



Competitive and Sustainable Growth Programme

VIVALDI Project GRD1 – 2001 - 40060

**VISIONARY & VIBRANT ACTIONS THROUGH LOCAL TRANSPORT
DEMONSTRATION INITIATIVES**

Aalborg • Bremen • Bristol • Kaunas • Nantes



Deliverable 9

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TABLE OF CONTENTS

1	INTRODUCTION	6
1.1	The Purpose of This Report.....	6
1.2	EC Context	6
1.3	The VIVALDI Context	6
1.4	Report Structure	7
2	OVERVIEW OF THE EVALUATION FRAMEWORK.....	9
2.1	The Evaluation Framework	9
2.2	Evaluating the Integrated Packages	9
2.3	The evaluation process	10
2.4	Ex-ante and Ex-post evaluation	13
2.5	Evaluation Objectives.....	15
2.6	The METEOR Impact Areas and Core Indicators.....	15
2.7	Impacts and Indicators for the Integrated Packages	17
	MEASURE LEVEL EVALUATION	18
2.8	Overview of Measures.....	18
2.9	Project Evaluation Results.....	20
2.9.1	Aalborg – Car Sharing (9.1)	21
2.9.2	Aalborg – Bus Priority and RTPI (12.3).....	29
2.9.3	Bremen – CNG Fleet.....	40
2.9.3.1	<i>Bremen - Clean and efficient vehicles (5.2)</i>	40
2.9.3.2	<i>Bremen - City logistic scheme/freight village (10.1)</i>	58
2.9.4	Bremen – Information and Ticketing.....	61
2.9.4.1	<i>Bremen - Integrated transport pricing system (7.2)</i>	62
2.9.4.2	<i>Bremen - Travel Information Centre (12.2)</i>	66
2.9.5	Bremen – New Tram Lines.....	71
2.9.5.1	<i>Bremen - Hybrid tram system (8.4)</i>	72
2.9.6	Bremen – Car Sharing Services	85
2.9.6.1	<i>Bremen - PT and car sharing (8.5)</i>	86
2.9.6.2	<i>Bremen - car sharing / city car club development (9.1)</i>	94
2.9.6.3	<i>Bremen - Integration with urban developments (9.2)</i>	107
2.9.7	Bremen – Cycling Infrastructure	108
2.9.7.1	<i>Bremen - Walking and cycling measures (11.4)</i>	109
2.9.8	Bristol – Promoting Clean and Efficient Vehicles.....	120
2.9.8.1	<i>Bristol - Clean and efficient buses (5.1)</i>	122
2.9.8.2	<i>Bristol – Clean fleet vehicles (5.2)</i>	131
2.9.8.3	<i>Bristol – Fuel supply infrastructure and local network (5.3)</i>	138
2.9.8.4	<i>Bristol – Renewable energy supply (5.3)</i>	145
2.9.8.5	<i>Bristol – Flywheel powered tram (5.4)</i>	147
2.9.9	Bristol – The City Centre Clear Zone.....	149
2.9.9.1	<i>Bristol – Development of City Centre Clear Zone (6.1)</i>	151
2.9.9.2	<i>Bristol – Access management (6.2)</i>	174
2.9.9.3	<i>Bristol – Clear zone orbital bus services (8.1)</i>	181
2.9.9.4	<i>Bristol – City logistics scheme (10.1)</i>	188
2.9.9.5	<i>Bristol – Freight loading and signing (10.2)</i>	205
2.9.9.6	<i>Bristol – Travel plans (11.2)</i>	210
2.9.9.7	<i>Bristol – Travel information centre & ITS integration (12.2)</i>	216
2.9.10	Bristol – Access and Safety in an Inner City Area.....	222
2.9.10.1	<i>Bristol – Residential traffic management (6.3)</i>	223
2.9.10.2	<i>Bristol – Community travel workers (11.1)</i>	236
2.9.10.3	<i>Bristol – Walking and cycling measures (11.4)</i>	240
2.9.11	Bristol – Social Inclusion in an Edge of City Community.....	253
2.9.11.1	<i>Bristol – Community delivery points and home shopping (10.3)</i>	255
2.9.11.2	<i>Bristol – Travelsmart (11.3)</i>	264
2.9.11.3	<i>Bristol – Information (i+) kiosks / advice screens (12.2)</i>	270
2.9.11.4	<i>Bristol – Widening access (12.5)</i>	294
2.9.12	Bristol - Improving Public Transport.....	296
2.9.12.1	<i>Bristol – Integrated pricing (7.2)</i>	298

2.9.12.2	Bristol – New forms of public transport contracts (Showcase) (8.6)	299
2.9.12.3	Bristol – Improved interchange (8.7)	303
2.9.12.4	Bristol – Promoting Park & Ride (8.7)	306
2.9.12.5	Bristol – Promoting walk / cycle and ride (8.7)	314
2.9.12.6	Bristol – Taxi-Sharing (8.7)	323
2.9.12.7	Bristol – City navigators (Info Bus) (12.2)	329
2.9.12.8	Bristol – Trip planner (12.2)	334
2.9.12.9	Bristol – Bus priority and RTPI (12.3)	338
2.9.13	Bristol – Developing New Mobility Services	345
2.9.13.1	Bristol – Demand responsive transport routes and technology (Dial-a-Ride) (8.3)	346
2.9.13.2	Bristol – Car club development (9.1)	353
2.9.14	Kaunas – New Public Transport Services (8.1)	363
2.9.15	Kaunas – Access and Security Improvements (8.8)	370
2.9.16	Kaunas – Integrated ticket system of public transport (7.2)	376
2.9.17	Kaunas – Integration of taxis and minibuses into the public transport system (8)	380
2.9.18	Nantes – Collective passenger transport stimulation	385
2.9.18.1	Clean and efficient buses/Fuel supply infrastructures (5.1/5.3)	385
2.9.19	Nantes – Soft measures	425
2.9.19.1	Nantes – Marketing and travel awareness campaigns (8.6)	426
2.9.19.2	Nantes – New forms for PT contracts and operations (8.6)	441
2.9.19.3	Nantes – Cycle/ride share (8.10)	443
2.9.19.4	Nantes – Travel Plan Strategies (11.5)	448
2.9.19.5	Nantes – Travel Plan Strategies – company travel plans (11.2)	451
2.9.19.6	Nantes – Land use planning - New parking policy (11.5)	459
2.9.19.7	Nantes – Travel information centre (12.2)	472
2.9.20	Nantes – Distribution of Goods	481
2.9.20.1	Nantes - City logistics scheme/freight village (10.1)	481
2.9.21	Nantes – Collective passenger transport stimulation	482
2.9.21.1	Nantes – New interchange facilities (8.7)	483
2.9.22	Nantes – Access restrictions – University campus	494
2.9.22.1	Nantes - Access controlled University zone - Remodelling of campus (6.5)	496
2.9.22.2	Nantes - Access controlled University zone - New PT services (8.1)	502
2.9.22.3	Nantes - Access controlled University zone - Creation of a new bus route	507
2.9.22.4	Nantes - Access controlled University zone - new Public Transport pass (8.6)	509
2.9.22.5	Nantes – Cycle/Ride share - car-pooling (9.3)	510
2.9.22.6	Nantes – Access controlled University zone – Vélocampus (9.3)	511
2.9.22.7	Nantes - Access controlled University zone - New student services centre (6.5)	512
2.9.23	Nantes – Access restrictions	516
2.9.23.1	Nantes – Corridor restriction – Vannes Road (6.6)	518
2.9.23.2	Nantes – Corridor restrictions – South East corridor (6.6)	530
3	CITY LEVEL EVALUATION	540
3.1	Aalborg – City-Level Evaluation	540
3.1.1	Do-nothing Scenario	540
3.1.2	City Level Results	545
3.2	Bremen City-Level Evaluation	549
3.2.1	Integration of the Measures	549
3.2.2	Integration at City Level	550
3.2.3	Economy	551
3.2.4	Energy	552
3.2.4.1	CNG car fleet	552
3.2.4.2	Cambio car fleet	553
3.2.5	Environment (Emissions)	555
3.2.5.1	CNG car fleet	555
3.2.5.2	Up-scaling CNG promotion measures	556
3.2.5.3	Comparison with Items	557
3.2.5.4	Cambio fleet (emissions)	558
3.2.5.5	Up-scaling car sharing measures	559
3.2.5.6	Comparison with Items	559
3.2.6	Society	560
3.2.6.1	Awareness	560

3.2.6.2	<i>Acceptability and involvement</i>	561
3.2.6.3	<i>Acceptance</i>	562
3.2.6.4	<i>Accessibility</i>	562
3.2.7	Digression: Awareness and Acceptance of Car Sharing – Results of a Citywide Survey	562
3.2.7.1	<i>Method of measurement</i>	562
3.2.7.2	<i>Name recognition of and knowledge of car sharing</i>	563
3.2.7.3	<i>Experiences with and attitudes towards car sharing</i>	564
3.2.7.4	<i>Potential analysis</i>	566
3.2.7.5	<i>Comparison with a nation-wide survey</i>	568
3.2.8	Transport	570
3.2.8.1	<i>Service reliability</i>	571
3.2.8.2	<i>Quality of service</i>	572
3.2.8.3	<i>Usage</i>	572
3.3	Bristol – City-Level Evaluation	574
3.3.1	Do-nothing Scenario Results	575
3.3.2	City Level Results (including core indicator results)	575
3.3.3	Economy	576
3.3.4	Energy	578
3.3.5	Environment	580
3.3.6	Society	585
3.3.7	Transport	592
3.3.8	Synthesis	596
3.4	Kaunas – City-Level Evaluation	598
3.4.1	Do-nothing Scenario Results	598
3.4.2	Economic	599
3.4.3	Energy and Environment	599
3.4.4	Society	599
3.4.5	Transport	599
3.4.6	City Level Results	599
3.5	Nantes – City Evaluation	609
3.5.1	Do-nothing Scenario Results	610
3.5.2	City-level Results	612
3.5.2.1	<i>Society</i>	612
3.5.2.2	<i>Economy</i>	612
3.5.2.3	<i>Transport</i>	614
3.5.2.4	<i>Environment</i>	628
4	PROJECT RESULTS	660
5	CONCLUSIONS	662

1 INTRODUCTION

1.1 The Purpose of This Report

This report has been produced by the VIVALDI evaluation team in order to disseminate the results of the evaluation that has assessed the impacts of radical integrated sustainable urban transport strategies, supported by innovative measures, technologies and infrastructures.

1.2 EC Context

VIVALDI is one of the four demonstration projects being supported by the CIVITAS initiative. CIVITAS is a major urban transport initiative supporting demonstration projects in a number of cities across Europe and is a key element of a new strategy on Clean Urban Transport prepared by the Transport and Energy Directorate-General of the European Commission. The initiative is supported with 50 million € from the budget of the Fifth Framework Programme for co-funding demonstration projects.

The objective of CIVITAS has been to assess the impacts of the introduction of radical integrated sustainable urban transport strategies, supported by innovative measures, technologies and infrastructures. These strategies have aimed to promote the development of an attractive alternative to the use of private cars in cities.

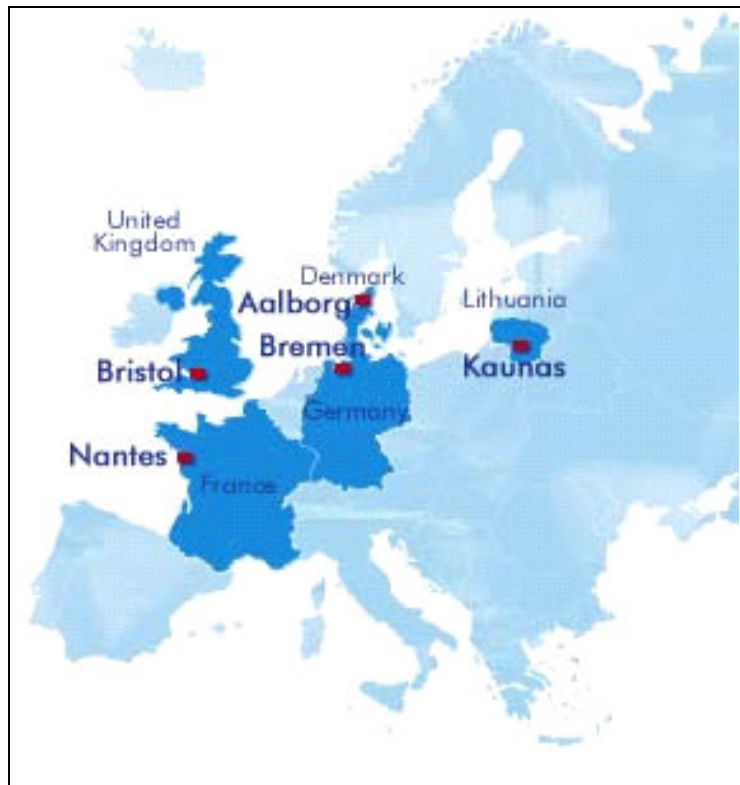
The following eight basic CIVITAS strategies or policy fields have been demonstrated throughout the demonstration projects and have provided interesting results and experiences that can be shared between Member States:

1. Energy-efficient, cost-effective and clean public and/or private vehicle fleets.
2. Demand management strategies based upon access restrictions to the inner city areas and other sensitive zones.
3. Integrated pricing strategies.
4. Stimulation of collective passenger transport and its quality of service.
5. New forms of vehicle use and ownership, and new mobility services.
6. New concepts for the distribution of goods in urban centres.
7. Innovative 'soft' measures for managing mobility.
8. Integration of transport management and information systems.

1.3 The VIVALDI Context

The VIVALDI project has had laboratory sites in Bristol, Bremen, Nantes, Aalborg and Kaunas that are all major European cities at the forefront of transport policy development and innovation. They have populations of between 170,000 and 550,000 and are regional centres for employment and economic activities. As such they need to not only support the mobility needs of their own citizens but also the many people accessing the cities for jobs, retail and leisure activities.

Figure 1.3-1 Location of the VIVALDI demonstration sites



The cities have worked together to provide each other with political support and the exchange of knowledge and experience to develop a body of results that will be transferable to a large number of similar sized cities across Europe.

1.4 Report Structure

The structure of this report is based around the requirements set out by the METEOR project. The METEOR project is an accompanying measure within the CIVITAS initiative, designed to assist the European Commission with monitoring, evaluating and disseminating the results of the CIVITAS demonstration projects throughout Europe. It is important that consistent reporting is carried out for the 4 demonstration projects so that METEOR can undertake a cross-site evaluation.

This report concentrates on the VIVALDI cities that have evaluated their own performance at the local/regional level. The report contains the following sections:

- Overview of the evaluation framework - describing the evaluation approach that was undertaken by the VIVALDI project. The report is structured so that each section is broken down by city.
- Evaluation Results – For each city the results are broken down into integrated packages. The section starts with a brief overview of the package targets and achievements followed by a detailed account of how each measure was implemented to achieve these targets.

- City Level Results – containing detail showing how each city has been able to evaluate measures at city level and details of achievements made for each of the METEOR impact indicators.
- Project Results – a summary of the achievements of the project measured against the original targets set.
- Outlook – a discussion on the next steps following VIVALDI and an overall summary of its achievements.

2 OVERVIEW OF THE EVALUATION FRAMEWORK

2.1 The Evaluation Framework

The results from the VIVALDI project demonstrations have been produced using an evaluation framework and indicators developed jointly with METEOR- a network within the CIVITAS initiative that is tasked with carrying out cross-site evaluation of CIVITAS demonstration projects. It is intended that METEOR will draw policy conclusions at the EC level and disseminate best practice. The VIVALDI demonstration has used a bottom up approach to the METEOR framework. In doing so the VIVALDI evaluation team developed a project-wide approach that is an interpretation of the METEOR framework.

A data collection programme was designed to provide the inputs for the calculation of indicators to measure the impact of the demonstration measures. Most of the results presented are the product of: ex-post evaluation of operational data; outputs which are directly measured impacts through a comparison of before and after data; or an analysis of time series data.

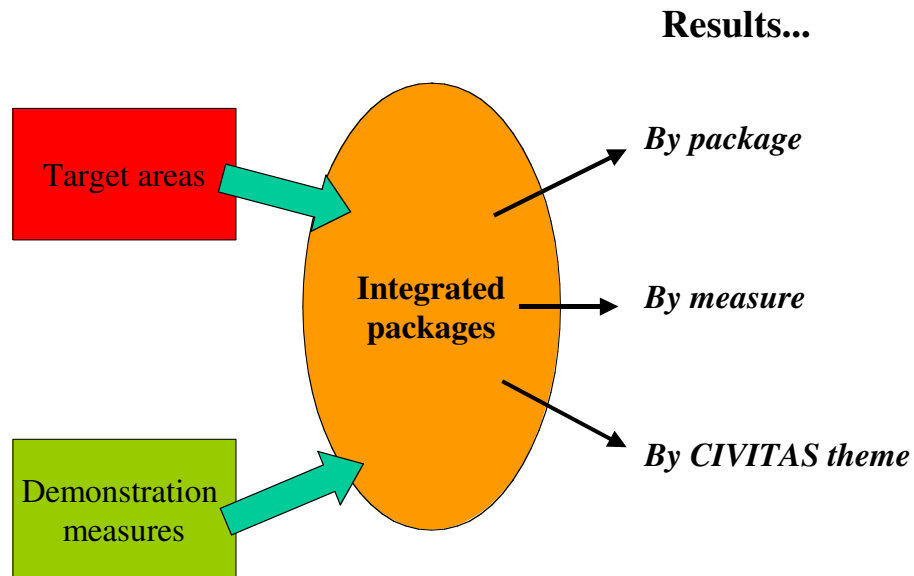
2.2 Evaluating the Integrated Packages

The evaluation of the VIVALDI project is structured around integrated packages, as shown in Figure 2.2-1. Each of the packages comprises a number of related measures focused in a specific area of the city. Each package has a consistent set of defined objectives against which they were evaluated. Since the measures are being implemented as a package, they may not be mutually exclusive and will have a combined effect. Evaluation results were planned at measure, package and by theme.

The project objectives set at the beginning of the project were based on a top level evaluation of the package as a whole. Each package of measures was designed to achieve a set of defined targets. Following the implementation of each measure detailed data has been collected to monitor any improvements as a result of the change. The detailed results for each measure will be discussed in full and the combined effect of these measures brought together to enable the assessment of the achievements made towards the objectives of the project.

For example, if a bus corridor is improved with real time passenger information and low floor accessible buses an analysis of patronage data will only detect the combined effect. Where possible results for the impact of individual measures, or the contribution of individual measures to the overall impact, is presented. In some cases this is straightforward. For example the change in fuel consumption of an individual vehicle fitted with exhaust emission after treatment can be measured through fuel consumption data, and the overall impact for the fleet of vehicles on the route can be calculated.

Figure 2.2-1 Integrated packages and results



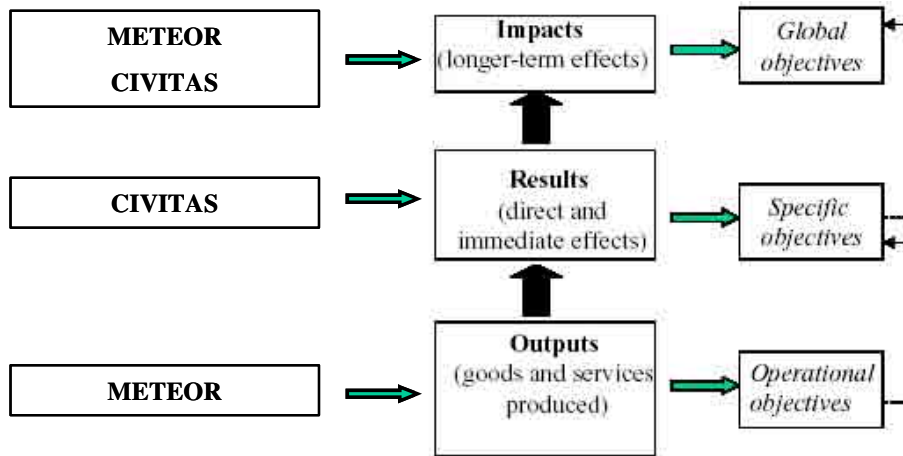
Therefore the results are calculated both at the package level and for individual measures where this is possible. From this analysis of the measure level results and interpretation of the package results, the VIVALDI project can also provide conclusions for each of the CIVITAS themes (which are conclusions made at the demonstration workpackage level).

2.3 The evaluation process

Operational data or outputs – is simply the monitoring of what measures have been implemented in the demonstration site. For example how many clean-fuelled vehicles have gone into operation or what proportion of the fleet is now fitted with vehicle location systems. This information will be contained within the VIVALDI progress reports and will be reviewed by METEOR.

Direct results – these are the direct results being measured by the CIVITAS sites for the measures and packages of measures they are implementing. The results will be compared against the local objectives that have been set for each package of measures. This work will be solely carried out by the VIVALDI partners. The results will then be provided to METEOR for cross-site analysis.

Levels of evaluation



Impacts – these will be derived largely from the analysis of the site results to consider the wider impacts of the measures if they were carried out as part of an urban transport policy. At the VIVALDI level this analysis will be carried to assess the objectives set at the project level for each of the CIVITAS policy fields. In addition there will be work with METEOR both in terms of ex-ante modelling and analysis of site results to consider policy implications at the EU level.

The focus of both this evaluation plan and the METEOR guidelines is the evaluation of the direct results and long term impacts.

Evaluation Risk Log

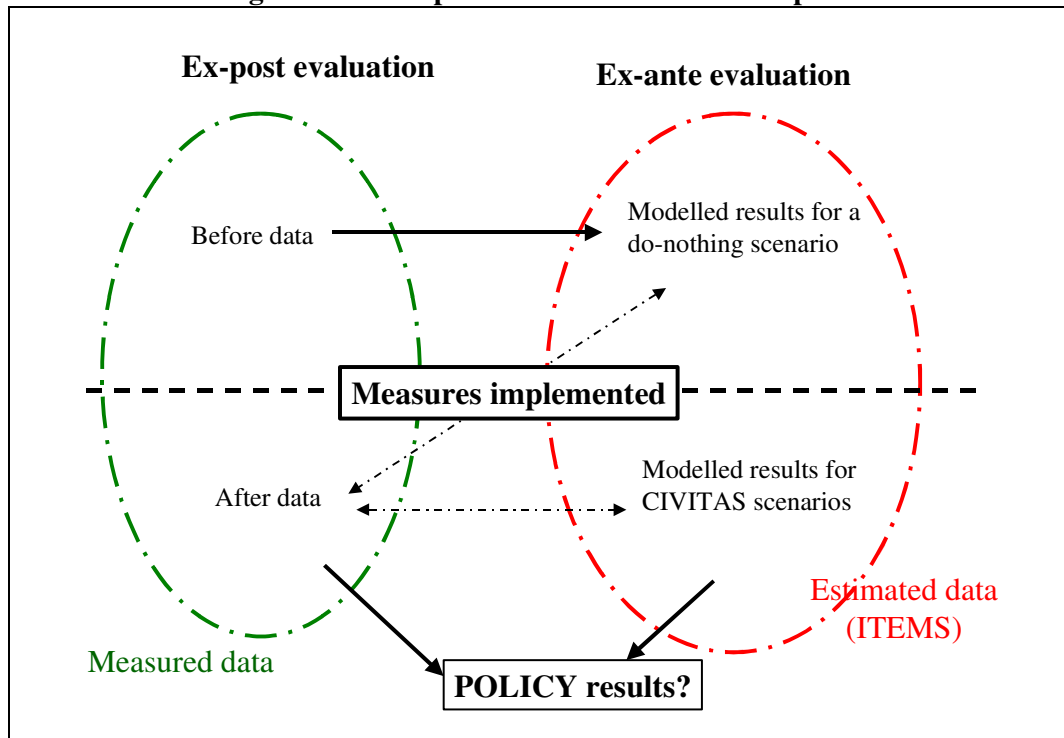
Summary					Description					Preventative Actions			Contingency Actions		
ID	Date Raised	Raised By	Impacted Partners	Status	Description of Risk	Description of Impact	Type	Likelihood	Impact	Preventative Actions	Preventative Owners	Preventative Outcomes	Contingency Actions	Contingency Owners	Contingency Outcomes
					Evaluation Risks										
VD-C-2	October 2002	LS	All		Loss or corruption of monitoring or evaluation data	Deliverable 4 will be affected	TECH	low	low	Always create a duplicate back-up copy which is stored on a separate server			The duplicate copy would be used and then investigate how/what happened		
VD-C-3	October 2002	LS	All		Insufficient or incorrect evaluation	Deliverable 4 will be affected	TECH	low	medium	Create an evaluation plan			Evaluation would be undertaken again with the possibility of a new evaluation plan		
VD-P-7	October 2002	RC	All, METEOR		Incompatibility of local evaluation plans and CIVITAS evaluation process	Results would not be comparable within the CIVITS initiative	TECH	medium	high	Active involvement in the evaluation liaison			Revision of evaluation process		
VD-P-8	October 2002	RC	All		Headline targets cannot be met	Overall goals will not be met	TECH	low	medium	Ensure realistic targets are set in consultation with stakeholders			Agree with relevant parties a redefinition of headline targets		
VD-P-9	October 2002	RC	All		Meeting the headline targets cannot be proven	Targets not clearly defined or data collection insufficient	TECH	low	medium	Ensure targets are well defined and data collection well focussed			Reassess targets		
VD-C-43	October 2002	Semitan	Nantes		Staff strike	Impact linked to evaluation process, such events always disturb the perception of public transport efficiency and quality in the eyes of the public Disturbs data collection	INST	medium	high	Semitan is always very sensitive to this subject and maintain an ongoing discussion and negotiation process with the unions.			Evaluation processes would be delayed within an acceptable period of the project		

2.4 Ex-ante and Ex-post evaluation

Within the overall evaluation approach there are two key concepts that need to be considered: ex-post evaluation and ex-ante evaluation. These concepts are shown schematically below in figure 5

The ‘ex-post’ evaluation is what could be considered a simple ‘before’ and ‘after’ evaluation, using measured data. A baseline of data is collected to reflect the current situation, the measures are then implemented and the respective data is collected again afterwards. The difference between the two gives a change or the calculated impact of the measures. *This is the approach that the cities will be using to measure the direct results for each of the demonstration packages.*

Figure 5 The ex-post and ex-ante evaluation process



However, a number of issues arise with ex-post evaluation particularly when evaluating large city scale demonstration:

- When do you carry out the after measurements? Measures may be implemented at different times and the effect of a measure can take some time (months or years) to manifest itself.
- What is the effect of other changes happening during the implementation process? Or in other words what would have happened anyway? This is particularly important in larger scale, longer-term projects where a large number of factors could affect the results.

The first issue can be dealt with to a large degree by careful planning of the data collection exercise, which can also be phased. There may also be a benefit to this in that you may be able to see the effect of multi-measures being implemented sequentially.

To consider the latter problem, the effect of factors which are not being measured, ex-ante evaluation is used. This approach uses the measured baseline and other data to model what may happen in the future. Two future scenarios are modelled:

- The ‘do-nothing’ which gives an estimate of the future without using the measures;
- The ‘do-something’ scenario an estimate of what will happen with the measures implemented.

These two scenarios can then be compared to provide another estimate of the potential impacts of implementing the measures.

The ex-ante of modelling approach can also have other uses:

- the expected impact of the measures can be modelled to see if they are likely to have the desired effect, if not changes can be made to the scheme design;
- the modelling approach can be used to estimate to effect of a wider scale implementation of the measures to give what could be considered policy level results

The ‘ex-ante’ evaluation work will be used to support the wider impact analysis at the policy level. The larger VIVALDI sites, Bristol, Bremen and Nantes, are working with METEOR and the common modelling tool they provide – the ITEMS modelling system. The work with METEOR will aim to:

- provide a common basis for the cross-site evaluation;
- provide broader policy level results to support EC policy development.

However in working with METEOR it is recognised that the ITEMS model results are purely an interpretation of the project for policy purposes, not direct results from the demonstration sites. It is also expected that not all the measures being demonstrated in the VIVADLI project can be interpreted with the ITEMS model.

Local modelling work will also be carried out in all the sites. This modelling work will be used to generate some of the direct impacts on the measures that are not practical to measure, such as vehicle emissions. In addition Aalborg will use this work to consider the do-nothing results.

2.5 Evaluation Objectives

The evaluation is structured around the objectives set for each of the integrated packages of measures in Aalborg, Bremen, Bristol, Kaunas and Nantes. Within the VIVALDI project three levels of objectives were set: measure objectives, local objectives and VIVALDI objectives.

Measure objectives – these are specific objectives for individual measures and relate largely to implementation objectives, such as retrofitting 40 diesel buses with particulate traps.

Local objectives – these have been set for each of the integrated demonstration packages. These set out what the specific package of measures is aiming to achieve or demonstrate at the local level, such as reducing vehicle emissions in the Clear Zone. These objectives are the focus of the local evaluation.

VIVALDI or policy objectives – these are the wider project level objectives that have been set for each of the policy themes. These represent what may be expected to be achieved if the measures were implemented at the city level. These objectives are shown below in Table 2.4-1. The objectives are assessed from an analysis of results across the sites and relate to what METEOR describe as policy level results. It was hoped that the ITEMS model might be used for this analysis, but the cities have no confidence in the model and the results that have been produced for their demonstrations.

2.6 The METEOR Impact Areas and Core Indicators

The impacts being measured within the VIVALDI project relate to the objectives defined above for each integrated package and CIVITAS theme. However, to assist in cross-site comparison within VIVALDI and with the other CIVITAS projects, METEOR has developed a common definition of impacts and a set of core indicators to use for measuring these impacts. These indicators sit under five evaluation categories, which are:

- Economy
- Energy
- Environment
- Society
- Transport

In addition to these common impact areas the VIVALDI cities decided that it was important to undertake process evaluation – how are the measures being implemented, what issues are being faced and how have these been resolved? This gives six impact areas for which evaluation has taken place within the VIVALDI sites as shown in Table 2.4.1.

Table 2.4.1 Evaluation categories in VIVALDI

EVALUATION AREA	IMPACT CATEGORY	IMPACT SUB-CATEGORY
ECONOMY		
	Benefits	Operating revenues

EVALUATION AREA	IMPACT CATEGORY	IMPACT SUB-CATEGORY
	Costs	Operating costs
ENERGY		
	Energy Consumption	Fuel Consumption
ENVIRONMENT		
	Pollution/Nuisance	Air Quality
		Emissions
		Noise
SOCIETY		
	Acceptance	Awareness
		Acceptance
	Accessibility	Spatial Accessibility
		Economic Accessibility
	Security	Security
TRANSPORT		
	Quality of Service	Service reliability
		Quality of service
	Safety	Transport Safety
	Transport System	Traffic Levels
		Congestion Levels
		Freight Movements
		Modal split
		Vehicle Occupancy
PROCESS		

2.7 Impacts and Indicators for the Integrated Packages

The impacts and indicators used for evaluating the integrated packages are based on these six impact categories and the core indicator set developed by METEOR. Indicators have been selected from a core list where they are relevant for the assessment of local objectives. Where impacts and indicators from the core list are not relevant to local objectives they have only been used where any additional data collection requirements are not onerous. In addition, new impacts and indicators have been included where appropriate ones do not exist in the core list.

The table below shows how many measure in each integrated package fall within the common core indicators.

		Economy		Energy		Environment		Society		Transport	
		Meteor	Local	Meteor	Local	Meteor	Local	Meteor	Local	Meteor	Local
	Integrated packages										
Bristol	Promoting clean and efficient vehicles	1	0	2	0	8	0	2	0	3	0
	The city centre Clear Zone	0	8	2	0	8	0	3	1	5	1
	Improving safety and access in an inner city area	1	0	0	0	1	3	3	3	5	2
	Developing Social Inclusion in South Bristol	0	1	0	0	0	0	3	2	6	1
	Providing better public transport services	2	0	2	0	7	0	4	0	8	5
	Developing new mobility services	2	0	2	0	4	0	4	0	2	6
Bremen	Development of a CNG fleet	1	0	2	0	7	0	2	0	1	2
	Information and ticketing measures	1	2	2	0	4	0	2	0	1	7
	Improving Tram Links	2	0	2	0	5	1	5	0	3	7
	Car sharing	2	0	2	0	4	0	5	0	3	10
	City logistics	1	0	2	0	4	0	2	0	1	5
	Cycling	1	0	2	0	0	0	0	0	1	7
Nantes	Clean vehicles	2	0	2	0	5	0	3	0	3	0
	Access restrictions	2	0	2	0	8	0	5	0	11	0
	Collective passenger transport stimulation	2	0	2	0	8	0	5	0	11	0
	Pricing strategies	0	0	2	0	8	0	5	0	9	0
	New mobility concepts	2	0	2	0	8	0	5	0	11	2
	Distribution of goods	2	0	2	0	8	0	5	0	11	0
	Soft measures	2	0	2	0	8	0	5	0	11	1
	Telematics	2	0	2	0	8	0	5	0	11	1
Aalborg	Car sharing	2	0	1	0	4	0	2	0	1	0
	Telematics	2	0	1	0	5	0	3	0	2	2
Kaunas	Public transport rationalisation	2	0	1	0	3	5	2	1	4	4

MEASURE LEVEL EVALUATION

2.8 Overview of Measures

Table 3.1-1 provides a summary of the measures that have been evaluated as part of the VIVALDI project. The tables illustrate the link between each measure and an Integrated Package and Host City.

Table 3.1-1 VIVALDI measures in Aalborg

Integrated Package	Measure	Implementation Completion Date	Evaluation Monitoring Period
New forms of vehicle use	9.1 Car sharing	Jan 2004	Oct 02 – Sep 2005
Telematics	12.2 Transport Information Centre	Mar 2004	Oct 2003 – Jun 2005
	12.3 Bus Priority	Mar 2004	Apr 2002 – Jun 2005
	12.3 RTPI	Mar 2004	Apr 2002 – Jul 2005

Table 3.1-2 VIVALDI measures in Bremen





















	Measure	Scope of measure	degree of implementation	Implementation Completion Date	Evaluation Monitoring Period
CNG Fleet	5.2 Clean and efficient vehicles			Sep 05	May 02-Oct 05
Information & ticketing	7.2 Integrated transport pricing system			May 05	Sep 04 – Oct 05
	12.2 Travel Information Centre			Nov 02	July 02 – Jul 05
New tram	8.4 Hybrid tram system			Jan 03 (tram line 4)	May 02 –Feb 05
Car-Sharing	8.5 PT and car sharing			Oct 04	Jan 03 –Aug 05
	9.1 City car club development			Jul 05	Jan 03 –Sep 05
	9.2 Integration with urban developments			continuously	Sep 05
Cycling	6.3 Residential traffic management			Jan 02	Sep 05
	11.4 Walking and cycling measures			Dec 05	Oct 04 –Sep 05
City logistics	10.1 City logistic scheme/freight village			mainly not implemented	sporadic

Table 3.1-3 VIVALDI measures in Bristol

Integrated Package	Measure	Implementation Completion Date	Evaluation Monitoring Period
Promoting clean and efficient vehicles	5.1 Clean and efficient buses	Feb 03	Jan 02 – Aug 05
	5.2 Clean fleet vehicles	Jan 03	Jan 03 – Aug 05
	5.3 Fuel supply infrastructure and local network	Jul 05	Jan 05 – Aug 05
	5.3 Renewable energy supply	Sep 02	Sep 02 – Sep 05
	5.4 Flywheel powered tram	Not Implemented	-

The City Centre Clear Zone	6.1	Development of a Clear Zone	Jan 03 – Jun 05	Jan 03 – Jun 05
	6.2	Access Management	Apr 05	Apr 05 – Sep 05
	8.1	Clear Zone Orbital Bus Services	Jun 05	Apr 03 – Aug 05
	10.1	City Logistics Scheme	May 05	May 05 – Sep 05
	10.2	Freight Loading & Signing	Feb 03 & Jul 05	Feb 03 – Jul 05 & Sep 05 - Oct 05
	11.2	Travel Plans	2004 – Jul 05	Jul 04 – Jul 05
Safety and access in an inner city area	12.2	Travel Information Centre	Apr 05	Jun 05 – Sep 05
	6.3	Home Zones	Jun 04	Dec 2002-Jul 2005
	11.1	Community Travel Workers	Dec 02	Dec 2002-Jul 2005
	11.4	Walking & Cycling	Jul 2003-Apr 2005	Jul 2005
Social inclusion in South Bristol	10.3	Home Shopping	Oct 03 & Dec 04	Dec 04 – Jun 05
	11.3	Travel Awareness/Marketing	Mar 2005	Sep 02 - Mar 05
	12.2	Information Kiosk/advice screens	Nov 02	Jan 03 – Dec 04
	12.5	Widening Access	Jul 05	Nov 05
Improving public transport	7.2	Integrated Pricing	Not Implemented	-
	8.6	New forms of public transport contracts	Dec 03	Apr 02 – Mar 05
	8.7	Improved Interchange	July 05	Oct 05
	8.7	Promoting Park & Ride	Apr 02	Apr 02 – Mar 05
	8.7	Promoting Walk/Cycle & Ride	Dec 04	Jan 05 – Sep 05
	8.7	Taxi Sharing	Feb 05	Mar 05 – Aug 05
	12.2	City Navigators (Info Bus)	Dec 03	Jan 04 – Oct 05
	12.2	Trip Planner	Jul 03	Jul 03 – Mar 05
	12.3	Bus priority and RTPi	Mar 04	Mar 04 – Dec 04
	8.3	Demand responsive transport routes and technology	Aug 02	Jan 03 – Apr 05
Developing Mobility Services	9.1	Car Club Development	Sept 02	Oct 02 – Jul 05
	12.4	Multi-Modal Scheduling Systems	Not Implemented	-

Table 3.1-4 VIVALDI measures in Kaunas

Integrated Package	Measure	Implementation Completed	Evaluation Monitoring Period
New Public Transport Services	7.2 Integrated transport pricing system	Month 40	Month09 – Month 45
	8.1 New PT Services	Month 8	Month 08 – Month 45
	8.7 New Interchange Facilities	Month 15	Month 15
	8.8 Access & security improvements	Month 30	Month 09 – Month 45
	8.9 Integration of Taxi / Microbuses with PT	Month 40	Month 09 – Month 45

Table 3.1-5 VIVALDI measures in Nantes

Integrated Package	Measure	Implementation Completion Date	Evaluation Monitoring Period
Implementing a new clean public transport fleet	1 Clean and efficient buses	dec-03	feb-02 – dec-04
	2 Clean fuels support services, fuel supply infrastructure	jun-03	jun-03 – dec-04
Improving the use of public transport and soft modes	1 Public transport promotion campaigns	jan-06	feb-02 – jun-05
	2 New SEMITAN quality contracts and improvement of PT perceived quality	jan-06	feb-02 – jun-05
	3 Park, walk, cycle and ride measures – Rent a bike service	dec-04	feb-02 – jun-05

	4	Implementation of Nantes Métropole mobility plan and promotion of company mobility plans	mar-04	mar-04 – jul-05
	5	Promotion of company mobility plans	jan-06	feb-02 – jul-05
	6	New parking policy and strategy	jan-06	feb-02 – oct-05
	7	Multimodal information and telematics	jan-06	feb-02 – jul-05
	8	Bus priority and RTPi	sep-03	sep-03 – may-05
Distribution of goods	1	City logistics scheme / freight village	jan-06	feb-02 – jan-06
Implementation of a large scale sustainable transport strategy	1	Creation of new railway link between the cities of Vertou, St Sébastien and Nantes	nov-03	dec-03 – jul-05
	2	Remodelling of RN801 motorway and PT projects	jan-06	feb-02 – jun-05
New mobility concept for the campus site	1	Remodelling of the university campus site, according to the new mobility policy	dec-02	feb-02 – jun-05
	2	Better and new PT services	jun-05	feb-02 – jun-05
	3	Incentives car-pooling – launch of www.illicovoiturage.com	feb-03	feb-03 – jun-05
	4	Vélocampus actions	dec-02	jan-03 – jun-05
	5	New student services centre with mobility services	sep-05	sep-05 -
Integration and rehabilitation program of Vannes road	1	Integration and rehabilitation program of Vannes road (commercial zone)	jan-06	feb-02 – jun-05
	2	Multi-Modal station at the junction of the line 3 and Vannes road	sep-04	sep-04 – oct-05

2.9 Project Evaluation Results

This section provides a summary of the evaluation for each of the groups of measures being evaluated in the VIVALDI cities. During the inception phase of the project each package of measures was set specific local objectives together with a list of impacts to be measured. For each of the VIVALDI packages of measures the original targets and data collection requirements will be discussed. The impacts set to be measured for each package is provided in a table, which indicates those impacts and indicators that relate to local objectives (LO), and those that are consistent with the common core indicator set provided by METEOR (M). The table also contains commentary as to whether the impacts and indicators were collected.

For each package the results achieved will be compared to the targets set, to provide an analysis of actually what was achieved, what could not be achieved and any added value that was not foreseen during the project planning stage.

2.9.1 Aalborg – Car Sharing (9.1)

Measure Overview

Car sharing is at an early stage in Denmark with only a few car sharing clubs, none of which area in Aalborg. More of the grass root car sharing initiatives are taken over by commercial car rental companies. Therefore, in order to make it attractive for these companies to introduce car sharing in Aalborg, the Technical Department transferred part of its annual 450,000 km use of private car for business journeys to a car sharing initiative.

The car sharing scheme Hertz Delebilen was launched on the 6th of January 2004 with a single site for car sharing. In April 2004, 4 more sites were opened. Now there are a total of 7 car sharing sites and 11 cars. The number of members of Delebilen has been increasing since the launch and has now passed 200.

A system has been introduced which allows members to book the car via the Internet, telephone or via the Transport Information Centre on the new Public Transport terminal. Each member has their own smart card and PIN number, making it easy to use the cars. With this technology, the member cannot access the car if they have not booked. The system also records the distance and renting charges that are sent out with the member's bill and members can at all times see how much time is left on their booking and what the mileage is.

The Technical Department and Hertz have provided a scheme for members of the staff in the Technical Department. The cars are also available for other users during working hours. By this scheme the transportation is more sustainable.

As a marketing strategy, from October to December 2005 users of public transport in Aalborg with a monthly travel card could join the car sharing scheme for a reduced cost. From this marketing initiative, more potential car owners will join, postponing the purchase of a car and instead using a combination of Public Transport and car sharing.

Local Objectives

The objectives of the car sharing integrated package were to:

- Demonstrate and stimulate public interest in car sharing;
- Pave the way for car sharing as an alternative to purchase of the first/second car;
- Design a scheme that reflects user requirements;
- Implement a car sharing service covering up to 2-3 sites with 4-6 vehicles estimated to replace 15-35 privately owned cars;
- Evaluate the environmental impacts of car sharing.

The table below gives an overview of the local evaluation objectives set and how these relate to the overall VIVALDI objectives and targets.

NO	LOCAL OBJECTIVE	TARGET	CONTRIBUTION TO VIVALDI TARGET (S)
<i>Aalborg IP – Car Sharing</i>			
LO1	Appreciate user requirements in scheme design	Interview: • 200 potential users, • experienced service provider	Basis of LO2
LO2	Stimulate the market for car-sharing locally	Implement: • 2-3 car-sharing sites, • 4-6 shared vehicles	VT13: 5 new car sharing sites VT15: Replace 1,000 cars
LO3	Assess the environmental impacts of car sharing	Monitor: • behavioural impact	VT1 - 250 Clean Vehicles across the sites VT2 - Reduce energy use and CO ₂ by 8% in demonstration area VT3 - Meet national air quality objectives

LO1 – Appreciate user requirements in scheme design

The Municipality of Aalborg carried out initial investigations into the potential user's attitude to car sharing during the Autumn 2002. The purpose was to decide the scale of the project by assessing the potential size and location of the car sharing sites.

A survey of 200 potential users took place to investigate attitudes to car sharing in general and the possibilities for modal shift at the car sharing sites. The results gave an indication about the highest acceptable distance between home and a car sharing site.

LO2 – Stimulate the market for car-sharing locally

Aalborg has implemented 7 Car Sharing Sites and introduced 11 shared vehicles as part of the VIVALDI project. This has exceeded the targets of 2-3 sites and 4-6 shared vehicles.

LO3 – Assess the environmental impacts of car sharing

The total fuel use for transportation in Aalborg has reduced by approximately 1 %. A total of 48,700 km was performed by the shared cars in the first year. The average journey was 52 km with a fuel consumption of 13.7 km/l. By selecting environmentally friendly cars Hertz Delebil has managed to keep the specific energy consumption level at 2.4 MJ pr km. The average for the private vehicle fleet in Aalborg is 3.1 MJ/km. With a total of 149 members, of which 41% considered buying a car, the potential energy savings add up to about 2.860 GJ within the first year of car sharing. This is about 1% of the current energy consumption for transport in Aalborg.

Evaluation Results

Society - Acceptance and awareness (13 & 14)

Car sharing in Aalborg was launched together with the changes in public transport services. The idea was to use the awareness created by these changes to promote car sharing. One of the main benefits of this approach is the high responsiveness by the media. All major or minor events in relation to car sharing have been covered in the newspapers, on radio or on television.

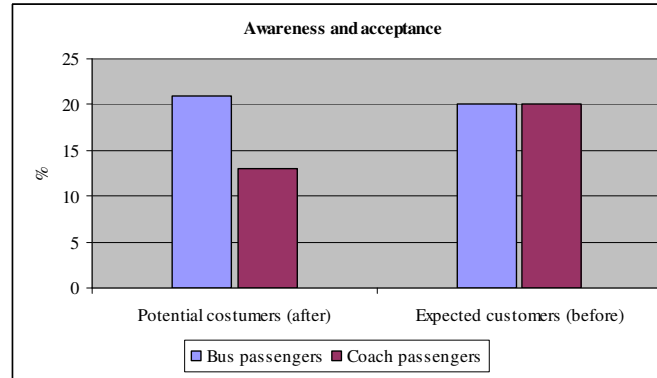
If we look at how the participants in the current car sharing service actually got the information on the service the local media accounts for no less than 66%. It is interesting that the public meeting at the launch of the service only accounted for less than 5% of the members.

None of the respondents refer to dedicated marketing efforts as the information that has triggered their membership. In their comments to the survey some of the members expressed surprise at the limited marketing of car sharing in Aalborg.

The private partner, Hertz Delebilen, obviously has tried to balance the marketing efforts and not 'oversell' a service still in its early development phase. One of the main marketing efforts by Hertz has been directed towards business customers in order to get a broader customer base and a better balance between workday and weekend use of the vehicles. Perhaps the private customer segment has not been sufficiently catered for in this process.

Nevertheless a survey among users of public transport shows that about 26% of bus passengers and 17% of coach passengers are aware of the car-sharing scheme in Aalborg (see Figure 2.9.1-1). This is particularly interesting since it seems that public transport is the primary alternative to the use of a shared car (see below). Ahead of the launch of car sharing in Aalborg about 20% of both bus and coach passengers thought that car sharing could be a relevant option for them. Now that the service is in place the share among coach passengers has dropped to about 13% while a minor increase among bus passengers can be observed. Now about 21% of bus passengers do consider joining the car sharing scheme.

Figure 2.9.1-1 Potential members of the car sharing scheme among users of Public Transport



The decline among coach passengers indicates a better knowledge of the concept of car sharing. Realistically, joining an Aalborg car sharing scheme while living in neighbouring municipalities 10-15 km away from the nearest car sharing site can only be useful to a few people.

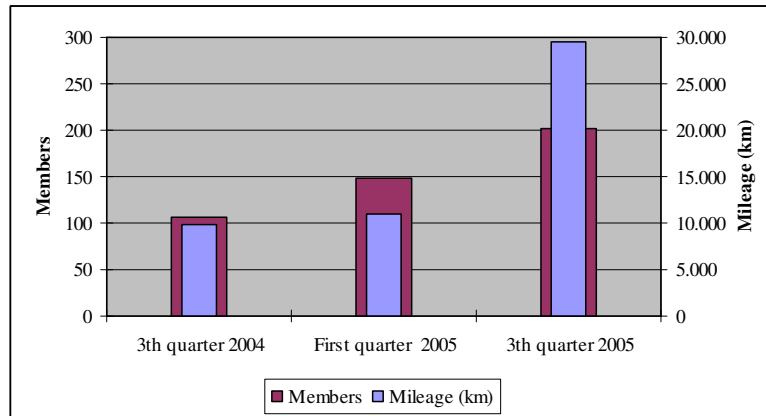
Those using the car sharing service are generally happy with it. There are comments regarding the current fleet of vehicles indicating that they do not fully cover user needs. Availability of a child seat and larger capacity - both in terms of passengers and luggage - are some of the main issues raised. If car sharing is supposed to establish itself as a 'transition mode' for young families clearly these demands must be taken seriously. Consequently a van is now included in the fleet.

Utilisation

Utilisation has risen since the beginning of the scheme. The number of members has doubled during the last year and more positive, the total use has tripled, see Figure 2.9.1-2.

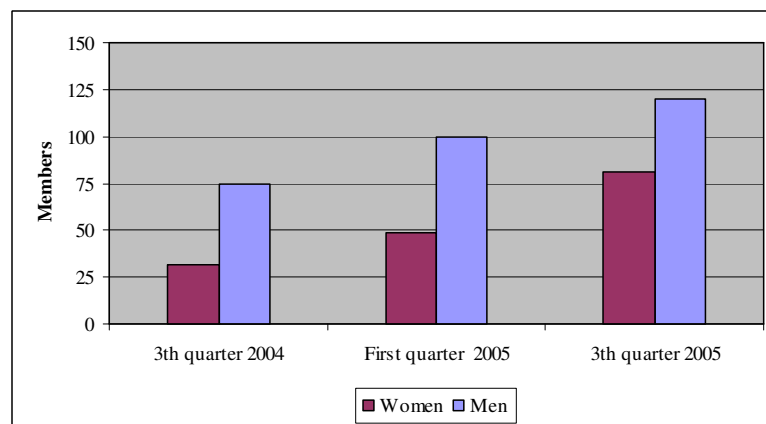
In general the car sharing scheme has risen both in terms of usage and number of members. Its potential is probably bigger than the existing scheme and if it grows further it may have a measurable influence on the level of congestion and emissions.

Figure 2.9.1-2 Development in Car sharing members and mileage



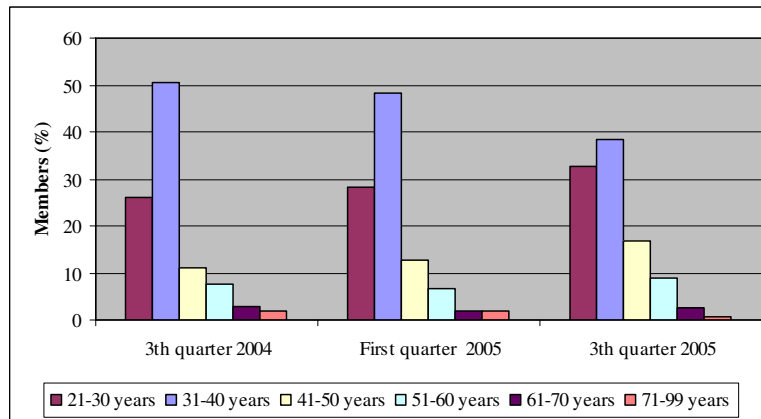
The gender distribution among users of car sharing is shown below. The proportion of female users has grown sharp and is now approximately 40 %.

Figure 2.9.1-3 The gender distribution among Car sharing users



The age distribution among users of car sharing is shown in Figure 2.9.1-4. It is remarkable that the proportion of young people has grown and now constitutes approximately one third of the users. It indicates that the scheme enables users to postpone purchasing their first car, which was a major reason for establishing the scheme.

Figure 2.9.1-4 The age distribution among car sharing users



Accessibility and security

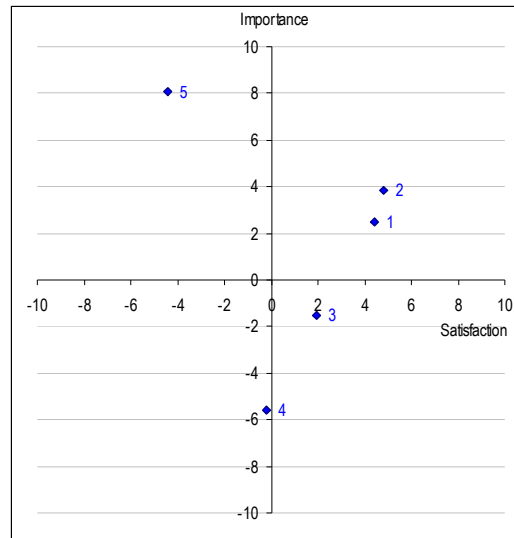
The users of car sharing in Aalborg were asked to assess five features characterising the current service in Aalborg. The availability of cars and the distance to the nearest car sharing site came out with a high score both on importance and satisfaction. The Internet based booking system and the smart card key system clearly contribute to make car sharing more easily accessible. These features receive positive comments from the users.

From a commercial point of view there is a delicate balance between getting satisfactory revenues from each shared vehicle and securing a sufficient amount of shared vehicles and car sharing sites. In Aalborg Hertz has recognised the importance of being close to the customers and providing a sufficient amount of vehicles and this is appreciated by the users. It was the decision of Hertz to up-scale the scheme to its current size and this has contributed to a positive image of the service.

The average distance between the home of the users and the nearest car sharing site in Aalborg is 2.9 km but for more than 60% of the users it is less than 1.5 km.

Figure 2.9.1-5 User responses on 5 indicators in relation to the car sharing service in Aalborg

1) Availability of cars	2) Distance to car-sharing site	3) Maintenance of shared cars
4) Variety of shared cars	5) Cost of use	



The main 'problem' in relation to the current car sharing service in Aalborg is the cost of use. More than 50% of the users find that a change in costs (lower rates per kilometre/hour) would make car sharing more attractive to them. Some suggest the introduction of corporate programmes rewarding dedicated use of car sharing.

It does seem as though it is difficult to fully understand the price structure of car sharing and to 'place it' between other alternatives such as public transport, taxi, car rental, car ownership etc. It is not likely that the costs of car sharing can be reduced significantly if it is to be an economically viable service. Therefore efforts must be made to explain the price structure and to increase transparency of the costs of other modes.

Transport - User perception

As shown in Figure 2.9.1-5 the costs of car sharing play an important role in users' perception of car sharing. But even though the cost is a real issue the availability of car sharing has had a positive impact on their urge to buy a car. The share of those planning to purchase a car has dropped notably due to the availability of the car sharing scheme.

Table 2.9.1-1 Plans for car purchase among users of car sharing scheme before and after the service was launched based on a 2-3 year perspective

	Share of members before	Share of members after
Considered purchasing a car	41%	22% ¹⁾

1) If car sharing ceases to exist in Aalborg a further 37% plans to purchase a car.

The role of car sharing as a 'transitional mode' before purchasing a first car is to some extent expressed by the growth in the number of persons considering buying a car if the car sharing service ceased to exist. From a situation before where 41% considered buying a car the figure is now 59%.

Since about 37% of the respondents are willing to remain car sharing users this is clear evidence of a positive perception of the current service.

Impact on transport

Some of the main problems created by car transport in the cities are related to rush-hour traffic between home and the workplace. Short car trips where the catalytic converters do not reach their working temperature, low vehicle occupancy rates and congestion problems characterise the traffic situation in many cities morning and evening.

If we take a look at how the shared cars are used in Aalborg we get an impression of how car sharing can contribute to reducing these problems.

Most of the current members of car sharing in Aalborg make use of the shared car less than once a week. The average figures for households in Denmark are between 2.5-5.0 trips per day with the lowest figures for inner city apartments where we find the current user group of car sharing in Aalborg. Hence, car usage levels are about 1/20 of those of the average city resident.

One of the main reasons is that a shared car is only rarely used in home-workplace journeys. Only 12% of car sharing members have used the shared car on the way to work. Shopping and leisure trips are the main areas of use.

This is also reflected in the average occupancy rates reported by the users. On an average there are 1.93 persons in a shared car. This is notably higher than the average in home-workplace trips which according to a national survey from 2001 is about 1.21 persons per vehicle in the morning and 1.48 persons per vehicle in the afternoon (The Danish Road Directorate, 2002, "Personer pr bil"). It is even slightly higher than the national average at weekends (1.87 persons per vehicle).

By taking the car away from the individual household and placing it in a car sharing service it does seem that there is less car traffic and a more efficient use of the vehicles on the roads.

The trips in a shared car typically replace either public transport journeys (46%) or other forms of individualised motorised transport (e.g. taxi, rental car etc.). A total of 39% of car sharing users would have used the latter option.

These figures are not surprising when we look at the purpose of trips. The main use of the shared car is in relation to leisure trips (e.g. family visits) and shopping. Work related trips only account for 15% of the trips. The price structure of car sharing seems to make it less attractive for vacation trips, as only 8% have made use of the shared car for this purpose.

Based on the above it does seem that car sharing can be a useful add-on to public transport and may assist in securing the customer base in daily transport by offering a quality service for specific purposes.

Environmental impacts

Within the first year of car sharing in Aalborg the shared cars were used for a total of 48,700 km. The average journey was 52 km with a fuel consumption of 13.7 km/l. By selecting environmentally friendly cars Hertz Delebilen has managed to keep the specific energy consumption level at 2.4 MJ pr km. The average for the private vehicle fleet in Aalborg is 3.1 MJ/km.

The shared cars also substitute non-motorised trips. Obviously these trips do not have an average length of 52 km. About 90% of all bicycle trips in the major cities in Denmark are less than 6 km.

Based on these figures and on the stated use of other modes had the car sharing service not existed it is possible to estimate the environmental impact of car sharing (see Table 2.9.1-2.).

Table 2.9.1-2 Energy savings due to the environmental friendliness of the shared car fleet.

	Annual mileage	Share of trips	Energy consumption
If done by other private car	22.081	39%	68,921 MJ/year
Done by shared car	22.081	39%	52,986 MJ/year
Saved			15,935 MJ/year

The results in Table 2.9.1-2 are only the direct impact of the current car sharing service. Providing the car sharing service had not existed some of the current users would have purchased their own car. Since each car purchased is likely to result in 15,000 new vehicle kilometres we can add about 47,000 MJ/year per saved vehicle to the above.

With a total of 149 members of which 41% considered buying a car the potential energy savings add up to about 2.860 GJ within the first year of car sharing. This is about 1% of the current energy consumption for transport in Aalborg.

This more than compensates for the increase in energy consumption occurring from the transfer of bicycle and public transport journeys to shared cars. In Table 2.9.1-3 an estimate of this increase is given.

Table 2.9.1-3 Increase in energy consumption due to transfer of journeys from bicycles and public transport

	Annual mileage	Share of trips	Energy consumption
Consumption due to transfer of PT trips	25,921	46%	62,201 MJ/year
Consumption due to motorisation of bicycle trips	711	15%	1,706 MJ/year
Total increase			63,907 MJ/year

Economy (1 & 2)

The private-public partnership agreement between Hertz Delebilen and Aalborg Kommune enables Aalborg to follow developments in membership and turnover in the car sharing project. However, in order to protect the commercial interests of Hertz Delebilen, an agreement has been made not to publish turnover figures externally.

Process Evaluation

Within the first year of car sharing in Aalborg it has not been possible to fully meet the economic targets for the service set by the private operator. This is due to a lower number of memberships and a lower mileage per member than budgeted for. Yet still the private operator considers the Aalborg car sharing scheme a success, and believes that the service will be economically viable.

The process of developing car sharing in Aalborg has benefited largely from the experiences of the professional operator Hertz Delebil and the in-depth knowledge of the city and its citizens at the Technical Department. Hertz Delebil was able to set up a service with state of the art technologies and Aalborg was able to identify those sites most likely to become successful car sharing sites.

Clearly the involvement of Aalborg Kommune is one of the main reasons why the service is now in place. If the Technical Department had not engaged itself in screening the potentials and creating awareness by using the service the increase in car sharing would have been much slower. Now not only Aalborg but also Esbjerg - another major city outside the Copenhagen area - has a car sharing service.

Throughout the project a close dialogue has been kept between the two partners in the private -public partnership enabling the continuous positive development of the service. Ideas and proposals have been discussed and transformed into adjustments or expansions of the service.

Hertz Delebil recognises that the amount of effort required to follow up on the service periodically has exceeded their capabilities. As car sharing in Aalborg will continue beyond VIVALDI Hertz Delebil has consequently increased the amount of staff. It is expected that this will enable an increased focus on individual marketing of the service.

Conclusion

At the end of the VIVALDI project, the car sharing scheme will be continued. The scheme has been increasing continually since its launch one and a half years ago. The 7 existing car sharing sites around the City of Aalborg may be up-scaled to include a few more. It could for example include the two largest shopping malls in the suburban area or a few other densely populated areas in the city that could be potential car sharing sites. However, it depends on the economics of the scheme, as the Municipality of Aalborg will not be a partner in the scheme after the end of the VIVALDI project. Nevertheless the Municipality of Aalborg will continue to be a member of the scheme. Finally, the measure will be further integrated with future projects with the aim of improving the environment in the urban areas.

2.9.2 Aalborg – Bus Priority and RTPI (12.3)

Measure Overview

Before the VIVALDI project, Bus Priority and AVL (Automatic Vehicle Location) were only operated on three bus lines in Aalborg. A total of 28 signalised intersections were then fitted to enable bus priority. AVL was not fitted to coaches, so consequently regional buses were caught in traffic in Aalborg. The coach terminal in the city was

planned for redevelopment to be completed in 2003. It was considered important to reduce space needed for the terminal area in order to reduce walking distances and to open the area for other urban activities including offices and shops - activities that were expected to increase the demand for public transport. That required flexible platforms with Real Time Passenger Information (RTPI). In order to free the city centre of buses heading for the coach terminal, a shortcut was made from the ring road system. This added further value to the new facility.

The RTPI came into operation in August 2004 and the Bus Priority in January 2005. In total, 209 buses are now fitted with bus computers and they are connected to a mobility centre which operates the RTPI system. Around the city there are 32 signs with RTPI placed at the most important bus stops and at the four local railway stations in Aalborg.

The number of intersections with Bus Priority has increased. There are now 51 intersections with this technology, compared to 28 previously. An after study on the impact of Bus Priority was made. In a corridor with 8 signalised intersections all fitted with Bus Priority the buses on an average saved up to 4% of their total travel time. This is quite remarkable considering that only buses delayed for more than 3 minutes actually gain priority.

The results are that the users of PT can now be informed about delays and irregularities at the central bus stops and furthermore can expect a 4% reduction in travel time in competition with private cars.

Local Objectives

The objectives of the telematics integrated package of measures were to:

- Integrate public transport services in one unified system
- Promote public transport as a "modern" means of transportation
- Ensure reliable PT services throughout the day
- Provide easy access to travel information
- Pave the way for future ITS services in public transport (e.g. electronic ticketing, widespread RTPI)
- Improve the working climate for drivers and user satisfaction

The table below gives an overview of the local evaluation objectives set and how these relate to the overall VIVALDI objectives and targets.

NO	LOCAL OBJECTIVE	TARGET	CONTRIBUTION TO VIVALDI TARGET (S)
<i>Aalborg IP – Public Transport Improvements by use of ITS</i>			
LO4	Integrate all PT services in one system	Implement: <ul style="list-style-type: none"> • new PT network structure • integrated info-systems 	VT9: Increase patronage by 20%
LO5	Increase reliability of PT services and perceived waiting time	Implement: <ul style="list-style-type: none"> • 20 bus priority units, • 188 bus computers • RTPI at interchange facilities. 	VT22: RTPI on quality corr. VT23: Increase use of PT-info
LO6	Change the decrease in PT passenger numbers	Achieve: <ul style="list-style-type: none"> • 2-3% more PT passengers • 2% larger modal share 	VT9: Increase patronage VT1 - 250 Clean Vehicles across the sites VT2 - Reduce energy use and CO ₂

			by 8% in demonstration area VT3 - Meet national air quality objectives
LO7	Promote PT as a modern means of transportation and increase satisfaction	Implement and achieve: <ul style="list-style-type: none"> • services reflecting demand • red. perceived waiting time 	VT9: Increase patronage

LO4 & LO5 - Integrate all PT services in one system and increase the reliability of PT services and perceived waiting time.

To achieve the above objectives Aalborg has introduced the following advanced ITS systems:

- Bus computers on 209 buses
- Real time passenger information (RTPI) displays at 32 locations
- Bus priority based at 23 intersections

All 3 targets have been met and exceeded by an additional 31 bus computers, 28 RTPI displays and 3 bus priority locations.

LO6 & LO7 – Change (reverse) the decrease in PT passenger numbers and promote PT as a modern means of transportation and increase user satisfaction.

The effectiveness of the PT measures implemented in Aalborg was evaluated by conducting a before and after survey of 1,260 passengers and 127 bus drivers. The results showed that there was a slight decrease in the frequency of public transport use (bus and coach) of -5% and -3% respectively. Possible explanations for this are addressed in the measure level evaluation below.

There was a difference in the perceived regularity of buses among bus and coach passengers. Both users of buses and coaches felt that there has been a reduction in the frequency of delays. The perceived reduction in delays for buses reduced from 39% to 30 % and for coaches from 26% to 24 %.

The project has also shown that the public is aware of the new opportunities. The self-service information kiosk placed at the terminal facility demonstrates this with 24,000 pages being activated monthly at the terminal with itineraries and schedules as key searches.

Evaluation Results

Society - Acceptance and awareness (13 & 14)

The timing of the VIVALDI activities in Aalborg co-ordinated with a major transformation of the entire public transport system has drawn the attention of the public. It is however interesting to observe that there has been a distinction between the critical voices raised against the new structure and increased fare levels in public transport and the positive acceptance of the new ITS in public transport.

Two primary reasons can be identified:

- A dedicated effort towards the media and the public explaining what could be expected from the ITS at what time; and

- The fact that the systems at the time they were rolled out proved fairly stable and reliable due to extensive development and testing phases.

Clearly in a situation with public transport in the spotlight, a failure would have been a major drawback with long-term impacts on the image of public transport.

The public is well aware of the new opportunities. The self-service information kiosk placed at the terminal facility demonstrates this. On a monthly basis 24,000 pages are activated at the terminal with itineraries and schedules as key searches.

It is very positive that this service which is the least visible of the ITS initiatives in Aalborg has been noticed and accepted by the users. A survey showed that 46% of those not using public transport in Aalborg did know of the travel planning tool that is accessible on the self service terminal and via the Internet.

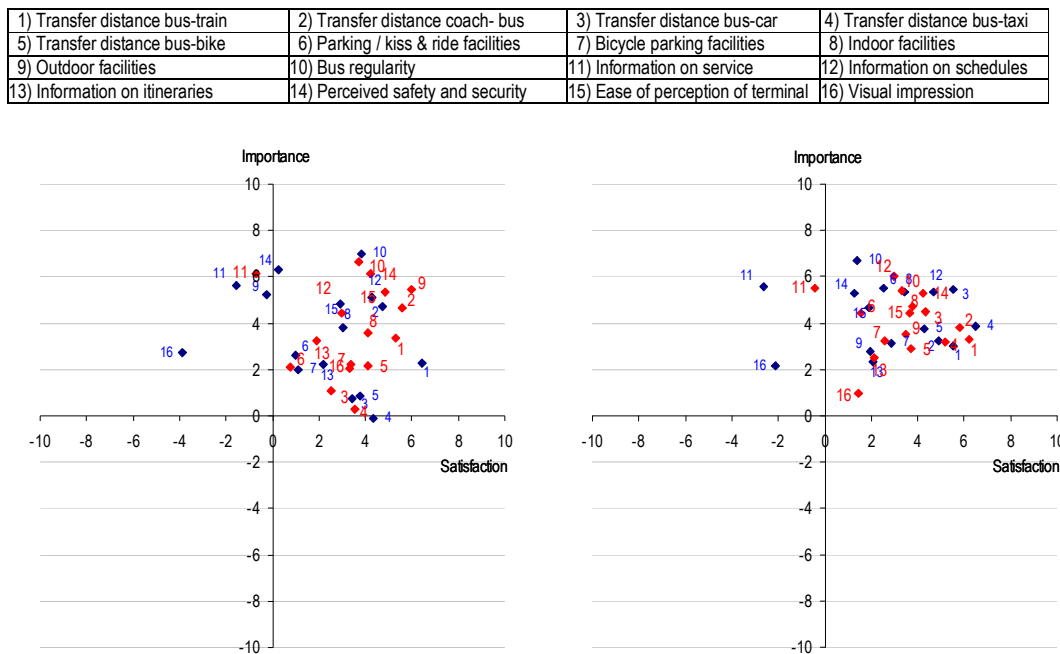
Another indication of the level of awareness is the informal comments received by the project members - e.g. 'how come the signs were shut down yesterday evening?', 'how does it work?', 'are all the signs replaced?' etc. Although the equipment is fairly discrete in its design the strategy of placing the VMS outside the bus shelters has made VIVALDI visible, and it draws the attention of those passing even if they are sitting in their car.

Accessibility and security

A key element of the new public transport system is the new terminal facility for buses and coaches controlled by advanced ITS. In order to monitor how the new layout and the new services were received by the users 16 indicators were analysed before and after restructuring the area.

Although the new terminal facility itself is not a VIVALDI measure, the telematics systems introduced in VIVALDI are indispensable measures in achieving the layout.

Figure 2.9.2-1 User responses on 16 indicators before (blue) and after (red) the changes at the bus terminal. Response from users of coaches to the left and for urban bus lines to the right.



The overall picture shows a positive development in user satisfaction. On average, satisfaction amongst the users of urban bus lines is 0.62 points higher after the introduction of the new terminal facility. Amongst users of coaches, the development is even more positive with a 1.25 point higher level of satisfaction.

If we look at the accessibility of the new terminal facility the general impression is that conditions have worsened in relation to accessibility by car and taxis. It is true that private cars are not allowed to enter the terminal facility. However, they are allowed to visit the parking facility at the terminal building - with elevators leading to the terminal - providing they pay the parking fee.

What we are really seeing is that the willingness to pay for parking when bringing somebody to the terminal facility is limited. This has a rather unfortunate consequence. A number of cars disregard the no entry signs and thereby cause problems for the bus drivers. This is a key issue currently being discussed with the police.

In spite of the problems with cars entering the area, the users now feel much safer at the terminal facility. The score on safety is 3.0-4.0 points higher after the reconstruction.

A common feature among both coach and urban bus line users is that they have not quite got used to the lack of timetables at the bus stops now fitted with real time passenger information. However, the users of coaches do not attach the same importance to the availability of schedules in the after situation - maybe because some of them use the self-service information kiosk or the ticket sales office instead. However, both user groups generally experience better information on the service due to the variable message signs.

In terms of bus regularity the perception is different among coach and bus passengers. While bus passengers report an improvement (1.6 points higher average score) coach passengers report a minor deterioration (0.1 point lower score). There is no obvious reason for these differences as the same priority systems have been implemented for buses and coaches.

Figure 2.9.2-2 Driver responses on 16 indicators before (blue) and after (red) the changes at the bus terminal.

1) Ability to keep schedules off peak	2) Ability to keep schedules in peak	3) Ability to inform on schedule	4) Ability to inform on oth. sch.
5) Ability to inform on transfers	6) Ability to send alarm	7) Cash payment option in buses	8) Bus access to terminal
9) Private car access to terminal	10) Taxi access to terminal	11) Bicycle access to terminal	12) Terminal layout for buses
13) Pedestrian traffic in terminal	14) Perceived safety and security	15) Ease of perception of terminal	16) Visual impression

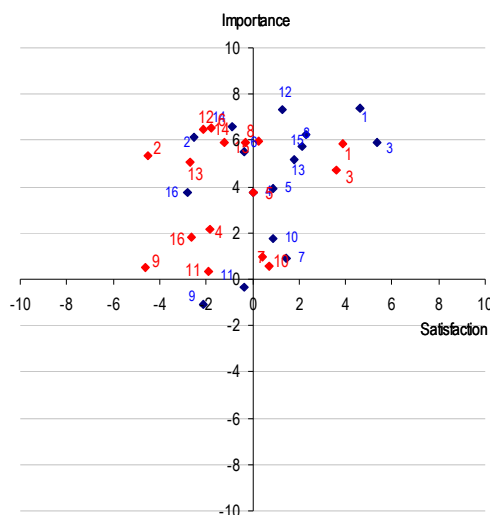


Figure 2.9.2-2 show the results of a similar survey among bus drivers. Unfortunately the survey results are characterised by a lack of interest by the drivers in the before study which only 28 drivers answered and a general discontent in the after situation leading to a negative assessment of all indicators even if they have not changed or indeed improved.

There is an ongoing dialogue between Nordjyllands Trafikselskab and the bus drivers in order to clarify the real problems and their reasons.

Table 2.9.2-1 Drivers satisfaction in relation to new service opportunities (range -10 to +10)

	Score before ¹	Score after
Ability to see the schedule and real time of other buses	5.2	5.2
Ability to get priority when delayed	5.5	7.4
Ability of providing answers on itineraries and schedules	-2.5	-0.8

¹⁾ For the first two subjects the score before represent the drivers expectations in relation to the new ITS system. For the third subject it represents their actual ability in the before situation.

The drivers were also asked about some of the opportunities offered by the new systems. It seems that the systems once they were in place have contributed to an increased level of satisfaction among the drivers. Their expectations in relation to the ability of getting information on other bus lines have been fulfilled or even better, and although the drivers are not yet satisfied with their ability to provide answers on

itineraries and schedules there has been a notable improvement. Some drivers find that it takes too long to find the information. This is likely to change as they get more experienced with the system but obviously opportunities for system improvements will also be examined.

According to the drivers the bus passengers do now have confidence in the real-time passenger information. This has had a positive impact on their attitude. They seem more relaxed boarding the buses, and even if the bus is delayed they do not seem to register the delay simply because they only refer to the real time information and not to the schedules. This contributes to an improved working environment for the bus drivers.

Transport – User perception

A key aspect in the evaluation of the VIVALDI ITS measures in Aalborg is of course the extent to which they have in fact changed transport or the perception of public transport.

