Socialdata

sustrans
JOIN THE MOVEMENT

Lancashire TravelSmart Programme

Interim Evaluation of Stage 2.1 (Torrisholme)

Report for Lancashire County Council

September 2007

Socialdata

sustrans
JOIN THE MOVEMENT

CONTENTS

1	**INTRODUCTION**	**1**
1.1	**This report**	**1**
1.2	**Background**	**1**
1.3	**Aims & objectives**	**3**
1.4	**Other evaluation**	**3**
2	**SURVEY METHOD**	**4**
2.1	**Survey design**	**4**
2.2	**Sampling strategy**	**4**
2.3	**Survey procedure**	**5**
2.4	**Survey implementation**	**6**
3	**ANALYSIS AND RESULTS**	**8**
3.1	**Introduction**	**8**
3.2	**Changes in travel behaviour**	**9**
3.3	**CO2 reductions**	**19**
4	**CONCLUSIONS**	**20**

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 2.1 of Lancashire's TravelSmart Individualised Travel Marketing (ITM) programme, conducted in Torrisholme between September and November 2006.

The findings are based on an analysis of data from an interim travel behaviour survey, conducted from the end of January to mid-April 2007 (representing the 'after' case), compared with those of the baseline research programme conducted in spring 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 Lancaster and Morecambe to obtain information on how people travel and the reasons for their mode choice[1].

The first part of the research was a postal survey of household and personal travel behaviour on a net sample of 2,262 people drawn from across the Lancaster urban area[2]. 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.

The second part of the research consisted of a series of in-depth interviews with 334 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).

[1] Separate surveys were conducted at the same time in Preston and South Ribble.

[2] 795 persons in Torrisholme; 775 in Lancaster city; and 692 in Morecambe.

Socialdata and Sustrans reported the findings of this research to Lancashire County Council in July 2006. 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 2.1 of an Individualised Travel Marketing (ITM) campaign, between September and November 2006.

The initial target population consisted of 8,500 private residential households in the Torrisholme, Bare, Skerton, Ryelands, Hest Bank and Halton areas. A total of 6,941 households (82% 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 2.1, more than 36,750 items of information, rewards and incentives were packed and delivered to 3,436 households in the target area. A total of 93 home visits were also 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 2.1 of the TravelSmart ITM programme.

The specific objectives were to:

- Undertake an interim travel behaviour survey on a net sample of 500 persons from the TravelSmart target group (Torrisholme) and a further 250 from the rest of Lancaster and Morecambe (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 have recommended 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 the Lancaster and Preston urban area in spring 2006. This design has been developed over many years by Socialdata and applied successfully in travel behaviour research and the evaluation of Individualised Marketing 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 trips[3] 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 rest of Lancaster and Morecambe (as a control group). This allowed the analysis to take into account any external influences on travel behaviour across the district, e.g. other programmes such as Celebrating Cycling, changes in the weather (including seasonal effects), major events affecting the highway network.

[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.

- 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 and without available telephone records. 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

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 January and 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 (Torrisholme)**	**Control group (Lancaster & Morecambe)**
Mail-out Gross	1,700	1,100	600
Sample loss[4] *)	153	94	59
Adjusted gross sample	1,547	1,004	541
Returns persons	**841**	**561**	**280**
Response rate in %	**54%**	**56%**	**52%**
(Contract persons)	750	500	250

As the target group for the TravelSmart programme in Lancaster and Morecambe included households with and without known telephone details, the samples for both the baseline and the interim surveys also included telephone and non-telephone households. Table 2.2 below shows the response rates etc for these two sub-samples in the interim survey.

[4] Sample loss: Moved away; deceased etc.

Table 2.2 Implementation of interim survey

	TOTAL	**With Telephone**	**Without Telephone**
Mail-out Gross	1,700	600	1,100
Sample loss	153	32	121
Adjusted gross sample	1547	568	979
Returns persons	**841**	**405**	**434**
Response rate in %	**54%**	**71%**	**45%**
(Contract persons)	750		

These response rates are comparable to those achieved during the baseline research programme, providing an excellent indicator of the willingness 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 mode[5];
- 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 TravelSmart 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

[5] 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 in the control area.

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 42% to 36%, 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

