primary school children	3.1%
Single parent with secondary school children	2.1%
Either / both parents with adult children / Living with parent(s)	12.5%
Respondents = 96	

Table A.3: *Household structure*

Do you possess a driving license?	
Yes	92.7%
No	7.3%
Respondents = 96	

Table A.4: *Driving license possession*

Regular access as driver	78.1%
Regular access as passenger	15.6%
Occasional access as driver	2.1%
Occasional access as passenger	2.1%
No access to a car	2.1%
Respondents = 96	

Table A.5: *Car access*

Cambourne	69.8%
Village within 4 miles of Cambourne	10.4%
>4 miles from Cambourne	19.8%
Respondents = 96	

Table A.6: *Approximate residential location*

Full-time	54.2%
Part-time	22.9%
Full-time parent	4.2%
Full-time education	4.2%
Unemployed	1.0%
Retired	13.5%
Respondents = 96	

Table A.7: *Employment status*

	Female	Male
Full-time	15.6%	38.5%
Part-time	21.9%	1.0%
Full-time parent	4.2%	0.0%
Full-time education	0.0%	4.2%
Unemployed	1.0%	0.0%
Retired	5.2%	8.3%
Respondents = 96		

Table A.8: *Employment status according to gender*

Cambourne	15.8%
Cambridge	50.0%
Work from home	9.2%
Other	25%
Respondents = 76	

Table A.9: *Employment / education location*

	Employment / education location			
Residential location	Cambourne	Cambridge	Work from home	Other
Cambourne	13.2%	35.5%	7.9%	10.5%
Village within 4 miles of Cambourne	0.0%	5.3%	0.0%	6.6%
>4 miles from Cambourne	2.6%	9.2%	1.3%	7.9%
Respondents = 76				

Table A.10: *Crosstabulation for residential and employment / education location*

Trip chain reference letter	Daily	Several times a week	Once a week	2–3 times a month	Once a month	Less than once a month	Total	Never	Respondents
A	6.2%	13.4%	6.2%	1.0%	2.1%	2.1%	30.9%	69.1%	97
B	6.3%	12.5%	6.3%	0.0%	1.0%	5.2%	31.3%	68.8%	96
C	2.1%	8.3%	13.5%	7.3%	3.1%	9.4%	43.8%	56.3%	96
D	2.1%	12.8%	16.0%	18.1%	6.4%	5.3%	60.6%	39.4%	94
E	2.1%	13.5%	9.4%	1.0%	5.2%	7.3%	38.5%	61.5%	96
F	2.1%	7.3%	6.3%	5.2%	3.1%	7.3%	31.3%	68.8%	96
G	2.1%	7.2%	8.2%	9.3%	5.2%	7.2%	39.2%	60.8%	97
H	3.2%	10.5%	6.3%	4.2%	1.1%	1.1%	26.3%	73.7%	95
I	2.1%	17.0%	5.3%	6.4%	2.1%	5.3%	38.3%	61.7%	94
J	1.0%	13.5%	21.9%	7.3%	5.2%	11.5%	60.4%	39.6%	96
K	2.1%	5.2%	9.4%	14.6%	15.6%	19.8%	66.7%	33.3%	96

Table A.11: *Trip chain participation*

Men									
Trip chain reference letter	Daily	Several times a week	Once a week	2–3 times a month	Once a month	Less than once a month	Total	Never	Respondents
A	4.0%	10.0%	2.0%	2.0%	4.0%	4.0%	26.0%	74.0%	50
B	2.0%	6.1%	6.1%	0.0%	0.0%	6.1%	20.4%	79.6%	49
C	2.0%	8.0%	12.0%	6.0%	2.0%	16.0%	46.0%	54.0%	50
D	2.1%	14.6%	14.6%	14.6%	10.4%	6.3%	62.5%	37.5%	48
E	2.0%	8.0%	10.0%	0.0%	4.0%	12.0%	36.0%	64.0%	50
F	4.1%	2.0%	4.1%	2.0%	0.0%	8.2%	20.4%	79.6%	49
G	2.0%	6.0%	12.0%	4.0%	6.0%	8.0%	38.0%	62.0%	50
H	4.0%	16.0%	6.0%	6.0%	2.0%	2.0%	36.0%	64.0%	50
I	4.2%	22.9%	4.2%	6.3%	4.2%	8.3%	50.0%	50.0%	48
J	2.0%	18.0%	18.0%	12.0%	4.0%	14.0%	68.0%	32.0%	50
K	2.0%	6.0%	6.0%	18.0%	12.0%	20.0%	64.0%	36.0%	50
Women									
A	8.7%	17.4%	10.9%	0.0%	0.0%	0.0%	37.0%	63.0%	46
B	10.9%	19.6%	6.5%	0.0%	2.2%	4.3%	43.5%	56.5%	46
C	2.2%	8.9%	15.6%	8.9%	4.4%	2.2%	42.2%	57.8%	45
D	2.2%	11.1%	17.8%	22.2%	2.2%	4.4%	60.0%	40.0%	45
E	2.2%	20.0%	8.9%	2.2%	6.7%	2.2%	42.2%	57.8%	45
F	0.0%	13.0%	8.7%	8.7%	6.5%	6.5%	43.5%	56.6%	46
G	2.2%	8.7%	4.3%	15.2%	4.3%	6.5%	41.3%	58.7%	46
H	2.3%	4.5%	6.8%	2.3%	0.0%	0.0%	15.9%	84.1%	44
I	0.0%	11.1%	6.7%	6.7%	0.0%	2.2%	27.7%	73.3%	45
J	0.0%	8.9%	26.7%	2.2%	6.7%	8.9%	53.3%	46.7%	45
K	2.2%	4.4%	13.3%	11.1%	20.0%	20.0%	71.1%	28.9%	45