As mentioned in the above there was a difference in the perceived regularity of buses among bus and coach passengers. This was examined in more detail in the survey. As it appears from Table 2.9.2-2, both users of buses and coaches have felt that there has been a reduction in the frequency of delays. But again buses come out better than coaches. Coach passengers even report a minor increase in the frequency of delays causing conflicts with personal arrangements.

Table 2.9.2-2 Calculated average the reported delays based on three levels (daily, weekly or monthly)

	Percentage of workdays with delays before	Percentage of workdays with delays after
Frequency of delayed buses	39%	30%
Frequency of delayed coaches	26%	24%
Frequency of bus delays affecting personal arrangements	13%	10%
Frequency of coach delays affecting personal arrangements	10%	11%

One of the reasons for the difference between buses and coaches may be the introduction of the Metro bus system. Previously, regional buses did not take up passengers within the built up area. Since this is not the case with the new Metro bus system, obviously the risk of delayed coaches due to inner city boardings has increased.

Therefore, it is not surprising that coach passengers report an increase in average perceived delays of 20 seconds (from 311 sec. to 331 sec.) once the buses are delayed. It could be so that the availability of bus priority is only partially able to compensate for time losses due to inner city boardings.

However, if we look at the urban bus lines there has not been a change in the way the buses operate, and therefore the results of the survey among these passengers perhaps better demonstrates the impacts of bus priority and real time passenger information.

On urban bus lines, the passengers report an average decrease in average perceived delays of 24 sec. (from 313 sec. to 289 sec.) once the buses are delayed. This is equivalent to an 8% reduction in perceived waiting times.

Impacts on buses

A separate study on the impact of bus priority has been made. In a corridor with eight signalised intersections all fitted with bus priority, the buses on average saved up to 4% of their total travel time. This is quite remarkable considering that only buses delayed more than 3 minutes actually gain priority.

Based on the study a rough estimate of the impact of the entire bus priority system is a daily travel time saving of about 4 minutes per bus passing each of the 51 signals with bus priority, or a total of 17 hours saved per day.

When looking into the surveys among users of public transport, there is a difference in the frequency by which they use the buses before and after the implementation of the new structure and the ITS measures in VIVALDI.

Table 2.9.2-3 Calculated average frequency in PT usage by passengers

	Percentage of workdays before	Percentage of workdays after
Frequency of bus use	72%	67%
Frequency of coach use	71%	68%

The simple and negative answer explaining this development could be the loss of part of the 'customers by force'. Such a loss is most likely to result in either an increase in trips by low cost modes i.e. bicycles or cancelling of trips. With the increase in fuel prices during the last year it is unlikely that this user group would have increased car trips significantly.

The positive interpretation of the results is that the availability of RTPI, the higher frequency of buses in key corridors and improved planning tools has opened public transport towards other users. The fact that you do not really need to know the schedules in advance due to the high frequencies in the rush hour and the information on when to expect the next arrival has made public transport less complicated. Hence, a new group of less frequent users is now seeing public transport as an alternative for them.

Perhaps these features are especially appealing to the male customer group as the surveys show an increasing share of male customers rising from 25% to 28% on urban bus lines and from 33% to 35% on coaches.

Local impacts on traffic and safety

It was foreseen that the number of pedestrian crossings near the terminal facility would increase due to the new functions at the terminal building (cinema, offices and shops). One of the key factors is that the Arcade through the terminal building followed the axis of the old boulevard. This is a problem as it was not possible to fit in a signalised pedestrian crossing at this point. It simply would not leave sufficient space for the bus stops. Therefore an increase in illegal crossings was likely to occur.

Both of the above expectations have come true. The total amount of pedestrian crossings in the period between 12 AM and 5PM has gone up from 150 per hour to 500 per hour. In the same period illegal crossings have increased from 13% to 17% of the

total amount of crossings. However, from video recordings it does appear as though those crossing outside the signalised intersections are well aware of the risk and more cautious. It was only at the signalised crossings that "near accidents" did occur - mainly because of pedestrians or cyclists ignoring the red light.

In a five year period ahead of the opening of the new terminal there were on average 2.6 accidents per year on J.F. Kennedys Plads in front of the terminal, of which 1.6 lead to personal injury. Since the opening of the new terminal in 2004 a total of 2.4 accidents per year have occurred, of which 1.6 caused personal injury. Before, pedestrians were included in 30% of the accidents while the figure now is about 50%.

It is likely that the growth in pedestrian accidents is to some extent related to the increase in pedestrian traffic and the after period is really too short to determine whether there is a safety problem. However, the growth appears significant and it is therefore important to monitor the accident rate in the area in future years.

Car traffic levels around the terminal facility have not changed as much as pedestrian traffic. The only differences are seen in Jyllandsgade to the east of the terminal where traffic has decreased by about 500 vehicles per day between 2002 and 2004. The main explanation is the re-routing of coaches to the new short cut between the terminal facility and the outer ring road Østre Allé. As a parking facility at the new terminal facility is also connected to Østre Allé it is not surprising that traffic levels here have gone up by about 1,300 vehicles per day in the same period.

The creation of the short cut between Østre Allé and the terminal has contributed to minimising the conflicts between motorised traffic and pedestrians on the 'city side' of the terminal. The main drawback of this solution is that it opens for car traffic illegally making a shortcut through the terminal facility. Unfortunately, some car drivers find this option too attractive, and even though it is only a few vehicles daily this hazardous behaviour does cause unnecessary and dangerous conflicts with buses.

Economy

As mentioned in the above the evaluation of bus priority indicates daily travel time savings of 17 hours per day. The delays primarily occur during rush hours where a large proportion of the passengers are either on their way to or returning from work and where the occupancy rates in the buses are at their peak.

The Danish Ministry of Transport suggests that the value of delay time in this situation is DKK 118 per hour ~ 15.75€ (MoT, 2004, Nøgletalskatalog til brug for samfundsøkonomiske analyser på transportområdet). Assuming 30-40 passengers occupy the buses the value of daily time savings due to bus priority can be estimated to 8,000-10,700€ per day.

To the extent that these time savings can also be converted into savings in schedules there is not only a benefit for the passengers but also for Nordjyllands Trafikselskab and Aalborg Kommune. Currently, the cost of one bus-hour is about DKK 427 ~ 57€, so the two project partners in VIVALDI will potentially save up to 740-970€ per day due to bus priority.

If these costs are compared to the daily costs of running the mobile communication between central servers, buses, signs and signals - currently about 155€ per day - it is obvious that a benefit of such an initiative has to come mainly from securing or expanding the customer base rather than increasing efficiency.

Process Evaluation

Process evaluation in VIVALDI has been ongoing throughout the project period. There has been a continuous dialogue between key stakeholders - politicians, technicians, operators and users - to keep the project on track. Processes and approaches have continuously been adapted whenever the situation required it.

A project like VIVALDI realised in a municipal or county organisation like the Technical Department and Nordjyllands Trafikselskab demands solid political support. Key drivers in the process of getting this support are the clear need for the project in Aalborg, the funding opportunities, the chances of success and the opportunity to become in the forefront of sustainable transport at National and European level.

The launch of CIVITAS coincided with the plans to restructure public transport and a private initiative of revitalising the terminal area. Due to its tight timescale, funding opportunity and focus on forefront technologies, CIVITAS proved to be an efficient incentive. This is acknowledged by politicians as well as technicians in Aalborg. It helped to set and reach the targets.

However, targets, political backup and funding do not necessarily create a success. The successful completion of the ITS in VIVALDI is closely related to:

- The decision to join forces with Greater Copenhagen Transport
- The capability to effectively take charge of the project
- A common commitment to succeed by project partners, consultants and suppliers

It is important to emphasise the large scale of such a complicated project, in order to attract the quality of suppliers that are able to manage its development professionally. In this case a national partner was found while in previous projects Aalborg has benefited from European contacts (e.g. in relation to investments in environmentally friendly vehicles).

We are convinced that without the dedicated effort and time spent by the ITS experts within the project team, the project would not have been successfully completed within time and budget. The resources needed were underestimated at the outset but an immediate response from the regional administration once this became apparent meant that resources were not a problem locally.

The distribution of roles between partners, consultants and suppliers not only secured the successful completion of the project; it also built up knowledge and the feeling of ownership within the organisation of Aalborg Kommune and Nordjyllands Trafikselskab. This has significant importance now that all the systems are in regular operation.

The apparent discontent among bus drivers does indicate problems in relation to the design of the terminal facility that have not been fully recognised or addressed. To

some extent this can be due to the agreements made in relation to the public-private partnership when designing the terminal facility.

There was a conflict between commercial interests in maximising building opportunities and the achievement of an optimal layout of the terminal facility and the access ramps. Having the options on land acquisitions the private partner to some extent determined the layout of the PT terminal facility. Placing the responsibility of the design of access ramps with the private partner created a design process not sufficiently co-ordinated with the 'ground-requirements' for the terminal facility.

Although these problems are external to VIVALDI they have played a key role in the bus drivers' assessment of the VIVALDI measures. The lesson learnt is that it is important to manage all aspects of a project.

Conclusions

When the VIVALDI project finishes the Telematics will continue. Moreover, it is planned that RTPI should be implemented in other parts of the city to improve the service level in the remaining part of the PT route network. Finally the measure will be further integrated with future projects to improve the environment in the urban area.

2.9.3 Bremen – CNG Fleet

The general objectives of the CNG fleet package are to:

- Enable a market breakthrough for CNG vehicles
- Improve air quality by reducing vehicle emissions
- Raise awareness about CNG vehicles

Specific targets set against these objectives:

- At least 50 CNG cars each year shall be available to private households, companies and taxi-operators

- Car traders will be trained enabling them to inform prospective buyers about CNG cars

- A public campaign will be carried out for residents living near a CNG station

The local objectives contribute to the VIVALDI targets:

LO 1 Enabling a market breakthrough for CNG vehicles

Important steps towards a market breakthrough have been made. More than 250 CNG cars have been sold and there is an increasing demand. In 2005 about 100 new CNG cars were registered. Experts estimated that, given a continuing campaign, there will be about 2,500 CNG cars in Bremen in 2010.

The training of the car traders has been a very successful strategy, because prospective buyers often consulted them for information on CNG cars. The campaign has been in general very successful and raised the awareness on CNG cars in the general public as well in prospective car buyers.

LO2 Contribute to meeting local air quality and energy targets.

The CNG car fleet has decreased energy use and emissions. Compared to a fleet made up of 60% petrol and 40% diesel cars, the CO₂ reduction amounts to 99,817 kg, which is -17%. The reduction for NO_x is 501 kg (-61%) and for PM10 34 kg (-98%).

2.9.3.1 Bremen - Clean and efficient vehicles (5.2)

Measure Overview

The core elements of this measure are a local awareness campaign for the use and purchase of CNG cars and a financial incentive to buy such cars with an environmentally friendly engine (the incentive/allowance amounts to 1,000€ for private households and up to 2,500€ for companies per CNG car). To improve the awareness of CNG cars, large stickers were attached to the cars. An information desk has been set up in the city centre by the local energy provider (SWB) to inform potential buyers about all aspects of CNG cars. The campaigning measures use different media and materials: printed materials, postcards, information panels, website, mailings, event days, participation at fairs, and establishing a cooperation network with key stakeholders. The target groups of the activities are the general public living close to the two CNG stations in Bremen, prospective car buyers, fleet managers and car traders.

There was also a plan to support the purchase of 4 CNG freighters, but this scheme was not successful. The motor industry offered such vehicles (e.g. DaimlerChrysler/Iveco) but was either not able to deliver them or prices were too high for running them in the real market. (For more detailed information on this, see the Implementation Report).

The main objective of this measure is to reduce pollution especially in urban areas by supporting and promoting CNG as an alternative fuel for vehicles. The awareness of CNG cars should be raised and the market for CNG cars stimulated through various activities and incentives.

Specific targets have been set against these objectives. 200 to 250 CNG vehicles should be introduced (through private households, companies and fleet-operators). Awareness campaigns were launched for various target groups and a strong network was established in particular with car traders, who are very important opinion makers by transferring the knowledge about CNG cars to prospective buyers. Another focus has been fleet managers and residents living next to CNG fuelling stations.

Evaluation Results

The Büro für Verkehrsökologie (BVÖ) and the University of Bremen carried out several surveys in order to measure the impact of the campaign. The first wave started in December 2002 when prospective private car buyers, business car buyers (fleet managers) and car dealers were asked to assess the situation at the outset of the campaign. In May 2003 the general public was asked about their knowledge of CNG cars and their perception of the campaign. This survey was repeated in June 2005. Fleet managers were asked in August 2003 and in August 2004 about their views on CNG cars, and car traders were also asked for a second time in August 2004. Persons and companies who bought a CNG car and received the allowance have been surveyed directly after the purchase and at the end of the project. These persons were also obliged to fill in fuel diaries.

Table 2.9.3-1 Overview of evaluation activities

Data collection activity	design	survey method	survey unit	sample size	recruitment	time
Surveying attitudes of the target group	ex ante survey	face to face interviews	potential car buyers	328	visitors of car traders exhibitions	12/2002
Surveying fleet manager / commercial users	ex ante, during and ex post survey	telephone interviews	managers of potential fleets	131 108 83	companies based on existing studies	12/2002 08/2003 08/2004
public campaign	ex post	telephone interviews	general public	205 297	residents in the vicinity of CNG station	5/2003 6/2005
Surveying automobile trade	ex ante and ex post survey	telephone interviews	owners / managers of automobile traders	88 57	traders in Bremen and Bremerh.	12/2002 08/2004
Surveying attitudes and experiences of CNG car users	ex ante ex post (panel) (oblige)	questionnaire (self complete)	registered CNG car users	95 58	obliged due to allowance	10/2005
Surveying attitudes and experiences of CNG car users	ex post survey	intensive interviews (face to face)	registered CNG car users	9	voluntary	10/2005
Survey fuel consumption	continuous (oblige)	operational data refuel diaries	registered CNG car users	144	all	10/2005
Calculation of CO ₂ reduction and average consumption	periodical	model calculation based on refuel diaries	registered CNG car users		-	9/2004 10/2005
CNG experts		focus group questionnaire		6 17		10/2005

The main issues of the surveys are listed below:

Prospective buyers (before campaigning)

- Understanding of car type, fuel consumption, environmental friendliness for buying decision
- Interest in alternative fuels
- Knowledge on and attitudes towards CNG cars
- Positive and negative aspects of CNG cars
- Motives for buying CNG cars
- Knowledge on CNG fuel stations

General public (at the beginning and at the end of the campaigning)

- Knowledge of and attitudes towards CNG cars
- Perception and assessment of the campaign
- Positive and negative aspects of CNG cars
- Knowledge on CNG fuel stations

Fleet manager (Before, intermediate and at the end of the campaigning)

- Size of the car pool
- Use of CNG cars and if so what cars
- Plans to buy a CNG car in the next 12 months
- Positive and negative aspects of CNG cars

- Motives for buying CNG cars
- Knowledge on CNG fuel stations
- Demand for more information on CNG cars
- Preferred sources of information on CNG cars

CNG users (at the start of the usage, after at least 6 months usage)

- Source of information about the allowance
- Reasons for buying a CNG car
- Positive and negative expectations
- Assessment of the CNG promotion
- Satisfaction with CNG car use
- Fuelling and related problems
- Reliability and servicing

Experts (at the end of the campaigning)

- Assessment of the success of several agencies/organisations regarding the stimulation of a CNG vehicle market
- Prognosis for the future role of several agencies/organisations regarding the stimulation of a CNG vehicle market until 2010
- Assessment of various context factors for the growth of the CNG market
- Ranking of the agencies due to their importance for the market stimulation
- Estimation of the number of CNG cars in Bremen in 2010

Awareness and acceptance of CNG cars

The main purpose of this measure is to raise awareness of CNG in different target groups. In order to measure any effect it was necessary to identify the situation at the outset. The vast majority of prospective car buyers and the general public are familiar with the term “Erdgasfahrzeug”. This may be due to the fact that this fuel is not new and has been under discussion for a long time. Moreover there is a general interest in alternative fuels. 51.8% of the prospective car buyers said that they are interested in engines based on electricity or hydrogen.

Table 2.9.3-2 Have you ever heard the term “Erdgasfahrzeug” CNG-car (%)?

	General public 5/2003 (N =205)	General public 6/2005 (N =297)	Prospective buyers 12/2002 (N =328)
Yes	84,4	89,9	89,6
No	15,6	10,1	10,4

Despite the high level of name recognition in the population, concrete knowledge about some basic features of CNG cars is low. Being asked if a CNG car is cheaper, the same or more expensive concerning fuel consumption than a conventional car, only about half of the respondents knew that it was cheaper. However, the knowledge of the eco-friendliness of CNG cars is well known.

Table 2.9.3-3 Knowledge about CNG cars (% of correct answers)

<i>Compared to conventional cars CNG cars are ...</i>	General public 5/2003 (N =205)	General public 6/2005 (N =297)
cheaper concerning fuel consumption	53,5	54,0
more expensive concerning purchase	72,9	74,5
safe in equal degree	64,7	71,4
more eco-friendly	86,5	88,6

The attitudes towards CNG cars include positive and negative aspects. The most frequently stated positive aspect is the relatively high eco-friendliness of CNG cars. After that, financial advantages in terms of low fuel prices and tax privileges are often mentioned, particularly by fleet managers.

Table 2.9.3-4 Positive aspects of CNG cars (multi-response question, %)

	Prospective buyers 12/2002 (N=294)	General public 6/2005 (N=244)	Fleet managers 12/2002 (N=128)
eco-friendliness	69,9	88,9	48,4
favourable price compared to other fuels	32,7	19,3	27,3
fuel saving	25,9	10,7	13,3
technology of the future	6,1	1,2	5,5
enjoying tax privileges	8,2	4,1	16,4
reliable energy source		7,4	
nothing positive	8,2	4,5	21,9
don't know	8,5		7,0

The weak point for using CNG cars is the poor infrastructure of fuelling stations. All target groups agree on this although the full capacity of these stations is not used. Another limitation is the low mileage range: an average CNG car can only go for around 300km with one full tank of L-CNG (low quality) that is available in the Bremen region. This point is stressed by prospective buyers and fleet managers, although this fact is not well-known in the broader public, who are more concerned about the limited loading capacity of CNG cars. This is to some extent a stereotype as the load area in modern CNG cars is only slightly smaller than in comparable conventional cars. Another stereotype is the opinion CNG cars were less safe than others.

Table 2.9.3-5 Negative aspects of CNG cars (multi-response question; %)

	Prospective buyers 12/2002 (N=294)	General public 6/2005 (N=244)	Fleet managers 12/2002 (N=128)
poor infrastructure of fuelling stations	51,9	49,2	54,7
high car price	16,4	12,6	8,6
low mileage	15,4	5,5	21,9
poor performance	12,2	6,3	3,1
poor loading capacity	16,7	11,4	12,5
undeveloped technology	7,5	6,7	3,1
safety reasons (risk of explosion)	16,4	6,3	10,2
nothing negative	9,8	15,4	21,1
don't know	7,5		

The use of CNG cars requires the knowledge of fuelling station. In Bremen two stations currently deliver CNG but the majority of the population and prospective private and business car buyers are not aware of them. However, it can be seen in the table below that the knowledge of the CNG stations has increased amongst the Bremen population (from 2003 to 2005).

People are more aware of fuelling stations if they live in the vicinity (within a radius of about 2 km). In June 2005, 33.4 % of the resident in these areas said they know a CNG station, whereas only 28.4 % of the residents in the remaining areas said so.

Table 2.9.3-6 Do you know any CNG fuelling station in Bremen? (%)

	General public* 5/2003 (N =170)	General public* 6/2005 (N =265)	Prospective buyers 12/2002 (N =328)	Fleet managers 12/2002 (N=128)
Yes	28,8	31,3	35,4	39,8
No	71,2	68,7	64,6	60,2

*those who know the term Erdgasfahrzeug

Campaign assessment - campaign awareness

The campaign “Bremer Offensive – Das Erdgasfahrzeug” consists of various activities in which several target groups are addressed with different media. The general public is reached mainly by advertisement and reports in the local daily newspapers. Moreover the message of the campaign was broadcast on television and radio. More intensively the campaign addresses residents living in the vicinity of the two CNG station. They received leaflets and had the chance to find out about CNG cars in their neighbourhood (e.g. by stands on local markets). Car traders and fleet managers were also addressed by mailing of various tailor-made information materials. A network of car traders was set up and a number of joint events carried out.

About one in every five adults in Bremen noticed the campaign “Bremer-Offensive - Das Erdgasfahrzeug”. This is a very high share as the subject is very specific and people

suffer increasingly from an information overload. The awareness of the campaign decreased slightly from 2003 to 2005. The reason is that in the first year of the campaign the activities related to the broader public were much more numerous than in the following years, when the campaign was focusing directly on specific target groups. Car traders and fleet managers are far more familiar with the campaign; although it must be stated that a huge part of them did not remember the information material they received.

Table 2.9.3-7 Have you ever noticed the campaign Bremer Offensive –Das Erdgasfahrzeug? (%)

	General public 5/2003 (N =205)	General public 6/2005 (N =297)	Car traders 8/2004 (N =57)	Fleet managers 8/2004 (N =83)
Yes	21,5	17,8	56,1	56,8
No	78,5	82,2	43,9	43,4

Campaign content

Those who noticed the campaign have a rather positive impression. The credibility and the importance of the issue were acknowledged by the majority of the population. However, only a minority feels that the campaign has a personal importance to them. Car traders and fleet managers also assess the campaign quite well. On the other hand about half of the fleet managers express a need for further information, particularly about the availability of CNG cars. The campaign managers produced a special vehicle leaflet to respond to this lack of information.

Table 2.9.3-8 Do you think the campaign is ... (% of affirmative responds)

	General public 5/2003 (N =42)*	General public 6/2005 (N =37)*		Car traders 8/2004 (N =57)*	Fleet managers 8/2004 (N =83)*
credible	74,4	75,5	informative	65,6	83,0
interesting	77,3	81,1	attractive	68,8	70,2
of general importance	70,5	81,1	comprehensive	71,9	66,0
of personal importance	31,8	40,5	sale-promoting	37,5	21,3

* those who noticed the campaign

Being asked what the message of the campaign was about, the majority of the general public and fleet managers could remember the items of eco-friendliness and of cost advantages. Those who noticed the campaign knew more about CNG cars than those who could not remember the campaign. This can be explained as a learning effect of the campaign but also by a selective perception of those who already knew something about this issue.

Table 2.9.3-9 Knowledge about CNG cars by perception of the campaign (Percentage of correct answers)

<i>Compared to conventional cars CNG cars are ...</i>	General public 6/2005	
	perception of the campaign (N=45)	no perception of the campaign (N=212)
cheaper concerning fuel consuming	60,0	51,9
more expensive concerning purchase	82,2	72,2
safe in equal degree	81,8	69,2
more eco-friendly	97,8	86,3

During the course of the campaign the awareness of the financial incentive for those buying a CNG car declined amongst the general public. This can be explained by the fact that in the course of the project the general public were becoming less of a focus for the campaign (see above).

Table 2.9.3-10 Do you know that the purchase of a CNG-car is supported with up to 2,500 Euros? (%)

	General public 2003 (N =173)	General public 2005 (N =264)
Yes	32,9	16,7
No	67,1	83,3

Demand and potential for CNG cars

The campaign succeeded in supporting the purchase of 250 CNG cars in Bremen in the VIVALDI project. By October 2005 the local gas provider received more than 300 applications for the incentive for the purchase of a CNG car: 297 were approved, of these 231 came from commercial users and 66 from private users. It was not planned to have more companies than private users, but it is probably due to the fact that companies receive a much higher allowance (2,500 €). The campaigners justify the unbalanced support by arguing that business cars have a higher mileage that makes them a better advertising medium. (The buyers of a car are obliged to show CNG stickers).

Table 2.9.3-11 Interest in VIVALDI-CNG cars (Number of applications by year)

Year	Number
2003	61
2004	82
2005 (Oct)	161
Total	304

Unfortunately not everyone whose allowance was approved used it. Up to October 2005, only 70% of the approved applicants bought a CNG car: in total, 160 vehicles have been purchased. The rest of the buyers either have to wait for the purchase,

because several manufacturers have already long waiting times for delivery of their vehicles, or has eventually decided to buy another car type.

Although the actual number of CNG cars sold is relatively small, there is a growing demand for them (see table below). Correspondingly the share of the surveyed car traders which have CNG cars on sale grew from 44.3% to 57.9%.

Table 2.9.3-12 Demands for CNG cars (percent)

	Car traders 12/2002 (N =88)	Car traders 8/2004 (N =57)
no	59,1	42,1
< 1 per month	31,6	26,3
> 1 per month	9,1	31,6

Amongst the general public the share of those who are interested in buying a CNG car decreased to a more realistic level.

Table 2.9.3-13 Can you imagine opting for CNG car the next time you buy a car? (%)

	General public 2003 (N =170)	General public 2005 (N =266)
Yes, absolutely	13,5	4,1
rather yes	25,3	28,2
rather not	17,8	30,8
absolutely not	24,7	19,9
not applicable	18,8	16,9

The main incentive to buy a CNG car is to have cost and fuel savings. Prospective buyers stated that the matter of fuel consumption is most important to them when buying a new car.

Table 2.9.3-14 Important aspects of car buying decisions of prospective buyers (%)

	important	somehow important	not important	do not know
brand of car	38,5	32,0	29,5	
fuel consumption	70,7	21,0	8,2	
eco friendliness	61,8	25,9	12,2	0,3

The target groups were asked which conditions or activities are needed for stimulating the demand for CNG cars. A prerequisite for all groups is a denser net of fuelling stations providing CNG. All state too that an allowance for the purchase of a car would be necessary: cost advantages either by operating or purchase costs are essential. Car traders underline the impact of a high quality and intensive advertisement campaign for further growth of the CNG market. They also say that they do not have sufficient

information about CNG cars. Both points mostly address car makers that often do not satisfactorily promote their CNG cars.

Table 2.9.3-15 Conditions for stimulating the demand for CNG cars (multi-response question, % of answers)

	Prospective buyers 12/2002 (N=328)	Car traders 8/2004 (N =57))	Fleet managers 8/2004 (N=128)
allowance to purchase	43,9	43,7	42,7
sustainable cost advantage	49,7	13,8	48,9
lower car taxes	37,2	13,8	32,1
denser net of CNG fuelling stations	34,5	57,5	43,5
better information	4,6	31,0	20,6
more intense advertisement		42,5	

User Experiences

People who had received allowances for their CNG car purchase were obliged to complete a survey just after they bought the car and another 6-12 months later. In the first survey 95 people took part: 40% of them individuals; 60% business people. The socio-demographic characteristics of the private users show that they were mostly male (76%), that, compared to the average population, they lived more frequently with partners and with children, and that about two thirds of them were between 30 and 49 years old (none of them were under 30).

There is a wide range of information sources by which the CNG car owners could have known about the promotion. Newspapers, the Internet and car traders have been the main information sources for the private users, whereas the business users have been pointed to the promotion by car traders, information brochures and personal recommendation. It is likely that at least the success of the brochure and of the car trade is a consequence of the intensive campaigning activities.

Table 2.9.3-16 How have you been made aware of the support programme?

	private (N=37)		business (N=58)		all (N=95)	
	responses	% of cases	responses	% of cases	responses	% of cases
daily newspapers	14	37,8	13	22,4	27	28,4
newspapers, magazines	3	8,1	7	12,1	10	10,5
radio	1	2,7	5	8,6	6	6,3
TV	2	5,4	2	3,4	4	4,2
information events	3	8,1	9	15,5	12	12,6
brochures	5	13,5	17	29,3	22	23,2
advertising letters	1	2,7	5	8,6	6	6,3
posters			5	8,6	5	5,3
Internet	14	37,8	10	17,2	24	25,3
car trader	10	27,0	18	31,0	28	29,5
person. recommendation	5	13,5	21	36,2	26	27,4
others			9	15,5	9	9,5

Source: BVÖ; 2005

The main reasons to purchase a CNG car have been, expectedly, cost advantages (beneficial fuel price, small fuel consumption, incentive, tax advantages) and environmental protection.

The second survey consisted of 58 people, most of whom filled in the questionnaire after having used their CNG cars for 5 to 8 months. The main findings are:

- Most respondents thought that in terms of cost the car use will be profitable after 2 years.
- The CNG car users were satisfied with the low fuel consumption and the performance of the engine but they were more critical of the mileage.

Table 2.9.3-17 User satisfaction

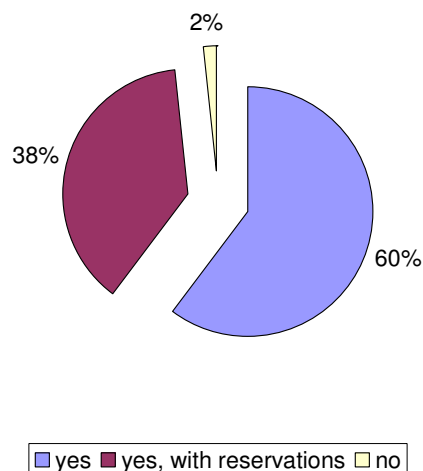
	fuel consumption		mileage		road performance		density of CNG filling stations	
	N	%	N	%	N	%	N	%
very satisfied	23	40,4	3	5,3	16	28,6	1	1,7
satisfied	32	56,1	29	50,9	37	66,1	16	27,6
dissatisfied	2	3,5	25	43,9	3	5,4	41	70,7

Source: BVÖ; 2005

- 70% of the CNG users are dissatisfied with the availability of fuelling stations in the Bremen region. Half the users had faced running out of CNG, because there was no fuelling station. (As CNG cars are mostly dual-fuel, drivers could switch to petrol and reach the next fuelling station or their destination.)
- The majority of the respondents (70%) prefer to refuel regularly at the same station, which is normally the one next to where they lived. Users estimate that it takes them, compared to a conventional refuel, 5 to 10 minutes more for each fill up. This is a real disadvantage for fleet managers.

- According to user comments the filling stations differ a lot in terms of the reliability and the technical facilities for refuelling.
- About half of those who had made long distance journeys with their CNG car had “occasionally had problems” to get CNG. Usually they prepare their journeys by taking up to date information about the fuelling station network from the Internet.
- About 57% of the users have not faced problems which required a visit to a garage. If they have to do so, 60% stated that the problems were solved quickly (60% of the incidents are due to the CNG engine). Except one, all cases have been handled under guarantee.
- The majority stated that they can “recommend with a clear conscience” a CNG car.

Figure 2.9.3-1 Can you recommend your CNG car with a clear conscience?



Up-scaling the measures – the view of the experts

Qualitative assumptions:

The VIVALDI CNG measure consists of a public campaign for buying CNG cars and financial support (promotion) for each purchase. These elements apply to the whole Bremen area and are limited for the VIVALDI project duration. Up-scaling is conceivable as an extension of the intensity of the measures (more campaigning, more financial incentive) or/and an extension of the measures.

Design and recruitment

The main methods in order to estimate the future scale of CNG cars are a focus group discussion and expert assessments. Experts are mainly those who are involved in the campaigning, in the selling of the CNG cars and in providing the infrastructure. The up-scaling depends heavily on the influence of unrelated conditions produced by, for instance, the economy (change of fuel price), the motor industry, the energy provider (delivering the natural gas and operating the fuelling stations), politicians and legal regulations (stimulating the market through incentives), and the potential car buyers. Analysing existing evaluation results and the outcome of the focus group discussion a list of relevant context conditions was created and transformed into a questionnaire sent to 28 experts selected by the focus group: 16 of them returned the questionnaire, a response rate of 57%. However the number of responses is rather unbalanced in terms

of representations. Experts working in the field of CNG provider or as consultants are unduly represented (see table below).

Table 2.9.3-18 Number of experts by organisation

Organisation / Agency	N
CNG provider	4
automobile trade	2
car drivers organisations (ADAC; VCD)	1
consulting/evaluation (ecolo, BVÖ, Büro A)	6
politicians/administration (SBUV, BMU, UBA)	1
business users (incl. BSAG; WEB)	1
car makers (Ford/IVECO)	-
driving school	1

The questionnaire

The experts were asked to assess the actions of different organisations, which are considered as important for a market breakthrough of CNG cars by 2010. The actions of the following seven agencies were to be judged by the experts: car manufacturers, CNG providers, politicians, car traders, prospective car buyers, supporting networks and campaigners. For each of these groups the experts were to assess how efficient the actions of this group is (assessment) and how likely the group will meet the expectations of the experts in 2010 (forecast). The scale for the assessment is 1 = is completely efficient, 2 = is efficient, 3 = must be improved and 4 = must be greatly improved. The scale for the forecast is 1 = very unlikely (25%), 2 = rather unlikely (25-50%), 3 = rather likely (50-75%) and 4 = very likely (75-100%). In the following tables the mean value of the data from all experts is presented for their assessments and forecasts. In addition the ratio forecast/assessment was calculated. This ratio should indicate the range of problems: a value below 1 indicates a relatively low likelihood that the problems can be solved and a value above 1 a relatively high likelihood.

To give an example (see the table): experts suggest that car manufacturers' action to produce a wide range of different CNG car models must be improved (the mean is 3.28 which is between 3 = "must be improved" and 4 = "must be greatly improved"). The likelihood that these improvements will have taken place in 2010 is relatively low (forecast value=2.56). The ratio forecast/assessment amounts to 0,78, which indicates a problem that is difficult to solve. On the other hand experts assess the reliability of CNG cars more efficient and suppose that it is rather likely that required improvements will be realised in 2010. The ratio is high and indicates that problems concerning this issue will be solved.

In the following tables items with a high standard deviation are marked. Means that are marked "***" indicate that the answers of the experts differ a lot (standard deviation > 0.7). If means are marked "***", experts disagree even more among each other (standard deviation > 0.9).

Results

Experts are quite confident that car makers will solve technical problems (mileage, loading capacity, engine's efficiency), but are in doubt, whether manufacturers' commitments to CNG cars will be sufficient to enable a market breakthrough.

Table 2.9.3-19 Experts' view on car manufacturers (means)

Car manufacturers	Assessment	Forecast	Forecast / Assessment
The commitment (propensity to invest) to develop and produce CNG cars	3,50	2,75	0,81
number of different models of CNG cars (range)	3,38	2,56	0,78
availability of CNG cars (delivery times)	3,25	2,69	0,85
efficiency and performance of the engines	2,44	3,06	1,28
mileage (reach) of CNG cars	3,38	2,94	0,90
loading capacity of the CNG cars	2,31	3,13	1,38
reliability (no mending)	1,94	3,25	1,76
information from the car maker to the car trader	3,25	2,63*	0,81
marketing (advertisement, public relations, information,...)	3,31	2,50	0,76

Vehicles running on CNG are manufactured by the car industry. How efficient is the action (performance) of this group concerning the following items?

How likely the car makers will have met your expectations for the year 2010?

The main problem is the low density of fuelling stations, particularly in Bremen and Europe. The forthcoming action of this group is optimistically estimated. Experts are confident that most of the problems can be solved.

Table 2.9.3-20 Experts' view on CNG Provider (mean)

CNG Provider	Assessment	Forecast	Forecast / Assessment
The commitment (propensity to invest) to develop an infrastructure of fuelling stations	3,06**	3,13	1,02
Number, density of CNG fuelling stations in Bremen	3,56	2,94	0,83
Number, density of CNG fuelling stations in Germany	3,06	3,19	1,04
Number, density of CNG fuelling stations in Europe	3,69	2,50	0,68
Access (sign-posting, opening hours) to the CNG fuelling stations	3,06	3,19	1,04
Reliability (low susceptibility to trouble) of the CNG fuelling stations	3,19*	3,13	0,98
Handling of refuelling (duration, easiness)	2,19**	3,06*	1,40

The CNG providers are responsible for the CNG and the fuelling infrastructure. How efficient is the action (performance) of the CNG providers concerning the following items?

How likely the CNG provider will have met your expectations for the year 2010?

Experts assess the political action as better than the actions of car makers and CNG providers. However it is still rather inefficient. The most important political decision is to tax vehicles according to their emissions. Tax advantages are seen as most effective for stimulating the market.

Table 2.9.3-21 Experts' view on policies (mean)

Politics	Assessment	Forecast	Forecast / Assessment
The political commitment to foster the CNG technology in the transport sector	2,56	2,62*	1,02
The aim of the EU to cover until 2020 10% of des fuel demand by CNG	2,81	2,38	0,85
Measures of the cities which have to take effect on the basis of the EU clean air legislation for particles(2005) and NO2 (2010)	2,81	2,31	0,82
garantueed tax advantages for CNG up to 2010 (about 50% cheaper than petrol)	1,94	3,06*	1,58

In politics objectives are determined and actions are taken. How sufficient is the current political action regarding a stimulation of the CNG vehicle market in the following fields? **Assessment:** 1= completely sufficient to 4 = very inefficient

How likely the politicians will have met your expectations for the year 2010? **Forecast:** 1= very unlikely to 4 = very likely

Politics (future requirements)	Assessment	Forecast	Forecast / Assessment
Obligation to label vehicles according to their emissions. (As a prerequisite for prioritising CNG vehicles in road traffic. E. g. guaranteed access to city centre in case of exceeding pollutant's critical values)	2,56*	3,06*	1,20
Obligation to label vehicles according to their energy consumption (as for electric appliances)	2,81**	2,62**	0,93

What other political decisions are necessary? **Assessment:** 4 = urgently required, 3 = desirable 1 = not necessary;

Forecast: 1= very unlikely to 4 = very likely

The experts asked a large number of car traders, but they are sceptical about implementation. It has to be considered that car traders are not a homogeneous group. A small number of companies which champion CNG cars contrast with the majority of traders who don't get involved.

Table 2.9.3-22 Experts' view on car traders (mean)

CAR TRADE	<i>Assessment</i>	<i>Forecast</i>	<i>Forecast / Assessment</i>
The commitment of car traders to sell vehicles running on CNG	3,34	2,50	0,75
The standard of knowledge of the staff about CNG cars	3,28	2,75	0,84
The garage service	2,97*	2,81	0,95
The availability of demonstration cars	3,09	2,56	0,83

Car traders sell CNG cars. How sufficient is the action (performance) of this group concerning the following items?

Assessment: 1= sufficient to 4 = must be improved

How likely the car traders will have met your expectations for the year 2010? **Forecast:** 1= very unlikely to 4 = very likely

Experts say that car buyers' knowledge about the economic and ecological benefits of CNG cars is insufficient. They are not confident that this will change by 2010. They have also no trust that conditions will make it more important for car buyers to buy eco-friendly vehicles.

Table 2.9.3-23 Experts' view on prospective car buyers (mean)

prospective Car buyers	<i>Assessment</i>	<i>Forecast</i>	<i>Forecast / Assessment</i>
The awareness of CNG cars	3,09*	3,00*	0,97
The knowledge about cost advantages and eco-friendliness of CNG cars	3,44	2,81*	0,82
The subjectively expected utility of fuel-efficient vehicles in the car buying decision	3,06	3,38	1,10
The subjectively expected utility of eco-friendly vehicles in the car buying decision	3,13*	2,63*	0,84

The demand of CNG vehicles depends also on the knowledge and the attitudes of the prospective buyers. How well are these features concerning the following items developed? **Assessment:** 1= completely sufficient to 4 = must be improved clearly

How likely the prospective car buyers will have met your expectations for the year 2010? **Forecast:** 1= very unlikely to 4 = very likely

The Bremen campaign "Bremer Offensive – Das Erdgasfahrzeug", the larger national network "Trägerkreis Erdgasfahrzeuge", the car user organisations and the support coming from VIVALDI are considered as the driving forces by the experts. The support of city fleet managers is urgently needed but not expected in full by 2010.

Table 2.9.3-24 Experts' view on supporting networks and agencies
(mean)

Networks and Agencies	Assessment	Forecast	Forecast / Assessment
The commitment of the „Trägerkreis Erdgasfahrzeuge“ (Association of the natural gas and motor industry)	2,38	3,19	1,34
The commitment of the Bremen Network of the campaign for CNG cars “	2,13	3,20	1,50
The support from environmental organisations	2,88	3,00	1,04
The support from national car user organisations	2,50	3,13	1,25
The support from driving schools	3,00	2,60	0,87
The support from public fleet managers (incl. PT operators)	3,60	2,47	0,69
The support from the <i>Vivaldi</i> -project of the EU	2,47	2,53*	1,02
The support from science/evaluation of the <i>Vivaldi</i> -project	2,40	2,57*	1,07

An introduction of a new technology requires the cooperation of several agencies. How sufficient are the activities of the following networks and agencies? **Assessment:** 1= completely sufficient to 4 = must be improved clearly
How likely the networks and agencies will have met your expectations for the year 2010? **Forecast:** 1= very unlikely to 4 = very likely

The issue is not solely down to the campaign. The activities are considered as efficient and desired improvements can be realised. Experts disagree among themselves about the amount of the incentive.

Table 2.9.3-25 Experts' view on the campaigners
(mean)

Campaigners	Assessment	Forecast	Forecast / Assessment
Information about the economic benefit of CNG car usage	2,13	3,40	1,60
Information about the allowance for the purchase of or a conversion to a CNG car	1,93	3,53	1,83
Information about the safety of CNG cars	2,27*	3,20	1,41
Information about the eco-friendliness of CNG car usage	2,07	3,53	1,71
variety of target groups (private and business user, car-trade)	2,27*	3,13	1,38
The standard of provision of information to target groups	2,53*	3,13	1,24
Range of media (press, print, Internet, tv, cinema, radio, face-to-face, test runs, ...)	2,20	3,07*	1,40
The offered amount of 1000 € allowance for private car buyers	2,29**	2,57**	1,12
The offered amount of 2500 € allowance for business car buyers	1,50	3,00*	2,00

In Bremen a campaign was carried out in order to inform about CNG cars and respective allowances (flyer, newspaper reports/advertisements, web-site, events, etc.). How sufficient are the activities of the campaigners? **Assessment:** 1= completely sufficient to 4 = must be improved clearly
Provided the campaign will be resumed until 2010, how likely the campaigners will have met your expectations for the year 2010? **Forecast:** 1= very unlikely to 4 = very likely

Experts also assessed which organisations are the most important for growth of the CNG car market by giving them points. Most important are clearly the car manufacturers (42 points) and the CNG providers (34), as they are important to ensure ample provision of CNG cars and fuelling stations. In relation to politics, national policy is considered more important than EU or local policy.

Table 2.9.3-26 Experts' view on the importance of agencies (points)

Points for agencies/organisations	sum	mean	N
car-manufacturer	42	3,23	13
CNG provider	34	2,43	14
EU-policy	11	1,83	6
national policy	23	2,30	10
local policy	6	1,20	5
car trade	18	2,00	9
prospective CNG car buyers	11	1,83	6
supporting networks	3	1,00	3
campaigners	13	1,44	9

What are the most important agencies/organisations that can induce a market breakthrough for CNG cars? Give them points depending to their importance: You have 10 points to share out which should be given to at least two agencies/organisations.

Furthermore, the experts were asked to consider the impact of different trends/developments on the CNG car market. Rising oil prices were seen as the factor that is likely to have the most stimulating influence on the CNG car market. Also political measures for clean air are considered crucial.

Table 2.9.3-27 Experts' view on the impact of context conditions

impact on the CNG market	< stimulating hold up>				
	++	+	0	-	--
development of the mineral oil price	15	1			
development of the natural gas price	4	2	2	6	2
development of the fuel cell		2	10	4	
development of alternative propulsion technologies		2	6	8	
development of the demand for cars	2	8	4	2	
consequences of climate change	4	8	4		
measures for clean air	7	8	1		

The development of the CNG market depends also on various context conditions. Will the following developments (so far you estimate them) stimulate or hinder in the coming 5 years the growth of the CNG market?

Finally, the experts were asked to estimate the future number of CNG cars in Bremen. All experts say that the number of CNG cars will rise in the forthcoming 5 years. Currently there are about 300 CNG cars registered in Bremen: provided the campaign continues, this number can increase to about 2,500 in 2010. This equates to an increase of 800% in 5 years. Without a further campaign, the growth will be only half as much.

Table 2.9.3-28 Experts' view on the number of CNG cars in Bremen in 2010

	N	Min	Max	mean
with campaigning	14	1000	5000	2518
without campaigning	14	600	3500	1175

In Bremen are by now about 300 CNG cars on the street. How many will be there in 2010? Assume two scenarios, first with the resume of the campaign, secondly without any campaigning.

2.9.3.2 Bremen - City logistic scheme/freight village (10.1)

The local objectives of the city logistic package are:

To strengthen the competitiveness of city logistics to conventional logistic offers by making it more efficient

To raise awareness in potential stakeholders through public campaigns and through the evidence of the demonstration project

A significant reduction in energy consumption and emissions in the city logistics fleet

A significant reduction in costs (energy costs, operating costs, investment costs)

To raise acceptance and efficiency of telematics by means of better utilisation, improved delivery quality, improved order processing and fuel savings

To increase acceptance of low emission vehicles in freight transport both by carriers and shop keepers

To get new clients into the scheme of consolidated transport

LO 11 The main local objective is to have more efficient freight transport in terms of costs and emissions

Most of the stated objectives have not been achieved. Progress has been made in terms of consolidating the transport goods. Taking the example of the consolidated freight deliveries to Dodenhof, about 50km from the freight village in Bremen, the costs per vkm could be reduced from 2.02 € to 1.76 €. In terms of fuel consumption 41.8 % could be saved.

Measure Overview

The overall aim of this measure is to reduce emissions and energy consumption by making the distribution of goods to difficult areas, such as the city centre, more efficient. To achieve this objective it is necessary to strengthen city logistics in comparison to conventional delivery systems. City logistic has to strive to get new clients into the scheme.

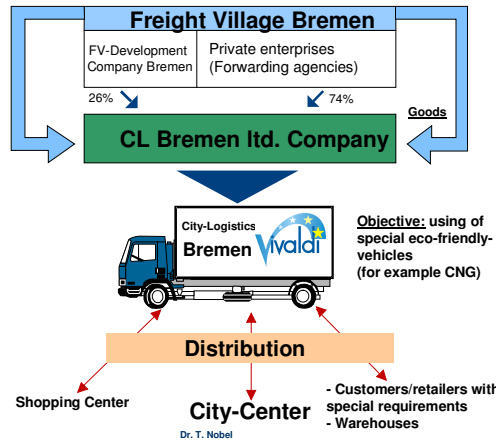
Measure description

This measure is about the improvement and development of an efficient urban freight distribution through consolidation systems and logistic software. There is already some experience with city logistics in Bremen, as the first application took place in the mid-90s. Based in the freight village ("Güterverkehrszentrum" GVZ) - the intermodal freight centre- the City-Logistik Bremen GmbH was founded to consolidate and deliver goods to recipients in so-called difficult inner-city areas. An update of City Logistik (CL) should happen with:

- Application of CNG trucks (up to 12t gross weight)
- Establishment of consolidated traffic into the city centre of Bremen and the region

- Development and application of telematics solutions for the optimisation of delivery flows

Figure 2.9.3-2 Bremen Freight Village Schematic



Evaluation Results

The evaluation is based on process interviews and on an analysis of operational data. One main element of this measure included the purchase of at least 4 CNG trucks. This could not be realised, because the vehicle industry could not deliver vehicles that had been ordered; or offered vehicles were not affordable. Because of this the potential impact of this measure had to be simulated. Unfortunately another element of this measure, namely the development of a route optimising software, was not implemented so far that it could be tested in practice; this could therefore not be evaluated.

Consolidation of delivery trips to a regional shopping centre

Consolidation of delivery trips means that one carrier takes over a number of jobs that formerly had been done separately. Through consolidation, the number of trucks can be reduced. CL for example took over the cargo of two carriers from GVZ (Bremen) to the regional shopping centre Dodenhof (Posthausen). The shopping centre is 50km from the freight village GVZ. A round-trip (including local distribution routes) is about 120km. CL does this trip 20 times per month with a truck-trailer combination. By using a self-unloading unit CL can move the goods into the warehouse easily and thereby reduce the times of loading and charging significantly.

The table below covers the monthly operating costs for goods transport. It shows the economic advantage of the consolidation. Before consolidation, two carriers had to each use a HGV, which are now replaced by a truck-trailer combination. The costs for two carriers amounted to 3.52 (=2*1.76) Euro/km. They are now reduced to 2.02 Euro/km. This amounts to a cost reduction of 42.7%.

Table 2.9.3-29 Economic impact of route bundling

	Solo-HGV	truck-trailer combination
leasing HGV	1280,10	1.280,10
leasing trailer	-	560
Fuel and lubricants	322,37	381,94
truck driver wage	2.045,20	2.045,20
social insurance	315,94	315,94
expenses driver	96	96
employers' liability insurance association	58,56	58,56
transport insurance	34,26	34,26
cellular phone	50	50
wash/small costs	15	15
total costs per veh.	4.217,43	4.837, .00
cost per km	1,76	2,02

Consolidation of transport saves fuel: the operating data of CL shows that a single truck consumes 18.5 l Diesel per 100km, whereas the fuel consumption of the truck-trailer combination is 21.8 l Diesel per 100km slightly higher. This leads to a 41.8 % reduction of fuel consumption for the trips to the shopping centre.

Scenarios for cleaner goods transport by consolidation and CNG trucks

The following table shows how freight consolidation and the use of clean vehicles reduces the emissions caused by the distribution of goods within the city. All scenarios simulate goods transports from the freight village to three different locations in the city. In scenario 1 this is done by 3 carriers using each a conventional truck. In total 100 vehicle km are necessary for this transport. Scenario 1 is the reference quantity to which the other scenarios are related. In scenario 2 the carriage is loaded on one truck (consolidation), which reduces the vehicle km from 100 to 60km and also reduces the emissions. If the truck has a diesel soot filter, as in scenario 3, micro particle emissions can be reduced to 12% (compared to 100% in scenario 1). The best situation is in scenario 4. A CNG truck emits hardly any particles (emission reduced to 1% of scenario 1) and the emissions of NO_x are also very low (18% of scenario 1).

Table 2.9.3-30 Scenarios for the impact of consolidation and CNG usage in freight transport

Scenarios	vehicle-km	particles [g]	NO _x [g]
Scenario 1 - Situation at present, several trucks	100	16,100 g	703,0 g
		(100 %)	(100 %)
Scenario 2 – bundling with conventional truck	60	9,660 g	421,8 g
		(60 %)	(60 %)
Scenario 3 – bundling with truck diesel soot filter	60	1,932 g	421,8 g
		(12 %)	(60 %)
Scenario 4 – bundling with truck running on CNG	60	0,145 g	126,5 g
		(1 %)	(18 %)

City Logistics have to deal with several structural problems and developments. The following list gives an overview of different barriers for the growth of city logistics:

- CL usually provides only transport services (value-added- services are often missing)
- Fluctuation/variation of delivery items / low level of “classic“ CL-goods (approx. 20% market share)

- Co-operation structure (almost no retailers but only wholesalers) – high intensity of competition
- Telematic problems: Exchange of data, collection activity, interfaces
- Corporate identity problematic
- There is no regulatory political preference for the CL vehicles
- Reduction of delivery sizes (more and smaller shipments – the grouping of goods is difficult)
- Intense growth of the courier, express and parcel services (“ebay-isation”)
- Economic problems after ending of the financial model support - for example: the high costs for the grouping of the goods endanger the economic success

All together these factors explain why the success of this measure, particularly in the city centre, is limited.

A city logistics company focussed solely on delivery to the city centre is not viable: successful companies get most of their profit by serving clients with special needs and by delivering to other “problem areas”. In order to sustain the service, city logistic companies need regulatory policy support; some kind of prioritisation in terms of delivery times or exclusive access is required.

Regarding the use of CNG trucks the situation is even worse. The vehicle manufacturers appear not to be taking the risk to push CNG in road freight transport. As stated in the implementation report: “Promising advertising of CNG trucks from car manufacturers always ended up with disappointing offers. Announcements of the new DING-technology (direct-injection natural gas engines) are only running as field tests with one truck and will not be on the market before 2005. Volvo will produce a new diesel truck which will fulfil EURO V standards in late 2004 and totally abandon the CNG programme. Mercedes will not produce 7.5 to 12.0 ton CNG trucks, because the research department is focusing on fuel cell and hydrogen technology.” The plan to buy at least one vehicle at the end of the VIVALDI project failed in June 2005, because a promised and advertised truck (IVECO EURO CARGO 12,0 ton CNG) has not been delivered due to a sudden management decision.

2.9.4 Bremen – Information and Ticketing

This package consists of the following measures: integrated transport pricing system (7.2) and travel information centre (12.2).

The general objectives of the PT information and ticketing package are:

To reduce sale and distribution costs of PT operator BSAG through the introduction of the “Kundenkarte” (card for registered PT users) and smartcard-based tickets

To make it easier for PT customers to get the information they want

To make it more comfortable for PT customers to buy and pay for tickets

To foster customers’ loyalty to the PT operator

To increase the number of request and post-paid trips

Against these general objectives the following concrete targets are set:

Concentration of several BSAG services (sales and distribution, annual subscription, time table and fare information) in a single place

Increase in staff numbers, number of information desks and the amount of space
Training the staff so that they can meet as many information demands of the customers as possible
The set-up of electronic travel information terminals for self service
Reduction of waiting times, so that visitors do not have to queue for information
Supply of information about other mobility services like car sharing, railway and integrated offers
Supply of a specific chip-card which enables PT customers to purchase tickets and settle the account by the end of each month (Kundenkarte)
Introduction of special price offers for those customers which have got a Kundenkarte
A public campaign for the use of the Kundenkarte

LO3 Better information on PT

The travel information centre has been set up. The previously cramped conditions changed to attractive premises equipped with four helpdesks and two self-service information terminals. The new facility has enough space for staff and visitors, and enables an agreeable stay. The staff have been trained, thus being able to advise on the car sharing service. Visitor surveys confirm a high satisfaction with the new facility in terms of waiting times and quality of consultancy. Better information on PT includes the awareness of new offers. The campaign for the new post-paid BOB ticket proves to be very efficient. An assessment of the advertising has shown that every third person in Bremen knows this offer.

LO4 Easier use of PT

The post-paid e-ticketing system now referred to as BOB Ticket was implemented in June 2005. No data on customer satisfaction is available. However the very good sales figures show the attractiveness of the offer. By the end of October 2005 already more than 10,000 PT users had subscribed to the BOB Ticket. Evidently, it has been a barrier for irregular PT users to buy ticket in advance or at the driver. The post-paid system makes it easier for them to use public transport.

2.9.4.1 Bremen - Integrated transport pricing system (7.2)

Measure Overview

On the basis of the GeldKarte (MoneyCard) of the German credit services sector, a chip card was launched in June 2005 which is a kind of debit card for the PT journeys of the user. It was named BOB-ticket which stands for “Bequem ohne Bargeld” (convenient without cash). The ticket allows customers to easily use public transport without prepaid tickets, electronic or hard cash: the passenger uses public transport now and pays later. The customer registers once at one of the three involved public transport operators in Bremen, Oldenburg, and Bremerhaven. When entering the PT vehicle, the customer electronically books in the destination and (when not travelling alone) the number of passengers for his journey. The information is stored on the registered smartcard and also transferred to a main database for the monthly bill, his bank account is billed at the end of the month. Customers doing several journeys a day are charged for the cheaper day ticket rather than several single trips. Integrating regional and peri-urban commuters the BOB-ticket started in Bremen at BSAG and two other public transport operators of the region.

The objective of this measure is to increase the patronage of local and regional transport. The measure address non-regular PT user, and aims to win new PT customers and to foster the loyalty of existing non-frequent users. The measure is an element of the electronic ticketing system, which should generally increase the number of passengers but also reduce the sale and distribution costs of the operator. A refinancing of the system within 5 years is the aim.

Evaluation results

The evaluation was carried out mainly by BSAG, the local PT operator. Two acceptance studies concerning the post-paid system and the Bonus system were carried out in October 2002. A representative sample of 1,000 residents in Bremen was surveyed by telephone interviews.

An acceptance study of the BOB-Ticket is currently ongoing. Operational data of BSAG will be used to assess changes in PT usage.

Table 2.9.4-1 Information on the Surveys

main survey question	survey design	survey method	survey unit	survey size	recruitment	time
acceptability of the post paid system/ bonus system	ex ante	telephone	representative sample	1000 500		10/2002 10/2002
advertisement for the post paid system	ex post	telephone	representative sample	80		5/2005
usage of the post paid system	ex post	operational data	<i>BSAG data on ticket sales</i>			from 5/2005
acceptance of the post paid system						10/2005

Researching the market for the post-paid and bonus systems, based on e-ticketing

Before the launch of the BOB ticket the acceptability of three elements of the post-paid system were investigated: paying after use, paying the best price for daily usage, paying the best price for monthly usage. Separately, the acceptability of a bonus system was tested. The respondents should say how likely they will use these offers. The table below shows the share of those who are likely to use them. The respondents are classified by the frequency they use PT: For example 22% of the non-regular PT users say that they are likely or very likely to use the post-paid system.

Table 2.9.4-2 Interest in elements of the post-paid system (percent of general public)

	regular user N=270	non- regular users N=151	potential users N=391	non users N=191	Total N=1003
post paid system	20	22	15	9	16
best-price system (daily basis)	24	23	18	9	19
best-price system (monthly basis)	20	21	12	11	14
	N=147	N=68	N=209	N=77	N=501
Bonus system	17	31	17	7	17

The market survey shows that interest in the new planned offers is not overwhelming. PT users (regular or non-regular) are more interested than potential and non-users. The interest decreases significantly, when respondents are older than 55 years. One key acceptance barrier was that the post-paid offers were originally combined with a basic monthly fee which amounts to 5 Euros for the post-paid / best daily price and to 10 Euros for the post-paid / best monthly price. The strategy to combine the offer with a basic fee was abandoned, when the BOB ticket was actually launched. Respondents are also reserved because they fear losing control of the costs if they pay afterwards by direct debit. The positive aspects of the offers are the possibility to pay without cash, to have the feeling of boarding quickly, and to be sure of always choosing the right tariff.

The bonus system reached a similar level of acceptability. The market survey revealed that the acceptability depends profoundly on the kind of bonus. One problem is that a bonus system is of interest only to non season tickets holders. Therefore, season ticket holders could be tempted by the bonus system and give up their season tickets. That is why the PT operators dropped the idea of the bonus system.

Respondents which show some interest in the offer were also asked if their use of the offer would have any impact on their use of PT. The majority of this sub-sample agreed. In total 12% of the respondents said that they would use PT more frequently, when the post-paid / best price (daily basis) is on sale.

The acceptance and the assessment of the advertisement for the BOB ticket

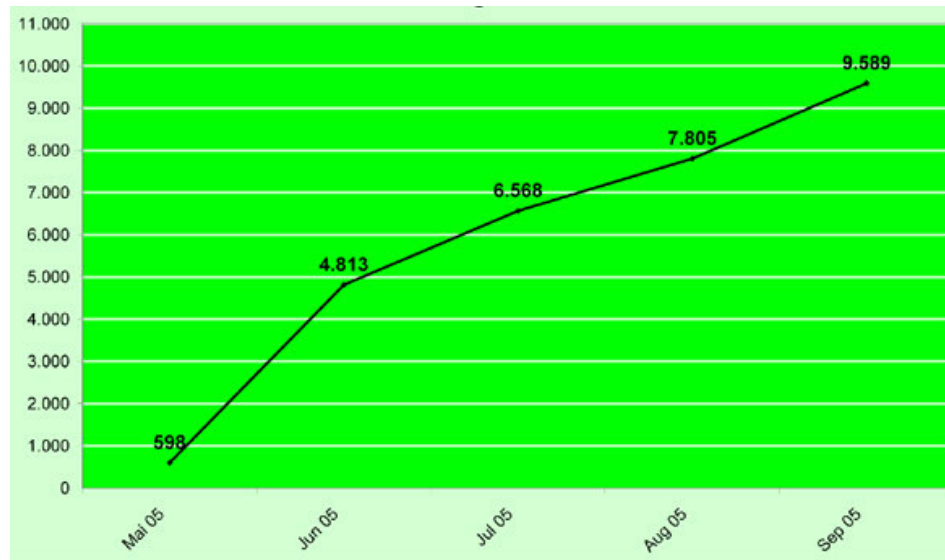
BSAG continuously checks the success of their advertising campaigns. The campaign for the BOB ticket was launched with the product in June 2005, mainly by poster, printed media and TV/radio. The advertising success was measured by a representative survey carried out in July 2005 with 306 people. The main results of this survey are:

- The campaign for the BOB ticket is one of the most successful PT advertisement campaigns: 42% of respondents remembered the campaign.
- The BOB ticket campaign improved the image of BSAG.
- Respondents mostly remembered advertising that they have noticed on posters at PT stops (42%), other posters (33%) and on vehicles (32%)
- Respondents not only remembered the design of the campaign but also the content. The main perceived messages are: cashless riding and getting the most favourable tariff. Other aspects such as cheaper than at the driver, no basic fee, daily best price, and no minimum volume need to be better communicated.

The actual demand for the BOB ticket

The measure outcome had not been evaluated by October 2005. Only data on purchased tickets and the postcodes of the subscribers are available. The figure below shows the growth of the BOB-Ticket since it has been launched in May 2005. BSAG officials said they did not expect such a demand and are very happy with it.

Figure 2.9.4-1 BOB-subscribers by September 2005



The postcode of the BOB ticket subscribers has been approximately assigned to city districts. The table below shows that the districts which surround the city centre attract above average subscribers of the BOB ticket. This is in line with findings that regular PT users holding a season ticket are more likely to live on the urban fringe. The target group of the BOB ticket, the irregular PT users, are more likely to live within the more central districts.

Figure 2.9.4-2 The districts of Bremen

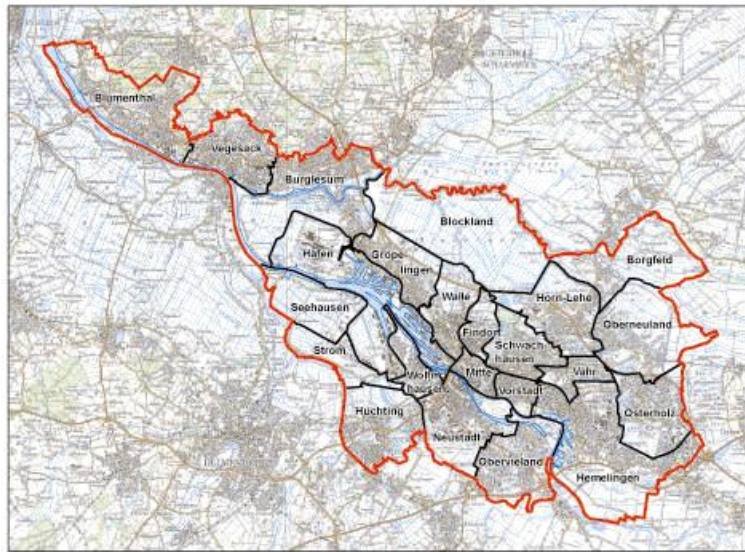


Table 2.9.4-3 BOB-subscribers and Bremen population by district (9/2005)

districts	BoB-subscribers		Bremen population.	difference (subscribers – Bremen pop.)
	N	%	%	%
Neustadt	925	11,7	7,8	3,9
Schwachhausen	917	11,6	6,8	4,8
Östliche Vorstadt	883	11,2	5,4	5,8
Hemelingen	597	7,5	7,7	-0,2
Horn-Lehe/Borgfeld	584	7,4	5,6	1,8
Findorff	501	6,3	4,7	1,6
Obervieland	492	6,2	6,4	-0,2
Vahr	478	6,0	5	1
Walle	454	5,7	5	0,7
Gröpelingen	383	4,8	6,4	-1,6
Huchting	333	4,2	5,4	-1,2
Burglesum	266	3,4	6,3	-2,9
Blumenthal	230	2,9		2,9
Woltmershausen	208	2,6	2,5	0,1
Osterholz	196	2,5	7,2	-4,7
Mitte	170	2,1	2,9	-0,8
Vegesack	152	1,9		1,9
Oberneuland	140	1,8		1,8

2.9.4.2 Bremen - Travel Information Centre (12.2)

Measure Overview

The Intermodal Travel Information Centre (ITIC) is operated by the local public transport operator BSAG. The ITIC opened in November 2002 and replaced a smaller centre which was mainly used for selling tickets. The ITIC concentrates several BSAG services (sales and distribution, annual subscription, timetable and fare information) in a single place. It also includes information about cambio, the local car sharing organisation. Visitors to the centre can join cambio on site, and cars are available in the

same building. Regarding telematics the existing intermodal Internet information platform is improved towards better passenger/customer information. This platform is not only available for the staff but also at a self-service terminal. Another terminal can be used for electronic ticketing. In comparison to the old customer centre in the ITIC, the area has been enlarged (from 58m² to 214m²) and additional staff employed. The ITIC centralizes a lot of functions in the PT operator's workflow: it houses several departments and has a lounge for bus and tram drivers, all improving the working conditions of the staff.

The ITIC was introduced using telematics as a tool for better customer services on public transport information of all different types as well as on other transport services. Better information, more staff and a convenient location should:

- Making it more convenient for potential passengers to use the information services
- Attract citizens who are not frequent PT customers
- Enable an easy and reliable access to public transport
- Reduce waiting times and make the visitors feel that their visit was worthwhile

Evaluation Results

The evaluation of the ITIC is based on data collections at three levels:

- A (trend) survey design addressing visitors of the old information centre (October 2002) and visitors of the new intermodal travel information centre (ITIC) (October 2003).
- Operational data from BSAG regarding ticket sales and accesses to the terminals in the ITIC (every July from 2002 to 2005)
- Qualitative interviews (3) with staff and stakeholders of BSAG about the design, implementation and acceptance of the ITIC measure

Table 2.9.4-4 Survey Methodology

Main survey question	survey design	survey method	survey unit	survey size	recruitment	time
acceptance/usage of the ITIC	ex ante and ex post	postal self-completing	Visitors of the old and the new BSAG centre	120 119	within the centres	10/2002 and 10/2003
usage of ITIC	ex ante and ex post	operational data	accesses on BSAG server			7/2002, 7/2003, 7/2004, 7/2005

Preliminary note

A comprehensive report on the ITIC measures is available in German and the Before questionnaire is available in English. If required mail to Henning Koch henkoch@uni-bremen.de. The visitor survey data are stored in SPSS.

Table 2.9.4-5 The socio-demographic characteristics of the customers of the ITIC and of the visitors of the old information centre

		before (old center)		after (ITIC)	
		N	col%	N	col%
gender	female	76	63,9%	74	64,9%
	male	43	36,1%	40	35,1%
age	< 18	3	2,5%	4	3,5%
	18 – 25	12	10,1%	15	13,0%
	26 – 45	41	34,5%	44	38,3%
	46 – 65	41	34,5%	28	24,3%
	> 65	22	18,5%	24	20,9%
place of residence	Bremen	103	86,6%	94	81,7%
	outside of Bremen, but within VBN area	11	9,2%	17	14,8%
	outside of the VBN- area	5	4,2%	4	3,5%

Points to note from the survey include:

- The information centres are more visited by women than men (no significant change between before and after).
- The age structure of the visitors is different to that of the PT users, because the share of younger visitors is relatively small, although the new ITIC attracts more younger people than the old centre.
- Most of the visitors are Bremen residents. The ITIC attracts more people from the VBN area, covering 8,400 km² around Bremen.
- The changes between before and after concerning age and place of residence are not statistically significant.

Table 2.9.4-6 Usage of public transport

<i>How often do you use public transport?</i>	before (old center)		after (ITIC)	
	N.	col%	N	col%
more than 30 times a month	31	26,1	40	34,5
15 - 30 times a month	36	30,3	34	29,3
8-14 times a month	25	21,0	14	12,1
3-7 times a month	22	18,5	13	11,2
1-2- times a month	3	2,5	4	3,4
less than 30 times a month	2	1,7	11	9,5

The ITIC is visited more often than the old information centre by non-regular PT users. Statistically there is a significant change in the PT usage of the visitors; however this statistical dependence should not be interpreted in the way that the ITIC has changed the PT usage of the visitors, but that the ITIC attracts a slightly different customer segment characterised by a more dispersed PT usage.

Table 2.9.4-7 Motives for visiting the information centres (multiple responses)

	before (old center)		after (ITIC)	
	frequ.	col%	frequ.	col%
<i>Why did you go to the BSAG customer centre at the Domsheide?</i>				
registration issues	13	11,0	9	7,1
information on time tables, tariffs and PT network	46	39,0	59	51,7
complaints	3	2,5	1	,8
„fare dodging“	3	2,5	4	3,4
ticket sales	92	78,0	68	59,1
information about <i>cambio</i> or combined PT/Car-Sharing offer (Bremer Karte Plus / AutoCard)	*	*	4	3,4
trip planner terminal (self service)	*	*	2	1,7
charging/decharging of electronic purse (Geldkarte)/Bremer Karte/Bremer Karte Plus (self service)	*	*	4	3,4
other issues	2	1,7	1	,8

* not available

The visitors use the information centres mainly in order to gather information or to buy tickets. The ITIC has more visitors than the old centre for information requests and fewer to buy tickets. A more detailed statistical analysis found that the demand for information in the ITIC is significantly higher by older visitors (> 45 years) than by the younger groups. The new features of the ITIC like self-service terminals and information on car sharing are relatively seldom a motive for a visit.

Table 2.9.4-8 Satisfaction with the visit

<i>How satisfied were you with the following aspects of the service?</i>	before (old center)		after (ITIC)	
	mean	N	mean	N
... staff	1,5	118	1,7	115
... duration of waiting times	1,7	110	1,8	114
... room conditions	2,5	113	1,6	113
... your attendance?	1,8	113	1,8	112
...quality of helpdesk	*	0	1,7	71
...trip planner (self-service)	*	0	2,2	36
...charging terminal (self-service)	*	0	2,5	23

* not available

A scale from 1 to 6 was given for this question, where 1 equals “very satisfied” and 6 equals to “not satisfied at all”. All service aspects are considered as satisfactory. Staff received the best average ranking in the before survey, but this decreased a bit in the after survey. This is because the ITIC is more often visited by younger and non-regular customers, who are significantly more critical than other customers. The same argument applies to the slight change in the appraisal of the waiting times. The assessment of the room conditions improved significantly from the before to the after survey. The satisfaction with new self-service terminals is not as high as the other elements.

Table 2.9.4-9 Assessment of the information centres

Which of the following characterisations do you feel is appropriate?	before (old center)		after (ITIC)	
	mean	N	mean	N
... modern	2,5	104	1,4	113
... attractive	3,0	103	2,0	110
... functional	2,1	110	1,7	111
... important to me	2,5	107	2,8	108
... important for PT users	1,9	99	2,1	100
... important for Bremen	1,9	111	1,9	112

For this question a scale from 1 to 6 was again set, in this case 1 meaning “very appropriate” and 6 meaning “not appropriate at all”. From the first three attributes modern, attractive and functional, the functionality was considered most appropriate by the customers of the old centre. The ITIC was found to be more modern, attractive and functional than the old centre. Many customers state that the centre has a more general importance for the city and traffic than for personal matters.

Table 2.9.4-10 Cooperation with cambio, the car sharing Organisation in Bremen

After survey (ITIC)	N	%
knowledge of offers of information about <i>cambio</i> , <i>AutoCard/Bremer Karte Plus</i>	32	27,8
knowledge of the <i>cambio</i> station within the building	29	25,4
use of offers of information about <i>cambio</i> , <i>AutoCard/Bremer Karte Plus</i>	8	7,3
use of the <i>cambio</i> station within the building	3	2,8
holder of an <i>AutoCard</i> or <i>Bremer Karte Plus</i>	6	5,2

After survey (ITIC)	mean*	number
Quality of helpdesk regarding <i>cambio</i>	2.7	7

*appraisal profile 1 = very good; 2 = good; 3 = fairly bad; 4 = bad

In the after survey customers of the ITIC were asked if they have known or made use of the offers of information on cambio or of cambio cars within the building. Approximately a quarter of the visitors stated, that they were aware of these offers, and 7.3% asked for further information related to cambio and the combined cards. These people found that the quality of the information was not very good.

Table 2.9.4-11 The self service terminals

After survey (ITIC)	mean	N
How did you rate the handling of the charging terminal	2.75*	4
How did you rate the handling of the information terminal	1,86**	28
How did you rate the quality of the received information	1,81**	32

*appraisal profile 1 (= very easy) to 4 (= very difficult)

** appraisal profile 1 (= very good) to 4 (= very bad)

The information terminal was used by nearly everyone who had noticed it (see above). The operating of the computer terminal and the quality of the information were well received. In contrast, the terminal, where users can charge up their electronic tickets was relatively seldom used and use of this terminal was considered more difficult.

Operational data

BSAG delivered continuous data about the transactions in the ITIC. Unfortunately this information captures only products which have been sold, records about the amount of the advice/consultation are not available. The data from July 2002 characterises the sales figures of the old information centre. The other three times refer to the ITIC. The table shows that the amount of tickets sold decreases clearly in the new ITIC. This finding is in line with the results of the user surveys. Visitors come mainly to the ITIC because they want to take advice. Most commonly tickets are also sold in a kiosk nearby, where waiting times may be shorter.

Table 2.9.4-12 Ticket sales in the ITIC

Kind of ticket	number of contacts			
	7/2002	7/2003	7/2004	7/2005
single tickets	636	487	272	342
4/10 tickets	5901	4438	2.984	4387
tickets for staff only	4	12	9	10
daily ticket	320	332	263	250
weekly ticket	726	907	705	1104
monthly ticket	2621	1900	1.850	1759
yearly ticket	140	123	116	381
<i>EntdeckerCard</i> (DiscoveryCard Northwest)	22	22	37	22
<i>Ferien Ticket</i> (holiday ticket for pupils)	111	286	353	371
<i>Schönes Wochenende</i> (weekend ticket incl. German Railway)	29	16	5	8
<i>Nacht Ticket</i> (night ticket)	6	1	0	1
time table booklet	113	84	54	45
total	10629	8608	6648	8680
<i>Bremer Karte Plus</i>		0	0	0
<i>AutoCard</i>		3	6	10
electronic purse (Geldkarte) sales				
2 €		15	13	4
22 €		21	5	3
total		36	18	7
charging of electronic purse (Geldkarte)		64	61	49
decharging of electronic purse (Geldkarte)		1	0	1
total		65	61	50

2.9.5 Bremen – New Tram Lines

The following objectives have been set:

LO 5 Increase in public transport usage and change of mobility behaviour along the new tramlines by enhancing the PT network

The extension of the tramline 4 to *Borgfeld* raised the numbers of passengers significantly. According to passenger counts the growth between February 2001 and February 2003 measured at various stops range from 7.7% (*Kirchbachstraße*) to 108.3% (*Horner Kirche*). According to a residential survey, the share of those residents who use

public transport increased by 7.3%. The number of PT trips of affected residents grew by 12%. In all, 26.9% of the residents reduce their car usage because of the new tram.

