

Lancashire TravelSmart Programme

Interim Evaluation of Stage 1.1 (South Ribble)

Report for Lancashire County Council

September 2007

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ANNEX A: CONCEPT OF EVALUATION

1 INTRODUCTION

1.1 This report

This report has been prepared for Lancashire County Council by Sustrans and Socialdata. It presents the results of an evaluation of Stage 1.1 of Lancashire's TravelSmart Individualised Travel Marketing (ITM) programme, conducted in South Ribble between May and July 2006.

The findings are based on an analysis of data from an interim travel behaviour survey, conducted from January to April 2007 (representing the 'after' case), compared with those of the baseline research programme conducted from March to April 2006 ('before').

1.2 Background

1.2.1 *Baseline travel behaviour research*

During spring 2006 a comprehensive programme of baseline travel behaviour research was conducted by Socialdata with support from Sustrans across South Ribble and Preston to obtain information on how people travel and the reasons for their mode choice¹.

The first part of the research was a postal survey of personal travel behaviour involving net samples of 1,290 persons in Preston and 706 persons in South Ribble². The findings provided a representative picture of day-to-day travel by the area's residents to help the County Council and its partners develop their local transport programmes and specifically to measure the effects of the TravelSmart initiative.

¹ Separate surveys were conducted at roughly the same time in Lancaster and Morecambe.

² These samples were drawn at random from a database of households with publicly available telephone numbers as this sub-set of the population was used to form the target population for the TravelSmart programme.

The second part of the research consisted of a series of in-depth interviews with 304 people to gauge their attitudes to transport issues and help understand their daily travel choices. The findings provide an insight into the potential for reducing car use by encouraging people to make more use of sustainable travel modes (walking, cycling and public transport).

Socialdata and Sustrans reported the findings of this research to Lancashire County Council in July 2006. Since then the research data have been disseminated at two local seminars and the publication of a summary briefing note aimed at local and national audiences.

1.2.2 Individualised Travel Marketing programme

On behalf of Lancashire County Council, and with support from Stagecoach and other partners, Sustrans and Socialdata implemented Stage 1.1 of the TravelSmart Individualised Travel Marketing (ITM) campaign in South Ribble between May and July 2006.

The initial target population consisted of 10,713 private residential households in the South Ribble area. A total of 9,813 households (92% of the target population) were successfully contacted in the initial stages of the programme and offered a range of personalised travel information and support.

During the course of Stage 1.1, more than 43,500 items of information, rewards and incentives were packed and delivered to 4,275 households in the target area. A total of 294 home visits were also successfully conducted to provide households with further information and support on walking, cycling and public transport.

1.3 Aims and objectives

The aim of this evaluation was to measure the impact on travel behaviour of Stage 1.1 of the ITM programme.

The specific objectives were to:

- Undertake an interim travel behaviour survey on a net sample of at least 500 persons from the ITM target population (South Ribble) and a further 250 from the Preston urban area (as control);
- Compare the findings of this survey with those of the baseline travel surveys;
- Analyse the changes in mode choice and other key indicators of personal travel behaviour that may be attributed to the ITM programme.

1.4 Other evaluation

This evaluation is based on travel behaviour surveys and thus gives a rounded picture of the impacts of the ITM programme on mode choice, car use etc. However, Sustrans and Socialdata recommend that further analysis is undertaken of bus passenger statistics and cycle counts to provide further evidence of behaviour change among the ITM target population.

2 SURVEY METHOD

2.1 Survey design

The survey design used in this interim research was identical to that used for the baseline travel behaviour surveys across South Ribble and Preston in spring 2006. This design has been developed over many years by Socialdata and applied successfully in travel behaviour research and the evaluation of ITM programmes in more than 15 countries world-wide.

For each household, the survey consists of a household questionnaire and a set of individual travel diaries for each of its members for a nominated day of the week. The survey sample includes households completing travel diaries for all seven days of the week. To ensure a high response rate, a pre-paid return envelope is provided with the survey and motivational telephone calls are undertaken. In cases where surveys are not returned this is followed with further motivation by post and telephone.

The survey aims to collect information on all trips³ to all out-of-home destinations on a nominated travel day for each household. The customer focus of the questionnaire design and individualised approach in the introductory mailing and subsequent motivation ensures high response rates and reliable results.

2.2 Sampling strategy

The sampling strategy for the interim research was determined by the need to provide a robust measure of changes in travel behaviour associated with the ITM programme. The key elements of this strategy were as follows:

- Separate samples were drawn from the TravelSmart target population and from the Preston urban area (as a control group). This allowed the analysis to take into account any external influences on travel behaviour across the city, eg other travel related programmes, changes in the

³ The subsequent analysis of day-to-day mobility excludes trips of more than 100km (a very small percentage of personal trips) to avoid skewing any distance-related indicators.

weather (including seasonal effects), major events affecting the highway network⁴.

- Net samples for the target and control groups (ie the number of complete survey responses) were required to be of a size sufficient to provide statistically significant results. These were set at 500 people for the target group and 250 for the control.
- All samples were drawn at random from residential households with publicly available telephone records⁵. To help provide results representative of the whole target population, the target group samples of the after survey included a proportional share of households which chose not to participate in the ITM programme.

2.3 Survey procedure

The procedure for the surveys was as follows:

- i) Mailing of an official announcement letter (bearing the Lancashire County Council logo and signed by Councillor Tony Martin, Cabinet Member for Sustainable Development), to all households in the gross sample;
- ii) Mailing of survey forms and official covering letter to all households in the gross sample;
- iii) Mailing of an official reminder letter to all households from whom a response had not been received after one week;
- iv) Mailing of a second reminder letter (on Socialdata headed paper and signed by the Socialdata project manager) to non-responding households a further week later; and

⁴ As the target population for the TravelSmart programme was drawn from across South Ribble, there was no appropriate area within the borough to provide a control group for this evaluation. Consequently it was agreed at inception to use the Preston urban area as control on the basis that travel patterns in the two areas, although not necessarily similar, would be subject to similar external influences during the timeframe of the TravelSmart intervention.

