Local Sustainable Transport Fund Evaluation: A Case Study Evaluation of Carbon Impacts and Congestion Relief

Final Report

Executive Report

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John Preston, Alan Wong, Adrian Hickford and Karen Ghali
with contributions from
Paul Kevill, John Rider, Tim Ryley and Lynne Stinson

Summary

Introduction

S1. The Carbon Impacts and Congestion Relief Case Study is a research project that has been undertaken for the Department for Transport (DfT) by the University of Southampton, in conjunction with Solent Transport (formerly Transport for South Hampshire[1]), Transport for Greater Manchester, Leicestershire County Council and Loughborough University, and forms part of the case studies as set out in the DfT's LSTF monitoring and evaluation framework[2]. The three Local Authority bodies involved in this work have received significant support from the Local Sustainable Transport Fund (LSTF) for the period 2012/13 to 2014/15, amounting to some £54 million. The overall aim of this research is to evaluate the impacts of the interventions made possible by the LSTF, focussing on the period from August 2013, when this research was commissioned.

S2. This case study has three primary research questions:

(i) To determine whether investment in sustainable travel as a result of the Local Sustainable Transport Fund (LSTF) has led to significant mode-shift to sustainable travel modes and a reduction in the number of car trips/distance travelled;

(ii) To identify who is changing their travel behaviour and why; and

(iii) To estimate the impact on carbon emissions of any net change in traffic that has resulted from LSTF investment.

S3. Our method is based on a comparison of five treatment areas (Coalville, Eastleigh, Gosport, Rochdale and Tameside) with three control areas (Fareham, Hinckley and Wigan), denoted by (T) and (C) respectively. A key component of our methodology was a self-completion postal survey that incorporated a seven-day travel diary. A before survey was initiated in November 2013, with an after survey repeated in November 2014. These surveys were supplemented by focus groups held in the summers of 2014 and 2015, and the collation of secondary data sets.

Research Question 1: Does investment in sustainable travel through the LSTF lead to significant mode-shift to sustainable travel modes and a reduction in the number of car trips and/or journey distance?

S4. Our key finding is that, compared to the control areas, the average aggregate difference-in-differences[3] in terms of car driving distance per person in a one-week period decreased by around 8 miles in the treatment areas, with the mean driving distance having decreased by over 3 miles in the treatment areas year-on-year, while it has increased by over 5 miles in the control areas. However, this difference is not statistically significant. This difference-in-differences reduction is equivalent to a 7% decrease in the before mean weekly car driving distance seen in the treatment areas, and is consistent with secondary data that has been collated, including traffic counts.

[1] Latterly, Transport for South Hampshire and the Isle of Wight

[2] https://www.gov.uk/government/publications/local-sustainable-transport-fund-monitoring-and-evaluation-framework

[3] Difference-in-differences = Δ treatment area – Δ control area, where Δ = the 'year-on-year' change (i.e. after survey minus before survey) in the mean distance travelled per person per week .

S5. At first sight, the use of sustainable travel, which combines active travel (walking and cycling) with public transport (bus and train), appears to have decreased slightly overall, by 0.7 miles per person per week in the treatment areas compared to the control areas, when the before and after surveys are compared year-on-year, using the same difference-in-differences method referred to above. However, this decrease is due to a relative fall in mean weekly train travel in the treatment areas compared to the control areas, principally due to increases in train travel in Wigan (C) and Fareham (C), while the relative mean distances travelled for walking, cycling and bus have all increased in the treatment areas versus the control areas. Similarly, travel by car passenger increased by over 6 miles per person per week in the treatment areas compared to the control areas.

S6. Overall, travel has decreased by over 11 miles per person per week in the treatment areas when compared to the control areas year-on-year. The majority of this decrease in overall travel is due to difference-in-differences reductions in car driving, and this is reflected in the change in modal splits, with the car driving share in the treatment areas reducing by 0.4 percentage points year-on-year, which is offset by a 0.4 percentage point increase in sustainable travel (active travel and public transport). In contrast, the modal splits for sustainable travel have reduced in the control areas year-on-year, while car travel has increased. However, these changes are all relatively modest and were not statistically significant.

S7. We have undertaken detailed analyses for each of the five treatment areas and find few statistically significant changes compared to their corresponding control areas, other than for a relatively positive change in bus use in Eastleigh (T) and increased travel by car passenger in Coalville (T). Studies of dosage exposure in Eastleigh (T) and Rochdale (T) (based on straight line distances from rail stations, tram stops and public transport interchanges) failed, in the main, to produce statistically significant results in the expected direction.

Research Question 2: Who is changing their travel behaviour and why?

S8. Using Thornton et al.'s (2011) nine market segments to examine who has changed their travel behaviour, we have found the greatest degree of switching to sustainable travel for segment 3 (Less affluent, older sceptics), segment 6 (Town and rural heavy car users) and segment 8 (Young urbanites without cars). The least responsive segments in this respect appear to be Affluent empty nesters (segment 4), Less affluent urban young families (segment 2) and Urban low income without cars (segment 9). We have no a priori explanation of why certain segments have exhibited greater behavioural change than others.

S9. The reasons for these variations are not due to differential changes in attitudes towards the use of active travel and public transport or awareness of LSTF-related activities which have been remarkably constant between the before and after surveys. Life-cycle and locational factors may be important but the differences between the market segments are most likely to be the result of random variation.

Research Question 3: What scale of impact does any net change in traffic have on carbon emissions?

S10. A small decline of around 3% of the before level of land-transport related carbon emissions is found in the treatment areas relative to the control areas year-on-year. This is equivalent to a notional decrease of 50 kg of CO_2e per person per annum, and is mainly related to the reduced

volume of car driving by the survey participants in the treatment areas compared to the control areas.

Summary

S11. The overall level of change in mode choice and carbon emissions in the areas studied over a one-year period has been relatively modest and, for individual treatment areas, has not always been in the anticipated direction. Moreover, some of the change is due to trip suppression which cannot be directly ascribed to the LSTF. The modest size of the change can be related to the relatively low awareness of LSTF related initiatives and some persistently negative attitudes towards sustainable travel, factors that were supported by the focus groups. There is evidence from secondary data on the effectiveness of some LSTF measures, such as Personalised Journey Planning, for those directly affected, but this case study has demonstrated that these lead to very modest changes in car driving volumes at a whole population level. We have identified some countervailing factors that may explain unintended outcomes for individual treatment areas, including the effects of other local transport initiatives such as reduced parking charges, road maintenance and other travel disruptions. For example, disruption to rail and tram services in central Manchester during the survey period had some impact on travel behaviour in our treatment areas of Tameside (T) and Rochdale (T), which may have negated any benefits from the LSTF-funded public transport interchange improvements. We have also identified a number of factors that weakened our experimental design, such as pro-sustainable transport policies that were introduced some considerable time before our survey period having an impact on our control areas (lags) or policies that were introduced after our survey period having an effect (leads).

S12. Overall, we have found from our primary data collection modest reductions in the total distance driven by car and hence in carbon emissions but these changes are not statistically significant and, given trip suppression, cannot all be directly ascribed to the LSTF. On its own this is relatively weak evidence. However, we have also shown that there are some indications of relationships between changes in awareness and behaviour, both from our primary data collection and from our focus groups. Furthermore, our secondary data illustrates how LSTF measures can lead to modest changes at a population level and the changes in road traffic in the treatment areas compared to the control areas are consistent with the changes in the levels of car driving we have found. For example the road traffic data suggests there has been a one to four percentage point reduction in traffic levels post 2012 in the treatment sites relative to the control ones, which is particularly prominent in Hyde (T) and Gosport (T), when compared to Wigan (C) and Fareham (C). Our multi-method approach thus leads us to believe that the LSTF has led to some changes in the intended direction in our case study areas but these changes have been modest in scale and inconsistent in application across our case study areas.

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1. Study Design

Introduction

1.1 The Local Sustainable Transport Fund (LSTF) supported investment in 96 local sustainable transport projects between July 2011 and March 2015.

1.2 The LSTF supported projects that were designed to meet two core policy objectives:

- To support the local economy and facilitate economic development, for example by reducing congestion, improving the reliability and predictability of journey times, or enhancing access to employment and other essential services; and
- To reduce carbon emissions, for example by bringing about an increase in the volume and proportion of journeys made by low carbon sustainable modes including walking and cycling.

1.3 Four secondary policy objectives were also identified:

- To help to deliver wider social and economic benefits (e.g. accessibility and inclusion) for the community;
- To improve safety;
- To bring about improvements in air quality and increased compliance with air quality standards, and wider environmental benefits such as noise reduction; and
- To actively promote increased levels of physical activity and the health benefits this can be expected to deliver.

1.4 The 'Carbon Impacts and Congestion Relief Case Study' was a two year research project undertaken for the Department for Transport (DfT) by the University of Southampton, in conjunction with Solent Transport (formerly Transport for South Hampshire), Transport for Greater Manchester, Leicestershire County Council and Loughborough University. The study began in August 2013, with an Interim Report delivered in August 2014.

1.5 The three local authority bodies involved in this work have received significant support from the LSTF for the period 2012/13 to 2014/15[4]. Transport for Greater Manchester received over £32 million from the DfT for the Let's Get to Work programme, Solent Transport received almost £18 million for a Better Connected South Hampshire and Leicestershire received £4 million for Smarter Travel for Business. In 2015/16, Transport for Greater Manchester received a further £5 million for the Let's Get to Work programme and Leicestershire a further £1 million for the Smarter Travel for Business programme.

[4] See DfT, 2013, Local Sustainable Transport Fund (https://www.gov.uk/government/collections/local-sustainable-transport-fund) for more information and details about each of the projects.

Research Questions

1.6 Given the above, this case study addresses three inter-related research questions:

1. Does investment in sustainable travel through the LSTF lead to significant mode-shift to sustainable travel modes and a reduction in the number of car trips and/or journey distance?

2. Who is changing their travel behaviour and why? (and the corollary – who is not changing their behaviour and why?)

3. What scale of impact does any net change in traffic have on carbon emissions?

1.7 Two secondary questions are also considered:

4. What lessons, in terms of mode shift, congestion relief and carbon impacts, have we learnt from these schemes?

5. What are the impacts of similar schemes in different areas and therefore how replicable are the results?

Treatment and Comparison Areas

1.8 The research questions will be answered with respect to a comparative assessment of a purposive sample of three different regions and eight different areas:

1. Greater Manchester is a polycentric conurbation, with LSTF interventions broadly distributed across the 10 districts. Our focus is on two Districts, Rochdale (treatment area, denoted by T) and Tameside (T), with a third (Wigan (control area, denoted by C)) used as a comparison. It should be noted that Wigan had extensive personalised travel planning undertaken in 2008/9 and therefore was relatively unaffected by the current LSTF initiatives.

2. Leicestershire provides the hinterland for a monocentric urban structure based on Leicester. The LSTF interventions are focused on two secondary centres, Coalville and Loughborough. Our focus is on Coalville (T), with Hinckley (C) used as a comparison. It should be noted that Hinckley (C) subsequently became a recipient of LSTF funding in 2015/16 but this was after the completion of our surveys[5].

3. South Hampshire is a duocentric conurbation based around Southampton and Portsmouth. LSTF interventions are based on nine corridors, six focused on Southampton and three on Portsmouth. Our focus is on two adjacent corridors in the Southampton area (Chandler's Ford/Eastleigh (T)) and one in the Portsmouth area (Gosport (T)). We use Lock's Heath (west Fareham (C)) as a comparison.

1.9 We therefore have a sample of five treatment (or intervention) areas where there will be physical LSTF interventions (such as cycling infrastructure and public transport interchanges, which we call primary interventions) supplemented by softer measures (such as personal travel planning, which we call secondary interventions). We also have three control (or comparison) areas where no LSTF activity had been expected during our survey period. Our case study areas are detailed in Table 1.1 below and further details are provided in Appendix A1.1.

[5] Hinckley was due to receive £978,500 of LSTF funding in 2015/16. It received some £109,000 of funding in 2014/5 mainly focussed on school and workplace based travel.

Table 1.1: List of Case Studies, Interventions and Controls

Case Study	Primary Interventions/ Treatments	Secondary Interventions/ Treatments	Control (or Comparison) Area
Eastleigh (T) (Pop. 126,000)	Interchange	Area Travel Plan (Valley Park); College Travel Plans; Station Travel Plans; Bus Priority; Smart Cards.	West Fareham (C) (Locks Heath) (Pop. 56,000)
Gosport (T) (Pop. 83,000)	Bus Priority	Area Travel Plan (HMS Daedalus); Cycle Links; Interchange; Personalised Journey Planning; Smart Cards.	
Rochdale (T) (Pop. 96,000)	Sustainable Access to Metrolink/Rail	Cycle Hub; Demand Responsive Transport; Personalised Travel Planning; Workplace Travel Plans; Smart Cards	Wigan (C) (Pop. 82,000)
Tameside (T) (Hyde/Hattersley) (Pop.46,000)	Demand Responsive Transport Station Access	Workplace Travel Plans; Smart Cards	
Coalville (T) (Pop. 35,000)	Cycling Infrastructure	Car Sharing; Personalised Travel Planning; School Travel Plan; Wheels to Work, Business Surveys.	Hinckley (C) (Pop. 43,000)

Methodological Approach

1.10 We have adopted a mixed methods approach that is predominantly quantitative, with the main component being a large scale before and after self-completion postal survey, with sample addresses drawn at random from the electoral register. Following a pilot survey in Woolston (Southampton), the before stage survey was implemented in late autumn 2013, with reminders issued in early spring 2014. The after survey repeated these timings in late autumn 2014 and early spring 2015. This primary data collection is supplemented by the collation of secondary data, particularly with respect to traffic volumes and journey times along with some secondary data relating to the impact of the secondary interventions detailed in Table 1.1.

1.11 It was recognised that this quantitative work may not capture all the nuances of the impacts of local transport policy on individual travel decisions. It has therefore been supplemented by more qualitative work based on focus groups held in the five treatment areas in the summers of 2014 and 2015. This methodology was informed by an expert workshop held in May 2014. Further details of our methodology, including the pilot, are given in Appendices A1.2 to A1.6.

1.12 Our primary data collection uses a survey tool that was developed by the iConnect project (Ogilvie et al., 2011), which investigated the links between physical interventions (which also principally formed the primary LSTF-measures analysed in this Case Study) and behavioural change. This survey tool is a postal self-completion questionnaire, which had been validated, tested for reliability and extensively applied as part of iConnect, and which includes attitudinal and awareness questions, along with a seven days travel diary - see Appendix A1.2 and A1.3 for details.

1.13 Using the approach suggested by AECOM (2012, Box 3.3), we estimated that for each site around 384 usable responses would be sufficient for statistical tests, assuming heterogeneous populations and applying a 95% confidence level and a 5% error margin (see also Bartlett et al., 2001). Therefore we had aimed to collect 400 usable responses at the stage of the follow-up, i.e. 3,200 observations (or 400 x 8 sites), which meant that, given the 50% attrition rate found previously in the iConnect study, we needed 800 responses per site for the before survey. We anticipated a 10% response rate, hence 8,000 initial contacts were required for each site initially.

1.14 Therefore in total, 64,000 postal self-completion surveys were distributed in the before stage (to cover the 8 case study areas), with some 8,461 returned (13.2%). However, a significant percentage of the returns (19.7%) were incomplete and hence 6,797 questionnaires were used for the initial 'before analysis' (10.6% of initial contacts). Despite the targeted use of reminders, there was considerable variation in response rates across the survey areas, being highest in Fareham (C) (15.2%) and lowest in Wigan (C) (7.3%).

1.15 From the original 6,797 people who responded to the before survey between November 2013 and March 2014, a follow-up survey of 6,745 questionnaires was despatched in November 2014. This after survey excluded those who had indicated that they did not wish to be contacted for further surveys, had moved out of the area, or did not have a recognisable ID. For the after survey, a total of 3,688 questionnaires were returned, representing a response rate of 54.7%. However, some of these were returned to sender or incomplete (3.4%), giving 3,562 completed questionnaires and a response rate of 52.8% which was above our target of 50%.