LO 6 Reduction of energy consumption, emissions and noise of public transport

Trams have less negative impacts on the local air quality than buses. VIVALDI user surveys confirm that trams are also perceived as less noisy. (No specific measurements could be made as tram line 1 and 8 are only planning measures.)

LO 7 Reduction of PT costs

Compared to buses, trams attract more passengers and thereby raise revenues. Trams are more cost efficient than buses because they can transport more passengers per vehicle and driver. In particular, operating costs have been saved due to the partial replacement of the bus feeder system.

Concerning the hybrid tram it was estimated that the operating costs of a tram using the existing railroad tracks would be about 20% less than the operating costs of a conventional tram.

2.9.5.1 Bremen - Hybrid tram system (8.4)

Measure Overview

The extension of tramlines 1 and 8 is part of the general plan of the PT operator BSAG to extend existing tramlines into suburban area (see figure below). Tramlines 1 and 8 are to run through Huchting (a big urban development from the 1960s) and then separate: line 1 leading to Mittelshuchting (a district of Bremen) and line 8 leading to Stuhr (a district in Lower Saxony). Two different routes to Huchting were under consideration. One route would use an existing freight rail track, the other would pass through a main road. By the expansion of the tramlines nearly 28.000 residents have direct access to the city centre. The construction work with its large investment (estimated to be about 40m Euros) will not happen within VIVALDI.

As the hybrid tram will not be put into service during the VIVALDI project, it was decided to survey the planning and implementation process and to evaluate a similar tram project in the northeast of Bremen, the extension of tramline 4. This substitution could be made because the tramline extensions in both areas share common features:

- Both are extensions of existing tramlines into the peri-urban area.
- Both measures share the same planning philosophy: the patronage of PT by a more attractive and eco friendly system.
- Both measures intend to attract commuters by linking the tramlines with P&R stations, railway stations or by planning to extend the tracks further into the periphery. The shift from bus to tram should also have a positive impact on the urban development of residential areas along the route.
- Both projects are major projects that require high investment

On the other hand there are some important differences constraining the comparability of the projects:

- The extensions of tramlines 1 and 8 will mainly run on an existing embankment, whereas line 4 has been built into the middle of an arterial road.

- There are some important social and structural differences between the catchment areas of the two extensions.

Figure 2.9.5-1 Plans to extend the tram net in Bremen

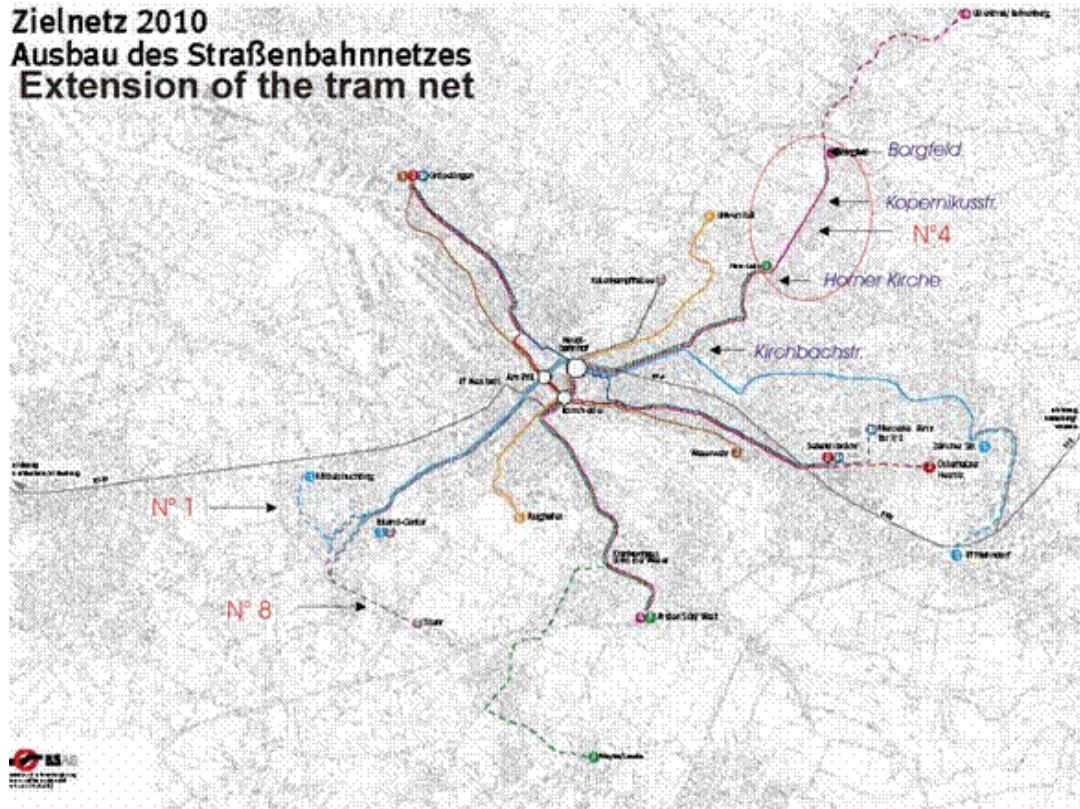


Figure 3.2.37.2: Extension of tram line 1 and 8

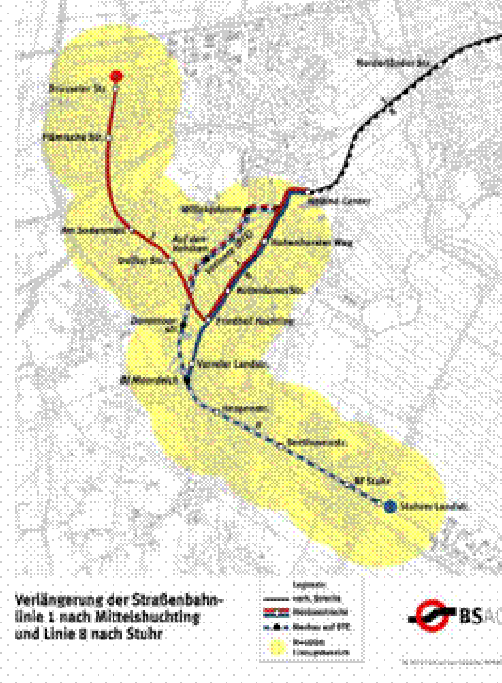
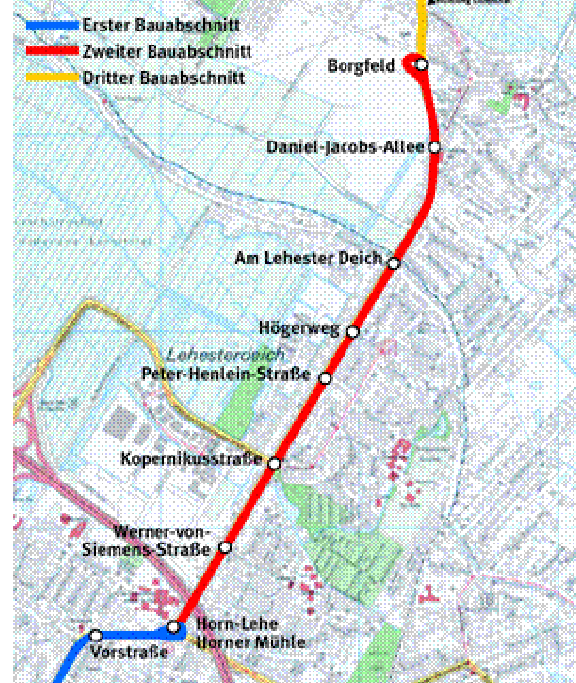


Figure 3.2.37.3: Tram line 4 (2nd construction phase)



The hybrid tram was planned as an extension of existing tramlines 1 and 8 in the southeast of Bremen and should meet the following objectives:

- Increase in public transport customers with season tickets
- Increase in use of electronic ticketing
- Measurable relief of road traffic in the corridor
- Increase of public transport share in the modal split

Evaluation Results

The evaluation is based on 3 data collection activities:

- Panel survey with residents living in the catchment area of line 4 extension
- Process interviews with key stakeholders involved in the planning and participating process of lines 1 and 8.
- Analysis of operational and traffic data, collected by BSAG and the road traffic department (*Amt für Straßenbau, ASV*)

a) The evaluation of tramline 4 is based on a panel survey design. The first survey was carried out in autumn 2002 before the opening of the new tram, the other in spring 2003 afterwards. A representative sample of 362 individuals was drawn from people living in the catchment area of the tram extension. They received a letter announcing a forthcoming phone interview about their views and usage of local transport: 235 were queried by computer-assisted-telephone-interviewing (CATI). When the new tram had been running for 5 months, those who had said that they have used or intended to use public transport (198) received another letter: 157 of them took part in a second telephone interview.

b) Face-to-face interviews have been conducted with representatives from the PT operator (BSAG), with the planning department of the City and with the citizens' initiative.

c) Transport and traffic data had been collected, in order to assess the situation before and after the new tramlines were put in service (estimated data for tram lines 1 and 8).

Table 2.9.5-1 Surveying on the tramline extensions

Main survey question	Design	Survey method	Survey unit	Sample size	Recruitment	Time
usage and acceptance of line 4	ex ante and ex post panel	telephone	(potential) users of the new tram line	235 153	random sample of residents	Nov 2002 (before) May 2003 (after)
usage of line 4	ex ante and ex post	counts	passenger		random sample	Nov 2002 Jan 2003
implementation of the hybrid tram	explorative qualitative, longitudinal	process int./ face to face	planners / experts	4	-	Aug 2003 Aug 2004

Tramline 4

Residents survey data

The new tramline 4 attracts significantly more residents than the bus, meaning that residents who have never used buses in the before situation now get the tram. The number of panellists who used PT after the tram has been in operation rose from 134 to

144, which is a growth of 7.5%. This growth rate is representative for the local population. The change in the PT usage induced by the extension of the new tram is highly significant.

Table 2.9.5-2 Bus usage in 2002 by tram usage until 5/2003

		tram usage until 5/2003		Total
		yes	no	
bus usage	yes	127	7	134
in 2002	no	17	6	23
Total		144	13	157

The PT journey frequency (PT trips per year) after the introduction of the new tram increased by about 12,4%. However this result is not statistically significant. The table below shows that there are fewer non-users and infrequent PT users (0 to 9 trips per year) and more users with more than 10 PT trips per year since the tram is running.

Table 2.9.5-3 Annual PT usage of residents (before and after)

	annual bus usage (2002)		annual tram usage (2003)		difference	
	N	%	N	%	N	%
trips per year						
0	22	14	13	8,3	-9	-5,7
1-9	24	15,3	16	10,2	-8	-5,1
10 – 49	43	27,4	52	33,1	9	5,7
50 – 199	54	34,4	61	38,9	7	4,5
>=200	14	8,9	15	9,6	1	0,7
total	157	100	157	100		
trips in total.	10197		11251			

Some 31 of the panellists said they would use PT more often since the new tram is in place. On the other hand, 12.4% stated that they use PT more seldom after the change of the PT system. The increase of PT usage correlates with a decrease in car usage of 26.9% of all panellists said that they would drive more seldom since they can use the new tram. Only 8.3% said that they would use the car more often.

Table 2.9.5-4

Expected change in PT usage when the tram will be in operation (before survey)

	N	%
more frequently	49	31,4
more seldom	13	8,3
no change	92	59,0
don't know	2	1,3
total	156	100,0

Table 2.9.5-5

Change in PT usage since the tram is in operation (after survey)

	N	%
	45	31,0
	18	12,4
	82	56,6
	145	100,0

Table 2.9.5-6

Expected change in car usage when the tram will be in operation (before survey)

	N	%
more frequently	9	5,7
more seldom	38	24,2
no change	66	42,0
not applicable	1	,6
don't know	43	27,4
total	157	100,0

Table 2.9.5-7

Change in car usage since the tram is in operation (after survey)

	N	%
	12	8,3
	39	26,9
	62	42,8
	32	22,1
	145	100,0

Since the change from bus to tram, PT is used more often for leisure activities. There are relatively more PT users in the after survey than in the before survey (51,6 % to 44,0 %) who use PT “mainly” for leisure purposes. The average PT usage for leisure activities increased from 62 trips to 73 trips per year. On the other hand the new tram did not attract new commuters. Trips to work as “the main travel purpose” by PT decreased from 2002 to 2003.

Table 2.9.5-8 Individual PT trips p. a. by travel purpose (before and after)

	Before survey			After survey		
	trips p.a.	col.%	N	trips p.a.	col.%	N
work	136	37,6%	31	114	29,0%	26
studies	60	,5%	1			
shopping	60	16,1%	30	57	16,2%	29
leisure	62	44,0%	80	73	51,6%	72
others	33	1,8%	6	65	3,2%	5
total		100%	148		100%	132

Most of the panellists use PT for journeys to the city centre. The introduction of the tram has had no influence on this aspect of behaviour.

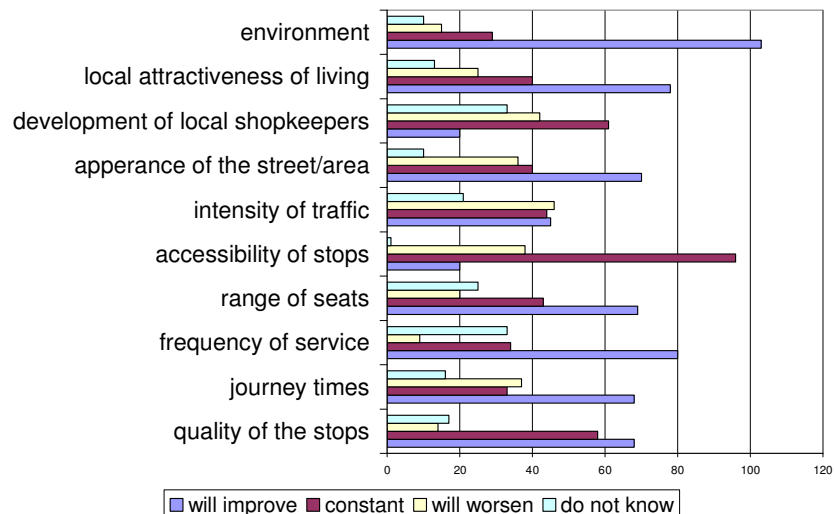
One of the most important reasons which panellists stated for their increased PT usage is: “no need for a change in journey” (as the new tramline is an extension of an existing one, to which, before, bus users had to change). Actually the share of those who had to interchange during their “most regular journey” decreased significantly from 53,8% to 18,9%. Other reasons are: “the tram is more convenient” and “reduced journey times”. These are the qualities of the tram that are perceived as the most important in relation to individual travel behaviour.

Accessibility of the stops worsened as a consequence of the conversion to rail. Additionally the panellists feel more exposed to exhaust fumes and traffic noise on the tram stops in the middle of the road. Nevertheless panellists prefer the comfort and the stay at the tram stops to the former light bus stops. In terms of speed and seat availability the panellists are much more satisfied with the tram than with buses. People younger than 45 years are more critical about these issues than people older than 45.

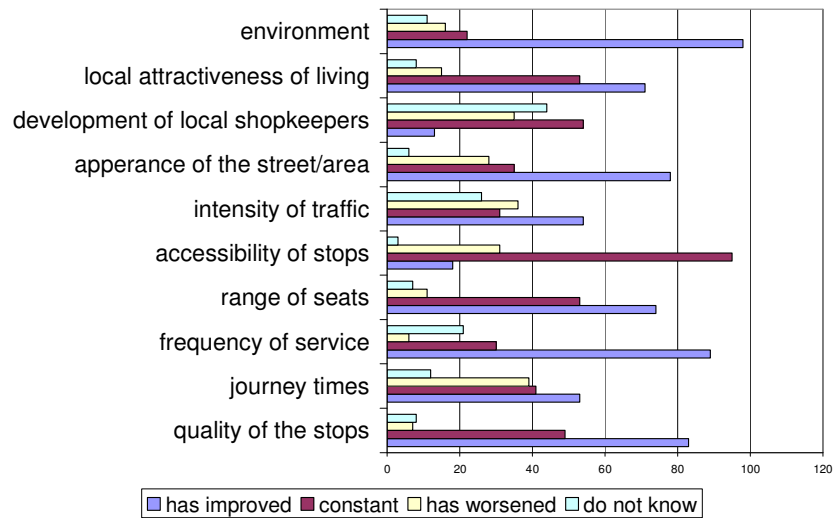
Table 2.9.5-9 Residents satisfaction with...

	very satisfied		satisfied		rather not satisfied		dissatisfied		don't know	
	freq.	row %	freq.	row %	freq.	row %	freq.	row %	freq.	row %
the punctuality of the bus	21	15,8	94	70,7	12	9,0	5	3,8	1	0,8
the punctuality of the tram	44	29,7	77	52,0	9	6,1	7	4,7	11	7,4
the speed of the bus?	34	25,6	87	65,4	9	6,8	2	1,5	1	0,8
the speed of the tram?	39	26,4	92	62,2	8	5,4	4	2,7	5	3,4
the availability of free seats in the bus	15	11,3	98	73,7	13	9,8	5	3,8	2	1,5
the availability of free seats in the tram	47	31,8	83	56,1	10	6,8	3	2,0	5	3,4
the quality of the bus stop	8	6,0	93	69,9	26	19,5	4	3,0	2	1,5
the quality of the tram stop	39	26,4	98	66,2	6	4,1	1	0,7	4	2,7

Concerning safety and driving comfort the tram makes a significant better showing than the bus. This is a result of a vehicle assessment with German school marks. The panellists expected beforehand that the tram would improve their conditions of mobility and (partly) of living. The figure below depicts that this applies for most elements, particularly the environment, the frequency of the tram service, and the local attractiveness of living.

Figure 2.9.5-2 Expectations of changes because of the forthcoming tram


After having used the tram, these high expectations were mostly exceeded. In particular the panelists have been positively surprised at the quality of the new tram stops, the frequency of service, the availability of seats, the change of road scene and the traffic volume on the main road.

Figure 2.9.5-3 Experiences/observations of changes because of the tram


Operational and traffic data (Tramline 4)

BSAG carried out passenger counts in order to find out the change in ridership resulting from the tramline extension. In February 2001, nearly one year before the tram was introduced, they counted passenger occupation in the buses at selected stops. One year after the opening of the new line they counted the occupation of the tram at these stops.

Table 2.9.5-10 Passenger Counts, Line 4 (Counts of occupancy on Tuesday until Thursday 6 to 9am and 3 to 7pm)

	Before	After	Change in %
stop	Feb 2001	Feb 2003	
Kopernikusstraße	2693	2901	7,7
Horner Kirche	4219	8792	108,3
Kirchbachstraße	5771	9136	58,3

Source : BSAG

Table 2.9.5-11 Estimated ridership, Line 4 (passengers/day)

	Before	After	Change in %
Stop	1999	2015	
Borgfeld	3000	4420	47,3
Horner Kirche	8.240	24.700	199

Source: Senator für Bau und Umwelt

Passenger forecasts based on data from 1999 also show a considerable growth of ridership. The growth is not to be expected mainly at the edge of the city in Borgfeld but more into the city at the first big interchange at Horner Kirche (compare Figure 2.9.5-4).

Further sources of information about the impacts of the tram extension are the road traffic census carried out by the “Department for Road Traffic” (Amt für Straßen und Verkehr) roughly two years before and two years after the new tram runs, counting the vehicles in both directions in the morning and the afternoon. In order to assess the figures one needs to know that tramline 4 runs in the middle of an arterial road, taking some space away that was formerly used by road traffic. With the completion of the tram extension a P&R facility was built at the new terminal stop in Borgfeld.

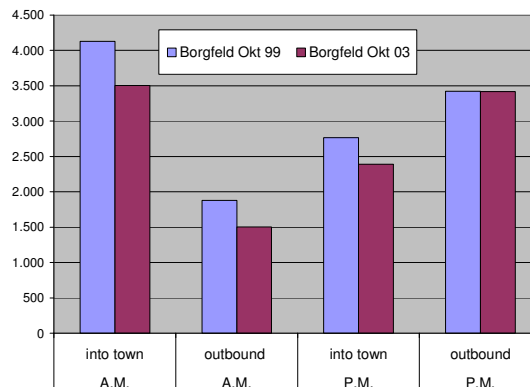
The table and the figure below show a decrease in the number of vehicles counted on the road after the tram commenced operation. This applies for both directions and in the morning as well as in the evening. It is reasonable to suppose, that this decrease of car traffic is caused by both a better service of the PT and the offer of the new P&R service. Perhaps the slight narrowing of road space also acted as a deterrent for car users.

Table 2.9.5-12 Traffic counts at stops of line 4 (vehicles/4h)

stop	time	A.M.		P.M.	
		into town	outbound	into town	outbound
Borgfeld	10/1999	4.127	1.881	2.766	3.420
	10/2003	3.505	1.503	2.390	3.419
Kopernikusstraße	10/1999	5.144	2.182	3.325	4.951
	10/2003	4.990	2.061	3.425	4.966

Source: Amt für Straßen und Verkehr

Figure 2.9.5-4 Traffic counts in Borgfeld (before/after)



Tramlines 1 and 8 (process evaluation)

Key figures for the planned extensions of the tram lines 1 and 8

For the extensions of tramlines 1 and 8, only planning and forecast data are available. The following table depicts some key figures. For line 1 two variants are shown: one follows the route on the main road Kirchhuchtinger Landstr (KHL), the other the route of the heavy rail track of the Bremen-Thedinghäuser-Eisenbahn (BTE).

Table 2.9.5-13 Key figures of the planned extensions of tramline 1 and 8

	Line 1		Line 8
	KHL (on street)	BTE (on rail track)	(on rail track)
Length (km)	3,75		3,2
Investment costs(Mill. Euro)	32	25	11,2
Share of eligible costs (%)	89	99	
Reduction of operating costs (Euro/a)	116.000 – 237.000	97.000 – 218.000	
Previous ridership (passengers/day)	7650		800
Expected growth in ridership (%)	31	30	94
Residents in the catchment area	20.150		10000
Workplaces in the catchment area	3.650		2590

The figures indicate that line 1 following the rail track (BTE) would be less expensive than a tramline on the KHL. Comparing the figures between line 1 and 8, it is noticeable that current ridership in the low-density catchment area of line 8 is low. This can be taken either as a poor demand for PT or as a huge potential that the tram can achieve.

The extensions of tramlines into peri-urban areas share some common characteristics that are important to consider for the understanding of the implementation process. Tramline extensions are major projects, which affect the mobility patterns of many people and which also have various consequences for those concerned. They are very expensive, and therefore rely heavily on financing by the state. They are controversial and require political backing and the acceptance of citizens. The alignments of new tramlines are a matter of dispute. These characteristics often cause a long lasting planning, participation and implementation phase, which can be seen as a barrier to realisation but also as necessary steps for a well accepted transport measure. In the following section the example of the VIVALDI tramline extensions in Bremen will be described along with the stakeholders and their main interests (A), their partial controversial views (B) and route alignments (C) of the tram extension, and finally the different strategies applied to enable the participation of the relevant population (D).

Stakeholders involved in the planning of tram line extension

Probably the most important stakeholder involved in the tram extension projects is the Public Transport operator in Bremen, BSAG. BSAG is a public company that belongs to the City of Bremen. The City of Bremen assured BSAG of running the PT lines until 2012. (Despite the Europe-wide liberalisation of the public transport market, these agreements are possible if the PT operator commits himself to act in a market-orientated way.) As the operator of the existing tramlines in Bremen, BSAG has an interest in the extension of the tram network. They argue that the company will benefit economically from it, because it will make the demand for PT grow and it will reduce operational costs. Moreover the competitive position of BSAG in the future liberalised PT market is likely to be better when operating trams than buses. For these reasons, BSAG promotes the tramline extensions by making draft planning proposals.

The political decision makers take up the ideas of tram extensions and put them onto their party platforms and coalition agreements. They argue tram extensions are useful for the whole city and give the population in the suburban regions better access to the city centre. The government of Bremen rests on a coalition agreement of the conservative party (CDU) and Social Democratic Party (SPD). Both agreed to give the extension of tramlines 1 and 8 a high priority in the field of transport policies. As the CDU party supports this planning project, it is based on a broad consensus by the public. The extension of the tramlines has always been backed up by the Senator (minister) for transport, whereas local politicians are often not always convinced of the advantage of new trams. They are more concerned with disturbances resulting from the noise and other disadvantages of the construction phase. Moreover they usually do not expect an economic benefit for their district because of the new tramline. Matters become complicated when politicians belong to different municipalities, as in the case of line 8 which runs to Stuhr. The division of responsibilities causes a need for the affected administrative entities to agree on the financing of the planning and operating costs.

Pressure groups also act in the sphere of politics, there being one initiative in Stuhr, termed Aktiv, and another in Huchting. In these groups, opponents of the tram predominantly get together, consisting of residents and shopkeepers, who argue the tram will adversely affect them and the local community. Local pressure groups against new tram lines often claim to speak for the concerned community; however as shown in the attitude survey among residents in the catchment area of line 4 the majority has a positive view on this change in the transport system.

The planning of the tram extension is partly done by operator (BSAG) and the planning department of the transport ministry (The Senator for Transport and Environment). The planning department has to show that a tramline extension is economically viable and that it provides a positive contribution to urban development. This means that forthcoming tram line extensions should meet a demand which is already quite high, indicated by high bus usage, or which is expected to grow rapidly, for instance because of new residential development in the catchment area of the new lines.

Concerned citizens are also involved in the tram projects and act as participants and addressees of local debates on the planned lines. There are four main groups that were affected by the implementation of the measure: residents, road users, PT users, and shopkeepers. Each of them anticipated a change of circumstances either of mobility or of living. Whereas car drivers and shopkeepers tend to oppose the tram, the majority of the residents and PT users favour it. Tram extensions are a major issue in local politics and in the local public debate. The local newspapers often report on the issue and if it comes to a voting as in Lilienthal about the further extension of line 4 (third section) the number of voters is extraordinary high (and the majority is in favour).

The tramline extensions in VIVALDI evaluation represent different stages of the planning and implementation process. The evaluation of tram line 4 covers a phase in which a tramline is actually built and made operational, whereas lines 1 and 8 are so far a matter of planning. Process evaluation therefore has to deal with problems specific for those phases.

The pro and cons for a tram line extension

One question in dispute is whether or not a forthcoming tram will significantly increase passenger numbers. The advocates say that there will be a large number of new passengers because the tram is faster, more convenient and more reliable than the bus. Moreover, more people do not have to change mode when the tramline runs from their residential area directly to the city centre. Previous examples of tramline extensions have also shown a positive impact on PT patronage.

The opponents highlight that the area is better developed by flexible bus routes than by a fixed tram line. A large number of people will have to travel longer distances to the tram station than to a bus stop. They also argue that the expected demand depends on the social characteristics of the residents. In some dispersed, wealthier areas, with high home ownership and high car ownership rates as in parts of Stuhler and Borgfeld the demand for PT is not likely to be high.

Another controversial issue is the financing of the tram extensions. Advocates argue that operational costs will fall after the extension and that infrastructure costs are financed by the municipality. However, there are still considerable operational costs attached to the project and opponents argue that the city and municipalities cannot afford such major projects and the money should be spent on other things.

The planning of a tram extension also raises the question of who mainly benefits from it: the city centre or the surrounding districts in neighbouring municipalities? Some locals fear that better access to the city centre due to a tramline will drain spending power from the district. Advocates highlight the importance of the project for the whole area, the advantages for PT users and argue that the accessibility of the peripheral district will be better with the tram extension.

Debate on the tramline alignment

In the debate on the final tramline alignment several criteria have to be considered, e.g. the change of the catchment area, costs, acceptance/enforceability, and existing infrastructure. In case of the line 1 extension, two routes were discussed: one route following existing railway tracks the other following the main road of the district. A final decision for the railway track was not made until February 2005, several steps by which the pro and cons of each option were weighted preceded this decision. The Planungsbeirat favoured the railway track option, mainly because of economic benefits (see Table 2.9.5-13). Moreover this alignment is better to enforce, because it produces less conflict with road users and shopkeepers. The disturbances during the construction phase will be less intensive and there is also no need for reallocation of road space. On the other hand the accessibility of the tram would be better if it runs through the Kirchhuchtinger Landstraße, which is also the districts' shopping street. To have the tramline where people shop and linger is the main argument for this option. Fortunately the railway tracks run through the residential areas, so that some will even have a shorter distance to the tram stop than they now have to the bus stop. Another important argument for the railroad track is that goods transport, that used to be the only usage, will benefit from the reconstruction of the track for tram use, and the disappearance of rail lines can be prevented.

Concerning tram line 4, two similar options have been discussed: one line would run on the main arterial road, the other on a former narrow gauge railway embankment, which is currently used as a cycle path (Jan Reiners Weg). The latter option was rejected because the route is too far from any residential area. After having decided to let the tram run on the arterial road the discussion focussed mainly on how to allocate the road space for the forthcoming tramline. Residents and car drivers feared that the new tramline would lead to more congestion. Before the road was rebuilt with rails for the new tram it had four lanes divided by a broad central reservation covered with trees. The planning proposed to run the tram on this middle section, but at some places, in order to protect the trees, it was necessary to use former road space for the tram tracks. The problem threatened to become worse during the construction period, when only one lane each direction was available for road traffic. People living near the new tram feared restricted access to their homes, being physically cut-off by the tram rails.

These problems were solved better than expected. A sub-company of BSAG ensured efficient management of the construction sites, which minimized congestion. Additionally an information centre with staff on-site was set up, so that everybody living in this area could inform themselves about the building project and the new tram line. After completion many sections of the road still have four, but narrower lanes. This is in line with the planning idea that the new tram should not restrict car use - as the main road is the only corridor from the east of Bremen to the city. The public transport philosophy is to attract patronage through its own qualities and not through blocking other modes of transport.

Involvement/participation of the public

Participation is a main issue when it comes to the implementation of tram extensions. Major projects cannot be implemented against the will of the local population. On the other hand the disputes about the tramlines cannot be settled alone by the local population. In VIVALDI the concerned stakeholders apply different strategies to convince the local residents of the project.

Information and communication with the public: The BSAG carried out successful information meetings at public places (Bahnhof Kirchweihe, Roland Center), distributing information material, exhibiting pictures and presenting videos of the future tram lines. Most important is perhaps that prominent people such as the ministry of transport and the head of BSAG attended meetings and participated in discussions with supporters and opponents. These events were attended by many people and normally had a positive impact.

Communication with the pressure groups: Even though there is a conflict of interests between BSAG and the organised pressure groups, they maintained an exchange of their different views. Some pressure groups like AKTIV are not only against the tram but also provide alternative proposals for an improved bus system. BSAG has to carefully deal with these proposals.

Mediation: Following the question over which route tramline 1 should take, a formal mediation procedure (Planungsbeirat) was carried out by the planning department. The task of the Planungsbeirat was to give informed recommendations on where the future tram will run. Local politicians, shopkeepers, and pressure groups are involved and

together with politicians and planners from the city, they reached the decision for the rail track option. This decision was very clear and supported by nearly all participants. However two important points should be stated: a) some local politicians complain about not being asked whether or not they would have the tram at all and b) the recommendation of the Planungsbeirat was not accepted fully by one governing party, which delayed the final decision.

A formal participation is intended by a project approval procedure. On the basis of a detailed planning, everyone concerned (homeowners, shop keepers, other residents, etc.) and who see their rights/interests infringed can make objections to the planning. The planning authority, respectively BSAG as operator of the tram, has to consider every argument seriously and should deliver solutions for the problems. If concerned people are not satisfied with the proposed solution they can take legal action against the project. The phase of this formal procedure has not been reached in case of the extension of the lines 1 and 8, but the experience of line 4 shows that this form of participation can delay the project.

Conclusions

In general the shift from bus to light rail in suburban regions is likely to be an efficient means of improving the public transport system, so that it can compete better with private car usage and contribute to the development of the area. Despite the high investment costs, which are covered mainly by the state and not by the city, a positive effect can be expected in the long run, as patronage increases and the operation of PT gets cheaper. In general terms, a tramline extension can be recommended for other cities.

Despite the fact that such major projects always produce negative effects on some residents the experiences especially of the extension of tramline 4 show that the majority of the affected population is in favour with tram projects. However, the public debate about the tram, and the consideration of informal and formal participation activities are essential. The arguments of opponents have to be taken very seriously and it is the task of the operator to deliver comprehensive information about the process and targets of the project onsite. By no means should these activities and processes be depreciated as factors which delay the implementation of the measures, they are likely to be necessary in each European country.

A further lesson concerns the use of existing infrastructure of old or underused freight rail tracks. It is a strong argument to revitalise these routes by running trams on them, but it also necessary to make the accessibility of these routes a very high priority. Only when residents have a close, convenient, and secure access to the tram stops these routes can be a success.

Finally the tram extension projects could teach Bremen a specific lesson. The extensions of the tramlines across the administrative borders of Bremen are a step towards the construction of a metropolitan area including Bremen and surrounding municipal areas. Because Bremen is both a city and a state, the barriers to create such a region are much higher than for other German cities. Public transport is fundamental for the building of such a region. If Bremen and its surrounding municipalities agree on a common tram network, this will be a big step forward.

2.9.6 Bremen – Car Sharing Services

This package consists of the following measures: PT and car sharing, car sharing/city car club development, and integration with urban developments. The more general objectives of the car sharing measures are:

To lower car dependence by enlarging and improving car sharing facilities

To raise awareness of car sharing as an alternative mode of travel

To reduce private car ownership (as car sharing is an alternative to private car ownership clients of car sharing organisations often abandoning their private car or plans to buy one).

To reduce the number of car trips. (Car sharers drive, on average, less after becoming a member of a car sharing organisation, because the access to a shared cars is more inconvenient than the access to one's own car. Moreover each trip has to be planned and the car booked.)

To enhance the co-operation between the car sharing organisation *cambio* and the local PT operator BSAG.

As a consequence of reduced car ownership and mileage, car sharing will lead to:

A more efficient use of road infrastructure and thereby deliver urban space for other purposes

Fewer emissions and an improvement of air quality

The more specific targets set against these objectives are:

Increase the number car share sites by 9 and the number of vehicles by 33

Increase the number of customers

Increase the user awareness/acceptance/satisfaction of/with *cambio*, notably of special target groups such as PT users and business people

Positive effects on individual mobility, i.e. decrease of individual's car mileage and/or car ownership

Common products in the range of tariffs (combined card), information, and marketing between BSAG and *cambio*

LO8 Reduce dependence on private cars, reduce car trips

The VIVALDI car sharing measures have had a significant impact on the growth of car sharing. The number of cars has been increased within VIVALDI from 80 to 100. The number of clients (contractual partners) went up by 700 (+39%), the number of people entitled to drive by 1,000 (+41%) within the 3 year VIVALDI time span (May 2002 to May 2005).

These growth figures for the car sharing service indicate a decline of private car dependence. Because of the service about 500,000 vkm/year could be saved. User surveys results have shown that about 30% of the new 700 clients have no private car due to the car sharing service, meaning that 190 cars were reduced by car sharing. Each *cambio* car replaces 9.5 cars.

The car sharing fleet consists of very new vehicles that emit on average 133g CO₂ per km. Compared to the average fleet composition about 100,000 kg CO₂ could be saved each year only because of using modern, small and clean vehicles. In addition, about 85,000 kg CO₂ could be saved per year due to the decrease in mileage.

LO9 Raise awareness of car sharing

Most of the people in Bremen are familiar with the terms ‘StadtAuto’ and ‘car sharing’, 57% of the population knows at least one of these terms. About 20% of the population has a high level of knowledge on what car sharing is and how it works. The level of awareness is in particular high with those who have a high education and use soft modes and public transport above average.

Awareness raising activities proved to be most successful when they address target groups such as business users with appropriate products in a directly and personal way.

LO10 Enhance the co-operation between the car sharing organisation cambio and the local PT operator BSAG

The working relationship between the two operators is good. In the course of the project it has changed from a more formally regulated to a more informal but very efficient co-operation, e.g. in terms of common marketing or exchanging information which is relevant for the partner.

2.9.6.1 Bremen - PT and car sharing (8.5)Measure Overview

This measure is about integration of public transport into car sharing (and vice versa) by developing, launching and promoting a combined offer for those who use both. The combined offer has a price and a technical aspect: PT users get an attractive tariff when using the cars of the CS company. In technical terms the access to both mobility providers is enabled by an intermodal smartcard. The integration is further underlined by establishing common mobility centres in which the combined offer can be bought and information about other services provided.

The general objective of this measure is to reduce private car dependence by making the use of public transport and car clubs/car sharing organisations (CSO) easier and more attractive: both providers complement one another. People who use public transport as their main mode often have problems in reaching destinations that are not served by PT either in terms of location or time (reduced service at night or weekend). When other modes like taxi or bike are not suitable, car sharing functions as a “missing link” to fill the “mobility gap” for those who do not drive private cars.

Good public transport service levels, fares and qualities are important requirements for the growth of car sharing. In general, a satisfying public transport system reduces the need to travel by car and thereby makes CSOs more attractive.

In this measure cambio the CSO of Bremen and BSAG the local public transport operator co-operated in terms of joint offers (PT season ticket and electronic car-key). A common mobility card was launched to attract more users/clients in both services.

Evaluation Results

The evaluation of this measure is focussed on the acceptance and impacts of the new combined offer. At the end of 2003, the University of Bremen surveyed the attitudes and mobility behaviour of subscribers to the new combined offers AutoCard and Bremer Karte Plus. A postal questionnaire was distributed among all 260 subscribers, thus persons who have a contract with cambio (AutoCard) or with BSAG (Bremer Karte Plus): 112 (41%) responded.

The design of the questionnaire was adapted from a former survey of the subscribers of the first combined offer from 1998. This approach enables a dynamic view on the short history of co-operation between car sharing and PT. However, if changes occur it has to be discussed if they depend on the modification of the offer or on a different perception of the car sharing organisation by the clients. Other sources for evaluating the measure are operational data from cambio on the AutoCard and Bremer Karte Plus and process interviews about the co-operation between cambio and BSAG.

Table 2.9.6-1 AutoCard and Bremer Karte Plus survey overview

main survey question	design	survey method	survey unit	sample size	recruitment	time
acceptance impact of PT&CS offer	single group, single observation & trend survey	postal self-completing	all (new) users of the combined card	112	via <i>cambio</i> customer list	11/2003
co-operation <i>cambio</i> BSAG	explorative qualitative, longitudinal	process interview	business managers / experts	3		2/2003 2/2004 8/2005
usage of common offer	periodical	operational data	usage and vehicle data			2/2003 2/2004 2/2005
up-scaling	explorative	focus group		5		9/2005

Combined Public Transport and Car Sharing Use

The combined offer consists of the AutoCard for PT season ticket holders and the Bremer Karte Plus for irregular PT users. From these two offers the demand for the AutoCard has been much higher. This could be explained by the fact that this card is free, whereas the dual mode smartcard requires a registration fee of 30 Euros. It is likely that this relatively high price kept a lot of infrequent PT users from buying the Bremer Karte Plus as most of these users are not willing to pay such a price for the added value of having access to both mobility providers by one single smartcard.

Table 2.9.6-2 The proportion of AutoCard / Bremer Karte Plus in the sample

	sample 2003	
	N	%
AutoCard	78	73,6
Bremer Karte +	28	26,4
Total	106	100,0

Data from cambio shows even more clearly that the AutoCard is much more popular than the Bremer Karte Plus. Despite the fact that the Bremer Karte Plus has been promoted intensively it did not sell well. The table below shows the share of PT related contracts and the share of remaining contracts. (A contract between cambio and the client usually covers one person, but in cases of partners/families more than one person can have one contract). About 60% of all contracts since the start of VIVALDI belong to a combined offer. To give PT users a special price for CS seems to be an efficient strategy for gaining new clients.

Table 2.9.6-3 Contracts related to the combined offer

	N	%.
AutoCard from 1998 to 11/2002 (30€ annual fee)	456	17,9
AutoCard 11/2002 (no annual fee, integration of students)	446	17,5
Bremer Karte Plus (from 5/2002 to 2004)	23	0,9
AutoCard 2004 (since Oct 04 entry fee, but 10% discount on km charge)	78	3,1
other contracts	1542	60,6

source: *cambio*

Socio-demographic characteristics of the users

The users of the combined offer for PT and car sharing show more clearly the characteristics of a car sharing client than the characteristics of a PT user. Like the average car sharing client the subscribers of the AutoCard and Bremer Karte Plus have a relatively high degree of education and slightly higher income than the average adult Bremen population. However the characteristics of the subscribers of the combined offer have changed significantly from 1998 to 2003. Due to the fact that since 2003 students have access to the combined offer, there have been more younger, better educated, single people than in 1998.

Table 2.9.6-4 Age (%)

	2003 (N=106)	1998 (N=126)
20 -30 years	34,8	16,2
31 -40 years	37,6	37,1
41 - 50 years	15,2	32,2
51 - 60 years	7,6	11,3
61 more than years	4,8	3,2

Table 2.9.6-5 Number of individuals in household (%)

	2003 (N=110)	1998 (N=129)
1 person	43,7	34,9
2 persons	31,8	28,7
3 persons	12,6	24,0
4 persons	6,4	10,1
5 persons	5,5	2,3

Table 2.9.6-6 Degree of graduation (%)

	2003 (N=110)	1998 (N=124)
general secondary school	10,0	14,5
modern secondary school	10,9	24,2
selective senior secondary school	78,2	60,5
no graduation	0,9	0,8

Mobility characteristics of the users

An important prerequisite for using the combined offer is good access to the city without owning a car. These opportunities are more concentrated in the central districts than in the periphery. This is why typical city dwellers in these districts (Mitte and Neustadt, Östliche Vorstadt, Findorff, Schwachhausen) make up the main proportion of clients of cambio and also of subscribers to the combined offer. Take Neustadt for example, a district in the VIVALDI corridor: in 2003 21.4% of all subscribers came from this district, whereas only 7.8% of the Bremen population lives there.

For competing with the private car, distances from home to the nearest car sharing station should not be too long. Customer should reach them easily on foot or by bicycle. The situation is quite good in the more central districts with a relatively dense net of CS stations, which has improved from 1998 to 2003. CS stations are often located at PT lines, which makes them accessible also for clients living in districts where no CS stations available.

It is plausible that users of the combined offer use PT regularly and frequently. This applied to the situation in 1998 but changed in 2003 as a shift to cycling as the main mode of transportation. Perhaps this change is caused by the students, which often use a bicycle as their main mode of transportation.

Table 2.9.6-7 Main mean of transportation (%)

	2003 (N=110)	1998 (N=130)
public transport	46,3	66,9
bicycle	42,8	27,6
car	10,9	5,5

Source of knowledge

Whether someone can make use of the combined offers requires some knowledge of them. Numbers on the sources from which subscribers have come to know about the service are displayed in the table below. In both samples the advertisements and information material produced by the providers is the most frequently stated source of information. Also, reporting in the media was very important for a rising awareness about the offer. This applies even more in 1998, when the integration between CS and PT in Bremen started and received a lot of public interest. As CS is a relatively new thing and is also a part of public transport, it is something on which the press has reported frequently. (However, the interest of the daily press on car sharing has decreased since.) The most striking result is perhaps the high proportion of people who heard of CSO from personal recommendation. People became aware of car sharing and the combined offer through the experiences and judgements of others. This stresses the importance of the social context of CS. If people are not really sure about an offer they tend to take advice from friends. This source of information seems to be at least as successful as advertisements and information that comes directly from the CSO to prospective customers by various sources.

Table 2.9.6-8 Sources for awareness of the combined offer by subscribers (% , multiresponse question)

	2003 (N=112)	1998 (N=130)
Daily newspaper, radio, TV	23,2	49,2
Internet	15,2	
printed info-material	44,6	61,5
personal recommendation	38,4	9,2
others	12,5	16,2

Impacts on mobility

When someone becomes a client of a car sharing organisation he is likely to change some of his mobility needs and patterns. The most drastic change affects car ownership and usage – CS reduces car ownership, fears that car sharing would generate more car traffic did not come true. Even if it is correct that CS is a new mobility option for those who are non car-owners, the net effect normally shows a decrease on both car ownership and usage. This is also true, if a large proportion of car sharers are regular public transport users as the subscribers of the combined offer.

Car ownership

In both samples from 1998 and 2003 only about half of the subscribers own a private car. Due to the new mobility option nearly one in five of these see no use in having a private car anymore. The combined offer also prevented about every second of those who have no car from buying one.

Table 2.9.6-9 Car ownership before and after subscribing the combined offer (%)

	2003 (N=106)	1998 (N=112)
Subscribers without private car (before and after)	53,1	52,8
Subscribers without private car abstaining from buying a private car	26,2	32,1
Subscribers who abolish their private car	8,5	9,4
Subscribers who kept their cars	12,3	5,7

Car mileage

Car sharers drive comparatively little. It has been shown that car usage decreases compared to the time before membership. The table shows that the car mileage per year of the subscribers has fallen by 32% in 1998 and by 54.4% in 2003. The mean per year and from 5,060 to 3,433km (1998) respectively from 4,559 to 2,079km (2003). The km savings are mainly caused by users giving up their cars and by the fact that clients do not use cars of friends or rental cars any more. Secondly, there is an effect of driving less as the result of long-term membership – car sharers learn to plan their car usage and try to avoid unnecessary car trips. For some users CS has been a step on their way to abstain totally from car use.

Table 2.9.6-10 Car-Kilometres per year by subscribers (mean)

car km per year	2003 (N=112)	1998 (N=103)
Before subscribing	4.559	5060
After subscribing	2.079	3433

Effects on use of public transport

Users of the combined offer were mainly PT users before subscribing, as intended. Nevertheless the public transport operator could gain new customers who will use buses and trams more regularly. According to the table the share of those who are holders of annual tickets for PT increased in both samples by about 10%.

Table 2.9.6-11 Availability of PT tickets before and after subscribing the combined offer (%)

	2003		1998	
	Before	After	Before	After
PT annual ticket	28,6	37,5	53,8	68,5
PT monthly season tickets	4,5	3,6	21,5	19,2
PT job ticket	9,8	9,8	6,9	
PT student term ticket	33,9	33	0,8	
single tickets	9,8	8	9,2	
other tickets; no specification	13,4	8,1	7,8	12,3

Subscribers of the combined offer increase their use of public transport. On average, the distance, clients made by public transport increased from 3,534 to 3,704km per year in 1998 and from 1,844 to 1,996km in 2003 which amounts to growth of 4.8% and 8.2%. The frequency of public transport usage has also increased. In 1998, 23.1 % and in 2003 16.4% of the respondents stated, that they would use public transport more often than

before. This affirms that CS does not compete against PT but complements it and intensifies its use. However, the use of trains has decreased, as clients possibly replace weekend and holiday trips by CS for which trains were formerly taken.

Table 2.9.6-12 PT kilometres per year by subscribers (mean)

	2003 (N=112)		1998 (N=103)	
km per year	public transport	German Railway	public transport	German Railway
Before subscribing	1.844,07	4.758,70	3534	6089
After subscribing	1.996,20	4.562,86	3704	5610
change in %	8,2	-4,3	4,8%	-7,1%

Assessment of the quality of use of cambio and BSAG

The subscribers of the combined offer rated the quality of the two providers: cambio the CSO and BSAG the PT operator. The applied scale ranges from 1(very good) to 6 (very poor). The table shows that the subscribers deemed the two suppliers more positively than negatively. However the quality of cambio was seen as better than BSAG: This difference increased from 1998 to 2003.

Table 2.9.6-13 General rating of the quality of cambio and BSAG (% ; German school marks)

	2003 (N=109)		1998 (N=126)	
school marks	<i>cambio</i>	<i>BSAG</i>	<i>cambio</i>	<i>BSAG</i>
1 (=very good)	22,6	6,4	12,7	0,8
2	68,9	38,5	75,4	40,5
3	7,5	44,0	10,2	34,9
4	0,9	9,2	1,7	17,5
5		1,8		6,3
6 (=very poor)				
mean	1,87	2,88	2,08	2,61

Detailed assessment of the combined offer

Car sharing organisations provide a transport service, which is characterised by various quality marks. In the table below the features which subscribers of the combined offer find important are listed. Certainty of having car access at the chosen time is what car sharers want the most. Other essentials are to have detailed invoices, a departure without delay and trouble-free booking. On the other hand clients find it less important to have the choice between different car models. Although this option is a big advantage over private car ownership, it is not seen as imperative, probably because it is an additional value only for rare situations. Also less important, is the opportunity to have the car at the desired station if it is at another. After the first survey in 1998 cambio launched two new features: the option to book cars over the Internet and to have a telephone at the CS station. Both facilities are rated the least important of all features; however, Internet booking is very frequently used: currently more than the half of bookings are made by the Internet.

Table 2.9.6-14 Important characteristics of CSOs in the view of subscribers of the combined offer
(mean; 1 = very important, 2 = less important; 3 = unimportant)

	2003 (N=112)	1998 (N=130)
that the booked car is at the station	1,03	1,01
to get a car at the time you want	1,04	1,05
a departure without delay	1,05	1,06
to have detailed invoices	1,1	1,06
trouble free booking	1,12	1,13
to have low fares	1,13	1,07
to start the car easily	1,24	1,21
have short distances to Car-Sharing stations	1,24	1,25
to have a high level of maintenance and safety of the car	1,25	1,2
have friendly and helpful administrative staff	1,26	1,21
an easy use of the chip card and the board computer	1,33	1,26
to book cars around the clock	1,38	1,51
to get the car at the place you want	1,43	1,22
to get always the car you want	1,68	1,79
to book via Internet	1,8	
to telephone from the station	1,87	

Up-scaling the measure- the view of the operator

Further co-operation between car sharing and public transport is one growth path for car sharing organisations. A focus group discussion at the end of VIVALDI in September 2005 arrived at the following results concerning the future development.

The working relationship between the two operators is good. In the course of the project it has changed from a formal to a more informal, but very efficient co-operation in terms of common marketing or exchanging information.

In terms of a common product the AutoCard is clearly regarded as more successful than the Bremer Karte Plus. Cambio officers said that charging a chip with tickets (Bremer Karte Plus) is not the right strategy to gain new clients. The success of the BOB-ticket proves that it is much better to bill them after they have made their journeys. However it is important to give regular PT users a benefit when they want to join cambio.

The current common offer is not very well known by prospective clients, and cambio have said a new marketing campaign is needed. However one has to consider experiences from other cities which reveal that campaigns for a common product lose force after they have been repeated, and the common potential of regular PT users and cambio clients seems to be exhausted then as it is supposed to be relatively small and mainly limited to inner city districts.

2.9.6.2 Bremen - car sharing / city car club development (9.1)

Measure Overview

Nine new car sharing locations with 33 vehicles have been set up in the laboratory site. Car sharing has also been expanded to more peripheral areas, which previously have not been a market area. The idea was to raise demand for car sharing by installing high quality stations with at least 2 cars. This concept was realised in Vegesack (2002) and in Borgfeld (2005), both districts at the very edge of Bremen.

Another element of this measure is to open the scheme up to new target groups such as business people, cyclists and commuters. A completely new product for business users has been developed. It consists of the following three core elements: an additional tariff that makes it easier for fleet managers to compare fees to those from conventional car rentals; the offer of suitable car types and the set up of car sharing stations in the city centre.

The main objective of this measure is to reduce private car ownership and car usage by enlarging the business of cambio. The more people use this service, the stronger the positive impact on the environment, as people normally use car sharing instead of a private car. This means less fuel consumption and fewer emissions. Through the reduction of the number of cars, more public space is available to be used for other purposes.

Evaluation Results

The evaluation of the new car sharing services and stations for business users is based on:

- An ex-post survey with self-employed business clients in September 2003. All 32 enterprises received a questionnaire, 22 sent them back (response rate 69%)
- Operational data from the car sharing operator on the usage of stations and vehicles
- Customer satisfaction surveys in 2000 and 2005
- Expert interviews

The evaluation of the strategy to raise demand in the sub and peri-urban region is based on:

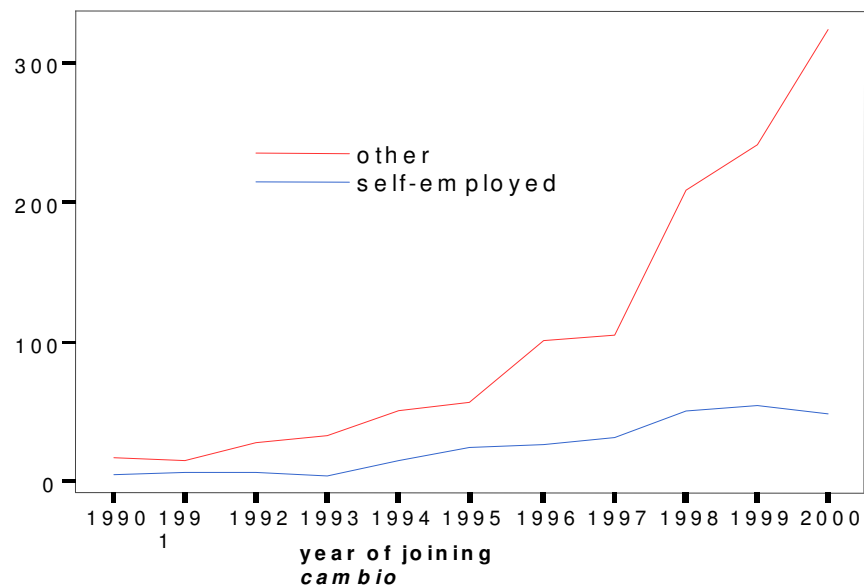
- Survey with prospective clients in the sub- and peri-urban area
- Face-to-face in-depth interviews with prospective clients
- Operational data from cambio on the spatial distribution of their clients' place of residence.

Table 2.9.6-15 Survey responses

main survey question	design	survey method	survey unit	sample size	recruitment	time
acceptance/usage of business tariff and stations	single group	postal self-completing	users of the new station, professional clients	22	via <i>cambio</i> customer list	9/2003
barriers of (prospective) sub-urban clients	single group	postal self-completing, face to face interviews	persons that contacted <i>cambio</i>	35 16	via <i>cambio</i> list of prospective clients	6/2005
usage of tariffs membership	periodical	operational data	usage and vehicle data			2/2003 2/2004 2/2005
up-scaling	explorative	focus group		5		9/2005

Business users and car sharing

Car sharing has always been attractive to clients who run a business. A customer survey in 2000 found out, that 25% of all members in Bremen were self-employed, whereas in Bremen only 6% of the working population can be defined in this way. Self-employed members of car sharing clubs use the cars more than others for work-related journeys.

Figure 2.9.6-1 Self-employed clients by year of joining


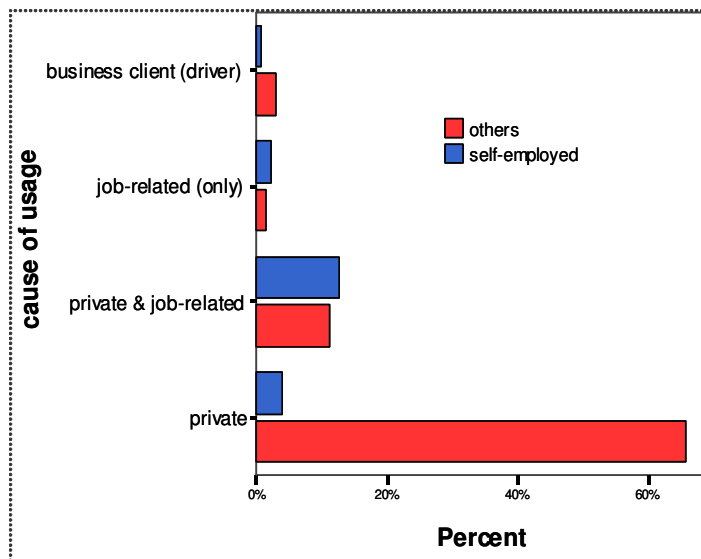
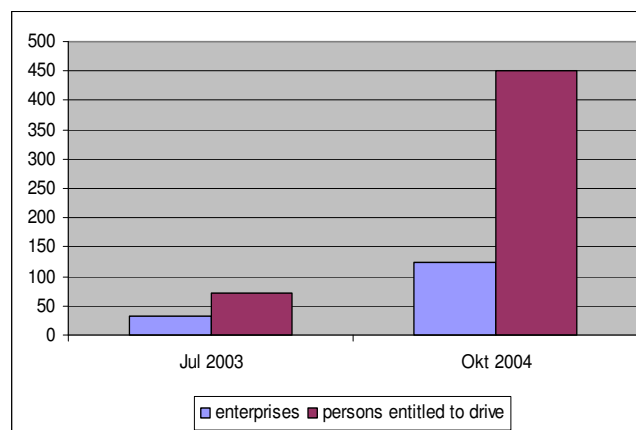


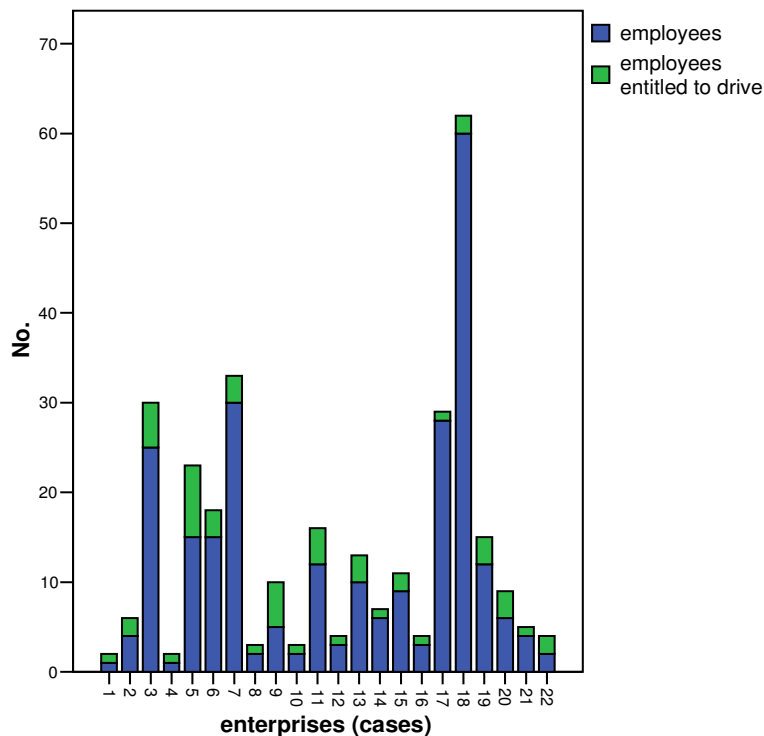
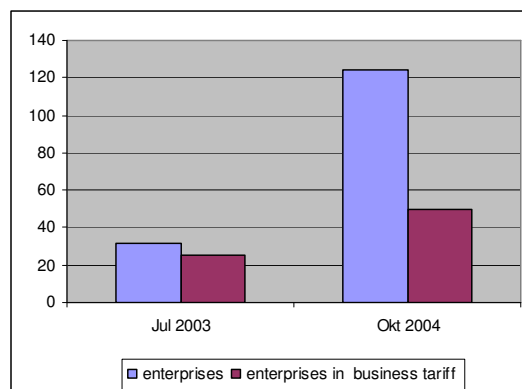
Figure 2.9.6-2 Travel purpose of self –employed cambio clients

Most self-employed members represent one-person companies. Since April 2002 cambio addressed bigger enterprises and tried to gain new ones with a marketing campaign for a new tariff. In July 2003 cambio acquired 32 such companies with 73 employees permitted to drive. Through continuous advertisement and sales approaches the number of companies grew rapidly to 124 in 2004, including 4 public authorities.

Figure 2.9.6-3 Business customers (enterprises)



From the 22 companies that responded to the survey in 2003 the number of staff and the persons who are allowed to drive are depicted below, the graph showing a wide variety.

Figure 2.9.6-4 Employees and drivers in enterprises

Figure 2.9.6-5 Enterprises using cambio


The business tariff

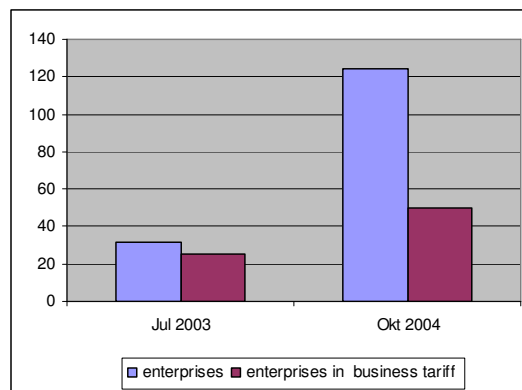
The *cambiobusiness* tariff is one of four different tariffs. The sum someone has to pay depends on such factors as membership fee, price per km and per hour, and size of car. These factors are composed in a specific way to meet the needs of different target groups. The purpose of the *cambiobusiness* tariff is to be competitive with conventional car rentals for long distance journeys. Moreover the tariff aims to balance the differences between the use of cars on weekdays and at weekend. The tariff has the following characteristics:

- Relatively high price per time unit
- Relatively low price for km

- Opportunity to block-book cars, so that there is 100% access to cars even in unforeseen situations
- Cars should be used mostly on weekdays

The *cambiobusiness* tariff ought to be the right tariff for long journeys in short time spans on weekdays. Compared to other tariffs it has not been particularly successful. Measured in booked hours the business tariff has gained only a share of 4%, even though the absolute number of companies who joined cambio since 2003 rose exponentially. This is because many of the new companies and authorities did not choose the business tariff after having joined the car club. Only 40 % of them did so in 2004 whereas in 2003 78% of all enterprises used the business tariff (compare figure below). The new enterprises said that the costs for booked time were too high.

Figure 2.9.6-6 Enterprises using cambio



Operational data revealed that the assumption business users would drive a large amount in a short time span was not true. Actually the average booking time of a business car sharer is longer than the average booking time of an average car sharing client. The existing tariff did not meet the demand of the business clients in this respect. This induced cambio to adjust the tariff to actual travel behaviour and launched a new tariff in 2005 that is more successful. In terms of utilisation (booked hours) the share of the *cambiobusiness* tariff increased from 4% in 2004 to 11% in 2005.

Business users survey results

What are the situations which cause companies to consider a car sharing service as useful? The results of the survey show that car sharing has most often been taken into consideration by companies when they needed a new car.

Table 2.9.6-16 Cause/situation to join cambio

	No.
start-up	3
(first) car became necessary	16
another car became necessary	4
company car failed	1
changed order situation	1
others	2

The main reason why business people joined the car club is the short distance from their company location to the (mostly new) CS stations. Financial aspects such as the low fixed costs compared to a private car are also important.

Table 2.9.6-17 Reasons to join cambio

	No.
own car rarely used	7
own car is too expensive	3
low fixed costs)	11
cost transparency	5
more capital available	4
time savings (i.e. no maintenance)	7
good complement to Public Transport	2
good complement to bicycle	5
CS stations nearby	17
options on different car types	8
better car availability	6
problem parking	4
access to cambio cars in other cities	1
environmental concerns	10
other	2

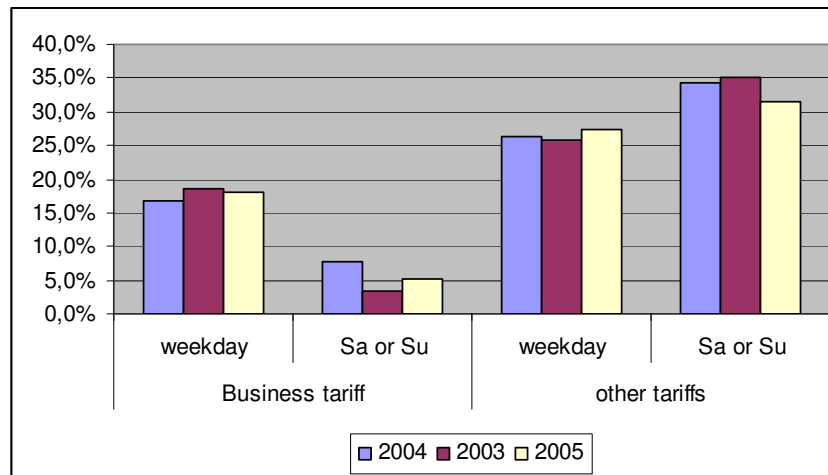
Nearly all surveyed companies considered alternative solutions to cambio. Most frequently they considered allowing employees drive their own cars.

Table 2.9.6-18 Alternatives to cambio

	No.
purchase of a (first) car	6
purchase of another car	1
leasing	9
courier service	2
car rental	7
cars owned by co-workers/employees	13
no alternative	1

The benefit for cambio

Conventional car sharers drive more at weekends and less on weekdays. One reason for car sharing organisations to launch a special product for business clients is to have a more balanced utilisation of the car fleet as business clients normally use cars on weekdays. The *cambiobusiness* tariff fulfilled this purpose. The graph below shows the times clients drive by their tariff. Business have used car sharing mostly during the working week. The utilisation at weekends is partial due to the fact that enterprises had block booked cars for the whole week.

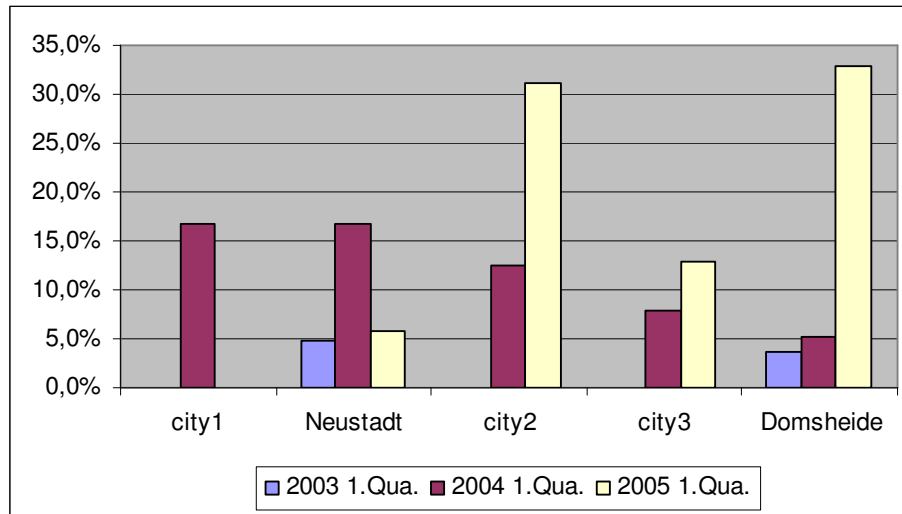
Figure 2.9.6-7 Utilisation rate of car sharing stations at weekends and on weekdays (%)


Business stations and cars

The introduction of *cambiobusiness* tariff has been linked with the opening of new stations in or at the edge of the city centre. In contrast to most of the other CS stations they have at least 3 cars in order to demonstrate to business clients that the availability of a car is always ensured. Cambio user surveys revealed that the availability of a car is much more important for clients than having the option of a certain car type. Like the private client business users prefer a small car, which is why cambio intends to replace the big “business” cars with smaller cars.

All business stations have a high utilisation rate and the share of companies with the business tariff is significantly above average at them. In particular there has been a considerable growth in 2005 at Domsheide and at 2 further city stations.

Figure 2.9.6-8 Share of business tariff users at the VIVALDI stations (%)



Stations that are close to and within the range of vision to public transport stops in the city centre are particularly popular with business clients. This applies particularly to Domsheide, which is highlighted in the VIVALDI framework, because it is a station in the very city centre, designed for business clients and located in the same building as the Travel Information Centre. According to the business survey results nearly half (9 of 22) of the surveyed companies have used this station, reaching it mostly by bicycle or on foot. They were asked in the survey to rate the quality of the station. The short distance and the centrality of the station proved to be its most positive characteristics: the location of the cars on the fourth floor of the car park and the feeling of security received disappointing marks. But they seemed better than expected and are obviously not a serious barrier for the use of this station.

Table 2.9.6-19 Qualities of the “Domsheide station”

	very good	good	satisfying	sufficient	dissatisfying	unsufficient
	No.	No.	No.	No.	No.	No.
distance to station	5	3	1	0	0	0
central location of the station	4	5	0	0	0	0
accessibility of the garage (station)	3	0	3	2	0	0
location of the parking lots in the garage	2	1	2	2	0	1
feeling of security	2	2	1	2	1	1
variety of car types	3	3	3	0	0	0
availability of cars	2	6	1	0	0	0

Up-scaling the CS service for business clients – the view of the operator

Private and public companies are a potential new target group for car sharing organisations. A focus group discussion in September 2005 arrived at the following results concerning the future development of this potential growth path.

For cambio the strategy to gain new customers who use car sharing for their business has been the most successful. The growth of this market segment is very satisfying and new stations set up in the city centre proved to be very well accepted by business users. Further success depends on important conditions: personal marketing in the business area, sufficient number of cars at the CS stations and the visibility of them (see above).

From a business point of view cambio also appreciated that the use of cars is more balanced over the week, meaning the existing fleet can be used more to capacity

Car sharing in the sub and peri-urban region

Car sharing organisations emerged and developed (at least in Germany) in the densely populated inner city districts of big cities. It is a typical product for city dwellers. In contrast to suburban residential areas, built to meet the demands of the automobile system, the inner city areas were able to resist to some extent the powers of the car-based society. Living patterns are not as de-localised as they are in the suburbs and car dependency is lower, as cars are harder to use due to the shortage of parking places and less urgently needed because of a good supply and accessibility to leisure and shopping facilities. Under this condition car sharing organisations could develop.

The maps below depict that this is true for Bremen. The CS stations and clients' place of residence are concentrated in the more central districts. On the other hand there is some demand for car sharing in the sub-urban and peri-urban areas. There is a small number of clients, which live far from any CS station. The map below shows the clients living in the adjacent administrative districts of Bremen.

Figure 2.9.6-9 Density of cambio's clients and cars in Bremen

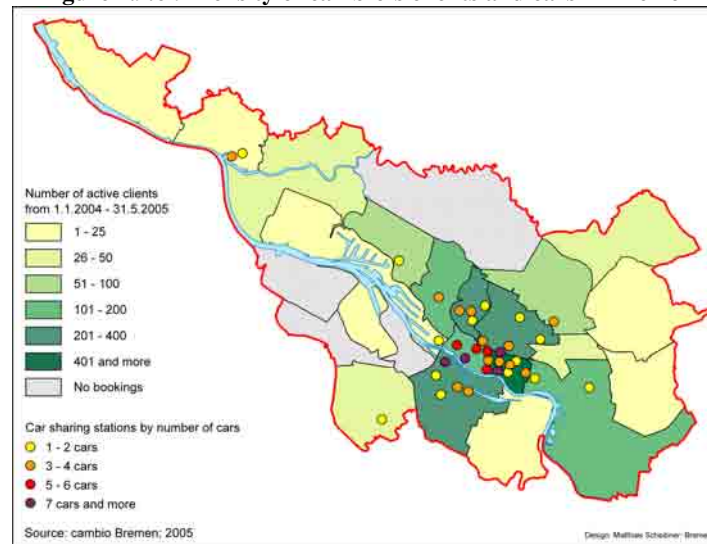
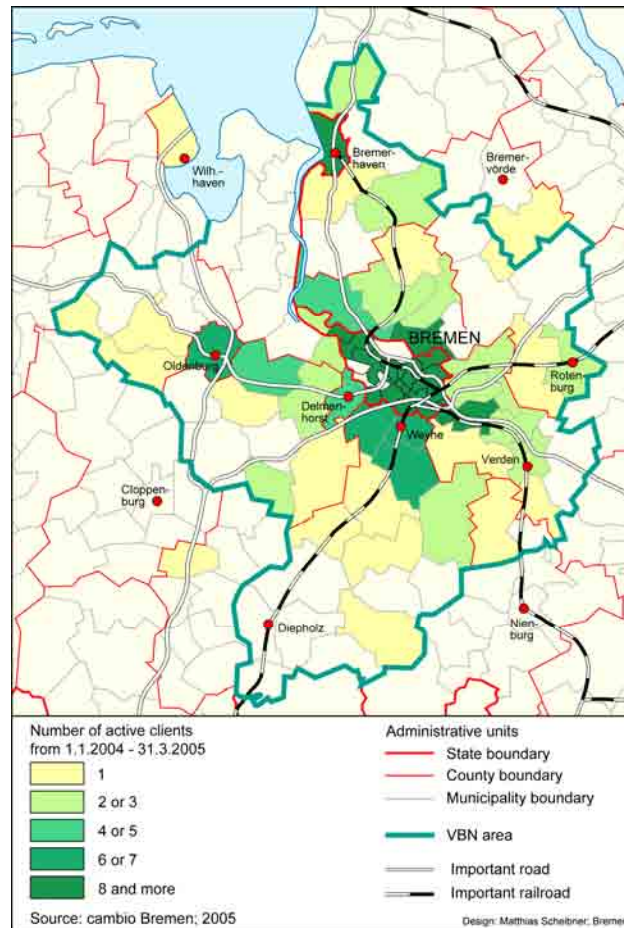


Figure 2.9.6-10 Density of cambio's clients in the Bremen region



Results of the prospective clients' survey and interviews

The sub- and peri-urban area can be divided into three segments: the suburban districts located at the administrative boundaries of Bremen, Bremen-Nord, the northern “bottleneck” of Bremen and the rural districts in Lower Saxony. The table below shows the distribution of actual clients, prospective clients, and interviewees by these spatial units. At the end of 2004 cambio has 611 clients living in this area, which makes up one fifth of their total patronage. Within this regional area both the actual and potential demand is the highest in suburban districts of Bremen. A relatively high interest (prospective clients) compared to actual membership (clients) can be seen in Bremen-Nord, which may indicate a high potential.