Table A.12: *Trip chain participation according to gender*

Trip chain reference letter	Car (driver)	Car (passenger)	Walk	Cycle	Bus	Multiple modes	Respondents
A	65.5%	3.4%	10.3%	3.4%	3.4%	13.8%	29
B	72.4%	3.4%	6.9%	3.4%	3.4%	10.3%	29
C	75.6%	2.4%	7.3%	9.8%	0.0%	4.9%	41
D	73.2%	1.8%	7.1%	8.9%	0.0%	8.9%	56
E	89.2%	0.0%	5.4%	2.7%	0.0%	2.7%	37
F	69.0%	0.0%	17.2%	6.9%	0.0%	6.9%	29
G	80.6%	0.0%	8.3%	5.6%	0.0%	5.6%	36
H	62.5%	0.0%	12.5%	12.5%	4.2%	8.3%	24
I	77.1%	0.0%	8.6%	8.6%	2.9%	2.9%	35
J	61.8%	3.6%	14.5%	10.9%	0.0%	9.1%	55
K	75.4%	11.5%	3.3%	3.3%	1.6%	4.9%	61

Table A.13: *Trip chain mode choice*

Trip chain reference letter	Car (driver)	Car (passenger)	Walk	Cycle	Bus	Multiple modes	Respondents
			Men				
A	75.0%	0.0%	0.0%	8.3%	0.0%	16.7%	12
B	88.9%	0.0%	0.0%	11.1%	0.0%	0.0%	9
C	72.7%	0.0%	4.5%	13.6%	0.0%	9.1%	22
D	75.9%	0.0%	0.0%	13.8%	0.0%	10.3%	29
E	94.4%	0.0%	0.0%	5.6%	0.0%	0.0%	18
F	66.7%	0.0%	22.2%	11.1%	0.0%	0.0%	9
G	82.4%	0.0%	11.8%	5.9%	0.0%	0.0%	17
H	58.8%	0.0%	11.8%	11.8%	5.9%	11.8%	17
I	73.9%	0.0%	8.7%	8.7%	4.3%	4.3%	23
J	56.3%	0.0%	18.8%	15.6%	0.0%	9.4%	32
K	80.0%	3.3%	3.3%	6.7%	0.0%	6.7%	30
			Women				
A	58.8%	5.9%	17.6%	0.0%	5.9%	11.8%	17
B	65.0%	5.0%	10.0%	0.0%	5.0%	15.0%	20
C	78.9%	5.3%	10.5%	5.3%	0.0%	0.0%	19
D	70.4%	3.7%	14.8%	3.7%	0.0%	7.4%	27
E	84.2%	0.0%	10.5%	0.0%	0.0%	5.3%	19
F	70.0%	0.0%	15.0%	5.0%	0.0%	10.0%	20
G	78.9%	0.0%	5.3%	5.3%	0.0%	10.5%	19
H	71.4%	0.0%	14.3%	14.3%	0.0%	0.0%	7
I	83.3%	0.0%	8.3%	8.3%	0.0%	0.0%	12
J	69.6%	8.7%	8.7%	4.3%	0.0%	8.7%	23
K	71.0%	19.4%	3.2%	0.0%	3.2%	3.2%	31

Table A.14: *Trip chain mode choice according to gender*

	Always for the whole journey	For part of the journey alongside one or more other modes	Sometimes / Alternates with one or more other modes	No	Respondents
Commute	70.1%	4.5%	13.4%	11.9%	67
School run	48.6%	0.0%	40.0%	11.4%	35
Children's after-school / extracurricular activities	63.2%	0.0%	28.9%	7.9%	38
Shopping	59.3%	1.1%	34.1%	5.5%	91
Sports / gym	54.7%	0.0%	25.3%	20.0%	75
Visiting family / friends	70.3%	3.3%	20.9%	5.5%	91