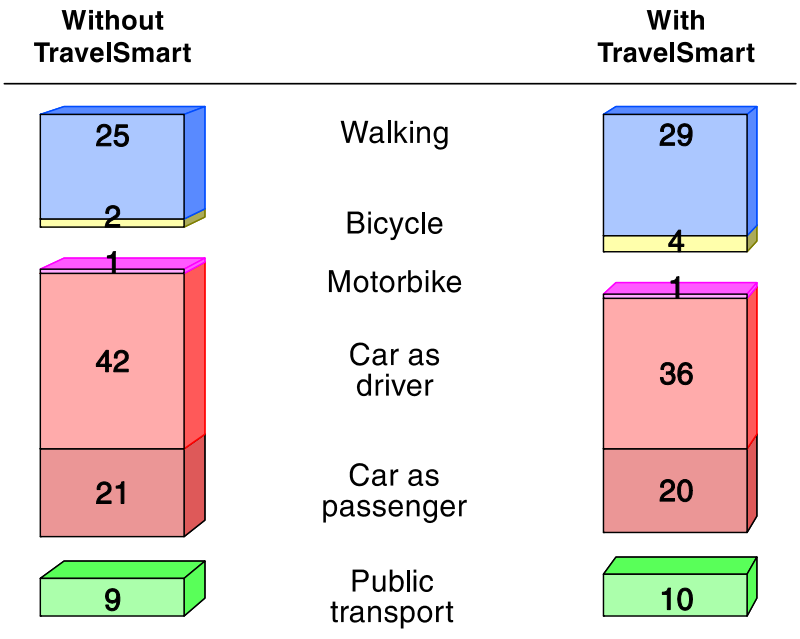
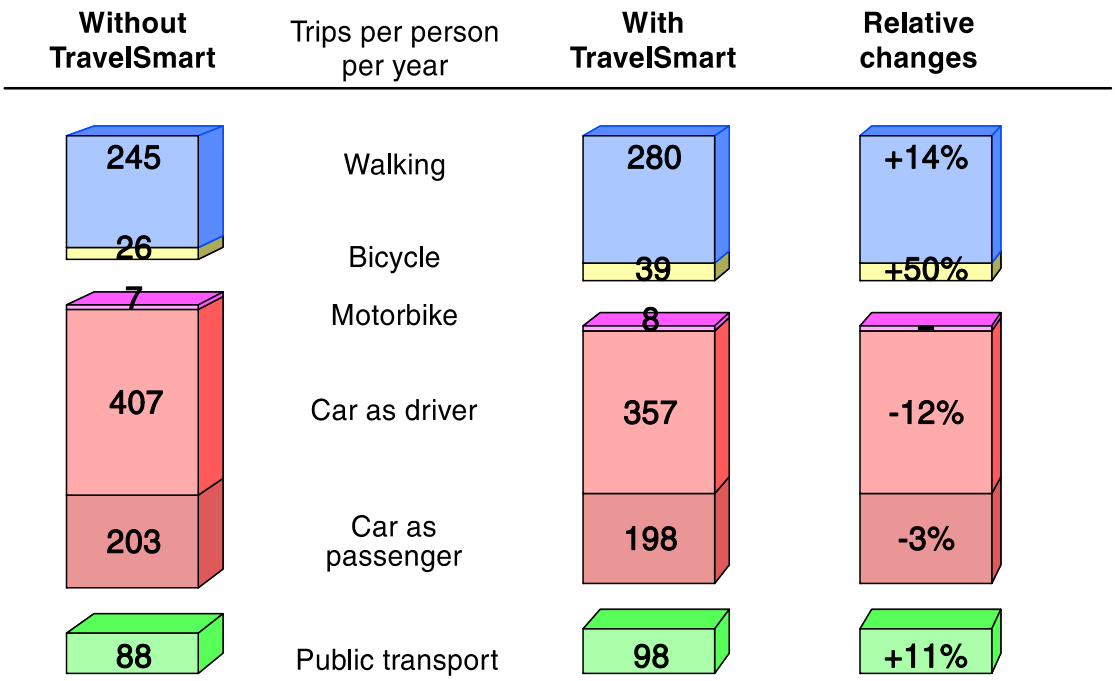


Figure 3.2 expresses the changes in mode choice in terms of trips per person per year and shows the relative changes achieved by the ITM intervention.

The net result was a 12% relative reduction in car as driver trips. This was achieved by switching 52 car driver trips per person per year to other modes, ie an average across the target population of just one trip per person per week.

Among the sustainable travel modes, walking saw the biggest absolute gains with an additional 35 trips per person per year being made on foot, a relative increase of 14%. From lower baseline levels, cycling and public transport also increased, by 50% and 11% respectively.

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



As shown in Figure 3.3, there were no significant changes in personal daily mobility as a result of the ITM intervention. This confirms that while ITM clearly influenced how residents travel (see Figure 3.2), it had little or no impact on the number of activities they undertake on a daily basis, their daily travel demand (measured by number of trips and distances travelled), or (despite the shift from car travel to more sustainable modes) on time spent travelling.