Table 2.9.6-20 Spatial distribution of clients and prospective clients in suburbia

place of living	clients		prospective clients		sample prospective clients		prospective clients interviewed	
	Number	%	Number	%	Number	%	Number	%
Bremen suburban districts	408	66,8	56	55,4	20	57,1	10	62,7
Bremen-Nord	65	10,6	27	26,7	9	25,7	3	18,8
Lower Saxony	138	22,6	18	17,8	6	17,1	3	18,9
Total sub- urban and peri-urban area	611	100,0	101	100,0	35	100,0	16	100,0

What are the situations which cause suburban residents to consider a car sharing organisation as useful? The situations depend a lot on whether or not the prospective client owns a car. In the survey sample about half own a car. Non-car owners, who are mainly single, expect that car sharing will improve their individual mobility and give them a new travel option for their occasional demand for a car. Car owners instead often have to cope with the situation that a private car may be abolished.

Table 2.9.6-21 Cause of interest by number of cars in household

	number of cars in household						Total	
	0		1		2		N	%
	N	%	N	%	N	%		
Occasional demand for car usage	9	52,9	3	21,4	1	33,3	13	38,2
new situation because car is abolished	5	29,4	4	28,6	1	33,3	10	29,4
costs considerations	2	11,8	4	28,6			6	17,6
Car-Sharing could improve individual mobility	4	23,5					4	11,8
Intention to abolish the private car			3	21,4			3	8,8
others	1	5,9	2	14,2	1	33,3	4	11,8
Total	17	100	14	100	3	100	34	100

Three of the 35 surveyed prospective clients have become an actual client since the start of the survey. The remaining stated why they did not join cambio. The following table gives an overview on the stated reasons.

Table 2.9.6-22 Reasons against entry to cambio (multi-reponse, %)

	responses	%
station too far away	10	28,6
cost	8	22,9
poor demand	6	17,1
organisational entry terms	4	11,4
uneasy, non spontaneous access to the cars	3	8,6
having alternatives	2	5,7
keep the private car	2	5,7
not decided yet	2	5,7
poor public transport	1	2,9
became a <i>cambio</i> client	3	8,6

Distance to station

The most often stated reason against membership of cambio is that the distance between the home and the CS station is too far. Ideally a car sharing station should be within walking distance, but this requires a high number of clients who live in the vicinity. From a business point of view the set up of a station is only worthwhile if the demand in this area is sufficient. The conditions are better the denser the area is populated, because this raises the number of potential customers living near a station and makes it harder to have a free parking place for private cars.

The majority of the surveyed prospective clients live more than 2km away from the nearest car sharing station. This is a long way compared to the distances for urban car sharers. To some extent this disadvantage can be compensated if the CS station is situated near a highly frequented PT stop, or is reachable on a safe and convenient cycle path, but in general a long distance to the CS station is a main barrier to join the car club.

The survey results show that demand can be stimulated by an existing station. A relatively large number of prospective clients live in the district “Vege sack” (a part of Bremen-Nord), where a suburban CS station is located. In this area the ratio of clients to prospective clients is higher than in all other areas.

Costs

One of the main reasons, in particular for non-car owners, is cost. The cost argument was also highlighted by nearly all residents interviewed. One important finding of the interviews is that many prospective clients had moved to the outskirts under the condition that a car is available, then their situation has changed (unemployment, retirement, relocation of children, move of the workplace, divorce) and a car is no longer available. These changes are appears to be stronger in suburbia as the car-dependence due to relatively poor public transport is higher in these areas than in the urban area.

The actual amount of costs for car sharing is often overestimated by prospective clients. Another issue is that the tariff system is often hard to understand for prospective clients. A lot of new comers were not able to get a clear picture of the actual money they would have to pay when they join cambio.

As most prospective clients want to save costs by car sharing, they say that they would prefer to use small cars if they become a client of cambio. For nearly all interviewed people a car is not a status symbol.

Poor demand for car use

Nearly all interviewees said that their demand for car use is relatively low. For journeys to the city centre they use public transport and can access shops and schools in the area they live without using a car. This is also true for the families who have a car, because this is normally taken for journeys to work (normally by the husband) and is not available for the partner, who makes all the journeys of the household and for the children. Most consider car sharing as an option for irregular journeys, e.g. to travel to the country side or for visiting relatives and friends. As a shopkeeper puts it: “I only need car sharing twice a year, to drive my relatives to the North Sea.”

Car sharing outside the city

The sub- and peri-urban space is not homogeneous; it consists of urbanised villages and residential areas built after the war, there are social housing blocks and smart residential districts. One result of the research is that the prospective clients do not live in the districts where the very poor or the very rich are concentrated; rather they live in districts dominated by the middle class, using a relatively good infrastructure.

The interviewed people regard themselves as pioneers concerning their interest in car sharing, saying that the lifestyle of most people in the neighbourhood is based on car ownership. However the interviewees do not feel the community is opposed to car sharing but simply lacks awareness of it.

Target groups and further marketing

Even if the demand for car sharing is relatively low in suburbia, some typical suburban target groups can be identified. There are families which often look for an alternative to the second car. There are the seniors, whose need for a car has decreased due to retirement. And there are those, who save money on a private car and who are looking for an interim solution.

Increasing demand in suburbia requires continuous efforts, as decisions to join cambio often take a long time. Prospective clients are aware that the demand is often too low in their living area to justify the introduction of a new station. However some of them are optimistic that in the long run sufficient people can come together. Cambio foster this process by constant advertisement and by bringing potential local clients together.

Up-scaling CS outside of the city - the view of the operator

To extend the car sharing service to the suburban region is one of the potential growth paths for car sharing organisations. A focus group discussion in September 2005 arrived to the following results concerning the future development.

The suburban region is not the core area where CS organisations can win new clients with pure market-based offers.

In the suburban region the demand for car sharing is too low from a business point of view. Cambio say that it is more worthwhile to compete with other CS organisations in residential areas of other big cities, like they do in Hamburg, than to provide their service in the region.

Further offers depend strongly on financial promotion. In the long run it cannot be guaranteed that stations at the edge of the city will not be closed.

2.9.6.3 Bremen - Integration with urban developments (9.2)

Integration into the Bremen urban planning concepts

In the course of the VIVALDI project the idea of car sharing was further integrated into the general city/regional transport policies and guidelines. It is part of the city/regional transport plan (Nahverkehrsplan) and of the city development plans (Stadtentwicklungskonzept). However, for these achievements to come about, barriers were overcome.

There are several ways to integrate the idea of car sharing in urban planning. They mainly depend on the area where car sharing stations should be located and on the planning stage. car sharing can be introduced in existing residential areas or in new developments; it could be implemented at an early stage by means of appropriate planning law or at a later phase by building law. Unfortunately the German national legal framework is not very beneficial for the implementation of car sharing. For new developments, the building law foresees that the developer provides parking according to a specific ratio. In existing residential areas the law prohibits public ground being allocated to car sharing stations.

However, there are some options left open to local politicians/planners. To make advantage of these options, supporters of car sharing have to co-operate. Car sharing is still a new and unconventional idea, it is promoted through a network of politician/planners that belong to different organisational levels.

Due to the activities supported by VIVALDI and other European projects (MOSES), solutions have been found to foster car sharing through urban planning despite these hindrances.

1. The project “Beginenhof” was the first development of a living and working centre for women introducing a car sharing location next to the flats. Through the car sharing location the number of required parking space (according to building law) could be reduced by 15%. The saved space has been used for further flats and shops. Administrative regulations allow further steps in combining housing and voluntary membership in a car-sharing scheme. The concrete aims of the MOSES project (mobility services for urban sustainability) have fed into this task.

2. Within VIVALDI, there have been negotiations with various stakeholders for a new inner city development on a former water supply plant near the river Weser

(Stadtwerder area). In summer 2004, the Parliament committee approved the formal development plan for this area. This is the first formal development plan in Bremen that foresees a certain area as public car sharing station – which can reduce the demand for parking space.

3. A further implementation of car sharing is foreseen in a former factory area (“Guldenhaus Quartier”) in the Neustadt district in Bremen where buildings for residents, students and offices are to be developed. This project was set off by a developer, however most developers are rather reluctant to adopt the car sharing idea, arguing that it is a financial risk to reduce parking spaces for private cars. This argument ignores the fact that in dense inner city districts residents’ car dependence is relatively low.

Transferring knowledge and awareness of car sharing to other European cities

A further aim of this measure is to disseminate the experiences gathered in Bremen to other European cities. The VIVALDI project has enabled new relationships. First contacts with Nantes in the VIVALDI context have shown the importance to build on best practice. A political delegation from Nantes visited Bremen to get more information about car sharing and its practical implementation. There is interest from other CIVITAS cities as well, including from the new member states.

These experiences show that a full range of media and different content levels are necessary to ensure that the appropriate target group is addressed by the appropriate media containing the appropriate information. At the beginning of the exchange process, inspiring and striking information is needed for distribution e.g. leaflets or presentations at conferences. Also short information presented on web-sites can arouse the interest in prospective local supporters. In the second phase, supporters need more detailed information to convince local decision makers. This can be delivered for example by reports. At the end of a successful exchange process the knowledge has to be transferred to a more personal level. Thematic workshops and particularly site visits are necessary to provide a realistic view. This gives also the opportunity to clarify technical and financial issues with the car sharing operator.

To contribute to the CIVITAS objective of further interrelation and knowledge exchange between cities, cambio has produced a brochure about car sharing services with all relevant aspects of operation and service levels. For the co-operation with Nantes, cambio has proposed a system concept.

2.9.7 Bremen – Cycling Infrastructure

This package consists of the following measures: residential traffic management and walking and cycling measures.

LO12 Increase safety of cycling

Residents and cyclists using the new cycle lanes feel significantly safer. The share of those who feel “very safe” or “safe” has grown for the Langemarckstraße (residents) from 17% to 79%, for the Lahnstraße (cyclists) from 10% to 79% and for the Hohentorsheerstraße (cyclists) from 39% to 71%.

LO13 Increase attractiveness of cycling

Residents and cyclists clearly assess the new facilities more attractive than the old ones. The share of those who appreciated the new lanes as “good” or “rather good” has increased for the Langemarckstraße (residents) from 16% to 88%, for the Lahnstraße (cyclists) from 18% to 76% and for the Hohentorsheerstraße (cyclists) from 14% to 95%.

There is also a considerable share of those who said that they would cycle more often because of the new cycle lanes. The proportion amounts to 10% for Langemarckstraße, 42% for Lahnstraße and 14% for Hohentorsheerstraße.

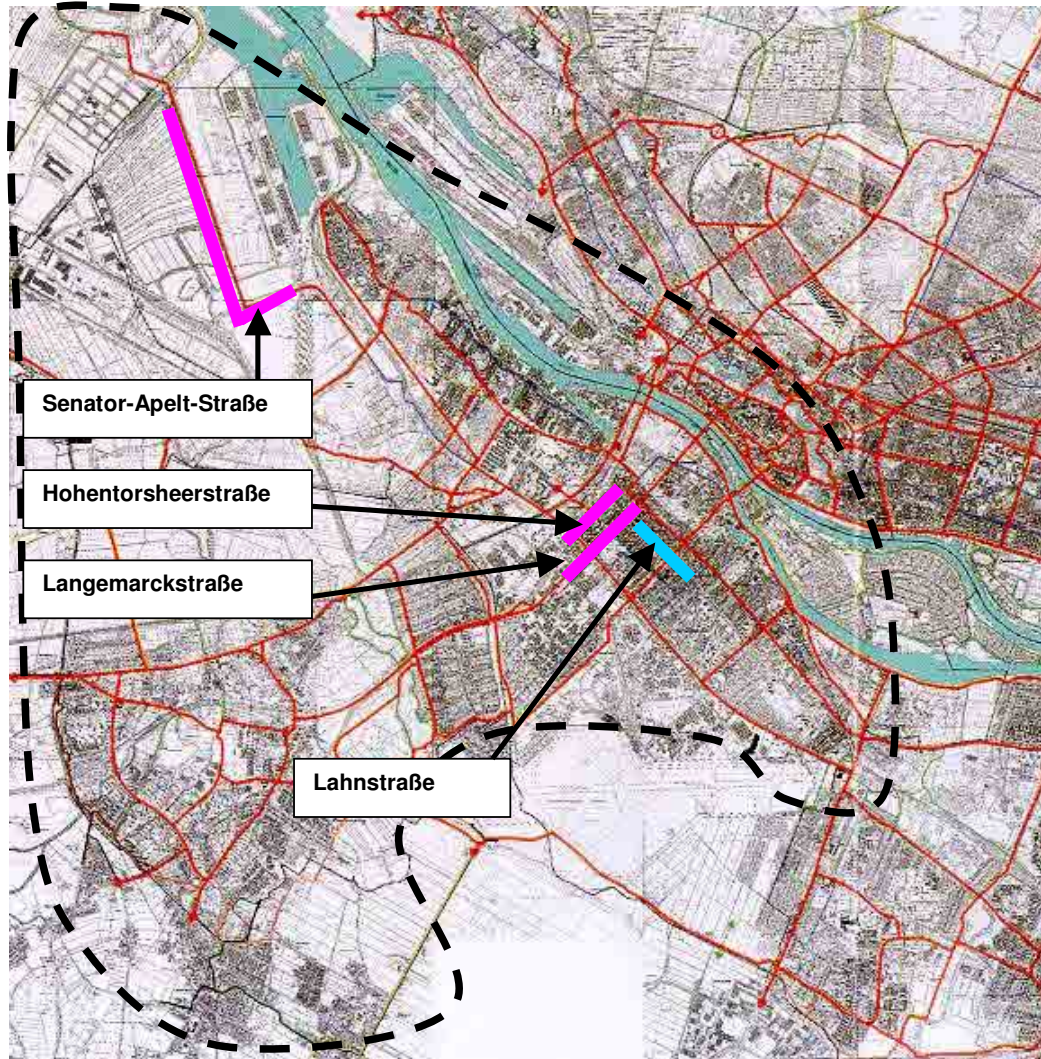
*2.9.7.1 Bremen - Walking and cycling measures (11.4)*Measure Overview

This measure consists of the following elements:

- Set up a contraflow lane (marking and signposting) for cyclists in the Lahnstraße to improve physical safety and install a set of traffic lights at a crossing.
- Reallocation of road space in the Hohentorsheerstraße, a through road in the northern part of the Neustadt area. The width of the road has been reduced, new cycle paths have been built, and a roundabout has been built in order to improve the physical safety and convenience of cycling.
- Reallocation of road space in Langemarckstraße, one of Neustadts’ main shopping and traffic streets. In large construction works (from May 2004 to December 2005) the road lane has been renewed, new rails and stops have been set up for the tram, vegetation and trees have been planted, new cycle tracks, cycle stands and walking paths with have been built. Waiting areas at PT stops and cycle paths have been separated. Pedestrians, cyclists and PT users should have better and safer conditions to travel, particularly in comparison to car users. Potential conflicts between road users should be minimised.
- Bridging a gap between the urban and the regional cycle network. The physical safety and guidance should be improved in a small section of the Senator-Apelt-Straße.

The following map depicts the network of the main cycle paths in Bremen and the locations of the measures supported by VIVALDI.

Figure 2.9.7-1 Cycle network in Bremen



Cycling is a way of life in Bremen. A high share in the modal split for cycling – 22% of all journeys of the population are done by bike – show how common cycling is. The overall aim of the walking and cycling measures is to stabilise and increase the existing potential. The target of the measures is focussed on improvements for cyclists and pedestrians in housing areas, along with restrictions for car use or as measures on their own. The main objectives are:

- To improve safety for cyclists, notably at critical points and for children
- To increase the number of cyclists at critical points
- To increase the perceived and actual safety on cycle paths
- To reduce the travel time of cyclist at critical points

The targets set against these objectives are:

- The provision of an infrastructure for a safer and faster cycling, notably at some critical traffic junctions
- The adjustment of local cycling regulation

Evaluation Results

Four different surveys have been conducted to evaluate the success of these measures.

- Cyclists passing through either Lahnstraße or Hohentorsheerstraße were given a short questionnaire in the form of a postcard. In Lahnstraße only cyclists passing in an east-west direction received questionnaires. These two surveys will be referred to as the cyclists-surveys, as 92,8% of the participants have the bicycle as the most important means of transportation.
- The third survey was a written household survey in Lahnstraße. Here, only the person who uses a bike most often was asked to answer.
- The fourth survey has been carried out in the Langemarckstraße. Here again, only the person who uses the bike most frequently was asked to answer. But beside residents (households) also shopkeepers have been addressed. Unfortunately the measure (construction work) has not been finished in parts of the Langemarckstraße. Due to the forthcoming end of VIVALDI the survey had been carried out at the latest time possible. The effect was that not all residents in the street could experience the improvements of the new cycle paths and of the other measure elements.
- (The closing of the gap in the cycle net (Senator-Apelt Straße) has not been evaluated, because the measure has been implemented too late to show any impacts. As this cycle path is mainly used for long distance leisure purposes measurable impacts are not likely to occur before summer 2006.)

Table 2.9.7-1 Survey methodology

main survey question	design	survey method	survey unit	sample size	recruitment	time
acceptance/impact of cycle path in Lahnstraße	single group	postal self-completing	residents cyclists	87 72	all residents on the street	9/2004 10/2004
acceptance/impact of cycle path in Hohentorsheerstr.	single group	postal self-completing	cyclists	60	on the street	10/2004
acceptance/impact of the reconstruction of the Langemarckstr.	single group	postal self-completing	residents	137	all residents	8/2005

Overview of all cycling measures concerning acceptance, safety and impact on cycling

As mentioned above, the surveys primarily address cyclists. In all cases there is a cyclist bias in the answers, which makes perfect sense when the success of cycling measures is at stake. On the other hand, these surveys do not represent only the views of the cyclists. In the household surveys about every second respondents' main mean of transport is not a bicycle. For further interpretation see the representative figures of the adult population in Neustadt in the table below.

Table 2.9.7-2 Main means of transportation (%)

street	Langemarckstraße	Lahnstraße	Lahnstraße	Hohentorsheerstraße	Neustadt*
sample	residents (N=109)	residents (N=87)	cyclists (N=72)	cyclists (N=80)	represent. sample
car	16,5	27.6	4.2	5.0	27,9
public transport	28,4	14.9	1.4	2.5	30,0
bicycle	47,7	50.6	94.4	91.3	28,6
foot	7,3	6.9	1.4	1.3	12,5

Although the new cycle paths differ a lot concerning their scope and integration into other road construction measures it may be useful to give an overview of their acceptance and their impact. In all surveys the respondents have been asked to assess the situations before and after the measures were implemented. It is clear to see in the following tables that all measures have been appreciated by the residents and cyclists. The construction measures in the Langemarckstraße and in the Hohentorsheerstraße are better rated than the regulation measure in the Lahnstraße. The most urgent need for improvement was stated by the residents for the Langemarckstraße and by the cyclists for the Lahnstraße: 40.3% and 25.4% of them assessed the before situation as very bad. Most satisfied are the cyclists in the Hohentorsheerstraße: 60% estimated the reallocation of road space and the new cycle paths as “very good”

Table 2.9.7-3 Assessment of new cycle measures (%)

street	Langemarckstraße	Lahnstraße	Lahnstraße	Hohentorsheerstraße
sample	residents/shopkeepers (N=137)	residents (N=87)	cyclists (N=72)	cyclists (N=80)
survey item	new cycle paths	new cycling regulation	new cycling regulation	reallocation/ new cycle paths
Very good	40,1	37,2	27,8	60,0
Rather good	48,2	41,9	48,6	35,0
Rather bad	5,1	9,3	20,8	5,0
Very bad	0,7	11,6	2,8	0,0
unknown	5,8			

Table 2.9.7-4 Assessment of the before situation (%)

street	Langemarckstraße	Lahnstraße	Lahnstraße	Hohentorsheerstraße
sample	residents/shopkeepers (N=137)	residents (N=87)	cyclists (N=72)	cyclists (N=80)
survey item	cycle paths before	cycling regulation	cycling regulation	road/cycle paths before
Very good	3,0	3,7	1,4	0,0
Rather good	13,4	18,5	16,9	13,8
Rather bad	38,1	55,6	49,3	58,8
Very bad	40,3	22,2	25,4	16,3
unknown	5,2		7,2	11,3

Table 2.9.7-5 Change after measure implementation (%)

street	Langemarckstraße	Lahnstraße	Lahnstraße	Hohentorsheerstraße
sample	residents/shopkeepers (N=137)	residents (N=87)	cyclists (N=72)	cyclists (N=80)
survey item	new cycle paths	new cycling regulation	new cycling regulation	reallocation/ new cycle paths
Very good	37,1	33,5	26,4	60
Rather good	34,8	23,4	31,7	21,2
Rather bad	-33	-46,3	-28,5	-53,8
Very bad	-39,6	-10,6	-22,6	-16,3
unknown	0,6	0	-7,2	-11,3

The cycling measures should improve safety. In all surveys the respondents have been asked to assess how safe they feel on the old and on the new cycle paths. The strongest improvements apparently happened in the Langemarckstraße, where the before situation has been assessed by a third of respondents as “very unsafe”. But new cycling regulations in the Lahnstraße also have a clear positive impact, even though these are not of the size as those for the Langemarckstraße. Cyclists considered the new measure in the Hohentorsheerstraße less positively with regards to safety: nearly 30% don’t feel safe when cycling there. This is likely due to the new roundabout. Cyclists believed car drivers frequently don’t seem to realize or accept the priority given to cyclists in this roundabout.

Table 2.9.7-6 Assessment of physical safety after measure implementation (%)

street	Langemarckstra�e	Lahnstra�e	Lahnstra�e	Hohentorsheerstra�e
sample	residents/shopkeepers (N=136)	residents (N=87)	cyclists (N=72)	cyclists (N=80)
survey item	new cycle paths	new cycling regulation	new cycling regulation	reallocation/ new cycle paths
Very safe	28,7	10,8	8,6	12,5
Rather safe	50,7	59,0	70,0	58,8
Rather unsafe	8,1	16,9	12,9	21,3
Very unsafe	,7	8,4	5,7	7,5
Don't know	11,8	4,8	2,9	

Table 2.9.7-7 Assessment of physical safety in the before situation (%)

street	Langemarckstra�e	Lahnstra�e	Lahnstra�e	Hohentorsheerstra�e
sample	residents/shopkeepers (N=137)	residents (N=87)	cyclists (N=72)	cyclists (N=80)
survey item	cycle paths before	cycling regulation	cycling regulation	road/cycle paths before
Very safe	2,2	1,2	0,0	5,0
Rather safe	14,7	15,7	9,7	33,8
Rather unsafe	40,4	37,3	50,0	43,8
Very unsafe	34,6	32,5	29,2	13,8
Don't know	8,1	13,3	11,1	3,8

Table 2.9.7-8 Change of safety assessment after measure implementation (%)

street	Langemarckstra�e	Lahnstra�e	Lahnstra�e	Hohentorsheerstra�e
sample	residents/shopkeepers (N=137)	residents (N=87)	cyclists (N=72)	cyclists (N=80)
survey item	new cycle paths	new cycling regulation	new cycling regulation	reallocation/ new cycle paths
Very safe	26,5	9,6	8,6	7,5
Rather safe	36	43,3	60,3	25
Rather unsafe	-32,3	-20,4	-37,1	-22,5
Very unsafe	-33,9	-24,1	-23,5	-6,3
Don't know	3,7	-8,5	-8,2	-3,8

The cyclists on Lahnstra e and Hohentorsheerstra e, and the residents of the Langemarckstra e were asked to estimate the impact of the measures on the frequency of their cycling. In the Lahnstra e, which has been opened for cyclists against a one-way street, cycling has increased the most. Because of the new regulation the street can

now be used in both directions. For the other two streets the measures will also induce more cycling. Surprisingly, more than 10% of the respondents say that they would cycle more frequently because of the new cycle paths.

Table 2.9.7-9 The measures' impact on cycling frequency (%)

street	Langemarckstraße	Lahnstraße	Hohentorsheerstraße
sample	residents/shopkeepers (N=137)	cyclists (N=72)	cyclists (N=80)
survey item	new cycle paths	new cycling regulation	reallocation/ new cycle paths
more frequently	10,4	41.7	13.8
same	71,9	52.8	85.0
less frequently	3,0	5.6	1.3
don't know	14,8		

New cycling regulation in the Lahnstraße

In Lahnstraße, whose use in an east-west direction was illegal for cyclists before the VIVALDI measure, both cyclists and households were also asked how they travelled before this change. In both cases, in the cyclist and the household survey, the vast majority passed through Lahnstraße against the one-way measure in an illegal manner. Thus, the opening of the one-way street legalized this use. As the rise in use after opening is much higher (41.7%) than the percentage of people who chose different ways before the opening (15%), the rise may be explained by an increased bike usage on the part of people who passed through Lahnstraße illegally before its opening.

Table 2.9.7-10 Use of Lahnstraße against the one way street regulation before its opening by cyclist and residents

	cyclists (N)	residents (N)
bike pushed (legally)	1	0
never used (legally)	6	12
Mainstraße (legally)	6	8
footpath (illegally)	7	5
street (illegally)	12	4
cycling lane (illegally)	48	53

In the household survey, people were asked for their opinion concerning four alternative possible traffic regulations for Lahnstraße. The four alternatives were:

- An extra cycling lane and fewer parking spaces, i.e. a clear priority for cycling
- The opening of the street for cyclists in both directions and a strict speed regulation for car traffic ("Fahrradstraße"), i.e. also a clear priority for cycling
- Opening of one way street for cyclists without "Fahrradstreifen", i.e. a less bike-friendly alternative
- Return to the old regulation, i.e. banning of cyclists from passing through Lahnstraße in an east-west direction

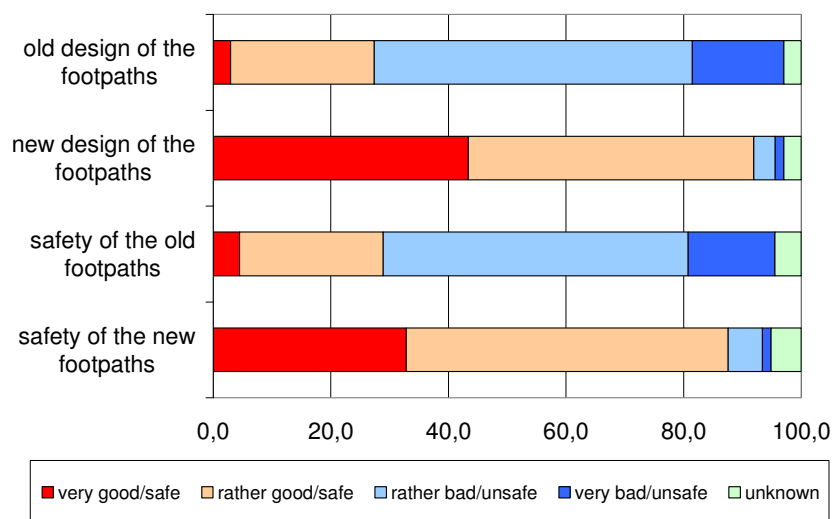
Table 2.9.7-11 Opinion concerning possible alternatives to Lahnstraße traffic regulation

	Very good	Rather good	Rather bad	Very bad
A: Extra cycling lane, less parking space	23.2	17.1	26.8	32.9
B: "Fahrradstraße"	30.9	25.9	29.6	13.6
C: No "Fahrradstreifen"	2.5	11.3	51.3	35.0
D: Return to old regulation	5.1	7.6	21.5	65.8

Evidently, the more bike-friendly alternatives A and B are far more popular than alternatives C and D that would take away some newly established qualities for cyclists. Especially the idea of a return to the old regulation is considered "very bad" by two thirds of the responses. Obviously the cyclist bias in the sample may have an effect here. Half of the "very bad" answers for alternative A came from people whose main means of transportation is the car. On the other hand though, almost 30% of the 'very bad' answers came from cyclists.

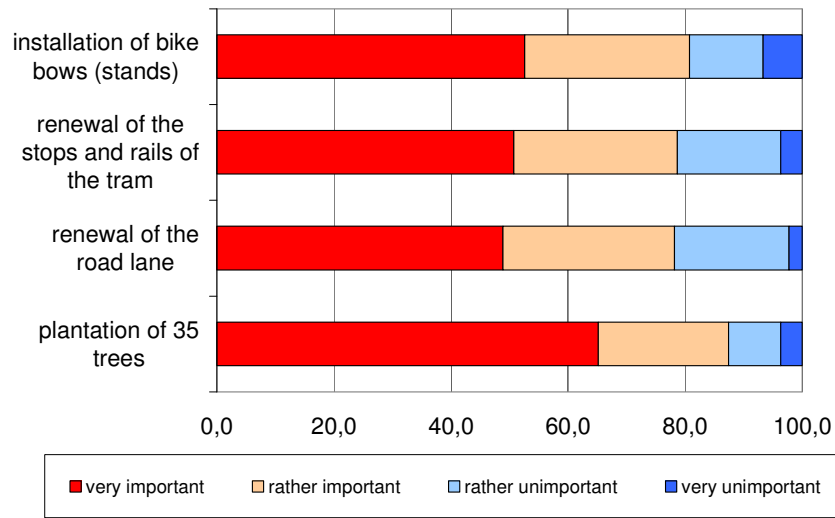
Reconstruction of the Langemarckstraße

The rebuilding of the Langemarckstraße consists of various elements including the construction of new footpaths. Previously, cyclists and walkers had to share the same pavement, separated by a line. This situation caused problems to pedestrians, who often felt threatened by cyclists, whereas cyclists could not cycle quickly. The figure below depicts that the new footpaths have been very well accepted and that the feeling of safety has also clearly increased.

Figure 2.9.7-2 Assessment of quality/safety of the old and new footpaths (%)


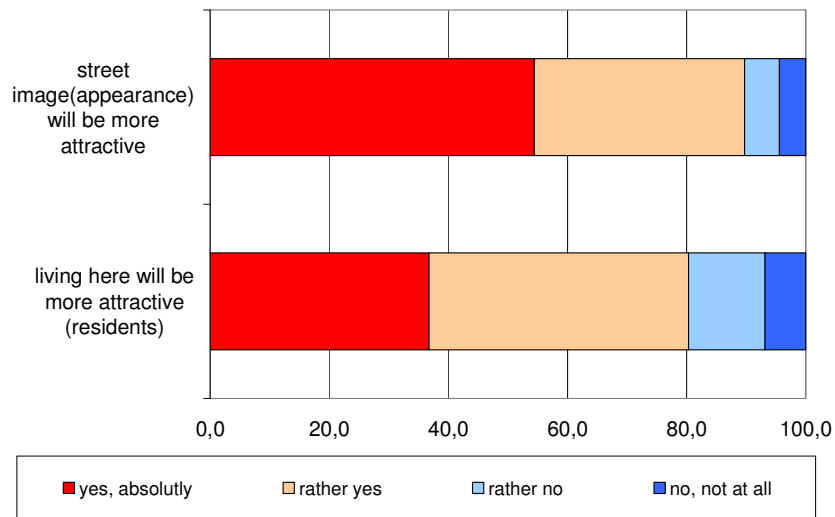
The separation into two different paths has been an extra item of the questionnaire: 40% of the residents value the new separation as "very good", whereas nearly no one was satisfied with the former situation. However there are some respondents (about 14%) who are not happy with the new solution.

Figure 2.9.7-3 Importance of accompanying measures (%)



Residents were asked about the general impact of the street rebuilding. Even though the construction work has not been finished in some parts of the Langemarckstraße, the majority of the residents stated that the look of the street has been (or will be) improved and that the living has become (or will be) more attractive.

Figure 2.9.7-4 Impact of the measure on living conditions



The respondents could also make free statements to open-ended questions concerning the pros and cons of the measures. 110 positive and 104 negative statements were given. The appearance of the street and the new vegetation has been appreciated the most followed by the measures dedicated to cyclists, pedestrians, PT users and car drivers.

Table 2.9.7-12 Positive statements about the new Langemarckstraße (multiresponse, %)

	% of cases
more attractive image (appearance)	30,0
trees	28,2
new cycle paths	23,6
new footpaths	17,3
clear separation between cycle paths and footpaths	17,3
new tram stops and rails	16,4
new road lane	15,5
appreciation of the business quarter	9,1
offer of car parking space	7,3
others	3,6
end of the rebuilding stage	2,7
everything is positive	2,7
can't assess it at the moment	2,7
nothing is positive	0,9

Most criticism relates to the side effects of the construction works. One in every five residents was not satisfied with the new road and the offer of parking spaces.

Table 2.9.7-13 Negative statements about the new Langemarckstraße (multiresponse, %)

	% of cases
rebuilding (noise, dirt, duration, costs)	50,0
new design of the road	19,2
offer of car parking space	19,2
deficit of planning	15,4
already welfare destruction (vandalism)	13,5
nothing is negative	9,6
loss of front gardens	7,7
new footpaths	6,7
new cycle paths	5,8
insufficient measure (not enough green)	5,8
loss of customers	3,8
still unattractive	2,9
new tram stops and rails	1,9
can't assess it at the moment	1,0

In general, shopkeepers' acceptance of the measures is in line with that of residents. However shopkeepers also have to bear in mind how the measure affects their business. The following table shows shopkeepers' answers on the question if, in the long run, they will win customers due to the rebuilding of the street. The majority of shopkeepers feel that the measure will have a positive rather than a negative impact on their business. Only 3 of the 19 shopkeepers fear a loss of customers.

Table 2.9.7-14 Impact of the measure on shopkeepers' patronage

Increase in patronage?	N
yes, absolutely	6
not likely	3
no (constant)	7
no (loss of customers)	3

2.9.8 Bristol – Promoting Clean and Efficient Vehicles

The key local objectives for the clean-fuelled vehicle package of measures were to:

- Stimulate the market for clean-fuelled vehicles in the city;
- Reduce vehicle energy use and emissions and contribute to meeting local air quality and energy targets;
- Improve the quality of public transport to support mode shift from cars to public transport.

The tables below set out the local evaluation objectives that were set and how these relate to the overall VIVALDI objectives and targets.

Table 2.9.8-1 Objectives for Clean and efficient vehicles

No	Local objective	Target	Contribution to VIVALDI target (s)
LO1	Stimulate the market for clean-fuelled vehicles in the city	Implement at least <ul style="list-style-type: none"> • 40 retrofit diesel buses, • 4 diesel/electric hybrid buses, • 50 LPG municipal vehicles, • 2 LPG mini buses 	VT1 - 250 Clean Vehicles across the sites
LO2	Contribute to meeting local air quality and energy targets.	Reduce vehicle energy use and emissions by 8%	VT2 - Reduce energy use and CO ₂ by 8% in demonstration area VT3 - Meet national air quality objectives
LO3	Improve the quality of public transport to support mode shift from cars to public transport.	Increase patronage on clean fuelled bus routes.	VT 9 - Increase patronage on key corridors by 20%

To achieve these targets the following measures were implemented:

- 5.1 Clean and efficient buses
- 5.2 Clean Fleet vehicles
- 5.3 Fuel Supply infrastructure and local network
- 5.3 Renewable energy supply

The project also hoped to implement a flywheel powered tram (5.4) but this was not possible (See Section 3.2.3.5).

The following summarises the achievements that have been made against the local objectives set out at the inception stage of the project. This section is followed by detailed analysis of each measure that was implemented to meet these targets. Although below is a useful summary of the evaluation results the reader is encouraged to closely study each of the measure results in detail to fully understand the many achievements for this integrated package of measures.

LO1 – Stimulate the market for clean-fuelled vehicles in the city

The VIVALDI project in Bristol has implemented many measures that have promoted and introduced the use of clean-fuelled vehicles to a wide variety of people in the city. The following is a summary of all the Clean Fuelled Vehicles that have been introduced:

- 58 Buses retro-fitted with Particulate traps;
- 73 LPG vehicles in the Council's Fleet;
- 5 Electric battery powered Reva G-Wiz cars as part of the Councils car pool;
- 1 Hybrid Toyota Prius;
- 1 Hybrid Bus;
- 5 LPG Mini Buses for a Demand Response Transport Service; and
- 50 LPG conversions to vehicles owned by Bristol residents, Council employees.

The above shows that the target total of the introduction of 92 vehicles has been exceeded by 101 vehicles giving a total of 193 clean fuelled vehicles implemented as part of the VIVALDI project in Bristol. This contributes 77.2% towards the VIVALDI project total of 250 vehicles.

LO2 – Contribute to meeting local air quality and energy targets

Target: reduce vehicle energy use and emissions by 8%.

VT2 – Reduce energy use and CO₂ by 8% in demonstration area.

VT3 – Meet national air quality objectives.

A range of cleaner vehicle technologies were implemented in the project, which contribute in various ways to local air quality, CO₂ and energy targets.

Considering air quality first, it is primarily NO_x and PM emissions that are of concern for local populations' health and the UK national air quality objectives.

LPG and petrol engines produce very low levels of PM compared to diesel, which is the fuel of choice for heavy-duty vehicles. PM emissions were targeted by:

- Retrofitting diesel vehicles (buses) with oxidation catalysts for older buses and particulate traps for newer ones;
- Using LPG in city council fleet vehicles, which would otherwise operate on diesel;
- Using LPG minibuses in a demand responsive transport fleet that would generally run on diesel.

A major reduction in PM was estimated for each of these vehicle fleets by either retrofitting emission abatement technology to existing older heavy diesel buses, or switching the purchasing decision for light and medium diesel vehicles to LPG fuels.

The pollutant NO₂ is produced from NO_x emissions, which are produced by both diesel, LPG and petrol fuelled engines. Diesel vehicles tend to produce more NO_x emission than LPG, and LPG more than petrol.

In the Bristol project a reduction in NO_x emissions was achieved by two pathways. One was to use fuel more efficiently, in a hybrid petrol-electric car (instead of a petrol-only model), and a small fleet of electric cars. The electric cars produce zero emissions at point of use, but even when compared to a diesel or petrol vehicle on a life-cycle emissions basis (taking into account the pollutants produced by the electricity generation) there were significant NO_x savings. Savings were minor in percentage

terms when compared to a NO_x-clean petrol baseline scenario, but considerable when compared to a diesel baseline.

The second method of reducing NO_x emissions has been through the purchase and use of LPG fuelled Council fleet vehicles. Compared to the more usual diesel equivalents this has not only reduced estimated PM emissions, but also produced significant percentage (and actual) reductions in NO_x. A similar result was found for the LPG minibus used in a demand responsive transport service.

A penalty of switching vehicles from diesel to LPG was estimated to be an increase in CO₂ emissions. Diesel engines produce relatively low levels of CO₂ in comparison. This climate change gas is not a local air quality pollutant, but has global implications. However, to balance this the greater fuel efficiency of electric-hybrid and electric vehicles in Bristol have resulted in estimates of significant (+50%) reduction in CO₂ emissions. Of greater significance was the conversion of 50 petrol vehicles to lpg/petrol running which has been estimated to reduce CO₂ emission by nearly a quarter on average.

Overall there has been a contribution to reduced emissions of PM, NO_x and CO₂ by varying degrees depending on the choice of vehicle technology.

LO3 – Improve the quality of public transport to support mode shift from cars to public transport.

VIVALDI Target 9 (VT 9) was to increase bus patronage on key corridors by 20%. First (the bus operating company in Bristol) rotate the buses used on most bus corridors and as a result it was not possible to collect patronage data for the retrofitted buses. However, dedicated clean fuelled buses were used for the two Park & Ride (P&R) services. The results showed that increases in patronage of 10% and 83% were achieved for the Bath Road (904) and the new Portway (902) services. On bus surveys for the P&R services (see Improving Public Transport, measure 8.7) also identified that bus passengers thought that the use of cleaned fuelled vehicles was important and that it played an important part in deciding to use the P&R services for a large proportion of passengers.

The following describes in detail the measure level results for this integrated package.

2.9.8.1 Bristol - Clean and efficient buses (5.1)

Measure Overview

The objective of this measure was to introduce a clean fleet of buses in the city of Bristol to support local air quality objectives. Following discussions with public transport operators it was clear that given the long operating life of buses there was also a need to clean up existing diesel vehicles. Consequently, the demonstration followed two implementation paths towards cleaner bus fleets – new hybrid diesel electric buses and retrofitting older vehicles with exhaust treatment equipment. Particulate traps for the older vehicles would use self-cleaning technology which enables the carbon element of the particulate technology to be burnt off at typical exhaust gas temperatures – the system is capable of removing over 90% of particulate matter, hydrocarbons and carbon monoxide.

The implementation plan set out for this measure included the:

- Introduction of 4 clean buses to replace existing diesel vehicles;
- Retrofit of up to 40 diesel buses; and
- Introduction of 2 new clean fuel buses to demand responsive fleet.

The actual implementation was as follows:

New Clean Fuel Vehicle

A Hybrid Bus was introduced and operated on a city centre orbital route. A funding contribution towards the hybrid development work was received from the Energy Savings Trust under their Transport Action Powershift programme. Specific engineering targets were set but in summary the aim was to significantly reduce all harmful emissions equivalent to a Euro 3 engined vehicle, by reducing CO by 25%, NO_x by 25%, HC by 25%, Particulates by 25% and CO₂ by 35%. The target fuel consumption reduction was some 30%.

Retrofitting Diesel Buses

Following a review of the bus operator First's fleet 34 buses were selected and fitted with retrofit equipment comprising 9 oxidisation catalysts and 25 particulate traps; the equipment was installed in December 2002. Catalysts (reducing Hydrocarbons and Carbon Monoxide by a minimum of 50%) were fitted on older pre-Euro vehicles and particulate traps (reducing HC and CO, plus Particulate Matter by up to 90%) were fitted on the slightly newer vehicles. Two buses operated by South Gloucestershire Bus and Coach were fitted with particulate traps in January 2003. A further 22 First Avon and Somerset buses were fitted with particulate traps during January and February 2005 (see 8.6).

LPG vehicles

It was decided to introduce LPG vehicles to a Demand Responsive Transport Service called Bristol Dial-a-Ride (BDAR). The launch of the first LPG vehicle operating in a new service area (see 8.3) took place in August 2002. The use of LPG was reviewed during the first six months of use and found to be operationally acceptable. On this basis four further LPG vehicles of a similar type have been introduced, replacing older diesel vehicles as part of fleet renewal. Throughout the course of the project, Bristol Dial-a-Ride were able to purchase five LPG/Petrol vehicles, which constitutes a third of the fleet.

The intention of the clean bus strategy was to assist in stimulating the development of a market for clean and efficient buses in accordance with the Council's Clear Zones and Local Air Quality Management strategies. The measure also aimed to positively impact on the following quantifiable targets as outlined in the Evaluation Plan (D4), within the integrated package of Clean and Efficient Vehicles:

- VT1: 250 Clean Vehicles across the sites;
- VT2: Reduce energy use and CO₂ by 8% in demonstration area;
- VT3: Meet national air quality objectives;
- VT9: Increase patronage on key corridors by 20%.

Evaluation Results

The following section describes the results that were obtained following a large data collection programme during the period January 2002 – August 2005.

Four bus operators are involved with this measure, operating services on very different routes within and around Bristol. Different vehicle types are involved and a mixture of technologies used i.e. catalysts, particulate traps, hybrid, and LPG. For this reason the data has been presented with this differentiation i.e. by operator, bus model and technology.

The main type of data used for the evaluation is operational data. This includes vehicle mileage, fuel issued and fuel consumption data. With the support of the local bus operators, First Bristol, First Somerset and Avon, Buglers and BDAR the collection of before and after data has been possible. In First Bristol's case operational data has been collected for their 27 retro-fitted buses from Jan 2002 to March 2005, providing data for a period of 12 months prior to the implementation of the measure and a full two years after implementation. Operational data has also been collected from First Somerset and Avon for their 20 retrofitted buses during the period Jan 2004 – Aug 2005.

Data has been collected from Buglers for the hybrid bus operating on the Clear Zone orbital bus route. However, because this bus only became operational in June 2005 only limited data is available. The hybrid bus has not been in service for a sufficient length of time to be meaningfully evaluated. The vehicle has only been in service for three weeks due to operational problems within this period. Without one complete month worth of data it is not possible to produce robust evaluation and therefore results for this vehicle have not been calculated.

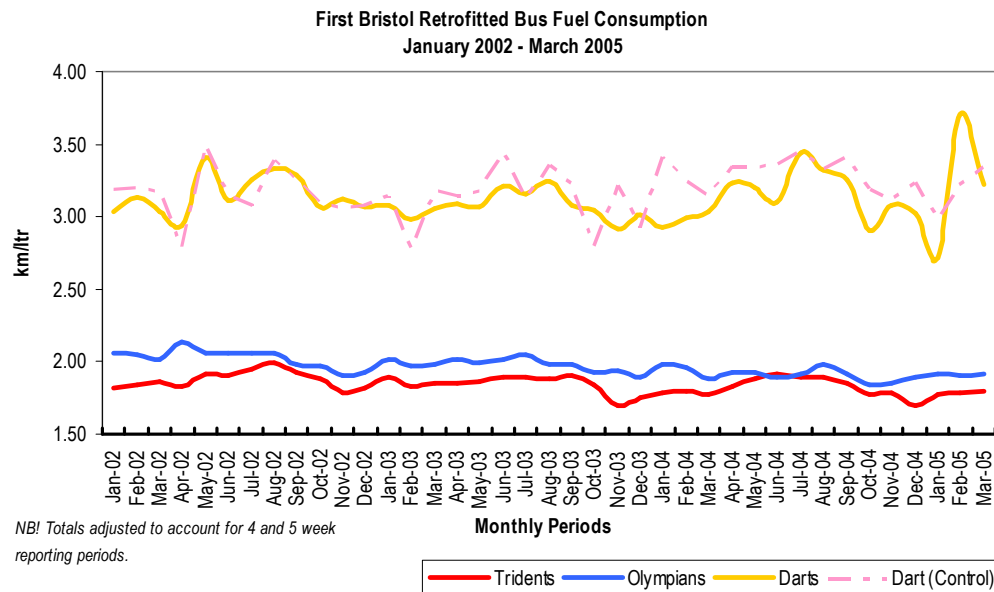
Data from BDAR was collected between January 2003 and December 2004.

Fuel Consumption (3)

Retrofit vehicles (particulate traps and catalysts)

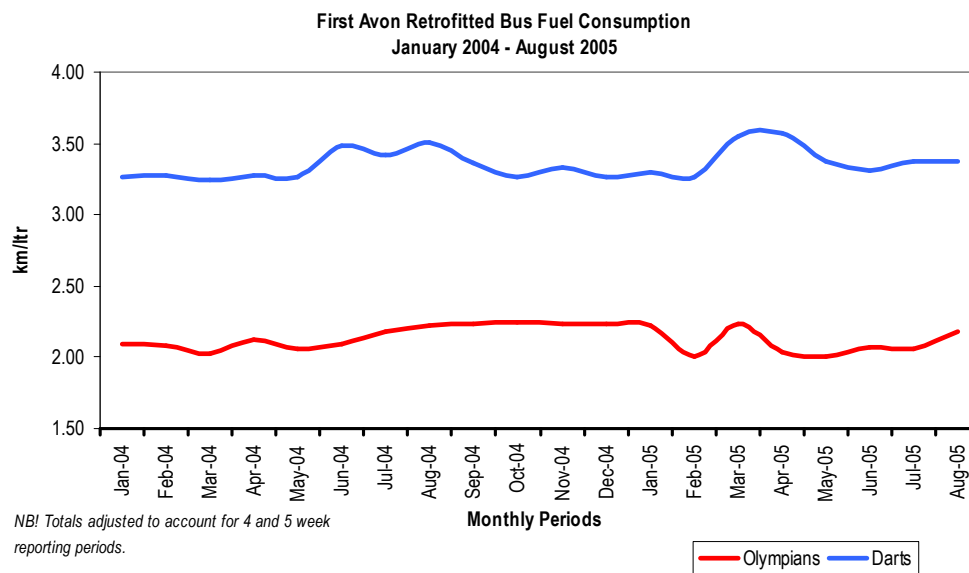
Analysis of the fuel consumption figures collected over the period January 2002 – March 2005 for the First Bristol retrofitted vehicles show that there has been a slight increase in fuel consumption on the Volvo Olympians and Dennis Tridents after being fitted with particulate traps in February 2003. In 2002, prior to the retrofit, fuel consumption on the Tridents averaged 1.88 Km-ltr, but after retrofitting in 2004 this figure had dropped to 1.82 km-ltr. Similarly the Olympians fuel consumption figures fell from 2.03 Km-ltr in 2002 to 1.91 Km-ltr in 2004. However, these results should be treated with some care as the variety of routes served and other factors could have contributed to these findings.

In contrast the vehicles fitted with just catalytic converters, for example the Dennis Darts, show little overall effect when compared to a control group of similar but non-catalytic vehicles. Both the control group and those fitted with catalytic converters have similar consumption figures during the period 2002 – 2005.

Figure 2.9.8-1 VIVALDI retrofitted bus fuel consumption data


There is also no noticeable effect of the retrofitting to the First Avon buses with catalytic converters. Between January and December 2004 the Volvo Olympians and Dennis Darts had average fuel consumption figures of 2.16 and 3.33 respectively, but between January and August 2005 averaged 2.09 and 3.40 respectively.

From these figures it possible to conclude that retrofitting the buses with catalytic converters has had no impact on the fuel consumption of the buses. However, it appears that fitting buses with particulate filters may well increase fuel consumption.

Figure 2.9.8-2 VIVALDI retrofitted bus fuel consumption


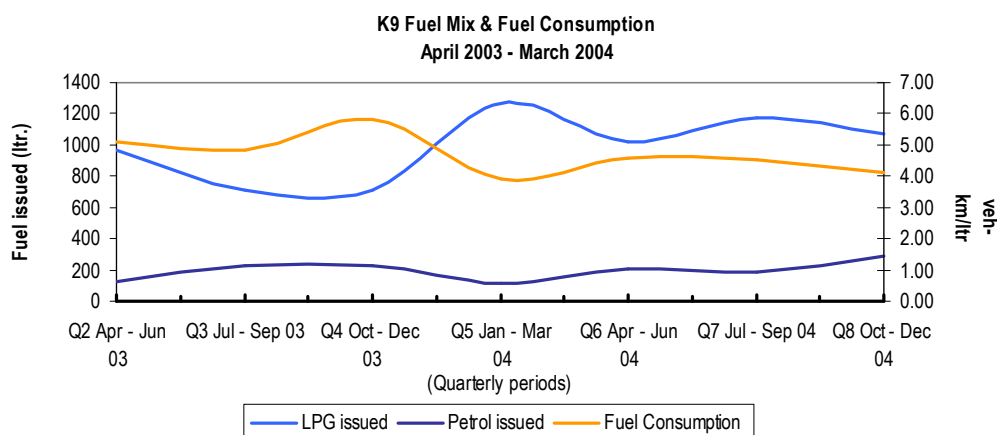
LPG bus

To provide a set of comparison figures against which to evaluate the LPG bus (a Mercedes Benz 314 Sprinter) a diesel fuelled Renault Master LM35D was operated in the same area undertaking the same duties for the period Feb – Apr 2005. The diesel vehicle was selected from the BDAR fleet as the nearest equivalent vehicle in terms of age, although it is approximately one year younger than the LPG bus and has a slightly lower seating capacity.

For the LPG bus fuel consumption over the period January 2003 to December 2004 varied between 3.9 and 5.8 km/ltr, recording an average of 4.7 km/ltr. In comparison the Diesel bus operated between Feb – Apr 2005 and recorded an average fuel consumption figure of 7.58 km/ltr. The diesel vehicle fuel consumption, although from a different make and model of vehicle, suggests that the LPG/Petrol vehicle is significantly less fuel efficient. However, other factors may have influence the results, such as time of year. A natural increase in fuel consumption can be anticipated during the winter months as the ambient temperature drops. In addition, it is necessary to use fuel powered heating, which has an impact on fuel consumption.

Finally, as shown in the graph below there is an apparent correlation between fuel consumption and the fuel mix, i.e. as the amount of LPG used increases the fuel consumption decreases. Therefore, it suggests that the fuel efficiency of the LPG vehicle could be improved if it was used with LPG rather than petrol more of the time.

Figure 2.9.8-3 VIVALDI LPG vehicle Fuel Mix and Fuel Consumption data



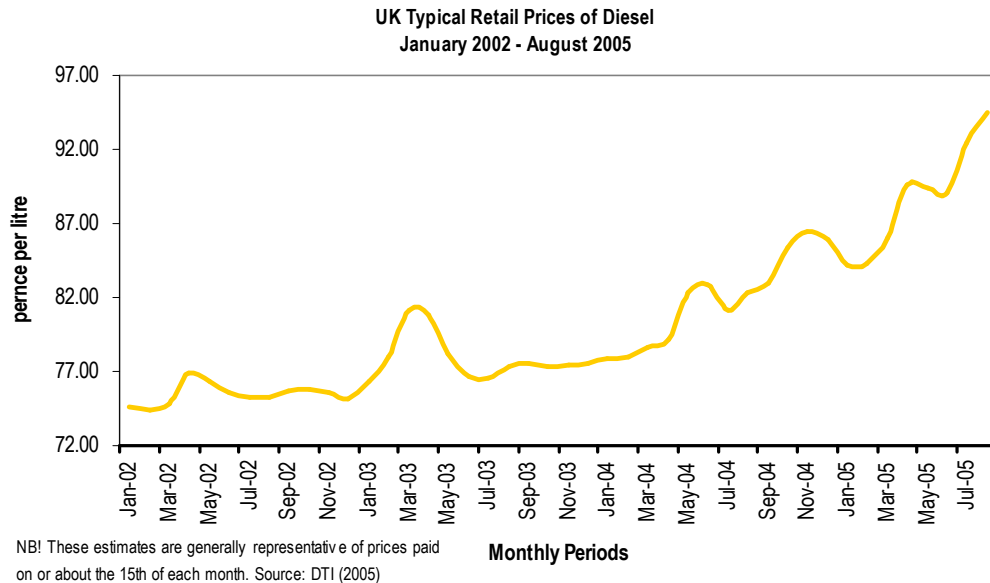
Fuel costs of operating (2)

Retrofitted vehicles (particulate traps and catalysts)

First Bristol and Avon bus companies buy their fuel in bulk, paying a fixed price per 12 months, and so are not affected by short-term fluctuations in the retail price of fuel. As the price they pay is commercially sensitive information, this analysis of fuel costs has been completed using national figures on the monthly retail price of fuels published by the DTI (Department of Trade and Industry).

For most users, the price of Diesel has risen significantly in the UK between Jan 2002 and August 2005. In this period the average monthly price of a litre of diesel has increased from £0.75 to £0.95 (£1 = 1.48 €).

Figure 2.9.8-4 UK Typical Retail Prices of Diesel Fuel



If subject to these costs, First Bristol's costs of operation would have also increased significantly. For the Trident and Olympian buses the cost per vehicle kilometre would have increased by £0.07 and £0.09 respectively, giving a cost in March 2005 of £0.48 and £0.45 per vkm. First Somerset and Avon's costs would have also been affected, the cost per vehicle kilometre increasing by £0.07 and £0.04 for the Olympians and Darts respectively, to a cost in August 2005 of £0.45 and £0.26 per vkm.

LPG

While LPG has remained much cheaper than petrol or diesel, due to lower rates of fuel duty imposed by the UK government, prices of LPG have also increased. Between Q3 2004 and Q4 2004 LPG prices increased by 13 per cent (DTI, 2005). In August 2005, the average forecourt price of LPG in the UK was £0.40 per litre.

On average the fuel costs of operating the LPG / Petrol vehicle is £0.09 per vehicle km. This compared to a figure of £0.11 per vehicle km for the period Feb – Apr 2005 recorded by the diesel replacement vehicle. Due to the cheaper price of LPG it is estimated that over the monitoring period BDAR have saved over £550 in fuel costs though operating the LPG / Petrol vehicle. This is estimated using figures from a Renault Master LM35D for Feb – Apr 2005.

Maintenance, repair costs (2) & Vehicle reliability (18)

It was not possible to collect detailed maintenance and repair costs from the vehicle operators as it was felt that it would be difficult to distinguish between general wear and tear and failures attributed to the retrofitting of emission abatement equipment. Also,

any failures of the particulate traps or catalytic converters themselves would be covered under warranty and therefore not show as a cost to the operator. However, a log of maintenance issues was kept by the operators to provide some qualitative data on any problems experienced. These have been summarised below.

Retrofit vehicles (particulate traps and catalytic converters)

The bus operating companies were offered the opportunity to provide feedback on any issues with regards to the maintenance and reliability of the retro-fitted buses. However, no comments were received.

LPG

There have been a number of reliability problems with the petrol / LPG minibus operating in the study area. This has included a problem with the fuel system which resulted in a serious petrol vapour leak and the exhaust system twice becoming seriously detached from the vehicle. Breakdown assistance has had to be summoned on both occasions. Finally, the fuel powered saloon heater continues to give problems. The vehicle has needed £3,665 in maintenance and repair costs between January 2003 and December 2004. This does not necessarily reflect a true figure of the overall cost of operating the vehicle, as some of the work carried out has been done under the Manufacturers Warranty.

A local company who service the LPG system have pointed out certain inadequacies in the installation of the system. There is very little clearance between the ground and the LPG tank when the vehicle is fully loaded. If the vehicle were to make contact with a speed hump or other such obstruction, it could result in serious damage.

In addition to the mechanical problems, the type of engine has not proved popular with some drivers. Drivers have reported that the vehicle is more likely to stall, requiring extra concentration and effort. However, the power of the LPG vehicle is adequate as it is only slightly lower than the petrol equivalent, and the engine is much quieter than a diesel model, which is thought to be a positive benefit for the passengers.

Hybrid

Since the new service launched on the 20th June 2005 the hybrid bus has only managed to complete three weeks in service from the 11 weeks during which monitoring data was collected. Between 20 June and 8 July 2005 the vehicle covered a total of 1,399km but a series of problems kept it off the road during that period. The main problems experienced have been associated with the batteries, either being drained or not recharging correctly, and computer / software issues. The manufacturer (Eneco) has replaced the batteries and updated the software to correct these problems. Eneco has also manufactured a shield to protect the batteries from being exposed to debris hitting the underside of the bus.

The vehicle broke down in service on Friday 8th July 2005 and had to be returned to the garage by a recovery vehicle. The bus has not been operational since this date and although Eneco have been out to fix the current problem the bus remained inoperable during September and October.

Buglers bus company's experience of operating the bus has been negative. While they were initially keen and enthusiastic, the frequency of failures and level of support to fix problems have damaged their trust in the vehicle. Buglers have been able to maintain the level of service promised for the route using the two conventional diesel buses.

Emissions (8-11)

The JET model has been used to calculate the emissions saving associated with the clean-fuelled buses. JET is a spreadsheet model developed within the JUPITER project as a tool to estimate the changes in energy and emissions from transport measures. The functions in JET take into account:

- Type of fuel;
- Average traffic speed;
- Distance travelled by each type of vehicle;
- Fitting of catalytic converters or particulate traps.

The pollutants for which total emissions are estimated are:

- Carbon Monoxide (CO);
- Nitrogen Oxides (NO_x);
- Volatile Organic Compounds (VOC);
- Total Particulate Matter (TPM);
- Carbon Dioxide (CO₂).

The JET model used data collected on vehicle km and fuel issued for each of the groups of buses. It was not possible to model the impact of fitting oxidisation catalysts to the First Bristol Dart buses as this technology is less frequently used and not included in the model. Therefore, calculations are presented solely for those vehicles fitted with particulate traps. The table below presents a summary of the emissions calculations produced using JET.

Table 2.9.8-2 Retrofit vehicles (particulate traps and catalytic converters)

Vehicle Type	Pollutant	Before	After	Difference	% Change
First Bristol Olympians	CO	2.51	0.25	-2.26	-90
	NOx	9.66	9.66	0.00	0
	VOC	0.73	0.07	-0.66	-90
	TPM	0.21	0.01	-0.20	-95
	CO2	989.21	1009.00	19.78	2
First Bristol Tridents	CO	0.44	0.04	-0.40	-90
	NOx	2.30	2.30	0.00	0
	VOC	0.15	0.01	-0.13	-90
	TPM	0.05	0.00	-0.04	-95
	CO2	329.74	336.33	6.59	2
First Avon Olympians	CO	0.82	0.08	-0.74	-90
	NOx	3.16	3.16	0.00	0
	VOC	0.24	0.02	-0.22	-90
	TPM	0.07	0.00	-0.06	-95
	CO2	323.28	329.75	6.47	2

First Avon Darts	CO	3.30	0.33	-2.97	-90
	NO _x	12.88	12.88	0.00	0
	VOC	0.86	0.09	-0.77	-90
	TPM	0.58	0.03	-0.56	-95
	CO ₂	1154.08	1177.17	23.08	2
Total Retrofits	CO	6.44	0.64	-5.81	-90
	NO_x	25.7	25.7	0	0
	VOC	1.74	0.17	-1.56	-90
	TPM	1.03	0.05	-0.98	-95
	CO₂	2466.58	2515.92	49.33	2

LPG

It can be seen from the table below that the main emissions reductions estimated from running the demand responsive community service bus on LPG-petrol was a major reduction in NO_x and some reduction for VOC. Little change is noted for PM.

Table 2.9.8-3 LPG Vehicle Total Emissions Calculations (tonnes per year) – Point of use

Pollutant	Before	After	Difference	% Change	
CO	0.03	0.09	0.06	203.61	
NO _x	0.03	0.01	-0.02	-74.92	
VOC	0.01	0.00	0.00	-29.42	
TPM	0.00	0.00	0.00	0	
CO ₂	7.54	7.98	0.44	5.86	

Hybrid

The hybrid bus has not been in service for a sufficient length of time to meaningfully evaluate the emissions savings of the vehicle. The vehicle has only been operational for three weeks and had some problems within this period. Without a completed month of data it is not possible to produce robust evaluation results.

Using claims made by the bus manufacturer Eneco it is possible to provide some indicative savings generated by the usage of the Hybrid bus on the 500 service. Eneco have tested bus emissions against a “standard” route (Known as “Route 159”) defined by the Energy Savings Trust and is regarded as typical of urban routes. When tested against a bus with a conventional diesel engine, the Hybrid powered bus achieved:

- 33% reduction in fuel consumption;
- 100% reduction in HC emissions;
- 100% reduction in CO emissions;
- 38% reduction in NO_x emissions; and
- 85% reduction in PM emissions.

Conclusion

The emission reduction benefits of the LPG vehicle, even with increased fuel use (measured in litres per vkm), were significant in percentage terms for NO_x, which showed a 75% reduction. This is important for local air quality. The increase in fuel consumption of an LPG vehicle meant that there was a very slight (6%) penalty by way

of increased CO₂ emissions. Some reliability problems with the vehicle point towards some good lessons learned for improving any follow-on LPG buses, particularly important if servicing costs are to be kept manageable. The lower cost of LPG meant that savings were made on fuel costs.

Due to operational difficulties it was not possible to evaluate the quantitative impacts of the hybrid bus, and in-service running was disrupted by problems. This points toward these vehicles being still in the 'piloting' stage of their development, and further work required for large scale demonstration and roll-out.

Finally, in terms of vehicle emissions the retrofitting of diesel buses with particulate traps led to a reduction in particulate matter (PM) which is important for local air quality. There was a slight penalty in terms of increased fuel consumption and therefore CO₂ emissions, which are a climate change gas. The increase in fuel consumption, and therefore cost, was estimated from monitoring data to 2.1% to 3.3% for Volvo Olympian and Dennis Dart buses respectively. The buses fitted with solely oxidation catalysts did not appear to suffer a fuel penalty, but did not remove as many pollutants (in particular PM) from the bus exhaust emissions.

2.9.8.2 Bristol – Clean fleet vehicles (5.2)

Measure Overview

The objective of this measure is to introduce clean municipal fleet vehicles in support of local air quality objectives. The Council vehicle fleet is operated with the primary purpose to provide home to school trips, to meet the special travel requirements for the Social Services Department, and to procure pool vehicles for other Departments within the Council. Prior to VIVALDI, 22 Liquefied Petroleum Gas (LPG) fuelled vehicles were operated within the municipal fleet whilst the remainder were diesel powered.

During the lifetime of the project this measure proposed to: introduce 50 additional LPG vehicles; add 5 electric or hybrid vehicles (diesel-electric or petrol-electric) to the Council's municipal fleet of cars, vans and coaches; and retrofit 10 older and larger diesel vehicles, less suited to LPG operation, with particulate traps or oxidation catalysts.

The actual implementation of LPG within the Council fleet has embraced a range of vehicle types including cars, vans and minibuses together with more specialist vehicles used for grounds maintenance. There are a range of vehicle manufacturers such as Renault, Vauxhall, Ford and Citroen. Vehicles include those operated directly by the Transport Services Team and also by other Council departments.

Procurement of vehicles has been based upon the approved list of suppliers held on a register by the Energy Savings Trust (a not for profit organisation supported by the UK government working to increase the take up of cleaner transport). In total, 44 LPG vehicles (as of May 2005) have been introduced and successfully operated within the Council's fleet since the start of the project, bringing the LPG proportion of the Council fleet to around 21%.

In terms of electric vehicles, 5 battery powered Reva G-Wiz cars were leased and delivered in March 2004. These are charged using renewable energy supply (see measure 5.3). These vehicles are used as pool cars for Council staff and are based at three separate buildings.

With regard to hybrid technology a Toyota Prius (hybrid synergy drive system combining petrol engine and electric motor) was introduced into the Council fleet in November 2004. This is petrol driven at high speed and under acceleration, and electrically driven at low speeds. This vehicle is used by the Council Environmental Quality Unit when undertaking their duties of mobile air quality monitoring.

In addition to the Prius, the Council has also commissioned a hybrid diesel-electric minibus which will be operated as part of the municipal fleet. The Council has commissioned the bus as part of a consortium formed by Eneco.

The actions have been taken to reduce pollution and to ensure the transport system complements good health and well-being. The measures are part of the Clean and Efficient Vehicles integrated package which has the following quantifiable targets as outlined in the Evaluation Plan (D4):

- VT1: 250 Clean Vehicles across the sites;
- VT2: Reduce energy use and CO₂ by 8% in demonstration area;
- VT3: Meet national air quality objectives; and
- VT9: Increase patronage on key corridors by 20%.

Evaluation results

The main type of data used in the evaluation of the clean and efficient fleet vehicles is operational data. This includes vehicle mileage, fuel issued and fuel consumption data. With the support of the local vehicle operators and users, monitoring data has been collected. The same basic data has been collected for the LPG, electric and hybrid vehicles over the lifetime of their operations. This has provided the following operational data:

- LPG Fleet monthly data for the period Jan 2003 – Mar 2005;
- G-Wiz electric car monthly data for the period May 2004 – Aug 2005;
- Toyota Prius monthly data for the period Nov 2004 – Jun 2005; and
- No data for the hybrid minibus as it was not operational within the evaluation period.

The clean fuelled fleet vehicles were introduced as new following the commencement of the VIVALDI demonstrations so there is no before data to use in the evaluation of this measure. To evaluate the LPG vehicles data for a control group of comparable vehicles was collected. Where possible the control group consists of similar makes, model and age of vehicles undertaking similar types of driving patterns.

There are several vehicle types involved within this measure and a mixture of technologies used i.e. hybrid, electric and LPG. For this reason the data has been presented in a way to show this differentiation e.g. by vehicle type and technology used. The following sections describe the results that were obtained for the monitoring period January 2002 – August 2005.

Fuel Consumption (3)

Hybrid

Over the period November 2004 – August 2005 the Hybrid Toyota Prius has covered a total of 13,110 km. The vehicle was used to complete 126 trips on council business, thus equating to an average trip length of 104km. Within the evaluation period the Hybrid Toyota Prius was refuelled with 682.1 litres of petrol. This equates to an average fuel consumption figure of 19.2 km/ltr.

Electric

Between May 2004 and July 2005 the two electric G-WIZ cars based at Wilder House covered a total of 3,593km. The two vehicles completed 350 trips on council business, thus equating to an average trip length of 11.3km. This reflects the use of these vehicles for travel between Council sites and within the city, a duty these vehicles are well suited to perform. It is estimated that the G-WIZ cars have consumed 502 kw/h of electricity. This figure is based on the manufacturers claim that the vehicle can complete 64.4km per full charge and that this requires 9kw/h of electricity.

LPG

The vehicles operating within the Council's fleet can be broadly split into six main groups, by make and model:

1. Ford Transit;
2. LDV Convoy;
3. Renault Kangoo;
4. Vauxhall Astra;
5. Vauxhall Combivan; and
6. Vauxhall Zafira.

Other LPG vehicles are operating in the BCC fleet, including other Vauxhall models, Ford Focus and Citroen Berlingos, but with no more than two of each vehicle type these have not been included within the detailed analysis. A control group of vehicles was also selected from within the city fleet. Unfortunately it was not possible to find similar makes and models for a complete comparison e.g. there were no diesel or petrol Vauxhall Zafira within the Council fleet.

During the monitoring period (January 2003 – March 2005) the LPG vehicles monitored have covered a total of 1,037,496km. During this period the vehicles have been issued with 76,254 litres of petrol and 56,946 litres of LPG.

There are a number of factors that influence fuel consumption and these must be taken into consideration. What is evident from the data is that fuel consumption varies greatly by month, vehicle type, make / model and vehicle user. As such, two identical models of vehicle can return very different fuel consumption figures even when used for very similar duties by the same department of the Council.

Comparing the LPG vehicles with their respective control group highlights that they are less fuel efficient than the diesel equivalent. For example, the average fuel consumption

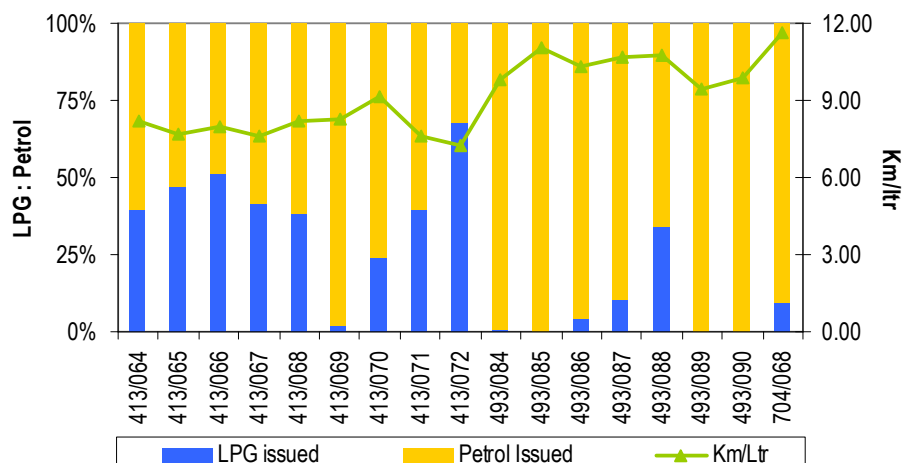
of the 17 LPG / petrol Renault Kangoos was 9.07 km/ltr while their diesel equivalents (9 in control group) recorded a figure of 13.05 km/ltr (See Table 2.9.8-4). This is a trend repeated for each of the vehicle groups with fuel consumption figures between 2.03 – 4.59 km/ltr less for the LPG / petrol vehicles as compared to their diesel equivalents.

Table 2.9.8-4 Fuel consumption comparison by vehicle make and model

Group	Make	Model	Petrol LPG (KM/ltr)	Diesel (KM/ltr)	Difference
Ft	Ford	Transit	4.12	7.65	- 3.53
Lc	LDV	Convoy	5.92	7.95	- 2.03
Rk	Renault	Kangoo	9.07	13.05	- 3.98
Va	Vauxhall	Astra	8.76	12.43	- 3.67
Vc	Vauxhall	Combivan	7.79	12.38	- 4.59
Vz	Vauxhall	Zafira	7.80	-	-

Another significant factor influencing fuel consumption appears to be the ratio of petrol to LPG used by each vehicle. Figure 2.9.8-5 presents the results from the group of Renault Kangoos to highlight the variation in fuel type use and its impact of fuel consumption. Generally, it appears that as the proportion of LPG increases, fuel consumption increases. It is noticeable that while some individual drivers regularly refuel using LPG and use significantly higher proportions of LPG over petrol, others have used very low amounts of LPG. It is not clear why some users have been filling their vehicle with LPG.

Figure 2.9.8-5 Fuel Ratio (LPG:Petrol) and Fuel consumption figures for Renault Kangoo Group



Fuel costs of operating (2)

The price of fuel has risen significantly in the UK between January 2003 – April 2005. In this period the average monthly price of a litre of Diesel has increased from £0.76 to £0.90, while petrol prices have risen from £0.75 to £0.85 per litre (£1 = €1.48). While LPG has remained much cheaper than petrol or diesel, due to lower rates of fuel duty imposed by the UK government, prices of LPG have also increased. Between Q3 2004 and Q4 2004, LPG prices increased by 13 % (DTI, 2005). In August 2005, the average forecourt price of LPG in the UK was £0.40 per litre.

Hybrid

Using the UK Retail Fuel Price average to calculate fuel costs, the hybrid has cost a total of £469.50. This gives an average cost of vehicle operation of £0.04 per km.

Electric

Energy prices have risen significantly in the UK during 2004 – 2005. All of the major UK electricity suppliers have raised prices significantly. The DTI Retail Prices Index: fuel components, reveals that electricity prices have risen by 11.2% over the past 12 months. Using current electricity prices the electric vehicles have cost between £35 - £75 to operate over the evaluation period. This equates to a maximum average cost of vehicle operation of £0.02 per km.

LPG

Between January 2003 – March 2005 the LPG vehicles have cost a total of £74,631 in fuel costs. While it is commonly viewed that there is a cost saving associated with using LPG due to the cheaper pump prices the higher fuel consumption of the vehicles monitored has significantly eroded this potential associated saving. As highlighted by the Renault Kangoos, Vauxhall Astras and Vauxhall Combivan there is little or no saving as compared to their diesel equivalent.