⁵ To reflect the composition of the TravelSmart target population.

- v) Reminder telephone calls to non-responding households each week to offer support in completing the forms and to motivate them to return them.

2.4 Survey implementation

The interim surveys were implemented between 24th January and 1st April 2007. The responses from target and control groups are shown in Table 2.1 below:

Table 2.1 Implementation of Interim Survey

	TOTAL	Target group (South Ribble)	Control group (Preston)
Mail-out gross	1,550	925	625
Sample loss ⁶	87	50	37
Adjusted gross	1,463	875	588
Returns (persons)	1,043	634	409
Response rate in %	71%	72%	70%
<i>(Contract persons)</i>	750	500	250

It is notable that the net samples exceeded the respective targets by a significant margin, helping to increase the reliability of the subsequent analysis. This increase of the net sample was provided by Sustrans and Socialdata without any additional costs. Furthermore the aggregate response rates are comparable to those achieved during the baseline research programme. These provide an excellent indicator of the willingness

⁶ Sample loss: moved away, deceased etc.



of respondents to co-operate with the surveys, and hence of the quality of the data provided.

3 ANALYSIS AND RESULTS

3.1 Introduction

The analysis of the before and after surveys was designed to show changes in key mobility indicators attributable to the TravelSmart intervention. This involved a comparison of behavioural data from the target and control group samples in the interim and baseline surveys. A summary of this methodology, including the statistical procedures used to account for changes in the data due to sampling factors or external influences, is given in Annex A.

The basic measure used for this analysis was the average number of trips per person per year on the grounds that this gives the best overall picture of personal travel behaviour, as opposed to average distances per person per year, the results for which would be skewed by the very small number of long trips.

The main indicators selected for the evaluation were as follows:

- trips per person per year by main mode⁷;
- personal daily mobility (including trip rates, distances travelled and trip purposes);
- time spent travelling per person per day by main mode, and total daily exposure to walking and cycling; and
- car use measured by actual usage, number of trips, travel time, distance travelled and average occupancy per private car per day.

A series of three second-tier indicators are also used to show the effect of ITM on mode choice by trip purpose, time of day, gender and age group.

For the purposes of this evaluation, a trip is defined as a one-way course of travel having a single main activity as its purpose. The number of trips per person per year was calculated on the standard formula that on average, a

⁷ The main mode of a trip is defined as the mode used for the greatest length of the trip.

person will spend 341 days of the year at home. This takes into account the days that a person travels away, for example on holiday or business.

The charts in the following sections use ‘Without TravelSmart’ and ‘With TravelSmart’ to represent the changes in the target group ‘before’ and ‘after’ the implementation of the Individualised Travel Marketing, taking into account the effects of external influences measured across the rest of the city (control group).

It is important to note that the following results show the changes in travel behaviour that were achieved across the whole TravelSmart target population including those in the ‘N’ (‘Not Interested’) group and non-respondent households.

3.2 Changes in travel behaviour

The net effect of the TravelSmart programme on mode choice is summarised in Figure 3.1. This shows the percentage of trips by main mode, with and without TravelSmart, as measured by a comparison of the after survey (‘With TravelSmart’) with the before survey (‘Without TravelSmart’). This comparison takes into account changes measured in the control group that were not offered TravelSmart. The share of car as driver trips was reduced from 57% to 50%, with corresponding increases in the share of trips by walking, cycling and public transport.

Figure 3.1 Changes in percentage of trips by main mode

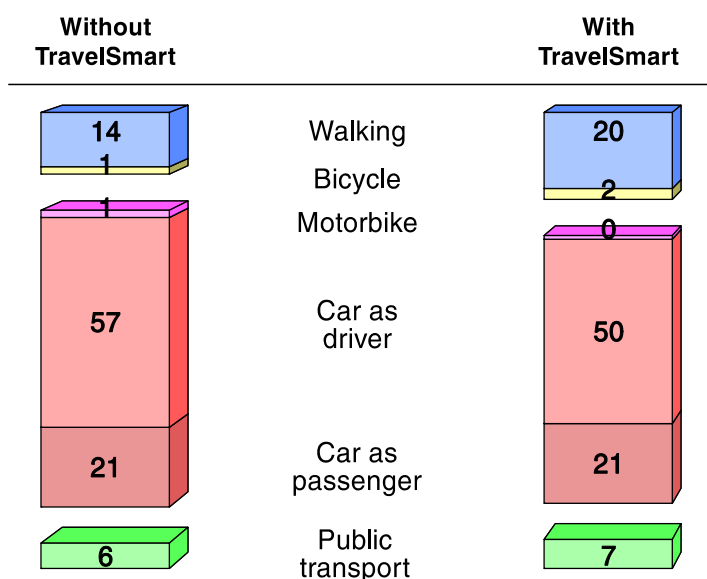
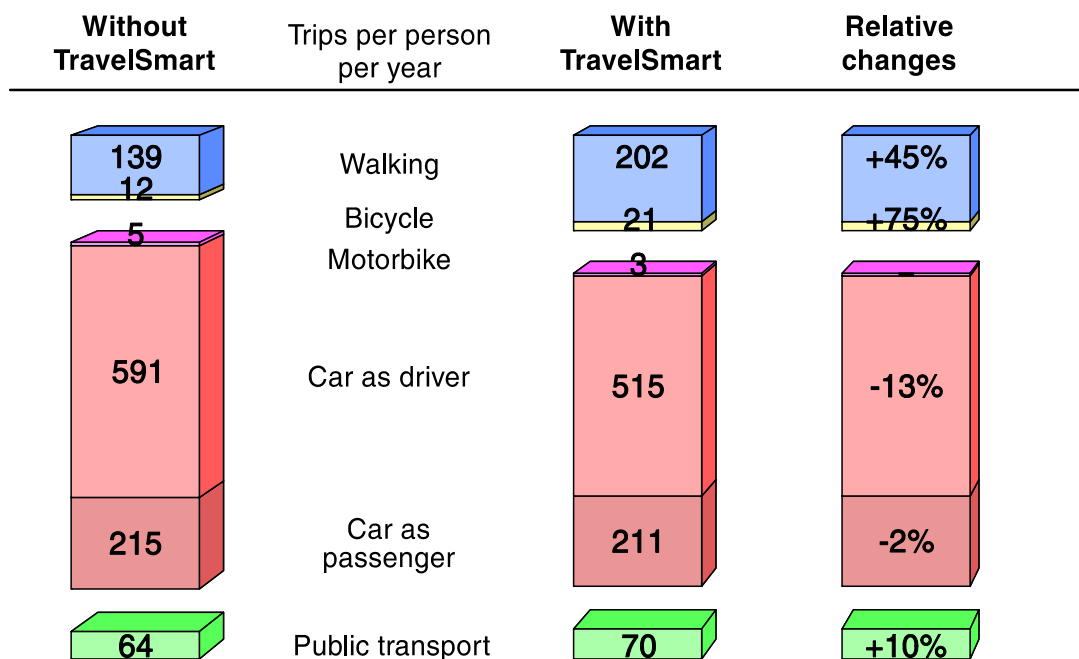