Table A.15: *Car use for single-purpose trips*

Always for the whole journey	64.0%
For part of the journey alongside other modes	8.0%
Sometimes / Alternatives with one or more other modes	16.0%
No	12.0%
Respondents = 25	

Table A.16: *Car use for commuting by respondents living in Cambourne and working / studying in Cambridge*

Is there an alternative mode of transport you could reasonably use?			
	Yes	No	Respondents
Commute	39.0%	61.0%	59
School run	74.2%	25.8%	31
Children's after-school / extracurricular activities	45.7%	54.3%	35
Shopping	59.3%	40.7%	86
Sports / gym	63.9%	36.1%	61
Visiting family / friends	48.2%	51.8%	85

Table A.17: *The perception of an alternative mode to the car for individual trips*

Is there an alternative mode of transport you could reasonably use?		
Yes	No	Respondents
40.9%	59.1%	22

Table A.18: *The perception of an alternative mode for commuting for respondents who live in Cambourne and work / study in Cambridge*

Route	Mode	Typical journey time (minutes)
Broad Street, Cambourne, to Drummer	Car	20–35
Street Bus Station, Cambridge	Bus	37–42
Broad Street, Cambourne, to	Car	22–35
Addenbrooke's Hospital, Cambridge	Bus	55–63
Broad Street, Cambourne, to Cambridge	Car	16–22
Science Park, Cambridge	Bus	58–69

Table A.19: *Typical journey times offered by Google Maps for three different Cambourne to Cambridge commutes at 0700 on Wednesday 7th August 2019*

	Commuting	School run	Children's after-school / extracurricular activities	Shopping	Sports / gym	Visiting family / friends
Quicker journey	56.5%	54.5%	75.0%	52.9%	84.2%	71.8%
More convenient	47.8%	27.3%	43.8%	54.9%	63.2%	69.2%
Safer	21.7%	4.5%	6.3%	2.0%	5.3%	10.3%
Cost	39.1%	4.5%	6.3%	7.8%	7.9%	41.0%
Personal safety concerns	8.7%	9.1%	18.8%	7.8%	10.5%	7.7%
Easy / free parking at destination	30.4%	0.0%	18.8%	33.3%	47.4%	30.8%
Flexibility	34.8%	31.8%	43.8%	33.3%	36.8%	59.0%
Weather conditions	26.1%	40.9%	68.8%	47.1%	47.4%	38.5%
Accompanying children	21.7%	N/A	N/A	N/A	N/A	25.6%
Difficulty in transporting equipment / items	N/A	31.8%	31.3%	72.5%	7.9%	N/A
Other	13.0%	13.6%	6.3%	3.9%	7.9%	2.6%
Respondents	23	22	16	51	38	39

Table A.20: *Reasons given for choosing the car over an alternative mode*

	Commuting	School run	Children's after-school / extracurricular activities	Shopping	Sports / gym	Visiting family / friends
Safer	2.8%	12.5%	16.7%	9.1%	18.2%	9.1%
Cost	11.1%	25.0%	22.2%	21.2%	13.6%	20.5%
Personal safety concerns	5.6%	37.5%	27.8%	15.2%	22.7%	9.1%
No public transport service to/from destination or not at time required	66.7%	75.0%	72.2%	63.6%	81.8%	70.5%
Too far to walk or cycle	47.2%	62.5%	77.8%	42.4%	72.7%	70.5%
Accompanying children	22.2%	N/A	N/A	N/A	N/A	25.0%
Difficulty in transporting equipment / items	N/A	0.0%	5.6%	63.6%	18.2%	N/A
Car required for job	25.0%	N/A	N/A	N/A	N/A	N/A
Other	19.4%	12.5%	16.7%	3.0%	4.5%	9.1%
Respondents	36	8	18	33	22	44

Table A.21: *Reasons given for perceiving there to be no alternative mode(s) to the car*

B SURVEY QUESTIONNAIRE

Does car dependence lead to car profligacy?: Car dependent practices, trip chaining and excess car use: Survey Questionnaire

Trip chaining

This section concerns whether you participate in any trip chains and what mode of transport you use. A number of common trip chains are listed below. For example, the first trip chain, school run undertaken on commute to work, refers to doing the school run as an additional journey purpose on the work commute. Trip chains containing more than one additional journey purpose should be considered on the basis of each separate additional purpose. For example, a trip chain where going to the gym and shopping are undertaken on the commute from work should be considered as 'Sports/gym on the commute from work' and 'Food/household shopping on the commute from work'. If you do not undertake a particular trip chain, please tick 'Never' under 'How often do you undertake this trip chain?' and continue to the next trip chain.