Table 2.9.8-5 Fuel Cost comparison by vehicle make and model

Group	Make	Model	LPG Petrol (£/km)	/ Diesel (£/km)	Difference
Ft	Ford	Transit	0.13	0.09	+0.04
Lc	LDV	Convoy	0.10	0.09	+0.01
Rk	Renault	Kangoo	0.07	0.06	+0.01
Va	Vauxhall	Astra	0.05	0.06	- 0.01
Vc	Vauxhall	Combivan	0.06	0.06	0.00
Vz	Vauxhall	Zafira	0.06	-	-

Overall, analysis of the data between Jan 2003 – Mar 2005 shows that there has been a higher fuel cost per vehicle km, when compared to diesel equivalents. For example on average the Renault Kangoos costs over an extra £200 per vehicle to operate, ranging between a £40 and a £450- £550 loss. In contrast analysis of the Vauxhall Astras show that significant savings can be made, by an average of £50 and up to £140 per vehicle. It is estimated that overall the LPG fleet has cost over £5,000 in additional fuel. However, if all the vehicles had used LPG to the maximum, rather than unnecessarily filling them with petrol, this may not have happened.

Maintenance, repair costs (2) & Vehicle reliability (18)

There have been no reported maintenance issues with the Prius since it was put into service.

Emissions (8-11)

The JET model has been used to calculate the emissions saving associated with the clean-fuelled buses. JET is a spreadsheet model developed within the JUPITER project as a tool to estimate the changes in energy and emissions from transport measures.

The model was run using the data collected on vehicle mileage and fuel issued for each of the groups of clean fleet vehicle. It should be noted that assumptions are on fuel type in order to compare the measure against the before (or business as usual scenario) as follows:

- LPG/petrol are compared with a diesel equivalent;
- G-Wiz are compared with a diesel equivalent;
- Toyota Prius is compared with a petrol equivalent.

The tables below presents a summary of the emissions calculations produced using JET.

Hybrid

Table 2.9.8-6 Hybrid vehicle total emissions – tonnes per year

Pollutant	Before	After	Difference	% Change
CO	0.0672	0.0299	-0.0373	-55.46
NOx	0.0015	0.0007	-0.0008	-55.46
VOC	0.0011	0.0005	-0.0006	-55.46
TPM	0.000	0.000	0.000	0.00
CO2	4.41	1.96	-2.44	-55.46

Electric

Calculations have been made by comparing the G-Wiz electric car against a small diesel engine car. They have been carried out for emissions at point of use (zero for an electric car) and also for the full life-cycle, in order to estimate impacts from electricity production.

Table 2.9.8-7 Electric vehicle total emissions (at point of use) – tonnes per year

Pollutant	Before (diesel)	After (electric)	Difference	% Change
CO	0.0024	0.0000	-0.0024	-100.00
NOx	0.0020	0.0000	-0.0020	-100.00
VOC	0.00037	0.00000	-0.00037	-100.00
TPM	0.00025	0.00000	-0.00025	-100.00
CO2	0.59	0.00	-0.59	-100.00

Table 2.9.8-8 Electric vehicle total emissions (full life cycle) – tonnes per year

Pollutant	Before (diesel)	After (electric)	Difference	% Change
CO	0.0024	0.0001	-0.0023	-94.88
NOx	0.0024	0.0006	-0.0017	-72.41
VOC	0.00132	0.00047	-0.00085	-64.52
TPM	0.00026	0.00004	-0.00021	-83.75
CO2	0.66	0.26	-0.40	-60.76

The estimations show that the G-Wiz car not only delivers zero emissions at point of use, which is relevant for local air quality objectives, but also makes significant percentage reductions in all key pollutants, including climate change gases, when examined with the full life cycle analysis.

The results of making the alternative assumption – that the business as usual is a petrol engine car – generates slightly different results. The lifecycle emissions show significant reductions in CO, VOC and importantly CO₂. However, because petrol burns relatively cleanly and is compared to power station emissions in the full life-cycle analysis (a proportion of which will be coal fired), there are minimal reductions in NO_x and a large percentage increase from what is probably a very small amount of PM.

Naturally, at point of use the after results for the G-Wiz car emissions are zero, which means that they are cleaner than a petrol equivalent.

Table 2.9.8-9 Electric vehicle total emissions (at point of use) – tonnes per year

Pollutant	Before (petrol)	After (electric)	Difference	% Change
CO	0.0106	0.0000	-0.0106	-100.00
NOx	0.0003	0.0000	-0.0003	-100.00
VOC	0.00022	0.00000	-0.00022	-100.00
TPM	0.00000	0.00000	0.00000	0.00
CO2	0.61	0.00	-0.61	-100.00

Table 2.9.8-10 Electric vehicle total emissions (full life cycle) – tonnes per year

Pollutant	Before (petrol)	After (electric)	Difference	% Change
CO	0.0107	0.0001	-0.0106	-98.83
NOx	0.0007	0.0006	0.0000	-1.09
VOC	0.00226	0.00047	-0.00179	-79.23
TPM	0.00002	0.00004	0.00002	93.91
CO2	0.69	0.26	-0.43	-62.61

LPG

Table 2.9.8-11 LPG vehicle total emissions – tonnes per year

Pollutant	Before (diesel)	After (lpg/petrol)	Difference	% Change
CO	0.33	1.20	0.87	264.21
NO _x	0.28	0.05	-0.23	-81.21
VOC	0.052	0.027	-0.024	-47.16
TPM	0.034	0.000	-0.034	-100.00
CO ₂	81.64	86.41	4.77	5.84

Emissions modelling shows that compared to the ‘business as usual’ operation of a diesel vehicle the LPG vehicle show a very marked reduction in NO_x and total removal of PM emission, which are of most concern for local air quality. This has been at a penalty of an estimated 6% increase in CO₂ emissions. This takes into account the higher than expected fuel consumption discussed in the relevant section above.

Conclusions

Due to its increased fuel efficiency over a normal petrol car the petrol-electric hybrid is estimated to have proportionately lower emissions of all pollutants compared to a business as usual (before) scenario, in the order of 55%. Fuel used and therefore fuel costs were lower than the comparable petrol car.

For the niche application for which it has been used the G-Wiz electric cars show some admirable cost and emissions savings. Not only are emissions zero at point of use, but total life-cycle emissions (taking into account electricity generation) are significantly lower on all counts compared to a diesel equivalent vehicle. Fuel costs were extremely low for this vehicle, for comparison roughly half that of the hybrid petrol-electric.

LPG vehicles show very marked reductions in NO_x (85%) and total removal of PM emissions, but at a cost of increased CO₂ production, compared to a diesel equivalent. There was also a marked decrease in fuel efficiency (vkm per litre of fuel). This might be expected in volumetric terms due to the lower density of LPG vs diesel. However, the high fuel use does mean that the lower cost of LPG was completely off-set and fuel costs actually rose. It is likely that the increase in fuel use and costs was partly due to drivers using petrol in the vehicles for a greater proportion of the time than was anticipated. This is likely to have been a factor in increased CO₂ emissions.

2.9.8.3 Bristol – Fuel supply infrastructure and local network (5.3)

Measure Overview

Prior to the VIVALDI project it was recognised that a significant barrier to the take up of clean fuelled vehicles was the lack of availability, user information and perhaps confidence in the supply and support services associated with their use. VIVALDI effort has sought to improve fuelling facilities for LPG and battery electric vehicles through new infrastructure provision. In addition this measure seeks to open up facilities dedicated to individual fleets to a wider cross-section of users through the establishment

of better cooperative arrangements. In parallel the project worked to develop a network of local supply and maintenance services to support the introduction of clean fuel vehicles.

The planned implementation under this measure, as set out at the inception stage, includes:

- New or upgraded provision of LPG refuelling infrastructure, allowing the facility to serve extended clean fuel municipal fleet and other users;
- Electric bus battery recharging facilities to be introduced at point of bus operation to improve duration of service;
- Provision of two new electric recharging facilities at city centre locations to extend the use of electric vehicles within the municipal fleet;
- Establish agreements and mechanisms to allow a broader cross-section of users to use existing dedicated facilities currently restricted to the operators vehicles;
- The creation of a widely publicised network of local vehicle supply and maintenance services to support the operation of clean fuel vehicles – the “Clean Vehicle Support Network”.

The following outlines the actual achievements that were made:

New Refuelling Facilities

Electric recharging points were introduced at city centre Council offices in early 2004 to enable recharging of the 5 G-Wiz electric pool cars (see measure 5.2). Despite the deployment of extra LPG vehicles in the Council fleet it was found that existing LPG facilities at the Council depot were able to cater for demand. Consequently no new LPG infrastructure was required.

Sharing of Refuelling Facilities

The Demand Responsive Transport Service, Bristol Dial-a-Ride (BDAR), have introduced 5 LPG vehicles within their fleet to provide a door-to-door service to mobility impaired travellers (see 5.1.). This raised the need for refuelling infrastructure because although the commercial supply of LPG is slowly growing this does not always match operational needs. As part of VIVALDI an agreement was reached whereby Bristol Dial-a-Ride could use the Council’s refuelling facility at the Transport Services depot, beginning in early 2003. The cost of the fuel used is invoiced on a quarterly basis. The LPG vehicles which operate near the depot have made regular use of this facility whilst other vehicles have continued to use commercial filling stations if more convenient. It is planned to continue this arrangement beyond the project and a movement to citywide rather than area based operation by BDAR should increase the scope for the use of this LPG re-fuelling facility.

Clean Fuel Support Network

A tendering process was undertaken and the contract awarded to the Greenfuel Company, based in Bath. The main part of the project (i.e. the conversion to LPG) was to be completed within 6 months from the start of the contract. The original timescale was a contract start date of August 2004 and the completion of all conversions by January 2005. However, the conversion period was extended to the end of July 2005. As

over half the conversions were completed by April 2005, the majority of evaluation inputs had been received as planned soon after the end of July 2005. These included log books completed by grant recipients, case studies and other evaluation produced by the Greenfuel Company.

The above actions have been introduced to support the introduction of clean vehicles to assist in meeting local air quality objectives and to reduce emissions of pollution from vehicles using the Bristol transport network. The measure is part of the Clean and Efficient Vehicles integrated package which has the following quantifiable targets as outlined in the Evaluation Plan (D4):

- VT1: 250 Clean Vehicles across the sites;
- VT2: Reduce energy use and CO₂ by 8% in demonstration area;
- VT3: Meet national air quality objectives; and
- VT9: Increase patronage on key corridors by 20%.

Evaluation Results

For this measure it was only possible to evaluate the Clean Fuel Network operated by the Greenfuel Company. Data was requested to ensure that all the objectives and impacts could be assessed. This included vehicle details and numbers from the grant and conversion process plus vehicle use information from user logbooks. Data from the grant and vehicle conversion process by Greenfuel included:

- Vehicle details (Vehicle make, model and age);
- Date of conversion;
- Name of converter; and
- VIVALDI Vehicle Group (taxi or private hire / Small businesses / Council employees / Bristol residents).

Log books were used to record data on vehicle usage following LPG conversion. This information was requested for a 6 month period for each vehicle converted to LPG to provide the following data:

- Vehicle usage (mileage reading);
- Fuel usage (litres);
- Fuel costs (pence per litre);
- Location of fuel purchase; and
- Comments on reliability and maintenance issues.

The user logbook was designed to be as simple as possible to encourage users to complete it. This was further encouraged by holding back the final incentive payment to users until the completed log books had been received. It was recognised that it was unlikely that a full set of logbooks would be returned and that due to a number of the conversions taking place toward the end of the implementation period, not all the vehicle owners could provide the planned 6 months of usage data. As a result of these factors, from the 50 vehicles converted to LPG 27 log books were received by the evaluation team. Unfortunately, 7 of the logbooks contained data for less than one month so these results were excluded from the analysis.

A record of the types of vehicles and dates of conversion was also received from the Greenfuel Company

Vehicle Conversions

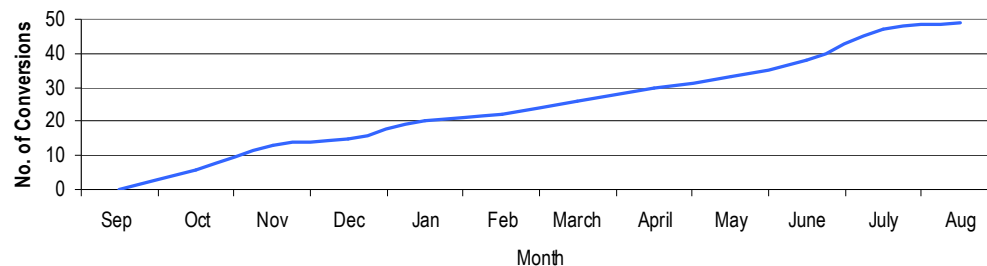
Marketing was commissioned that was specifically targeted at each of the four key VIVALDI user groups. This included:

- Posters displayed in Taxi Drivers' meeting areas;
- Letters to Fleet Managers of SMEs in the Bristol area;
- Promotional message featured in Bristol City Council employees' payslips;
- Local radio and press campaigns; and
- Promotional material in local refuelling stations.

In total the project met its primary operational objective of converting 50 vehicles owned and used in the Bristol area. Slightly over half (27) of all project participants were residents within the Bristol City Authority area. The remaining 23 participants consisted of 11 taxi drivers, 9 Bristol City Council Employees and 3 Small-Medium sized Enterprises (SMEs). Therefore, the measure has actively involved a wide range of drivers from across Bristol, using their vehicles for business and personal reasons.

Take up was slower than anticipated and on average only 4 conversions were completed each month. Greenfuel found it particularly difficult to meet their target of converting SMEs. This is thought to be because of complications over fleet finance arrangements, the grant window not coinciding with businesses' plans to renew/replace vehicles and the attractiveness of diesel vehicles to fleet managers. However, for most users the cost of conversion is something that needs to be anticipated and carefully considered.

Figure 2.9.8-6 Greenfuel VIVALDI Conversion Rates



A wide variety of makes and model of vehicle were converted. While this included 7 Toyotas, 6 Renaults, and 4 Vauxhalls, nearly all of the major car manufactures were represented within the scheme. The range of vehicles converted included large off road vehicles, people movers and compact small engine vehicles. Figure 2.9.8-7 shows the range of vehicle engine sizes that were converted as part of the scheme. It should be noted that only 7 vehicles (14%) with engines smaller than 1400 cc were converted, while 26 vehicles with engines over 2000cc were also converted, 10 in excess of 3000cc.

Due to the eligibility criteria set for conversions, all vehicles were registered in the period 1997 – 2005. Figure 2.9.8-7 shows the proportion of vehicles by year for this period and indicates that the majority of vehicles were 4 years old, registered in 2001.

Figure 2.9.8-7 Engine Sizes of Conversions

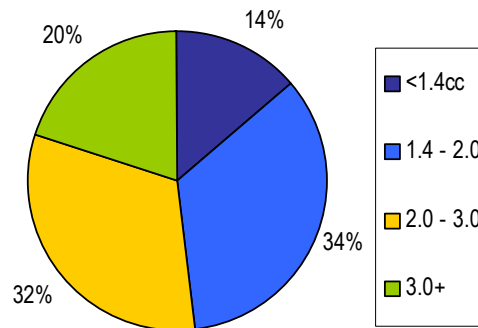
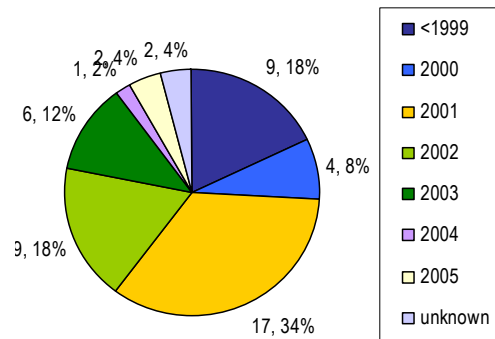


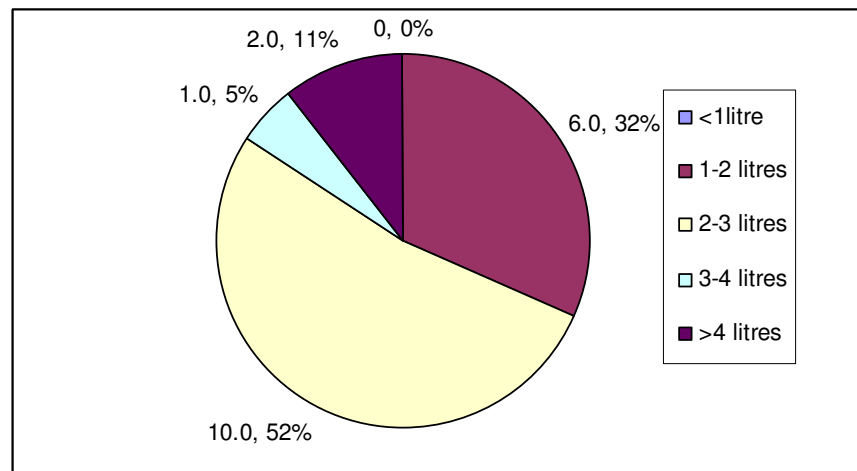
Figure 2.9.8-8 Vehicle age of conversions



A total of 27 logbooks were returned to the evaluation team. It was intended that all log books would contain approximately 6 months' of data for analysis. Seven of the logbooks returned contained data for less than one month and as a result their results were not included in this analysis. The remaining sample of 20 users provided on average 5 months worth of data per conversion.

It should be noted that the petrol and LPG fuel levels were not recorded at the beginning and end of the trial. Therefore the fuel consumption figures have been based on the assumption that both fuel tanks were empty at the start of the monitoring period and all fuel issued was used. This will result in a maximum error of plus or minus one tank of each fuel in the calculations.

Figure 2.9.8-9 provides a breakdown of the different vehicle engine sizes that log book data was provided for and shows that 52% of the sample were vehicles between 2 and 3 Litre in engine capacity.

Figure 2.9.8-9 Engine size of vehicles in log book sample


The sample comprising the LPG vehicles averaged a monitoring period of 147 days during which an average 13,316 miles were covered per vehicle, giving an estimated annual distance of 35,000 km. The following summarises the results that were achieved across the group, produced as average figures.

Fuel Consumption (3)

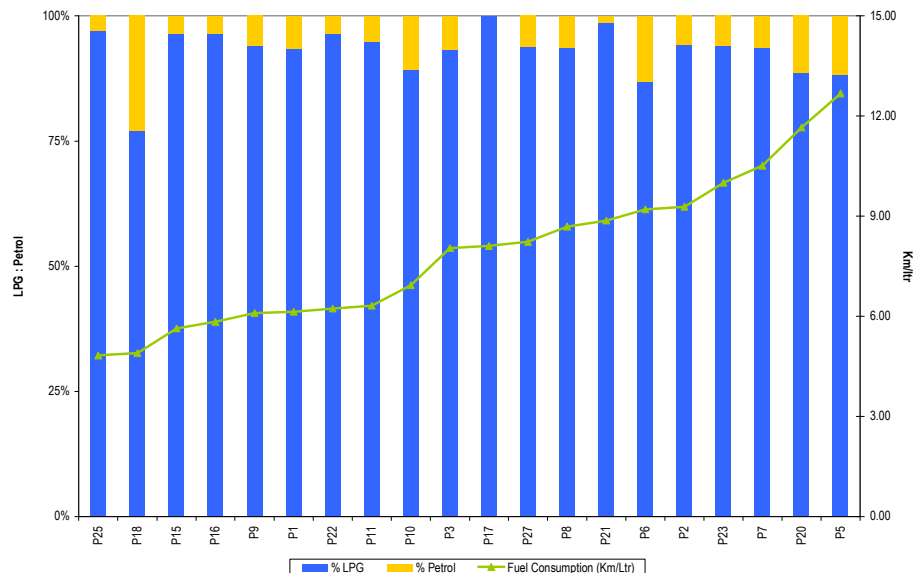
The fuel consumption figures were calculated for each of the vehicles in the sample. Overall the average fuel consumption was 7.91 Km/Ltr. Due to the nature of this sample it was not possible to identify a control group and vehicle owners did not provide a record of their fuel consumption prior to conversion. However, when compared to the fuel consumption figures produced by the City Fleet Vehicles (see Measure 5.2) it can be seen that the fuel efficiency is less than that achieved for the Renault Kangoo and Vauxhall Astra vehicles' LPG conversions and their control groups (see Table 2.9.8-12 below).

Table 2.9.8-12 Fuel Consumption comparison with City Fleet Vehicle Conversions

Vehicle Group	Petrol/LPG (Km/Ltr)	Diesel (Km/Ltr) – Control
Greenfuel conversions	7.91	-
City Fleet Renault Kangoos	9.07	13.05
City Fleet Vauxhall Astras	8.76	12.43

Measure 5.2 identified that the fuel consumption of vehicles appears to drop as the ratio of LPG/petrol used increases. However, Figure 2.9.8-10 shows that the ratio of LPG to petrol for the Greenfuel sample is extremely high when compared to the city fleet data, which is the contrary to what might be expected. The average proportion of LPG/petrol ratio of the Greenfuel group was 0.93, as drivers wished to maximise the return on their investment in an LPG conversion. A significant factor in the level of fuel consumption by the Greenfuel converted vehicles is likely to be the large engines present in a high proportion of these vehicles, compared to the city fleet LPG and control groups.

Figure 2.9.8-10 Fuel Ratio (LPG:Petrol) and Fuel consumption figures for the Greenfuel Conversion



Fuel Costs of operating (2)

The cost figures in this section have been converted from UK sterling to Euros using the conversion rate of 1.4769 (1st November 2005). The average costs per km for the Greenfuel logbook sample was 0.08€ per km.

Maintenance, repair costs (2) and Vehicle reliability (18)

It was not possible to collect cost information regarding maintenance and repair costs. However, the logbooks did contain the opportunity for vehicle owners to report any difficulties that they experienced. A selection of typical types of response are given below:

- Using LPG pumps – different nozzle types were difficult to use and gloves should be provided as gas tends to blow back when releasing the catch on the nozzle after refuelling;
- One person was charged an additional premium by their insurance company following the conversion;
- Several reports of difficulties experienced with the fuel gauges; and
- Several people commented that the LPG tank capacity was too small.

Emissions (8-11)

The JET model has been used to calculate the emissions saving associated with the clean-fuelled vehicles. JET is a spreadsheet model developed within the JUPITER project as a tool to estimate the changes in energy and emissions from transport measures.

The model was run using the data collected on vehicle mileage and fuel issued for each of the groups of vehicles. The table below presents a summary of the emissions calculations produced using JET.

Table 2.9.8-13 Greenfuel LPG vehicles total emissions – tonnes per year

Pollutant	Before	After	Difference	% Change
CO	3.54	1.98	-1.55	-43.94
NO _x	0.09	0.16	0.07	78.94
VOC	0.062	0.079	0.017	27.86
TPM	0.000	0.000	0.000	0.00
CO ₂	214.76	165.32	-49.45	-23.02

These emission calculations were carried out using petrol engines as the ‘before’ or business as usual scenario. It has had to be assumed that the vehicles had one full tank of petrol at the start of the monitoring period and one full tank of LPG at the end. Examining the emission calculation based on fuel used during the monitoring period it can be seen from Table 2.9.8-13 above that NO_x emission increased (by some 80%), but that CO₂ emission reduced by some 23%.

Conclusions

A number of significant results were found from the experience of expanding the supply and support service associated with clean vehicle fuels. Practically, new sharing arrangements for LPG refuelling have proved successful and are likely to be extended in the future. A new Clean Fuel Support Network was set up and demonstrated with the conversion of 50 existing vehicles owned by a variety of private and company users to LPG running. Detailed data on 20 of these vehicles was collected by the project for evaluation purposes and experience was gained through this initiative and promotion/marketing undertaken.

For the clean fuel supported vehicles (Greenfuel conversions) it was found that fuel consumption was higher than for the City Fleet LPG vehicles. It is likely that this was influenced by the larger than average engine size in the Greenfuel conversions. Examining the emission calculation based on fuel used during the monitoring period it was estimated that NO_x emissions increased (by some 80%), but that CO₂ emission reduced by some 23%.

2.9.8.4 Bristol – Renewable energy supply (5.3)

Measure Overview

This measure focuses upon the generation and procurement of renewable electricity to recharge electric vehicles or to power transport infrastructure. Developing the use of renewable energy was progressed through a number of linked tasks: electric vehicles; school warning signs (wig-wags); mobile VMS and bus shelter illumination; and portable traffic signals. As a result the VIVALDI project implemented the following measures:

- The introduction of 5 new G-Wiz electric vehicles for use as pool cars by staff;
- The facility to recharge the electric vehicles batteries using local renewable energy; and
- The introduction of school warning signs on roads in the vicinity of schools in the City that use photo voltaic power (PV).

Evaluation of results

The evaluation of the 5 G-Wiz electric vehicles is reported under measure 5.2. The electric vehicle batteries were recharged using local renewable energy. Unfortunately, it was not possible to measure the electricity used as it was aggregated within the Council's utilities bill.

The VIVALDI project installed 50 Solar Powered School Warning Signs that flash during periods of the day when school children are likely to be walking or crossing the road in close proximity to a school. The signs are to alert drivers, make them proceed with caution and be alert to high levels of pedestrian activity in the area.

The signs were installed at 21 different locations in Bristol. Pairs of signs were installed at 16 locations, with the other sites requiring more signs to be installed (3-5) due to the layout of the road network. All signs were installed and operational by the 1st September 2002. The evaluation of this measure therefore starts from this date.

To evaluate these signs it was decided to calculate the energy that has been saved by making a comparison with the power that would have been used if conventional mains powered signs had been installed at each of the VIVALDI sites.

It was established that the equivalent mains powered controller to the solar powered signs was called a 'series 4 controller'. Power consumption figures for these signs were sought to enable a calculation to be made on the energy savings for each sign installed. The location for all but one sign was achieved. It was not possible to obtain the precise installation dates, so the installation-completed date of September 2002 was used.

The photo voltaic (pv) powered signs are fully solar powered and do not require any mains electricity. The mains powered equivalent signs use a permanent hourly power consumption of 9 Watts (W). Therefore the yearly mains electricity power saving from each of the solar powered signs installed has been calculated as follows:

$$\begin{aligned}\text{Power Saving} &= \text{Saved Hourly Power Consumption} \times \text{No of Hours in a Year (KWh)} \\ &= 0.009 \times 8760 \\ &= 78.84 \text{ KWh}\end{aligned}$$

The METEOR units of measurement for power consumption are Joules. Therefore the equivalent power saving is 283.82MJ (1KWh = 3.6M Joules)

Power savings at each site were therefore calculated for each location over the 3 year period from 1st September 2002 to 31st August 2005 and the results can be seen in Table 2.9.8-14. The calculations show that as a result of the installation of the 50 VIVALDI School Wig Wag Signs the mains power consumption figures have been reduced by 42,573.6MJ (11,826 KWh) over the 3 year period following implementation.

Table 2.9.8-14 Power Consumption Savings of the VIVALDI School Wig-Wag signs

Sign Ref.	Location	No. of Signs	Power Savings (KWh)	Power Savings (MJ)
2510	Novers Park Road	2	473.04	1702.944
2511	Lockleaze Road	2	473.04	1702.944
2501	St Mary's Walk	2	473.04	1702.944
2502	Barracks Lane	2	473.04	1702.944
2506	Johnson Road	2	473.04	1702.944
2503	Wells Road	2	473.04	1702.944
2508	Walsh Avenue	2	473.04	1702.944
2563	Lower High Street	2	473.04	1702.944
2512	Windmill Close	2	473.04	1702.944
2515	Egerton Road	2	473.04	1702.944
2516	Bell Hill	2	473.04	1702.944
2518	Beaufort Street	2	473.04	1702.944
2519	New Kingsley Road	2	473.04	1702.944
2520	Westbury Road	2	473.04	1702.944
2522	College Road	2	473.04	1702.944
2523		2	473.04	1702.944
Sign Ref.	Location	No. of Signs	Power Savings (KWh)	Power Savings (MJ)
2513	Bayswater Avenue	3	709.56	2554.416
2514	Blackmoors Lane	3	709.56	2554.416
2524	Reedley Road	3	709.56	2554.416
Sign Ref.	Location	No. of Signs	Power Savings (KWh)	Power Savings (MJ)
2521	Aberdeen Road	4	946.08	3405.888
Sign Ref.	Location	No. of Signs	Power Savings (KWh)	Power Savings (MJ)
2505	Coombe Road	5	1182.6	4257.36
VIVALDI Measure Power Saving =			11826	42573.6

Conclusion

The G-Wiz electric car's consumption was estimated for the purposes of emission calculations, but was not possible to measure its actual consumption. However, this can be estimated based on the number of times the vehicle was charged and the capacity of the batteries (based on manufacturers figures) which show that the two G-Wiz cars have consumed 502 kw/h of electricity. This has been supplied from renewable energy sources.

The School Wig-Wag signs, powered by PV cells through this project, have saved around 15,768 KWh or 5,676 MJ in electricity in the four years of operation.

2.9.8.5 Bristol – Flywheel powered tram (5.4)

Measure Overview

This measure aimed to develop an Ultra Light Rail (ULR) route linking the city centre with an office development. The proposed ULR route would provide a service between the Industrial Museum and the CREATE Centre (some 1.8km), with the aim of providing a workable public transport service in addition to a test-bed for new technology. This was proposed as a short-medium term solution with the opportunity for future conversion to more conventional Rapid Transit, and further assessment of the scope for subsequent extension. The ULR concept was demonstrated between May 1998 and September 2000 when contractor Bristol Electric Railbus (BER) operated a

flywheel powered tram over a trial route linking the Industrial Museum and SS Great Britain attractions.

Owing to the range of stakeholders involved and the legal complexities, this scheme was the subject of detailed discussion from the commencement of the VIVALDI project. Council officers and BER prepared a detailed specification which defines the responsibilities of both parties and operational requirements. The proposed ULR route would have provided an at least hourly weekday service between 7:30am and 6:30pm running between the Industrial Museum and the CREATE Centre (some 1.8km). This scheme aimed to provide a viable public transport service in addition to being a test-bed for new technology whilst enabling an assessment of the scope for further extension. The setting and collection of fares for the ULR demonstration would have been the responsibility of the contractor with a headline fare that would be comparable with the commercial bus fare for a journey of equivalent length, currently £1.00 (€1.48) single.

One key issue for consideration in the specification of the service was the relationship with the Harbour Steam Railway, a service operated by volunteers on some weekends and public holidays along the quayside for tourists and enthusiasts. It was agreed that the ULR demonstration would not conflict with Steam Railway operation.

In terms of fuel, the choice was left open to the contractor pending examination of current technology with the condition that a clean fuel solution must be implemented (likely to be electric flywheel, electric battery or hybrid diesel/electric power).

The City Council has been negotiating the purchase from the Strategic Rail Authority (SRA) of those parts of the Wapping Wharf Railway between the Industrial Museum and the CREATE Centre not owned by the Council. These negotiations were protracted, due to a raft of legal, technical and financial issues.

As an initial part of acquiring the Wapping Wharf Railway, the Council has taken over from the SRA two road bridges over the line, both of which required extensive repairs. Repairs to Cumberland Road bridge necessitated the closure of the railway line. The work on the bridges commenced on site on 3 May 2004. Originally the works were planned to be finished in October, but substantial completion was delayed until 24 December 2004. These works put a limit on the earliest start date of a VIVALDI service which restricted the duration of the trial. It was not considered that a shorter duration trial would be contractually possible, would be a credible public transport service, or be cost effective, and therefore this measure was abandoned.

The Council has made progress in acquiring the railway track for future transport use. The potential future use of this route will require assessment in the context of future transport needs of the city, particularly in relation to any development in the south west of Bristol.

As a useful outcome of this measure, the Council has now negotiated with SRA a new procedure whereby the social benefits (e.g. modal shift, reduced parking area requirements, improved public transport access levels and enhanced redevelopment opportunity) of continued or renewed rail use can be used to justify a reduction in the cost of the land transfer to the Council.

The promoters of ULR have used the time to develop their ideas and technology further. It is not yet clear what role, if any, ULR can play in an urban public transport system, but clearly it has the potential to play a useful role, subject to appraisal in comparison with other public transport options. The promoters of the scheme still wish to use the available railway line to operate a service, though this requires modest capital investment.

2.9.9 Bristol – The City Centre Clear Zone

The Local Objectives for the Clear Zone integrated package of measures were to:

- Reduce traffic levels in the city centre;
- Reduce parking and road space in order to create a greater amount of space for pedestrian and leisure activities;
- Reduce vehicle emissions and contribute to local air quality targets;
- Increase economic activity in the area;
- Increase employment opportunities.

The table below set out the local evaluation objectives set and how these relate to the overall VIVALDI objectives and targets.

Table 2.9.9-1 Clear Zones local objectives

No	Local objective	Target	Contribution to VIVALDI target (s)
LO4	Reduce traffic levels	Reduce traffic levels in Clear Zone by 10% Ensure all companies in Clear Zone have a travel plan.	VT4 Reduce car traffic in managed area by 10% VT16 Reduce lorry movements by 5% VT20 Travel plans in all organisation in target areas
LO5	Reduce parking levels	Reduce parking spaces by 10%	VT7 Reduce parking space in area by 10%
LO6	Reduce vehicles emissions and contribute to local air quality.	Reduce vehicle energy use and emissions by 8%	VT2 - Reduce energy use and CO ₂ by 8% in demonstration area VT3 - Meet national air quality objectives
LO7	Increase economic activity	Increase economic activity by 5%	VT5 Increase economic activity in area by 5%
LO8	Increase employment opportunities	Increase employment by 5%	VT6 Increase employment opportunities by 5%

To achieve these targets the following measures were implemented under the Clear Zone Integrated Package:

- 6.2 Access management;
- 8.1 Clear Zone Orbital Bus Service;
- 10.1 City Freight Logistics Scheme;
- 10.2 Freight loading and signing;
- 11.2 Travel Plans; and
- 12.2 Travel Information Centre & ITS Integration.

The following measures that have been implemented as part of other integrated packages have also had a beneficial impact on the area:

- Clean vehicles (the majority of the Clean Vehicles implemented as part of the Clean and efficient vehicles work package operate within the Clear Zone) (5.1, 5.2 and 5.3);
- The Cycle Resource Centre (8.7);
- The Park & Ride services (8.7);
- Improved Travel Information across the city via i+ Information kiosks and the mobile information bus (12.2);

All of the above demonstration measures have been evaluated in detail and many positive impacts have been shown. However, the Clear Zone area within in Bristol has undergone major changes throughout the VIVALDI project timescale. The main shopping area in the centre of Bristol, 'Broadmead', is undergoing a major re-development that is scheduled for completion in 2008. As a result of this re-development, the existing shopping centre has been in a gradual decline and a high turn over of businesses in the area. It is thought that the effects of these changes will far outweigh any changes made as a result of the VIVALDI demonstration areas. The project has also investigated two access control schemes in the Clear Zone area that will be implemented as part of the area re-development and outside the timescale of the project. As a result of the above, a decision was made not to measure the direct impacts on traffic levels and economy of the Clear Zone as a whole.

LO4 – Reduce traffic levels

The above measures have been introduced in Bristol to reduce traffic levels by providing better public transport information, improved alternatives to the car (or taxi) and the consolidation of freight movement to target areas within the Clear Zone. Studies have also been carried out to investigate the feasibility of introducing access control schemes in two areas of Bristol.

The Freight Consolidation scheme has demonstrated that it is a successful measure that can deliver a more sustainable freight solution and has reduced vehicle movements in the target area by approximately 50%. This exceeds the VIVALDI Target 6 (VT 6) of a 5% reduction of lorry movements in the target area.

The orbital bus service has shown an initial increase in patronage and many of the other measures are showing early positive results following their introduction that are likely to have an effect on the growth of traffic travelling through the Clear Zone. It is recognised that to significantly reduce traffic levels in an area, significant access control measures are required. Due to the age and scale of the demonstrations, it was decided not to analyse traffic data for the whole Clear Zone area as it was thought that no significant effects would be shown.

LO5 – Reduce parking levels

None of the measures implemented as part of the Clear Zone package reduced the number of car parking spaces in the area. The Cycle resource centre was built on the location of 20 parking spaces. However, these spaces had to be relocated to other areas in Bristol as compensation. The CZ package did not contribute to the VIVALDI Target 7 (VT7) of reducing car parking in the area by 10%.

LO6 – Reduce vehicles emissions and contribute to local air quality traffic levels

The only measure within the Clear Zone to have a measurable effect on vehicle emissions was the Freight Consolidation Centre. Due to the size of the demonstration in relation to the total area of the Clear Zone it was not practical to make any assumptions on the Clear Zone CO₂ levels. However, calculations for the scheme estimated that due to the reduced lorry vehicle movements in the scheme the reduction levels were at least the following on a monthly basis: 150kg CO₂; 25g NO_x; and 300g PM₁₀. The following maximum reduction levels achieved in June 2005: were 600kg CO₂; 95g NO_x; and 1300g PM₁₀.

Bristol have not yet met their National Air Quality targets but the VIVALDI measures have shown on a small scale that changes can be made.

LO7 – Increase Economic Activity

VIVALDI Target 5 (VT5) is to increase economic activity in the area by 5%. It has not been possible to measure any direct impacts on economic activity in the Clear Zone due to the overriding effect of the Broadmead re-development.

LO8 – Increase employment opportunities

VIVALDI Target 6 (VT6) is to increase employment opportunities in the area by 5%. It has not been possible to measure any direct impacts on economic activity in the Clear Zone due to the overriding effect of the Broadmead re-development.

The following describes in detail the measure level results for this integrated package.

2.9.9.1 Bristol – Development of City Centre Clear Zone (6.1)Measure Overview

The city centre Clear Zone concept focuses on traffic reduction, environmental improvement and technological innovation. This measure focus on the implementation of an integrated Clear Zone access strategy which provides the policy context for the following measures that have been implemented:

- Clean vehicles – this has included 84 new clean vehicles in the Council and Dial-a-Ride fleets, and also retrofitting exhaust treatment equipment to 58 diesel buses (see 5.1, 5.2 and 8.6).
- Access control and management systems – this has included 3 new bus priority measures, a bus lane enforcement trial and the investigation of new access management measures (see 6.2).
- New orbital bus service – formally launched in June 2005, this provides an accessible and high quality service with improved service linking key city centre sites (see 8.1).
- Cycle Resource Centre – opened in December 2004 providing secure parking, showers, lockers, cycle repair/maintenance and information (see 8.10).
- Freight consolidation scheme – commenced operation in May 2004 and has progressively grown in scale to include over 50 retailers with an encouraging reduction in the number of delivery trips (see 10.1).
- Travel Plans for city centre leisure sites – the development of the Travel Plans has been supported by on and off-site measures including new cycle parking and lockers for staff, a cross harbour ferry service which commenced in July 2004 and improved pedestrian signing and route finding (see 11.2).

- New TravelBristol Info Centre – opened in November 2004 with operator First providing information and ticketing for commercial bus services, and the Council providing a range of other travel and transport information (see 12.2a).
- Travel Information – a number of city centre events have been supported by the mobile information vehicle the Info Bus which was launched in December 2003 (see 12.2c), whilst on-trip information has been provided through i+ information kiosks (see 12.2b) and real time bus information displays (12.3).

The Clear Zone also promotes, complements and supports the schemes developed in the Air Quality Action Plan.

The key aims of the Clear Zone Strategy are to:

- Reduce traffic levels in the city centre;
- Reduce parking and road space in order to create a greater amount of space for pedestrian and leisure activities;
- Reduce vehicle emissions and contribute to local air quality targets;
- Increase economic activity in the area; and
- Increase employment opportunities.

The following objectives for the Clear Zone integrated package of measures were also set at the inception phase of the VIVALDI project:

- VT4 – Reduce car traffic in a managed area by 10%;
- VT16 – Reduce lorry movements in a target area by 5%;
- VT20 – to introduce travel plans in all organisations in a targeted area;
- VT7 – Reduce parking space in the area by 10%;
- VT2 – Reduce energy use and CO₂ by 8% in the demonstration area;
- VT3 – Meet national air quality objectives;
- VT5 – Increase economic activity in the area by 5%; and
- VT6 – Increase employment opportunities by 5%.

Evaluation results

The implemented measures described above have been evaluated in detail and are reported on individually within this report. However, to gauge the public's view and perceptions of all the measures, the project administered before and after surveys of members of the public and local businesses.

The survey's primary purpose was to find out how people travel around central Bristol and their views are on transport issues that affect the central area. More specifically the objectives can be defined as gathering data to assess:

- The accessibility and attractiveness of the city centre Clear Zone area;
- The availability of information on, and knowledge of, various transport measures planned for implementation; and
- The perceived impact of transport measures planned for implementation.

Clear Zone Public Survey

An on-street before survey was conducted in the centre of Bristol during the Autumn 2003. The on-street after survey was undertaken between the 20th June – 15th July 2005, and planned to capture views and opinions after many of the VIVALDI transport

measures had been implemented. At the time of the before survey, access to information about the measures was limited, with few respondents having seen or heard about any of the measures already implemented or to be introduced through VIVALDI. In comparison, at the time of the after survey, most measures had been implemented in Bristol and therefore it is expected that the two surveys may illustrate a growing understanding and awareness of what improvements have taken place in the city.

The methodology used to complete the before survey was repeated for the after survey, ensuring consistency between the two sets of results. As before, an interviewer-assisted survey method was selected, with the intercept survey administered face to face with respondents. The survey used the same quota sampling and same survey locations as the before survey.

Clear Zone Public Survey

This section describes the clear zone public after survey results and compares them to the before survey undertaken in the autumn of 2003 that provided a baseline.

A total of 1031 public on-street surveys were completed. The set quotas were closely met in the sample, therefore providing a robust dataset that closely corresponds with the before survey and the 2001 Census information for central wards with regard to key socio-economic characteristics. The table below provides an overview of the expected quota and actual sample achieved.

Table 2.9.9-2 Quota Vs Sample

Criteria		Expected Quota	Actual sample
Gender	Male	45%	49.4%
	Female	45%	50.6%
	Remainder Left Free	10%	-
Employed	Working	40%	61.8%
	Non-working	40%	38.2
	Remainder Left Free	20%	-
Age	16-24	15-20%,	22.7%
	24-34	25-30%,	20.3%
	35-44	15-20%,	16.4%
	45-54	8-10%,	13.4%
	65+	8-10%,	14.1%
	Remainder Left Free	29% max.	-
Ethnicity	White	90-92%	91.7%
	Black & Ethnic Minority	8-10%	8.3%

Points to note in relation to the sample include:

- Although targeting users of the city centre area, respondents came from a wide area, including home postcodes as far north as Edinburgh and as far south as Devon, highlighting the large catchment area that Bristol has as the major city in the South West for shopping, employment and entertainment facilities.

- The majority of respondents live within the old Avon area, and more specifically within Bristol itself. They are therefore appropriate respondents to comment on transport and mobility measures within the city.
- Nearly 45% of respondents who took part in the survey work in central Bristol, with the remaining either working elsewhere or not working, as shown in Table 2.9.9-3. This is higher than in the before survey, although it was noted that it might be thought that the number of people working in the centre should be slightly higher than the before survey identified.
- Table 2.9.9-3 shows, 51.6% of the on-street sample do not have access to a car on a daily basis. The before survey made a similar finding and suggested that given ever-increasing levels of car ownership it is something of a surprise that half of the sample still do not have daily access to a car.

Table 2.9.9-3 Survey Results

<i>. Working in central Bristol</i>		<i>Daily access to a car</i>	
Response	On Street	Response	On Street
Yes	44.8	Yes	48.4
No	55.2	No	51.6
No response given	0.0	No response given	0.0
Total	100.0	Total	100.0

The Clear Zone Public Survey results are split into the following 3 sections:

- Travelling Into Central Bristol;
- Central Bristol as a place to Visit; and
- Transport schemes in Central Bristol.

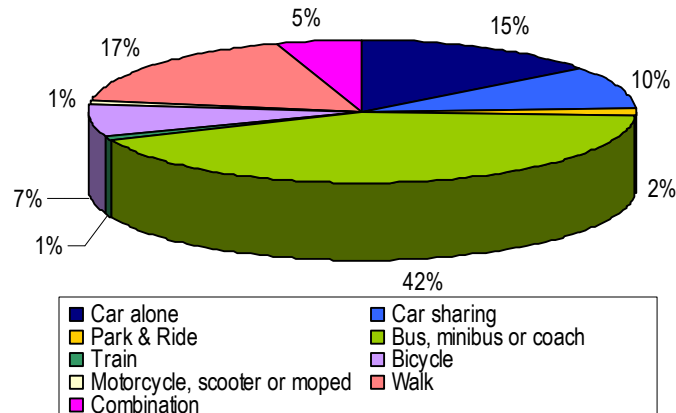
Travelling Into Central Bristol

The survey reveals that a full range of modes is used by respondents to travel into central Bristol. The sample achieved largely corresponds with the quotas set and the main findings are summarised under the following series of sub-headings.

Usual Mode

- The most dominant ‘usual’ mode of transport was the bus, minibus or coach, representing 42% of the sample (Figure 2.9.9-1). The same distribution was observed in the before study, but an 11% increase in the Bus mode has corresponded with a reduction in modes including single car trips and train use. This is possibly explained by the low levels of daily car access as discussed in the background demographics section.
- A total of 24.2% of the sample stated that the car was their usual mode, 14.6% driving alone and 9.6% car sharing (Figure 2.9.9-1).
- Walking is also a common means of travel identified by some 17.5% of on-street respondents.

Figure 2.9.9-1 Usual mode of travel into central Bristol



Frequency and timing of travel

Slightly over 40% of respondents travel into central Bristol at least five times a week, an increase of some 5% from the before survey. However, there is a relatively even split between those who are frequent travellers and those who are less frequent (Figure 2.9.9-2), with around 44% travelling into the central area less than twice a week.

Table 2.9.9-4 shows that 53.8% of respondents only travel on weekdays, with over 30% travelling outside the rush hour (defined as being between the hours of 07:00 – 09:00 in the morning and 16:30 – 18:30 in the evening). A further 38.4% travel on both weekdays and weekends, while only 4.6% travel in on weekends only.

Figure 2.9.9-2 Frequency of travel into central Bristol

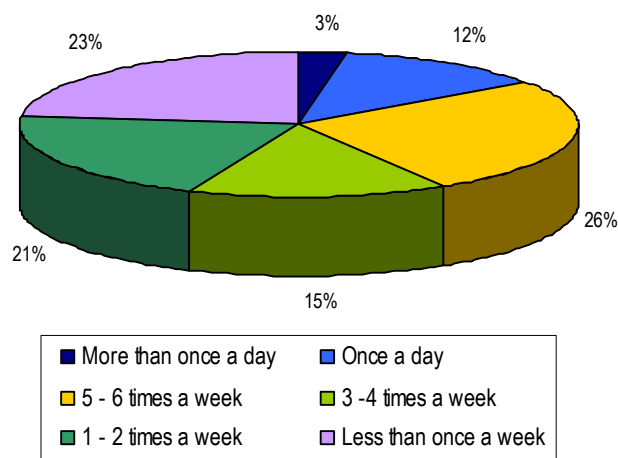
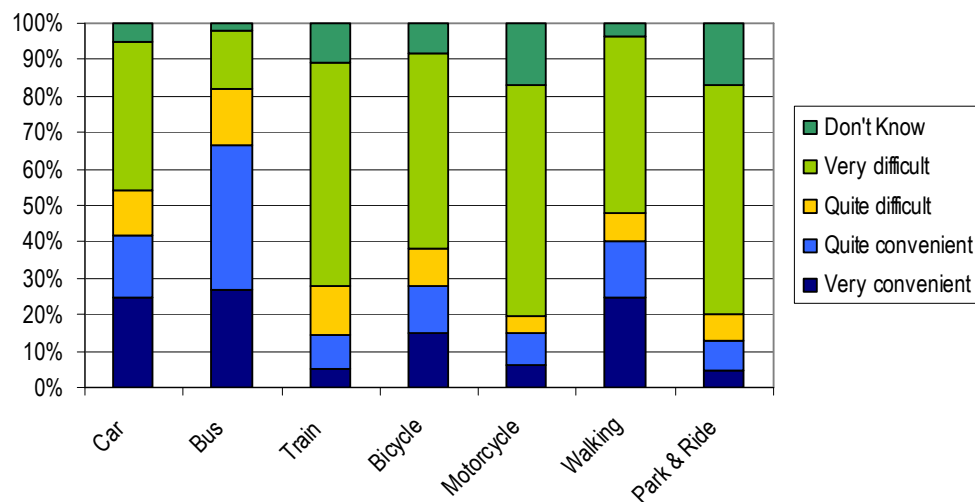


Table 2.9.9-4 When travel is made into central Bristol

Timing	On Street (%)
Weekdays only, during rush hour	22.4
Weekdays outside rush hour	31.4
Both weekdays & weekends	38.4
Weekends only	4.6
Other	3.2
Total	100

Surprisingly, the car was not viewed as the most convenient form of transport, unlike in the before survey. Over 50% stated that it would be either quite or very difficult to travel into central Bristol using the car.

As compared to the before survey, a far higher percentage of respondents noted that the bus was quite or very convenient. This represents an increase of some 12% between the two surveys. However it is not possible to explain this increase in the context of any improvements that may have occurred between the timing of the two surveys.

Figure 2.9.9-3 Rating of convenience by mode


Central Bristol As A Place To Visit

The main points raised by the survey concerning the reasons of travel and conditions in central Bristol are summarised below.

Reasons for being in central Bristol

The two main reasons for being in central Bristol when surveyed was for shopping or work related activities and mirrored the results in the before survey. However, in the after survey it is work activities that are the main journey purpose as opposed to

shopping, which has declined from 39% to 28% between the before and after surveys (see Figure 2.9.9-4).

Further analysis of mode choice by journey purpose shows that the car is used less for shopping trips while conversely the bus is more frequently used and vice versa for work trips (Table 2.9.9-5).

Figure 2.9.9-4 Activity on day of interview

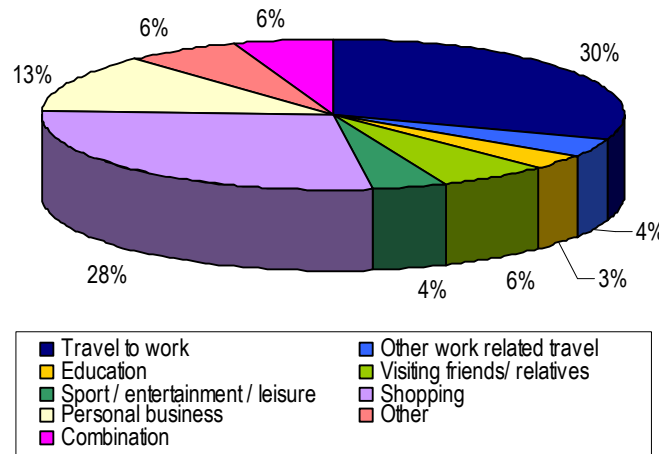


Table 2.9.9-5 Usual mode of travel by activity purpose (%)

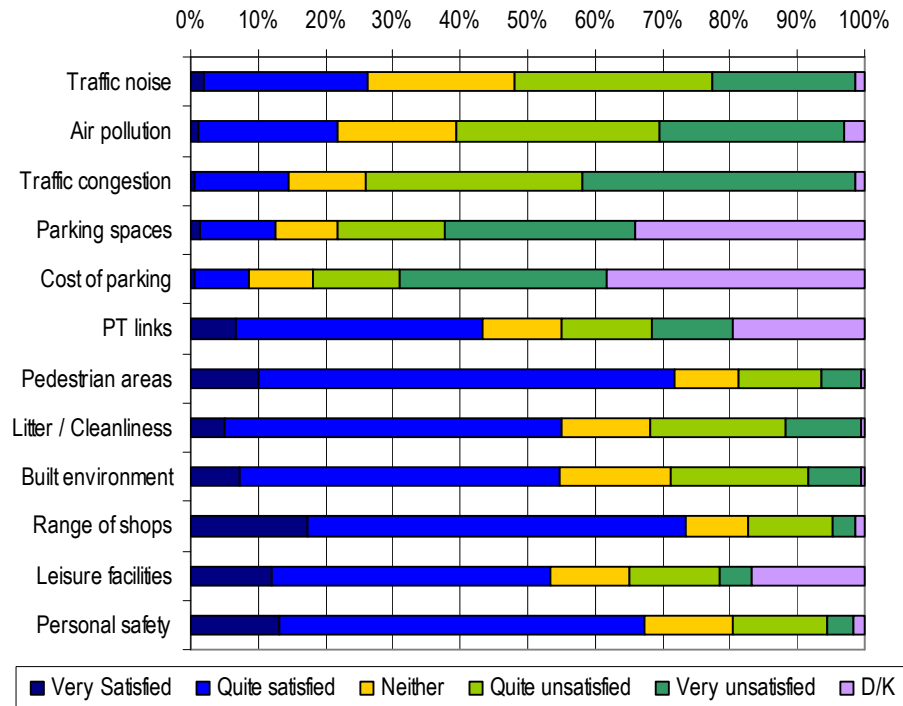
Purpose	Car alone	Car sharing	Park & Ride	Bus	Train	Bicycle	2-wheelers	Walk	Combination
Work	23.3	6.7	1.0	34.2	1.3	11.8	1.9	14.1	5.8
Other work	26.3	15.8	2.6	21.1	0.0	5.3	0.0	21.1	7.9
Education	2.8	8.3	0.0	61.1	2.8	5.6	0.0	16.7	2.8
Friends/relatives	8.1	14.5	0.0	48.4	1.6	6.5	0.0	16.1	4.8
Sport/ent/leisure	9.3	4.7	0.0	46.5	2.3	7.0	0.0	23.3	7.0
Shopping	10.1	12.9	2.1	47.0	0.7	2.8	1.0	19.2	4.2
Personal business	10.8	4.6	1.5	49.2	0.8	7.7	0.0	23.1	2.3
Other	14.1	10.9	3.1	34.4	3.1	9.4	0.0	18.8	6.3

Perception of central Bristol

The after survey identifies significant reductions in satisfaction levels with conditions in central Bristol. With the exception of the provision of leisure and entertainment facilities, which slightly improved by 7.5%, all other features recorded lower satisfaction scores.

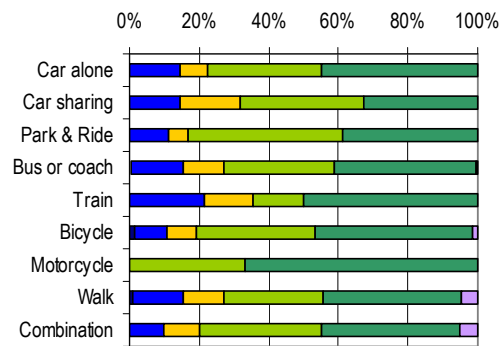
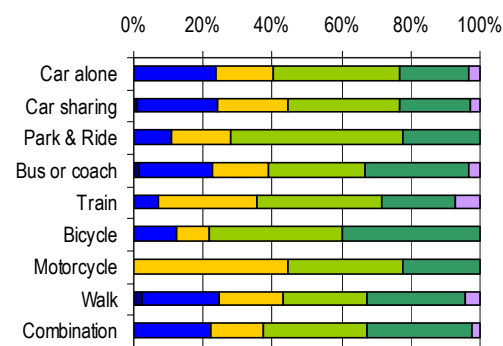
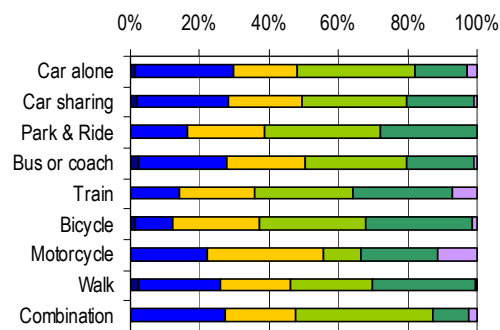
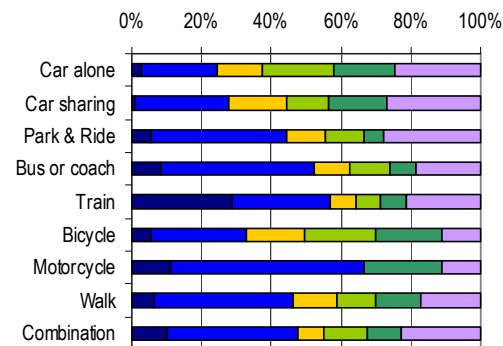
Respondents in the after survey were less satisfied with features of the central area such as traffic noise, air pollution and traffic congestion. For these three features the survey revealed extremely high levels of dissatisfaction, with 72.8%, 57.5% and 50.4% respectively identifying conditions as being either quite or very unsatisfactory.

Figure 2.9.9-5 Conditions in central Bristol



The series of graphs below show the rating given to four important factors affecting users view of the central area and how these are affected by mode choice. The main noted are:

- Park & Ride users, cyclists and motorcyclists are most dissatisfied with traffic congestion in the central area;
- Car users are most satisfied with levels of traffic noise in the central area, while train users and cyclists are least satisfied;
- Cyclists and Park & Ride users are most dissatisfied with air pollution, 78.1% and 72.2% respectively identifying conditions as being either quite or very unsatisfactory; and
- The highest levels of dissatisfaction with the provision of public transport into the central area are displayed by car users, while PT users display the highest levels of satisfaction.

Figure 2.9.9-6 Ratings of pollution and public transport
Traffic congestion by mode

Rating of air pollution by mode

Rating of traffic noise by mode

Rating of PT links by mode

Transport Schemes In Central Bristol

The main points raised by the survey concerning the knowledge and awareness of the VIVALDI project and its related measures are summarised below.

Knowledge of the VIVALDI project

Of the 1,031 members of the public surveyed 87 (8.4%) had heard of the VIVALDI project. This represents a 5% increase when compared with the before survey which reported that 3.4% had heard of the VIVALDI project.

Many cannot remember what the project is about, have confused it with other initiatives, or only have a very basic understanding of what the project involves.

A total of 23.4% of the sample had seen either the VIVALDI project logo or the CIVITAS programme logo, although as discussed above many did not know about the VIVALDI project. The logos were commonly identified as having been seen on the back of buses, posters and flyers. A small number of respondents also identified having seen the logos on the Council's electric cars, on the Council's website, and for one respondent on the back of their travel card.

Knowledge of transport measures

The degree to which the public are aware of the VIVALDI measures ranges between 61% having heard about or seen the at stop real time displays and i+ kiosks, to only 3% having knowledge of the Info Bus and 8% the trip planner.

The survey reveals greater awareness levels of the VIVALDI measures than evident in the before survey.

Figure 2.9.9-7 Awareness of transport schemes

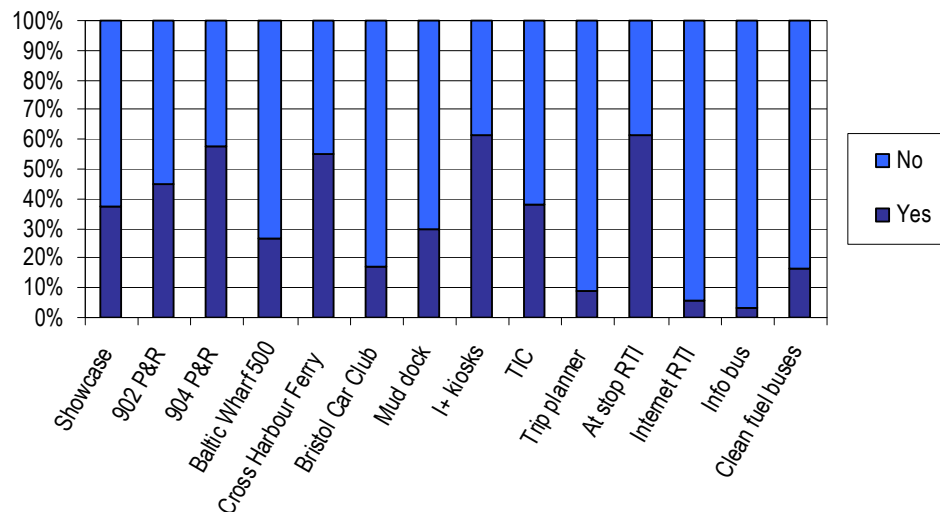


Table 2.9.9-6 Awareness of transport schemes (%)

Transport Schemes	Yes	No
Showcase	37.2	62.8
902 P&R	44.8	55.2
904 P&R	57.4	42.6
Baltic Wharf 500	26.5	73.5
Cross Harbour Ferry	55.0	45.0
Bristol Car Club	16.9	83.1
Mud dock	30.0	70.0
I+ kiosks	61.2	38.8
TIC	37.9	62.1
Trip planner	8.8	91.1
At stop RTI	61.4	38.6
Internet RTI	5.9	94.1
Info bus	3.0	97.0
Clean fuel buses	16.3	83.7

Use of measures introduced or improved through VIVALDI

Figure 2.9.9-8 Transport scheme usage

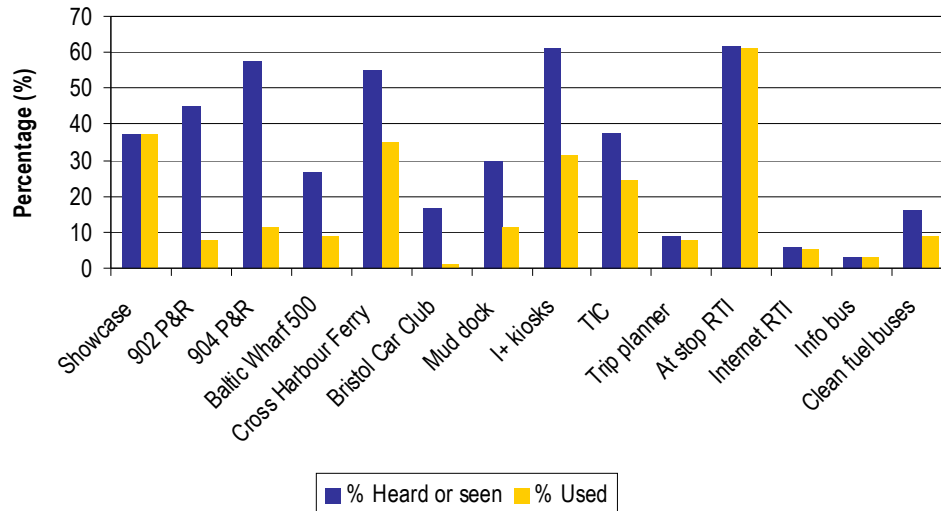


Figure 2.9.9-8 shows that for some measures a high proportion of the sample reported having used the service. For example the following services had a high percentage of reported use:

- Bus Stop RTI (61%);
- Showcase bus route (37%);
- Cross harbour Ferry (35%);
- i+ Kiosks (31%); and
- The Travel Information Centre (25%).

The average percentage of respondents across the range of measures was found to be 18%.

Although awareness levels are relatively high for the two Park & Ride services less than 12% have used these services.

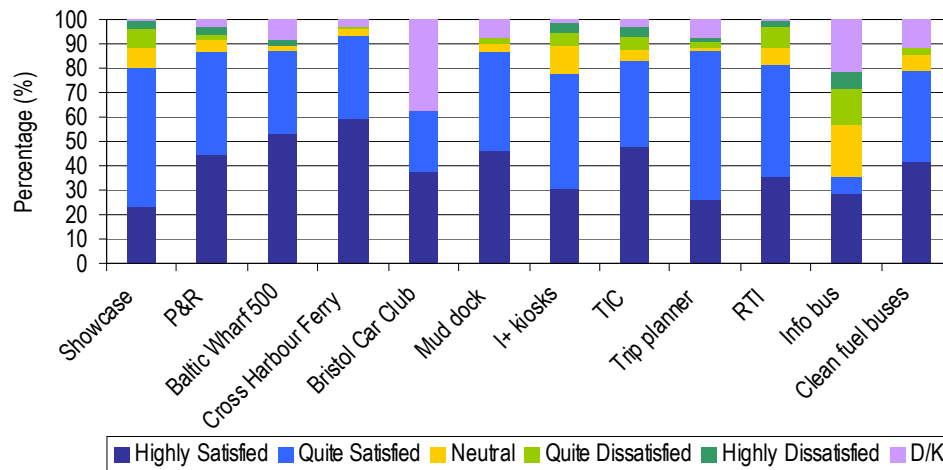
User satisfaction with measures used and effect of transport schemes

Although in some cases the number of people who have used each of the measures can be relatively small, user satisfaction is generally very high for all measures.

Users of the three bus measures (the showcase, Park & Ride services and 500 service) displayed high levels of user satisfaction. In each case over 80% of respondents who had used the service indicated that they were very or quite satisfied with the service provided.

Over 90% of users of the cross harbour ferry were satisfied with the service.

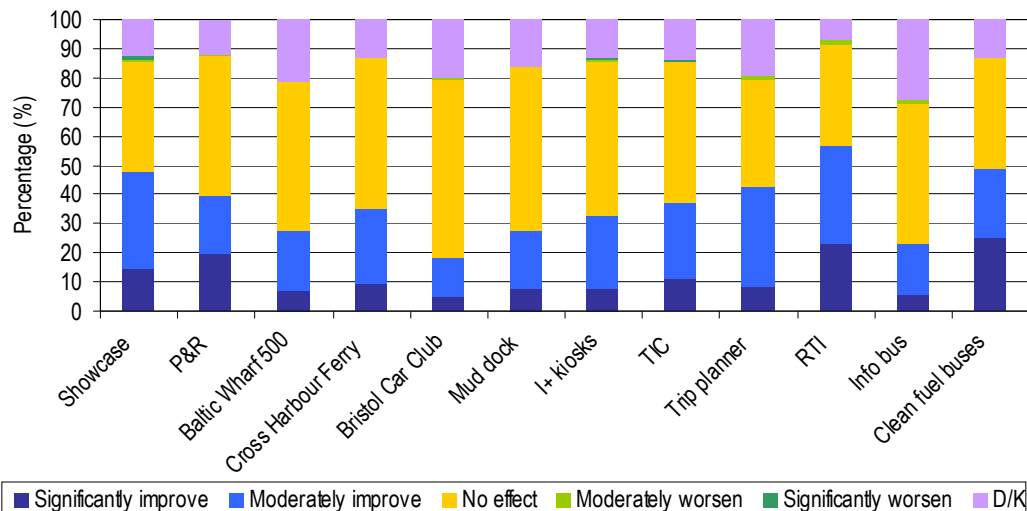
Over 75% of users of the measures providing improved travel information (TIC, trip planner, RTI) are satisfied with the services provided.

Figure 2.9.9-9 User satisfaction with measures used


Survey respondents (those with a previous knowledge of the schemes) have mixed views on the impact that they believe each of the measures introduced or improved through VIVALDI will have.

A total of 48% of those respondents who have heard, seen or used the showcase bus route believe that it will improve their travel into and around central Bristol.

The provision of real time information is the measure identified by the highest proportion of respondents (57%) who have heard, seen or used this measure as improving their travel into and around central Bristol.

Figure 2.9.9-10 Effect of transport schemes


While it is evident that awareness of the VIVALDI project has increased since the timing of the before survey, awareness of many of the measures introduced or improved through VIVALDI remains relatively low. However, the survey has shown an increase

in awareness and a far larger proportion of the sample stated that they had recognised the VIVALDI and CIVITAS logos.

The survey has also revealed the relatively low proportions of people who have used some of these measures although it must be said that some measures will take time to build up usage levels. In general all user satisfaction for all measures was very high, often over 80% either quite or very satisfied with the service.

Clear Zone Business Survey

The Clear Zone business after survey was undertaken in May 2005. The survey was a repeat of the 'before survey' undertaken in 2004. The purpose was to identify whether any changes in business attitudes had occurred since the before survey, particularly in terms of conditions within the central area, knowledge and awareness of the VIVALDI measures and attitudes towards the measures introduced.

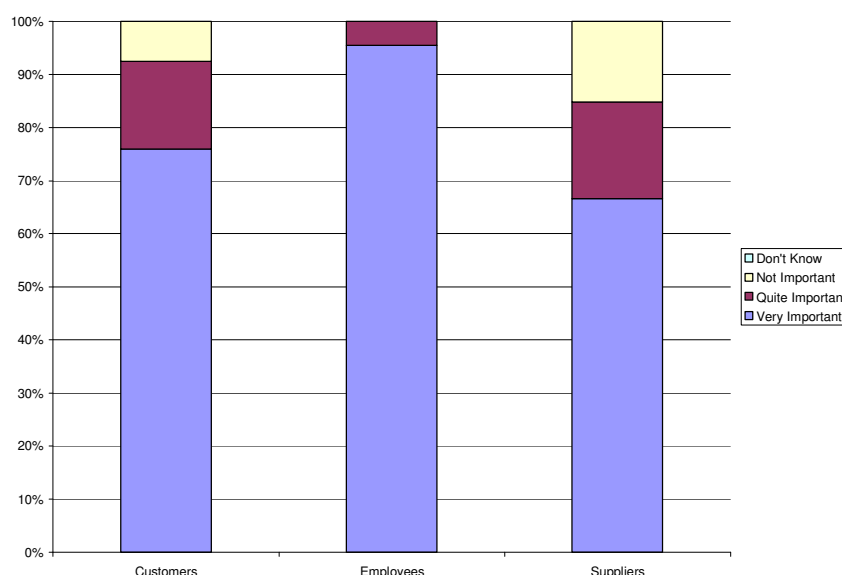
An attempt was made to conduct the survey with the 101 businesses that took part in the before survey. As a result a total of 67 out of these 101 businesses were surveyed. These were made up of eight main business types with over a third of businesses being a bank, business or insurance company. An additional business type, agricultural/utilities was seen in the previous survey

The results are in three main sections covering the key questions of travelling into and around Bristol (accessibility), quality of the environment to do business (attractiveness) and transport in the future (awareness, availability of information, accuracy of information and potential impact).

Travelling into and around Bristol

Importance of access to the business premises

When asked the importance of access to the business premises, the majority of the businesses surveyed considered it to be very important for customers, employees and suppliers (76%, 96% and 67% respectively, see Figure 2.9.9-11). There has been a slight increase in the level of importance placed on each group since the previous survey (a 6% increase for customers/clients, 5% increase for employees and 3% increase for suppliers).

Figure 2.9.9-11 Importance of being able to reach business premises


Nearly half of the businesses surveyed felt that the movement of people and goods to the business premises was more important than other forms of communication such as email, the post and telephone. Less than a quarter of respondents (24%) thought that the movement of goods and people was less important than other forms of communication (Table 2.9.9-7).

The number of businesses placing more importance on the movement of people and goods compared to other forms of communication to their premises has slightly decreased by 4% since the previous survey. An increase of 10% of businesses thought that the movement of people and goods to the business premises was less important compared to other forms of communication.

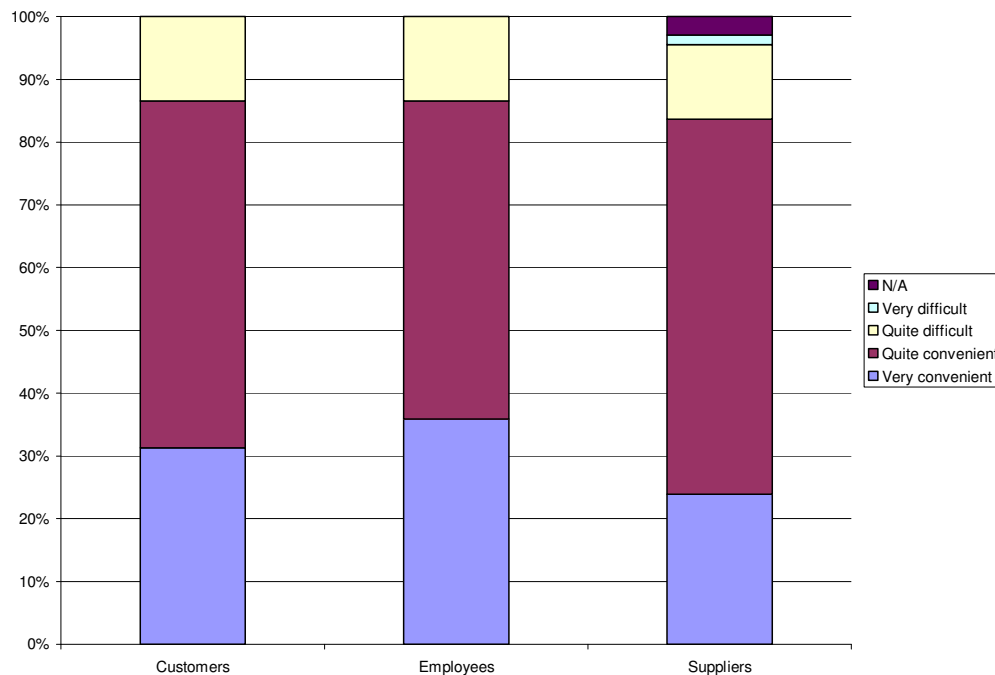
Table 2.9.9-7 Importance of goods and people

Importance	2004		2005	
	Frequency	%	Frequency	%
Very much more	39	38.6	20	30.3
Quite a bit more	12	11.9	11	16.7
About the same	33	32.7	19	28.8
Less important	14	13.9	16	24.2
Don't know	3	3.0	0	0
Total	101	100	66	100

Access to business premises

A high majority of businesses consider their location to be very convenient or quite convenient for customers, employees and suppliers to reach (87%, 87% and 84% respectively). This is an improvement for all three groups from the before survey (an increase of 17% for customers, 14% for employees and 21% for suppliers).

Figure 2.9.9-12 Convenience in reaching business premises



Car parking availability

Table 2.9.9-8 shows that only 43% of the businesses surveyed stated that car-parking was available for employees and less than a quarter of the businesses had spaces for customers and suppliers. The number of car parking spaces for customers has slightly increased since the previous survey by 4%, but the availability of parking spaces for employees and suppliers has since decreased (by 6% and 10% respectively). This may be due to a decrease in the number of businesses surveyed in the repeat survey rather than an actual change in parking space availability.