Figure 3.2 expresses the changes in mode choice in terms of trips per person per year and shows the relative changes achieved by the TravelSmart intervention.

The net result was a 13% relative reduction in car as driver trips. This was achieved by switching 76 car driver trips per person per year to other modes, i.e. an average across the target population of around 1.5 trips per person per week.

Among the sustainable travel modes, walking saw the biggest absolute gains with an additional 63 trips per person per year being made on foot, a relative increase of 45%. From lower baseline levels, cycling and public transport also increased, by 75% and 10% respectively.

Figure 3.2 Changes in trips by main mode (trips per person/year)



As shown in Figure 3.3, the TravelSmart campaign had no effect on the number of trips or activities undertaken per person per day. However there were slight reductions in daily travel time and distances travelled for day-to-day trips, suggesting that the modal shift from car to other modes was accompanied by a substitution of some longer journeys by more local travel.

Figure 3.3 Changes in personal mobility (per person/day)

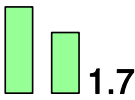
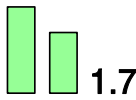


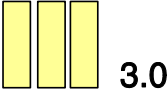
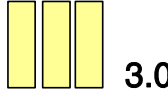


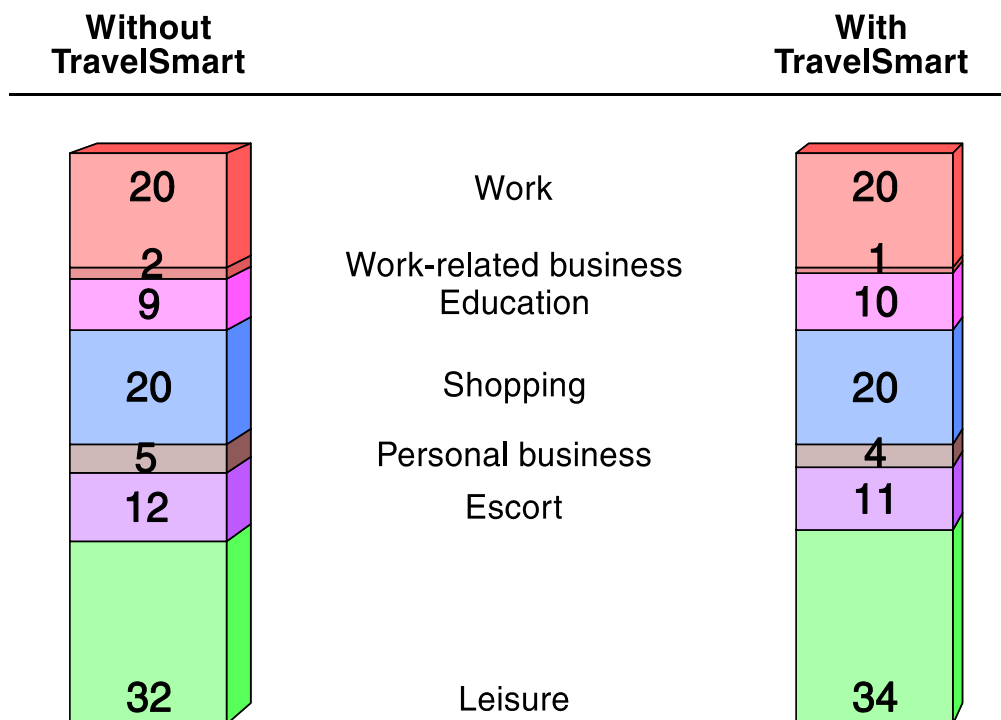
Without TravelSmart	Per person/day	With TravelSmart
	ACTIVITIES	
	TRAVEL TIME (min)	
	TRIPS	
	DISTANCE (km)	

Figure 3.4 provides an analysis of trips by purpose, without and with TravelSmart. This shows that ITM had little effect on the type of trips being undertaken by residents. The proportion of commuting trips remained constant at one fifth of all trips, with shopping and leisure remaining the largest trip generators, accounting for around half of all trips.

Figure 3.4 Changes in trip purpose (%)



An examination of car use reinforces the reduction in car as driver trips; Figure 3.5 shows reductions in the proportion of cars used per day (79% to 72%), trips (from 2.8 to 2.4), duration of use for day-to-day trips (from 38 to 37 minutes), and distances travelled trips (from 27 km to 24 km). There was no measurable change in average car occupancy, remaining constant at 1.4 people per trip.