1.16 Our aim was to have 400 observations for each of the eight areas in the after survey and hence at least 3,200 questionnaires overall. In the event, over 3,500 completed questionnaires in total were received but the target of 400 completed questionnaires was not achieved in three of the eight survey areas, namely Coalville (T), Rochdale (T) and, particularly, Wigan (C). There was a large variation in response rates to the after survey between the survey areas, with the highest response rate in Gosport (T) (61.7%) and the lowest in Wigan (C) (41.0%).

1.17 The before and after data were extensively cleaned, matched and assessed for representativeness, and these processes are described in Appendix A1.4. It was found that, although the sample was broadly representative in terms of gender, it was not representative in terms of age - see Appendix A1.5. In particular, those aged 19 to 44 were under-represented and those aged 60 to 74 over-represented. This phenomenon was evident in the before survey and reinforced in the after survey. A number of variables to re-weight the sample were considered, including income and economic activity status, but age was found to be the most appropriate. It is recognised that a less desirable by-product of weighting is that, when the variance of the weights is large, it can result in standard errors that are larger than they would be for un-weighted estimates. The weights varied from 0.43 (for 60 to 74 year olds in Tameside (T)) to 4.99 (for 17 to 29 year olds in Coalville (T), Hinckley (C) and Fareham (C)) which are not excessively large. Further details are provided in Table A1.7 of Appendix 1. As a result of the age matching of the before and after data, the sample size reduces slightly to 3,445. If the approximation developed by Kish (1965) is used, the effective sample size as a result of these weights is computed as 1,997. In addition, the before and after matched sample of 3,445 observations, while exceeding our original target of 3,200 respondents for statistical power tests, represented only 5.4% of the initial 64,000 contacts.

1.18 Our methodology was also informed by the logic maps that had been used to determine the intended effects and outcomes of the LSTF interventions in the first place. These maps were based on consideration of local context and objectives and related inputs to outputs, outcomes (both short term and long term) and impacts. Our work on logic maps was synthesised into an overarching causal chain that shows how LSTF interventions might lead to reductions in greenhouse gases or carbon dioxide equivalent emissions. This causal chain is given in Figure 1.1. Our work in this report focuses on changes in travel behaviour and attitudes and relates these to changes in road traffic levels, journey times and congestion and on the resultant greenhouse gas emissions. Our primary data collection provides us with vital information on changes in travel behaviour, attitudes and carbon dioxide equivalent emissions. In combination with secondary data (such as vehicle counts), it also provides data on road traffic levels, congestion and journey times.

Report Structure

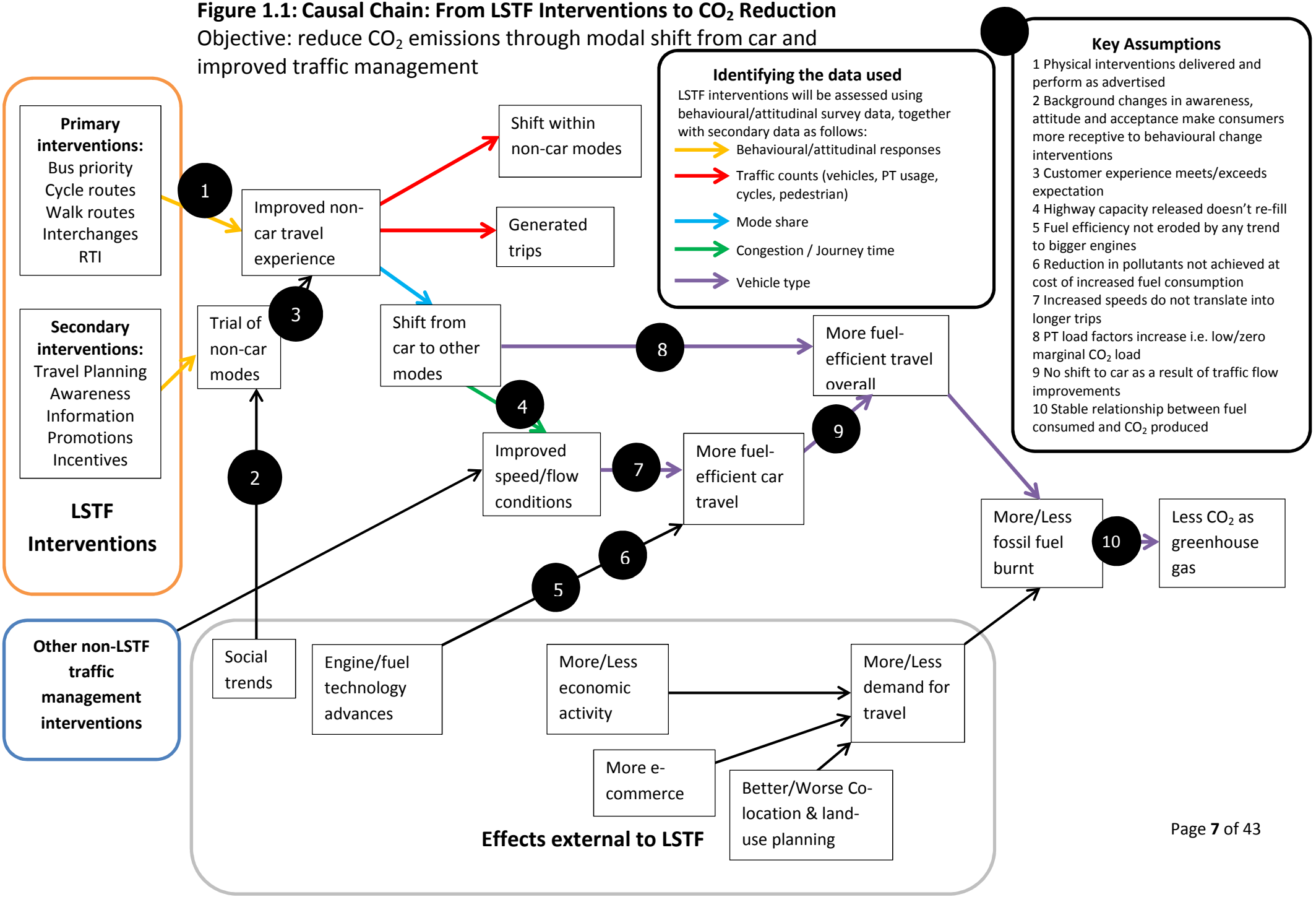
1.19 Given the above, the rest of this Executive Report will be structured as follows:

- In section 2, we will examine changes in travel behaviour, with a particular emphasis on changes in mode split and on the differences between our treatment and control areas, including year-on-year difference-in-differences comparisons and further 'dosage' analyses.
- In section 3, we examine changes in attitudes and perceptions. We have segmented respondents into the nine categories identified by Thornton et al. (2011) in order to determine which groups are most likely to change their behaviour. We have also assessed whether there were travel behaviour differences between those who became aware of the local LSTF schemes and those who did not.
- In section 4, we analyse travel attitudes, awareness and associated behaviour.
- In section 5, we provide the changes in the estimates of carbon emissions from our primary data.
- In section 6, we summarise the secondary data we have used to determine changes in traffic flows, journey times and the extent of secondary interventions such as personalised journey planning, workplace travel planning and school travel plans.
- In section 7, we detail the more qualitative focus group work undertaken and explain how this complements the quantitative data that is the focus of this report.
- Lastly, in section 8, we conclude by summarising what we have learnt from this study.

1.20 This Executive Report is complemented by Technical Appendices (Appendix 1 to 7), that describe each of the first seven sections of this report in more detail.

Figure 1.1: Causal Chain: From LSTF Interventions to CO_2 Reduction

Objective: reduce CO_2 emissions through modal shift from car and improved traffic management



2. Changes in Travel Behaviour

Introduction

2.1 This section focuses on a comparison of our before and after surveys in terms of travel behaviour. It finds some modest differences between the treatment and control areas but these changes are not, in the main, statistically significant. Moreover, only a modest amount of the change can likely be ascribed directly to the LSTF.

2.2 Overall, we have a matched before and after sample of 3,445 individuals. However, 16 respondents did not substantively complete any sections of the travel diary in the before survey, and 2 in the after survey, so the maximum travel diary dataset sizes are 3,429 and 3,443 respectively.

2.3 In order to determine whether the LSTF leads to significant mode shift to sustainable travel modes and/or a reduction in the number of car trips/journey distance (Research Question 1), we need to examine changes in patterns of travel behaviour. Our starting point is to determine the changes in the volume of travel between our before and after samples. This can be measured in three ways: number of round trips per week, number of miles travelled per week and time spent travelling per week.

Travel Volumes: Trips

2.4 Our initial analysis focussed on trips. However, it should be noted that observations are only included where the number of trips (including zero) has been given for the particular journey purpose category stated, i.e. to/from work, in the course of business, for education, for shopping and personal business, and for social/visiting. We found in many cases respondents were unable to state the number of return trips made because (for example) they were self-employed and could not distinguish between work and business trips, or they engaged in trip chaining across more than one journey purpose, e.g. to school and work or shopping and social. The data set is thus further reduced to 2,574 valid observations in the before sample and 2,266 in the after sample. Among those who had stated the number of trips across all journey purposes, this implies an average of 10.3 (round) trips per respondent per week in the before sample, reducing slightly to 10.1 trips in the after sample (down 2%) - see Appendix A2.1 for further details.

2.5 The journey purpose split also changed somewhat between the before and after surveys in the treatment and control areas combined. In particular, the percentage of trips that are to/from work increased from 34% in the before sample to 37% in the after sample. Our analysis of the before survey had indicated that we were finding a much larger percentage of travel related to going to/from work than from other sources, and this seems to have been accentuated in the after survey.

2.6 We have also disaggregated the trip results by the (five) treatment areas and the (three) control areas. For the treatment areas the mean number of trips remains constant at 10.1 round trips per week. However, for the control areas, the mean number of round trips per week decreases from 10.6 in the before situation to 10.1 in the after situation. To permit this comparison, we have given double weightings to the results from Fareham (C) and Wigan (C) so that we have five treatment areas matched with five control areas. However, this weighting has little impact

on the trip level results (see Appendix 2 for details). For both the treatment and control areas the phenomenon of journeys to/from work becoming a larger proportion of all trips is observed, with this being particularly marked in the control areas - see Table 2.1.

Table 2.1: Travel Behaviour Change: Trips by Journey Purpose (return trips per week)

	Treatment Areas			Control Areas**		
Frequency of Journeys*	**Before**	**After**	**Difference**	**Before**	**After**	**Difference**
To/from Work						
Mean	3.3	2.9	-0.4	3.1	2.8	-0.3
% of total across all purposes	36%	37%	1.7%	31%	37%	5.8%
n	1,730	1,845		1,740	1,904	
In the Course of Business						
Mean	0.8	0.7	-0.1	1.0	0.7	-0.3
% of total across all purposes	9%	9%	0.3%	10%	9%	-1.0%
n	1,736	1,787		1,802	1,837	
For Education/Study						
Mean	0.7	0.6	-0.2	0.7	0.5	-0.2
% of total across all purposes	8%	7%	-0.8%	7%	7%	-0.8%
n	1,773	1,853		1,855	1,903	
For Personal Business and Shopping						
Mean	3.4	3.4	0.0	4.1	3.5	-0.6
% of total across all purposes	29%	29%	0.0%	34%	31%	-3.1%
n	1,398	1,235		1,427	1,264	
For Social/Visiting						
Mean	2.1	1.8	-0.3	2.1	1.8	-0.2
% of total across all purposes	18%	16%	-1.3%	17%	16%	-0.9%
n	1,361	1,284		1,415	1,252	

* Note unless stated otherwise all Tables and Figures are based on weighted results.
** Control Areas are also weighted to provide one-to-one comparisons between the five Treatment Areas and three Control Areas.

2.7 Given problems with the reporting of the trip metric for multi-purpose journeys and for journeys that do not have a clear outward and return leg, and the resultant high level of non-reporting of the number of round trips made (especially in the after survey), our focus is on the amount of weekly travel in terms of time and distance. Table 2.2a and 2.2b show the breakdown of trips by mode (for all purposes) in the eight individual treatment and control areas, including the mean time and distance for each mode in the before and after surveys respectively.

Travel Volumes: Distance

2.8 Our key measure is travel distance. Overall, in terms of the percentage mode splits across both surveys, we find that 64-5% of travel is by car driver, 11% by car passenger, 10% by other modes (including aviation), 9% by train, 2-3% by bus, 2% by walking and 1% by cycling. If sustainable transport is defined as active travel (walking and cycling) and public transport (bus and train), then only 15% of travel is by sustainable transport in both surveys, albeit with a very slight decrease overall. For the before survey, we find the highest car driver share in Hinckley (C) and Coalville (T) (68% and 67% respectively), the highest car passenger share in Rochdale (T) (over 13%), the highest other modes share in Coalville (T) (15%), the highest train share in Rochdale (T) (14%), the highest bus share in Rochdale (T) (6%), the highest walking share in Wigan (C) (5%) and the highest cycling share in Gosport (T) (3%). For the after survey, car driver share remains highest in Hinckley (C) and Coalville (T) (74 and 71%), the highest car passenger share remains in Rochdale (T) (19%), the highest train share is now in Wigan (C) (16%), the highest bus share

remains in Rochdale (T) (but is now joined by Tameside (T) and Gosport (T) on 4%), the highest walking share remains in Wigan (C) (4%), and the highest cycling share remains in Gosport (T) (3%). The other share, which includes ferry, is now highest in Gosport (T) (24%). If we assume the mean number of round trips per week is 10.3 in the before survey and 10.1 in the after (paragraph 2.4 above), we find the mean round trip distance overall to be 20 miles in both surveys, with the longest trips in Fareham (C) and Hinckley (C), and the shortest in Rochdale (T).