Table 2.9.9-8 Car Parking Availability

	%			
	2004		2005	
	Yes	No	Yes	No
Customers	19.8	80.2	23.9	76.1
Employees	48.5	51.5	43.3	56.7
Suppliers	24.8	75.2	14.9	85.1

Importance of different transport modes

Figure 2.9.9-13,

Figure 2.9.9-14 and Figure 2.9.9-15 show which modes of transport were considered most important for customers, employees and suppliers to reach the business premises. Over half the sample, 54% of businesses, thought that the car would be the first choice of transport for their customers, followed by the bus and the train. This was similar to

that found in the previous survey, although there has been a 9% decrease in the number of businesses that believe that this is the case.

Figure 2.9.9-13 Most important transport modes for customers/clients

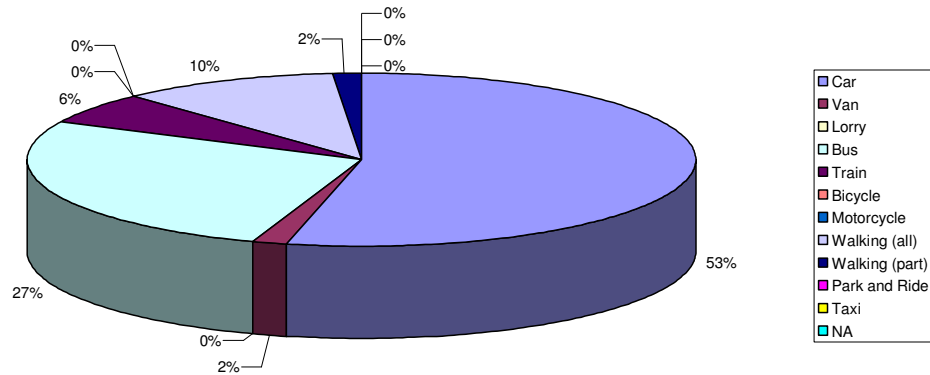


Figure 2.9.9-14 Most important transport modes for employees

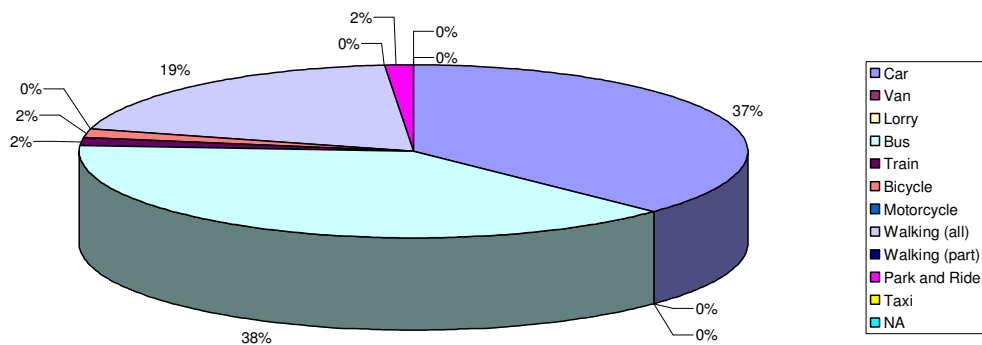
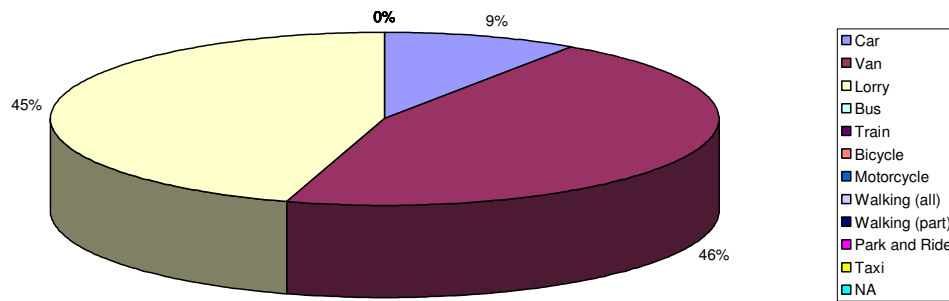


Figure 2.9.9-15 Most important transport modes for suppliers



The bus was considered to be the most important mode of transport for employees (39%) closely followed by the car (37%). This is different to the before survey when the car was considered to be the most important mode of transport for employees.

For suppliers it was not surprising to find that van and lorry are considered to be the most important modes of transport (both 45%). In the before survey, the van was considered to be most important (58%).

Change in accessibility to business premises

In a majority of cases (over 70%), it was felt that the ease with which customers, employees and suppliers can reach the business premises had remained about the same over the last year in comparison to over 60% in the previous survey. Around 20% of businesses surveyed felt that the situation had worsened for each group (Table 2.9.9-9). A very small percentage felt that matters had improved (less than 3%).

Fewer businesses in the repeat survey felt that the ease with which employees and customers can reach their premises had deteriorated in the past year but there was a slight increase in the number of businesses that thought that the ease with which suppliers can reach their premises had deteriorated in the past year (Table 2.9.9-10).

Table 2.9.9-9 Accessibility change in 2005

			%		
	Easier	Harder	About the same	Don't know	Total
Customers	3	21.2	72.7	0	
Employees	1.5	27.2	71.2	0	
Suppliers	0	23.1	75.4	1.5	

Table 2.9.9-10 Accessibility change in 2004 (before study)

			%		
	Easier	Harder	About the same	Don't know	No response given
Customers	1.0	29.7	63.4	3.0	3.0
Employees	3.0	29.7	65.3	2.0	0.0
Suppliers	1.0	22.8	67.3	5.0	4.0

The reasons given for the decline in accessibility included:

- An increase in traffic volume and congestion (12)
- Worsening of public transport including unreliability, an increase in delays and an increase in fares (2)
- Difficulties parking and problems with roadworks and the road system (4)
- An increase in petrol prices (1)

Quality of the environment

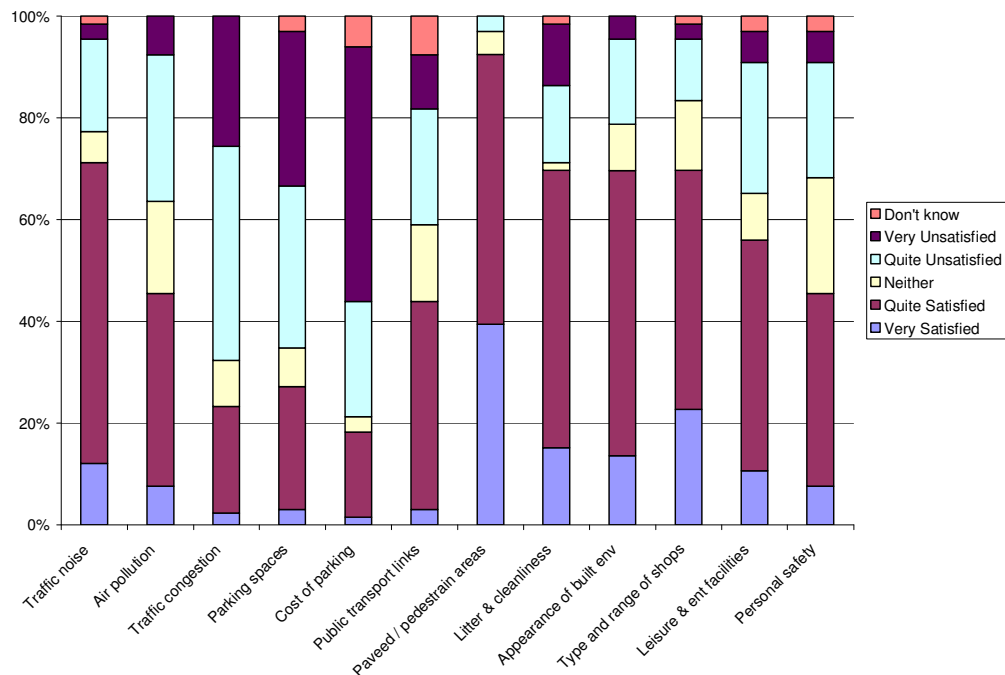
The results from Section 2 of the questionnaire addressed indicators important for evaluating the city centre as a place to do business, based on perception of the quality of the environment.

Quality of area business located

The businesses surveyed were generally satisfied with the facilities / conditions in the area in which they are located (Figure 2.9.9-16). However, businesses identified traffic congestion, parking spaces and the cost of parking as being particularly unsatisfactory, 68.2%, 62.1% and 72.7% respectively. A reasonable number of businesses also noted dissatisfaction with air quality, public transport provision and personal safety issues, although over 40% still thought these to be satisfactory.

Traffic congestion and parking spaces were found to be particularly unsatisfactory in the before survey. The percentage of businesses being unsatisfied with these conditions had slightly decreased (by 2% for both). Public transport provision and personal safety issues were also thought to be unsatisfactory in the before survey by a number of businesses.

Figure 2.9.9-16 Quality of area business located



Respondents were invited to comment on their reasons for the level of satisfaction or dissatisfaction they attributed to these city centre features. Not all responded and in some cases the minority expressed comments.

Traffic congestion: 68% of respondents were either very dissatisfied or quite dissatisfied with the level of travel congestion. All 5 respondents who commented further on this matter view the situation as a problem.

Parking spaces: Over half of the respondents (62%) reported their dissatisfaction with regard to the lack of parking spaces with 5 respondents commenting further about specific issues.

Public transport: Opinion about public transport links with business premises was divided almost equally between those who were very satisfied or quite satisfied (44%) and those who were very dissatisfied or quite dissatisfied (33%). The majority of additional comments (7) about public transport pointed out shortcomings in the service.

Litter and cleanliness: The majority of respondents (70%) were satisfied with the cleanliness of the environment surrounding their business premises. Several people made further comments about particular concerns.

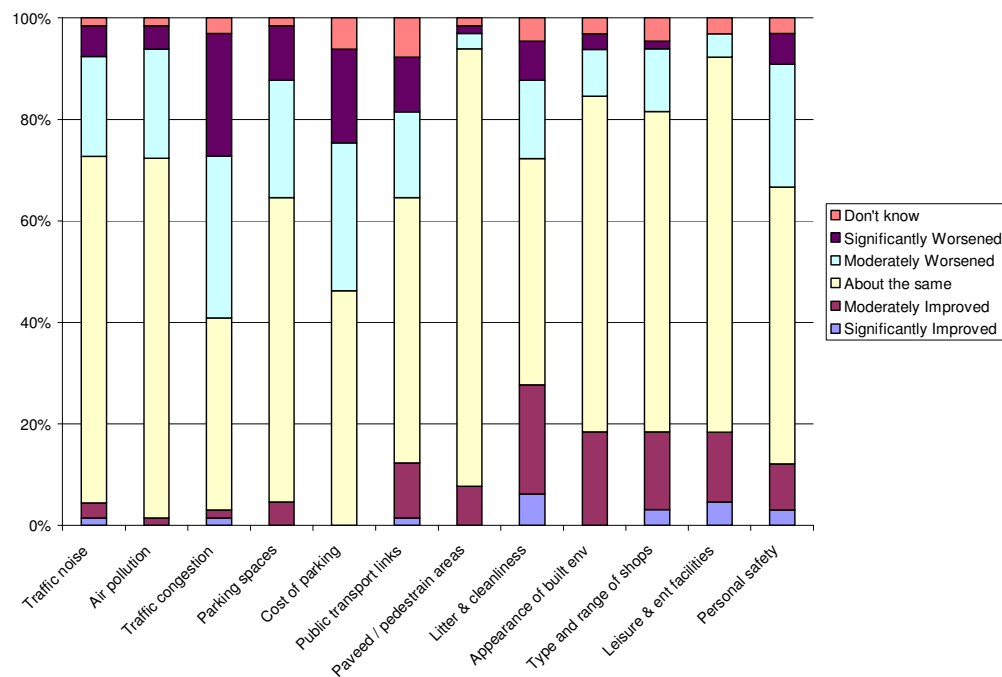
Personal safety: Less than half of the respondents (46%) reported being happy with issues of personal safety and a considerable number (29%) were dissatisfied with this aspect. It is notable that 19 respondents (over a quarter of the sample) reported further on their concerns regarding personal safety. There was a general feeling that it was not safe to be in the area in the early hours of the morning and in the evening and many

businesses also reported on crimes that had been experienced or witnessed by staff at the businesses concerned. Some respondents felt that crime was increasing in the area and others that the presence of some people made them feel uneasy. Some respondents required a larger police presence and more street lighting. Positive comments from business representatives with regards to security included good relationships with police and feeling comforted by the presence of the security cameras.

Change in quality of area business located

Businesses generally thought that the conditions in their area had remained about the same over the past year. With regards to traffic congestion however, the majority felt that the conditions had moderately or significantly worsened (56%).

Figure 2.9.9-17 Change of conditions in central area



Transport in the future

The results from Section 3 of the questionnaire gather data to answer questions raised by VIVALDI about current transport measures and policies under development or investigation, i.e. transport in the future.

VIVALDI Awareness

A positive 23% of businesses were aware of the VIVALDI demonstration project (see Table 2.9.9-11). This is a 14% increase since the previous survey when only 8.9% were aware of the project.

Table 2.9.9-11 VIVALDI Awareness

	Frequency	%
Yes	15	22.7
No	51	77.3

The respondents were asked if they has heard or seen any of the current transport schemes introduced or improved by the VIVALDI project. It is apparent that respondents have an extremely varied knowledge of the introduced or improved transport schemes (Table 2.9.9-12).

Table 2.9.9-12 Have you seen or heard about the following transport schemes in Bristol?

Transport Schemes	%	
	Yes	No
Showcase bus route 76/77	21.7	78.3
Park and ride- Portway 902	47.5	52.5
Park and ride - Bath Road/Brislington 904	70.3	29.7
Baltic Wharf Service 500	28.8	71.2
SS Great Britain Cross-Harbour Ferry	69.8	30.2
Bristol Car Club	30.6	69.4
Mud dock cycle resource centre	60.9	39.1
I+ information kiosks	62.5	37.5
Travel information centre	40.3	59.7
Internet Trip Planner	11.5	88.5
Real time bus information – at stop	24.2	75.8
Real time bus information – on internet	10.2	89.8
Info Bus	6.8	93.2
Cleaner fuelled buses	57.8	42.2
Clean fuelled City Council fleet vehicles	27.4	72.6
Broadmead Freight Consolidation Centre	16.7	83.3

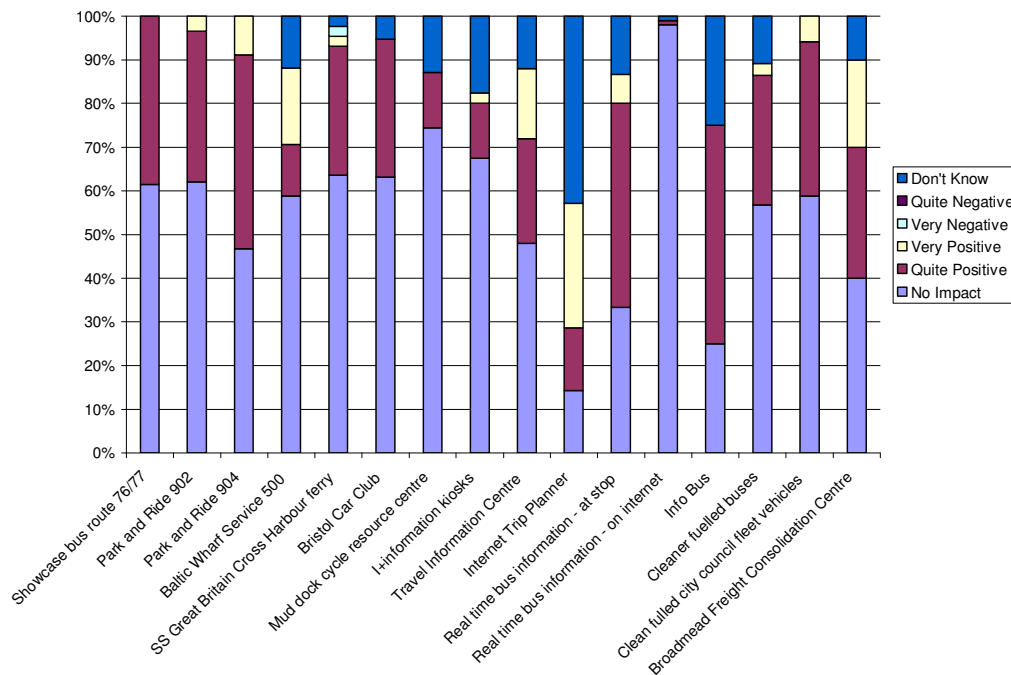
A number of transport schemes do not have a high profile with the businesses covered by the sample. Those transport schemes that were recognised by the majority of business representatives were the 'Park & Ride (Bath Road 904)', the 'SS Great Britain Cross-Harbour Ferry', the 'Mud dock cycle resource centre', the 'i+ information kiosks' and the 'Cleaner fuelled buses'.

How transport schemes and their impacts are viewed

Those who stated that they had heard about a particular scheme were asked what impact they thought the measures would have on their business. The following figures and tables are based on those respondents who stated that they knew about the individual schemes, rather than a result of prompting those who had not heard about it in Bristol to speculate on what the impact might be.

Figure 2.9.9-18 shows that the 'Park and Ride (Bath Road 904)' scheme and the 'Real time bus information at stop' were thought to have the most positive impact on the respondent's business, (53.3% and 53.4 % respectively). Only one scheme, the 'SS Great Britain Cross-Harbour Ferry' was thought to have a negative impact on one respondents business presumably for specific business reasons.

Figure 2.9.9-18 What effect do you think each of these measures will have on your business?



Conclusions

The adoption of the Clear Zones Strategy assisted the implementation of the measures by providing the policy framework. The designation of the Air Quality Management Area also highlighted the need to take action to reduce traffic related air pollution in the city centre and endorsed the approach of integrated packages of measures as subsequently adopted in the Air Quality Action Plan.

The public and business surveys have identified the people of Bristol's perception and feedback on a number of key elements that fall within the Clear Zone area. It also provided information on why people travel and how they travel to the Clear Zone.

The survey has shown that the bus is the most used mode of transport, particularly for shopping trips. When compared to the before study, there was an 11% increase in the proportion of the sample stating that they use the bus. Walking formed the majority of the 'other' modes category, with 17.5%. The after survey has also revealed a growth in the convenience rating of bus services into and around the central area, with over 60% of bus users indicating services to be quite or very convenient. Conversely the proportion of respondents rating the car as convenient has dropped, possibly reflecting the growth in respondents who highlighted dissatisfaction with traffic congestion and parking.

The central area environment is thought to be satisfactory with highest levels of satisfaction amongst survey respondents for the type and range of shops and paved / pedestrianised areas. However, the after survey identifies significant reductions in satisfaction levels with some of the conditions in central Bristol. Features of the central

area such as traffic noise, air pollution and traffic congestion were identified by 72.8%, 57.5% and 50.4% as being either quite or very unsatisfactory.

The public survey has shown an increase of 5% in the awareness of the VIVALDI project. There have also been a relatively high number of respondents claiming to have heard or know about many of the VIVALDI measures and there were also high reported levels of use for the bus RTI (61%), Showcase bus routes (37%), the Cross Harbour Ferry (35%), i+ kiosks (32%) and the Travel Information Centre (24%).

Generally user satisfaction for the VIVALDI measures was very high, with over 80% of respondents who had used the three bus measures indicating that they were very or quite satisfied with the service provided, and over 75% of users of the measures providing improved travel information being satisfied with the services provided.

One perhaps unexpected barrier to the formulation and advancement of the Clear Zones strategy was the use of the term “Clear Zone” itself. Some stakeholders considered that the term could have negative connotations as being suggestive of access restrictions alone rather than a broader package approach.

The results of the repeat business survey managed to seek the views of 67 of the 101 businesses surveyed as part of the before study. The study show that businesses located within the city centre of Bristol are generally considered to be accessible to customers/clients, employees and suppliers with an increase in the number of businesses who think it is convenient for customers/clients, employees and suppliers to reach their business since the before survey. The ease with which customers/clients, employees and suppliers can reach the business premises was thought to have remained the same in the previous year, again a higher percentage than that in the before survey.

Parking was identified to be a particular concern for businesses. When asked to comment on how convenient it was thought to be for customers/clients, employees and suppliers to reach their premises, many businesses commented on parking problems. It is evident that there has been an increase in the amount of parking available for customers/clients since the before survey but a decrease in parking spaces available for employees and suppliers.

The car has remained the most important mode of transport for customers and clients since the before survey, but the bus rather than the car was thought to be the most important mode of transport for employees in this repeat survey. The van and lorry were found to have equal importance for suppliers rather than the van being the most important mode of transport for suppliers in the ‘before survey’.

The centre of Bristol was generally thought to be an attractive place to do business but the three main areas that emerged as giving cause for concern are traffic congestion, parking and the cost of parking. Generally, the quality of the conditions in the area was thought to have remained the same in the previous year apart from traffic congestion which was thought to have worsened.

The survey showed that there was a growing understanding and awareness of the VIVALDI project since the before survey. Almost a quarter of the businesses surveyed were aware of the VIVALDI project. Those that had heard of the project did not have a

good understanding of what the project was about. There was a varied knowledge of the transport schemes introduced or improved by the VIVALDI project and only five schemes were recognised by the majority of respondents. The potential benefits to the respondents' businesses of implementing a number of the transport schemes was not recognised. It was generally felt that these schemes would have no impact but it is encouraging that most businesses did not think that the schemes would have a negative impact on their business and that a number of respondents viewed the schemes positively when asked to provide comments on this issue.

2.9.9.2 Bristol – Access management (6.2)

Measure Overview

The access management and bus priority systems seek to reduce the impact of motor vehicles (particularly through traffic) in central retail and business areas and to increase the attractiveness of public transport services.

This has been achieved via a range of city centre access management tools including controls based upon vehicle type, bus priority systems including bus lanes and pre-signals, and a bus lane camera based enforcement trial using Automatic Number Plate Recognition (ANPR) technology.

The effects of access control schemes and other bus priority measures are accounted for in the evaluation of the Showcase (8.6) and Park & Ride bus services (8.7).

For Bus lane enforcement, the project sought to carry out a trial examining the technological requirements and legal implications of using Automatic Number Plate Recognition (ANPR) cameras to record vehicle violations in designated bus lanes around the city. It is hoped that if motorists could be fined for illegally using a bus lane using technology which was easily transferable and needed few resources to operate then bus journey times would be greatly reduced and thus encourage a mode shift from private car to public transport.

Parliament has passed the Traffic Management Act 2004, which includes Civil Enforcement of Driving Offences and means that local authorities will have the powers to take over the enforcement of traffic contraventions from the police, including bus lane violations. Although the Act received Royal Assent last year, it is largely still not in force. The relevant section of the act, Part 6, was activated in the week beginning 1st November and the Council is currently liaising with central government to clarify regulations made by the Secretary of State as to the detailed procedural operation of the Act.

The trial used equipment previously purchased to examine road user charging in the PRoGRESS project. It was initially an aspiration to set up three sites around the city at locations identified by the Public Transport Team as bus lanes which suffer from particularly high levels of bus lane violations. Computer Recognition Systems (CRS), who originally provided the ANPR equipment required were again used to carry out camera installation and system setup.

Evaluation Results

The trial was initially planned to take place for six months from April – September 2005. There were problems with several locations identified for the cameras, as there was not enough space in the pavement for the camera posts to be installed due to other utilities being present. Finally, two locations were found where the cameras could be located and had an unobstructed view of the highway.

The locations each had different characteristics. The first was located in a suburban area on a busy in-commuting route in the south of Bristol (Bath Road) whilst the second (Lewins Mead) was located on a busy city centre location used by many buses and emergency vehicles (several hospitals are located nearby).

Installation of the cameras was carried out in the early months of 2005 and data collection started from April 1st 2005. Data capture was carried out by the ANPR system matching a captured vehicle registration number against a list of vehicles that could legitimately use the bus lane (Buses, certain taxis etc). When a vehicle is captured which does not match the 'non violator' list several images are recorded and encoded in a file along with a text document containing information such as time and date of violation, location of violation, registration number of vehicle and confidence rating the system has for the correct reading of the registration number. This data is then archived in folders according to date.

Data collection involved transfer of data from the site computer to a laptop computer on which a program was able to decrypt the data and convert it into usable image and text files. This transfer of data had to be carried out by a member of staff physically on site, as remote access was not available. Once the data was transferred onto the laptop the files were then decrypted and split into six files per violation (five image files and one text).

This raw data was then fed into the SIDEM parking service program, which acts as an interface between the City Council and the central government department (Driver and Vehicle Licensing Agency - DVLA). The SIDEM system is then able to produce reports on the violations, which in a full working process would begin the creation of a penalty notice. The raw data collected from each site included:

- Number of violations per site broken down by month and day;
- Number of violations over a 95% confidence rating (per month and per day);
- Accuracy of captured data; and
- Captured data compared against roadside surveys conducted at each site.

As the legal power of bus lane enforcement has not yet been granted to the City Council and Data Protection laws prevent the use of the data until it is granted, it is not possible to send information to the DVLA for processing.

Issues with data collection meant that evaluation of the results has not been as exhaustive as envisaged. Examination of recorded violations revealed that the non-violator list was severely out of date and the list had a large number of omissions, which led to many legitimate vehicles being recorded. This is due to the lack of an organised and regular data exchange between the relevant parties.

Analysis of the raw data was carried out by the SIDEM parking services software, which involved a bespoke application to feed the data from disc into the system. Unfortunately, when the cameras were set up, the text files created for each of the two sites were in different formats and the bespoke application could not read the Lewins Mead data into the SIDEM system. This has meant that the following results are based purely on Bath Road data.

Bath Road bus lane is a peak time in-commuting bus lane and only operates between 07:00 and 10:00am.

Road Side surveys were also carried out so to compare the accuracy of the cameras against an actual count carried out by surveyors on site.

The ANPR system gave a rating for each recorded violation to measure how confident the system was to accurately record the correct vehicle registration number/mark (VRM). It was decided that results above a level of 95 confidence will be used in the comparison of results (except figs 1.1 & 1.5), however it should be noted that this is not a level decided on through industry standards and any further technological trials should establish a recognised standard.

Table 2.9.9-13 outlines the total count of vehicles over the whole trial period and displays the count of cases identified with a confidence rating of lower than 95 and higher than 95. A total of 40.5% of cases fell below the 95 confidence level, which, if the system were in full operation would not be an acceptable number of cases. To reach a level acceptable for a fully operational system it must be decided that either the acceptable confidence level can be lower or the technology must improve to accurately and confidently identify vehicles.

Table 2.9.9-13 Total recorded vehicles over the trial period

	Count	Percentage
Cases below 95	20364	40.5
Cases above 95	29933	59.5
Total	50297	100

Figure 2.9.9-19 shows the count of vehicles identified by the ANPR camera, and does not take into consideration any confidence ratings. The figure shows results sorted by month and exhibits large differences in the number of vehicles identified. The difference between the number of vehicles in July and the number in August is 10687. This can be explained by the very high number of days in which the ANPR system failed and no cases were recorded. The issue of the system failing has caused evaluation of the data to be very difficult and the results inferred cannot be accurately relied upon.

Figure 2.9.9-19 Total number of recorded offences per month

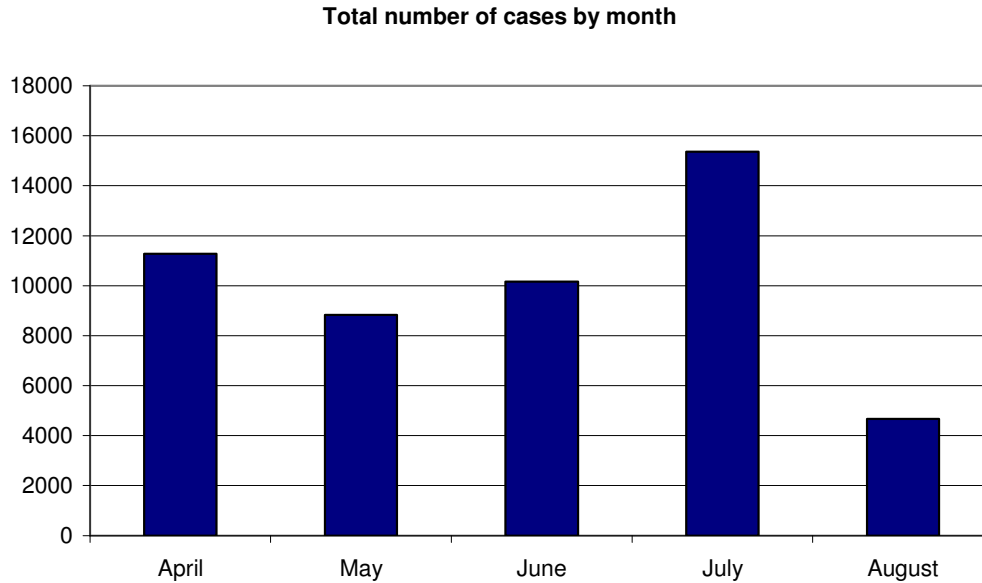


Figure 2.9.9-20 shows the number of days in which the system failed and for which no data was recorded. The cause of the equipment failing to record cases is not fully known as full system tests would be required, however the equipment supplier suggested that as the hardware was not bespoke to the trial the requirements were above the capabilities of the system. For instance it was suggested that the hardware system processor could not cope with such high levels of data creation due to the high volume of traffic at the Bath Road site and subsequently crashed on several occasions requiring manual re-setting of the system.

Figure 2.9.9-20 Number of days without data

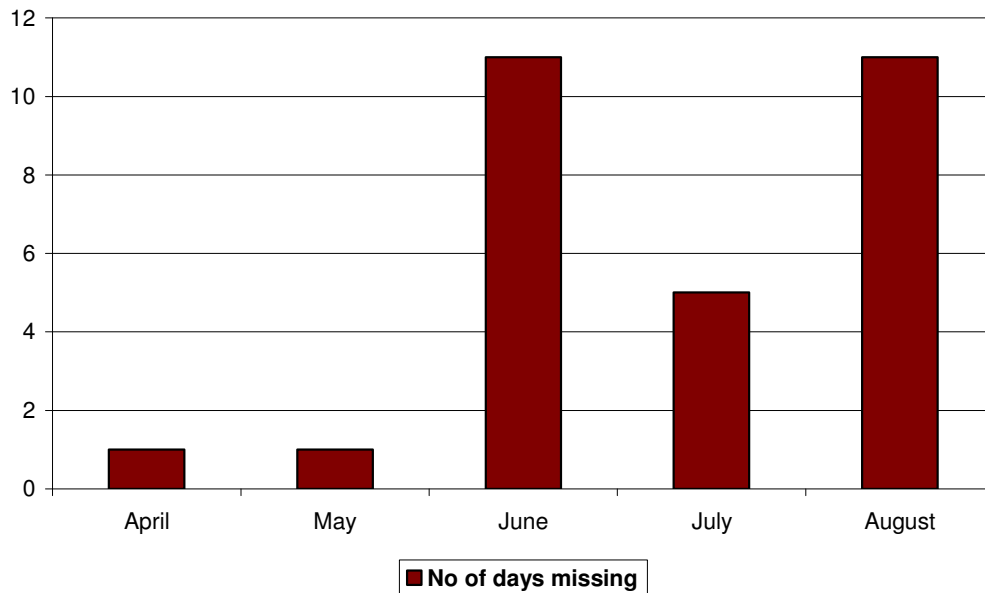


Figure 2.9.9-21 shows the vehicle count sorted by month and by time, filtered for cases over a 95 confidence rating. The results show a peak of traffic between 08:00 and 09:00, which is what would be expected on a congested commuter route (the lack of available data explains why the count is so low in August).

Figure 2.9.9-21 Vehicle count by month

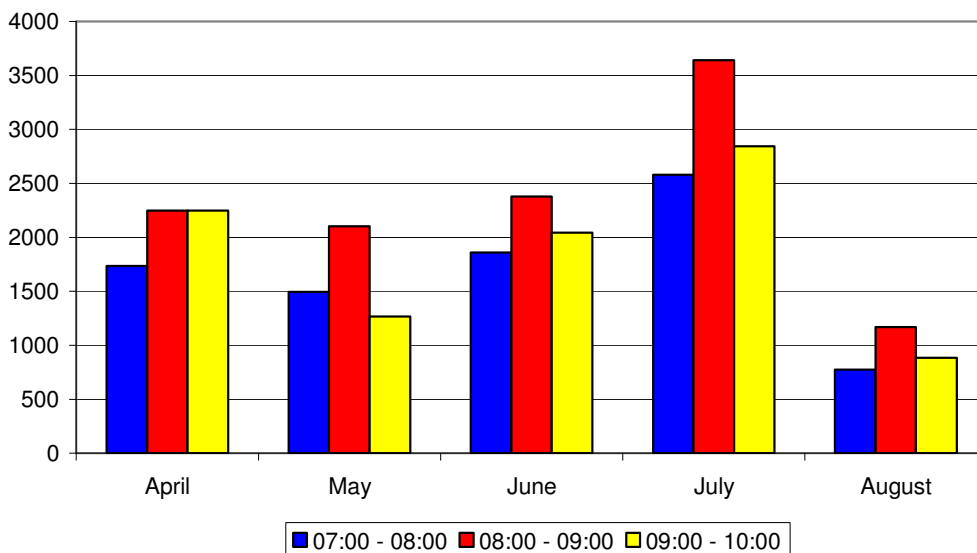


Figure 2.9.9-21 shows the vehicle count sorted by month and confidence rating from 95 to 99. This figure demonstrates that of the vehicles identified above a 95 confidence rating a higher number had a 99 confidence rating than any other (except for during May). This is encouraging as it means the technology is identifying a large number of

VRMs correctly. However, it must be noted that cumulatively more cases had a lower confidence rating than those which had a confidence rating deemed as ‘high’ (see Table 2.9.9-13).

Figure 2.9.9-22 Vehicle Count by month and confidence rating

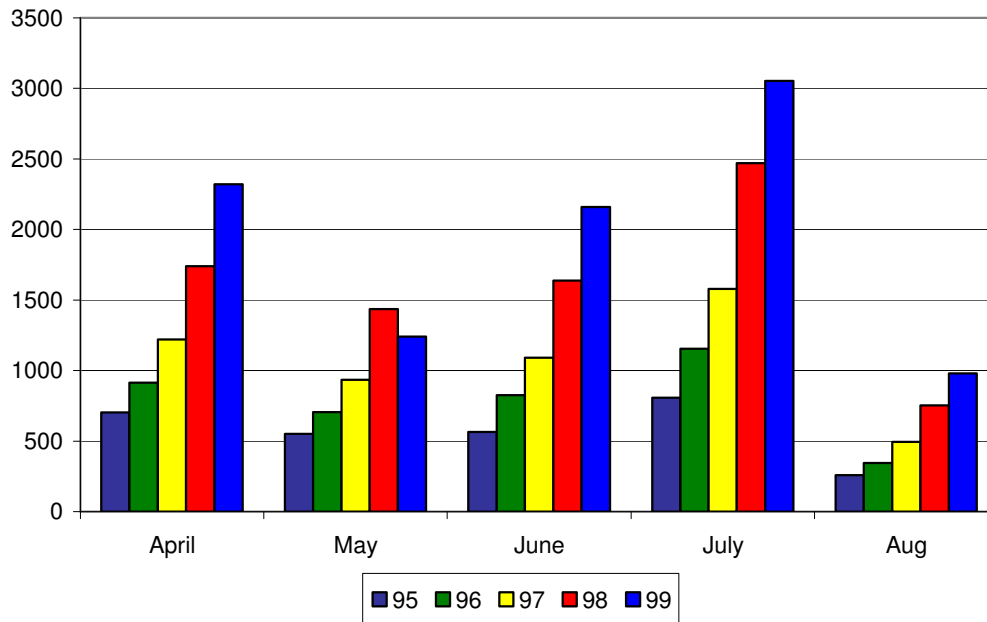
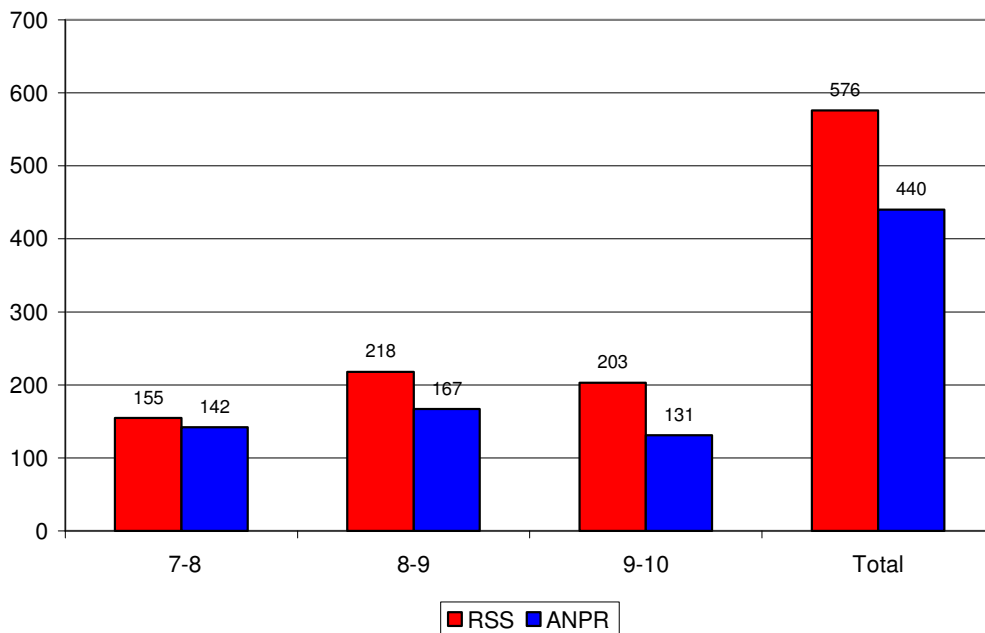


Figure 2.9.9-23 shows Roadside Survey Results compared against results from the ANPR camera. The roadside surveys were carried out on Tuesday 10th May. Results are based on actual counts and cases have not been filtered according to confidence level. It is surprising that the surveys produced a higher count of vehicles than the ANPR camera. This would suggest that the equipment is not accurately recording all vehicles, which would need to be addressed in any further trials before full implementation.

Figure 2.9.9-23 Roadside Survey Results comparison



Conclusions

The Bus Lane Enforcement trial set out to test the available technology to identify issues and potential problems which could occur in a more extensive trial or full implementation. The trial did not set out to be a fully functioning system where no problems occurred. To this degree the trial can be regarded as a great success. Many issues and problems were identified and have been discussed above; however, it is with this information that further development work can be carried out and potential issues can be predicted.

The scheme encountered the following barriers and obstacles during the initial installation phase and also during the data collection phase:

- Locating cameras was problematic due to the size of the poles needed and also due to the lack of space available in the pavement;
- Data collection is carried out 24 hours a day. Bath Road is only a part time bus lane and therefore created large amounts of erroneous data which was time-consuming to manually remove;
- Transfer of data on site is time consuming and could be resolved if files were transported automatically using ISDN lines;
- The non-violator list was not complete and contained large gaps in information. Many vehicles were recorded, which should not have been. This could be resolved by improving the updating of the lists from the relevant bodies;
- Due to strict formatting requirements of the non-violator list initially all vehicles were recorded;
- Decrypting files to .txt and image files is time consuming (around 5-10 minutes for each day). This had to be carried out for each day and for each site (a total of 306 days across both sites); and

- There were major issues relating to data capture at the Bath Road site. On many occasions the equipment failed to work and capture any records. This occurred very frequently toward the end of the trial and resulted in the trial ending one month earlier than planned (August rather than September). These issues were attributed to insufficient processing power of the on site computer, which was designed for another trial.

Bus Lane Enforcement is beginning to take a high profile within local authorities and associated equipment suppliers due to the impending commencement of the Traffic Management Act 2004. It has been identified in the Joint Local Transport Plan due for public publication in early 2006 and as part of a Major Scheme Bid submitted to the UK government in July 2005, which would help to provide funding for a further, more extensive trial and possible full implementation.

2.9.9.3 Bristol – Clear zone orbital bus services (8.1)

Measure Overview

This measure has involved the upgrading of the Baltic Wharf Loop (service 500) operated by local bus company Buglers. Service 500 operates around the city centre linking locations poorly served by public transport.

There was an identified gap in bus services between the railway station, areas of business and the city centre. Public transport provision was especially poor to the Create Centre, which is a council owned building located on the south west of the Harbourside, due to the low number of bus services stopping there.

To fill this gap a small Bristol based bus operator, Buglers, were operating the 500 service under contract to the Council, using a fleet of old diesel buses. The buses were not accessible and the service was operated at a frequency of two buses per hour. The service was not particularly high profile and considering the central stops it served, patronage figures were low. Under VIVALDI works to improve the service have included an increased service frequency and modifications to the route. These changes have been accompanied by improvements including improved waiting facilities and promotional initiatives. The service has also been operated by the new hybrid diesel-electric vehicle (see 5.1 Clean and Efficient Buses).

This measure forms part of the city centre clear zone integrated package of measures. The Inception Report details 3 measure objectives for the Clear Zone Orbital Bus. These are:

- Provide quality alternatives to the car and encourage their use;
- Lessen dependency on the car especially at peak periods; and
- Reduce emissions of, and human exposure to, air pollution.

The integrated package is also tasked with contributing to the following VIVALDI targets:

- VT4 – Reduce car traffic in a managed area by 10%;
- VT16 – Reduce lorry movements in a target area by 5%;
- VT20 – to introduce travel plans in all organisations in a targeted area;

- VT7 – Reduce parking space in the area by 10%;
- VT2 – Reduce energy use and CO₂ by 8% in the demonstration area;
- VT3 – Meet national air quality objectives;
- VT5 – Increase economic activity in the area by 5%; and
- VT6 – Increase employment opportunities by 5%.

Evaluation Results

A mix of quantitative and qualitative data has been utilised in the evaluation of the 500 service upgrade. Operational data including vehicle mileages, fuel issued and fuel consumption, patronage and vehicle reliability have all been collected with the support of the service operator Buglers. Patronage data has been collected since April 2003 so that trends could be detected up to the time of the service upgrades and after their implementation. The remaining operational data which is important in the evaluation of the new Hybrid bus was collected from the time of the upgraded service launch in June 2005. In addition, qualitative data on vehicle reliability was collected from the fleet manager. This provided information on the type of problems experienced with the new bus and how each problem was overcome.

An on-bus user survey was undertaken during September 2005. A total of 151 self-completion questionnaires were completed over two days, Saturday 3rd September, between 08.30am and 6pm, and Thursday 8th September, between 7am and 7pm. The results of the survey provides information on:

- Usage (who uses the service, when, to go where, for what purpose etc);
- Reasons for use;
- User satisfaction with the service provided;
- User reactions to recent upgrades; and
- User attitudes to clean fuelled buses.

A process interview was also conducted to add further context to the quantitative data, and to assess: the steps, decisions, and actions taken; the obstacles and opportunities encountered; and the roles and contributions of the different parties of relevance.

The following results were obtained over the period April 2003 – August 2005. It should be noted that the improved 500 service was launched in June 2005, toward the end of the monitoring period.

Patronage (LO22)

Since April 2003 the 500 service has carried over 125,000 passengers. Bus service patronage levels over the monitoring period vary month on month, often corresponding with the seasons of the year.

During the monitoring period the overall trend has been a gradual decrease in passenger numbers using the 500 service. In 2004 some 5,000 less passenger journeys were made on the service compared to 2003 and the monthly average number of passenger journeys dropped from 4,493 to 4,080. However, since April 2005 passengers numbers have been steadily increasing.

Further analysis of the patronage data reveals that since the service upgrade and launch there has been an increase in usage levels. Data for June – August 2005 reveals that patronage levels are up by 1,257 passengers from the same period the previous year. This represents a 10% increase or an additional 400 passenger journeys per month. However, without sufficient after data it is not possible to determine whether this patronage growth will be sustained over time.

The user survey provides some insight into how and why the service is currently being used. The main results from the survey indicate that:

- The service has a long standing passenger base with over 100 respondents using the 500 service for over 12 months prior to the timing of the survey, representing over two thirds of the sample. Only 23 users of the service had been using it for less than one month;
- Passengers are using the service regularly with nearly half (70) using the service at least four times a week, and over 70% using it both during the week and at the weekend; and
- The 500 service provides an important link for shopping and work trips between the Baltic Wharf/Hotwells area and the city centre, Temple Meads railway station and Park Street. The most common journey purposes were shopping and travel to work, representing two thirds of all responses - 38% (55) and 28% (41) respectively (see Figure 2.9.9-24)

Figure 2.9.9-24 Main Journey Purpose

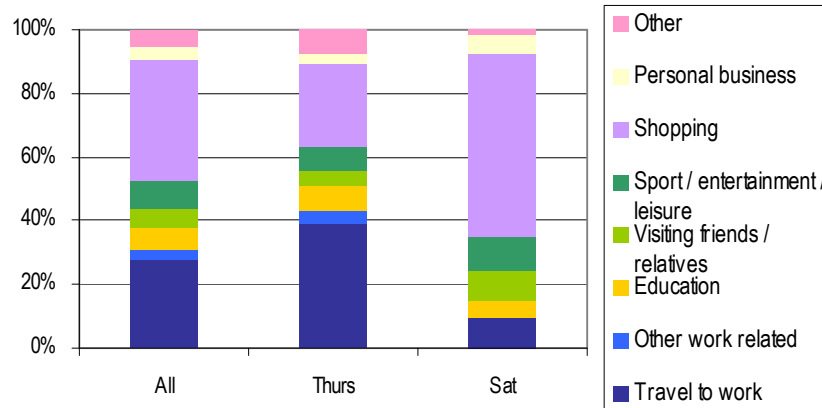
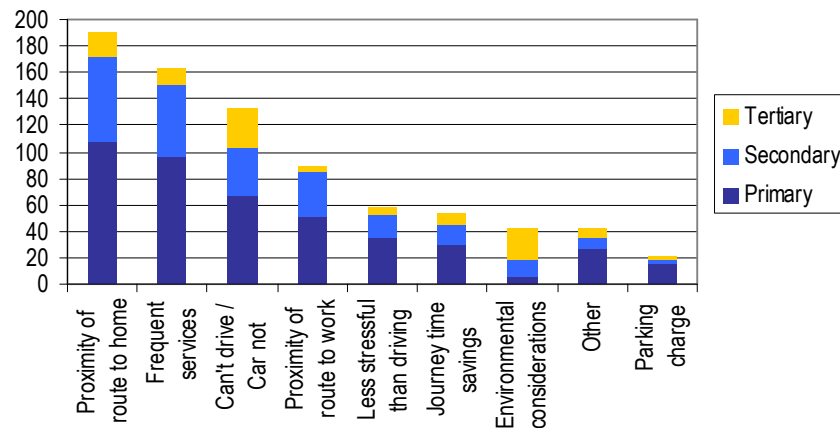


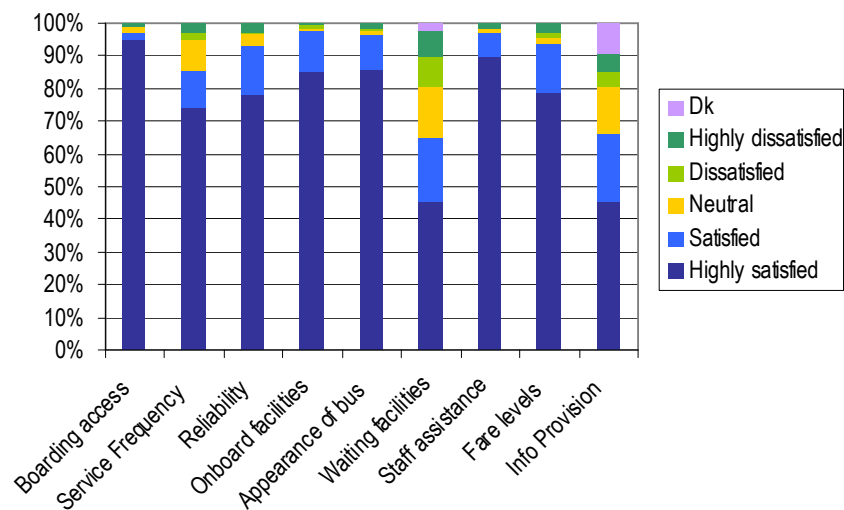
Figure 2.9.9-25 shows that the most important reasons for using the service were identified as being the proximity of the route to respondents' home location, the frequency of the service and not having a car or being unable to drive.

Figure 2.9.9-25 Most Important reasons for using the 500 service


Service Quality (17 & 19)

An important aspect of the survey was to identify levels of user satisfaction and users reactions to the service upgrades recently undertaken. Figure 2.9.9-26 shows that the main results from the survey indicate:

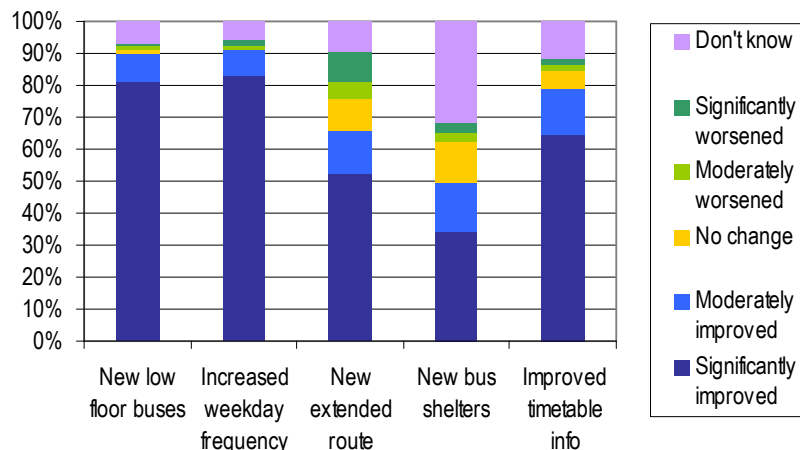
- Users are extremely satisfied with the service provided, particularly with access boarding the bus, and staff assistance. Over 90% of respondents identified that they were extremely satisfied with these aspects of the service.
- Two aspects of the service appear to be less satisfactory. Information provision and bus stop waiting facilities recorded lower levels of user satisfaction, although in both cases only 11% (14) and 17% (23) respectively noted these aspects to be either dissatisfactory or highly dissatisfactory.

Figure 2.9.9-26 User Satisfaction Levels


- Many users feel that this is an excellent service and that the recent upgrades have further improved it. In particular, it is worth noting the number of users who praised the drivers and the quality provided by the service. Users commented:

- “Satisfied is not good enough to describe the drivers. Almost without exception they go out of their way to be helpful.”;
- “A first class service, on a very useful route around Bristol.”; and
- “I have nothing but praise for this service... it is always reliable, very, very friendly and very cheap.”
- The recent service upgrades are viewed as having had a very positive impact on the quality of the service. The introduction of new low floor buses and the increased frequency were identified by over 80% of respondents as having significantly improved the service provided (Fig 5). One respondent commented about the new buses “the low level floor buses are a great help as I have a baby and therefore prefer buggy-friendly buses”.
- Many users highlighted that there are few improvements that could be made to the existing service although many users indicated that they would like to see the service further extended with the introduction of earlier morning and later evening weekday and Saturday services, and the commencement of a Sunday service. Given the numbers of users suggesting these improvements it is recommended that these be further explored.

Figure 2.9.9-27 Impact of Service Upgrades



Vehicle Reliability (18)

Since the new service launched on the 20th June 2005 the hybrid bus has only managed to complete 3 weeks in service out of the 11 weeks monitoring data was collected. Between 20th June and 8th July 2005 the vehicle covered a total of 1,399km but was not continuously in service as varying problems took it off the road temporarily. The main problems experienced have been associated with the batteries, either being drained or not recharging correctly, and computer / software issues. Eneco have replaced the batteries and updated the software to correct these problems. Eneco have also manufactured a shield to protect the batteries from being exposed by debris hitting the underside of the bus.

The vehicle broke down in service on Friday 8th July and had to be returned to the garage by a recovery vehicle. The bus has not been operational since this date and although Eneco have been out to fix the current problem the bus remained inoperable during September and October.

Buglers experience of operating the bus has been very negative. While they were initially keen and enthusiastic, the frequency of failures and level of support to fix problems have removed their trust in the vehicle. However, Buglers have been able to maintain the level of service provided using the two conventional diesel buses.

Emissions

The hybrid bus has not been in service for a sufficient time to meaningfully evaluate the emissions savings of the vehicle. The vehicle has only been operational for 3 weeks and had some problems within this period. Without a completed month of data and a month of trouble free running it would be extremely difficult to produce robust evaluation results.

Using claims from the bus manufacturer Eneco it is possible to provide some indicative savings generated by the usage of the hybrid bus on the 500 service. Eneco have tested bus emissions against a “standard” route (Known as “Route 159”) defined by the Energy Savings Trust and is regarded as typical of urban routes. When tested against a bus with a conventional diesel engine, the Hybrid powered bus achieved:

- 33% reduction in fuel consumption;
- 100% reduction in HC emissions;
- 100% reduction in CO emissions;
- 38% reduction in NO_x emissions; and
- 85% reduction in PM emissions.

Conclusions

The survey has highlighted extremely high levels of user satisfaction for the 500 service. This is particularly due to the quality of the vehicles, reliability and the friendly service provided by the staff. The recent service upgrades are widely seen as having improved an already excellent service. Many users highlighted that there are few improvements that could be made to the existing service although many users indicated that they would like to see the service further extended with the introduction of earlier morning and later evening weekday and Saturday services, and a Sunday service. Given the numbers of users suggesting these improvements it is recommended that these be further explored.

The evaluation of this measure has been affected by the limited time series of information available post measure implementation. The service upgrades were only launched in June 2005 and as such only provides two complete months of evaluation data. This is insufficient to provide a detailed evaluation of this measure as long terms impacts on usage, vehicle operability, and emissions savings can not be established with any certainty.

It is recommended that the scheme be closely monitored outside VIVALDI to complete a more robust evaluation of the impacts of the service and to ascertain whether a cultural change is adopted over time that is receptive to alternatives to the use of private cars and increased public transport use.

Through the process interview a number of opportunities and obstacles were identified. The main points are summarised below.

Opportunities

- The scheme met with the joint objectives of the AQMA, Clear Zone principles and a long-standing objective of serving the Create Centre.
- The route serves many tourist destinations and is important in connecting the centre and the Harbourside area.
- VIVALDI has enabled the Council to try Hybrid bus technology for the first time and be involved in the joint development of this technology. It has kick started the initiatives which BCC hopes it can maintain.
- Buying the buses themselves enabled the Council to define the bus and reduce the contract price of the service. Purchasing two standard diesels also allows these to be retrofitted as hybrids if the test vehicle proves to be a success.

Obstacles

- Delivery of the measure was slow and took 12 months longer than envisaged at the outset. The delivery of the hybrid caused the greatest hold up and delayed the contract negotiations as the Council wanted to avoid starting the new contract until the hybrid bus was fully operational. Eneco gave regular progress updates but were unwilling to release their vehicle until they thought it would work as expected. This met with BCC's view that it was critical to get a vehicle that worked.
- Most of the marketing work to promote the enhanced 500 service has been put on hold while the hybrid is off the road. A new leaflet and harbourside attraction map advertise the route but a major press launch has been postponed as the hybrid is seen as the major point of interest.
- The bus has yet to complete a satisfactory period in operation without problems affecting the ability of the operator to run the service. The hybrid bus failures have eroded the confidence of the bus operator in the hybrid technology. The operator also feels let down on promises made regarding responsiveness to faults.

The following 3 lessons have been learnt from the experience:

- The purchase of the three buses was an unusual step for the Council. Through the project the Council has established the legal status for the purchase of the three buses and their lease back to the service operator. In this case the Council found justification because the scheme matched several plan objectives and had pilot project status. Other UK Councils have followed a similar approach to reduce the revenue costs of contracted bus services. However, Bristol City Council's legal position is that this is not something they can do on a regular basis or undertake on a larger scale. It is therefore unlikely that the Council will purchase more buses under similar arrangements with operators unless there are changes to the law.
- The Council had to register the vehicle which proved to be a long process to complete. This was complicated by the fact that the vehicle was meant to be new but actually completed 5,000 miles in testing. As a consequence it had to be registered as a used vehicle.
- The bus operator Buglers and the Council were already in the middle of an existing contract. As the Council did not want to sever the current contract and go out to tender for the service a contract extension was negotiated. The Council had

to justify the manner by which they were going ahead with the contract extension through its Community Strategy and the Well Being Policy of the Local Government Act.

The immediate next steps for the 500 service are to complete all the stop upgrades and install real time information points along the route. An important step in the delivery of RTI on this route is to install compatible ticket machines on the buses which could also tie in with Smartcard development (See 7.2 Integrated Pricing).

2.9.9.4 Bristol – City logistics scheme (10.1)

At the commencement of VIVALDI there was little co-operation between organisations involved in goods distribution at the local level within the Clear Zone. Organisations made individual delivery arrangements, which contributed to duplication in effort and increased numbers of goods vehicles. This measure has developed a co-operative city logistics scheme to increase the efficiency of the goods distribution network and reduce traffic impacts. A pilot scheme has been created utilising freight consolidation to reduce the numbers of delivery vehicles entering the Broadmead city centre shopping area of Bristol. This retail area comprises 325 retail units and receives over 100,000 deliveries per year. The pilot uses vehicles meeting Euro III standard whilst clean fuel options continue to be explored.

The works under VIVALDI have included the creation of a pilot freight consolidation centre operated by Exel Logistics (UK) providing consolidated deliveries to 33 retailers within the Broadmead area. The centre is located some 11 km from the city centre close to the strategic road network. The scheme has been developed with the active support and participation of key local and national stakeholders including the Broadmead Board (who represent the interests of retailers), Business West (Chamber of Commerce) and representatives of the freight sector.

This measure forms part of the Clear Zone integrated package of measures that has been designed to contribute to the following VIVALDI project targets:

- VT4 – Reduce car traffic in a managed area by 10%;
- VT16 – Reduce lorry movements in a target area by 5%;
- VT20 – Introduce travel plans in all organisations in a targeted area;
- VT7 – Reduce parking space in the area by 10%;
- VT2 – Reduce energy use and CO₂ by 8% in the demonstration area;
- VT3 – Meet national air quality objectives;
- VT5 – Increase economic activity in the area by 5%; and
- VT6 – Increase employment opportunities by 5%.

Evaluation Results

Operational Performance

Exel Logistics has been gathering operational data month-by-month (based on the weekly accounting calendar) since the introduction of the centre in May 2004. The following factors have been monitored:

- Retailer Start Dates;

- Reduction in Vehicle Movements;
- Role Cage Deliveries;
- Vehicle Utilisation;
- Vehicle Kilometres Travelled;
- CO₂ and Other Vehicle Emissions; and
- On Time Delivery Performance.

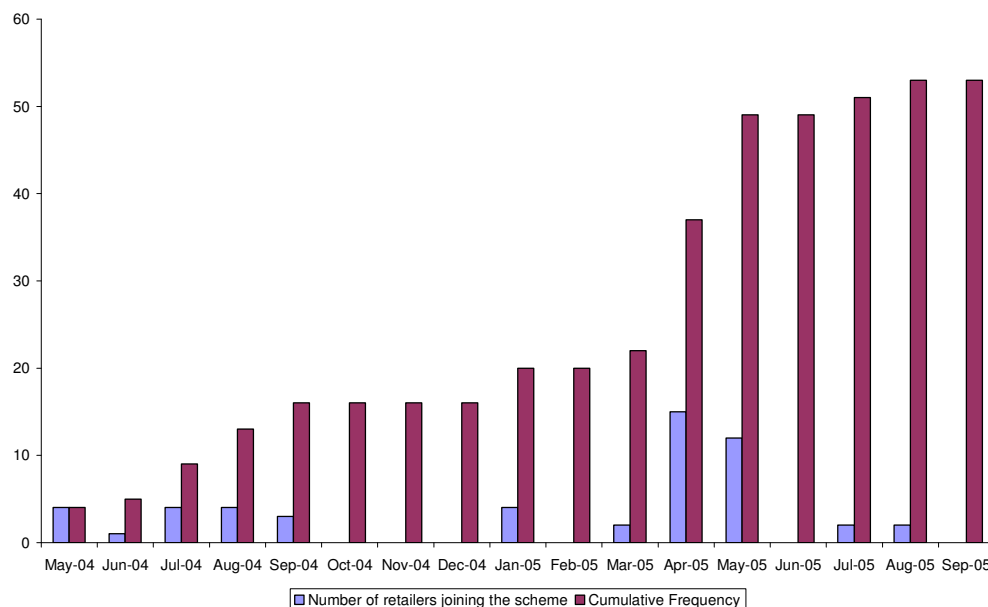
Retailer Start Dates

Since the introduction of the scheme, the number of retailers involved in the scheme has increased. Figure 2.9.9-28 that four retailers were initially involved in the scheme and that 49 additional retailers had joined the scheme by the end of August 2005. Only two retailers have dropped out of the scheme during its duration. One of these businesses closed and the other was moving out of Bristol.

The number of retailers joining the scheme is encouraging and suggests that retailers have viewed the scheme positively and that, with time, more and more retailers may become involved in the scheme. There were months during the duration of the scheme in which no retailers became involved, generally during peak trading months in the run up to Christmas or early summer. The scheme still has capacity available and will be further promoted to encourage additional retailer participation.

Monthly satisfaction surveys were distributed to retailers taking part in the scheme. In September 2005, after the scheme had had time to become established, telephone interviews were conducted with both retailers that had taken part in the consolidation scheme and retailers that had not taken part in the scheme.

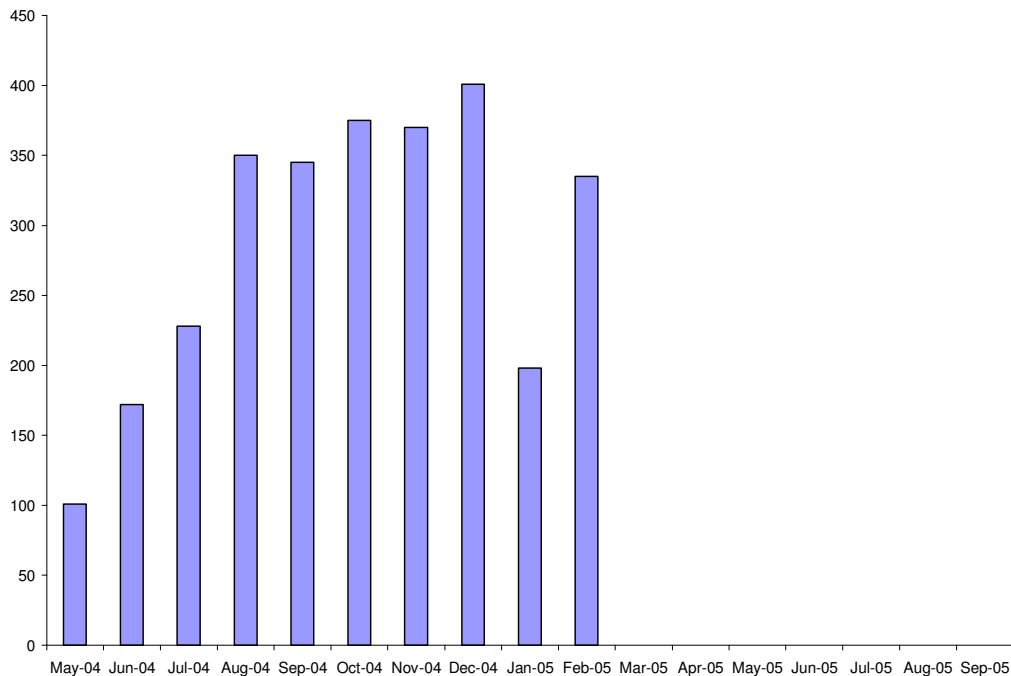
Figure 2.9.9-28 Number of retailers involved in the scheme



Roll Cage Deliveries

Throughout the duration of the scheme, the number of roll cages passing through the Freight Consolidation Centre (FCC) was monitored. Figure 2.9.9-29 shows the number of roll cages that have passed through the centre per month since the start of the scheme.

Figure 2.9.9-29 Number of Roll Cages Delivered



The number of roll cage deliveries passing through the centre per month generally increased although fluctuations are apparent. The number of cages rose from 101 in May 2004 to 401 in December which reflects both the increase in the number of retailers joining the scheme and the fact that December is the busiest time of the year for retail trade. In January 2005 the deliveries fell to 198 which can also be explained by the decrease in retail trading after the busy Christmas period, with stores concentrating on selling stock already held in the stores. A rise in the number of roll cage deliveries was then seen in February.

Unfortunately, from February onwards it has not been possible to get data for the number of roll cages broken down by month. Exel have been able confirm that between January and mid October 2005 they had delivered a total of 11,230 roll cages. Allowing for the 533 delivered in January and February, this leads to an average number delivered between March and mid-October 2005 of 1426 per month, which is a significant increase on levels in 2004, reflecting the increased numbers of retailers participating in the scheme.

Vehicle Utilisation

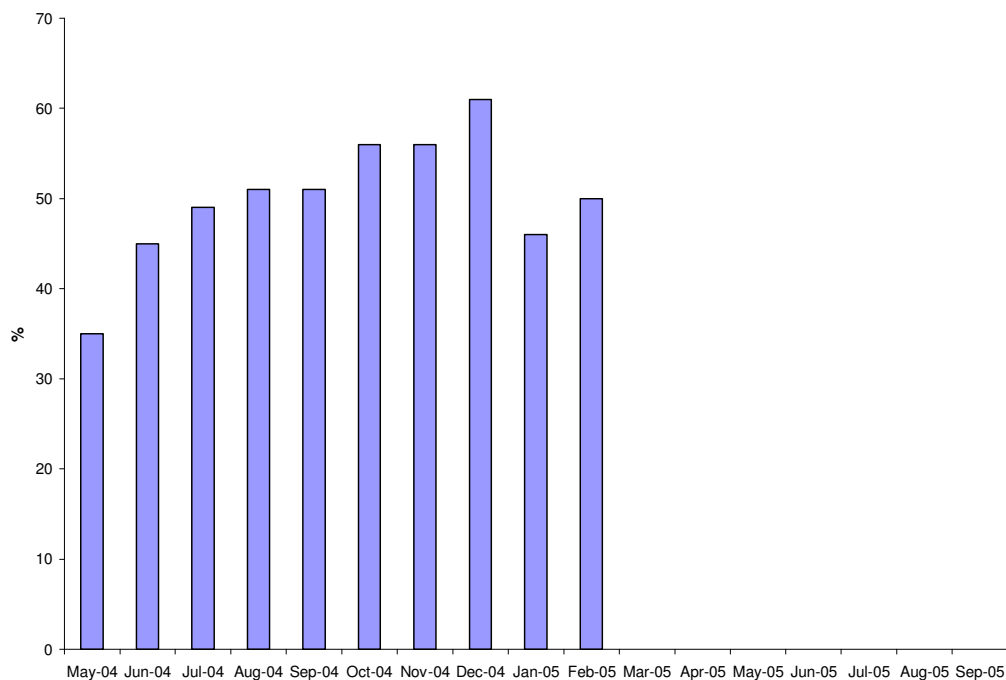
Vehicle utilisation refers to how well the available space within the vehicles travelling from the consolidation centre to the shops is utilised in terms of vehicle fill. At the

outset of the scheme it was expected that the consolidation scheme would result in increased levels of vehicle utilisation because vehicles with only part-loads destined for the centre of Bristol would deliver these part-loads to the FCC, resulting in the objectives of the scheme being met.

Figure 2.9.9-30 shows the level of vehicle utilisation month by month since the start of the scheme in 2004. At the start of the scheme the vehicle utilisation level was 35% and this figure increased each month up to 61% until December 2004. In January 2005 the level of vehicle utilisation dropped to 46%, reflecting the drop in number of roll cages passing through the centre.

Unfortunately it has not been possible to get month-by-month figures for most of 2005. It was ascertained from Exel that Vehicle Utilisation from January to mid October 2005 averaged 65%, which is a considerable improvement on the operations of the FCC in 2004. It also indicates that the vehicles still have room for further retailers to join the scheme without further additional trip generation.

Figure 2.9.9-30 Vehicle Utilisation



Reduction in Vehicle Movements

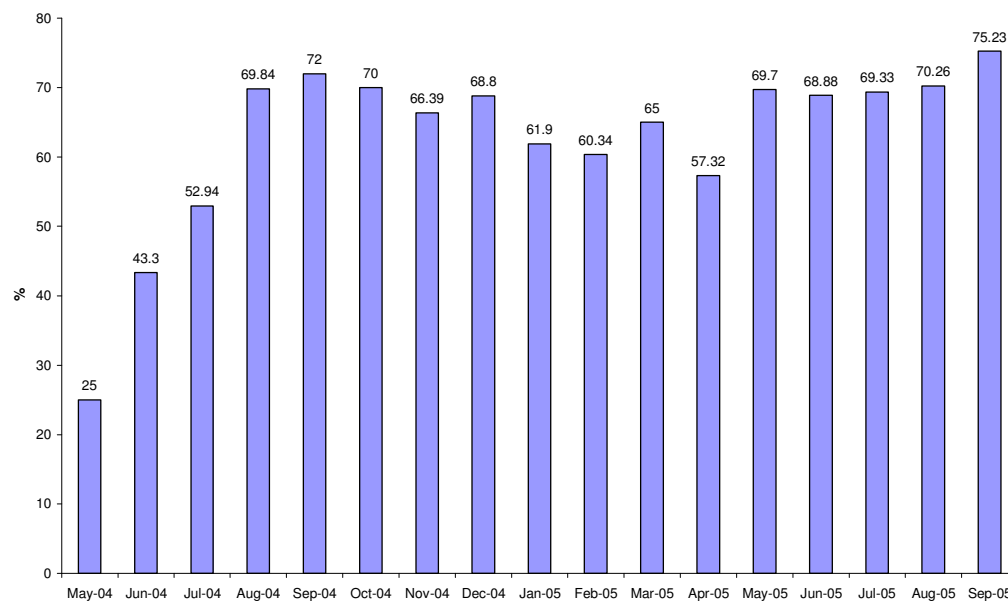
It was expected that the consolidated nature of the deliveries to and from the FCC would result in a reduction in vehicle movements in that area. The number of vehicle deliveries to the site each month was monitored as well as the total number of vehicle deliveries from the site. The percentage reduction in vehicle numbers accessing the participating stores was then calculated. (Note that if a vehicle that delivered a part-load to the consolidation centre travelled into Bristol in order to make its next delivery, then this has not been counted as a vehicle trip being removed.) Figure 2.9.9-31

presents the percentage reduction in vehicle movements in Bristol per month since May 2004.

There has been a reduction in delivery vehicle movements to participating retailers every month since the introduction of the scheme. Generally, the percentage reduction in vehicle movements has been high and from the third month of operation the percentage of vehicle reduction has remained at over 50%.

The general increase in the percentage reduction in vehicle movements is the result of the increase in the number of retailers joining the scheme, with the increased throughput allowing greater use of the available space within the dedicated consolidation centre delivery trips. The slight fluctuations in the figures will in part be explained by fluctuations in the retail trade, particularly after the busy Christmas period.

Figure 2.9.9-31 Percentage Reduction in Vehicle Movements



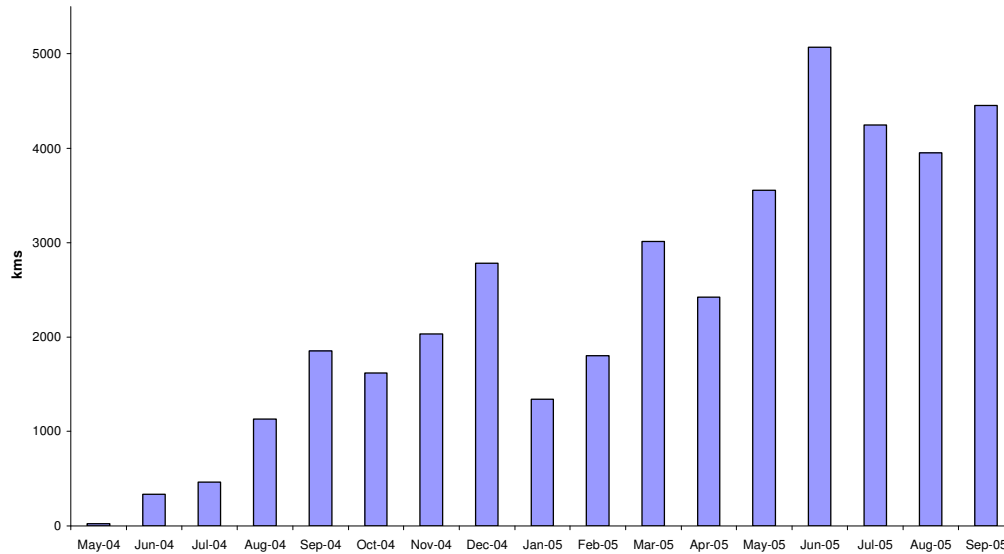
Vehicle Km Travelled

As well as the consolidated nature of the deliveries to and from Bristol Consolidation Centre resulting in a reduction in vehicle movements it was expected that there would be an impact on vehicle kilometres travelled. Figure 2.9.9-31 presents data on the total reduction of kilometres travelled from May 2004 up until September 2005.

A reduction in vehicle kilometres travelled is evident every month since the start of the scheme and this reduction has remained at over 1000 kilometres per month since June 2004. In December 2004 the total reduction in miles travelled was nearly double that seen in August 2004, which reflects the greater throughput and consolidation achieved in this busy period, with more deliveries being made. From June 2005 to September 2005 the extent of the reduction in kilometres travelled reduced which may be in line with general retail sales trends with summer being a slow season and this being a

particularly slow year. The results generally mirror the reduction in vehicle movements that would be expected.