Figure 3.5 Changes in car usage (per car per day)

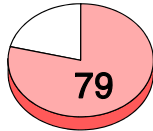
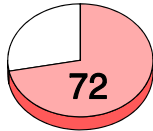
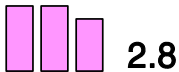
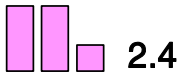




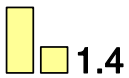
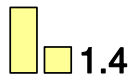
Without TravelSmart	Per (private) car/day	With TravelSmart
	USAGE (%)	
	TRIPS	
	DURATION (min)	
	DISTANCE (km)	
	OCCUPANCY (per trip)	

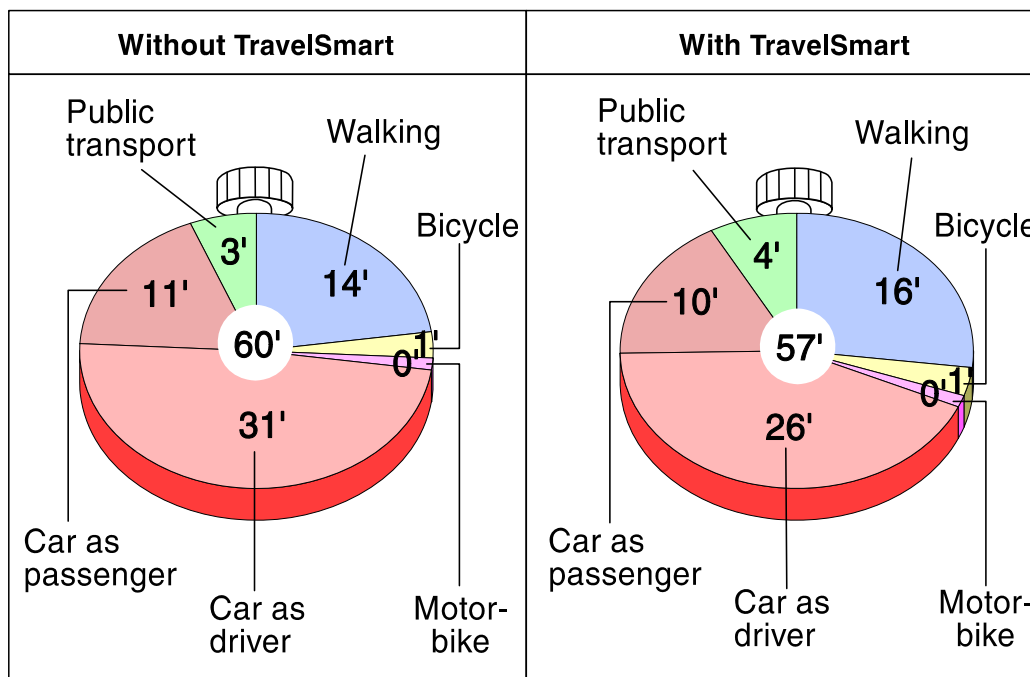
Figure 3.6 shows the changes in car distances travelled for day-to-day trips in more detail. Unexpectedly there was a reduction in the number of cars owned by households in the project area, dropping from 15,000 to 14,400. The distance travelled per car per day was reduced from 26.5 to 23.9 km, resulting in a net saving of 18.2 million car km per year (relative reduction of 13%).

Figure 3.6 Changes in car distances travelled

Without TravelSmart		With TravelSmart
15,000	(Private) Cars in total	14,400
26.5	Kilometres per car per day (everyday mobility)	23.9
135.6 m	Total kilometres per year (341 days) in mio	117.4 m
	Reduction (km per year)	-18.2 m
	Relative reduction	-13%

Figure 3.7 shows the total time spent travelling per person per day by mode, without and with TravelSmart. This analysis includes all trip stages eg walking to a bus stop or from car park to final destination. It shows that while total daily travel time was relatively constant, there was a small increase in the time spent walking, from 14 to 16 minutes. Overall, time spent travelling by active travel modes (i.e. walking and cycling) increased from 15 to 17 minutes per person per day.

Figure 3.7 Changes in travel time by mode (min per person per day)



Over the course of a year, the effect of TravelSmart would be to increase the total exposure to active travel from 88 to 99 hours per person (see Figure 3.8). This 13% increase is likely to make a significant contribution to increasing overall levels of physical activity amongst the target population.

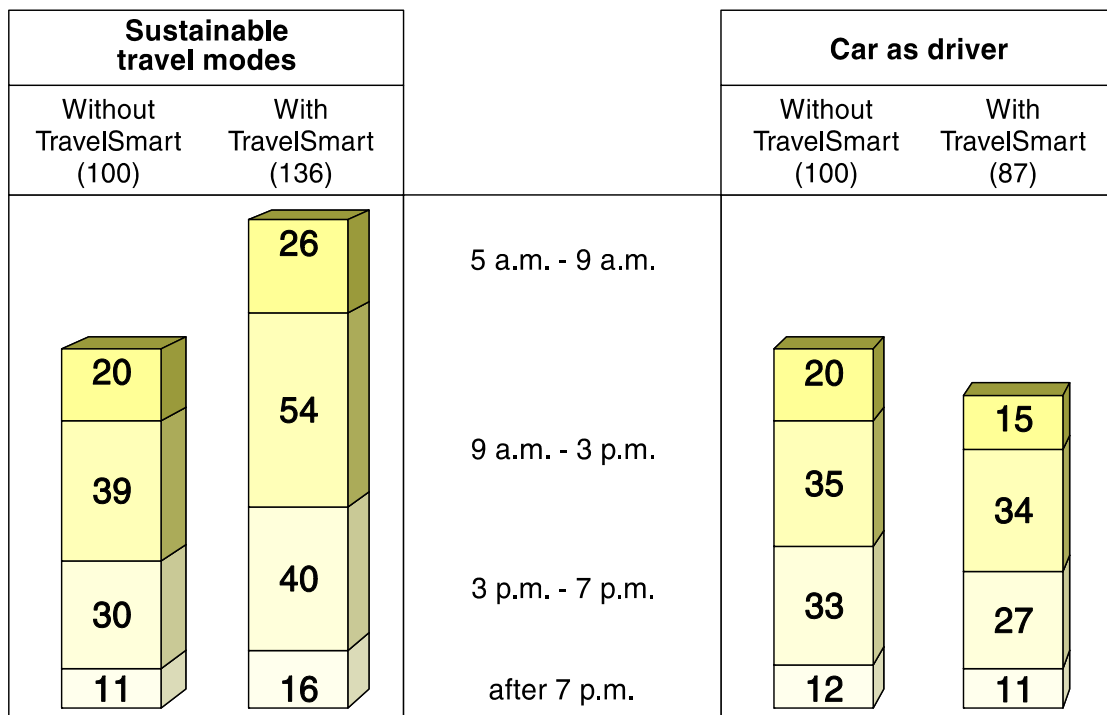
Figure 3.8 Changes in total active travel time (hrs per person per year)