Table 2.2a: Mean Travel Times (minutes) and Distances (miles) per Week - Before Survey

	BEFORE SURVEY (Weighted)																	
	Rochdale (T)		**Tameside (T)**		**Wigan (C)**		**Coalville (T)**		**Hinckley (C)**		**Eastleigh (T)**		**Gosport (T)**		**Fareham (C)**		**All**	
Mean Walking Time (mins)	105	21%	106	17%	152	27%	102	18%	100	16%	100	17%	112	17%	92	15%	105	17%
Mean Cycling Time (mins)	5	1%	5	1%	6	1%	7	1%	14	2%	12	2%	46	7%	15	2%	16	3%
Mean Bus Time (mins)	55	11%	69	11%	33	6%	31	5%	21	3%	32	5%	31	5%	19	3%	35	6%
Mean Train Time (mins)	25	5%	38	6%	33	6%	7	1%	33	5%	32	6%	19	3%	32	5%	28	5%
Mean Drive Time (mins)	222	46%	329	53%	261	47%	332	58%	384	60%	321	56%	371	55%	389	61%	338	56%
Mean Passenger Time (mins)	58	12%	50	8%	50	9%	57	10%	72	11%	57	10%	51	8%	65	10%	58	10%
Mean Other Time (mins)	18	4%	29	5%	22	4%	38	7%	15	2%	24	4%	42	6%	20	3%	26	4%
Total Mean Times - All Modes (mins)	488	100%	625	100%	557	100%	574	100%	638	100%	579	100%	673	100%	633	100%	605	100%
Mean Walking Distance (miles)	4	3%	4	2%	7	5%	4	2%	4	2%	5	2%	5	3%	5	2%	5	2%
Mean Cycling Distance (miles)	1	0%	1	0%	1	0%	1	1%	2	1%	2	1%	6	3%	3	1%	2	1%
Mean Bus Distance (miles)	8	6%	6	3%	4	3%	7	3%	4	2%	5	2%	4	2%	5	2%	5	3%
Mean Train Distance (miles)	19	14%	18	10%	21	13%	6	3%	23	9%	22	10%	11	6%	24	10%	18	9%
Mean Drive Distance (miles)	72	53%	113	61%	99	64%	132	67%	170	68%	128	61%	125	66%	159	66%	130	64%
Mean Passenger Distance (miles)	18	13%	17	9%	14	9%	18	9%	32	13%	21	10%	17	9%	28	12%	22	11%
Mean Other Distance (miles)	13	9%	26	14%	9	6%	30	15%	13	5%	26	12%	22	12%	17	7%	20	10%
Total Mean Distances - All Modes (miles)	135	100%	184	100%	154	100%	198	100%	249	100%	209	100%	190	100%	240	100%	202	100%
Note the % mode splits are shown shaded.																		
Unless stated otherwise all Tables and Figures are based on weighted results.																		
% Sustainable Travel (distance based)	**24.2%**		**15.2%**		**21.1%**		**9.0%**		**13.5%**		**16.3%**		**13.4%**		**15.1%**		**15.0%**	

Table 2.2b: Mean Travel Times (minutes) and Distances (miles) per Week - After Survey

	Rochdale (T)		**Tameside (T)**		**Wigan (C)**		**Coalville (T)**		**Hinckley (C)**		**Eastleigh (T)**		**Gosport (T)**		**Fareham (C)**		**All**	
Mean Walking Time (mins)	94	19%	104	18%	146	24%	91	16%	91	15%	92	16%	89	15%	87	14%	96	16%
Mean Cycling Time (mins)	5	1%	12	2%	14	2%	9	2%	13	2%	13	2%	40	7%	13	2%	16	3%
Mean Bus Time (mins)	41	8%	51	9%	36	6%	22	4%	14	2%	28	5%	44	7%	15	2%	30	5%
Mean Train Time (mins)	21	4%	29	5%	44	7%	4	1%	20	3%	35	6%	16	3%	41	7%	27	5%
Mean Drive Time (mins)	248	50%	327	56%	304	49%	341	61%	379	63%	332	57%	321	53%	379	61%	336	57%
Mean Passenger Time (mins)	71	14%	51	9%	53	9%	62	11%	61	10%	47	8%	61	10%	61	10%	58	10%
Mean Other Time (mins)	21	4%	11	2%	18	3%	29	5%	27	4%	31	5%	34	6%	26	4%	25	4%
Total Mean Times - All Modes (mins)	501	100%	584	100%	615	100%	557	100%	604	100%	578	100%	606	100%	622	100%	587	100%
Mean Walking Distance (miles)	4	3%	4	3%	7	4%	3	2%	4	2%	4	2%	4	2%	4	2%	4	2%
Mean Cycling Distance (miles)	0	0%	2	1%	1	1%	1	1%	2	1%	2	1%	5	3%	2	1%	2	1%
Mean Bus Distance (miles)	5	4%	6	4%	5	3%	5	3%	2	1%	4	2%	8	4%	3	1%	5	2%
Mean Train Distance (miles)	8	6%	15	9%	27	16%	3	2%	15	7%	31	15%	10	5%	28	11%	18	9%
Mean Drive Distance (miles)	76	59%	110	69%	106	64%	129	71%	161	74%	135	64%	107	53%	168	65%	129	65%
Mean Passenger Distance (miles)	24	19%	18	12%	17	10%	23	13%	22	10%	19	9%	20	10%	25	10%	21	11%
Mean Other Distance (miles)	10	8%	4	3%	3	2%	16	9%	12	5%	14	7%	48	24%	28	11%	19	10%
Total Mean Distances - All Modes (miles)	128	100%	160	100%	166	100%	181	100%	218	100%	211	100%	202	100%	258	100%	199	100%
Note the % mode splits are shown shaded.																		
Unless stated otherwise all Tables and Figures are based on weighted results.																		
% Sustainable Travel (distance based)	**13.6%**		**17.0%**		**23.7%**		**7.1%**		**10.4%**		**20.0%**		**13.5%**		**14.5%**		**14.6%**	

2.9 A comparison of the change in distance travelled for each treatment area (listed against its corresponding control area) in the before and after surveys is given by Table 2.3. If we are looking for increases in travel distances for sustainable travel modes (walk, cycle, bus, train) and reductions for car driver, there is very little evidence in the treatment areas, with perhaps the most notable exceptions being an increase in train use of 9 miles per person per week in

Eastleigh (T) and a reduction in car driver miles per person per week of 18 in Gosport (T), although the latter is not statistically significant relatively, and the former only has partial significance (at the 10% level, paired samples t-test). Overall, there seems to be more change in the volumes of travel by car passenger and by other modes, although it should be noted that the increase in other travel in Gosport (T) (up 26 miles per person per week, again not significant) could be partly related to the Go Solent travel card integrating bus and ferry tickets (although the ferry crossing is less than a mile).

Table 2.3: Changes in Mean Travel Distances (miles) per Week by Area

		Treatment Areas				Control Area		Treatment Area		Control Area		Treatment Areas				Control Area	
		Rochdale		Tameside		Wigan		Coalville		Hinckley		Eastleigh		Gosport		Fareham	
		Change in Means / Mode % (After - Before)															
		Miles	%	Miles	%	Miles	%	Miles	%	Miles	%	Miles	%	Miles	%	Miles	%
Walking	distance per week	0	0%	0	0%	0	-1%	0	0%	0	0%	0	0%	-1	-1%	-1	0%
Cycling	distance per week	0	0%	2	1%	1	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Bus	distance per week	-4	-2%	1	1%	1	0%	-2	-1%	-2	-1%	-1	0%	4	2%	-2	-1%
Train	distance per week	-11	-8%	-3	-1%	6	3%	-3	-1%	-8	-3%	9	4%	-1	-1%	4	1%
Car Driver	distance per week	4	6%	-2	8%	8	0%	-3	4%	-8	6%	7	3%	-18	-13%	10	-1%
Car Passenger	distance per week	6	6%	1	2%	3	1%	5	4%	-10	-3%	-2	-1%	3	1%	-4	-2%
Other	distance per week	-2	-1%	-22	-12%	-5	-4%	-14	-6%	-1	0%	-12	-6%	26	12%	11	4%
Total	**distance per week**	-7	-5%	-24	-13%	12	8%	-17	-9%	-31	-12%	2	1%	13	7%	18	7%
% Change in sustainable travel			-11%		2%		3%		-2%		-3%		4%		0%		-1%

Note: subject to rounding error

2.10 In Table 2.4, we use a Difference-in-Differences (DiD) method to produce some further results. This is computed for each mode as:

DiD = Δ Treatment Area – Δ Control Area,

Where Δ = Change in mean distance travelled per mode per week (After minus Before).

Table 2.4: Difference-in-Differences of Weekly Travel Distance per person by Mode (miles) - Treatment Areas compared to relevant Control Area (Note: subject to rounding)

	Walk	Cycle	Bus	Train	Car Driver	Car Pass.	Other	Total
Rochdale (T)	0	-1	-4	-17	-4	+4	+3	-19
Tameside (T)	0	+1	0	-9	-10	-2	-17	-36
Coalville (T)	0	0	0	+5	+4	+15 *	-13	+12
Eastleigh (T)	0	0	+1 *	+5	-2	+2	-22	-15
Gosport (T)	0	0	+6	-5	-27	+7	+15	-5

* Change statistically significant at the 5% level (Mann-Whitney U-test).

2.11 From Table 2.4, we can see that in four of the treatment areas, the overall level of travel has reduced relative to the control areas, with the exception provided by Coalville (T). Given that Kolmogorov-Smirnov tests indicated that the differences in travel distances were not normally distributed, Mann Whitney U-tests were undertaken to test the statistical significance of these results. The only changes that were found to be significant at the 5% level were with respect to bus use at Eastleigh (T) (as compared to Fareham (C)) and with respect to car passenger travel at Coalville (T) (as compared to Hinckley (C)) - see Appendix A2.7. Relaxing the assumption about

non-normality enabled further t-tests to be conducted, although these did not change the significance of the broad findings.

2.12 Nonetheless, compared to Wigan (C), it can be seen from Table 2.4 that both Rochdale (T) and Tameside (T) have reductions in car driving, but also in train travel and, in Tameside (T), reductions in the use of other modes (which might be related to the fading of the novelty effect of the Ashton Metrolink in the before situation). The treatment areas in Greater Manchester exhibit bigger reductions in travel overall compared to Wigan (C). Trip suppression seems to be a factor here. The reductions in rail use in Rochdale (T) may be related to the re-development of Manchester Victoria station (as part of the Northern Hub scheme) and disruptions to the Metrolink services in central Manchester. This reduction in rail use can also be attributed (from the focus group feedback - see section 7 below) to issues of access, including parking at stations, and problems with overcrowding and the poor condition of the rail rolling stock.

2.13 In Coalville (T), compared to Hinckley (C), there have been increases in train, car driver and passenger travel. There is little evidence of the LSTF measures having their intended effect, or alternatively they had already had an effect by the time of the before survey (as is suggested by the higher levels of awareness in the primary intervention for Coalville (T) in the before survey - see Table 4.1 in section 4). It should also be noted that Hinckley (C) became a recipient of LSTF funding in 2015/16, which is reflected in a higher level of awareness of such schemes among the respondents in the after survey (Table 4.2 in section 4), and this may have reduced the significance of any year-on-year changes between the two areas. The statistically significant increase in car passengers might be ascribed to the LSTF as there were a number of workplace travel schemes that encouraged lift sharing and this was commented upon in the focus groups. However, subsequent analysis found that the increase in car passenger travel occurred amongst those who were least aware of the LSTF measures (see section 4).

2.14 The treatment areas in South Hampshire show trends that are most consistently in line with the expectations of the LSTF, with modest increases in sustainable travel (except for train in Gosport (T) – although note that the Go Solent card may have encouraged some switching from train to bus) and decreases in car driving relative to the control area of west Fareham (C). The net reductions in car driving and increases in bus, car passenger and other travel (which includes Ferry) in Gosport (T) compared to Fareham (C) is associated with relatively high levels of awareness in the local LTSF schemes compared to other areas, particularly for the bus priority measures, public transport interchange improvements, and personal and area travel plans in Gosport (see section 4 below). The improved interchange at both Eastleigh and Southampton Airport Parkway stations also appears to have sustained the year-on-year use of buses in Eastleigh (T) as compared to Fareham (C), where it has fallen. The distance travelled by train for Eastleigh (T) has also increased over that of Fareham (C) (Table 2.3), although this effect is not significant, and it is difficult to attribute specific effects to the LSTF schemes at the population level.

Aggregate Travel - Treatment versus Control Areas

2.15 Our aggregate results for the treatment and control areas are given by Table 2.5. We have again double weighted the control areas in Fareham (C) and Wigan (C) in this analysis.

Table 2.5: Aggregate Mean Travel Distances (miles) per Week

		BEFORE SURVEY						AFTER SURVEY						CHANGE (AFTER - BEFORE)					
		Treatment Area		Control Areas**		Difference		Treatment Area		Control Areas**		Difference		Treatment Area		Control Areas**		Difference	
		Miles	%	Miles	%	Miles	%	Miles	%	Miles	%	Miles	%	Miles	%	Miles	%	Miles	%
Walking	distance per week	4	2%	5	2%	-1	0%	4	2%	5	2%	-1	0%	-0.4	-0.2%	-0.6	-0.3%	0.2	0.2%
Cycling	distance per week	2	1%	2	1%	0	0%	3	1%	2	1%	1	1%	0.2	0.1%	0.0	0.0%	0.2	0.2%
Bus	distance per week	6	3%	5	2%	1	1%	6	3%	3	1%	3	2%	0.1	0.2%	-1.5	-0.7%	1.6	0.9%
Train	distance per week	15	8%	23	10%	-8	-2%	14	8%	25	11%	-11	-3%	-0.8	-0.2%	1.9	0.5%	-2.7	-0.8%
Car Driver	distance per week	116	63%	149	66%	-32	-4%	113	63%	154	67%	-41	-4%	-3.1	0.1%	5.3	0.5%	-8.4	-0.4%
Car Passenger	distance per week	18	10%	26	12%	-8	-2%	21	11%	23	10%	-2	2%	2.4	1.6%	-3.7	-1.9%	6.1	3.5%
Other	distance per week	24	13%	14	6%	9	6%	20	11%	19	8%	1	3%	-3.7	-1.6%	4.8	1.9%	-8.4	-3.5%
Total	**distance per week**	186	100%	224	100%	-38		181	100%	230	100%	-50		-5.3	-3%	6.1	3%	-11.4	
* Mean travel distances shown. Unless stated otherwise all Tables and Figures are based on weighted results. This table is subject to rounding error.																			
** Control Areas are weighted to provide one-to-one comparisons between the five Treatment Areas and three Control Areas.																			
	% Sustainable Travel	14.9%		15.6%				14.8%		15.1%				-0.1%		-0.5%		-0.4%	
	% Car Driver travel	62.5%		66.3%				62.7%		66.9%				0.1%		0.5%		0.4%	
	%All Other Travel	22.6%		18.1%				22.5%		18.1%				-0.1%		-0.0%		0.0%	

2.16 Again using our key metric for mean distances travelled, it can be seen that for the treatment areas travel has decreased slightly (by five miles per person per week) between the before and after surveys, with modest reductions in car driving, walking, train and other travel, and slight increases in bus, cycling and car passenger travel volumes. For the control areas, the volume of travel increased slightly (by six miles per person per week), with reductions in mean travel distances for walking, bus and car passenger. Cycling distances are broadly constant but train, car driving and other travel have increased. Comparing the treatment and control areas year-on-year overall, there are relative increases in walking, cycling, bus and car passenger travel in the treatment areas, with decreases in train, car driving and other travel.

2.17 If we calculate modal splits based on the distance measure, we find that car driving in the treatment areas has slightly increased (62.5% in the before situation, 62.7% in the after situation). For the control areas there is an increase in car driving from 66.3% to 66.9%. Superficially this might suggest that the treatment areas have avoided a car driving modal shift of around 0.4 percentage points, with sustainable travel having gone up by an offsetting 0.4 percentage points (see bottom of Table 2.5)

2.18 Overall, in terms of percentages, we find that the modest reduction in the distance travelled per week in the treatment areas is equivalent to 3% of the before travel distance in the treatment areas and the modest increase in the control areas is equivalent to 3% of the before travel distance in the control areas, subject to rounding. The mean time spent travelling is down 4% in the treatment areas but largely unchanged in the control areas. These trends may be indicative of external factors (such as the substitution of physical travel by virtual activity) or the ageing of the panel itself - although these factors seem to have different effects between the treatment and control areas.

Travel Speeds

2.19 We also calculated the mean car driving speeds between the aggregate treatment and control areas using the mean travel times and distances as given in Table 2.2a and 2.2b above (with the controls again weighted), as car driving speeds can be a determinant of both congestion and carbon emissions. It can be seen from Table 2.6 that car driving speeds have slightly decreased in the treatment areas and slightly increased in the control areas, even though car driving by those surveyed has increased in the control areas relative to the treatment areas. It may be that congestion is acting as a trip suppressant in the treatment areas, as they have lower speeds than the control areas.

Table 2.6: Change in Car Driver Speeds (miles per hour)

	BEFORE SURVEY			AFTER SURVEY			OVERALL CHANGE		
	Treatment Areas	Control Areas	Difference	Treatment Areas	Control Areas	Difference	Treatment Areas	Control Areas	Difference
Mean Car Driver Speed (mph)	21.8	24.7	-2.9	21.5	25.4	-4.0	-0.3	0.7	-1.0

2.20 Table 2.7 examines the changes in driving speeds by survey areas. Relative to of Wigan (C), both Rochdale (T) and Tameside (T) exhibit relative increases in speed. However, in Leicestershire, Coalville (T) exhibits a greater decrease in speed than Hinckley (C), whilst in South Hampshire both Eastleigh (T) and Gosport (T) have relative decreases in speed compared to Fareham (C).