Figure 2.9.9-32 Total Reduction in Kilometres Travelled



Reduction in CO₂ and Other Emissions

It was expected that the FCC would have an impact on the vehicle kilometres travelled and that there would be a consequent saving in vehicle emissions, both those affecting the global environment (CO₂) and those affecting the local environment (NO_x and Particulate Matter). A reduction in these emissions has been seen and the extent of that reduction has mirrored that of the reduction in kilometres travelled.

Reduction in CO₂

Figure 2.9.9-33 Total kg of CO₂

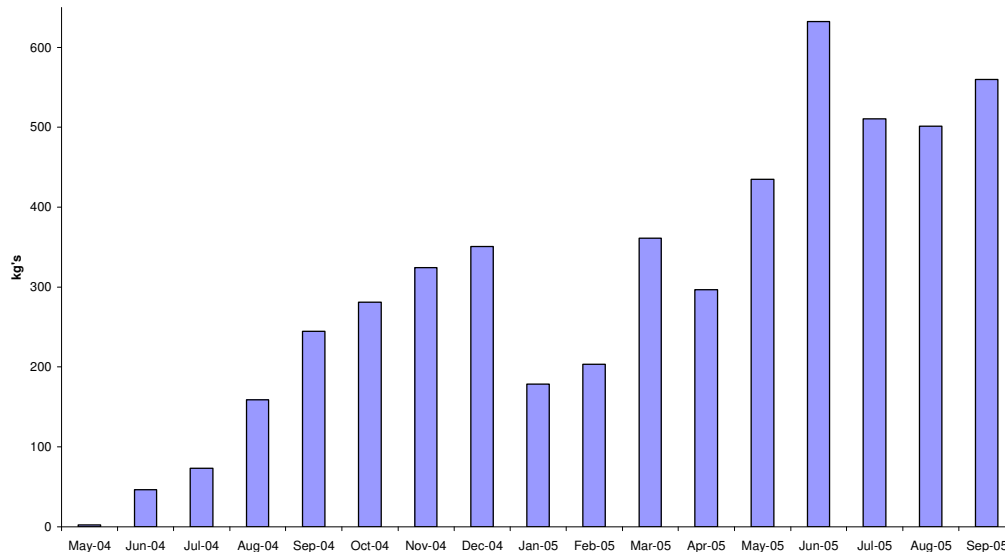
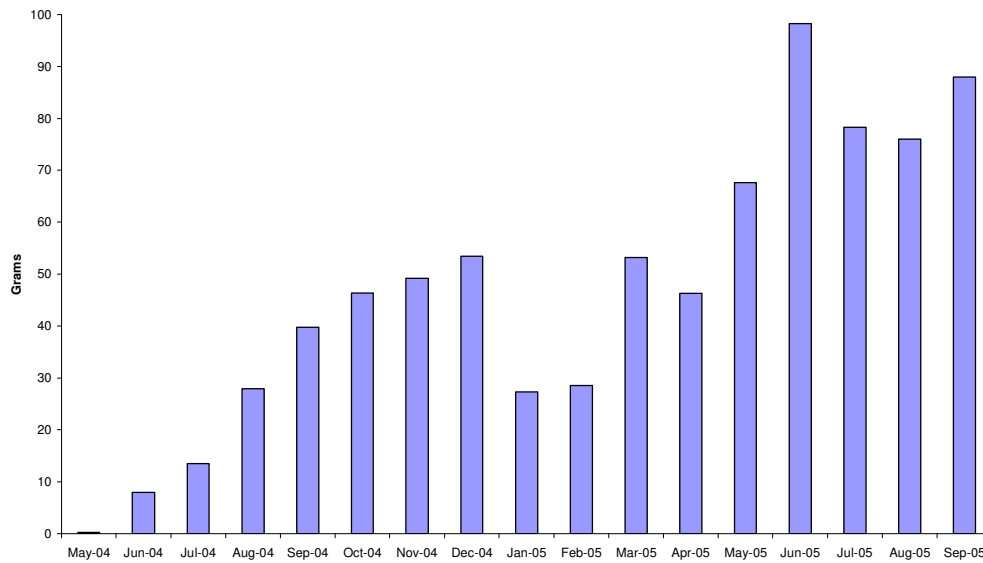


Figure 2.9.9-33 shows the reduction in carbon dioxide (CO₂) from May 2004 to September 2005 derived from the reduction in delivery vehicle kilometres as a result of the scheme. After July 2004 the reduction in CO₂ was at least 150 kg each month.

Reduction in NO_x

Figure 2.9.9-34 shows the reduction in NO_x from May 2004 to September 2005 derived from the reduction in delivery vehicles kilometres as a result of the scheme. After July 2004 the total period reduction in NO_x remained above 25 grams each month.

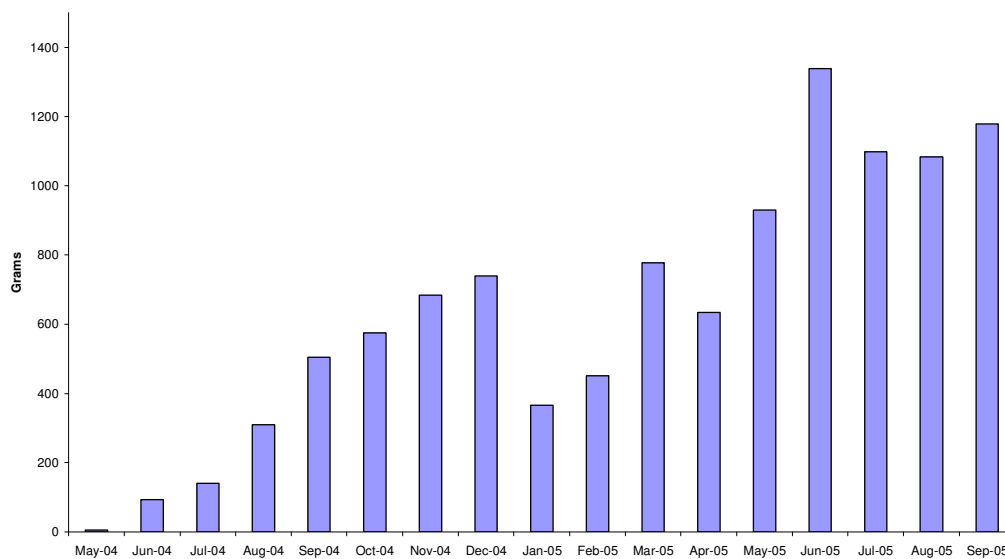
Figure 2.9.9-34 Total period reductions in NO_x



Reduction in PM_{10s}

Figure 2.9.9-35 shows the reduction in Particulate Matter (PM_{10s}) from May 2004 to September 2005 derived from the reduction in delivery vehicle kilometres as a result of the scheme. After July 2004 the total period reduction in PM_{10s} has remained above 300 grams every month.

Figure 2.9.9-35 Total period reductions in PM₁₀



User Satisfaction

It is important that the Consolidation Centre scheme is viewed positively by all stakeholders as well as making the delivery of freight more sustainable. The views of

these stakeholders should be considered in order to maximise the effectiveness of the scheme.

In order to evaluate how well the scheme has been received by retailers, surveys and interviews were conducted with those involved in the scheme. The logistic company managing the centre, Exel, continuously monitored retailer satisfaction with the scheme and their attitudes, opinions and experiences of using it. Monthly satisfaction surveys were distributed to retailers taking part in the scheme. After the scheme had had time to become established, telephone interviews were conducted with both retailers that had taken part in the consolidation scheme and retailers that had not taken part in the scheme.

To identify whether efficiency had improved over the course of the scheme, comparisons were made between retailers surveyed before the introduction of the centre and after. In 2003, a retailer survey was undertaken, in which 119 retailers in Broadmead were contacted before the introduction of the FCC in order to assess their current delivery situation. The results of this survey are the basis for comparison.

Monthly Satisfaction Surveys

Retailers that were involved in the Consolidation Centre scheme were asked 14 questions on a monthly basis regarding their deliveries and the consolidation centre suppliers. A total of 9 retailers completed the monthly satisfaction survey in September 2005.

Table 2.9.9-14 Delivery Satisfaction

	Yes		No		Total	
	Frequency	%	Frequency	%	Frequency	%
Were deliveries made on time?	9	100	0	0	9	100
Were deliveries put in the correct place?	9	100	0	0	9	100
Have there been any discrepancies?	9	100	0	0	9	100
Have there been any damages?	9	100	0	0	9	100

All of those retailers that responded to the monthly satisfaction survey thought that deliveries were made in time and were put in the correct place. Discrepancies or damages to deliveries had not been experienced by any of these retailers (Table 2.9.9-14).

Satisfaction with the distribution company Exel

All retailers felt that the FCC delivery team had left the delivery area clean and tidy and, for those retailers that had items collected by the centre, all felt that they had been taken at the correct time. All retailers also felt that the delivery team had responded courteously and, of those retailers that had their recycling collected, all felt that items had been collected promptly. Of those that had received monthly reports, all had felt that these reports had provided them with enough information and no retailers felt that they required any additional support from Exel (Table 2.9.9-15).

Table 2.9.9-15 Satisfaction with suppliers

	Yes		No		Total	
	Frequency	%	Frequency	%	Frequency	%
Did the team leave the delivery area clean and tidy?	9	100	0	0	9	100
Were items for collection taken at the correct time?	8	100	0	0	8	100
Have the team responded courteously?	9	100	0	0	9	100
Have items for recycling been collected promptly?	3	100	0	0	3	100
Are the monthly reports giving you enough information?	4	100	0	0	4	100
Is there any other support we can provide?	9	100	0	0	9	100

We recognise that this is a small sample and is ‘self-selecting’ but would argue that any retailers who had experienced difficulties would be most likely to voice concerns as part of such a survey, leading to a tentative conclusion that service levels are judged extremely positively.

Interviews

Interviews were conducted with the store managers of some retailers that were involved in the scheme and some that were not involved in the scheme. It should be recognised that the retail sector is a busy working environment and it is difficult to get store managers to spare their time for such surveys, particularly those who are not participating in the scheme. Of those retailers that were contacted, 7 interviews were conducted with those that were involved in the scheme and 4 with those that were not involved in the scheme.

Duration of Deliveries

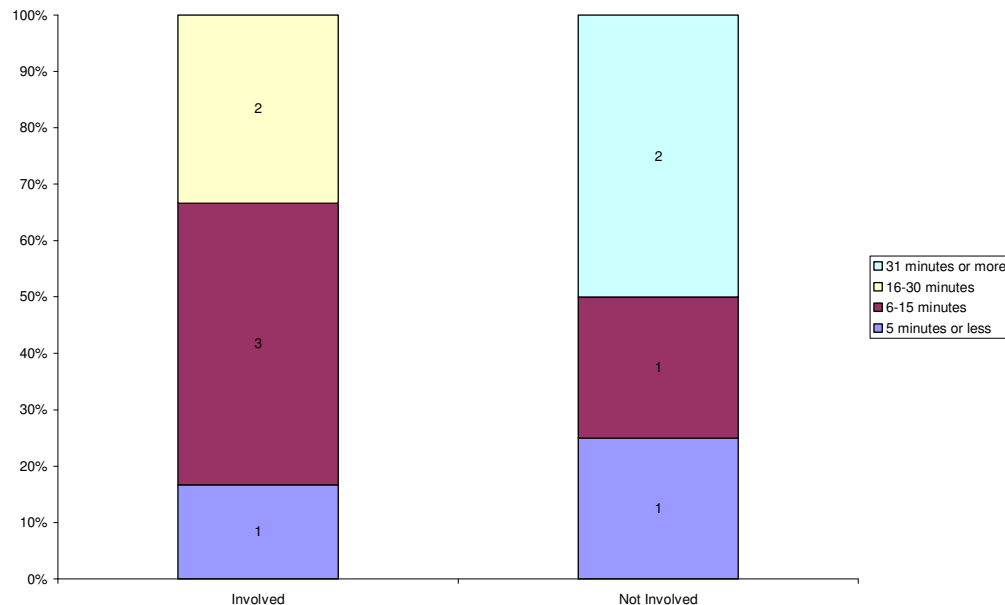
Retailers were asked how long on average they thought deliveries took at their premises.

The majority of retailers that were involved in the scheme took less than 15 minutes to deal with their deliveries. No retailer took more than 30 minutes to deal with their deliveries. Of those that were not involved in the scheme, half took over 30 minutes to deal with their deliveries and half less than 30 minutes (Table 2.9.9-16 and Figure 2.9.9-36).

Table 2.9.9-16 How long on average do deliveries take at your premises?

	Involved		Not Involved	
	Frequency	%	Frequency	%
5 minutes or less	1	14.3	1	25
6-15 minutes	3	42.9	1	25
16-30 minutes	2	28.6	0	0
31 minutes or more	0	0	2	50
Other	1	14.3	0	0
Total	7	100.1	4	100

This observation suggests that delivery times are generally shorter for those retailers that are involved in the consolidation scheme although only a small amount of retailers were interviewed so caution should be taken in the interpretation of these results.

Figure 2.9.9-36 How long on average do deliveries take at your premises?


When retailers were asked whether they thought deliveries took longer or were shorter than before the start of the scheme, nearly half of those retailers that were involved in the scheme thought that delivery times were shorter and nearly half did not know whether delivery times were longer or shorter. Of those retailers that did not know, the store managers were all recent recruits to their store and therefore were not in the position to make comparisons. No retailers thought that their deliveries took longer in duration than before the start of the scheme. Those retailers that were interviewed and did not take part in the scheme were not able to confirm whether deliveries were longer or shorter than before the scheme started, indicating that any secondary effects of the consolidation scheme and any effects on delivery times due to other changes in the area are minimal.

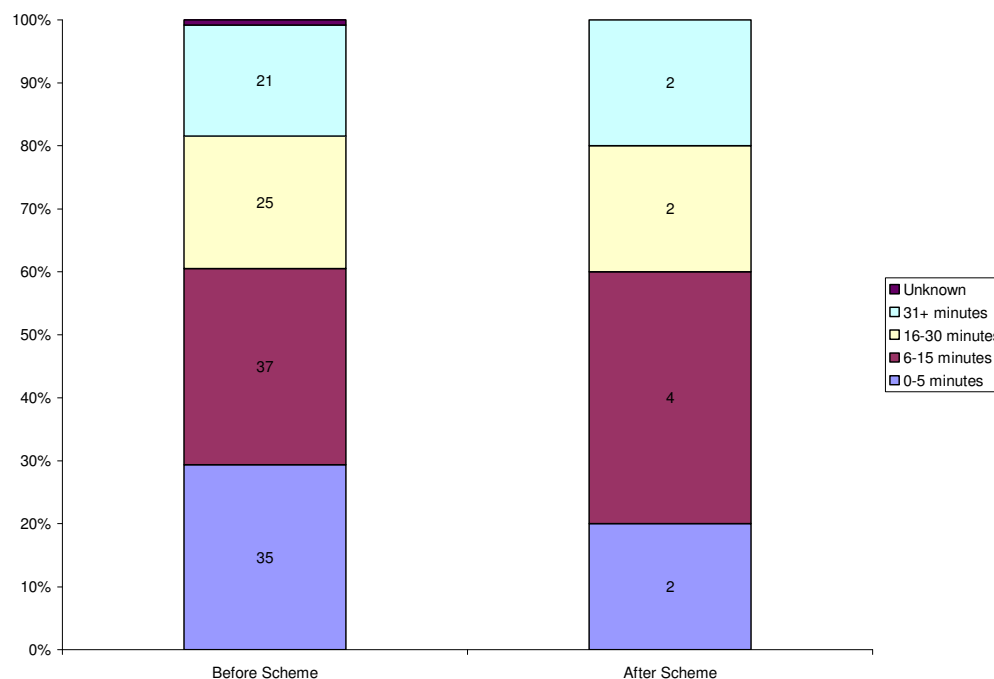
Comparisons between ‘before’ and ‘after’ data

Before the scheme, retailers were asked how long their deliveries took at their premises. When this was compared to those retailers surveyed after the scheme had been introduced (including those that were not involved in the scheme), there appeared to be no key changes in delivery duration (Figure 2.9.9-37 and Table 2.9.9-17) although it is difficult to make accurate comparisons due to the large differences in sample size.

Table 2.9.9-17 How long on average do deliveries take at your premises?

	Before Scheme		After Scheme	
	Frequency	%	Frequency	%
5 minutes or less	35	29	2	20
6-15 minutes	37	31	4	40
16-30 minutes	25	21	2	20
31 minutes or more	21	18	2	20
Unknown	1	1	0	0
Total	119	100	10	100

Figure 2.9.9-37 How long on average do deliveries take at your premises?



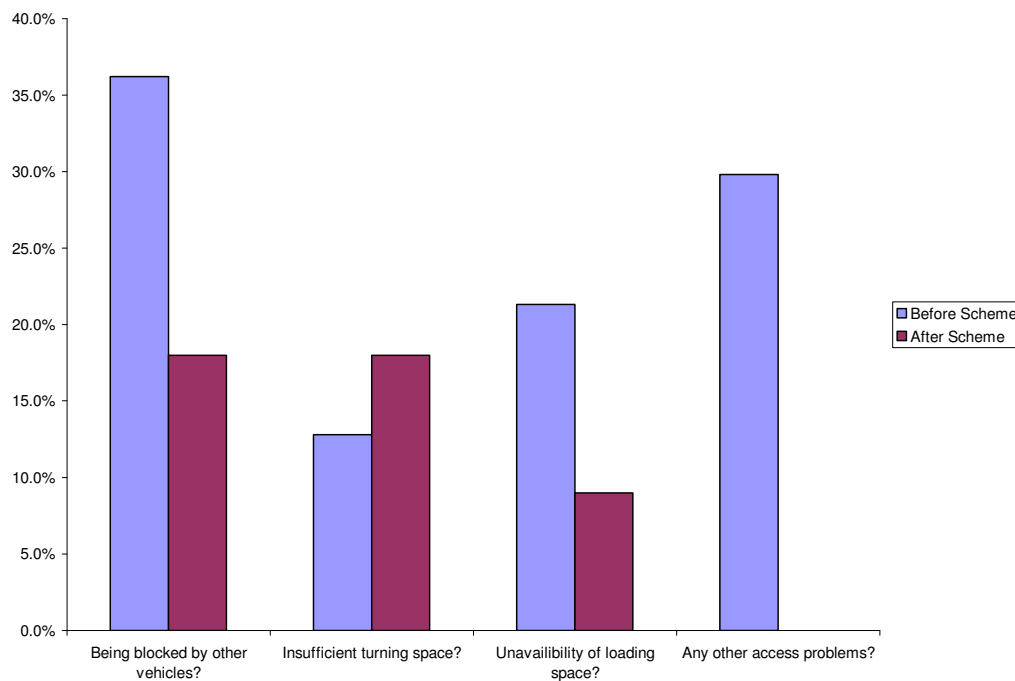
Access for vehicles making deliveries

Of those retailers that were involved in the scheme, only one retailer reported access problems with regards to being blocked by other vehicles and insufficient turning space. No retailers reported any problems with unavailability of unloading space or reported any other access problems. Of those retailers that had not been involved in the scheme, the same number reported problems with being blocked by other vehicles and insufficient turning space. One retailer also reported a problem with regards to unavailability of unloading space. No other access problems were reported (Table 2.9.9-18). These results suggest that there have been no key changes in the amount and type of access problems experiences since the introduction of the scheme.

Table 2.9.9-18 Access Problems

Access Problems	Frequency	
	Retailers Involved in Consolidation Scheme	Retailers not Involved in Consolidation Scheme
No access problems	5	3
- Insufficient Turning Space	1	0
- Unavailability of unloading space	0	0
- Being blocked by other vehicles	1	0
Insufficient Turning Space and Unavailability of unloading space and Being blocked by other vehicles all a problem	0	1

A comparisons between ‘before’ and ‘after’ data shows that 47 out of 119 retailers (39.5%) reported access problems at their premises before the scheme was introduced and 3 out of 11 retailers (27.3%) reported access problems after the introduction of the scheme.

Figure 2.9.9-38 Access Problems


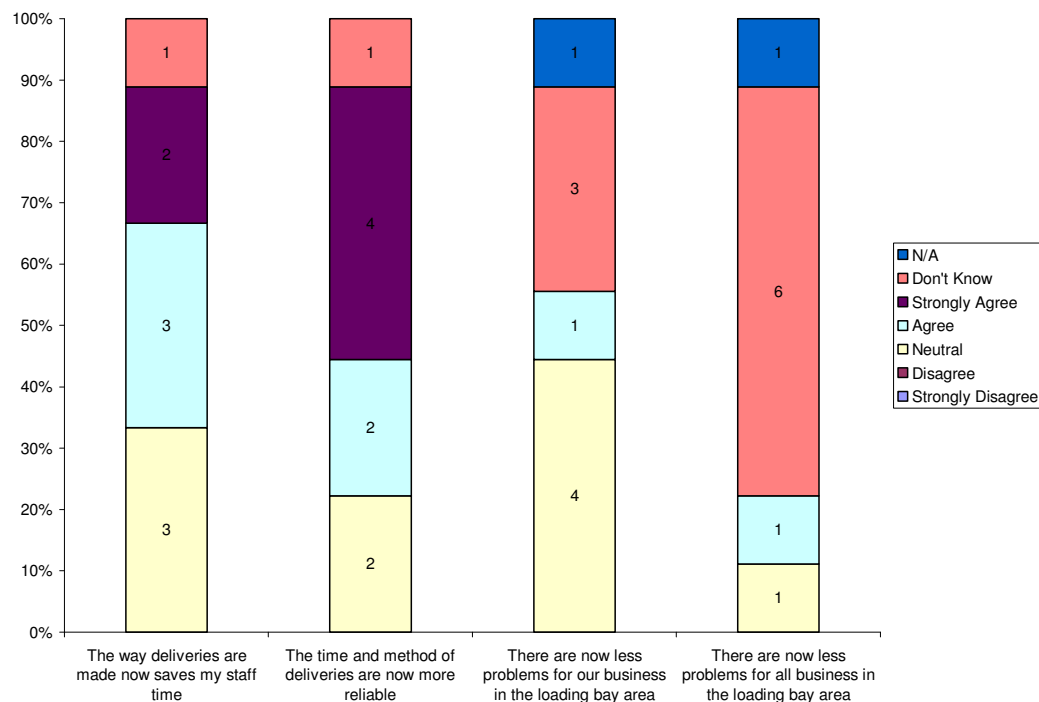
After the implementation of the consolidation scheme, a lower number of retailers reported being blocked by other vehicles and having insufficient turning space than before (Figure 2.9.9-38). Fewer retailers reported problems with regards to unavailability of unloading space after the centre had been introduced and no retailers reported any other access problems. Due to the large differences in sample sizes, it is difficult to make comparison between the ‘before’ and ‘after’ data.

Deliveries

Those retailers involved in the scheme and those not involved were asked to consider the situation before the FCC opened, compared to the situation after its introduction, with regards to deliveries. Figure 2.9.9-39 shows the ease of deliveries compared to the situation before the FCC for those involved.

The majority of those involved in the scheme agreed that the way in which deliveries are made now saves their staff time and that the time and method of deliveries was now more reliable. With regards to whether there were fewer problems in their loading bay, the majority of participating retailers either did not know whether there were fewer problems or gave a neutral opinion. The majority of these retailers did not know whether there were now fewer problems for all businesses in the loading bay area.

Figure 2.9.9-39 Ease of deliveries compared to the situation before the consolidation centre for those involved



Of those retailers that were not involved in the scheme, half disagreed that there were now fewer problems for their business and for all other businesses in the loading bay area and half of the retailers interviewed did not know.

Feelings and experiences of using/not using the freight consolidation centre

All retailers were asked to provide a brief statement that summarised their feelings for and experiences of using or not using the freight consolidation centre.

Retailers not involved in the scheme:

A sportswear company that was not involved in the consolidation scheme thought that the scheme was ‘a great idea’ and that they could see the advantages of the centre and that it would be ‘beneficial if it worked’. They thought that the scheme would benefit those retailers that have regular delivery days and that it would only benefit them ‘if had more shops/deliveries’. They thought that there would be difficulties for the consolidation centre particularly at the busiest times of the year for retailers: ‘won’t be easy to do...at busiest time of year when stores are expecting deliveries everyday, it would be really tight...difficult for consolidation centre to cope with’.

A house and home company that was not involved in the scheme thought that the scheme was a ‘very good idea’ but thought that it would not work for them and an outdoor leisure pursuits store that was not involved in the scheme commented that the scheme was ‘quite a good idea’ and asked to be provided with information on the scheme. A fashion and clothing store that was not involved thought that ‘for an individual retailer....’ the scheme was a ‘...brilliant idea’ and was positive about the idea of receiving ‘one big delivery rather than lots of small ones’. It was felt however that ‘for multiple retailers’ the scheme was ‘.....not so good’ as they were receiving individual deliveries anyway. It was also thought that there may be a ‘...problem if all deliveries haven’t been made’ to the consolidation centre prior to the delivery leaving the consolidation centre for the shop.

Retailers that were involved in the scheme:

Of those retailers that were involved in the scheme, many of those that were interviewed provided comments. A health and beauty company thought that the delivery team were ‘incredibly helpful’ and ‘always polite and friendly’ and went as far as to say that scheme was the ‘best thing that ever happened to us as far as deliveries are concerned’. They commented that ‘everyone should use the centre’ and it was ‘all good’. No negative comments were provided. A fashion and clothing company stated that ‘Everything’s fine’ with the scheme and a footwear company also stated that ‘it’s all fine’ when asked to comment on the scheme.

A gift and entertainment store had ‘no dislikes’ and ‘no problem at all’ when asked for their opinion of the scheme and thought the scheme was ‘very good’ and that the delivery team was ‘courteous and well mannered’. A fashion and clothing store for women commented that they like the scheme the way it is and, from speaking to others, commented that deliveries were ‘a lot better, quicker, more organised’. A fashion and clothing store for children stated that deliveries were ‘pretty prompt’, ‘always on time’ and that the ‘system seems to be working’. Out of line with the majority of comments made, a fashion and clothing store stated that the scheme made ‘no difference whatsoever’, was ‘not better, not worse’ and that they ‘never had problems before’ they became involved in the scheme.

Would recommend the consolidation centre to others?

Of those that took part in the scheme, two thirds thought that they would recommend that other retailers join the scheme and none would advise against it. Those that had not taken part in the scheme did not feel that they could comment on this issue.

Table 2.9.9-19 Would you recommend to others?

	Yes		Not Sure		Total	
	Frequency	%	Frequency	%	Frequency	%
Would recommend consolidation centre to others?	4	66.7	2	33.3	6	100

Staff working

Half of those that took part in the scheme felt that their involvement had changed the way in which their staff work and half felt that it had not (Table 2.9.9-20). Those that thought it had improved the way in which their staff work commented that staff hours could now be determined. It was also felt that because the ‘delivery times were guaranteed’, the staff worked shorter hours which one retailer claimed had ‘cut the wage bill down’. Another retailer also thought that it had helped avoid staff injuries because staff no longer had to carry the stock up to the stock room. Not surprisingly, those that had not taken part in the scheme did not comment.

Table 2.9.9-20 Way of Staff Working

	Yes		No		Total	
	Frequency	%	Frequency	%	Frequency	%
Has your involvement in the scheme changed the way your staff works?	3	50	3	50	6	100

Conclusions

A total of 53 retailers have taken part in the Freight Consolidation Scheme in Bristol since its introduction in May 2004, with the number of retailers increasing throughout the duration of the scheme.

It is clear that the consolidation achieved by the centre has had an impact on a number of factors that have been monitored over the course of the scheme. It has resulted in:

- Reduction in vehicle movements;
- Reduction in vehicle kilometres travelled;
- Reduction in vehicle emissions;
- An increased level of roll cages passing through the centre; and
- An increase in vehicle utilisation.

Although the extent of these effects has fluctuated during the scheme due to external factors such as time of year in the retail industry and the number of retailers joining the scheme, the consolidation centre appears to have made a positive impact in terms of making the delivery of freight more sustainable.

The results of the initial phase of the scheme were so positive that Bristol City Council decided to extend the duration of the scheme. It is expected that as the number of retailers joining the scheme increases the greater the benefits demonstrated by the scheme will become. Because the consolidation centre allows better control of vehicle movements, it is thought that other benefits will be seen as a result of the scheme such

as an easing of congestion in the target areas, a reduction of noise pollution in the area and an improvement of air quality. Unfortunately, the remit of the study has not been extended to allow an investigation of these wider benefits at this time.

As well as making the delivery of freight more sustainable it is important that the Freight Consolidation Centre was well accepted by stakeholders. Interviews and surveys were conducted with retailers that were involved in the scheme and retailers that were not involved in the scheme in order to gain knowledge on how successful the scheme had been in terms of satisfaction and efficiency.

All of those retailers that took part in the scheme and completed the satisfaction survey in September 2005 were happy with the deliveries to their premises and the distribution company, Exel. All deliveries were made on time and put in the correct place and there were no discrepancies or damages reported. All retailers thought that the delivery room was kept clean and tidy, that all items for collection were taken at the correct time and that the delivery team responded courteously and promptly. They also thought that the monthly reports had provided them with enough information and required no other support from Exel.

When comparing the change in the duration of deliveries for all retailers before the introduction of the scheme and after (those involved in the scheme and those not involved), no significant changes were apparent. However, none of the retailers that took part in the scheme thought that deliveries took longer than before their involvement. A slight decrease in the duration of deliveries was seen when comparing those that were involved and those that were not involved in the scheme after the scheme had become established.

Slight changes in the number and type of access problems experienced by retailers since the introduction of the FCC were evident with more problems being reported with regards to being blocked by other vehicles and insufficient turning space but less problems being reported with regards to unavailability of unloading space and other access problems. Small sample sizes may explain this finding. When comparing the access problems for those involved in the scheme and those not involved in the scheme after the centre had been established, the results are more positive.

The majority of those retailers that were involved in the scheme thought that the way deliveries were made now saved their staff time and that the time and method of deliveries are now more reliable. The majority of retailers involved and not involved in the scheme did not report that there were more or fewer problems in the loading bay area. Although the scheme has not resulted in fewer problems in the loading bay area, it is evident that it has not resulted in more problems.

Retailers were invited to give comments regarding their feelings and experiences of using or not using the consolidation centre and a number of comments were provided. Most of these comments were positive. Those retailers that had not taken part in the scheme provided positive comments when the scheme was explained to them. Many of these retailers were not involved because they did not think the scheme would 'work for them'. One retailer asked to be sent literature regarding the scheme in order to discuss the possibility of getting involved with their head office. Of those that were involved in the scheme, there were no negative feelings and experiences reported.

A small number of retailers were surveyed before the FCC had time to become established so their views should be analysed with caution. Nonetheless, this user analysis has given an indication of what retailers thought of the scheme and no major problems with the scheme have been reported. The main benefits of the consolidation scheme for retailers seem to be the subsequent improvements in staff time and delivery reliability.

2.9.9.5 Bristol – Freight loading and signing (10.2)

Measure Overview

A necessary precursor to the implementation of a City Logistics scheme (see 10.1) is an understanding of the road network pertaining to freight and the current pattern of commercial vehicle movements. The City Council commenced a review of the road hierarchy and the audit process for on-street signing infrastructure. This review enabled a Commercial Vehicle Drivers' Atlas to be produced to help drivers of freight vehicles find the most appropriate routes for deliveries to business parks and other key destinations in the City (and included details of height and weight restrictions). In addition 6 Variable Message signs have been introduced, 5 fixed and 1 mobile, to encourage freight and other vehicles to use the most suitable routes and advise of diversions during roadworks, incidents and events. The works under this measure as set out at inception included:

- Examination of road network and allocation of primary routes; and
- Installation of signage specifically for goods vehicles (both static and VMS) alongside complementary loading measures.

The measure is part of the Clear Zone integrated package that has the following objectives:

- VT4 – Reduce car traffic in a managed area by 10%;
- VT16 – Reduce lorry movements in a target area by 5%;
- VT20 – to introduce travel plans in all organisations in a targeted area;
- VT7 – Reduce parking space in the area by 10%;
- VT2 – Reduce energy use and CO₂ by 8% in the demonstration area;
- VT3 – Meet national air quality objectives;
- VT5 – Increase economic activity in the area by 5%; and
- VT6 – Increase employment opportunities by 5%.

Evaluation Results

The Commercial Vehicle Drivers' Atlas

The evaluation team recommended that a record was kept of distributed copies together with details of any feedback received on the Commercial Vehicle Drivers' Atlas. In total 5,000 copies of the Atlas were printed and all have been distributed free of charge.

The measure Implementation Manager reported that all responses received regarding the document were favourable, including some from haulage companies that were located outside the Bristol area. These included one from Shetlands, and another from

Yorkshire requesting the team to produce a version for the UK city of Leeds. Particular praise was received for the lorry-route network, and for the comprehensive listing and mapping of trading estates and industrial sites in the Bristol area.

This information has also been used to inform the South West Region who are preparing a draft lorry-route network in preparation for the South West local authorities transport officers' forum allied to the South West Assembly.

The UK Department for Transport (DfT) regard the atlas as a model to be adopted at a national level. The document was also highly praised by the UK Road Haulage Association, who are in favour of the production of an electronic version of the Atlas that would be available on the Internet. The UK West Midlands area has now adopted the format produced for Bristol.

Traffic Information VMS

The VMS were first used in August 2005. It was established that a full assessment of diverted traffic would not be possible due to time and resource constraints. Therefore the operators made a log of the utilisation of the signs. It was also agreed that a process interview would be held for this measure.

Utilisation data was provided for the period 26 September 2005 to 26 October 2005. The information provided showed the date and time of messages that were shown on the VMS signs over the above period. The duration of time that each message was displayed was not available.

Information for the period 1 August to 25 September was not available due to limitations on the utilisation log database which only could contains a months worth of information at a time.

A process interview to discuss the implementation of the signs was conducted in September 2005.

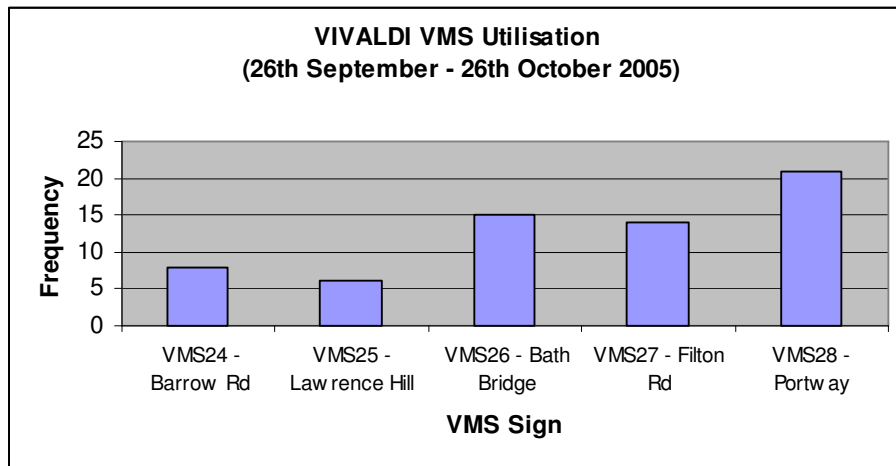
Five VMS signs were installed at strategic locations within the VIVALDI area, see Table 2.9.9-21.

Table 2.9.9-21 VIVALDI VMS

VMS Ref	VMS Location
VMS24	Barrow Rd
VMS25	Lawrence Hill
VMS26	Bath Bridge
VMS27	Filton Rd
VMS28	Portway

VMS Utilisation

In total the VMS signs were activated 64 times over the evaluation period. Figure 2.9.9-40 shows the number of times each sign was activated over the period and shows that the most activated sign in the period was VMS28 located on the Portway.

Figure 2.9.9-40 VIVALDI VMS Utilisation


For the purpose of this analysis the messages displayed have been split into the following categories shown in Table 2.9.9-22.

Table 2.9.9-22 VMS Message Categories

Message Category	Example
Traffic Information	CITY CENTRE CLOSED
Weather/Road Conditions Warning	CAUTION FOG
Advanced Traffic Information	A4 PORTWAY CLOSED ON 16/10/2005
Public Transport Information	PARK & RIDE OPEN
Courtesy Information	WELCOME TO BRISTOL

Figure 2.9.9-41 shows the message types that were displayed during the evaluation period. The results show that the majority of messages shown on the signs were to advise drivers of traffic incidents ahead.

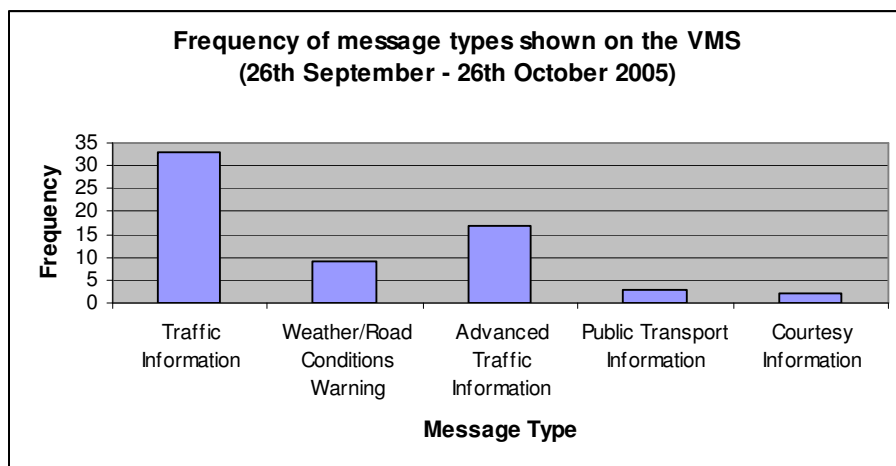
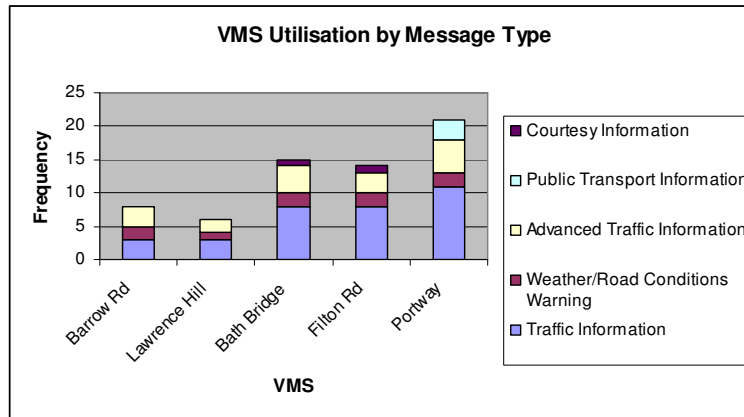
Figure 2.9.9-41 Information displayed on the VIVALDI VMS


Figure 2.9.9-42 provides information on the type of message that was displayed at each of the VIVALDI VMS locations.

Figure 2.9.9-42 Message types shown at each of the VMS locations



The data provided for the evaluation period suggests that the VMS have been used strategically for 26 incidents/events in the city, see Table 2.9.9-23. For many of these events a combination of VMS have been used to inform and manage the traffic entering the city. Figure 2.9.9-43 shows the number of VMS signs that have been activated for each incident. The graph shows that for the majority of incidents only 1 sign is required to warn drivers of problems ahead or expected delays in the future and all signs have been used to warn drivers of an incident in the City on 5 occasions.

Figure 2.9.9-43 Number of VMS activated for each event

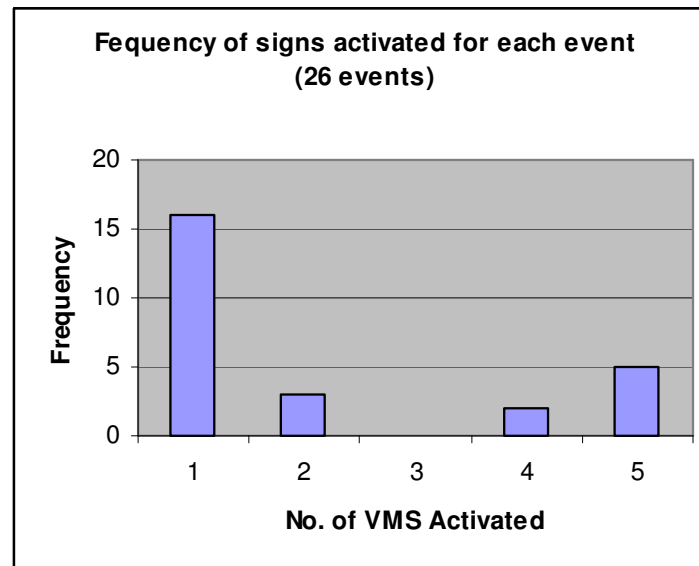


Table 2.9.9-23 Incidents/Events during the period 26th September – 26th October 2005

Incident	Date	Sign	Message	Message Type	No of Signs
1	27/09/2005	VMS26 - Bath Bridge VMS28 - Portway	ROAD WORKS HOTWELLS RD EXPECT DELAYS	Traffic Information	2
2	27/09/2005	VMS27 - Filton Rd	ROAD WORKS KELLAWAY AVE EXPECT DELAYS	Traffic Information	1
3	27/09/2005	VMS28 - Portway	LANE CLOSURE A4 PORTWAY	Traffic Information	1
4	28/09/2005	VMS27 - Filton Rd	ROAD WORKS HOTWELLS RD EXPECT DELAYS	Traffic Information	1
5	29/09/2005	VMS27 - Filton Rd	ROAD WORKS KELLAWAY AVE EXPECT DELAYS	Traffic Information	1
6	03/10/2005	VMS24 - Barrow Rd VMS25 - Lawrence Hill VMS26 - Bath Bridge VMS27 - Filton Rd VMS28 - Portway	CITY CENTRE CLOSED	Traffic Information	5
7	03/10/2005	VMS28 - Portway	LANE CLOSURE A4 PORTWAY	Traffic Information	1
8	04/10/2005	VMS28 - Portway	LANE CLOSURE A4 PORTWAY	Traffic Information	1
9	04/10/2005	VMS28 - Portway	ROAD WORKS HOTWELLS RD EXPECT DELAYS	Traffic Information	1
10	05/10/2005	VMS24 - Barrow Rd VMS25 - Lawrence Hill VMS26 - Bath Bridge VMS27 - Filton Rd VMS28 - Portway	CAUTION FOG	Weather/Road Conditions Warning	5
11	05/10/2005	VMS28 - Portway	PARK & RIDE OPEN	Public Transport Information	1
12	05/10/2005	VMS28 - Portway	ROAD WORKS HOTWELLS RD EXPECT DELAYS	Traffic Information	1
13	07/10/2005	VMS26 - Bath Bridge	ROAD WORKS HOTWELLS RD EXPECT DELAYS	Traffic Information	1
14	10/10/2005	VMS24 - Barrow Rd VMS25 - Lawrence Hill VMS26 - Bath Bridge VMS27 - Filton Rd VMS28 - Portway	A4 PORTWAY CLOSED ON 16/10/2005	Advanced Traffic Information	5
15	11/10/2005	VMS28 - Portway	A4 PORTWAY CLOSED ON 16/10/2005	Advanced Traffic Information	1
16	12/10/2005	VMS24 - Barrow Rd VMS26 - Bath Bridge VMS27 - Filton Rd VMS28 - Portway	CAUTION SKID RISK	Weather/Road Conditions Warning	4
17	12/10/2005	VMS24 - Barrow Rd VMS26 - Bath Bridge VMS27 - Filton Rd VMS28 - Portway	A4 PORTWAY CLOSED ON 16/10/2005	Advanced Traffic Information	4
18	13/10/2005	VMS24 - Barrow Rd VMS25 - Lawrence Hill VMS26 - Bath Bridge VMS27 - Filton Rd VMS28 - Portway	AVOID CITY CENTRE LONG DELAYS	Traffic Information	5
19	13/10/2005	VMS24 - Barrow Rd VMS25 - Lawrence Hill VMS26 - Bath Bridge VMS27 - Filton Rd VMS28 - Portway	A4 PORTWAY CLOSED ON 16/10/2005	Advanced Traffic Information	5
20	13/10/2005	VMS28 - Portway	PARK & RIDE OPEN	Public Transport Information	1
21	16/10/2005	VMS27 - Filton Rd VMS28 - Portway	A4 PORTWAY CLOSED FOLLOW DIVERSION	Traffic Information	2
22	18/10/2005	VMS26 - Bath Bridge VMS27 - Filton Rd	WELCOME TO BRISTOL	Courtesy Information	2
23	23/10/2005	VMS26 - Bath Bridge	CONTRAFLOW HOTWELL ROAD FROM 24TH OCTOBER 2005	Advanced Traffic Information	1
24	24/10/2005	VMS26 - Bath Bridge	CONTRAFLOW IN OPERATION HOTWELL ROAD EXPECT DELA	Traffic Information	1
25	25/10/2005	VMS26 - Bath Bridge	CONTRAFLOW IN OPERATION HOTWELL ROAD EXPECT DELA	Traffic Information	1
26	26/10/2005	VMS26 - Bath Bridge	CONTRAFLOW IN OPERATION HOTWELL ROAD EXPECT DELA	Traffic Information	1

Mobile VMS Unit

The mobile VMS unit is awaiting Type Approval from the Highways Agency before it can be used on the transport network. It has therefore not been possible to produce any utilisation figures for this measure. Barriers and drivers for the delivery of this measure were discussed in a process interview.

Conclusions

The production of the Commercial Vehicle Drivers' Atlas has proved to be a success as all produced copies have been distributed and it has received positive feedback. The Atlas has also drawn attention from the National Department for Transport and is likely to be used as a benchmark for the production of similar documents in other UK towns

and cities. The team are currently exploring the options of producing an electronic version of the atlas for wider circulation.

The results achieved for the VMS signs show that they are regularly used and were in operation for part or all of 17 days in the 31-day monitoring period. The views of how the VMS are performing were sought from the Operations Team and the following response was received:

“I can say that they are having a positive influence on the way the public respond and see us as a department. For example, when we had a demonstration and the city centre was closed as a result we had calls from the public, but not complaining about the delays to the journey they had experienced. Instead there were calls from people saying that they saw the signs and wanted to know what was going on and if it would affect them the next day. This is a massive change as there were no complaints!”

The team also stated that when people know that they will have a delay they tend not to complain about it. They just receive enquiries about how long the delay will be.

However, the team are concerned that the signs should not be used regularly for non-strategic messages or they will risk overloading the public with information. This is because they feel that people will start to ignore the signs as experience has shown with other signs.

When asked about the importance of VIVALDI the response received was that “The VMS project would not have happened without it!”

The work undertaken in the project made use of existing communication links to the signs which has been a huge benefit having saved the cost of a private line rental and provided a platform for future expansion. It is proposed to use the same network for the second Showcase Bus Route in Bristol on the A420. The network can also be used for CCTV and number plate recognition activities.

The Council aim to expand the system and order more VMS. There are plans for signs near the Harbourside development and three more on Jacob’s Wells Road.

The Council will also work with neighbouring authorities, linking to new signs for people coming into the area from places outside the city such as Long Ashton.

2.9.9.6 Bristol – Travel plans (11.2)

Measure Overview

For a number of years the Council has been working with major employers to encourage the development of Travel Plans. However, limited work has been undertaken for sites that generate significant trips by visitors. Through VIVALDI this measure aims to bring together the major leisure and tourism destinations on Bristol's Harbourside (an area to the western edge of the Clear Zone) and improve access and travel choices for visitors to help reduce traffic congestion in the city. The primary method was planned to be through the development and implementation of a joint visitor travel plan.

The aim of the travel plan work with leisure sites was to:

- Establish a core group of major leisure and tourism destinations and to develop and implement an area-wide travel plan, supported by site-specific measures;
- Initiate a programme of site audits of the major destinations to assess current provision for visitor access and to recommend improvements;
- Facilitate access for the core group to free consultancy advice from the Government's Transport Energy Best Practice Programme, and to other sources of funding and support, to assist in the travel plan process;
- Facilitate co-operation and collaboration between the Harbourside core group, to establish mutually beneficial visitor travel plans that are inclusive and sustainable;
- Implement identified improvements that may include cycling/pedestrian facilities, public transport services or new visitor guides/maps for the area.

The overall measure objectives were to:

- Lessen dependency on the car especially at peak periods.
- Foster a cultural climate that is receptive to alternatives to the car.
- Ensure that the transport system contributes towards a successful economy by creating access to jobs and an attractive environment.

The project involved bringing together a number of the leisure sites on Bristol's Harbourside to work together to achieve the common goals of improving levels of sustainable transport to both the sites themselves and the area as a whole, where previously sites were working on an individual basis. Access to free consultancy advice for the core group of sites was secured from the Government's Transport Energy Best Practice Programme, and also to other sources of funding and support to assist in the travel plan process.

Results

The result of the measure implementation was a number of initiatives and partnerships developing over the lifetime of VIVALDI.

Meetings: a number of meetings on an approximately bi-monthly basis were arranged to provide a forum allowing the sites to discuss common issues and how these might be approached in the travel plan process, steered by BCC and Sustrans.

Sustainable Travel Action Plan: following advice on site travel plans and also a zonal travel plan, the group developed a collective action plan to record all achievements and future plans to improve sustainable travel in the Harbourside area. The action plan was developed gradually throughout the project and was intended to be a 'living' document.

Improvements to existing public transport services: a cross-harbour ferry service run by Bristol Ferry Boat Company was introduced as part of the work to improve access both to and between the sites. The service operates on demand and provides a useful link for both commuters and visitors between the north side of the harbour at Capricorn Quay and the south side at SS Great Britain, where previously there was no direct access.

Website: a more co-ordinated approach to visitor information built on the City Tourism organisation's 'VisitBristol' web-site, by presenting the Harbourside Travel website as part of this site. Using a very simple design, the website aims to present information and travel choices for travel to and within the sites, encouraging people to use alternative modes to the private car to travel to and within the area.

Visitor map: the map aims to highlight Harbourside visitor attractions and opportunities for walking, cycling and using public transport for travel to and within the Harbourside area. The map has been distributed to the sites themselves and to the arts venues identified on the map, and also to a large number of bars, hotels and restaurants in the Harbourside area.

In terms of achieving quantifiable results, the project has:

- Developed a forum for discussion between the businesses located in the Harbourside area. A number of meetings have been held on an approximately bi-monthly basis allowing the sites to discuss common issues and how these might be approached in the travel plan process. A programme of site audits of the major destinations to assess current provision for visitor access took place and recommended improvements. These meetings have also resulted in the production of the Harbourside Visitor Map.
- The introduction of the Harbourside ferry service has proved successful and provides a useful link across the harbour area of the city. The service is heavily used in the summer months and the patronage data also suggests that the service has 1000 regular users per month throughout the year. User satisfaction of the service is high, with many users wanting the service to be extended.

Sustainable Travel Action Plan

Foxley Tagg Planning Ltd have prepared Travel Plan reports on behalf of the SS Great Britain, @t Bristol, the Create Centre, Bristol Industrial Museum and Bristol City Council. Separate plans have been produced for each of the four visitor attractions and a zonal plan which brings together each of these individual plans.

The individual travel plans identify site specific and on-site issues and make recommendations on the opportunities that can be addressed by the respective venues. These include services and facilities for staff and measures aimed at facilitating sustainable travel. Some measures will benefit some or all of the venues and consequently are suitable for joint action.

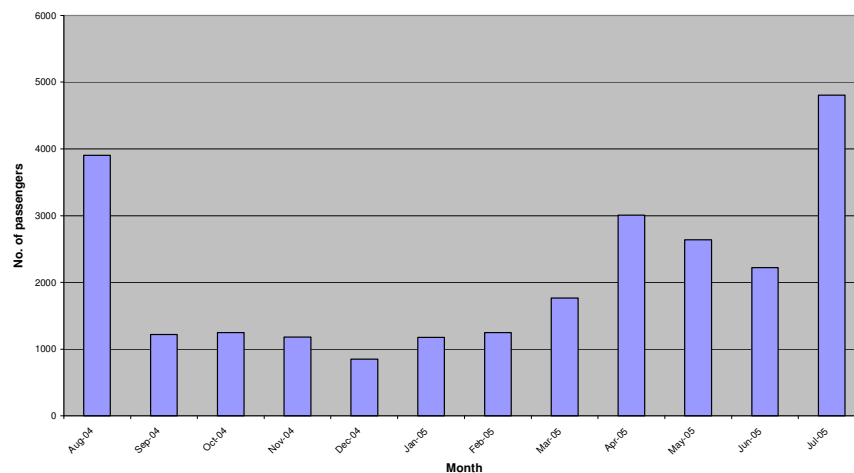
Improvements to existing public transport services

Patronage data

The VIVALDI Cross Harbour Ferry Service was launch on 17th July 2004. Patronage data was collected for the period 17th July 2004 – 31st July 2005 and the results showed that 27,554 passengers have used the service since its introduction. Figure 2.9.9-44 shows the patronage levels achieved during each month of the monitoring period. The results show an expected seasonal trend where patronage is far greater during the spring and summer months. For example, large figures in July will be partially due to the

Harbourside festival that attracts a large number of visitors to the area. However, the results do show that there are approximately 1,000 sustained passengers that use the service on a regular basis. Patronage figures can be analysed by direction of travel. The results show that slightly more passengers use the service to travel from the SS Great Britain site to Capricorn Quay (from the South side of the Harbour to the North side).

Figure 2.9.9-44: VIVALDI Cross Harbour Ferry Patronage



The Cross Harbour Ferry user survey was conducted on the 6th and 9th July 2005. A total of 105 surveys were conducted on one weekday (Wednesday (40)) and one weekend day (Saturday (65)). The questionnaires were completed by passengers using the ferry and returned before they departed the service.

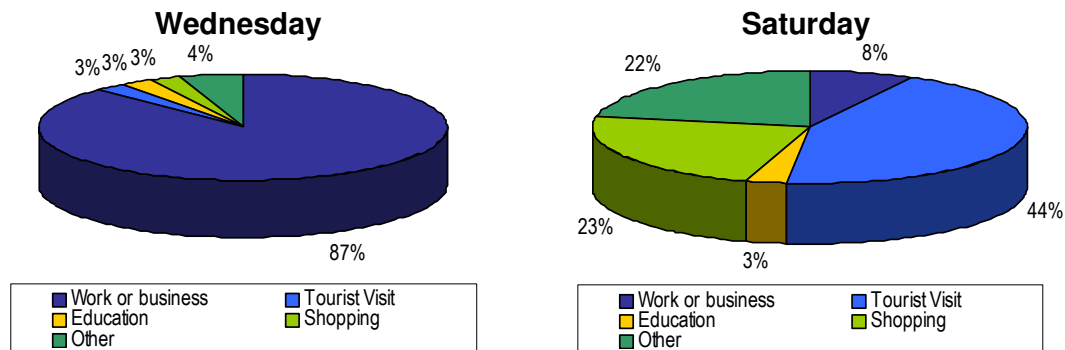
The following sections summarises the key findings of the survey:

Origin and destination analysis

The survey respondents had a wide range of origins and destinations. However, many of the ferry users did start their journeys in close proximity to the ferry. This includes origins such as the Harbourside, Hotwells, Clifton, Bedminster and Southville. Destinations commonly identified also included the Harbourside, Hotwells and Clifton and additionally included the city centre, Broadmead and the SS Great Britain. As such the service appears to be providing an important link between origins and destinations on either side of the river and enhancing the accessibility between the areas identified above.

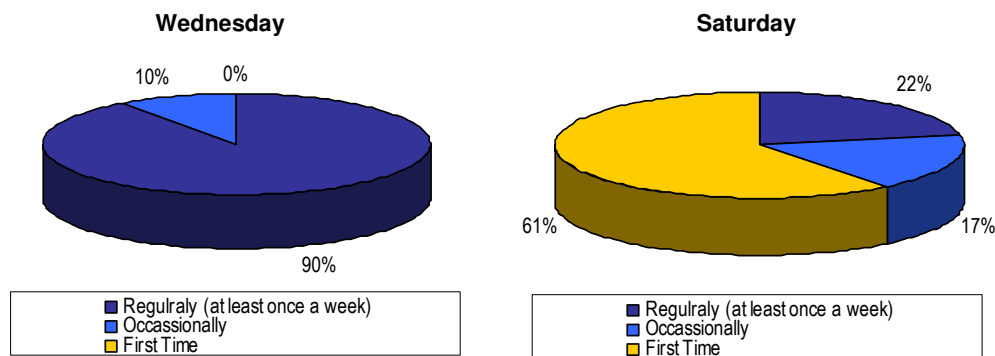
Journey purpose

Overall, the main journey purpose of passengers using the ferry service was travel for work or business, accounting for 39% of users' activity. Tourist trips were the second most common trip purpose representing a further 28% of those users surveyed. From the weekday data it is noticeable that work and business trips are even more dominant as the main purpose of travel accounting for 35 of the 40 passengers surveyed, or 87.5% of those sampled on that day. Correspondingly, the ferry service is used more commonly at the weekend for tourist trips and for shopping.

Figure 2.9.9-45 Main Journey Purpose (Split by day of use)


Frequency of use

Over a third of passengers surveyed were using the ferry service for the first time. A further 37% use the service frequently, either daily or at least 3-4 times a week. Further analysis of frequency of use by journey purpose shows that it is those passengers making work or business trips that use the service frequently, i.e. daily or at least 3-4 times a week, while many of the tourists were using the service for the first time. This is highlighted in the variation by day of the service usage, which highlights that weekday users make more frequent use of the service.

Figure 2.9.9-46: Frequency of ferry use


Using other forms of transport

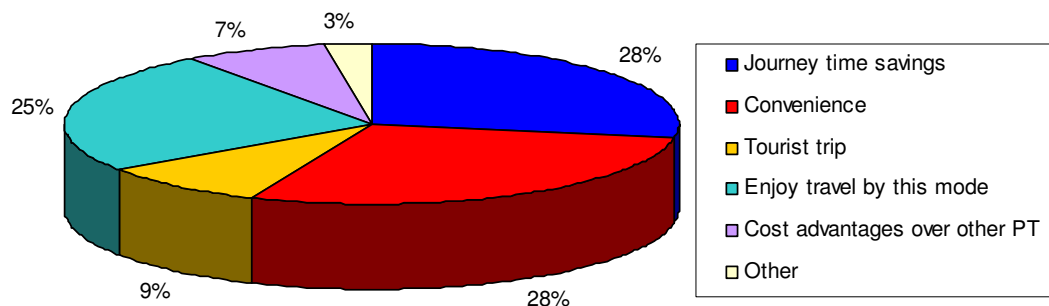
Walking was the most frequent other mode of travel used as part of the journey being made by ferry passengers. This mode represented 61% of responses, while a further 21% identified using the car for part of their journey. Public transport accounted for less than 10% of the responses given.

It was found that some 58% of passengers making the same journey before and after the introduction of the ferry service used to make the journey by walking. However, 12% previously used their car for the longest part of their journey, showing that there has been a mode shift away from this form of transport.

Reasons for use

The survey revealed three common reasons for using the ferry service. These were journey time savings, convenience and enjoying travelling by this mode. Each of these three reasons represented over a quarter of the total number of responses given. The most frequent response given by those making work or business trips was journey time savings.

Figure 2.9.9-47 Common reasons for using the ferry service



User satisfaction

Passengers were asked to rate their satisfaction with five aspects of the ferry service. Overall, user satisfaction was very high with all elements of the service provided. Ease of access, fare levels and staff assistance were all rated as highly satisfactory by 84% of respondents. These high ratings are also reflected in the comments received on the survey forms. They included:

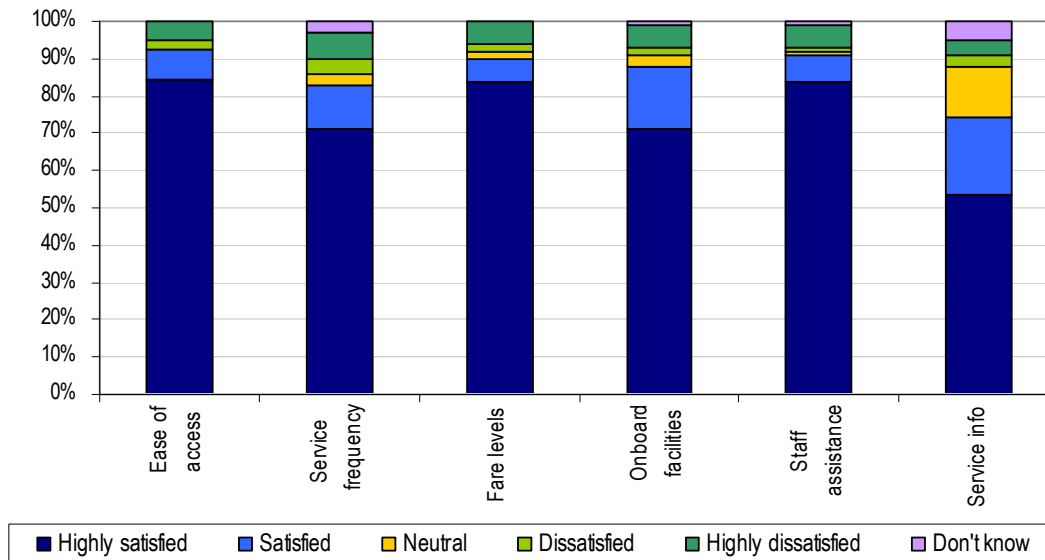
“This boat is vital in my journey to work - please keep it going!”

“Excellent local facility”

“A welcome introduction, making Park Street and Brandon Hill easily accessible.”

“Staff are extremely friendly, helpful and chatty!”

“A ‘star’ service, saves a 30 minute walk or £1.50 on a ridiculously short bus ride.”

Figure 2.9.9-48 User Satisfaction


Service frequency and the quality of onboard facilities were also highly rated although a noticeable proportion of respondents thought these simply ‘satisfactory’. In the user comments three people suggested that a better shelter from wind and rain was required with one respondent noting “Great service, only when wet and windy is it a little less pleasurable, otherwise great”. A number of other comments were received relating to the operating times. Ten respondents made comments about the time that the ferry service finished in the evening, saying “The service stops too early! (6.15 pm). It should at least run until 7.00 pm.” Other respondents suggested that Friday or Saturday late night services would be useful to them.

Conclusions

The ferry survey has revealed that the service is popular for work and tourist purposes and that user satisfaction is extremely high. During the week there is a core group of frequent users who are using the service to get to work or make business trips. At the weekend the service is used more by tourists. The service is also important in linking origins and destinations either side of the Harbourside area.

2.9.9.7 Bristol – Travel information centre & ITS integration (12.2)

The Inception Report details three measure objectives, which are:

- Provide quality alternatives to the car and encourage their use;
- Lessen dependency on the car, especially at peak periods;
- Develop integration of individual modes to ensure that the transport system serves the function of the city.

A new Travel Information Centre (TIC) was introduced in conjunction with other transport information providers and located in a high profile city centre position. The centre aims to provide a single point of interface with the public whether in person or communicating by phone or electronically. The key functions of the TIC include:

- Providing a public interface for transport and trip planning information – a staffed office for a range of transport information supported by electronic displays, Internet kiosks and paper-based materials;
- A centre for company travel planning, awareness campaigns and mobility initiatives;
- Improved coordination of transport services and linkages between modes;
- Integration of transport management and information services.

Additional complimentary services are being trialled, in the form of a tourism information presence at the TIC which provides tourist and related transport information and services.

The works on the TIC have been supported by actions to integrate ITS systems and outputs. The objectives, as set out at inception, were to:

- Develop a central data management and dissemination hub;
- Integrate existing systems and applications through the central hub;
- Develop a common application / system specification to ensure that future initiatives can be successfully integrated to existing systems.

To evaluate the TIC a snapshot of its usage was carried out, as a guide to its overall use. In discussion with BCC it was agreed that usage would be monitored by the permanent members of staff based at the centre. Since June 2005 an employee of Tourist Information has been based alongside the staff placed at the centre by First. Both organisations were asked to monitor user requests to determine the uses of the centre and its value in providing transport and travel information. First recorded usage over a one week period between 01/08/05 – 06/08/05. Tourist Information monitored usage over two months during June and July.

In addition to monitoring the use of the various facilities available at the TIC it was also important to monitor user satisfaction, done through a user survey. A face-to-face user survey was undertaken during September 2005 on Wednesday 7th between 08.30 – 17:30 and Saturday 10th between 08.30 - 13.00 pm. A total of 128 questionnaires were undertaken using trained enumerators, with 94 surveys completed on the Wednesday and 34 on the Saturday.

The results of the survey provided information on:

- Reasons for use;
- Mode information sought for;
- Other sources of travel information regularly used; and
- User satisfaction with the information provided and facilities available.

The inception report outlined two expected results. These are identified in the table below as are the initial results in relation to these targets.

Table 2.9.9-24 Targets and results

Target	Headline Results
<i>Improved user knowledge of the transport network and services.</i>	Over 1,600 people per week use the centre to purchase travel tickets and make enquires regarding transport services in Bristol. There have been significant increases in the sales of First bus and National Express tickets sold from the centre.
<i>Operation efficiency though data sharing and improved interrelationship between transport responsables.</i>	Through the measure a strong partnership has been formed with First Bus and Tourist Information. The Centre has allowed the Council and its partners to consolidate their individual activities and enhance the provision of information to the public.

There is limited quantifiable data available on the use of the TIC. Thus a snap shot of usage had to be collected rather than being able to present a timeseries of usage showing trends over time. While utilisation data has been provided the only other source of information is provided through the user survey undertaken during September 2005.

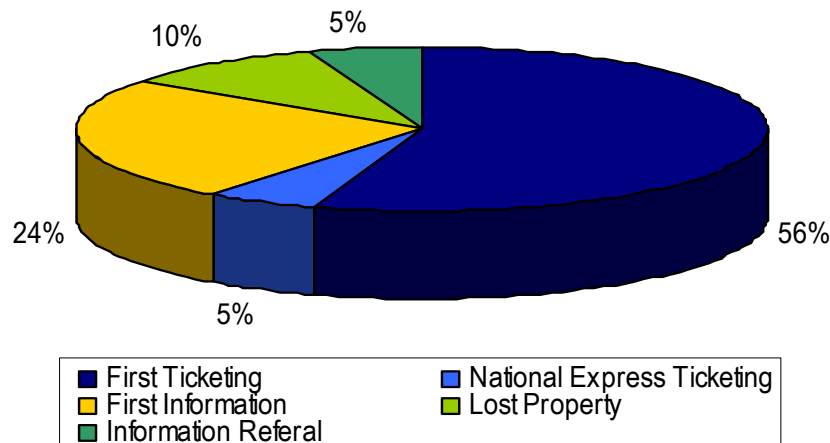
Measure Results (November 2004 – August 2005)

TIC Usage

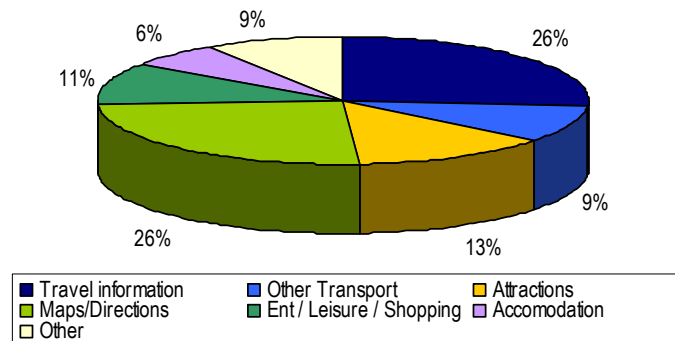
The monitoring conducted by First and Tourist Information staff indicates that the centre is well used by people seeking travel information or services, with over 1,600 people per week using the centre.

First's monitoring identified that 1,316 people made enquiries with their staff in a one-week period. Over half (725) of the enquiries they took were for First's travel tickets, and a further quarter (322) for information relating to First services within the area. Other uses for the centre included lost property used by 131 (10%) users and National Express ticket purchases, which account for only 5% of all enquiries.

The new centre has proved extremely successful in increasing the number of tickets that First have been able to sell from its central ticket office. First ticket sales (bus tickets and seasons) have increased by 88% year on year and National Express ticket sales have increased by 210% compared to sales made at the previous ticket office. However, some of this increase can be partly explained by disruption at the bus station where construction work has been taking place since November 2004.

Figure 2.9.9-49 First Enquiries


Tourist Information usage monitoring logged some 2,400 user enquiries over a two month period. This equates to on average 300 users per week over the monitoring period. Although many of the information requests were non transport related and reflect the Tourist Information staff's wider role in assisting visitors to the city, 27% (635) of all enquiries were to disseminate travel information. A further 26% (612) of enquiries were for maps and directions.

Figure 2.9.9-50 Tourist Information Enquiries


Further analysis of the usage data reveals Mondays and Fridays to be the busiest days at the TIC. The centre is well used throughout the day with the busiest period between 11:00 – 13:00 with usage gradually declining after this time until closing.

The user survey further highlighted some of the reasons for using the TIC and the importance of the information provided. The following main points were noted:

- The majority of respondents were repeat users of the Centre, 83 (65%) having used the TIC prior to the survey.
- Of those respondents who had previously used the centre, the majority indicated that they use the centre infrequently, 31 respondents (37% of valid responses) less than once a month.
- The two main reasons for using the TIC are to get public transport timetable and ticket / fares information.

- Use of the centre was dominated by 114 respondents seeking information on bus services (86%), with very few seeking information on other modes of transport.
- The information provided at the centre is important for planning new journeys, obtaining travel information and purchasing tickets / passes. 75 respondents (60%) stated that they found the transport information received useful in planning a new journey. 35 respondents (29%) identified that the information provided had influenced the type of transport that they intended to use, highlighting that the TIC could significantly influence mode shift.

User Satisfaction

An important aspect of the user survey was to identify levels of satisfaction with the new facilities provided at the TIC. The following main points are noted:

Users are extremely satisfied with the location, look and access to the premises, with over 90% satisfied or very satisfied with each of these three aspects. (Figure 2.9.9-51)

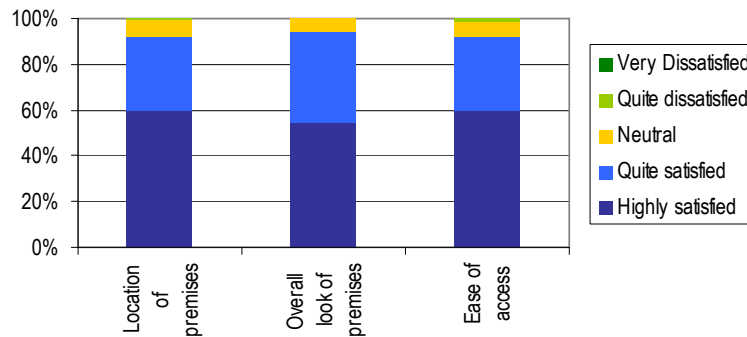
Users of the TIC are extremely satisfied with the facilities they have used within the centre. 103 respondents, 93% of those who used this facility, were satisfied with the assistance they received from First staff (70% extremely satisfied) and over half of respondents using the paper based transport information provided rated it as highly satisfactory, with a further 32% rating it as quite satisfactory.

Although user satisfaction levels were extremely high, a number of the comments highlight some areas for concern and areas for improvement. Reasons for dissatisfaction with the TIC, albeit from a minority of users, mainly relate to comments about the staff and the route and timetable information available. This included four respondents who identified issues with the helpfulness of the staff and problems with long queues forming, and some specific requests regarding route and timetable information.

A number of suggested improvements were recommended by the survey respondents. Frequently made suggestions included:

- An Info Centre in the Broadmead area;
- Production of a Bristol Bus Map / Comprehensive timetable booklet;
- Employing more staff;
- Information publicising travel in the South West;
- Better signage to the TIC and more publicity of its existence;
- Longer opening hours;
- Organising the queuing system for ticket purchases to avoid conflict with other centre users.

Figure 2.9.9-51 TIC User Ratings



Conclusions

The TIC is in a high profile location and is attracting a large number of users. This has led to a significant increase in First and National Express ticket sales. Both the First staff and the Tourist Information staff based at the centre are also dealing with a large number of travel enquiries, mainly related to public transport timetable, ticket and fares information. The survey has shown that this information is important in planning new journeys and has been influential in determining the form of transport that users intended to use. The introduction of the new Travel Information Centre has improved the provision of travel information and is subsequently improving user knowledge of the transport network and available services.

2.9.10 Bristol – Access and Safety in an Inner City Area

This package of integrated measures is designed to improve access and safety in an inner city area of Bristol - Barton Hill, within the Lawrence Hill ward of Bristol. One key measure, the Home Zone, is targeted on an area within Barton Hill known as The Dings while other measures will impact on Barton Hill more widely.

The measures within this package were designed to improve access and safety in the inner city areas to:

- Lessen the dependency on the car especially at peak periods;
- Ensure that development takes place in such a way as to reduce the need to travel;
- Provide quality alternatives to the single occupant car and encourage their use;
- Reduce transport collisions and improve safety and security;
- Ensure that the transport system makes an active contribution to the physical, social and environmental regeneration of Bristol and its local communities;
- Ensure community participation in and ownership of the other area-based project measures.

The table below sets out the local evaluation objectives that were set and how these relate to the overall VIVALDI objectives and targets.

Table 2.9.10-1 Objectives for safety and access in inner city area

No	Local objective	Target	Contribution to VIVALDI target (s)
LO9	Lessen dependence on the car	Increase the level of walking and cycling trips from the area.	VT8 Reduce mode share for cars by 5% VT18 Increase cycle trips by 30% VT19 Increase walking trips by 10%
LO10	Reduce the need to travel	Reduce traffic flows in area by 10% Reduce the levels of non-residents parking	VT4 Reduce car traffic in managed area by 10% VT7 Reduce parking space in area by 10%
LO12	Provide alternatives to the car	Develop new car share sites in the area	VT13 Increase number of car share sites by 5
LO13	Improve safety	Reduce road accidents	VT21 Decrease road accidents by 20%
LO14	Contribute to regeneration	Improve property values	-
LO15	Ensure participation	Consult 75% of residence on scheme development	-

To achieve these targets the following measures were implemented for the Package:

- 6.3 Residential traffic Management (Home Zone);
- 11.1 Community Travel Workers; and
- 11.4 Walking & Cycling Measures.