	Without TravelSmart	With TravelSmart	Change (hours)	Relative change
Hours per person per year	88	99	+11	+13%

The following three charts show how the increases in use of sustainable travel modes and the reductions in car driver trips achieved by TravelSmart were distributed by time of day, age and gender groups and trip purpose. For the purposes of this analysis, trips by sustainable travel modes (walking, cycling and public transport) are aggregated and compared with car driver trips. TravelSmart resulted in an overall 36% increase in use of sustainable travel modes for all trip purposes (increasing from a set baseline of 100 to 136). The overall reduction in car driver trips of 13% is shown by the change from a baseline of 100 to 87.

Figure 3.9 shows that the greatest relative reductions in car driver trips occurred before 9am and between 3pm and 7pm, i.e. at peak hours. Although significant growth occurred at all times of the day, the greatest relative increases in use of sustainable travel modes also occurred between 9am and 3pm, and between 3pm and 7pm. The results of this analysis demonstrate that TravelSmart contributes to reducing traffic at peak hours as well as increasing active travel at all times of the day.

Figure 3.9 Changes in mode choice by time of day (%)



The distribution of travel behaviour change by age and gender achieved by TravelSmart is shown in Figure 3.10. Increases in walking, cycling and use of public transport were measured throughout the age and gender groups, with the most significant relative growth occurring in women and men aged between 20 and 59. The greatest relative reduction in car driver trips was among people over 60 followed by women aged between 20 and 59.

Figure 3.10 Changes in mode choice by age and gender (%)

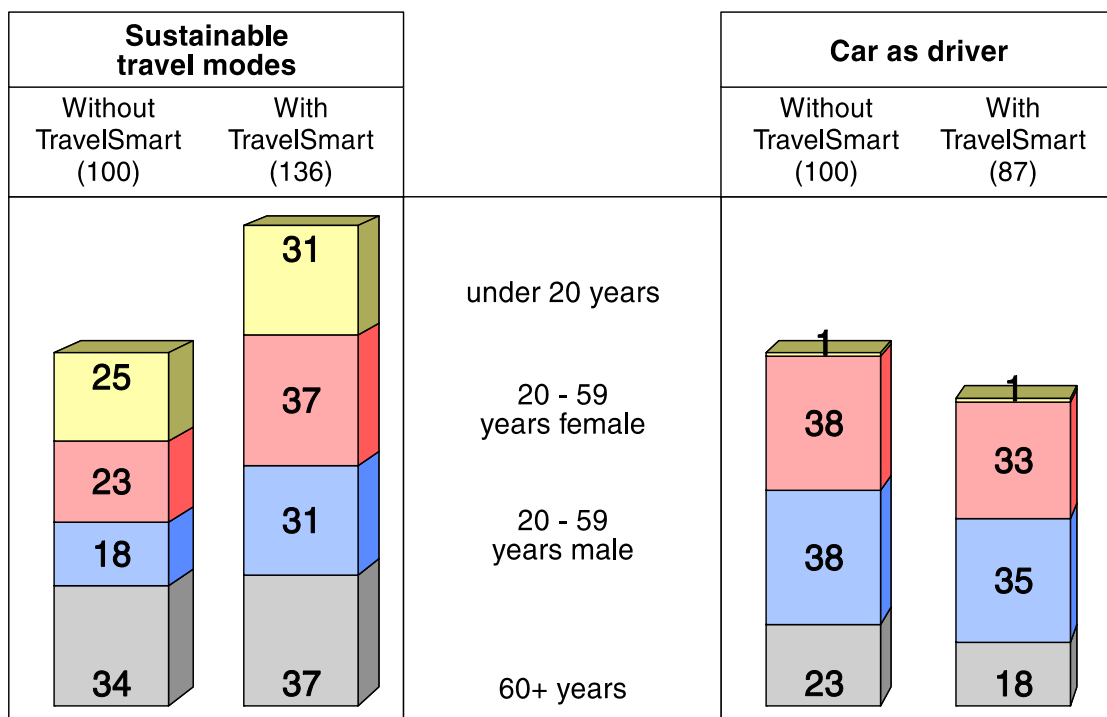
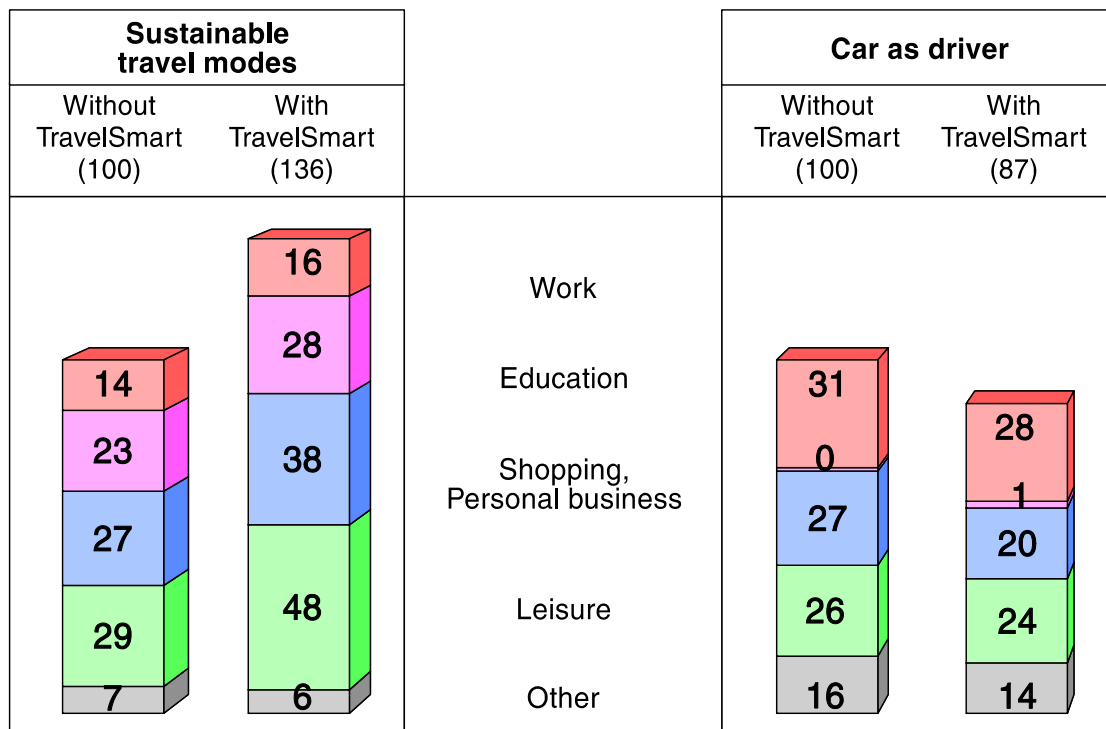