	How often do you undertake this trip chain?							What mode of transport do you use?							
	Daily	Several times a week	Once a week	2-3 times a month	Once a month	Less than once a month	Never	Car (driver)	Car (passenger)	Walk	Cycle	Bus	Other public transport	Taxi / ride-hail service	Multiple modes
School run undertaken on commute to work	1	2	3	4	5	6	7	1	2	3	4	5	6	7	8
School run undertaken on commute from work	1	2	3	4	5	6	7	1	2	3	4	5	6	7	8
Food / household shopping on commute to work	1	2	3	4	5	6	7	1	2	3	4	5	6	7	8
Food / household shopping on commute from work	1	2	3	4	5	6	7	1	2	3	4	5	6	7	8
After-school / extracurricular activities on commute from work	1	2	3	4	5	6	7	1	2	3	4	5	6	7	8
Food / household shopping on school run	1	2	3	4	5	6	7	1	2	3	4	5	6	7	8
Food / household shopping on after-school / extracurricular activities	1	2	3	4	5	6	7	1	2	3	4	5	6	7	8
Sports / gym on commute to work	1	2	3	4	5	6	7	1	2	3	4	5	6	7	8
Sports / gym on commute from work	1	2	3	4	5	6	7	1	2	3	4	5	6	7	8
Food / household shopping while going to/from sports / gym	1	2	3	4	5	6	7	1	2	3	4	5	6	7	8
Food / household shopping on visiting family/friends	1	2	3	4	5	6	7	1	2	3	4	5	6	7	8

Are there any other trip chains you under take?
(Include description and frequency) _____

Car use

In this section, you will be asked a series of questions on the use of cars for a number of specific journeys or journey purposes.

1. Commute to/from work or education

1.1 Do you undertake this journey?		[1] Yes Move onto Question 1.2	[0] No Move onto the next journey purpose (2)	
1.2 Do you use a car for the journey?	[1] Yes, always for the whole journey. Move onto Question 1.3	[2] Yes, for part of the journey alongside one or more other modes. Move onto Question 1.3	[3] Sometimes / Alternates with one or more other modes. Move onto Question 1.3	[0] No. Move onto the next journey purpose (2)
1.3 Is there an alternative mode of transport you could reasonably use? Alternative modes include walking, cycling, public transport or taxi/ride-hail service.			[1] Yes Move onto Question 1.4	[0] No Move onto Question 1.5

1.4 If an alternative mode is available, which of the following reasons apply in using a car over the alternative(s)? Tick all that apply. When finished, skip 1.5 and move onto the next journey purpose (2).

[ ] Quicker journey	[ ] Flexibility	[ ] Safer	[ ] More convenient	[ ] Cost	[ ] Accompanying children	[ ] Personal safety concerns	[ ] Weather conditions	[ ] Easy / free parking at destination
Other (please specify) [ ]								

1.5 If an alternative mode is not available, which of the following reasons apply in there being no alternative mode(s) of transport? Tick all that apply. When finished, move onto the next journey purpose (2).

[ ] Personal safety concerns	[ ] Safer	[ ] Too far to walk or cycle	[ ] Cost	[ ] Accompanying children	[ ] Car required for job	[ ] No public transport service to/from destination or not at the time required
[ ] Other (please specify)						