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

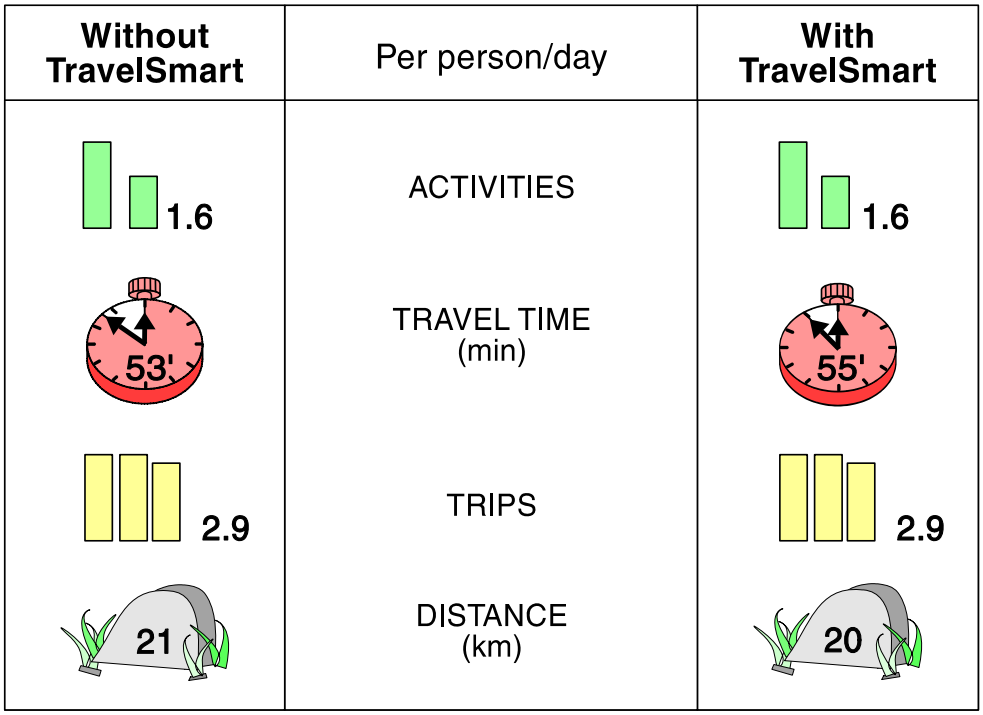
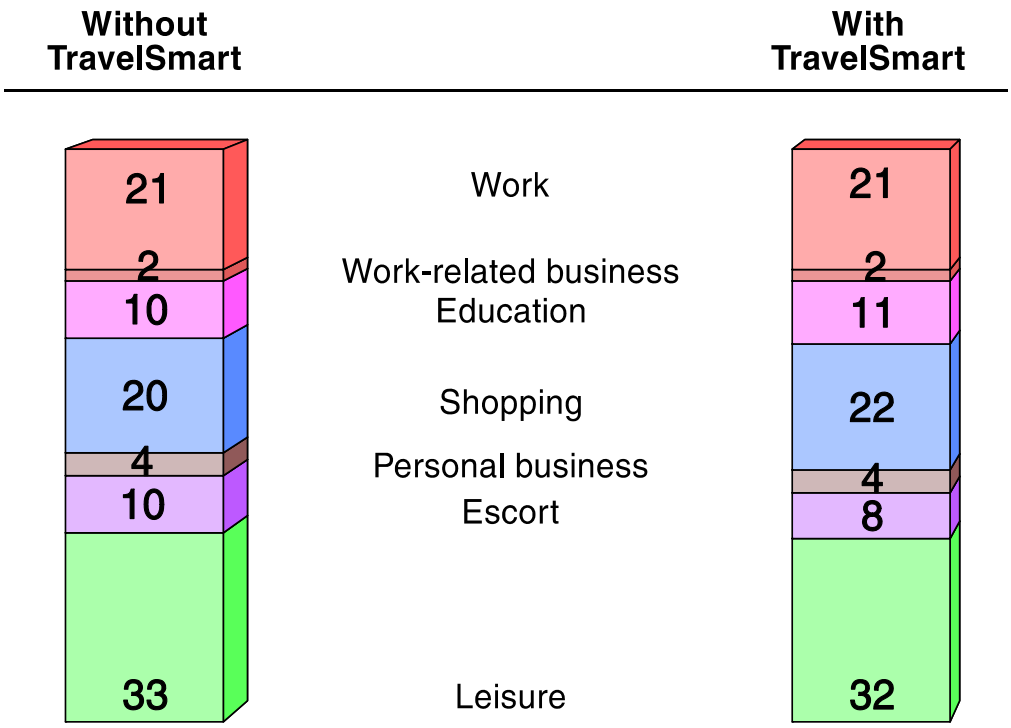


Figure 3.4 provides an analysis of trips by purpose, without and with TravelSmart. This shows that ITM had little effect on the type of trips being undertaken by residents. The proportion of commuting trips remained roughly constant at around one fifth of all trips. Shopping also continued to account for around a fifth of all trips and leisure, the largest trip generator, for roughly a third.