Table 2.7: Changes in Car Driving Speeds by Survey Areas (miles per hour)

	Rochdale (T)	Tameside (T)	Wigan (C)	Coalville (T)	Hinckley (C)	Eastleigh (T)	Gosport (T)	Fareham (C)	Total
Before speed	19.5	20.6	22.7	23.9	26.6	23.9	20.2	24.5	23.1
After speed	18.4	20.3	21	22.7	25.6	24.4	20	26.7	23.1
Change in speed	-1.1	-0.3	-1.8	-1.2	-1.0	0.5	-0.2	2.2	0.0
DiD	0.7	1.4		-0.2		-1.7	-2.4		

Conclusions

2.21 Using the difference-in-differences approach, it can be inferred from Table 2.5 above that there has been an overall mean reduction in car driving of 8.4 miles per person per week in the treatment areas compared to the control areas. This represents a 7% reduction in the before level of car driving in the treatment areas. This is similar to that found in other studies – for example the Sloman et al. (2010) review of the Sustainable Travel Towns found traffic reductions of around 5 to 7%. However, this change is not found to be statistically significant and cannot be directly ascribed to LSTF measures.

2.22 We find that walking and cycling levels in the control areas fell by 0.2 miles per person per week more than in the treatment areas. There were also reductions in bus and car passenger travel

(of 1.5 and 3.7 miles per person per week respectively) in the control areas. This compares to year-on-year increases in bus and car passenger use in the treatment areas (of 0.1 and 2.4 miles respectively). In addition to the reductions in car driving between the treatment and control areas year-on-year, there have also been reductions in the use of other modes (down 8.4 miles per person per week) and train (down 2.7 miles per week). The total travel in the treatment areas has also decreased by over 11 miles per person per week compared to the control areas. The LSTF measures were designed to encourage more use of sustainable travel modes, namely active travel and public transport, in the treatment areas. However, the usage of these modes decreased by 0.7 miles per person per week, largely due to decreases in rail (and tram) usage in Rochdale (T) and Tameside (T) (as discussed in 2.11 above), as compared to increases in Wigan (C). However, if car passenger is included in the definition, sustainable travel would increase by 5.4 miles per week - some 64% of the reduction in car driving - and the mean distances travelled by walking, cycling and bus have all increased or were reduced by a lesser extent in the treatment areas compared to the control areas.

2.23 In Appendix 2, we provide detailed breakdowns of changes by journey purpose. Again, there seems to be very little change in sustainable travel overall between the before and after surveys across all purposes, although again there is an increase in bus travel in Gosport (T) compared to Fareham (C) for Business and Personal purposes.

2.24 Also in Appendix 2, in order to assess whether the results of the study are dependent on the evaluation approach that has been adopted, we examined whether behavioural change was related to dosage exposure, following the work of Goodman et al. (2014) and Heinen et al. (2015). However, many of the primary measures we were examining such as cycle lanes in Coalville (T), bus priority in Gosport (T) and demand responsive transport in Rochdale (T) and Tameside (T) are spatially diffuse and dosage cannot be proxied by a distance measure, whilst some of the secondary measures we considered (such as awareness campaigns) are aspatial. However, we did identify those living within a straight line distance of 800 metres from a train station, tram stop or public transport interchange in both Eastleigh (T) and Rochdale (T), with around a quarter of the sample in Eastleigh (T) and Rochdale (T) living in these high dosage areas. However, there were few statistically significant findings from this analysis, and those that were significant were largely unrelated to LSTF, for example the decline in rail usage in Rochdale (T) referred to earlier. This broadly confirmed the findings of our original evaluation.

2.25 In conclusion, in this section we have shown that there have been some changes in travel behaviour as measured by travel distance in the expected direction given the LSTF interventions. However, only a small number of these changes have been statistically significant, whilst there have also been a number of changes in unexpected directions. Overall, there has been a modest reduction in car driving between the treatment and control areas in the before and after surveys, which is equivalent to around 8 miles per person per week (around a 7% reduction). However, some of this reduction may be attributed to trip suppression which was not an intended outcome of the LSTF. On the other hand, this reduction may also be related to the increase in car passenger usage (of an equivalent 6.1 miles per person per week), which is a common outcome of LSTF-type measures (ITP, 2015). In addition, the level of sustainable travel has also been maintained in the treatment areas overall, whereas they have decreased slightly in the control ones, although these changes are again not significant.

3. Market Segmentation

Introduction

3.1 In order to determine who is changing their travel behaviour and why (Research Question 2), we need to segment our data in an appropriate manner. For this analysis, the data we have collected has been segmented into nine market segments based on Thornton et al. (2011)'s classification, as suggested by the DfT. A key aspect of this segmentation is the distinction between car owners (segments 1 to 6) and non-car owners (segments 7 to 9). A feature of our before and after sample is the high level of car ownership at 90% overall, with this being slightly higher in the control areas (93%) and slightly lower in the treatment areas (88%). In comparison, for the 2013 National Travel Survey, 81% of adults overall lived in a household with a car.

Segmentation of Survey Respondents

3.2 From Figure 3.1, we find around 34% of our before and after sample is in segment 3 (Less affluent, older sceptics) compared to 12% nationally, according to Thornton et al. (2011). This has increased from the 26% reported for the before sample (i.e. including those who did not respond to the after survey). In addition, 32% of our sample is in segment 6 (Town and rural heavy car users) compared to 13% nationally, whilst segment 4 (Affluent empty nesters) accounts for 12% of the sample but only 9% nationally. All other segments are under-represented compared to national averages, in particular segment 5 (Educated suburban families) which accounts for only 1% of our sample but 17% of the national population, according to Thornton et al. Such differences could be due to location variations in our sample or in the method we have employed to map individuals to these market segments.

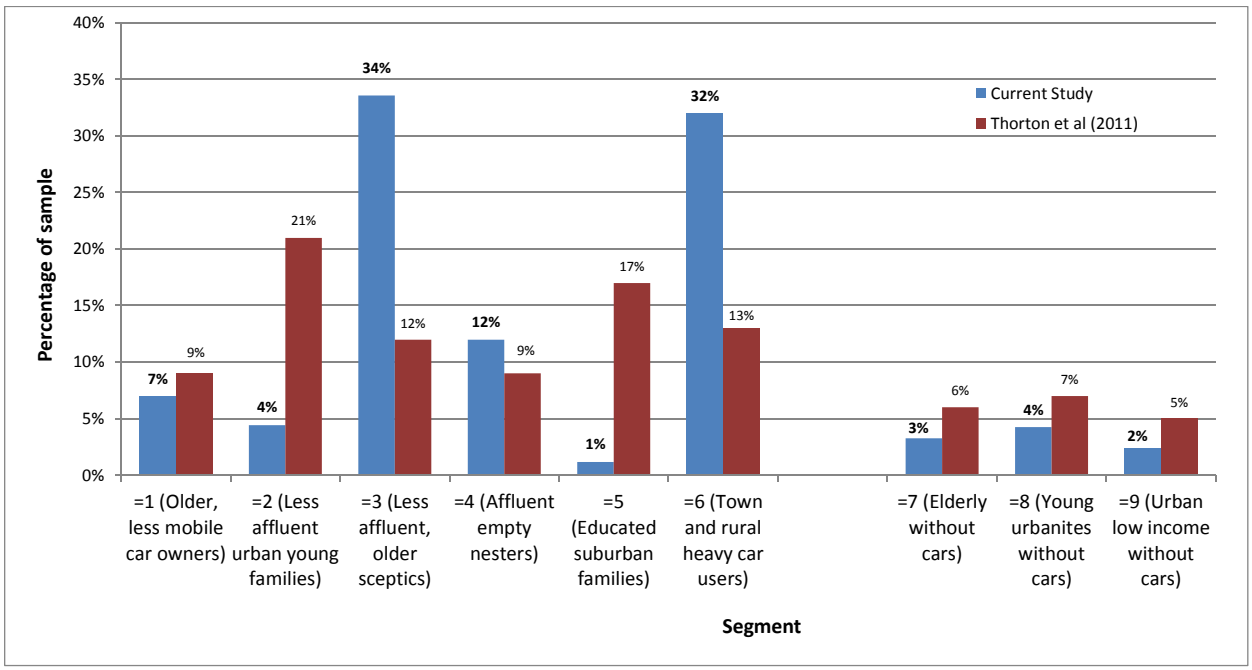


Figure 3.1: Market Segmentation of Survey Respondents

3.3 As Figures 3.2 and 3.3 below indicate, we find the pattern of market segmentation broadly similar between the treatment and control areas, particularly with respect to the low representation of segment 5.

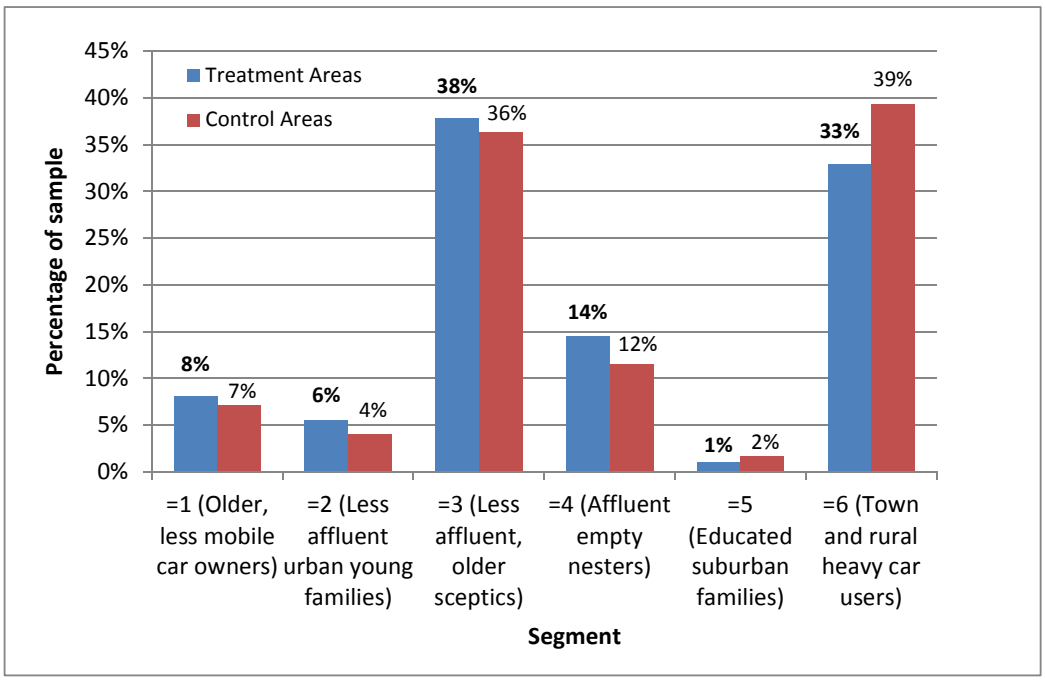


Figure 3.2 Survey Market Segmentation: Car Owners

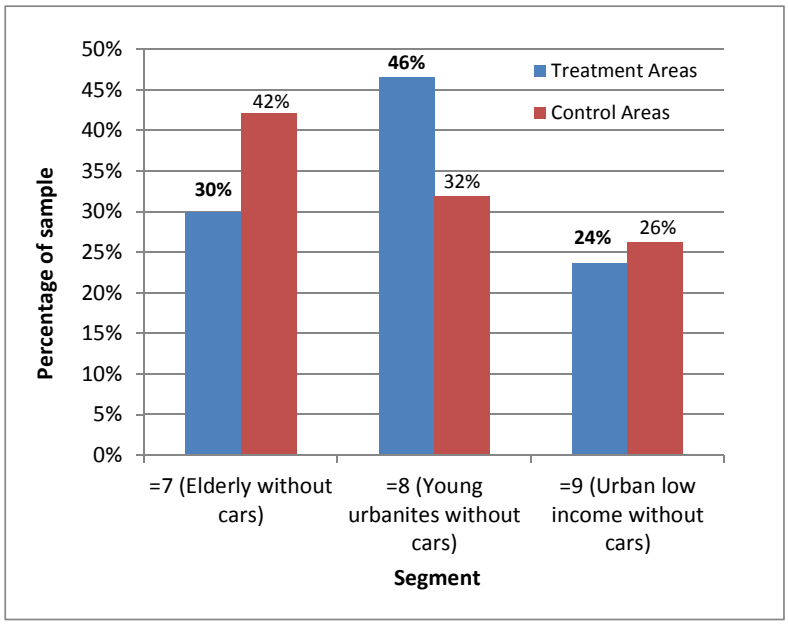


Figure 3.3: Survey Market Segmentation: Non-Car Owners

Travel Behaviour by Segments

3.4 We have analysed the change in travel behaviour in terms of market segment. Our findings for the car owning segments are illustrated by Table 3.1. We examine the difference-in-differences in percentage mode split by distance travelled between the treatment and control areas, with a particular focus on sustainable travel (active travel and public transport). We find that for three out of the six segments there are stronger trends toward sustainable travel for the control areas compared to the treatment areas, contrary to our expectations. The three exceptions are segment 3 (Less affluent, older sceptics), segment 5 (Educated suburban families) and segment 6 (Town and rural heavy car users). However, the very low percentage of our sample that is in

segment 5 should be reiterated. By contrast, segments 3 and 6 are well represented in our sample and there is an indication that these segments might be relatively responsive to LSTF measures. Based on the difference-in-differences approach, the least responsive segments appear to be Affluent empty nesters (segment 4) and Less affluent urban young families (segment 2).

Table 3.1: Change in Modal Split in Treatment and Control Areas by Car Owning Market Segments

	Treatment Areas	Control Areas	
% change in distance travelled (after survey - before)	Sustainable Travel	Sustainable Travel	DiD Sustainable Travel
Segment 1 (Older, less mobile car owners)	4.3%	8.2%	-3.9%
Segment 2 (Less affluent urban young families)	2.9%	11.6%	-8.7%
Segment 3 (Less affluent, older sceptics)	1.5%	-2.9%	4.4%
Segment 4 (Affluent empty nesters)	-2.6%	6.6%	-9.3%
Segment 5 (Educated suburban families)	2.1%	-4.1%	6.2%
Segment 6 (Town and rural heavy car users)	-0.4%	-2.6%	2.2%
Total (All Segments)	-0.1%	-0.9%	0.8%

3.5 Our findings for the non-car owning segments are given by Table 3.2. This suggests that segment 8 (Young urbanites without cars) has exhibited stronger shifts towards more sustainable travel in the treatment areas. By contrast, for segment 9 (Urban low income without cars) there has been a reduction in the sustainable travel share in the treatment areas compared to a strong switch to sustainable modes in the control areas which is again related to increases in rail use (see section 2 above).

Table 3.2: Change in Modal Split in Treatment and Control Areas by Non-Car Owning Market Segments

	Treatment Areas	Control Areas	
% change in distance travelled (after survey - before)	Sustainable Travel	Sustainable Travel	DiD Sustainable Travel
Segment 7 (Elderly without cars)	1.7%	10.4%	-8.7%
Segment 8 (Young urbanites without cars)	44.7%	35.1%	9.6%
Segment 9 (Urban low income without cars)	-4.2%	34.4%	-38.6%

Conclusion

3.6 In this section, we have seen that the proportions of respondents in each of the nine segments as suggested by Thornton et al. are generally similar between the treatment and control areas, although the numbers falling in segment 5 (Educated suburban families) is very low. We have also conducted further analysis of respondents' travel behaviour by segments, which suggests that those in segments 3 (Less affluent, older sceptics) and 6 (Town and rural heavy road users) among car-owners, and segment 8 (Young urbanites without cars) among non-owners, exhibited stronger shifts towards more sustainable travel in the treatment areas compared to the control areas. The causes of the variation in behaviour across market segments are not easy to explain - the most likely explanation is that this is due to random variation. Moreover, in our sample we were unable to replicate the national average segmentations as suggested by Thornton et al. This may be important because segments 5 and 8 are heavily underrepresented, but they are potentially the most responsive to LSTF interventions (as shown by Tables 3.1 and 3.2). The next section will assess the extent to which respondents' attitudinal views to sustainable travel varies by segment.