Figure 3.11 shows the effect on mode choice for different types of trips. The greatest relative reductions in car use were for shopping and personal business, but reductions were observed across all trip purposes except education. The greatest relative increases in sustainable travel modes were for leisure journeys followed by shopping and personal business, and work.

Figure 3.11 Changes in mode choice by trip purpose (%)



3.3 CO₂ reductions

The evaluation provides for an estimate of the annual reductions in CO₂ emissions accrued as a result of Stage 1.1 of the TravelSmart programme. Based on a UK fleet average emission factors⁸, the reduction of 18 million car kilometres (Figure 3.7) would result in annual savings of 3,800 tonnes of CO₂.

Figure 3.12 CO₂ reductions

Reduction in car kilometres (per year)	18m
Reduction in CO₂ emissions	3,800 tonnes

⁸ 207.5 g CO₂ per vehicle km, from: Guidelines to DEFRA's GHG Conversions Factors for Company Reporting, DEFRA 2007

4 CONCLUSIONS

The following key conclusions can be drawn from this evaluation:

- There is robust evidence that Stage 1.1 of the Lancashire TravelSmart programme (South Ribble) achieved significant changes in travel behaviour among the target population of 10,713 households.
- Analysis of the data from the baseline and interim travel behaviour surveys shows a 13% relative reduction in car driver trips across the Stage 1.1 target population. This was equivalent to a reduction of 76 car driver trips per person per year across the target population, or nearly one and a half trips per person per week.
- This reduction was generated by significant relative increases in levels of walking (45%), cycling (75%) and public transport use (10%). In absolute terms, the most significant contribution to this change was made by the growth in walking, which gained 63 trips per person per year.
- The reductions in car use were higher during the morning and afternoon 'peaks', suggesting that TravelSmart makes a significant contribution to reducing traffic congestion. Furthermore, the resulting 13% reduction in car distances travelled for day-to-day trips (equivalent to 18.2 million km per year) will generate a substantial cut in CO₂ and other vehicle emissions.
- The reported modal shift resulted in a 13% increase in daily use of active travel modes (walking and cycling) across the target population, either as main travel mode or as linking mode in a car or public transport trip
- These results show that the positive responses from the local community to Stage 1.1 of the TravelSmart programme in South Ribble (which resulted in a total of more than 43,500 items of information, rewards and incentives being delivered to 4,275 households) were translated into significant behavioural change.
- These outcomes, and the experience gained by all project partners in achieving them, provide a solid foundation for the remainder of the Lancashire TravelSmart programme.

ANNEX A: CONCEPT OF EVALUATION

1 Travel behaviour surveys

To prove the effects of Stage 1.1 the Individualised Travel Marketing (ITM) programme in South Ribble behavioural travel surveys were conducted to measure the change achieved in travel behaviour. The surveys used the New KONTIV[®]-design, a self-administered mail-back survey technique with follow-up by post and telephone.

The survey concept was planned as ‘before’ and ‘after’ surveys, each approaching the ITM target group and a control group not approached in the marketing intervention. As before the baseline survey was used covering both the ITM stage 1.1 target area as the rest of the city as control area.

The after surveys were cross-sectional surveys based on independent randomly drawn samples of households in the target area (South Ribble) and the rest of the city.

Table 1 shows the dates, response rates and net sample sizes for each of the surveys.

Table 1: Survey Data

	Survey date	Response rate	Net sample
			Persons
TARGET GROUP			
Before survey	March - April 2006	69 %	706
After survey	Jan. - March 2007	72 %	634
CONTROL GROUP			
Before survey	March - April 2006	64 %	1,290
After survey	Jan. - March 2007	70 %	409

The survey samples ensure an acceptable level of statistical significance in the key outcomes presented (see Section 3 of this Annex). However the evaluation also includes a weighting procedure to ensure the response behaviour of the target group sample is representative of that found in the ITM target population as a whole. To provide the correct basis for comparison the distribution of the ITM groups ('I', 'R' and 'N' and non-respondents) in the survey sample is adjusted to that found during the contact phase of the ITM campaign. Furthermore a weighting (based on gender / age) was applied for the after survey using the before survey as given distribution.

2 Control group effects

The changes in mode choice are the central indicators for the success of an ITM campaign. To separate the effect of ITM from other influences, a survey design with a control group was applied. Both the target group and the control group were surveyed before and after the campaign.

Table 2 shows findings of the before (= baseline survey). The first step is a disaggregation of the baseline survey data for the ITM area (South Ribble = Target Group) and Preston (= Control Group)

Table 3 shows the before and after results for the Target Group. Before the ITM campaign, 14 % of all trips were made (exclusively) on foot, 2 % by bicycle, 1 % with a motorbike, 55 % with car-as-driver, 23 % with a car-as-passenger and 5 % with public transport. After the campaign the share of walking had risen to 20 %, cycling was the same (2 %) whereas the share of car drivers decreased to 50 %. Car passenger decreased and public transport increased each by 2 %-points.