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 (73% to 70%), trips (from 2.0 to 1.8), duration of use for day-to-day trips (from 35 to 32 minutes), and distances travelled (from 18.6 km to 17.8 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/day)

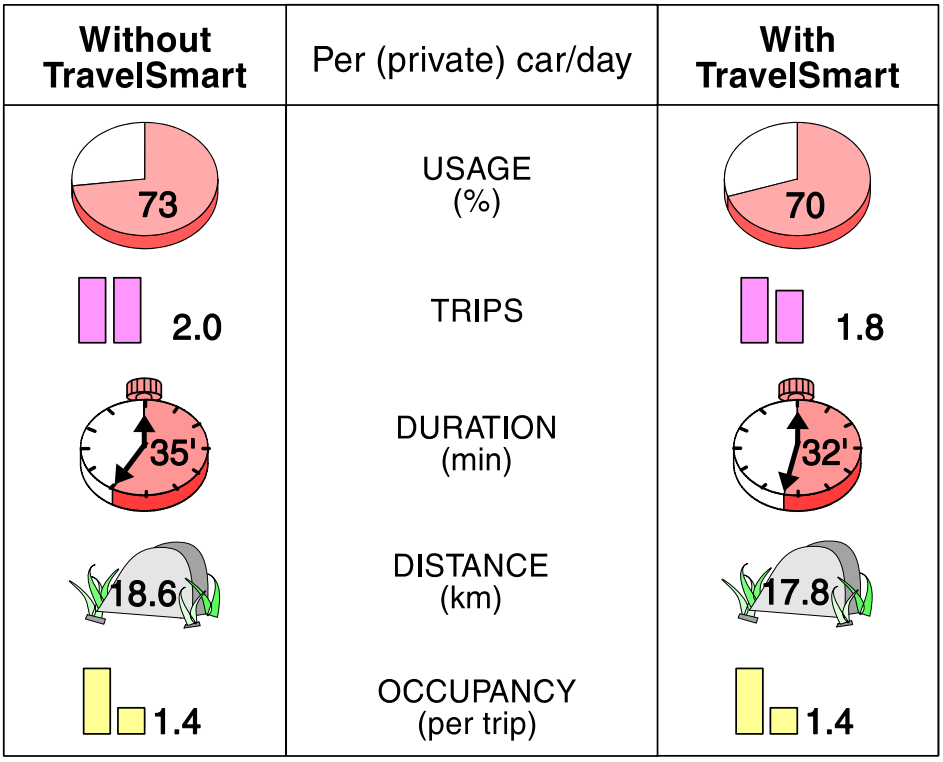


Figure 3.6 shows the changes in car distances travelled for day-to-day trips in more detail. Unexpectedly there was a reduction in the number of cars owned by households in target population, from 11,050 to 10,300. The distance travelled per car per day was reduced from 18.6 to 17.8 km, resulting in a net saving of 7.5 million car km per year (relative reduction of 11%).

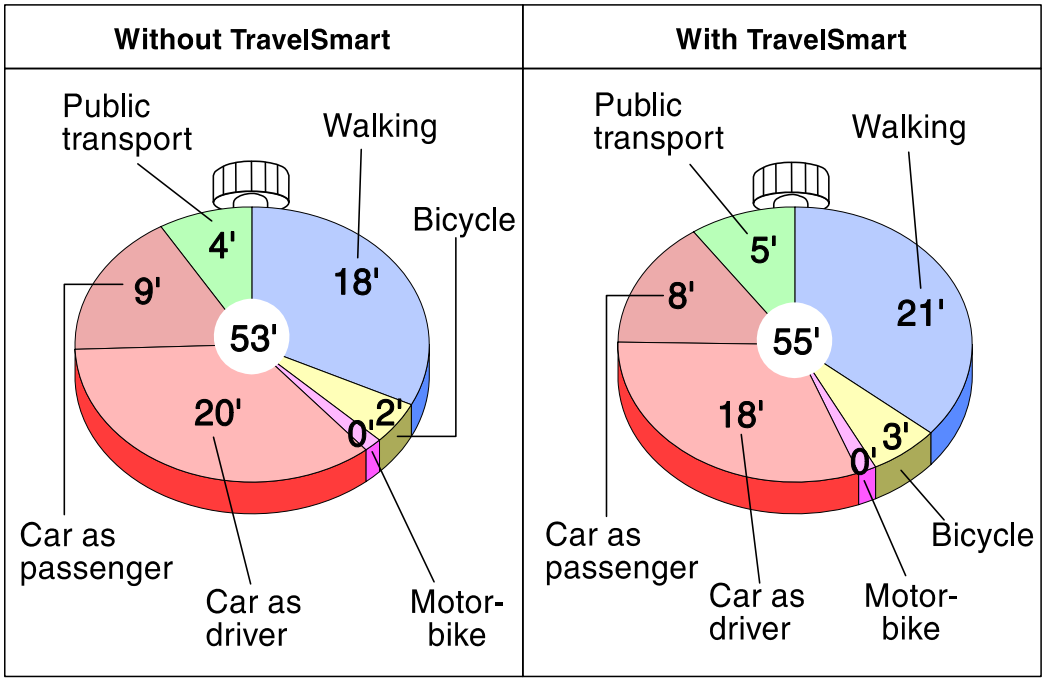
Figure 3.6 Changes in car distances travelled

Without TravelSmart		With TravelSmart
11,050	(Private) Cars in total	10,300
18.6	Kilometres per car per day (everyday mobility)	17.8
70.1 m	Total kilometres per year (341 days) in mio	62.6 m

Reduction (km per year)	-7.5 m
Relative reduction	-11%

Figure 3.7 shows the total time spent travelling per person per day by mode, without and with ITM. This analysis includes all trip stages e.g. 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 an increase in the time spent walking, from 18 to 21 minutes. Overall, time spent travelling by active travel modes (i.e. walking and cycling) increased from 20 to 24 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 ITM would be to increase the total exposure to active travel from 114 to 133 hours per person (see Figure 3.8). This 17% increase is likely to make a significant contribution to increasing overall levels of physical activity amongst the target population.