2. School run

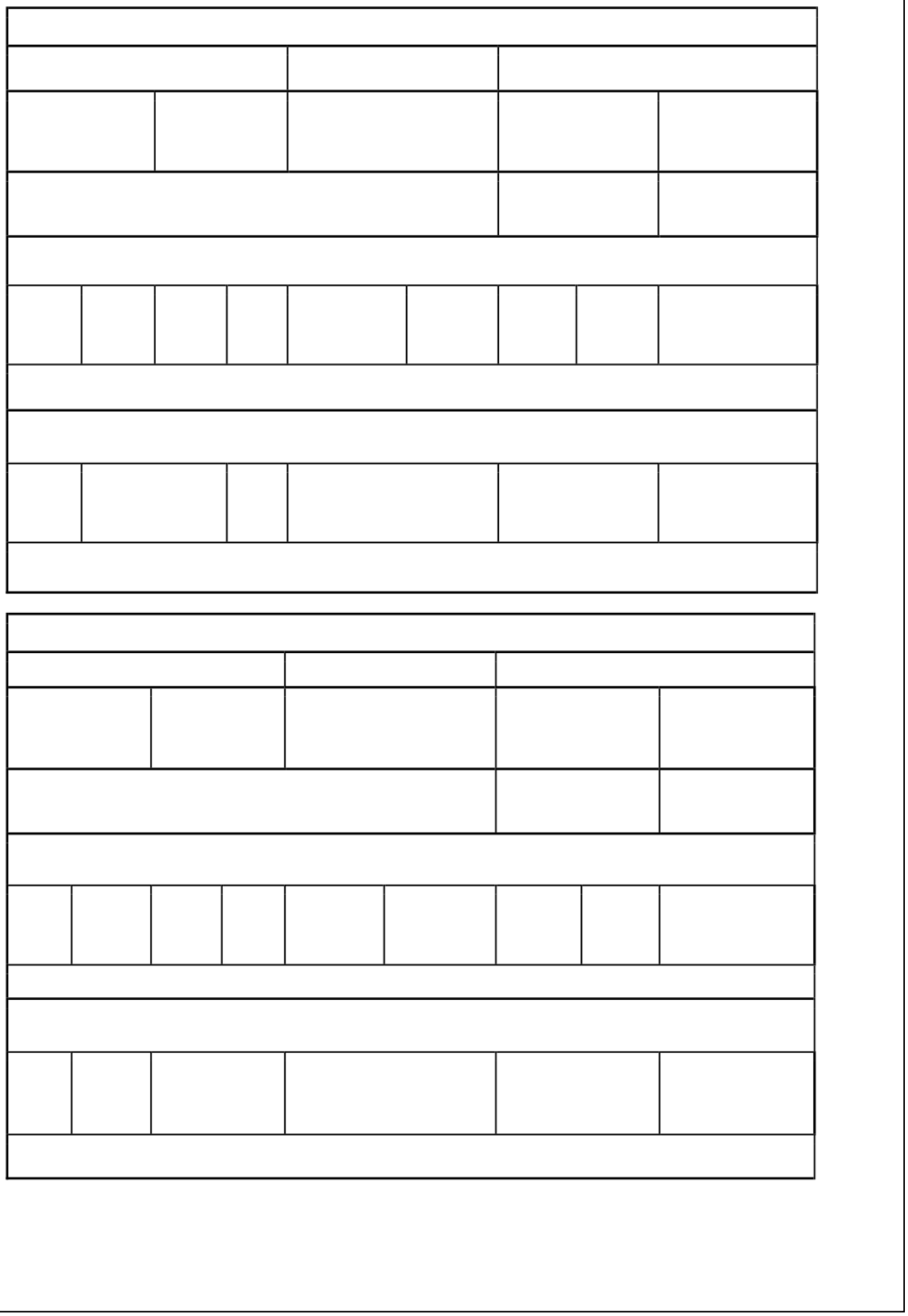
2.1 Do you undertake this journey?		[1] Yes; move onto Question 2.2	[0] No; move onto the next journey purpose (3)	
2.2 Do you use a car for the journey?	[1] Yes, always for the whole journey. Move onto Question 2.3	[2] Yes, for part of the journey alongside one or more other modes. Move onto Question 2.3	[3] Sometimes / Alternates with one or more other modes. Move onto Question 2.3	[0] No Move onto the next journey purpose (3)
2.3 Is there an alternative mode of transport you could reasonably use? Alternative modes include walking, cycling, public transport or taxi/ride-hail service.		[1] Yes Move onto Question 2.4		[0] No Move onto Question 2.5

2.4 If an alternative mode is available, which of the following reasons apply in using a car over the alternative(s)? Tick all that apply. When finished, skip 2.5 and move onto the next journey purpose (3).

[ ] Weather conditions	[ ] More convenient	[ ] Cost	[ ] Quicker journey	[ ] Flexibility	[ ] Easy / free parking at destination	[ ] Personal safety concerns
[ ] Difficulty in transporting equipment / items (e.g. too large and/or heavy)			[ ] Safer	[ ] Other (please specify)		

2.5 If an alternative mode is not available, which of the following reasons apply in there being no alternative mode(s) of transport? Tick all that apply. When finished, move onto the next journey purpose (3).