4. Analysis of Travel Attitudes, Awareness and Associated Behaviour

Introduction

4.1 This section looks at respondents' awareness of the LSTF interventions, their self-reported behaviour change, and attitudes to active travel and public transport. In general, the level of awareness of the LSTF schemes was relatively low, especially for the secondary schemes, with the exception of the primary interventions in Rochdale (T), Tameside (T), Coalville (T) and Gosport (T). Unsurprisingly, this resulted in uniformly-low levels of self-reported behaviour change towards sustainable travel, although there was some perceived change in Rochdale (T) and Tameside (T) (due to public transport interchange improvements), Coalville (T) (due to cycling infrastructure schemes) and in Gosport (T) (due to all measures), as compared to their corresponding control areas. Section 2 had previously also demonstrated there were some modest changes in respondents' travel behaviours. As a result we have also examined year-on-year changes in awareness of LSTF measures and some significant changes in behaviour have been detected among those who became more aware of the LSTF measures. In addition, we have used the segmentation described in section 3 to help assess perceptions of active travel and public transport (some of which are pre-cursors to behavioural change), with the detailed results given in Appendix 4. Overall, our attitudinal analysis work indicates there are still some substantial deterrents to sustainable travel. For active travel, security and safety are considered key barriers, particularly for non-car owners. For public transport, value for money is the main concern, particularly for car owners. The social norm is seen as being that successful people travel by car, with this being especially supported by non-car owners. These attitudes appear to be generally constant over time. Similarly, compared to the other modes, cycling was perceived to be at greatest risk of both crime and being involved in an accident.

Awareness of LSTF Schemes

4.2 Tables 4.1 and 4.2 show the level of respondents' awareness of the LSTF interventions in the before and after surveys (respectively), which was rated on a scale of 1 to 4, where 1 indicates "not aware at all", 2 reflects "partly aware", 3 is "fully aware but not directly affected" and 4 indicates "fully aware and directly affected". In the before survey (Table 4.1), those who were at least partly aware of the LSTF schemes (i.e. rated 2, 3 or 4) were uniformly low, and this held true across all the areas. The main exception was for public transport interchange improvements, where awareness was higher in Rochdale (T), with over 80% of respondents being at least partly aware of this policy intervention, and nearly a third being fully aware but not directly affected. It should be noted that the new £11.5 million interchange was opened in Rochdale Town Centre (T) on 17 November 2013, which coincided with the launch of our survey. There was also evidence of higher awareness of public transport interchange and cycling infrastructure improvements in Gosport (T), with 48% and 51% of respondents being at least partly aware of these schemes (respectively), and of cycling infrastructure and car sharing schemes in Coalville (T) with 63% and 39% of people being at least partly aware respectively, and these results reflect the pre-November 2013 LSTF-related initiatives in these two locations. However, in all locations there was particularly low awareness of LSTF-related travel planning activity, even though such activities had commenced in some of our treatment areas, e.g. Coalville (T) and Gosport (T). This suggests there could be little diffusion, at least in the short-run, of these policies to the wider public. The results could also reflect the personalised nature

of such travel planning, which typically target areas of highest need, and it is possible that while such neighbourhoods and workplaces were sampled, an insufficient proportion of the beneficiaries took part in the surveys.

Table 4.1: Awareness of LSTF Interventions - Before Survey
(% of respondents who were at least "partly aware" of the local LSTF measures)

	Rochdale (T)	Tameside (T)	Wigan (C)	Coalville (T)	Hinckley (C)	Eastleigh (T)	Gosport (T)	Fareham (C)
a) Awareness of Public Transport Interchange Improvements								
% aware of LSTF measures	**81%**	**44%**	33%	22%	25%	**22%**	**48%**	15%
b) Awareness of Bus Priority Measures								
% aware of LSTF measures	41%	33%	36%	23%	18%	**25%**	**60%**	44%
c) Awareness of Demand Responsive Transport / Community Transport								
% aware of LSTF measures	**38%**	**31%**	26%	24%	17%	30%	23%	19%
d) Awareness of Cycling Infrastructure Schemes								
% aware of LSTF measures	**28%**	21%	21%	**63%**	24%	42%	**51%**	34%
e) Awareness of Car Sharing Schemes								
% aware of LSTF measures	27%	26%	29%	**39%**	25%	43%	26%	26%
f) Awareness of College Travel Plans								
% aware of LSTF measures	16%	12%	30%	17%	11%	**17%**	12%	13%
g) Awareness of Personalised Travel Plans								
% aware of LSTF measures	**17%**	**15%**	30%	**13%**	9%	15%	**14%**	7%
h) Awareness of Workplace Travel Plan								
% aware of LSTF measures	**15%**	**14%**	22%	**18%**	12%	18%	16%	12%
i) Awareness of Station Travel Plans								
% aware of LSTF measures	32%	20%	27%	9%	9%	**15%**	10%	7%
j) Awareness of School Travel Plans								
% aware of LSTF measures	15%	11%	22%	**16%**	12%	17%	11%	11%
k) Awareness of Area Travel Plans								
% aware of LSTF measures	24%	17%	23%	14%	12%	**15%**	**20%**	13%

LSTF-related interventions are shown in bold and boxed. Primary interventions are highlighted in yellow (other bold/boxed are secondary measures).

4.3 Table 4.2 shows a similar view for the after survey, which indicates there has been very little change in the awareness of LSTF measures. Indeed, the biggest change was in Hinckley (C) with respect to cycling infrastructure schemes (from 24% to 49% being at least partly aware). Although at the formulation of this research we had designated Hinckley (C) as a control area, it benefitted from LSTF measures from March 2015 onwards, and there may have been some attitudinal changes in advance of physical implementation. We suspect this was also a feature of our treatment areas in the before survey, particularly for Coalville (T), Gosport (T) and Rochdale (T), where awareness has tailed off slightly in the after survey. In other words, there may be a lead effect, i.e. awareness can increase in advance of actual measures being implemented due to pre-publicity.

Table 4.2: Awareness of LSTF Interventions - After Survey

(% of respondents who were at least "partly aware" of the local LSTF measures)

	Rochdale (T)	Tameside (T)	Wigan (C)	Coalville (T)	Hinckley (C)	Eastleigh (T)	Gosport (T)	Fareham (C)
a) Awareness of Public Transport Interchange Improvements								
% aware of LSTF measures	**73%**	**44%**	43%	20%	39%	**26%**	**51%**	35%
b) Awareness of Bus Priority Measures								
% aware of LSTF measures	41%	32%	38%	23%	29%	**26%**	**59%**	47%
c) Awareness of Demand Responsive Transport / Community Transport								
% aware of LSTF measures	**34%**	**27%**	28%	27%	18%	28%	26%	20%
d) Awareness of Cycling Infrastructure Schemes								
% aware of LSTF measures	**29%**	22%	35%	**58%**	49%	41%	**49%**	34%
e) Awareness of Car Sharing Schemes								
% aware of LSTF measures	27%	23%	32%	**29%**	28%	44%	25%	25%
f) Awareness of College Travel Plans								
% aware of LSTF measures	16%	8%	20%	16%	12%	**15%**	13%	13%
g) Awareness of Personalised Travel Plans								
% aware of LSTF measures	**16%**	**8%**	17%	**14%**	10%	13%	**14%**	8%
h) Awareness of Workplace Travel Plan								
% aware of LSTF measures	**17%**	**9%**	17%	**14%**	13%	19%	14%	14%
i) Awareness of Station Travel Plans								
% aware of LSTF measures	24%	16%	24%	9%	10%	**15%**	10%	8%
j) Awareness of School Travel Plans								
% aware of LSTF measures	19%	9%	16%	**15%**	9%	17%	10%	12%
k) Awareness of Area Travel Plans								
% aware of LSTF measures	23%	13%	19%	12%	12%	**15%**	**19%**	15%

LSTF-related interventions are shown in bold and boxed. Primary interventions are highlighted in yellow (other bold/boxed are secondary measures).

Change in Awareness and Travel Behaviour

4.4 Figure 4.1 shows the proportions of respondents who had increased their awareness of the LSTF primary and secondary interventions between the before and after surveys across the five treatment areas. It should be noted that this figure only shows the increases in awareness of the relevant schemes for each particular area, as listed in Table 1.1 in section 1 above. Figure 4.1 shows the change in awareness was lowest in Tameside (T), where only 31% of respondents were more aware of the intervention measures (with particularly low awareness of secondary schemes - which reflects a low level of such activity in the surveyed areas), whilst almost 52% of those sampled were more aware in Gosport (T). The awareness of sustainable transport schemes also appeared to have increased in the control areas as well as in the treatment areas, and this could reflect LSTF schemes that were started before or during the period of the after survey, as was the case in Hinckley (C), or they reflect awareness of other sustainable transport initiatives.

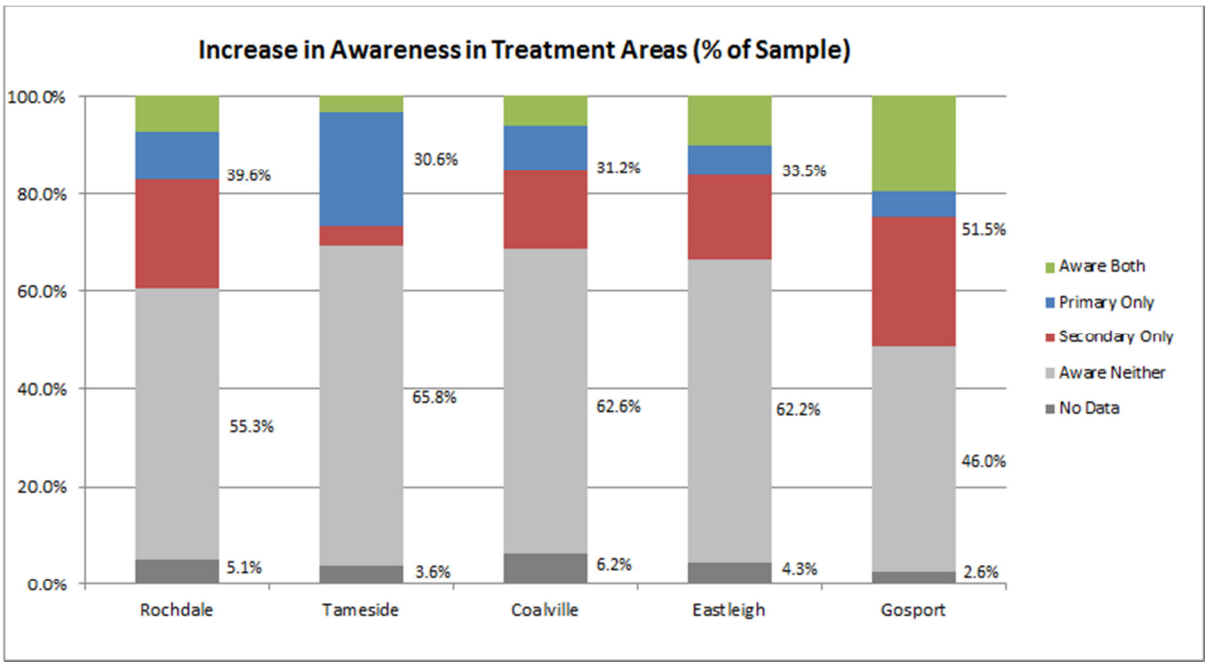


Figure 4.1: Changes of Awareness of Primary and Secondary Measures.

4.5 Given the limited insights provided by market segmentation (as examined in section 3), an alternative approach was developed to assess the impact of changes in awareness and any associations with travel behaviour between the before and after surveys - see Appendix A4.3 for further details. The difference-in-differences in travel distances across different modes (as defined previously) for respondents whose awareness had increased in both the primary and secondary interventions were therefore compared to those whose awareness had not changed or decreased. This detected a few significant changes, including positive increases (relatively) in train travel, public transport usage and use of sustainable travel modes in Eastleigh (T), which are in line with expectations, along with reductions in the use of other modes in Tameside (T). There was also a statistically significant difference for car passenger travel in Coalville (T), although contrary to our expectations, the growth here was for those who were unaware of the LSTF interventions - see Appendix A4.3.

Self-Reported Behaviour Change

4.6 As discussed previously, we found that awareness of the LSTF schemes has remained low overall, particularly for travel planning activity. The effect of such awareness is reflected in relatively low levels of self-reported sustainable behaviour change across the different areas - see Table 4.3, which shows the percentage of respondents who reported that they had changed their behaviour as a consequence of the associated sustainable travel schemes. This self-reported behaviour change is rated between 1 and 3, where 1 is “my behaviour didn’t change”, 2 indicates “my behaviour changed a little” and 3 reflects “my behaviour changed a lot” due to the schemes. Table 4.3 shows the highest proportion is found in Rochdale (T) for public transport interchange improvements, where 31% of respondents said they had changed their behaviour (either a little or a lot) as a consequence of this LSTF scheme. There were also very modest self-reported behaviour changes in Gosport (T), where between 14 to 20% of respondents said they had changed their behaviour due to local public transport interchange, bus priority and cycling infrastructure improvements. Although relatively small generally, these

self-reported changes support the evidence of modest changes in travel behaviour as reported through respondents' weekly diaries (see section 2 above) and in the focus groups (section 7 below).

Table 4.3: Reported Changes in Travel Behaviour

(% of respondents who indicated they had changed their behaviour)

	Rochdale (T)	Tameside (T)	Wigan (C)	Coalville (T)	Hinckley (C)	Eastleigh (T)	Gosport (T)	Fareham (C)
a) Change due to Public Transport Interchange Improvements								
% who indicated they had changed behaviour	**31%**	**17%**	12%	5%	14%	**9%**	**20%**	10%
b) Change due to Bus Priority Measures								
% who indicated they had changed behaviour	17%	9%	10%	9%	9%	**8%**	**20%**	12%
c) Change due to Demand Responsive Transport / Community Transport								
% who indicated they had changed behaviour	**10%**	**4%**	5%	5%	4%	5%	4%	3%
d) Change due to Cycling Infrastructure Schemes								
% who indicated they had changed behaviour	**7%**	2%	12%	**15%**	12%	7%	**14%**	8%
e) Change due to Car Sharing Schemes								
% who indicated they had changed behaviour	6%	1%	7%	**4%**	4%	4%	3%	2%
f) Change due to College Travel Plans								
% who indicated they had changed behaviour	5%	1%	6%	3%	2%	**2%**	3%	1%
g) Change due to Personalised Travel Plans								
% who indicated they had changed behaviour	**10%**	**4%**	8%	**4%**	5%	5%	**6%**	2%
h) Change due to Workplace Travel Plan								
% who indicated they had changed behaviour	**6%**	**3%**	8%	**2%**	4%	3%	3%	2%
i) Change due to Station Travel Plans								
% who indicated they had changed behaviour	11%	6%	7%	4%	3%	**2%**	3%	2%
j) Change due to School Travel Plans								
% who indicated they had changed behaviour	4%	1%	5%	**2%**	2%	2%	2%	2%
k) Change due to Area Travel Plans								
% who indicated they had changed behaviour	9%	6%	8%	3%	5%	**3%**	**5%**	4%

LSTF-related interventions are shown in bold and boxed. Primary interventions are highlighted in yellow (other bold/boxed are secondary measures).

Attitudes to Active Travel and Public Transport

4.7 We also analysed the extent to which respondents agreed with a series of attitudinal statements relating to active travel, including safety in walking and cycling. These attitudinal statements were rated by respondents this time on a five-point scale between -2 and +2, with +2 indicating "strongly agree", +1 representing "somewhat agree", 0 being "neither agree nor disagree", -1 "somewhat disagree" and -2 "strongly disagree". In the before survey, we found that there were concerns across all areas over safety and personal security with respect to active travel (particularly for cycling) and perceived poor levels of provision for active travel. This also appeared broadly consistent across the market segments, but with some indications that Non-car owners (segments 7 to 9) have some greater concerns about walking safety and anti-social behaviour. Table 4.4 shows the proportions of those who strongly or somewhat agreed with each of the nine active travel statements in the after survey across the nine segments, and there has been little change in these perceptions between the before and after surveys, either in total or across the market segments.