Table 2: Mode Choice Before – Target and Control Group

	BEFORE	
	ITM area (South Ribble) %	Control area (Preston) %
Walking	14	23
Bicycle	2	2
Motorbike	1	0 ⁾
Car as driver	55	43
Car as passenger	23	22
Public transport	5	10
TOTAL	100	100

⁾ less than 0.5 %

Table 3: Mode Choice (%) – Target Group

	TARGET GROUP	
	Before %	After %
Walking	14	20
Bicycle	2	2
Motorbike	1	0 ⁾
Car as driver	55	50
Car as passenger	23	21
Public transport	5	7
TOTAL	100	100

⁾ less than 0.5 %

The mode choice can also be shown in trips per person per year. An average person of the Target Group undertakes in the before survey 1,026 trips per year (on 341 days at place of residence). 139 out of these trips are made on foot, 12 with a bicycle, 591 with a car as driver, etc.

Table 4: Mode Choice (trips per person per year) – Target Group

	TARGET GROUP	
	Before	After
	Trips per person per year	
Walking	139	202
Bicycle	12	21
Motorbike	5	3
Car as driver	591	515
Car as passenger	215	211
Public transport	64	70
TOTAL	1,026	1,022

However the changes between before and after are not necessarily the effects of the ITM campaign. To determine other influencing factors (seasonal and external influences), the concept of a control group, which was not exposed to the ITM campaign, was used.

Before the IndiMark® campaign in the control group (= Preston) 23 % of all trips were made (exclusively) on foot, 43 % with cars as driver and 23 % with a car as passenger. Public transport accounted for 10 % and cycling for 2 %. After there were slight increases in car as driver and public transport use and slight decreases in walking, cycling and car as passenger.

Table 5: Mode Choice – Control Group

	CONTROL GROUP	
	Before %	After %
Walking	23	22
Bicycle	2	1
Motorbike	0 ⁾	0 ⁾
Car as driver	43	45
Car as passenger	22	20
Public transport	10	12
TOTAL	100	100

⁾ less than 0.5 %

These changes in the control group have to be taken in account when the reference for the situation ‘with ITM’ is established. The observed changes for the control group between before and after would also have been to be expected in the target group. Comparing before and after on the basis of trips per person per year, a ‘transfer factor’ is derived (Table 6). And with this transfer factor the before of the target group is adapted (Table 7). So not the ‘before’ situation of the target group is the reference for determining ITM effect but the ‘before’ corrected by the control group effects (‘without ITM’).

The fact that the chosen control group Preston urban area differs in its behaviour (less car-oriented) from South Ribble does not impact its validity as a control group significantly as the transfer factors are based on changes between before and after and not on the differences in the modal split.

Table 6: Mode Choice – Control Group (trips per person per year)

	CONTROL GROUP		Transfer Factor
	Before	After	
Walking	228	219	0.961
Bicycle	20	15	0.750
Motorbike	3	3	1.000
Car as driver	432	452	1.046
Car as passenger	225	202	0.897
Public transport	103	119	1.155
TOTAL	1,011	1,010	

Table 7: Mode Choice – Target Group (trips per person per year)

	TARGET GROUP		
	Before		Before
Walking	145	0.961	139
Bicycle	16	0.750	12
Motorbike	5	1.000	5
Car as driver	565	1.046	591
Car as passenger	240	0.897	215
Public transport	55	1.155	64
TOTAL	1,026		1,026

This shows that following the after survey there would have been without ITM 139 walking trips per person per year, 12 bicycle trips, 591 trips with the car as driver and 215 trips as passenger, and 64 public transport trips. The true changes due to ITM can then be measured.

Table 8 shows the findings of the after survey (“with ITM”). In the target group 20 % of all trips were now made (exclusively) on foot, 2 % by bicycle, less than 0,5 % with a motorbike, 50 % with car-as-driver, 21 % with a car-as-passenger and 7 % with public transport.

Compared to ‘without ITM’ the share of walking trips had risen from 14 to 20 %, the share of the bicycle stayed at 2 % and public transport trips increased from 6 to 7 % whereas the share of car drivers decreased from 57 to 50 %.

Table 8: Mode Choice – Target group

	Without ITM %	With ITM %
Walking	14	20
Bicycle	1	2
Motorbike	1	0 ⁾
Car as driver	57	50
Car as passenger	21	21
Public transport	6	7
TOTAL	100	100

⁾ less than 0.5 %

The mode choice can also be shown again in trips per person per year (Table 9). An average person undertakes without ITM 1,026 trips per year and with ITM 1,022 trips.

Out of these for 139 trips walking was the means of transport “without ITM” compared to 202 walking trips “with ITM”. Cycling increased from 12 to 21

trips per person per year, public transport from 64 to 70 trips. Whereas the car use as driver decreased from 591 to 515 trips and car as passenger from 215 to 211 trips.

Table 9: Mode Choice – Target Group

Trips per person per year	Without ITM	With ITM
Walking	139	202
Bicycle	12	21
Motorbike	5	3
Car as driver	591	515
Car as passenger	215	211
Public transport	64	70
TOTAL	1,026	1,022

This leads to a change in trips per person per year and to relative changes (Table 10).

Table 10: Mode Choice – Change

Trips per person per year		Relative change %
+63	Walking	+45
+9	Bicycle	+75
-2	Motorbike	n. a.
-76	Car as driver	-13
-4	Car as passenger	-2
+6	Public transport	+10

The walking trips per person per year increased by 63 (+45 %). This is the greatest increase in number of trips. The bicycle increased by +9 trips (+75 %) and public transport by +6 (+10 %).

ITM resulted in a decrease in use of the car of 76 car driver trips per person and year (-13 %).

So the ITM campaign has reduced the car use by 13 % and increased the share of sustainable travel modes walking (+45 %), cycling (+75 %) and public transport (+10 %).

3 Statistical Significance of the Changes in Mode Choice

Concerning the statistical significance of the changes in mode choice, expert opinions differ whether this test should be based on persons or trips. For that reason the following test was implemented for both persons and trips. The statistical significance of change in mode choice is located between the results of these two tests. Basis for the test are independent samples before and after.