[ ] Difficulty in transporting equipment / items (e.g. too large and/or heavy)	[ ] Cost	[ ] Safer	[ ] Too far to walk or cycle	[ ] No public transport service to/from destination or not at the time required	[ ] Personal safety concerns
Other (please specify) [ ]					



5. Travelling to/from playing sports or going to/from the gym

5.1 Do you undertake this journey?	[1] Yes; move onto Question 5.2		[0] No; move onto the next journey purpose (6)	
5.2 Do you use a car for the journey?	[1] Yes, always for the whole journey. Move onto Question 5.3	[2] Yes, for part of the journey alongside one or more other modes. Move onto Question 5.3	[3] Sometimes / Alternates with one or more other modes. Move onto Question 5.3	[0] No. Move onto the next journey purpose (6)
5.3 Is there an alternative mode of transport you could reasonably use? Alternative modes include walking, cycling, public transport or taxi/ride-hail service.			[1] Yes Move onto Question 5.4	[0] No Move onto Question 5.5

5.4 If an alternative mode is available, which of the following reasons apply in using a car over the alternative(s)? Tick all that apply. When finished, please skip 5.5 and move onto the next journey purpose (6).

[ ] Quicker journey	[ ] Flexibility	[ ] More convenient	[ ] Cost	[ ] Personal safety concerns	[ ] Safer	[ ] Weather conditions	[ ] Easy / free parking at destination	[ ] Difficulty in transporting equipment / items (e.g. too large and/or heavy)
[ ] Other (please specify)								

5.5 If an alternative mode is not available, which of the following reasons apply in there being no alternative mode(s) of transport? Tick all that apply. When finished, please move onto the next journey purpose (6).

[ ] Difficulty in transporting equipment / items (e.g. too large and/or heavy)	[ ] Cost	[ ] Too far to walk or cycle	[ ] Safer	[ ] No public transport service to/from destination or not at time required	[ ] Personal safety concerns
[ ] Other (please specify)					

6. Visiting friends / family

6.1 Do you undertake these journeys?	[1] Yes; move onto Question 6.2		[0] No; move onto the Background information section	
6.2 Do you use a car for these journeys?	[1] Yes, always for the whole journey. Move onto Question 6.3	[2] Yes, for part of the journey alongside one or more other modes. Move onto Question 6.3	[3] Sometimes / Alternates with one or more other modes. Move onto Question 6.3	[0] No. Move onto the Background information section
6.3 Is there an alternative mode of transport you could reasonably use? Alternative modes include walking, cycling, public transport or taxi/ride-hail service.			[1] Yes Move onto Question 6.4	[0] No Move onto Question 6.5

6.4 If an alternative mode is available, which of the following reasons apply in using a car over the alternative(s)? Tick all that apply. When finished, please skip 6.5 and move onto the Background information section.

[ ] Quicker journey	[ ] Safer	[ ] Cost	[ ]

Background information

Do you possess a driving license? [1] Yes [0] No

Which of the following best describes your access to a car?

Regular access as driver	[1]
Regular access as passenger	[2]
Occasional access as driver	[3]
Occasional access as passenger	[4]
No access to a car or other private vehicle	[5]

What best describes your employment status?

Full-time	[1]	Part-time	[2]	Full-time parent	[3]
Full-time education	[4]	Unemployed	[5]	Retired	[6]

If you are in either employment or education, what is the main location of you employment or education?

[1] Cambourne [2] Cambridge [3] Work from home [4] Other

Approximately, where do you live?

Cambourne	[1]
Village within 4 miles of Cambourne	[2]
(e.g. Caxton, Papworth, Bourn, Highfields Caldecote, Great Gransden)	
More than 4 miles from Cambourne	[3]

Which of the following best describes the current structure of your household?

Single person household	[1]
Multiple person household (unrelated)	[2]
Couple without children (includes where children have left home)	[3]
Couple with preschool children	[4]
Couple with primary school children	[5]
Couple with secondary school children	[6]
Single parent with preschool children	[7]
Single parent with primary school children	[8]
Single parent with secondary school children	[9]
Either or both parents living with adult children / Living with parents	[10]

What is your age?

18-25 [1] 26-35 [2] 36-45 [3] 46-55 [4] 56-65 [5] Over 65 [6]

What best describes your gender?

Female [1] Male [2] Prefer not to say [3] Prefer to self-describe .....

C RISK ASSESSMENT

RISK ASSESSMENT FORM
FIELD / LOCATION WORK

The Approved Code of Practice - Management of Fieldwork should be referred to when completing this form
http://www.ucl.ac.uk/estates/safetynet/guidance/fieldwork/acop.pdf

DEPARTMENT/SECTION Bartlett School of Planning

LOCATION(S) Cambourne

PERSONS COVERED BY THE RISK ASSESSMENT David Knapp

BRIEF DESCRIPTION OF FIELDWORK Surveys on trip chaining behaviour within a new, mainly residential development in the UK

Consider, in turn, each hazard (white on black). If **NO** hazard exists select **NO** and move to next hazard section.
If a hazard does exist select **YES** and assess the risks that could arise from that hazard in the risk assessment box.
Where risks are identified that are not adequately controlled they must be brought to the attention of your Departmental Management who should put temporary control measures in place or stop the work. Detail such risks in the final section.