Table 4.4: Attitudes Towards Active Travel - by Segment (After Survey)

(% who "strongly agree" or "somewhat agree" with the following statements)

Segment:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1 to 9**	**1 to 6**	**7 to 9**
	Older, less mobile car owners	Less affluent urban young families	Less affluent, older sceptics	Affluent empty nesters	Educated suburban families	Town and rural heavy car users	Elderly without cars	Young urbanites without cars	Urban low income without cars	All Segments	Car owners	Non-owners
1a) Walking is unsafe because of traffic												
% who agree	38%	24%	22%	30%	13%	18%	45%	40%	31%	24%	23%	39%
1b) Cycling is unsafe because of traffic												
% who agree	80%	66%	73%	73%	63%	71%	69%	67%	53%	72%	72%	67%
1c) Level of crime/anti-social behaviour means walking/cycling is unsafe												
% who agree	41%	31%	19%	29%	33%	20%	38%	40%	38%	25%	23%	39%
1d) There are pavements suitable for walking												
% who agree	75%	78%	84%	78%	78%	84%	74%	86%	77%	82%	82%	80%
1e) There are dedicated routes or paths for cycling												
% who agree	66%	63%	67%	68%	55%	67%	66%	68%	64%	67%	67%	66%
1f) Routes for walking and cycling are generally well lit at night												
% who agree	31%	39%	35%	37%	36%	38%	44%	41%	38%	37%	36%	42%
1g) Routes are pleasant for walking or cycling												
% who agree	42%	48%	47%	51%	48%	47%	56%	55%	49%	48%	47%	54%
1h) I am willing to cycle on the roads (e.g. to work/school/the shops)												
% who agree	19%	37%	28%	28%	28%	41%	29%	20%	24%	32%	32%	24%
1i) I would cycle more if there were more dedicated cycle paths												
% who agree	50%	55%	38%	45%	30%	58%	35%	41%	39%	47%	48%	39%

4.8 Similarly, with respect to the attitudes towards public transport, we found in the before survey that non-car owners (segments 7 to 9) appeared to have more positive views than car owners (segments 1 to 6), although both groupings indicated concerns over value for money, particularly with respect to rail. Both groups seemed to agree that the social norm is that successful people tend to travel by car rather than public transport, with this being more strongly supported by the non-car owning segments. This is mirrored in the after survey, with the agreement towards the twelve public transport attitudes statements shown in Table 4.5 further below. Again, there has been very little change in these perceptions between the before and after surveys across the segments.

4.9 We also examined respondents' rankings of perceived risks of accidents and being a victim of crime in using bikes, buses, trains and cars. In the before survey, we found these were uniform across the different areas, with cycling considered the riskiest form of travel for both accidents and personal security. Car is considered the second riskiest mode in terms of accidents, followed by buses, with trains the safest. Buses are considered the second riskiest form of travel in terms of personal security, followed by trains, with car considered the safest. Again, there was very little change in these rankings between the two surveys - see Appendix A4.2 for details.

Table 4.5: Attitudes toward Public Transport - by Segment (After Survey)

(% who "strongly agree" or "somewhat agree" with the following statements)

Segment:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1 to 9**	**1 to 6**	**7 to 9**
	Older, less mobile car owners	Less affluent urban young families	Less affluent, older sceptics	Affluent empty nesters	Educated suburban families	Town and rural heavy car users	Elderly without cars	Young urbanites without cars	Urban low income without cars	All Segments	Car owners	Non-owners
2a) Bus services go where I need to go												
% who agree	52%	57%	61%	64%	40%	39%	80%	83%	63%	55%	53%	77%
2b) Train services go where I need to go												
% who agree	59%	62%	67%	63%	60%	63%	77%	74%	59%	65%	64%	71%
2c) Buses are a reliable/punctual form of travel												
% who agree	47%	42%	55%	57%	30%	33%	61%	61%	43%	47%	46%	57%
2d) Trains are a reliable/punctual form of travel												
% who agree	54%	54%	63%	56%	50%	58%	64%	72%	47%	59%	59%	63%
2e) Bus stops are conveniently located												
% who agree	58%	64%	67%	72%	60%	56%	74%	86%	70%	64%	63%	78%
2f) Train stations are conveniently located												
% who agree	48%	60%	56%	56%	58%	57%	64%	65%	59%	57%	56%	63%
2g) Bus journeys are pleasant												
% who agree	46%	37%	45%	51%	20%	25%	61%	64%	51%	40%	38%	60%
2h) Train journeys are pleasant												
% who agree	55%	55%	62%	57%	40%	56%	65%	72%	51%	58%	58%	64%
2i) The value for money of the bus ticket is generally satisfactory												
% who agree	31%	25%	35%	37%	25%	19%	51%	51%	39%	30%	28%	48%
2j) The value for money of the train ticket is generally satisfactory												
% who agree	25%	25%	27%	24%	13%	23%	41%	36%	17%	25%	25%	33%
2k) In general, I think that successful people tend to travel by car rather than by bus												
% who agree	72%	57%	67%	71%	50%	60%	81%	71%	59%	65%	65%	71%
2l) In general, I think that successful people tend to travel by car rather than by train												
% who agree	61%	46%	51%	60%	30%	38%	72%	64%	49%	49%	48%	63%

Conclusions

4.10 To conclude, we find low levels of awareness of the LSTF measures generally, which has not changed much over time, but there are some indications of higher awareness for certain measures, particularly in the primary (or physical) interventions in some treatment areas, especially in the before survey (for example, public transport interchange improvements in Rochdale (T)), and there is a relatively high level of awareness for all LSTF-related measures in Gosport, in both the before and after surveys. However, we find very little self-reported behaviour change as a consequence, although some change is reported in those treatment areas where some awareness of the LSTF measures was also found. This reinforces the findings from the travel diaries (in section 2) of only relatively modest behaviour changes overall. In addition, we find there are some persistently negative attitudes towards sustainable travel that do not vary much between market segments and have not changed over time.

5. Greenhouse Gas Emissions

Introduction

5.1 We have used the findings from our travel diaries to estimate the changes in greenhouse gas emissions, as measured in carbon dioxide equivalents, and which are dominated by carbon dioxide. Overall, we find a small decline of around 3% of the before level of land-transport related carbon dioxide equivalent emissions in the treatment areas relative to the control areas. This is mainly due to a reduced volume of car driving by the survey participants in the treatment areas compared to the control areas, particularly in Gosport.

5.2 In order to determine the scale of impact of changes in traffic on greenhouse gases (Research Question 3), we need to develop and test a methodology that provides estimates of carbon dioxide equivalent emissions (CO_2e). We have used our travel diary data to compute the equivalent carbon dioxide emissions for land based transport. The methodology is outlined in Appendix 5. For consistency, we continue to make use of the average speed approach advocated by the Department in WebTAG for cars and vans and the DEFRA 2013 Greenhouse Gas Emission factors to account for buses and trains.

5.3 In addition to mileage and average speed, our surveys give data on vehicle and fuel type. For example, we find 62.8% of the vehicles in our sample are fuelled by petrol, 36.4% by diesel and 0.8% by other fuels (predominantly hybrids). It should be noted that our approach to calculating carbon emissions is pragmatic, and could therefore mask some detailed features of individual travel behaviour and the vehicle stock. We also do not take into account any changes in the variability of speeds and different stop/start conditions, nor do we account for possible rebound effects, e.g. reductions in congestion unlocking suppressed demand for driving.

Emissions

5.4 From Table 5.1, we find that the mean travel emissions per person in the after survey are 1.69 tonnes CO_2e per person per annum, with 93% of this related to car and van travel (see Appendix 5). These calculated carbon emissions are 28% higher per person in the control areas than the treatment areas, at 1.89 tonnes and 1.48 tonnes CO_2e per annum respectively (note that Fareham (C) and Wigan (C) are double weighted in Table 5.1 as before).

5.5 Table 5.1 also indicates that overall there has been little change in carbon emissions – being 1.68 tonnes CO_2e per person per annum in the before survey and 1.69 in after survey. However, there have been small increases in the control areas while there are small reductions in the treatment areas, so that using a difference-in-differences (DiD) approach there has been a decline of 0.05 tonnes (50kg) CO_2e per person per annum - or around 3% of the before emissions levels in the treatment areas.

Table 5.1: Summary of Changes in Carbon Emissions (tonnes CO_2e per annum)

	Treatment Areas		Control Areas		Total (All Areas)	
Average per person:	(Tonnes CO2e per annum)		(Tonnes CO2e per annum)		(Tonnes CO2e per annum)	
After Survey	**1.48**		**1.89**		**1.69**	
Before Survey	**1.50**		**1.86**		**1.68**	
Change (After - Before)	**-0.02**		**0.03**		**-0.00**	
% Change	**-1.4%**		**1.5%**		**0.2%**	
Difference-in-difference (**DiD**)	-0.05	(change in treatment area – change in control areas)				
% Change	-3.3%					

5.6 Table 5.2 provides a further breakdown by individual survey area. It can be seen that, again using the DiD method, there are reductions in carbon emissions per person per annum for three of the five treatment areas (Gosport (T), Tameside (T) and Rochdale (T)) ranging from around 9% to 15% of the before emissions levels. However, there are increases in carbon emissions per person in two areas, Coalville (T) and Eastleigh (T), ranging from 3% to 8% of the before emissions levels.

Table 5.2: Carbon Emissions by Survey Area (tonnes CO_2e per annum)

	Rochdale (T)	Tameside (T)	Wigan (C)	Coalville (T)	Hinckley (C)	Eastleigh (T)	Gosport (T)	Fareham (C)
Average per person:	(Tonnes CO2e per annum)							
After Survey	**1.05**	**1.50**	**1.45**	**1.56**	**1.92**	**1.74**	**1.42**	**2.04**
Before Survey	**1.05**	**1.51**	**1.32**	**1.60**	**2.08**	**1.62**	**1.59**	**1.98**
Change (After - Before)	**-0.01**	**-0.01**	**0.12**	**-0.04**	**-0.16**	**0.12**	**-0.17**	**0.07**
% Change	**-0.7%**	**-0.6%**	**9.3%**	**-2.4%**	**-7.8%**	**7.1%**	**-10.5%**	**3.3%**
DiD	-0.13	-0.13		0.12		0.05	-0.23	
% Change	-12.4%	-8.8%		7.8%		3.1%	-14.7%	

Conclusion

5.7 Using the before and after data from respondents' travel diaries, we have estimated the changes in carbon dioxide equivalent emissions between the two situations. Overall, we have found a small reduction in transport-related greenhouse gas emissions in the treatment areas compared to the control areas, although this changes was not statistically significant. This reduction in emissions is associated with relative reductions in the volume of car driving, although this appears to be mitigated by changes in car driving speeds . However, this pattern is not consistent, with only three out of the five treatment areas exhibiting reductions in greenhouse gas emissions, with Gosport (T) having the greatest reduction.

6. Secondary Data and Interventions

Introduction

6.1 So far, we have discussed the magnitude of travel behaviour changes and the resultant greenhouse gas emissions based on samples from our primary surveys. However, if we are to determine population level changes, we will need to also use secondary data to ascertain the relative size of the reduction in car trips and journey distance (Research Question 1), given the knock-on effects on non-local travel. In order to do this, we have collated traffic count data from some 70 sites, along with other data on bus, rail and cycle usage. In addition, we have also collated secondary data on the impact of measures such as personalised journey plans, workplace travel plans and school travel plans. This is described in Appendix 6.

Road Traffic Data

6.2 Results for the traffic data we have collated for our three case study areas are shown by Figures 6.1 to 6.3.

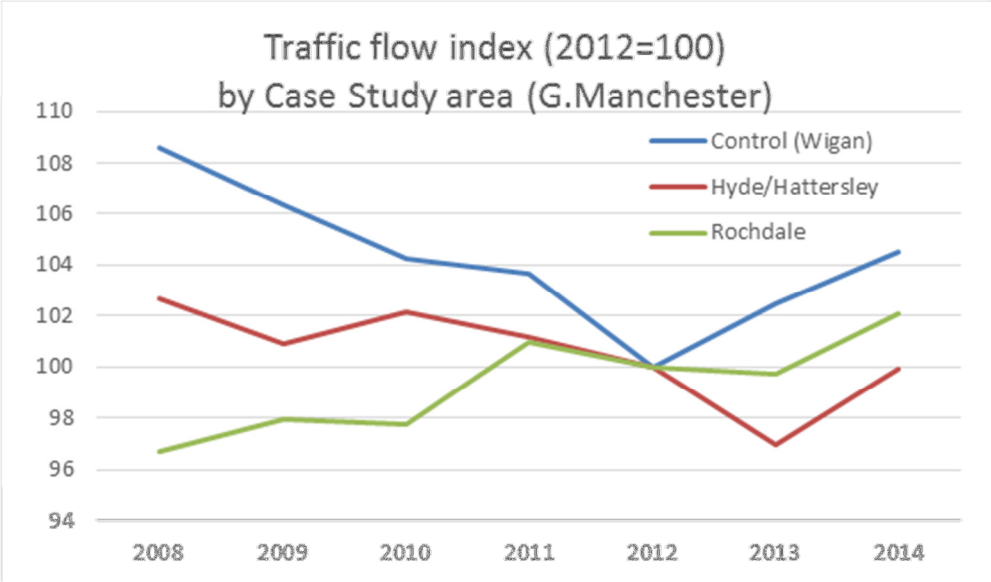


Figure 6.1: Traffic Trends in Greater Manchester

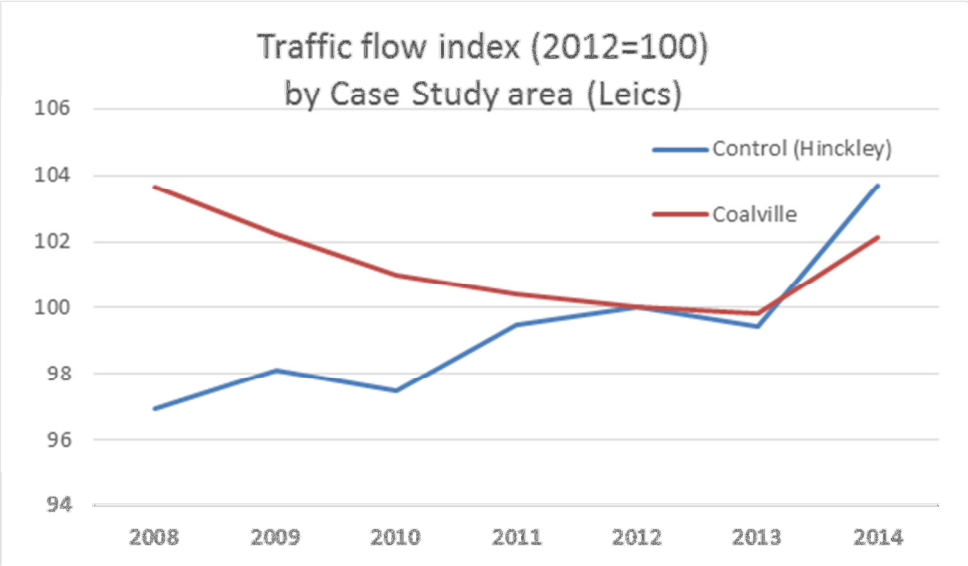


Figure 6.2: Traffic Trends in Leicestershire

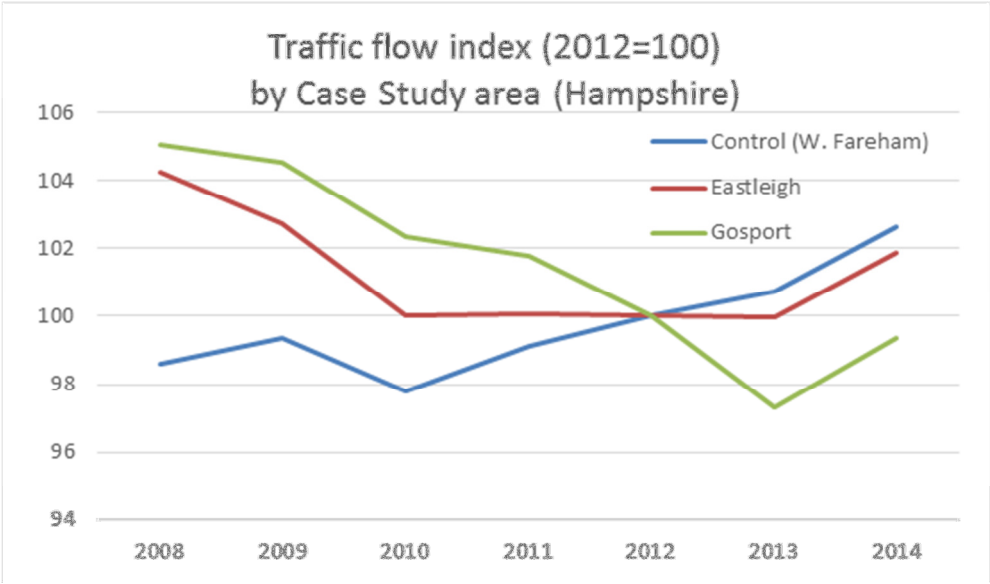


Figure 6.3: Traffic Trends in South Hampshire

6.3 Some small variations in the trends between our intervention sites and the control sites appeared between 2012 and 2013, in four out of five cases, but with a return to trend in 2014. There appear to be reductions in traffic levels, relative to the control sites, of around three to four percentage points for two of our treatment areas, namely Gosport (T) and Tameside (T). For the three other treatment sites, Coalville (T), Eastleigh (T) and Rochdale (T), there has been a one to two percentage point drop. This difference in the trends for the treatment areas compared to the control areas has become particularly prominent post 2012 for Greater Manchester and Leicestershire. For South Hampshire, this seems to be more likely to be due to the continuation of historic trends.