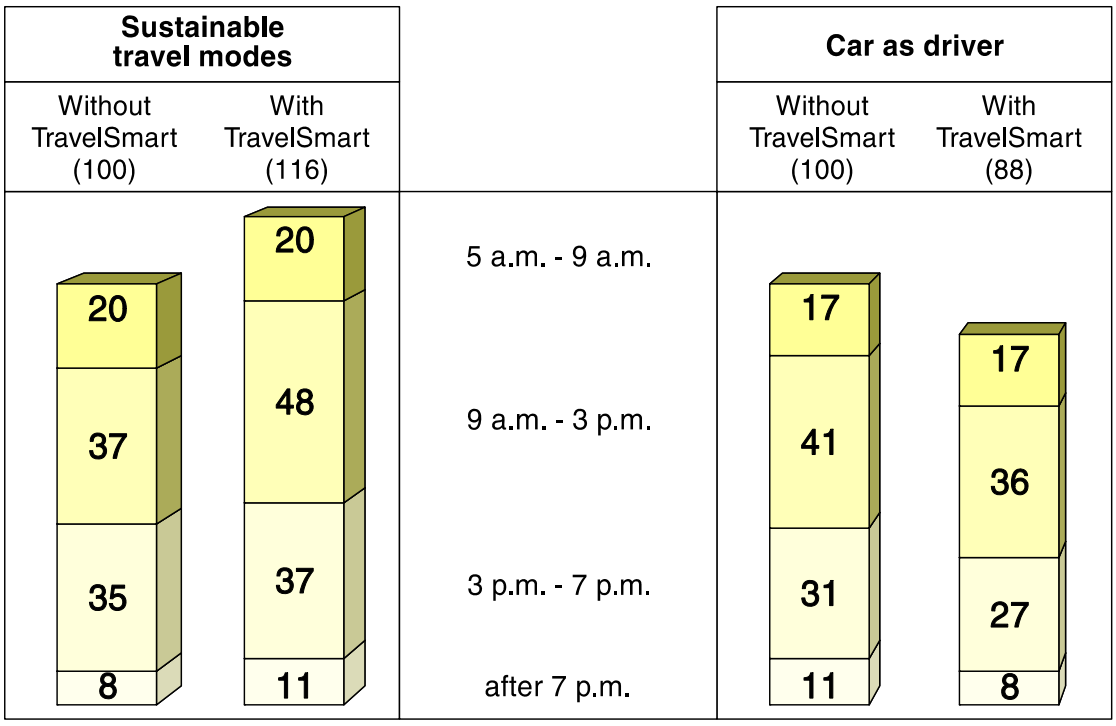
Figure 3.8 Changes in total active travel time (hrs per person per year)

	Without TravelSmart	With TravelSmart	Change (hours)	Relative change
Hours per person per year	114	133	+19	+17%

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 16% increase in use of sustainable travel modes for all trip purposes (increasing from a set baseline of 100 to 116). The overall reduction in car driver trips of 12% is shown by the change from a baseline of 100 to 88.

Figure 3.9 shows that reductions in car driver trips occurred throughout the day, except before 9am. Likewise, usage of sustainable travel modes increased at all times of the day after 9am, but with the greatest relative growth occurring at off-peak times between 9am and 3pm. The results of this analysis confirm that TravelSmart can contribute to reducing traffic congestion as well as increasing active travel at most 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 ITM is shown in Figure 3.10. Increases in walking, cycling and use of public transport were measured throughout all age and gender groups with the most significant relative growth occurring with people above 60, but to a lesser extent among women aged 20-59. The greatest relative reductions in car driver trips were seen among people over the age of 60, followed by men aged 20-59.