ENVIRONMENT	**The environment always represents a safety hazard. Use space below to identify and assess any risks associated with this hazard**
e.g. location, climate, terrain, neighbourhood, in outside organizations, pollution, animals.	Examples of risk: adverse weather, illness, hypothermia, assault, getting lost. Is the risk high / medium / low ? Risk of attack/abuse and personal injury - low risk Risk of getting lost - low risk

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**
☐	work abroad incorporates Foreign Office advice
☐	participants have been trained and given all necessary information
☐	only accredited centres are used for rural field work
☐	participants will wear appropriate clothing and footwear for the specified environment
☐	trained leaders accompany the trip
☐	refuge is available
☐	work in outside organisations is subject to their having satisfactory H&S procedures in place
✓	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

Where practicable, undertake surveys in public buildings with numerous people present.
Study destination and route prior to visiting. Ensure up-to-date map is to hand at all times.

EMERGENCIES	**Where emergencies may arise use space below to identify and assess any risks**
e.g. fire, accidents	Examples of risk: loss of property, loss of life

Risk of injury - low risk

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**
☐	participants have registered with LOCATE at http://www.fco.gov.uk/en/travel-and-living-abroad/
☐	fire fighting equipment is carried on the trip and participants know how to use it
✓	contact numbers for emergency services are known to all participants
✓	participants have means of contacting emergency services
☐	participants have been trained and given all necessary information
☐	a plan for rescue has been formulated, all parties understand the procedure
☐	the plan for rescue /emergency has a reciprocal element
☐	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

EQUIPMENT	Is equipment used?	No	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. clothing, outboard motors.	Examples of risk: inappropriate, failure, insufficient training to use or repair, injury. Is the risk high / medium / low ?		

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
☐	the departmental written Arrangement for equipment is followed
☐	participants have been provided with any necessary equipment appropriate for the work
☐	all equipment has been inspected, before issue, by a competent person
☐	all users have been advised of correct use
☐	special equipment is only issued to persons trained in its use by a competent person
☐	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

LONE WORKING	Is lone working a possibility?	Yes	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. alone or in isolation lone interviews.	Examples of risk: difficult to summon help. Is the risk high / medium / low?		

Difficulties in summoning help when required - low
Travelling alone on foot - risks of personal attack/abuse - low
Travelling alone by car - risk of accident - low

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
✓	the departmental written Arrangement for lone/out of hours working for field work is followed
☐	lone or isolated working is not allowed
☐	location, route and expected time of return of lone workers is logged daily before work commences
✓	all workers have the means of raising an alarm in the event of an emergency, e.g. phone, flare, whistle
✓	all workers are fully familiar with emergency procedures
✓	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

Ensure important details are given to at least one trusted individual. Details to include location of work, estimated time of return and contact details. Mobile phone to be carried at all times.
Carrying valuables and large sums of money to be avoided where practicable. Valuables and money to be kept hidden where practicable. Awareness of surroundings to be maintained at all times. Travel on foot outside daylight hours to be avoided.
Car use to be minimised. Car to be kept in good working order. Journey to be planned beforehand with details given to at least one trusted individual. Car to be parked at secure, well-lit, highly visible locations, with high footfall where practicable. Do not leave valuables visible in the car.

ILL HEALTH	The possibility of ill health always represents a safety hazard. Use space below to identify and assess any risks associated with this Hazard.
e.g. accident, illness, personal attack, special personal considerations or vulnerabilities.	Examples of risk: injury, asthma, allergies. Is the risk high / medium / low? Risk of injury - low Fatigue leading to lack of concentration, accidents and risk of injury - low Lack of Physical Fitness leading to risk of personal injury/illness - low Extensive computer use - low

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
☐	an appropriate number of trained first-aiders and first aid kits are present on the field trip
☐	all participants have had the necessary inoculations/ carry appropriate prophylactics
☐	participants have been advised of the physical demands of the trip and are deemed to be physically suited
☐	participants have been adequate advice on harmful plants, animals and substances they may encounter
☐	participants who require medication have advised the leader of this and carry sufficient medication for their needs
✓	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

Minimise risk of accidents e.g. by crossing roads in a safe manner, using the appropriate footwear and, if unforeseen activities with risk potential are necessary, undertaking a separate risk assessment.
Limit total hours spent working to 12 hours door-to-door. Ensure a minimum of 5 minute break per hour worked. If feeling tired and/or inattentive, stop work or driving immediately.
Do not drive or work if feeling unfit. Do not undertake any activities that may exceed physical fitness / ability.
Carry mobile phone and emergency contact details at all times. Leave itinerary and contact details with at least one trusted individual.
Ensure desk, computer and chair are setup correctly to minimise injury. Take regular breaks away from the computer. Use prescribed eyewear.