Share of car as driver

Persons

The following test can be performed. The zero-hypothesis and the alternative-hypothesis are:

$$H_0: P_1 \leq P_2$$

$$H_1: P_1 > P_2$$

P_1 = share of car as driver without ITM

P_2 = share of car as driver with ITM

The zero-hypothesis postulates that the car share with ITM is not lower than without ITM. If this zero-hypothesis can be rejected, there is an impact of ITM on the reduction of the car share.

The share of car as driver without (57 %) and with ITM (50 %) and the number of observed persons are the input (before: $n_1 = 706$; after: $n_2 = 634$).

For the test value following formula exists:

$$T = \frac{P_1 - P_2}{\sqrt{\frac{P_1(1-P_1)}{n_1} + \frac{P_2(1-P_2)}{n_2}}} =$$

$$= \frac{0.072}{\sqrt{0.0007}} = 2.6439$$

Test-decision:

$$\varphi(y, y) = \begin{cases} 1 & \text{if } T < z_a \\ 0 & \text{other} \end{cases}$$

$z_{0.001} = 2.326$ (critical value for a level of significance of 99.0 %).

It follows that based on this test the zero-hypothesis (no decrease of the share of car as driver after) can be rejected with a probability of over 99 %.

Trips

For testing on the basis of trips, the same test can be performed.

The zero-hypothesis and the alternative-hypothesis are:

$$H_0: P_1 \leq P_2$$

$$H_1: P_1 > P_2$$

P_1 = share of car as driver without ITM

P_2 = share of car as driver with ITM

The zero-hypothesis postulates that the car-share with ITM is not lower than without ITM. If this zero-hypothesis can be rejected, there is an impact of ITM on the reduction of the car-share.

The calculation is done as t-test for independent samples. The share of car as driver without (57 %) and with ITM (50 %) and the number of observed trips are the input (before: $n_1 = 2,191$; after: $n_2 = 1,1902$).

For the test value following formula exists:

$$T = \frac{P_1 - P_2}{\sqrt{\frac{P_1(1-P_1)}{n_1} + \frac{P_2(1-P_2)}{n_2}}} =$$

$$= \frac{0.072}{\sqrt{0.0002}} = 4.6160$$

Test-decision:

$$\varphi(y, y) = \begin{cases} 1 & \text{if } T < z_\alpha \\ 0 & \text{other} \end{cases}$$

$z_{0.01} = 2.326$ (critical value for a level of significance of 99 %).

It follows that the zero-hypothesis (no decrease of the share of car as driver after) can be rejected with a probability of more than 99 %. The reduction of car usage achieved by the ITM campaign is statistically highly significant.

So the significance tests performed produced a significance level of more than 99 % both based on persons and on trips. These values alone prove definite reductions in car use.

Table 8: Overview of significance tests for car reduction

	Persons	Trips
Level of significance	> 99 %	> 99 %

Share of environmentally friendly modes

Again the statistical significance of the changes in mode choice was also tested for the achieved increase of the share of environmentally friendly modes (EFM = walking, bicycle, public transport).

Persons

The following test can be performed. The zero-hypothesis and the alternative-hypothesis are:

$$H_0: P_1 \geq P_2$$

$$H_1: P_1 > P_2$$

P_1 = share of EFM without ITM

P_2 = share of EFM with ITM

The zero-hypothesis postulates that the EFM share without ITM is larger than or equal as with ITM. If this zero-hypothesis can be rejected, there is an impact of ITM on the increase of the EFM share.

The surveys of before and after are two independent samples. The calculation is done as a t-test for independent samples.

The share of EFM without (21 %) and with ITM (29 %) and the number of observed persons are the input (before: $n_1 = 706$; after: $n_2 = 634$).

For the test value following formula exists:

$$T = \frac{P_1 - P_2}{\sqrt{\frac{P_1(1-P_1)}{n_1} + \frac{P_2(1-P_2)}{n_2}}} =$$

$$= \frac{-0.077}{\sqrt{0.0006}} = -3.2623$$

Test-decision:

$$\varphi(y, y) = \begin{cases} 1 & \text{if } T < z_a \\ 0 & \text{other} \end{cases}$$

$z_{0.001} = 2.326$ (critical value for a level of significance of 99 %).

It follows that based on this test the zero-hypothesis (no increase of the share of EFM after) can be rejected with a probability of over 99 %. The increase of EFM usage achieved by the EFM campaign is statistically highly significant.

Trips

For testing on the basis of trips, the same test can be performed. The zero-hypothesis and the alternative-hypothesis are:

$$H_0: P_1 \geq P_2$$

$$H_1: P_1 > P_2$$

P_1 = share of EFM before ITM

P_2 = share of EFM after ITM

The zero-hypothesis postulates that the EFM share without ITM is larger than or equal as with ITM. If this zero-hypothesis can be rejected, there is an impact of ITM on the increase of the EFM share.

The calculation is done as t-test for independent samples. The share of EFM without ITM (21 %) and with ITM (29 %) and the number of observed trips are the input (before: $n_1 = 2,191$; after: $n_2 = 1,902$).

For the test value following formula exists:

$$T = \frac{P_1 - P_2}{\sqrt{\frac{P_1(1-P_1)}{n_1} + \frac{P_2(1-P_2)}{n_2}}} =$$

$$= \frac{-0.077}{\sqrt{0.0002}} = -5.6956$$

Test-decision:

$$\varphi(y, y) = \begin{cases} 1 & \text{if } T < z_a \\ 0 & \text{other} \end{cases}$$

$z_{0.01} = 2.326$ (critical value for a level of significance of 99 %).

It follows that the zero-hypothesis (no increase of the share of EFM after) can be rejected with a probability of over 99 %. The increase of EFM usage achieved by the ITM campaign in target area is statistically highly significant.

So the significance tests performed produced a significance level of more than 99 % both based on persons and on trips.

Table 9: Overview of significance tests for EFM increase

Level of significance	Persons	Trips
	> 99 %	> 99 %

These values are proving definitely an increase of the use of environmentally friendly modes by ITM stage 1.1 in South Ribble.