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

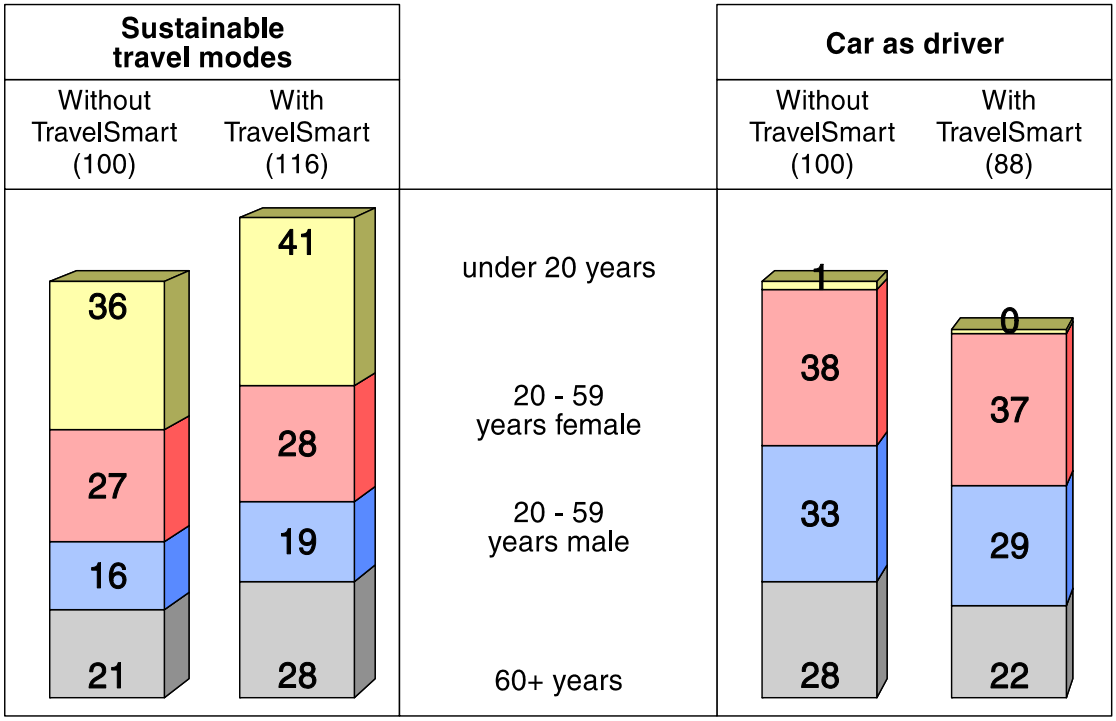
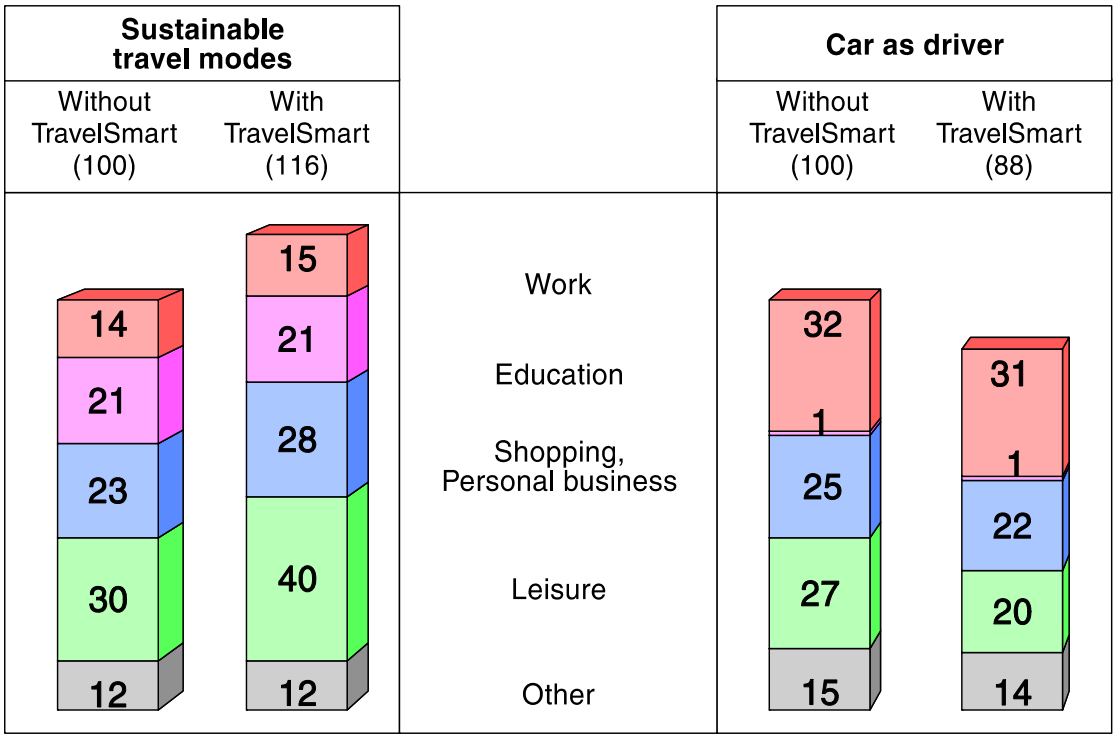


Figure 3.11 shows the effect on mode choice for different types of trips. The greatest relative changes were seen among leisure trips, followed by shopping and personal business.