TRANSPORT	Will transport be required	NO		Move to next hazard
		YES	✓	Use space below to identify and assess any risks
e.g. hired vehicles	Examples of risk: accidents arising from lack of maintenance, suitability or training Is the risk high / medium / low?			
Driving own vehicle - low				

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
☐	only public transport will be used
☐	the vehicle will be hired from a reputable supplier
✓	transport must be properly maintained in compliance with relevant national regulations
✓	drivers comply with UCL Policy on Drivers http://www.ucl.ac.uk/hr/docs/college_drivers.php
✓	drivers have been trained and hold the appropriate licence
☐	there will be more than one driver to prevent driver/operator fatigue, and there will be adequate rest periods
✓	sufficient spare parts carried to meet foreseeable emergencies
☐	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

DEALING WITH THE PUBLIC	Will people be dealing with public	Yes	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. interviews, observing	Examples of risk: personal attack, causing offence, being misinterpreted. Is the risk high / medium / low? Risk of personal attack/abuse due to misunderstanding of nature of work - low Aggressive behaviour - low Physical attack - low		

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
☐	all participants are trained in interviewing techniques
☐	interviews are contracted out to a third party
☐	advice and support from local groups has been sought
✓	participants do not wear clothes that might cause offence or attract unwanted attention
✓	interviews are conducted at neutral locations or where neither party could be at risk
☐	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

WORKING ON OR NEAR WATER	Will people work on or near water?	No	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. rivers, marshland, sea.	Examples of risk: drowning, malaria, hepatitis A, parasites. Is the risk high / medium / low?		

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
☐	lone working on or near water will not be allowed
☐	coastguard information is understood; all work takes place outside those times when tides could prove a threat
☐	all participants are competent swimmers
☐	participants always wear adequate protective equipment, e.g. buoyancy aids, wellingtons
☐	boat is operated by a competent person
☐	all boats are equipped with an alternative means of propulsion e.g. oars
☐	participants have received any appropriate inoculations
☐	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

MANUAL HANDLING (MH)	Do MH activities take place?	No	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. lifting, carrying, moving large or heavy equipment, physical unsuitability for the task.	Examples of risk: strain, cuts, broken bones. Is the risk high / medium / low?		

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
☐	the departmental written Arrangement for MH is followed
☐	the supervisor has attended a MH risk assessment course
☐	all tasks are within reasonable limits, persons physically unsuited to the MH task are prohibited from such activities
☐	all persons performing MH tasks are adequately trained
☐	equipment components will be assembled on site
☐	any MH task outside the competence of staff will be done by contractors
☐	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

SUBSTANCES	Will participants work with substances	No	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. plants, chemical, biohazard, waste	Examples of risk: ill health - poisoning, infection, illness, burns, cuts. Is the risk high / medium / low?		

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
☐	the departmental written Arrangements for dealing with hazardous substances and waste are followed
☐	all participants are given information, training and protective equipment for hazardous substances they may encounter
☐	participants who have allergies have advised the leader of this and carry sufficient medication for their needs
☐	waste is disposed of in a responsible manner
☐	suitable containers are provided for hazardous waste
☐	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

OTHER HAZARDS	Have you identified any other hazards?	No	If 'No' move to next section If 'Yes' use space below to identify and assess any risks
i.e. any other hazards must be noted and assessed here.	Hazard: Risk: is the risk		

CONTROL MEASURES	Give details of control measures in place to control the identified risks

Have you identified any risks that are not adequately controlled?			
	NO	✓	Move to Declaration
	YES	☐	Use space below to identify the risk and what action was taken

Is this project subject to the UCL requirements on the ethics of Non-NHS Human Research? Yes

If yes, please state your Project ID Number 15725/001

For more information, please refer to: http://ethics.grad.ucl.ac.uk/

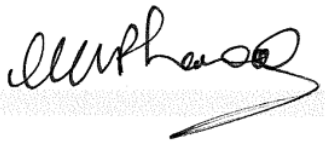
DECLARATION	The work will be reassessed whenever there is a significant change and at least annually. Those participating in the work have read the assessment.

Select the appropriate statement:

☑ I the undersigned have assessed the activity and associated risks and declare that there is no significant residual risk

☑ I the undersigned have assessed the activity and associated risks and declare that the risk will be controlled by the method(s) listed above

NAME OF SUPERVISOR TIM PHAROAH

SIGNATURE OF SUPERVISOR  DATE 23 MAY 2019