6.4 There was a mixed pattern of road traffic trends in the period before the introduction of LSTF (2008 to 2012). Five areas have exhibited declines in traffic: one control area (Wigan (C)) and four treatment areas (Coalville (T), Eastleigh (T), Gosport (T) and Tameside (T)). By contrast, three areas have exhibited growth in traffic: two control areas (Fareham (C) and Hinckley (C)) and one treatment area (Rochdale (T)). In some instances, this might indicate that pro-

sustainable travel policies were implemented prior to the introduction of LSTF. For example, in Wigan (C) in 2008/9 personalised travel planning was implemented along the A49 corridor and by the NHS.[6] In addition, given the variability and inconsistency of past traffic trends across both the treatment and control areas, it is possible that any post-2012 trends are due to 'natural' variability rather than any specific LSTF initiative.

6.5 We have been able to use traffic models to distinguish the proportion of traffic levels that are either through traffic or local traffic. The results are shown by Table 6.1. We find that through traffic as a proportion of total traffic varies from zero in Gosport (T) (which has a peninsular location) to as high as 39% in the Coalville area (T). It should be noted that, due to different base years for each of the models used, traffic is given for 2010 for South Hampshire, 2011 for Leicestershire, and 2012 for Greater Manchester.

Table 6.1: Base Traffic Levels in the Study Areas (AM Peak)

	Through Traffic	Total Traffic	% of Through Traffic
Coalville (T)	5,570	14,350	39
Eastleigh (T)*	6,425	23,005	28
Gosport (T)	0	9,841	0
Hinckley (C)	2,279	16,684	14
West Fareham (C)	4,262	18,263	23
Rochdale (T) **	2,213	19,139	12
Tameside (T)	3,492	12,426	28
Wigan (C)	4,638	18,986	24

* Excluding through Motorway Traffic on the M3 and M27.
** Excludes traffic on M60, M62 and A627M.

6.6 We have used Trafficmaster sourced data on journey times to supplement our survey estimates of speeds. For example, Table 6.2 shows that between 2011/12 and 2013/14, there were substantial increases in AM peak journey times for South Hampshire (around 10%) and for corridors 4/5 serving Eastleigh (T) (around 15% - but in part related to road works at Junction 5 of the M27). By contrast, there was a 9% reduction in the corridor serving Gosport (T) in the peak direction (northbound), but a 2% increase in the counter-peak direction (southbound). For the Gosport (T) corridor we find counter-peak speeds are 48% higher than those in the peak direction. As would be expected these peak speeds are considerably below the all week speeds reported in section 2. For example, the speed for Eastleigh implied by Table 6.2 is 12.8 miles per hour compared to 23.9 miles per hour in Table 2.7. Similarly, the average speed for Gosport implied by Table 6.2 is 16.5 miles per hour compared to 20.2 miles per hour in Table 2.7.

Table 6.2: Journey Times in South Hampshire. AM Peak. Minutes per mile.

	2009/10	**2010/11**	**2011/12**	**2012/13**	**2013/14**
South Hampshire	3.56	3.48	3.44	3.52	3.70
Corridor 4/5	4.39	4.07	4.06	4.22	4.67
Corridor 7NB	4.34	4.46	4.97	4.76	4.50
Corridor 7SB	3.04	3.13	2.99	2.94	3.04

Corridor 4 serves Chandler's Ford, Corridor 5 Eastleigh, Corridor 7 Gosport.

[6] See Wigan Council (2011) Local Area Implementation Plan. March. http://www.tfgm.com/ltp3/Documents/LAIP-Wigan_v2.pdf

Secondary data relating to public transport usage

6.7 With respect to other modes, we have found that the trends in rail usage in the two areas where this is a viable mode (Greater Manchester and South Hampshire) are remarkably similar between the treatment and control areas. Disaggregate data on bus usage is not readily available but Local Authority level data indicate that between 2011/12 and 2013/14 there has been some modest growth in Greater Manchester (around 5%) and more substantive reductions in Leicestershire (around 9%), whilst usage in Hampshire is broadly stable. It is not possible to draw any conclusions regarding the effects of LSTF investment using this data as there are many factors that influence aggregate levels of rail and bus usage.

Secondary data relating to the impact of Personalised Journey Plans

6.8 We have recorded the level of these secondary interventions in the five treatment areas and the accompanying surveys (see Appendix 6). Purely as an illustrative case study, we examine the impact of Personal Journey Plans (PJPs) in Gosport (T). Consultant WSP reported that PJPs in Gosport in 2013 led to a 10% reduction in car driving trips for commuting and leisure trips and a 19% reduction for shopping and personal business trips for a sample of participants (Winmill, 2015). It should be noted that the impact of PJPs on education and employer's business trips is not stated nor is whether these trips have been abstracted or supressed. In similar work in Basingstoke, it was found the main effect was switching to walking, whilst work in Andover, Eastleigh and Farnborough found the main effect was a switch to car passenger (ITP, 2015). Although the reductions in car driving in Gosport amongst PJP participants look impressive, we find that this only leads to a 0.3% reduction in traffic for the whole of Gosport. Our detailed calculations for Gosport are given below. Similar calculations for Coalville are given in Appendix 6.

6.9 Our matched before and after sample for Gosport (T) consists of 507 observations. These surveys indicated that at the before stage on average 38 miles were travelled per adult per week as a car driver for work, 23 miles for shopping and 27 miles for leisure purposes. This suggests that the PJP could lead to a weekly reduction in car driving per affected adult of 10.9 miles. It is estimated that the mean miles driven per adult per week in Gosport (T) is around 125, suggesting the PJP has led to an 8.7% reduction in car driving amongst affected adults, if the PJP results are relied on.

6.10 Given 2,128 participants to the PJPs in Gosport (T), this represents a potential reduction of 1.21 million vehicle miles per annum. These participants were sampled from 7,321 households. In 2011, the mean household size in Gosport was 2.36 and there were 35,000 households – meaning the PJPs covered only a little over one in five of the population.

6.11 Our estimates of overall traffic movements in Gosport (T) are based on Sub Regional Transport Model estimates of 137,694 vehicle movements per 24 hours in 2010. Given annual average daily traffic (AADT) counts of 33,555 in 2010 and 31,904 in 2013, we estimate the total daily vehicle movements in Gosport (T) in 2013 as 130,919.

6.12 Our survey data for Gosport (T) suggests an average of 13.2 single journeys as a car driver per adult per week – or 1.89 per day. Given an adult population of around 67,000, this accounts for

around 127,000 car movements per day. If we assume, using the Sub-Regional Transport Model, that the total vehicle movements is 139,000, this is suggesting that almost 91% of vehicle movements in Gosport (T) is attributable to car driving by local residents. This indicates a very high degree of self-containment, reflecting Gosport's peninsular nature, but it may also reflect measurement error in our various traffic data sources.

6.13 Our survey data also suggests a mean distance per car driver journey made by an adult in Gosport (T) is 9.5 miles. This is relatively high and suggests that only a relatively small proportion of car driving trips will be amenable to switching to active travel. Overall total annual car driving travel of around 440 million miles is inferred. Given we estimated above that the PJP could reduce vehicle traffic by 1.21 million miles, this illustrative calculation suggests a total traffic reduction of around 0.3%. AADT count data indicates a 2.7% reduction in the Gosport (T) area between 2012 and 2013. These calculations suggest that only 11% of this reduction can be attributed to PJPs (based on the findings of the Winmill, 2015 study). The remainder could be attributed to a range of other factors, such as other transport interventions internal to the LSTF (such as bus priority, Workplace Travel Plans and School Travel Plans), transport interventions external to the LSTF (such as the launch of the Eclipse bus rapid transit system in 2012[7]), transport interventions external to the local policy domain (e.g. fuel prices) and non-transport factors such as changes in population, employment and income.

Conclusion

6.14 While the secondary data alone cannot be used to show the direct effects of LSTF in an attributable way, the findings suggest a relative reduction in traffic levels in the treatment areas compared to the control areas, which is consistent with the primary data analysis that also showed a relative reduction in car driving by respondents in the treatment areas compared to the control areas. Furthermore, based on secondary data, it is shown in this section that LSTF measures such as Personal Journey Plans may have resulted in modest changes at a population level and to changes in road traffic.

[7] In 2013, the Eclipse routes carried around 1.9 million passengers of which 14% were abstracted from car. However, this route (between Fareham and Gosport) is only around 7 miles long, suggesting that at most this intervention would abstract 1.9 million vehicle miles per annum – 0.4% of the Gosport total.

7. Focus Groups

Introduction

7.1 It is recognised that our quantitative work may not capture all the nuances of the impacts of local transport policy on individual travel decisions. As a result, we have undertaken focus groups at each of our five treatment area sites, in the summers of both 2014 and 2015. The details are given by Table 7.1. Overall, 51 people attended the before focus groups and 41 attended the after focus groups, which represented a total of 92 participants (including those who repeated). Attendees of the after focus group were a purposive mix of attendees of the before focus groups (23 participants) and new attendees (18 participants). In all cases, invitees had filled-in both before and after postal surveys. The discussions of these focus groups have been transcribed and thematic analyses undertaken (further details of the focus groups and methodology applied are given in Appendix 7).

Table 7.1: Extent of Focus Groups.

Focus Group Sites		**Date**	**Number of Participants**
South Hampshire	Eastleigh (T)	14th July 2014 13th July 2015	10 9
	Gosport (T)	10th July 2014 20th July 2015	10 6
Greater Manchester	Rochdale (T)	16th July 2014 15th July 2015	9 12
	Tameside (T)	17th July 2014 16th July 2015	9 5
Leicestershire	Coalville (T)	7th July 2014 9th July 2015	13 9

'Before' Focus Groups: Aims and Findings

7.2 The aims of the before focus groups were to collect views on local travel conditions and how these might be improved, whilst also examining awareness of, and support for, LSTF measures. Particular emphasis was placed on the determination of contextual factors unique to each location that might not be apparent from the responses to the self-completion survey.

7.3 The before focus groups found that Tameside (specifically Hyde) (T) and Gosport (T) are both impacted by long standing road congestion bottlenecks. Rochdale (T) has been impacted by the arrival of Metrolink from 2013 onwards and the opening of a new Interchange. Coalville (T) is impacted by the relative inaccessibility of the rail network, in marked contrast to Eastleigh (T) which is characterised by good rail access. There were some common themes, such as congestion and parking difficulties, concerns over cycling safety and the cost and quality of public transport services. There appeared to be a low awareness of LSTF related initiatives (including Smartcards) but higher awareness of other transport initiatives, including the extension of the Metrolink network in Rochdale (T) and Tameside (T) and the development of the Eclipse bus network in Gosport (T). Overall, the before focus groups did not suggest a groundswell of support for radical change, although there were numerous suggestions for incremental improvements and there was a perceived need for interventions to be coordinated as part of a wider strategy to encourage sustainable travel, particularly when it comes to cycling.

'After' Focus Groups: Aims

7.4 The aims of the after focus groups concentrated on two main aspects. Firstly, there was detailed consideration of how people travel (for example, mode of transport usually used), and whether there has been any change in behaviour over the last year due to LSTF measures. Secondly, changes in attitudes towards the key topics (that emerged from the thematic analysis of the before focus groups transcripts) were examined along with how these attitudes have affected behaviour.

'After' Focus Groups: Awareness and Impacts of LSTF

7.5 In terms of awareness of the LSTF interventions amongst the after focus group participants, these were generally low but slightly higher for the physical measures implemented over the last year. It appeared that the higher visibility of physical measures, and conversely the lower visibility of softer measures, impacted on awareness. The most recognised measures were, in descending order of awareness, demand responsive transport, cycling measures and station improvements. This broadly mirrors the findings from the primary data surveys. There was lower awareness of smarter choice measures, with greatest recognition of School Travel Plans, followed by Workplace Travel Plans, Smart Cards and Personalised Journey Planning. There tended to be higher awareness in Greater Manchester, which might relate to the marketing activity of Transport for Greater Manchester.

7.6 Participants in the after focus groups were asked to fill in a short questionnaire. Their responses to a question on awareness of LSTF measures are shown in Tables 7.2. This table indicates that only a little over 50% of participants professed any awareness of LSTF measures in their local area over the last year, and as a result, even fewer said they changed their behaviour in any way over the past year as a result of the LSTF interventions (see 7.16 below). This is despite some of the after focus group participants having previously taken part in the before focus groups.

Table 7.2: After Focus Groups - Awareness of LSTF Measures

	Not Aware at All	Partly Aware	Fully Aware but Not Directly Affected	Fully Aware and Directly Affected
Rochdale (T)	4	3	2	2
Tameside (T)	4	1		
Coalville (T)	4	2	1	2
Eastleigh (T)	3	3	1	
Gosport (T)	3	3		
TOTAL	18 (47%)	12 (32%)	4 (11%)	4 (11%)

7.7 In discussions of awareness of the LSTF, transport integration and levels of service provision were the dominant areas of discussion or 'themes' (see also Table 7.4 below). In both Tameside (T) and Gosport (T), integration was the leading theme, primarily associated with information and publicity, as well as improved access and intermodal connections (especially to/from heavy rail), although in Gosport (T) infrastructure provision was an equally important theme, associated with continuing changes made to accommodate the Eclipse bus rapid transit system, which while being beneficial for bus passengers, was seen as inconveniencing car drivers, for example. In Coalville (T) and Eastleigh (T), the discussion focussed more on service issues. In Coalville (T), the discussion related to shared services that had been stimulated by school travel

plans and workplace travel planning such as lift sharing and works buses. By contrast, in Eastleigh (T) the discussion was much more focussed on community buses - this involved consideration of demand responsive transport (dial a ride and taxi buses) as well as the more conventional bus network. In Rochdale (T), finance was the dominant issue, related particularly to public transport ticketing.

7.8 The low awareness of the LSTF and the extent to which intended measures had been implemented was frequently commented upon. For example:

Has this package[8] been implemented or is it supposed to be implemented because I'm not aware of it but I would be very interested to know what it means.

(Male, Non-Working Age, Eastleigh)

Moreover, it was sometimes expressed that there was an overreliance on the internet for information provision:

I think a lot of things are, basically, it's online and things (are) on the internet if people are willing to access the internet and probably find out a lot more.

(Male, Working Age, Tameside)

7.9 There was also some discussion about the lack of publicity of LSTF measures in the local media - but this was cast in terms of changes to the nature of local media itself:

.. the local newspaper has gone really wide now. So there is nothing very local in it. So you wouldn't know if anything was happening, you would be hard pressed to know about it really.