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



3.3 CO_2 reductions

The evaluation provides for an estimate of the annual reductions in CO_2 emissions accrued as a result of Stage 2.1 of the TravelSmart programme. Based on a UK fleet average factor[6], the reduction of 7.5 million car kilometres (Figure 3.7) would result in annual savings of 1,600 tonnes of CO_2.

Figure 3.12 CO_2 reductions

Reduction in car kilometres (per year)	**7.5m**
Reduction in CO_2 emissions (per year)	**1,600 tonnes**

[6] 207.5 g CO_2 per vehicle km, from: Guidelines to DEFRA's GHG conversion Factors for Company Reporting, DEFRA 2007.

4 CONCLUSIONS

The following key conclusions can be drawn from this evaluation:

- There is robust evidence that Stage 2.1 of Lancashire's TravelSmart programme achieved significant changes in travel behaviour among the target population of 8,500 households.

- Analysis of the data from the baseline and interim travel behaviour surveys shows a 12% relative reduction in car driver trips across the target population in Torrisholme. This was equivalent to a reduction of 52 car driver trips per person per year across the target population, or one trip per week.

- This reduction was generated by significant relative increases in levels of walking (14%), cycling (50%) and public transport use (11%). In absolute terms, the most significant contribution to this change was made by the growth in walking, which gained 35 trips per person per year.

- The reductions in car use were distributed throughout the day (except before 9am, and concentrated among leisure, shopping and personal business trips. This confirms that TravelSmart can make an inportant contribution to tackling traffic congestion while influencing travel choices for a wide range of trips. Furthermore, the resulting 11% reduction in car distances travelled for day-to-day trips (equivalent to 7.5 million km per year) will generate a substantial cut in CO_2 and other vehicle emissions.

- The reported modal shift resulted in an 17% 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 2.1 of the Lancashire ITM programme (which resulted in a total of nearly 37,000 items of information, incentives and rewards being delivered to 3,436 households) were translated into signifcant 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 2.1 the Individualised Travel Marketing (ITM) programme in Lancaster 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 in Torrisholme and a control group in Lancaster and Morecambe not approached in the marketing intervention. As before the baseline survey was used covering both the ITM stage 2.1 target area and Lancaster / Morecambe as control area.

The 'after' surveys were cross-sectional surveys based on independent randomly drawn samples of households in the target area 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	59 %	795
After survey	Jan. - March 2007	56 %	561
CONTROL GROUP			
Before survey	March - April 2006	55 %	1,467
After survey	Jan. - March 2007	52 %	280

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 Individualised Marketing target population as a whole. To provide the correct basis for comparison the distribution of the Individualised Marketing (IndiMark®) 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 and with / without telephone) 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 Individualised Marketing 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 the findings of the before (= baseline) survey. The first step is a disaggregation of the baseline survey data for the ITM area Torrisholme (=Target Group) and the control area (= Lancaster / Morecambe).

Table 2: Mode Choice Before – Target and Control Group

		BEFORE	
BEFORE (Lancaster / Morecambe) %		ITM area (Torrisholme) %	Control area (Lancaster / Morecambe) %
30	Walking	27	31
2	Bicycle	2	2
1	Motorbike	0*)	1
40	Car as driver	41	40
20	Car as passenger	22	18
7	Public transport	8	8
100	TOTAL	100	100

*) less than 0.5 %

Table 3 shows the before and after results for the Target Group. Before the ITM campaign, 27 % of all trips were made (exclusively) on foot, 2 % by bicycle, less than 0.5 % with a motorbike, 41 % with car-as-driver, 22 % with a car-as-passenger and 8 % with public transport. After the campaign the share of walking had risen to 29 %, of cycling to 4 % whereas the share of car drivers decreased to 37 %. Car passenger decreased by 2 %-points and public transport increased by 2 %-points.

Table 3: Mode Choice (%) – Target Group

	TARGET GROUP	
	Before %	After %
Walking	27	29
Bicycle	2	4
Motorbike	0*)	0*)
Car as driver	41	37
Car as passenger	22	20
Public transport	8	10
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 973 trips per year (on 341 days at place of residence). 360 out of these trips are made on foot, 23 with a bicycle, etc.

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

	TARGET GROUP	
	Before	After
	Trips per person per year	
Walking	260	280
Bicycle	23	39
Motorbike	7	8
Car as driver	394	357
Car as passenger	214	198
Public transport	75	98
TOTAL	973	980

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 (Table 5) 31 % of all trips were made (exclusively) on foot, 40 % with cars as driver and 18 % with a car as passenger. Public transport accounted for 8 % and cycling for 2 %. After there were slight increases in cycling, car as driver and public transport and slight decreases in walking and car as passenger.

Table 5: Mode Choice – Control Group

	CONTROL GROUP	
	Before %	After %
Walking	31	29
Bicycle	2	3
Motorbike	1	1
Car as driver	40	41
Car as passenger	18	17
Public transport	8	9
TOTAL	100	100

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').

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

	CONTROL GROUP		
	Before	After	Transfer Factor
Walking	305	287	0.941
Bicycle	25	28	1.120
Motorbike	5	5	1.000
Car as driver	390	403	1.033
Car as passenger	179	170	0.950
Public transport	74	87	1.757
TOTAL	978	980	

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

	TARGET GROUP		
	Before	Transfer factor	Without ITM
Walking	260	0.941	245
Bicycle	23	1.120	26
Motorbike	7	1.000	7
Car as driver	394	1.033	407
Car as passenger	214	0.950	203
Public transport	75	1.157	88
TOTAL	973		976

This shows that following the after survey there would have been without ITM 245 walking trips per person per year, 26 bicycle trips, 407 trips with the car as driver and 203 trips as passenger, and 88 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 29 % of all trips were now made (exclusively) on foot, 4 % by bicycle, 1 % with a motorbike, 36 % with car-as-driver, 20 % with a car as passenger and 10 % with public transport.

Compared to 'without ITM' the share of walking trips had risen from 25 to 29 %, the share of the bicycle from 2 to 4 % and of public transport trips from 9 to 10 % whereas the share of car drivers decreased from 42 to 36 %.

Table 8: Mode Choice – Target group

	Without ITM %	With ITM %
Walking	25	29
Bicycle	2	4
Motorbike	1	1
Car as driver	42	36
Car as passenger	21	20
Public transport	9	10
TOTAL	100	100

The mode choice can also be shown again in trips per person per year. An average person undertakes without ITM 976 trips per year and with ITM 980 trips.

Out of these for 245 trips walking was the means of transport "without ITM" compared to 280 walking trips "with ITM". Cycling increased from 26 to 39 trips per person per year, public transport from 88 to 98 trips. Whereas the

car use as driver decreased from 407 to 357 trips and car as passenger from 203 to 198 trips.

Table 9: Mode Choice – Target Group

Trips per person per year	Without ITM	With ITM
Walking	245	280
Bicycle	26	39
Motorbike	7	8
Car as driver	407	357
Car as passenger	203	198
Public transport	88	98
TOTAL	976	980

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 %
+35	Walking	+14
+13	Bicycle	+50
+1	Motorbike	n. a.
-50	Car as driver	-12
-5	Car as passenger	-3
+10	Public transport	+11

The walking trips per person per year increased by 35 (+14 %). This is the greatest increase in number of trips. The bicycle increased by +13 trips (+50 %) and public transport by +10 (+11 %).

ITM resulted in a decrease in use of the car of 50 car driver trips per person and year (-12 %).

So the ITM campaign has reduced the car use by 12 % and increased the share of sustainable travel modes walking (+14 %), cycling (+50 %) and public transport (+11 %).

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 persons in 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 (42 %) and with ITM (36 %) and the number of observed persons are the input (before: $n_1 = 795$; after: $n_2 = 561$).

For the test value following formula exists:

$$T = \frac{P_1 - P_2}{\sqrt{\frac{P_1(1-P_1)}{n_1} + \frac{P_2(1-P_2)}{n_2}}} = \\ = \frac{0.053}{\sqrt{0.0007}} = 1.9589$$

Test-decision:

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

$z_{0.025} = 1.96$ (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 97.5 %.

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 after is not lower than before. 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 (42 %) and with ITM (36 %) and the number of observed trips are the input (before: n_1 = 2,345; after: n_2 = 1,612).

For the test value following formula exists:

$$T = \frac{P_1 - P_2}{\sqrt{\frac{P_1(1-P_1)}{n_1} + \frac{P_2(1-P_2)}{n_2}}} = \\ = \frac{0.053}{\sqrt{0.0002}} = 2.3385$$

Test-decision:

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

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

It follows that the zero-hypothesis (no 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.

Table 11: Overview of significance tests for car reduction

Level of significance	Persons	Trips
	> 97.5 %	> 99 %

These values alone prove definite reductions in car use.

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, pubic 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 before (36 %) and after ITM (43 %) and the number of observed persons are the input (before: $n_1 = 795$; after: $n_2 = 561$).

For the test value following formula exists:

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

$$= \frac{-0.058}{\sqrt{0.0007}} = -2.1391$$

Test-decision:

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

$z_{0.025}$ = 1.96 (critical value for a level of significance of 97.5 %).

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 97.5 %. 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 (37 %) and with ITM (43 %) and the number of observed trips are the input (before: n_1 = 2,345; after: n_2 = 1,612).

For the test value following formula exists:

$$T = \frac{P_1 - P_2}{\sqrt{\frac{P_1(1-P_1)}{n_1} + \frac{P_2(1-P_2)}{n_2}}} = \\ = \frac{-0.058}{\sqrt{0.0003}} = -3.6455$$

Test-decision:

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

$z_{0.01}$ = 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 12: Overview of significance tests for EFM increase

Level of significance	Persons	Trips
	> 97.5 %	> 99 %

These values are proving definitely an increase of the use of environmentally friendly modes by ITM stage 2.1 in Torrisholme.