(Female, Working Age, Tameside)

7.10 When asked to reflect upon improvements to local travel choices, the dominant discourse related to integration in three of the five areas, with improved access and connections being highlighted in Coalville (T) (especially with respect to cycling) and Tameside (T) (especially with respect to heavy rail) and improved information highlighted in Gosport (T) (especially concerning local buses and smart cards). In Eastleigh (T) and Rochdale (T) the related theme of time dominated, with particular emphasis on the usefulness of recently installed real time information systems associated with heavy and light rail, as well as local buses. Most of these improvements could be related to LSTF initiatives, although some initiatives pre-dated the LSTF such as the real-time information provision associated with light rail in Rochdale or were associated with related funding streams such as real-time information in Eastleigh associated with the Better Bus Area Fund.

7.11 Table 7.3 shows the numbers of focus group participants who indicated that LSTF had impacted upon the travel behaviour in the short questionnaire that they completed prior to the focus group discussions. Only a little over 20% of respondents suggested that they had changed their travel behaviour in any way over the last year as a result of the LSTF, which is broadly reflective of the results from the wider primary survey. These figures are also supported by the focus group discussions that suggested limited behaviour change had resulted from LSTF measures.

[8] This LSTF package involved improvements to the pedestrian links between Eastleigh's train and bus stations and cycling links between the train station and Bishopstoke and Leigh Roads which were still on-going at the time of the focus group. Other elements of the package such as College, Personalised and Work Place Travel Plans and feeder bus services (e.g. between Southampton Airport Parkway and Chandler's Ford) had been completed.

Table 7.3: After Focus Groups - Travel Behavioural Change as a Result of LSTF

	Didn't Change	Changed a little	Change a lot
Rochdale (T)	8	1	2
Tameside (T)	4	1	
Coalville (T)	7	1	1
Eastleigh (T)	5	1	
Gosport (T)	4	1	
TOTAL	28 (78%)	5 (14%)	3 (8%)

7.12 The discussion around changes in travel behaviour was of direct relevance to research question 1 (Does investment in sustainable travel through the LSTF lead to significant mode-shift to sustainable travel modes and a reduction in the number of car trips and/or journey distance?) In all five areas the dominant theme related to integration, in particular to issues concerning connections and access. This was often related to perceived deteriorations in the quality of the public transport network related to cutbacks in tendered services but there were instances of where improvements to public transport services or active travel networks had led to shifts to more sustainable travel. Concerns were often expressed that changes to the deregulated bus industry, both to the commercial and social networks, were acting as a barrier to shifting to more sustainable travel.

7.13 There was relatively little discussion of trip suppression but when it was mentioned it was associated with increasing congestion and petrol prices:

I drive probably one day less a week now and I put £10 to £15 a week more fuel in the car and I drive less purely because of the traffic. (Female, Working Age, Rochdale)

7.14 The focus groups did indicate that there was some behavioural change over the last year, with car being used less and/or active travel and public transport being used more in four out of five treatment areas. However, most of these changes were explained as being due to changing personal circumstances, such as changing work, moving home, retiring or personal injury, rather than due to LSTF related measures.

'After' Focus Groups: Exploring Attitudes and Perceived Barriers

7.15 The focus group discussions surrounding participants' attitudes towards LSTF interventions and changing travel behaviour were analysed using a thematic analysis approach advocated by Braun and Clarke (2006) and the data labelling approach of Fitzpatrick (2014). The themes that were identified are shown by Table 7.4. The majority of themes were discussed in terms of factors directly impacting on travel behaviour (and hence research question 1). This included much of the discussion concerning finance, integration and service. Other factors were discussed more in terms of background conditions and hence factors having an indirect impact on travel behaviour, including infrastructure and planning. The discussions relating to safety and security and concerning time were often personalised and were suggestive of who might be changing behaviour and why (research question 2). For example, concerns over personal security were a factor in the reluctance to use public transport for some groups, whilst the influence of time often depended on personal circumstances, including family commitments. The discussion on the environmental theme was often with reference to reductions in the emission of pollutants, including carbon dioxide (research question 3).

Table 7.4: Focus Group Themes

Parent Node	Child Node	High Level Description of the overall Themes
Safety and Security	Personal Security	Personal security and safety
	Safety	
	Threat Perception	
Finance	Ticketing	The cost of ticketing by different modes and carriers
	Fares	The cost of tickets
	Car Parking	Car parking costs
Infrastructure	Congestion	Roads congested by various means, amount of traffic, roadwork's, accidents, etc.
	Cycle Paths	Design and Signage
	Maintenance	Road works, utility works, repairs
	Road Layout	Design and Signage
	Town/City Infrastructure	Shops/Layout/Amenities
Integration	Access	Access, parking, routes, personnel at bus, train and tram stations; cycle bays, lack of space on trains/trams for bikes; crossing design, disability, airport; Park and Ride; Ferry
	Connections	Bus, train, tram, ferry connections to each other. Integration
	Publicity/Information	
Environment	Pollution	Smog and gases/air quality
	Sustainable Travel	Cycling, walking, trams, electric vehicles, trains
Time	Real Time Information (RTI)	Real Time Information (trams, buses, trains) at base or via mobile/Wi-Fi
	Journey Time	A person's timeline, Paper timetables
	Convenience	Personal circumstances
Planning	Planning	Design and planning of new towns, roads, motorways, cycle paths, land use
Service Issue	Capacity	Capacity on trains, trams, buses
	Community Buses	Community buses
	Shared Services	Work Place Travel Schemes/Plans, School Travel Schemes/Plans, Lift Sharing

7.16 Although no new themes (or parent nodes) emerged in the after discussions (compared to the before discussion), a number of new sub-themes were identified. Car parking emerged as an issue, particularly in Greater Manchester where there had been reductions in charges in both Rochdale (T) and Tameside (T). This discussion was often linked to debates concerning the vitality of town centre facilities as all of the treatment areas lie in the shadow of much larger city centres (Leicester, Manchester, Portsmouth, and Southampton). In Coalville (T), redevelopment in the town centre was causing major traffic disruption. Other new sub-themes related to publicity and information, particularly with regards to LSTF measures, with this reflecting a more mature appreciation of issues related to the LSTF. Generally awareness was low and this was partly attributed to lack of information in the local media. There was particularly low awareness of the specific details of measures such as demand responsive transport and smart cards. However, there was greater awareness (at least relative to the before focus groups) of shared services, such as lift sharing and taxi sharing schemes, that was also identified as a new sub-theme. Overall, the discussions were consistent with the findings of the primary survey concerning limited modal shift towards sustainable transport, some trip suppression (due to congestion) and limited awareness of LSTF schemes but with some recognition of local improvements.

7.17 A diverse range of other local transport issues emerged. Finance was the dominant theme, but this was due to extended discussion of car parking in Gosport (T), although there was also a discourse on this topic in Rochdale (T). In Coalville (T), Rochdale (T) and Tameside (T), integration returned as the dominant theme. In Coalville (T), this related to aspirations to use the freight rail line that goes through the area for passenger traffic, as well as better joining up of cycling infrastructure improvements schemes. Re-instatement of rail was also an issue in Gosport (T), although here the track has been lifted and the right of way is currently used by buses. In Tameside (T), the discussion related to the lack of connections between Hyde bus station and nearby rail stations (Hyde Central, Hyde North, Godley for Hyde) whilst in Rochdale (T) the key issue was access, including parking at heavy and light rail stations and issues of overcrowding and the poor condition of the rolling stock on heavy rail. In Eastleigh (T), the discussion focussed on infrastructure and particularly road layouts in the town centre.

Conclusion

7.18 Overall, neither the before nor the after focus groups indicated a groundswell of support for radical change in travel behaviour or local transport policy, although there were numerous suggestions for incremental improvements. Although we have not adopted psychological, sociological or other conceptual models to understand behavioural changes in this project, if we were to use the language of the trans-theoretical model of behavioural change, we would suggest that most of the participants to our focus groups were at the 'pre-contemplation' stage, i.e. they are not yet aware of a major need for change. Only around one in five of those involved in the after focus groups were fully aware of the LSTF measures, with a similar number having undergone some behavioural change, which again endorses the findings from the primary surveys, and demonstrates the scale of the challenge for delivering wider population changes towards sustainable transport.

8. Conclusions

8.1 In order to meet the research objectives of this case study, we have adopted a mixed methods approach which is predominantly quantitative. The main component was a large-scale before and after self-completion postal survey, where the sample respondents were drawn at random from the electoral register for five purposive treatment areas that were subject to the LSTF interventions, and compared to those from three similar control areas, which were not (at the time of the study design). This primary data is supplemented by secondary information relating to traffic volumes and journey times obtained from other sources, and a more qualitative analysis from focus groups that were conducted in the five treatment areas after both surveys. Using this approach, we have made substantive progress in answering our three main research questions and the two subsidiary research questions. What we have learnt may be summarised as follows.

Main Research Questions

8.2 With respect to research question 1 (Does investment in sustainable travel through the LSTF lead to significant mode-shift and a reduction in the number of car trips and/or journey distance?), we have developed an assessment methodology capable of providing appropriate answers. We have shown our survey tool provides consistent results between treatment and control areas and indicates that these two types of areas are broadly comparable, although the control areas have slightly higher income levels, travel speeds and travel distances.

8.3 Using the difference-in-differences approach, our key finding is that car driving in the treatment areas has gone down by around 8 miles per person per week relative to the control areas (or around 7% of the before levels of car driving). However, this result is not statistically significant and is likely to be related to trip suppression, given overall travel in the treatment areas compared to the control areas is down by 11 miles per person per week. This cannot be directly attributed to the LSTF. However, if we define sustainable travel as including car passenger then we find that such travel increased by 5.4 miles per person per week in the treatment areas compared to the controls. In other words, 64% of the change might be ascribed to mode shift. If we assume the 8.4 miles per person per week reduction in travel by 'other modes' in the treatment areas compared to the control areas is entirely due to trip suppression (or alternatively is excluded from our analysis[9]), we could conclude that around 3 miles (36%) of the reduction in car driving is due to trip suppression.

8.4 Within the treatment areas themselves, absolute changes are relatively modest. Of the changes anticipated from the LSTF, the most notable changes are an increase in train use of 9 miles per person per week in Eastleigh (T) and the reduction in car driver miles per person per week of 18 miles in Gosport (T), although the former only has partial statistical significance and the latter is not statistically significant. The only statistically significant changes are in terms of the relative increase in bus travel in Eastleigh (T) compared to Fareham (C) and the increase in travel as a car passenger in Coalville (T) relative to Hinckley (C).

[9] Travel by 'other modes' is dominated by air travel – so either approach might be justified.

8.5 Overall, there is a modest relative reduction in the car driving mode split in the treatment areas compared to the control areas (by 0.4 percentage points) and an increase in sustainable travel (by 0.4 percentage points).

8.6 We also found relatively low awareness of LSTF measures amongst our survey sample in the treatment areas year-on-year, whilst only around half of focus group participants were aware of LSTF measures, despite their involvement in the research, and this may be a factor in part for low behaviour change take-up.

8.7 With respect to Research Question 2 (Who is changing their travel behaviour and why?), we have used Thornton et al.'s nine market segments. We have found that segment 3 (Less affluent, older sceptics), segment 6 (Town and rural heavy car users) and segment 8 (Young urbanites without cars) were most likely to increase their uptake of sustainable travel. The least responsive segments appeared to be Affluent empty nesters (segment 4), Less affluent urban young families (segment 2) and Urban low income without cars (segment 9).

8.8 The causes of the variation in behaviour across the market segments do not appear to be related to LSTF measures. This is because the variations in behaviour across the segments were not related to differential attitudes (or changes in attitudes) towards sustainable travel or differences in awareness of (or changes in awareness of) LSTF measures.

8.9 With respect to Research Question 3 (What scale of impact does this net change in traffic have on carbon emissions?), we have established changes in levels of traffic, journey speeds (and hence congestion) and carbon emissions in our five treatment and three control areas. We find a small decline of around 3% of the before level of individual carbon dioxide equivalent emissions in the treatment areas relative to the control areas. This is equivalent to 50 kg of CO_2e per person per annum. This is largely due to the reduced volume of car driving by our survey participants not all of which can be attributed to LSTF measures. Furthermore, in two of our five treatment areas we found increases in carbon emissions relative to the control areas. Our findings can be compared with those of Sloman et al. (2016, Table 14.2), whom in an interim meta-analysis of 12 large LSTF schemes (including Greater Manchester and South Hampshire) found a reduction in transport carbon emissions (using Department of Energy and Climate Change data) of 3.22% but also found a reduction for all other Local Authorities of 3.08%.

Subsidiary Research Questions

8.10 Our findings with respect to the subsidiary research questions are necessarily more speculative. With respect to the first of these questions (What lessons, in terms of mode shift, congestion relief and carbon impacts, have we learnt from these schemes?), our conclusion is that we find modest reductions in car driving mileage in our treatment areas compared to our control areas, although this is not statistically significant. Some 36% of this reduction could be related to trip suppression rather than mode shift. Thus, 64% of this change might be attributed to LSTF measures, suggesting a reduction of around 5.4 miles per person per week (or around 4.5% of the before levels of car driving in the treatment areas). This change in car driving over a one year period is greater than that observed from secondary data for local traffic. However, non-local car drivers (particularly through traffic) and non-car traffic are unlikely to be affected by LSTF measures. If the reduction in car driving is the main yardstick, all five treatment areas

exhibited either an absolute reduction or a reduction relative to the control areas, with the largest reduction in Gosport (T).

8.11 With respect to the second of our subsidiary questions (What are the impacts of similar schemes in different areas and therefore how replicable are the results?), we would emphasise that detailed comparisons are difficult. Each treatment area had a different set of treatments applied at different scales and at different times, not all of which coincided with the time between our before and after surveys. The corridor-based approach in South Hampshire seems to have been relatively effective, particularly for Gosport (T) where the A32 is a notorious bottleneck (and hence an obvious locus for interventions) and the LSTF was able to build on earlier physical interventions, related to the Eclipse bus rapid transit. There have also been some statistically significant changes in the intended direction in Eastleigh (T), both for our initial analysis and our comparison of those who were aware and unaware of LSTF measures, with these changes largely related to measures that improved interchange with rail.

Conclusions and Countervailing Factors

8.12 We conclude that the overall level of change in our case study has been relatively modest and, for individual treatment areas, has not always been in the anticipated direction. The modest size of the change can be related to the relatively low awareness of LSTF related initiatives and some persistently negative attitudes towards sustainable travel, related to safety concerns for active travel and value for money concerns for public transport.

8.13 We have identified some countervailing factors that may explain unintended outcomes for individual treatment areas:

- Disruption to both heavy and light rail service in central Manchester, impacting on use of these modes in Rochdale (T) and Tameside (T).
- Road works affecting travel speeds, particularly in Coalville (T) and Eastleigh (T).
- Car parking charges being reduced in a race-to-the-bottom between Districts in Greater Manchester, affecting car use in Rochdale (T) and Tameside (T).
- Important LSTF, and other, interventions occurring before our surveys started, including the Metrolink extension and Interchange in Rochdale (T) and the cycling facilities in Coalville (T).

8.14 In addition, it is also possible that behaviour changes towards sustainable travel may not have been fully embedded in the period between our before and after surveys and hence detectable during the course of one year. For example, seasonality means that investments in active travel that are completed in the autumn may not begin to have an impact until the following spring. Other factors that weakened our experimental design include:

- Lags (Wigan (C)) and leads (Hinckley (C)) in sustainable travel measures affecting our control areas during our survey period.
- The failure of certain measures to be delivered in our treatment areas, for example personalised travel planning in Tameside (T) took place in Audenshaw rather than Hyde.

- The late delivery of some primary measures, such as the road improvements in Eastleigh (T) Town Centre, which meant there may have been insufficient time for the stimulation of behavioural change.
- The dissemination of some LSTF measures to both treatment and control areas, particularly web-based information systems, leading to some contamination of our experimental design.

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