VIVALDI target (VT8) is to reduce mode share for cars by 5%. This has been successfully achieved by the residential traffic management (Home Zone) measure where the number of available parking spaces in the area has been significantly reduced. The VIVALDI target (VT18) is to increase the number of cycle trips by 30%. This has been achieved through the cycling and walking measure where cycling increases between 35-80% have been observed. The VIVALDI target (VT19) is to increase the

number of walking trips by 10%. This has again been achieved by the walking and cycling measure where infrastructure improvements on cycle paths in targeted areas have increased walking by between 37-100%.

The following describes in detail the measure level results for this integrated package.

2.9.10.1 Bristol – Residential traffic management (6.3)

Measure Overview

The Dings, comprising a residential area surrounded by light industrial businesses, is located within the Lawrence Hill ward to the east of the city centre. It is on the edge of the redeveloped Temple Quay area, characterised by new office developments.

Lawrence Hill has been recognised for many years as Bristol's most deprived ward, suffering from high levels of social stress. As wards in Bristol are relatively large in terms of population, with many containing a variety of neighbourhoods, local variation is often lost when information is collated into ward averages. A new geography based on smaller Super Output Areas (SOAs) seeks to address this, with Bristol divided into 252 SOAs, each with an average of 1,500 people.

Old Market and the Dings is ranked as the SOA with the most overall deprivation in Bristol (19th nationally). Further, it is the worst in Bristol for Employment Deprivation (54%, 7th nationally). Income deprivation affects 97% of children living in the ward, the second worst in Bristol (13th nationally). Fifty-five percent of households have no access to a car or van, significantly lower than the average for Bristol, although the car continues to account for over a third of all daily trips. Subsequently, walking accounts for the main transport mode for residents (48.5%). According to the 1991 census, 52.1% of families were worried about heavy traffic in the Barton Hill area (the highest percentage in Bristol).

The area however has many significant historic buildings and several waterways, including a stretch of the historic harbour. A number of affordable homes have been built in the area, and both recent and future developments are set to transform the former dereliction in the area.

Home Zones are now part of UK policy, and various initiatives including Government funded pilot schemes (resulting in the Department for Transport funding the Home Zone Challenge) and private developers becoming involved in, and implementing, Home Zones, have resulted in an increase of such schemes. At the outset of the Dings Home Zone, however, there were only a limited number of pilot schemes. Many of the practices focused on traffic calming schemes in residential streets but with the absence of integration of residential traffic management with broader Home Zone measures such as community involvement, reallocation of road space and environmental improvements.

The Home Zone in the Dings involved the implementation of a new retrofit Home Zone in seven residential streets (Dings Walk, Birkin Street, Union Road, Barton Vale, Tyler Street, Oxford Street and Barton Road). Three streets (Union Road, Birkin Street and Dings Walk) are currently completed and subsequent results will be reported on these.

The streets were remodelled to ensure equal priority was given to pedestrians, cyclists and motor vehicles, and the level of commuter parking in residential streets was reduced through perpendicular parking and a proposed residents parking scheme. The implementation of the Home Zone involved coordination with other project measures (Community Travel Workers, 11.1 and Walking and Cycling measures, 11.4) to provide an integrated package of benefits within the demonstration area. The balance of the streetscape within the Dings has changed from a vehicle dominated space to a more equitable social space, open to pedestrians and other non-motorised users.

Design features within the Home Zone include: new surface materials helping to create a more vibrant streetscape whilst also providing a shared surface; reduced sight lines for motorists encouraging lower vehicle speeds; traffic route alignments including previously unavailable fire appliance access; street furniture and new street lighting including LED up-lighters positioned under trees to maintain a balanced lighting level across the streetscape; a link to the Bristol/Bath cycle/walkway; and improved amenities including a new post box and postal collection service. Through positioning the new post box in the Home Zone and not in the adjacent residential development, it is hoped that new residents moving to the area will integrate with the existing community within the Dings.

A number of innovative approaches to the design and implementation of the Home Zone were taken including the inclusion of a ‘Sustainable Urban Drainage System’ (SUDS). The SUDS is a permeable paving system allowing rainwater falling on the highway surface to follow its natural course and drain into the sub grade and not into the piped sewer system. This paving type reduces the volume of water entering the sewer system and is one of the first and largest areas of permeable paving in the adopted highway in the United Kingdom, and is the first area that the Highway Authority has adopted and agreed to maintain in Bristol. Furthermore, innovative social aspects have been implemented in the Home Zone including public artwork of some considerable stature, designed to enhance the streetscape, identity and community ownership of the area.

The design and implementation of the Home Zone aimed to meet the following measure objectives: ensuring the transport system makes an active contribution to the physical, social and environmental regeneration of Bristol and its local communities; reducing transport collisions and improving personal safety and security; and ensuring that the transport system complements good health and well being. The measure also aimed to positively impact on the following quantifiable targets as outlined in the Evaluation Plan (D4), within the integrated package of Safety and Access in an Inner City Area:

- VT4: Reduce car traffic in a managed area by 10%
- VT7: Reduce parking spaces in an area by 10%
- VT8: Reduce mode share for cars by 5%
- VT13: Increase the number of car share sites by 5%
- VT18: Increase cycle trips by 30%
- VT19: Increase walking trips by 10%
- VT21: Reduce road accidents by 20%

Evaluation results

Street Simulations and Street Events

During the consultation phase street simulations were presented to residents enabling them to view the different features of the proposed Home Zone. The simulation included alternative vehicle parking arrangements, shared surface-space areas and traffic calming measures (location of planters and chicanes). Although simulations did not use the same materials as the final design, it enabled residents to demonstrate the potential that the Home Zone will have and provided an opportunity for discussion regarding its features. The simulation was presented to residents as part of a number of street events organised by Community Travel Workers (11.1). The street simulation and street events were evaluated via house-to-house surveys.

Seven street events were organised during the period August 2002-December 2003:

- August 2002: Street party and Home Zone awareness raising exhibition.
- October 2002: Trial Home Zone layout in Tyler Street (street simulation event).
- February 2003: Home Zone marketing exhibition.
- June 2003: Fire engine trial designed to assess level of emergency vehicle accessibility to the Dings before and after the Home Zone implementation (street simulation event).
- August 2003: Detailed consultation with residents over Home Zone features and materials (Figure 2.9.10-1)
- October 2003: Trial layout of Home Zone features in Oxford Street North (street simulation event).
- December 2003: Trial layout of Home Zone features in Union Street South (street simulation event).

Street simulations (Figure 2.9.10-2) and street events were important to raise awareness and acceptance of the Home Zone and ensure community involvement in the remodelling of residential streets in the area. Attitudes and opinions were measured as part of residents' surveys and will be reported accordingly in a subsequent section.



Figure 2.9.10-1 Shared surface space incorporating block paving



Figure 2.9.10-2 Example of a street simulation event in the Dings

Residents' Surveys

Residents living within the streets comprising the Dings were surveyed during the course of the project (2002-2005), to gauge their attitudes on acceptance of design features, the consultation process and overall acceptance of the Home Zone.

A pre-survey conducted in December 2002 measured the level of support for the Home Zone and provided an opportunity for residents to raise concerns about it during the early stages of the project. 115 households were surveyed with a 90% response rate. Of the 80% of residents who had heard about the Home Zone concept, 82% supported the idea, 13% were unsure about the concept and only 1% presented a view against redevelopment of the area.

The high level of support for redevelopment was an important factor for the overall success of the Home Zone. 66% of residents own at least one car, and interestingly support amongst car owners was comparable to support from non-car owners in the area. 51% of residents also supported perpendicular parking rather than parallel parking, facilitating the reduction in the number of available parking spaces in the area and contributing towards reducing vehicle flow and speed (quantifiable targets VT4 and VT7). Reduction in the number of pavements received less support from residents (40%), with many residents concerned about pedestrian (particularly child) safety. There was considerable support for increases in the number of trees and aesthetic features (68%) in the area.

The three primary concerns raised by residents (accounting for 63% of responses) were: unsafe and nuisance parking (primarily from commuter parking, blocking access to roads and residential addresses); poor access for delivery and emergency vehicles; and antisocial behaviour (particularly from children and teenagers).

A survey in December 2003 focused on feedback collection regarding the 'Dings Home-Zone News Sheet' which was sent to residents on a bi-monthly basis as part of the consultation process. The News Sheet was delivered by Community Travel Workers (11.1) who had previously reported that effective implementation of the Home Zone was largely dependent on residents being kept informed about relevant changes to *their* environment. In addition to collecting views on the News Sheet, the survey investigated views on public seating areas and vegetation in the area:

- 73 of 117 households were successfully surveyed, a 62% success rate.
- 73% of people surveyed had read the News Sheet, with 93% of these stating it was interesting and of use in keeping them informed about progress in the area.
- Residents were largely supportive of seating and new vegetation in the area, although the maintenance of such features was reported as very important. Residents stressed that vegetation should be regularly attended to.
- Personal safety was measured by asking residents about their experiences of antisocial behaviour (including vandalism and graffiti) during the last 12 month period, and whether they thought this would change once the Home Zone had been implemented. The results can be seen in Table 2.9.10-2:

Table 2.9.10-2 Responses to the question of whether residents had been affected by antisocial behaviour in the last 12 month period.

<i>Have you been affected by antisocial behaviour in the last year?</i>		
	Number	% of those surveyed
Not at all	20	27
Sometimes	41	56
Frequently	5	7
Very Frequently	6	8
Don't Know	1	2

71% of surveyed residents had been affected by antisocial behaviour during the previous 12 months, and approximately 40% believed that the development of a Home zone would reduce such behaviour in the area. Interestingly only a small minority believed that development would increase antisocial behaviour.

A residents' survey was completed on Dings Walk in December 2004 following implementation of the first remodelled street. Of the 13 households successfully interviewed, 92% stated that they were happy with the new street design and that there had not been any surprises as to how the street looked. Residents commented on the attentiveness of construction workers and engineers involved in the implementation of the new design:

“Workmen really good” – Dings Walk Resident
 “Great! Lighting is really good” – Dings Walk Resident
 “Couldn't expect more” – Dings Walk Resident

A post-implementation survey (conducted in July 2005) focused on Birkin Street, Dings Walk, Barton Vale and Union Road, where 29 out of 39 households were successfully surveyed. The 78% success rate is slightly higher than the total number of households as 3 houses were vacant at the time of the survey. 22 of the households rated their street as more attractive, 5 households rated their street as average and only 1 household rated the street as unattractive now work had been completed.

Table 2.9.10-3 shows perceptions to the level of safety in the completed streets and

Table 2.9.10-4 shows the level of concern from residents about problems in the area.

Table 2.9.10-3 Perception of street safety post implementation

What do you think of the way your street now looks? In general is it:			
	Safe	Sometimes Unsafe	Often Unsafe
Number of responses	12	10	4

Table 2.9.10-4 Perception of problems post implementation

	Concerned	Not Concerned	Undecided
Unsafe & nuisance parking	11	14	3
Vehicle speed	8	19	1
Unsafe play for children	12	11	6
Poor access for delivery and emergency vehicles	6	19	2
Vehicle noise	2	26	0
Anti-social behaviour	15	10	3
Personal safety	7	19	2

Residents rated safety as the most improved aspect of the area since it had been developed. With the exception of children's play and anti-social behaviour residents viewed that the Home Zone had positively contributed towards the existing problems in their streets. Residents remain concerned about children playing in the street:

“I’m concerned because there are no pavements so now it’s more dangerous for the kids. I’ve had to re-educate them to play inside the garden.”

“I think it’s more dangerous to walk around now as you have to walk in the middle of the road”

Residents have also commented on the anti-social behaviour aspect of the area which may have contributed towards 15 households commenting that anti-social behaviour remains a concern:

“Children playing in the street are still unsupervised and start vandalising and spoiling my garden by chucking stones and litter.”

“It will be interesting to see what happens when the benches go in and whether we have any trouble”

“The way the street is now, encourages very young children to play in the street more – there is much more litter and my car gets scraped by their bikes.”

Although some residents have concerns about the Home Zone, the overall acceptance level by residents in the completed streets remains high. 90% of residents who were

surveyed maintain that the Home Zone is still a good idea for the Dings. Further, 48% of surveyed residents believe that people driving through the Home Zone are more considerate as a result of the completed streets. These concerns, however, are initial reactions to completed streets and as the scheme is not yet complete, perceptions are likely to change over time.

As concern for safety, vehicle speed and emergency access among residents has reduced as a result of the Home Zone, this measure has successfully contributed towards removing the concerns residents had during the consultation phases during 2002 and towards ensuring that the transport system makes an active contribution to the physical, social and environmental regeneration of a local community.

Business Surveys

The views of 12 local businesses who surround the wider Home Zone area were sought during the consultation and implementation phases of the project and once the initial three streets had been completed. A survey conducted in March 2003 sought the views from local businesses about their ideas for the Home Zone and the perceived impacts on their business. Some of the businesses were invited to attend the 'Design Week' showcasing potential designs for two streets in particular (Barton Road and Oxford Street), chosen as these are through roads for vehicles travelling to and from businesses in the area.

Of the 12 businesses that were interviewed 4 believed that the development of a Home Zone would benefit their business. They believed that improving the access along Barton Road would be beneficial to their business along with general improvements making the area more attractive for potential customers. The remaining 8 businesses, however, believed that the Home Zone would have no effect on their business. Businesses reported individual needs in relation to Home Zone development, primarily focusing around the level of access that it would either create or restrict. In conclusion, the responses from businesses were generally positive with none of the 12 reporting that they would be inconvenienced by the development of a Home Zone in the Dings area.

Following implementation of the first three Home Zone streets, 10 businesses were surveyed during July 2005. Of the 10 businesses surveyed, 8 believed that the Home Zone was a good idea for the Dings and 3 of these believed that the Zone would have a positive impact on their business:

“For the people who live in the Dings and couldn’t park outside their house before its lovely – and they shop here as well!” - Stop Press News Shop

“I think it’s great – It looks Brilliant. They’ve done a good job and I’ll reap the benefits, as I’ll be living there soon. I’m moving into 6 Barton Vale” - The Barley Mow Public House

“It’s excellent – commuter problems have been terrible for years – this couldn’t come soon enough” – Julie’s Café

Three of the businesses maintain some concern with regard to access to their business and the road closures that occurred during development:

“I’m a bit concerned that lorries won’t be able to get through Oxford Street and that the lorries that deliver to us can’t get under the railway bridge at Gas Lane so have to manoeuvre to turn around. The building works can be a bit noisy and we haven’t been kept very well informed about road works. We’d have liked to have known more”

Parking Counts and Flow Data

The level of commuter parking and the speed of vehicles travelling through the Home Zone remained a concern for local residents during the consultation and implementation of the Home Zone. The number of vehicles and type (resident owned or commuter) were counted during three time periods across a two-day period prior and post infrastructure change. The time periods were chosen to highlight the commuter parking levels that were being experienced during the day (1100-1300) and compare them to time periods where the majority of parked cars belonged to residents (0600-0730 and 1800-1930). The counts taken in July 2005 were prior to the residents parking scheme being finalised (and therefore implemented). Traffic flow and speed data was measured on the three completed streets (Birkin Street, Union Road and Dings Walk).

The results of the parking count taken in December 2002 can be seen in Table 2.9.10-5.

Table 2.9.10-5 Average number of resident and commuter parkers in the Dings during 10th and 11th December 2002

Street	Location	06:00am-7:30am		11:00am-13:00pm		18:00-19:30pm	
		Resident	Commuter	Resident	Commuter	Resident	Commuter
Folley Lane	Non-Dings Street	1	0	1	42	2	5
Princess Street	Non-Dings Street	0	0	0	21	1	1
William Street	Non-Dings Street	0	0	1	18	1	3
Alfred Street	Non-Dings Street	0	0	0	18	3	1
Sussex Street	Non-Dings Street	0	1	0	29	4	2
Days Road	Non-Dings Street	2	7	1	36	4	4
Kingsland Street	Non-Dings Street	7	1	4	23	4	4
Union Road South	Dings Street	12	1	5	23	11	3
Barton Road	Dings Street	7	0	4	63	15	2
Barton Vale	Dings Street	12	1	5	26	13	2
Oxford Street	Dings Street	9	1	4	29	7	2
Tyler Street	Dings Street	12	0	8	9	9	1
Birkin Street	Dings Street	21	1	8	18	16	1
Dings Walk	Dings Street	6	0	3	9	4	0
Total		87	11	42	361	91	25

The table shows the number of vehicles belonging to residents and commuters at each of the streets within the Home Zone area. The number of commuter vehicles in the area increases during the day before declining again in the evening. The Home Zone has contributed towards the targets VT4 (reduce car traffic by 10%) and VT7 (reduce parking spaces by 10%), and the relative changes can be seen in

Table 2.9.10-6.

Table 2.9.10-6 Average number of resident and commuter parkers in the Dings during the 28th and 29th July 2005

Street	Location	06:00am-7:30am		11:00am-13:00pm		18:00-19:30pm	
		Resident	Commuter	Resident	Commuter	Resident	Commuter
Folley Lane	Non-Dings Street	3	1	1	41 (-2%)	3	7
Princess Street	Non-Dings Street	0	0	0	27 (+29%)	0	3
William Street	Non-Dings Street	0	0	0	11 (-39%)	0	1
Alfred Street	Non-Dings Street	0	0	0	15 (-17%)	0	1
Sussex Street	Non-Dings Street	0	0	0	28 (-3%)	0	3
Days Road	Non-Dings Street	4	4	2	34 (-6%)	2	7
Kingsland Street	Non-Dings Street	10	3	5	39 (+70%)	8	4
Union Road South	Dings Street	8	5	5	5 (-78%)	8	1
Barton Road	Dings Street	7	1	4	23 (-63%)	5	7
Barton Vale	Dings Street	8	2	3	10 (-62%)	6	3
Oxford Street	Dings Street	11	5	5	29 (0%)	8	5
Tyler Street	Dings Street	13	1	7	10 (+11%)	10	2
Birkin Street	Dings Street	10	1	4	14 (-22%)	8	3
Dings Walk	Dings Street	5	1	3	3 (-67%)	4	2
Total		77	21	36	286 (-26%)	60	46

Between 11:00-13:00 the total number of commuter vehicles in the Dings (all streets) has declined by 26%, successfully contributing towards the 10% (VT4) target. Commuter vehicles parked during the morning and evening time bands have however increased by approximately 50%. The latter increase may be as a result of continued re-development in the area attracting more businesses and therefore commuters. The Home Zone is currently awaiting the residents parking scheme to be implemented which may have also resulted in higher than expected commuter parking in the streets within the Home Zone.

Average traffic speed and flow data from three of the completed streets (Birkin Street, Union Road and Dings Walk) can be seen in Table 2.9.10-7, Table 2.9.10-8 and Table 2.9.10-9 respectively.

Table 2.9.10-7 Average flow and speed for Birkin Street (21st June – 27th July 2005)

Time	Direction of Travel	Mean Volume	Mean Speed (KPH)	Direction of Travel	Mean Volume	Mean Speed (KPH)
00:00	Eastbound	1	23.2	Westbound	1	21.44
01:00		0	22.08		0	24.8
02:00		0	20.48		0	20.48
03:00		0	20.48		0	20.48
04:00		0	24.64		1	22.4
05:00		0	22.56		0	31.36
06:00		1	21.28		1	26.4
07:00		2	21.44		4	24.8
08:00		5	21.44		9	23.84
09:00		4	22.08		6	24.16
10:00		4	22.88		4	23.2
11:00		4	21.44		6	22.56
12:00		4	21.44		4	23.68
13:00		4	21.6		4	22.72
14:00		4	21.92		4	23.84
15:00		5	21.6		6	22.56
16:00		8	21.92		9	23.84
17:00		7	21.6		9	23.68
18:00		8	22.4		9	23.36
19:00		8	22.08		9	23.52
20:00		6	22.4		6	24.64
21:00		4	22.24		5	24.16
22:00		2	21.92		3	25.28
23:00		2	22.56		2	23.52

Table 2.9.10-8 Average flow and speed for Union Road (21st July – 27th July 2005)

Time	Direction of Travel	Mean Volume	Mean Speed (KPH)	Direction of Travel	Mean Volume	Mean Speed (KPH)
00:00	Northbound	1	20.96	Southbound	1	21.12
01:00		0	21.28		0	20.48
02:00		0	21.76		0	20.48
03:00		0	20.48		0	20.48
04:00		1	22.72		0	20.48
05:00		0	23.52		1	23.2
06:00		1	23.2		4	22.24
07:00		6	21.92		3	21.6
08:00		9	21.12		5	20.64
09:00		7	21.6		5	20.48
10:00		5	21.6		5	20.8
11:00		8	21.28		6	20.64
12:00		6	22.24		5	20.96
13:00		7	20.8		7	20.64
14:00		7	21.12		6	20.8
15:00		9	21.6		9	23.04
16:00		10	21.92		9	21.28
17:00		8	22.24		8	21.12
18:00		11	21.92		9	21.28
19:00		10	22.08		8	20.64
20:00		9	22.08		8	20.96
21:00		8	22.88		8	21.76
22:00		5	22.24		3	20.96
23:00		3	22.24		2	21.92

Table 2.9.10-9 Average flow and speed Dings Walk (22nd July – 27th July 2005)

Time	Direction of Travel	Mean Volume	Mean Speed (KPH)	Direction of Travel	Mean Volume	Mean Speed (KPH)
00:00	Eastbound	0	39.68	Westbound	0	39.68
01:00		0	39.68		0	39.68
02:00		0	39.68		0	39.68
03:00		0	39.68		0	0.00
04:00		0	39.68		0	39.68
05:00		0	39.68		0	39.68
06:00		0	39.68		0	39.68
07:00		1	39.68		1	39.68
08:00		2	39.68		1	39.68
09:00		1	39.68		1	39.68
10:00		1	40.64		1	41.28
11:00		2	39.68		2	39.68
12:00		1	39.68		1	39.68
13:00		1	39.68		1	39.68
14:00		2	39.68		2	39.68
15:00		2	39.84		3	39.68
16:00		5	39.68		7	39.68
17:00		5	39.68		8	39.68
18:00		6	39.68		7	39.68
19:00		6	40.00		8	39.68
20:00		3	39.68		4	39.68
21:00		2	40.32		2	40.48
22:00		1	39.68		1	39.68
23:00		0	39.68		0	39.68

As expected, average traffic flow and speed increase throughout the day. Once the Home Zone is completed further speed and flow counts should be taken for comparison. Further counts are not possible at the current time because implementation works are on-going.

Process Interviews

Process interviews were conducted with a Community Travel Worker (11.1) who worked in the Dings during the consultation, implementation and first development phase and a civil engineer involved with the design and implementation of the Home Zone and the Sustainable Urban Drainage System (SUDS) and with local residents. Excerpts from interviews are provided below to further demonstrate key aspects of the measure:

Community Travel Worker

When commenting on implementation barriers the Community Travel Worker stated:

“Barriers in the Home Zone have primarily arisen from technical limitations, and there are a lot of those. The complexities of the utility companies could not have been foreseen during the initial design stages of the Home Zone. Around thirty-two utility companies were involved and consulted for example...anyone starting a Home Zone should first consult with the utilities companies, as this is a key controlling factor”

The Community Travel Worker also commented on the scheme as a whole stating:

“In general there is the need to understand and appreciate that people *chose* to live in Home Zones. The development has led to an overall improvement in the area to such an extent that local residents will want to stay living there...when completed the Home Zone will definitely be successful. There are still some issues and minor details to be resolved with residents, such as the whether cobbles should be kept in streets or replaced with tarmac. Assuming this issue will successfully be dealt with and the Council is able implement a residents parking scheme shortly after completion, the scheme will be very successful.”

Local Authority Civil Engineer

The civil engineer and part-time Home Zone manager has made the following comments on the implementation and outcomes of the Home Zone.

“ Home Zones are a new concept in the UK and Sustrans has the edge as they have engineers who think ‘outside of the box’...Sustrans presented views from residents to the Council about what the residents would like in the Home Zone, and the Council have been involved in ‘fleshing’ out the vision, working with the local Police and Fire authority and building on the work completed by Sustrans...The whole process has involved a ‘team’ making decisions rather than just single individuals”

“Knowledge sharing (between residents, Sustrans, utility companies, Police and Fire authorities) has aided the overall understanding of Home Zones”

“The most important outcome of the Home Zone is that the community are ‘happy’ with what they have received, and take pride and ownership in their wider environment. Another important outcome is changing the way in which streets are used, not just by the community who live there but also by drivers – making them (drivers) feel like guests in the street and enable the community to carry on using the street differently in a safe environment”

Local Residents

Local residents (living in the completed streets) have made the following comments:

“I think they are doing a good job (*engineers and builders*), all the way through, I don’t think anybody could fault them at all, I have spoken to them, they are quiet pleasant, and I can’t see nothing wrong” – Resident 1

“I think one problem is that the town parkers are still parking in there (*Home Zone streets*), and not knowing that they are supposed to park anywhere else than the black squares, and they are just parking anywhere, and it’s a shame because there is lots of oil in the road already” – Resident 1

“That is only temporary though, by the end of this year it will become a no go (area), or else they will get towed away, the idea all along was to slow traffic down, which it is achieving, what it intended to do” – Resident 2

“I have lived here since March and driving around and home in the evening, and when I go to the post box, I say hello to more of my neighbours and I know more of my neighbours names, and where they live. Previous to this, I lived on the same street in Totterdown for 10 years, and barely would anyone speak, so it is a huge, huge difference” – Resident 3

“We were so involved with the design...we all had the chance to be involved in the design, how many times have people been here? ...it would be crazy to complain about the design!” – Resident 2

Conclusions

The Home Zone concept has already been implemented in other parts of Europe, but several aspects of this Home Zone make it a good model for future work in other cities.

The community involvement process has helped to demonstrate the positive impact that residents can have on local transport projects and the enthusiasm they have for helping to improve their local environment. Allowing residents to lead involvement on a number of art installations in the form of plaques recording memories of the Dings and gateway sculptures has helped to strengthen the local identity of the Dings.

The pilot use of Sustainable Urban Drainage (SUDS) in the Home Zone is now going to be actively encouraged for future developments within Bristol.

The project has also shown that streets can be designed with non-conventional street features without comprising safety. The new layouts create a unique local environment that not only keep cars moving slowly, but give equal priority to motor vehicles, cyclists and pedestrians, and include many of the ideas from residents reflecting their environment in the process.

This process (as identified by the local authority civil engineer) has been championed by a number of people and not attributed to any one individual. The unique interplay between involved parties has ensured the success of this measure.

2.9.10.2 Bristol – Community travel workers (11.1)

Measure Overview

Other local transport projects have found that local support for the project is higher when an involved consultation process is carried out with the individuals and organisations that are likely to be affected by the project. Although true across a number of measures, the project plan for the Home Zone (6.3) required significant effort to encourage residents to actively participate and raise their views and opinions during the process of planning and designing a remodelled residential streetscape.

Two part-time Community Travel Workers (CTWs) were recruited, leading a programme of community involvement within the Dings area including face-to-face surveying, community meetings, street trial events, co-ordination of an arts group, liaison between project partners and local residents, assistance with the co-ordination of the project's steering group and design advisory group, and a programme of sustainable travel promotion.

In addition to involvement in the Dings Home Zone, CTWs have also been involved in travel awareness and marketing through the TravelSmart programme (11.3). Due to complications in the design of the Home Zone, CTWs were required to devote more resource to this measure than had previously been anticipated. This close involvement however has led to an excellent final design and construction, and a high level of satisfaction among residents as previously identified.

Community Travel Workers aimed to achieve the following measure objectives: lessen the dependency on the car especially at peak periods; foster a climate that is receptive to alternatives to the car; and ensure community participation in and ownership of the other area-based project measures. The measure also aimed to positively impact on the following quantifiable targets as outlined in the Evaluation Plan (D4), within the integrated package of Safety and Access in an Inner City Area:

- VT4: Reduce car traffic in a managed area by 10%
- VT7: Reduce parking spaces in an area by 10%
- VT8: Reduce mode share for cars by 5%
- VT13: Increase the number of car share sites by 5%
- VT18: Increase cycle trips by 30%
- VT19: Increase walking trips by 10%
- VT21: Reduce road accidents by 20%

Evaluation results

Community Travel Workers have been evaluated through the roles they have played during the development of the Dings Home Zone (WP 6.3) and TravelSmart campaign (11.3). The success of these measures, particularly the first, has been largely dependent on the involvement of Community Travel Workers. Process interviews with CTWs have investigated their role in more detail and identified how the CTWs believe they have contributed towards the success of the measure.

Dings Home Zone

Community involvement within the Dings has remained high throughout the design and implementation of the measure. CTWs were successful in engaging 84 (74%) of the 115 households in the Dings, 11 households (10%) refused to participate in the survey and a further 20 households (16%) could not be contacted. This successful engagement with the local community contributed towards 82% of residents supporting the concept of a Home Zone at the Dings in 2002. Following the first phase of implementation in December 2004, 13 of the 16 relevant households were contacted by the CTWs and 92% of residents were happy with the new street lay out and reported that they felt they had been adequately informed and involved in the design process.

In conclusion of the first Home Zone phase, one of the Community Travel Workers has stated that:

“The process of community involvement appears to have been successful in that there have been no major surprises in the look of the layout and people have felt well informed in the design process”

CTWs have also been engaged with local businesses in the Dings area. Of the 12 businesses interviewed about the Home Zone development, 9 stated that it was a ‘good idea’ for the area and 3 were unsure. The high support for the Home Zone is largely attributable to the level of involvement CTWs have had with the local community and in their aim to inform, involve and empower them at all stages of development.

CTWs were successful in contacting 29 out of 39 households in the completed streets comprising the Dings Home Zone. 24 households stated that they had been provided with sufficient information and consulted adequately about the development of the Home Zone.

A residents’ association has been set-up in the Dings, including street representatives with a heavy focus on involvement of the community in deciding the appearance of the area. A community arts group has been established and youth groups have been consulted and involved in the design of the zone. The community artists have been appointed following a successful bid to Community at Heart. Residents in the Dings Home Zone have stated:

“Leaflets and meetings were regular”

“We’re really grateful”

“I liked people calling round as I couldn’t attend meetings because of work”

CTWs have contributed towards the VT4 quantifiable target (reduce car traffic in a managed area by 10%). Flow and speed counts were taken in three of the completed Dings Home Zone streets in 2005 (Birkin Street, Union Road and Dings Walk). As expected, average flow and speed increase throughout the day. Once the Home Zone is completed, further speed and flow counts should be taken for comparison. Further counts are not possible at the current time because implementation works are on-going.

CTWs have been involved in ensuring that alternative mode information and relevant rewards were personally delivered to households as part of the TravelSmart campaign. The success of the campaign, accounting for relative reductions in car trips of 9% in Bishopsworth and 12% in Hartcliffe are largely attributable to the personalised service level that the campaign offered. CTW's have successfully contributed towards reducing the number of car trips beyond the 5% quantifiable target (VT8) in targeted areas. Figure 2.9.10-3 shows a Community Travel Worker delivering information to a local resident.



Figure 2.9.10-3 Community travel worker delivering requested information and incentives

The campaign also accounted for a relative walking increase of 10% in Bishopsworth and 15% in Hartcliffe. This successfully contributes to the VT19 target of a 10% increase in the number of trips made by walking. Furthermore, as a relative cycling increase of 17% was observed in Hartcliffe, contributing towards the VT18 target of 30%.

During a process interview with a Community Travel Worker the following comments were made:

“Being a Community Travel Worker has built stronger links with the community”
 “Community Travel Workers should definitely be involved with Home Zones in the future, especially retro-fit zones to ensure people who live there are involved and that both micro and macro comments are fed back to ensure the implementation is progressed”

“The Home Zone will definitely be successful. There are still some issues and details to be resolved with residents such as the residents parking scheme. Assuming that this is successfully dealt with the Home Zone will be very successful”

Conclusions

Community Travel Workers (CTWs) have been an integral and vital component of the Dings Home Zone and the subsequent success of the Home Zone implementation. The involvement of a trusted independent third party enabled strong lines of communication to form between residents and all partners involved in the project. Strong, clear communications also helped to overcome and avoid misinformation and resolve quickly any conflicts if and when they occurred. The development of a respectful working relationship between residents, Sustrans, Bristol City Council and other partners on the project led to a clearer, more holistic approach to the development of the Home Zone.

Utilising expertise from all partners has led to more sustainable travel options to be promoted and incorporated throughout the design and implementation process.

This measure provides a good model for how difficult decisions relating to local transport issues can be resolved through a meaningful consultation process. The use of CTWs has provided a valuable model which it would be anticipated could be employed in the future by the Council in developing major schemes, particularly those which are likely to be innovative or contentious, where information exchange and involvement of residents or other affected groups will be vital to successful implementation.

2.9.10.3 Bristol – Walking and cycling measures (11.4)

Measure Overview

Works have been progressed in two specific locations – within the inner city and edge of city identified areas. Cycling and walking improvements will assist in improving access to education, employment and services, both within these areas and other parts of the city. The key aims of this measure are the provision of cycle and walking infrastructure in targeted areas and corridors, and the linking of new or extended provision to other project measures (integration of corridors to the Dings Home Zone for example).

Seven target schemes have been identified; Avon Trail Phase 1 (Figure 2.9.10-4), Avon Trail Phase 2 (Figure 2.9.10-5), Bristol-Bath Railway Path Extension (Figure 2.9.10-6), Netham Park (Figure 2.9.10-8), Crox Bottom (Figure 2.9.10-8), Wilmott Park (Figure 2.9.10-9) and Safer Routes to Schools in Hartcliffe (Figure 2.9.10-10).

Inner City Area

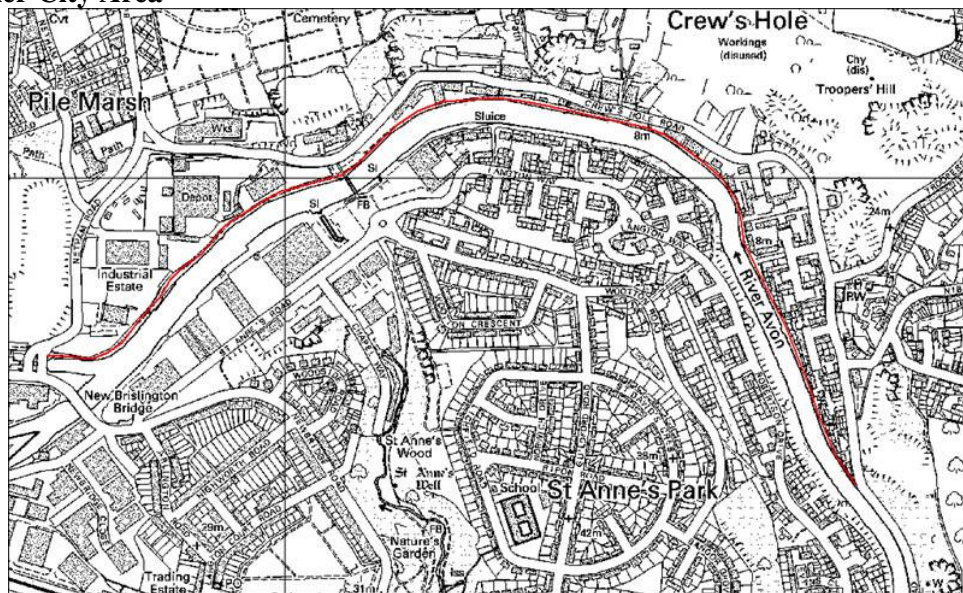


Figure 2.9.10-4 Avon Trail (Phase1)

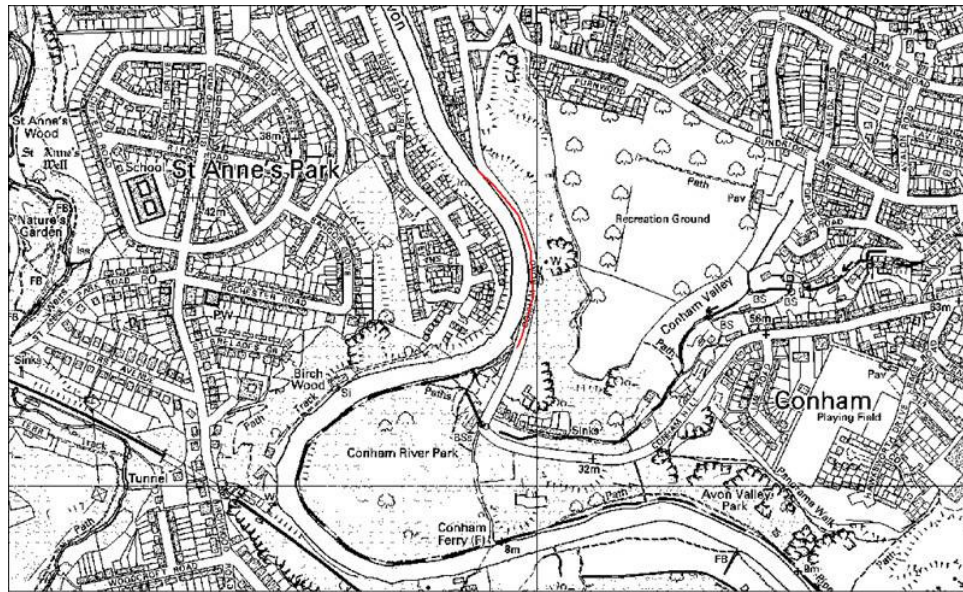


Figure 2.9.10-5 Avon Trail (Phase 2)

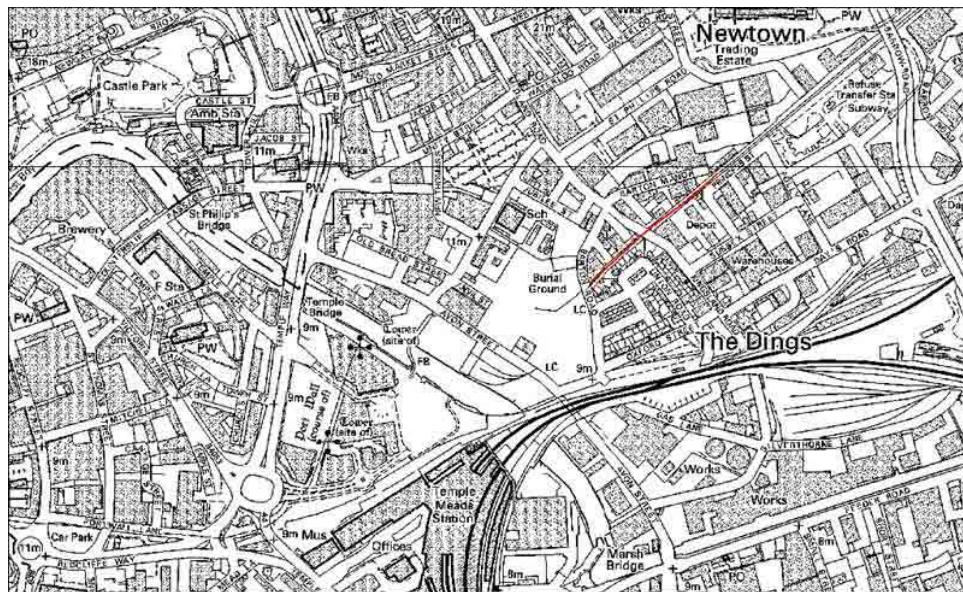


Figure 2.9.10-6 Bristol-Bath railway path extension

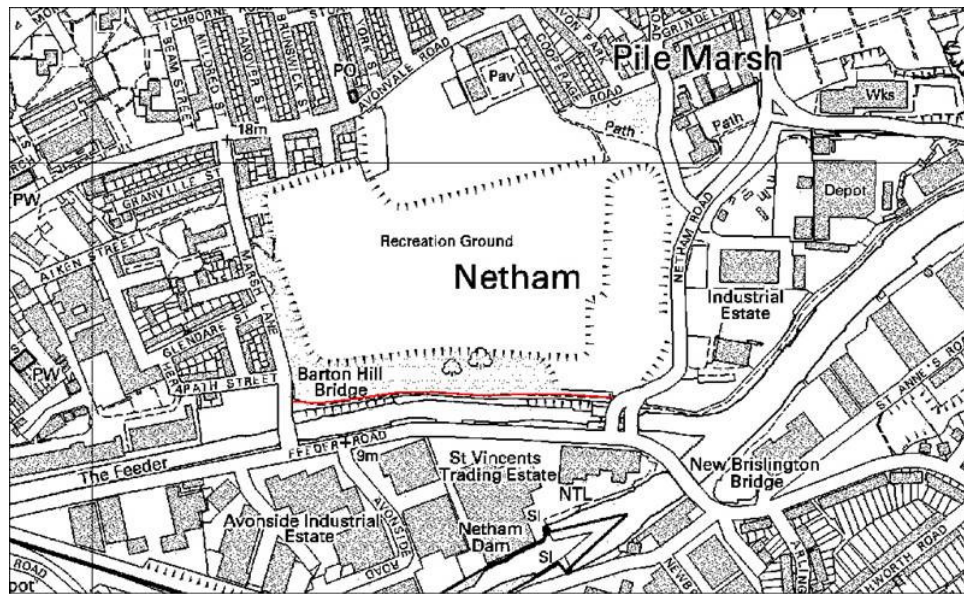


Figure 2.9.10-7 Netham Park

Edge of City Area

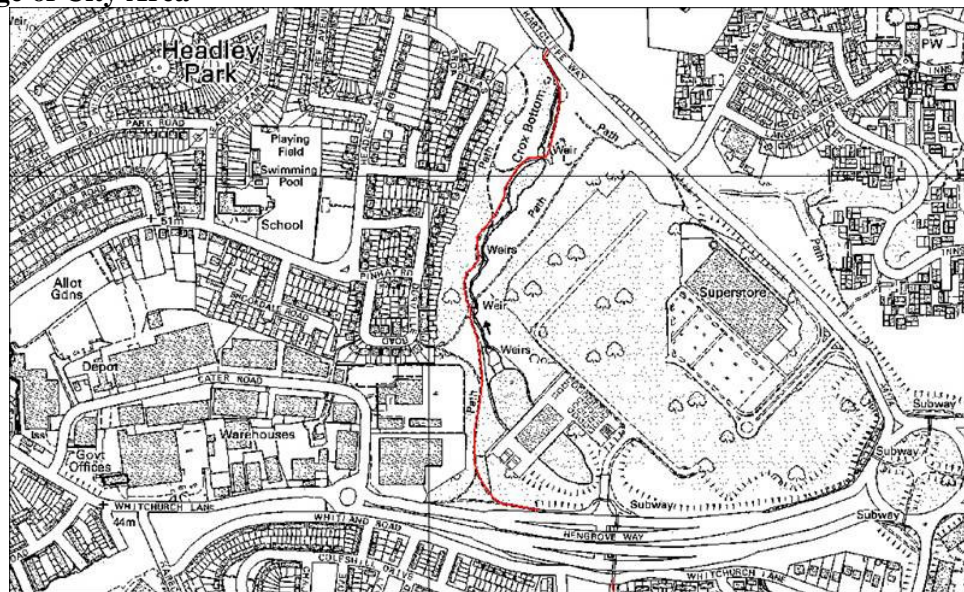


Figure 2.9.10-8 Crox Bottom

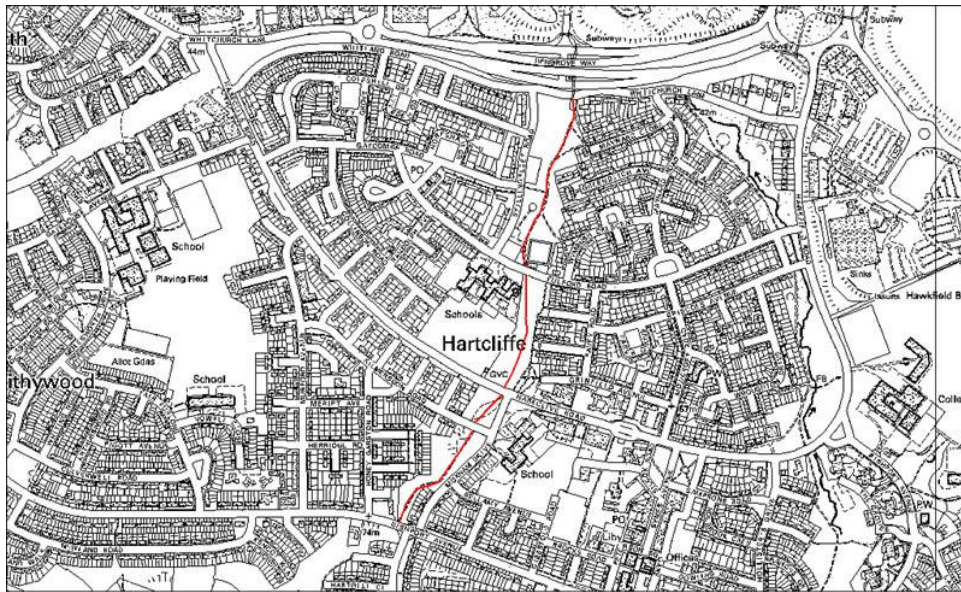


Figure 2.9.10-9 Wilmott Park

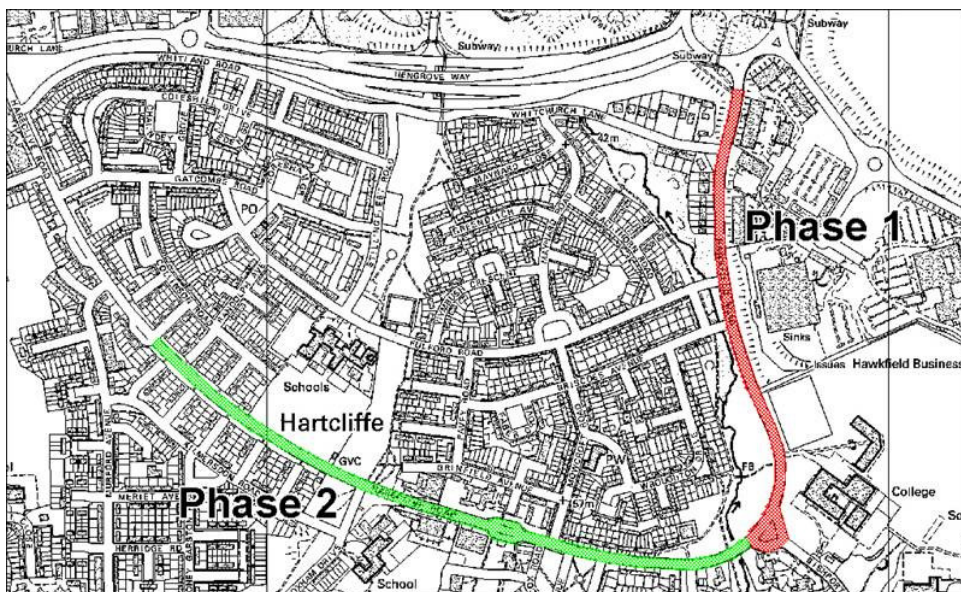


Figure 2.9.10-10 Safer Routes to Schools (Hartcliffe)

Improvements in cycling and walking aimed to achieve the following measure objectives: encourage use of alternatives to the car; foster a cultural climate that is receptive to alternatives to the car; and lessen the dependency on the car especially at peak periods. The measure also aimed to positively impact on the following quantifiable targets as outlined in the Evaluation Plan (D4), within the integrated package of Social Inclusion in South Bristol:

- VT6: Increase employment opportunities by 5%
- VT8: Reduce mode share for cars by 5%
- VT18: Increase cycle trips by 30%
- VT19: Increase walking trips by 10%

- VT23: Increase the number accessing public transport (PT) information by 50%

Evaluation Results

Due to the fragmented cycle infrastructure across the city, many of the routes due for evaluation were new-build routes with no pre-existing user data available. Table 2.9.10-10 indicates whether the scheme is a new-build route or an extension to an existing cycle path.

Table 2.9.10-10 The seven target schemes and their build status

Scheme	Build status	Pre-build data available
Inner City Area		
Avon Trail (Phase 1)	New build cycle path	No
Avon Trail (Phase 2)	New build cycle path	No
Bristol/Bath Railway Path	Extended cycle path	No
Netham Park	New build cycle path	No
Edge of City Area		
Crox Bottom	Resurfaced and widened cycle path	Yes
Wilmott Park	New build cycle path	No
Safer Routes to Schools (Hartcliffe)	Civil engineering works	No

New build cycle paths (as indicated above) have been evaluated through pedestrian and cycle survey counts along the route during specified dates in June 2005. Avon Trail Phase 1 and Netham Park were completed in 2003 and 2004 respectively, and previous count data was collected shortly after implementation and again in June 2005. Count data is available for Crox Bottom prior to and after infrastructure change. The extended Bristol/Bath railway path has been evaluated through a dedicated survey asking residents in the Dings area about their anticipated use of the path.

Hartcliffe Safer Routes to Schools involved two schools in Hartcliffe (Hartcliffe Secondary School and Teyfant Infant and Junior School) working with a School Travel Plan Officer. School children marked their walking and cycling routes to school on a map and identified localised problems (including crossing the road and speeding drivers). The results of the mapping exercise were utilised to prioritise civil engineering works at Hawkfield Road (Phase 1) and Hareclive Road (Phase 2), where traffic calming measures were introduced. Mode of travel to each of the schools was measured using a representative sample of pupils from each school.

Inner City Area

Avon Trail (Phase 1)

The first phase of the Avon Trail scheme was to upgrade a Public Right of Way along the bank of the River Avon from Netham Lock to Conham Road. The path was widened to 2.5 metres along its entire length and the surface sealed. Where banks were not wide enough to accommodate a widened surface, width was achieved through bank stabilisation and land procurement. Figure 2.9.10-11 and Figure 2.9.10-12 show a section of the route prior to infrastructure change and after.



Figure 2.9.10-11 Avon Trail (Phase 1) prior to infrastructure change



Figure 2.9.10-12 Avon Trail (Phase 1) after infrastructure change

Initial walking and cycling survey data suggests that the improved path is being utilised by both pedestrians and cyclists. Figure 2.9.10-13 shows count data for a 12 hour period in September 2003 and a 12 hour period in May 2005. Reduced pedestrian and cyclist counts in 2005 (with the exception of child pedestrian) could be attributed to wet weather on the day the count was completed, compared to a sunny and warm day on the 23rd September 2003.

Avon Trail (Phase 1): Walking and Cycling Count Data Post Implementation
During September 2003 and May 2005 (07:00-19:00 hrs)

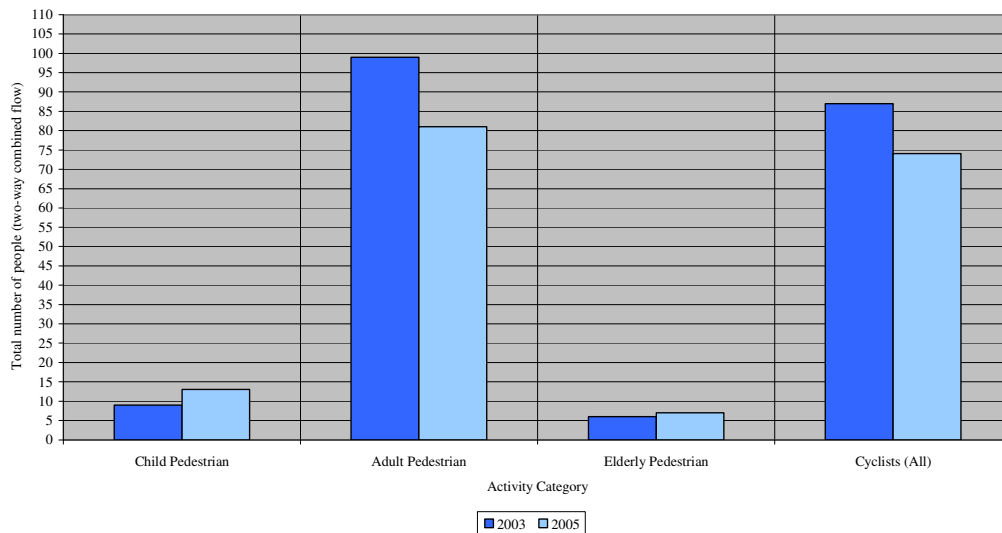


Figure 2.9.10-13 Walking and cycling count data for Avon Trail (Phase 1)

Avon Trail (Phase 2)

Path improvements undertaken as part of Phase 1 merge onto a narrow section of Conham Road. The west side of the road is bounded by the river and the east side by a high retaining wall. Bristol City Council are currently exploring solutions to narrow the existing road carriageway using road markings to reduce traffic speed and make the environment safer for walkers and cyclists. Due to the lengthy consultation process involved, this phase of the project will not be implemented within the VIVALDI timescale.

Bristol-Bath Railway Path Extension

The Bristol-Bath railway path has been extended along the alignment of an old railway line into Temple Meads Station. This will provide access opportunities to the station for residents of the Dings Home Zone (WP 6.3) and Temple Quay North development. Land was purchased between Barton Road and Princess Street adjacent to the Dings Home Zone and construction was completed at the end of April 2005. Figure 2.9.10-14 and Figure 2.9.10-15 below show a section of the route prior to infrastructure change and after.



Figure 2.9.10-14 Bristol-Bath railway path extension prior to infrastructure change



Figure 2.9.10-15 Bristol-Bath railway path extension after infrastructure change.

A survey conducted with Dings residents during July 2005 questioned 124 people (73 male and 51 female) within an age range of 16-60+ years. 37 people stated that they were aware of the Dings Railway Path and 87 stated that they were not. Respondents were asked if they anticipated using the completed railway path with 94% stating they would use the path and only 6% stating they would not. Table 2.9.10-11 shows anticipated trip use on the path:

Table 2.9.10-11 Anticipated trip use on the Bristol-Bath railway path extension

Trip Use	Number of Respondents	% of Respondents
Commuting	67	54%
Leisure	52	50%
Shopping	14	11%
School	1	1%
Other	8	1%

Respondents were asked how often they would anticipate using the extended path (Table 2.9.10-12):

Table 2.9.10-12 Anticipated frequency of use of Bristol-Bath railway path extension

Frequency	Number of Respondents	% of Respondents
More than once a week	45	38%
Once a week	20	17%
Once a month	37	31%
Less than once a month	16	14%

More than half of the respondents would anticipate using the path on a regular basis (once a week or more) and only 14% of respondents would use the path on an infrequent basis.

Netham Park

Netham Park is bounded on its southern side by the Feeder canal and towpath. The towpath, constructed from stone setts and concrete was in a poor condition prior to construction and made walking and cycling through the park difficult. The new path construction was completed in October 2004. The new path continues to use the exiting stone setts as part of its design and now joins the Avon Trail (Phase 1), to provide a more integrated walking and cycling route. Figure 2.9.10-16 and Figure 2.9.10-17 show a section of the route prior to infrastructure change and after.


Figure 2.9.10-16 Netham Park route prior to infrastructure change

Figure 2.9.10-17 Netham Park route after infrastructure change

Figure 2.9.10-18 shows walking and cycling count data for the 5th August 2004 and 24th May 2005 both taken over a 12 hour period. The weather conditions in August 2004 were warm and overcast and in May 2005 the weather condition was showers. The

usage compared to Avon Trail (Phase 1), which Netham Park meets, is considerably less.

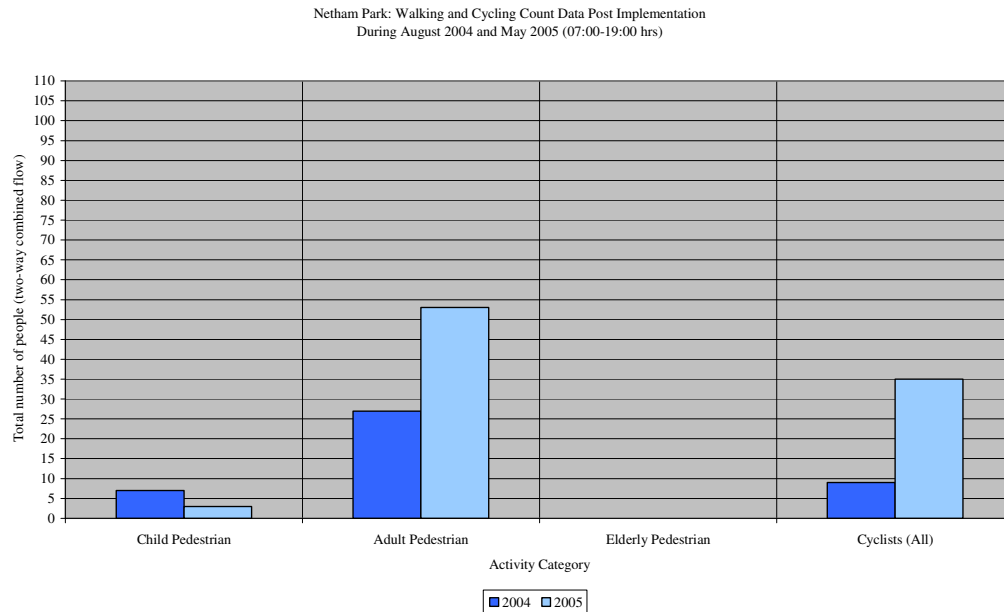


Figure 2.9.10-18 Walking and cycling count data for Netham Park

There is a 50% increase in the number of adult pedestrians using the path between the count points. This contributes towards the VT19 target (increase walking trips by 10%). Cycling trips have increased by 35% between the two counts which positively contributes towards the VT18 target of 30%.

Edge of City Area

Crox Bottom

Although a path existed through Crox Bottom the condition of the path, like that of Netham Park, was very poor. The path is an important strategic route linking Hartcliffe to the Malago greenway radial route. Work on the path included widening and resurfacing the path along the valley bottom. Crox Bottom is linked to the northern end of Wilmott park and was completed in March 2005. Figure 2.9.10-19 and Figure 2.9.10-20 show a section of the route before and after the infrastructure change.



Figure 2.9.10-19 Crox Bottom route prior to infrastructure change



Figure 2.9.10-20 Crox Bottom route after infrastructure change

The walking and cycling count collected at Crox Bottom before and after infrastructure change can be viewed in Figure 2.9.10-21. Counts were taken over 12 hour periods on the 3rd August 2004 (a school holiday period) and 24th May 2005. The weather condition for both days was showers.

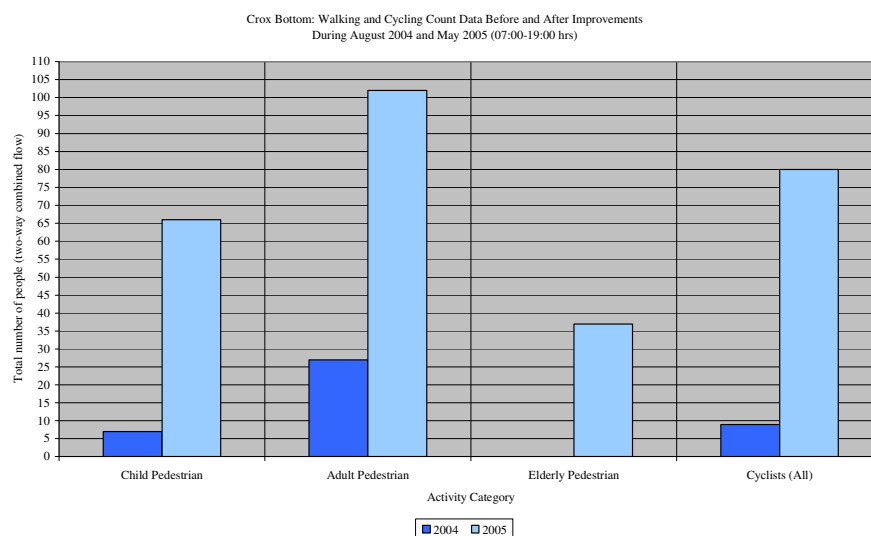


Figure 2.9.10-21 Walking and cycling count data for Crox Bottom

Improvements to the path have successfully contributed towards VT18 and VT19. Child pedestrians have increased by approximately 66%, adult pedestrians by 100% and elderly pedestrians by 37%. Cyclists have increased by approximately 80%. These figures exceed the targets and contribute significantly towards the measure objectives.

Wilmott Park

Wilmott Park is a linear space that runs north to south through Hartcliffe (this area was targeted as part of the travel awareness and marketing measure, WP 11.3). A new 900 metre path was constructed through the space linking a crossing under Hengrove way to Bishport Avenue. Walking and cycling count data collected at Wilmott Park for a 12 hour period on the 25th May 2005 are shown in Figure 2.9.10-22. The weather conditions for the 25th May were fine and clear.

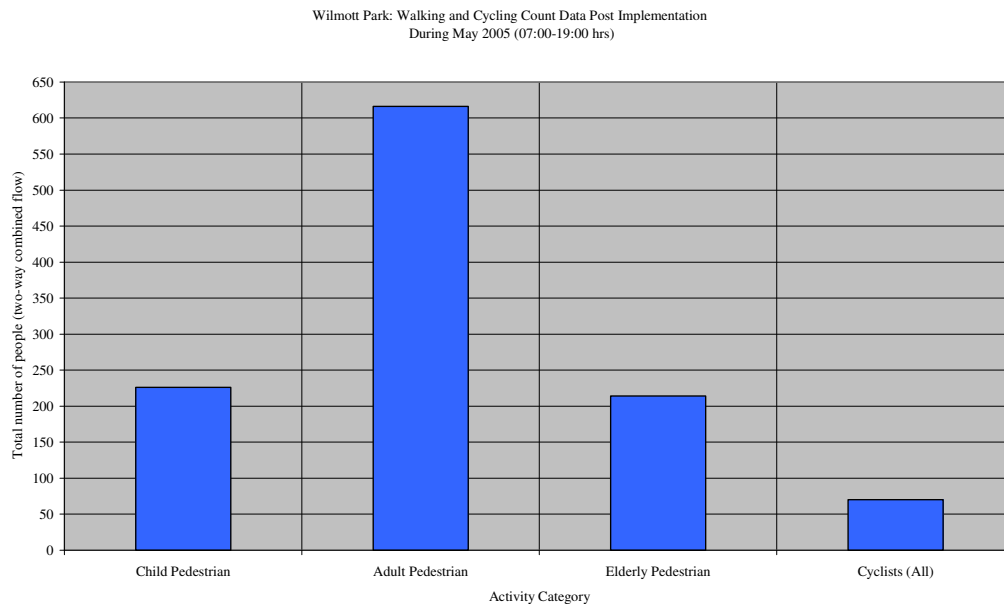


Figure 2.9.10-22 Walking and cycling count data for Wilmott Park

Usage of Wilmott Park is high amongst all pedestrian age groups but is utilised less by cyclists in comparison to pedestrians. The number of adult pedestrians using the path is approximately six times the number of adult pedestrians using Crox Bottom.

Safer Routes to Schools (Hartcliffe)

As previously discussed, this aspect of the measure identified walking and cycling accessibility issues for school pupils. Traffic calming measures were implemented at two locations near the school and mode of travel to the school is reported before and after infrastructure change. Table 2.9.10-13 shows the percentage of pupil using different transport modes to get to school before and after infrastructure change, and the percentage change. Counts were taken prior to infrastructure change and post infrastructure change on 3rd March 2005.

Table 2.9.10-13 Percentage of children arriving at school by mode before and after infrastructure change and percentage difference

School & Mode	% using mode before change	% using mode after change	% difference
Teyfant Community School			
Walk	65%	51%	-15%
Cycle	0%	2%	2%
Car	33%	39%	7%
Bus	2%	2%	0%
Other	0%	6%	6%
Hartcliffe School			
Walk	56%	64%	8%
Cycle	0%	2%	2%
Car	21%	25%	4%
Bus	7%	8%	1%
Other	16%	1%	-15%

There is an 8% increase in the number of children walking to school following infrastructure change at Hartcliffe Secondary School, but a 15% reduction at Teyfant Community School. Seasonal variations may partly account for this, as the initial survey was conducted on a warm overcast day and the second survey during a day when the weather was dry and cold. Seasonal variation may also account for the slight rise in car use. During the period 1992-2003¹ the proportion of primary aged children walking to school has declined nationally from 61% to 53%. Nationally there was 9% increase in the number of children being driven to school. These national shifts may partly account for the changes experienced at Teyfant Community School. Nationally there was a similar, although smaller, shift from walking to car use for secondary school pupils. The results at Hartcliffe Secondary School however positively impact on the V19 target. The other category included children who came to school by motorcycle, taxi or by other means e.g. non-motorised scooter or skateboard. Other categories were not consistent across before and after implementation counts making direct comparisons difficult.

There are encouraging signs for increases in cycling with a 2% increase in students cycling to school at both schools, contributing towards the V18 target.

Casualty Data

Adult and child pedestrian and cyclist road casualty statistics for Bristol in 2003 are displayed in Table 2.9.10-14:

Table 2.9.10-14 Road casualty statistics for children and adult pedestrians and cyclists in 2003

Accident Severity	Child (0-15)	Pedestrians	Child Cyclists (0-15)	Adult (16-71+)	Pedestrians	Adult Cyclists (16-71+)
Fatal	0		0	6		0
Serious	16		3	47		39
Slight	77		30	172		158
Total	93		33	225		197

Child casualty numbers continued to fall during 2003 and the interim child KSI (Killed or Seriously Injured) 2003 target was met. Child pedestrian casualties fell below the

¹ Office for National Statistics: Driving force – fourth fifths of annual travel by car. Available at: <http://www.ons.gov.uk> (Last accessed 01-06-2005)

1994-1998 average of 123 casualties per year. Child cycle casualties however rose slightly from 30 in 2002 to 33 in 2003 but remained below the 1994-1998 average of 46.

Adult pedestrian casualties for Bristol were lower than in 2002 (236 casualties) but remained above the 1994-1998 average of 216 casualties. Adult cyclist casualties increased from 153 in 2002 to 184 in 2003. This again remained above the 1994-1998 average of 153 adult cyclist casualties.

Conclusions

Extended and new build routes have been successful in increasing the number of pedestrians and cyclists using those routes. The role of Community Travel Workers (11.1) in the Dings Home Zone (6.3) has been important to the success of the extended Bristol/Bath Railway Path. Local residents were consulted about aspects of the path extension, especially the mural signifying the entrance to the 'Dings Home Zone'. Furthermore, Community Travel Workers have been successful in promoting the path through a cycling picnic designed to engage the local community, especially children.

2.9.11 Bristol – Social Inclusion in an Edge of City Community

The main objective of this package of measures was to make up a strategy to enhance accessibility to employment, leisure and other services for residents and others within the South Bristol area. Measures were also proposed to reduce the need for mobility, by establishing centres for e-working, commerce and learning.

The key Local Objectives of the social inclusion in South Bristol package of measures are to:

- Increase access to and awareness of travel information;
- Lessen the dependency on the car especially at peak periods;
- Provide quality alternatives to the car and encourage their use;
- Ensure that development takes place in such a way as to reduce the need to travel; and
- Ensure that the transport system contributes towards a successful economy by creating improved access to jobs.

The table below sets out the local evaluation objectives and how these relate to the overall VIVALDI objectives and targets.

Table 2.9.11-1 Objectives for inclusion in South Bristol

No	Local objective	Target	Contribution to VIVALDI target (s)
LO16	Increase access to PT information	Provide personalised travel information to all residence in target area	VT23 Increase number accessing PT information by 50%
LO17	Lessen dependency on the car	Improve walking and cycling links in the area	VT18 Increase cycle trips by 30% VT19 Increase walking trips by 10%
LO18	Provide alternatives to the car	Develop new car sharing sites	VT13 Increase number of car share sites by 5

LO19	Reduce the need to travel	Develop community delivery points to reduce car use.	VT8 Reduce mode share for cars by 5%
LO20	Increase access to employment	Develop e-learning and tele-working opportunities to increase level of employment by 5%	VT6 Increase employment opportunities by 5%

To achieve these targets the following measures were implemented for the package:

- 10.3 Home Shopping;
- 11.3 TravelSmart;
- 12.2 Information kiosks/advice screens; and
- 12.5 Widening Access (E-centres).

LO16 – Increase Access to PT information

VIVALDI target (VT23) is to increase the number accessing PT information by 50%. The travel awareness and marketing (TravelSmart) measure contributed to this target through the targeting of households in demonstration areas. In total 2,624 pieces of PT information were delivered to households who had expressed an interest in the TravelSmart scheme and in subsequently receiving PT information.

The evaluation of the usage of the i+ kiosks has shown that on average the Bristol Travel Channel (BTC) is used 6 times a day, which has shown that the public will use on-street kiosks for information. The results also suggest that there may be a sustained set of users of the kiosks and regular users of the BTC.

LO17 – Lessen the dependency on the car

VIVALDI target (VT18) is to increase cycle trips by 30%. The travel awareness and marketing (TravelSmart) measure contributed to this target by increasing the number of cycle trips in Hartcliffe by 27%, Bishopston by 42% and 7% in Southville, Bedminster and Windmill Hill. TravelSmart positively contributed towards the VT18 target in all demonstration areas.

VIVALDI target (VT19) is to increase walking trips by 10%. TravelSmart contributed towards this target in Bishopsworth by 10%, Hartcliffe by 7%, Bishopston by 5% and in Southville, Bedminster and Windmill Hill by 7%.

LO18 – Provide alternatives to the car

VIVALDI target (VT13) is to increase the number of car share sites by 5. The number of car share sites was not increased as part of social inclusion in South Bristol.

LO19 – Reduce the need to travel

The results for the Community Delivery Points and Home Shopping trials have shown that there has been a reduction in car trips as a result of the two schemes, but it has not been possible to state any quantified effect towards the Integrated Package targets. However, it should be stated that both schemes, and in particular the Home Shopping trial, have provided social benefits to the end users.

The Widening Access scheme (12.5) has provided Internet access to 40 homes in Knowle West in south Bristol. A user survey has identified that the scheme has reduced

travel in some homes. For example, many users now bank on-line and shop on-line and no longer have to travel to the local library to access the Internet.

LO20 – Increase Access to employment

The Widening Access scheme has provided Internet access to 40 homes in a socially excluded area. Due to the scale and time of implementation of the scheme it has not been possible to measure the direct impact on access to employment. However, a user survey identified that 25% of users intended to use the service for on-line training to improve their skills and 13% hoped to be able to use the service to work from home.

The following describes in detail the measure level results for this integrated package.

2.9.11.1 Bristol – Community delivery points and home shopping (10.3)

Measure Overview

The works included under this measure, as set out at inception, were to identify suitable sites for delivery points and develop delivery logistics and protocols for participating retailers. The creation of Community Delivery Points within VIVALDI has incorporated the use of locker banks and the Local Collect scheme for Royal Mail deliveries and an innovative Home Shopping trial for housebound people.

The Local Collect service was developed by Royal Mail with the aim of improving their parcel delivery service by improving convenience to customers and reducing the number and length of journeys made by the delivery vans. Customers can ask for the Local Collect service to be used when they place an order. They will then be asked whether they would prefer the package to be taken to their local Post Office or to a secure Locker Bank nearby.

The locker bank system involved the installation of secure electronic locker-bank technology at locations that are more convenient for the customer than the nearest Royal Mail depot. The trial scheme was implemented in Bristol postal wards BS1 and BS2; a significant geographical area incorporating both the VIVALDI city centre and edge of centre areas. It involved a number of local Post Offices and a new locker-bank in an area without a Post office and was introduced in these wards in October 2003.

The Home Shopping trial was delivered as a partnership between Bristol City Council, Brunel University, Somerfield and Bristol based charity the Dolphin Society. It was designed to enable housebound clients of the Council's Social Services Department to shop independently from home. People who need Social Services' assistance with shopping have to provide a care worker with their shopping list and the care worker will then go to the supermarket to purchase the shopping and deliver it to the client's home.

Previous research undertaken on this subject had shown that the clients wanted a more straightforward alternative to Internet shopping. To solve this problem, Brunel University designed and manufactured a low technology bar code reader and computer, known as the Companion, for the trial. The Companion was designed to enable people to scan bar codes to select their shopping. The Companion can compile a shopping list from these selections and submit it electronically.

People taking part in the trial were provided with a catalogue of products stocked by the Somerfield supermarket, based at Broad Walk in Knowle. The catalogue contained a brief description and accompanying bar code for each individual product, as well as bar codes that represent instructions to the Companion computer, e.g. to go back over the list or to submit it when completed. As each item is selected, the Companion reads it back to the person using the system. At any point in the process, the user can select a bar code that instructs the Companion to read back the whole list to check it.

Evaluation Results

Community Delivery Points

A request was made by the evaluation team for the following monthly information:

- The number of people registered for the scheme;
- Post codes of users. (work and home);
- The number of carrier deliveries of goods to the Locker Bank (visits per day);
- The number of notification messages sent by mail, email and SMS (i.e. the number of users); and
- The time each locker is occupied for each delivery (hrs per delivery).

The data collection for this measure was outside the control of the evaluation team and after several communications, the scheme contact at Royal Mail revealed that they were unable to gather specific information on transport implications, but did have a full market research evaluation of user acceptance and perceptions of alterations to travel patterns. However, this was not broken down by location. There were six towns or cities involved and the research was conducted across all locations.

Scheme Usage

The following information was provided by the Royal Mail contact. The trial in Bristol formed two of the six postcode trial areas. However, it has not been possible to separate the data.

There were six postcodes involved in the trial and a mix of locations, including a city centre, a city urban environment, a semi rural area and a fully rural area. Over the course of the trial an average of 2214 items per day were not delivered to the addressee because they did not answer the door. There were a total of 124,000 addresses in the trial. The trial included 7 locker banks and 63 Post Office Branches. Although scheduled for 3 months the trial continued due to the popularity of the service until budgets ran out.

Consumer Reaction

A survey was conducted across all the addresses but involving only those who had used the service. A statistically significant sample was surveyed with the following results:

- 84% thought Convenient Delivery has made collection of their items easier;
- 76% thought collection is more convenient than before;
- 39% will consider buying more through home shopping channels as a result of convenient delivery;

- 28% have bought more through home shopping channels as a result of convenient delivery;
- 20% will check with their retailer before ordering to see if Royal Mail is delivering the item;
- Overall satisfaction ratings have improved over those in the pre trial survey;
- 33% of users stopped using a car to collect items;
- Although the perception of waiting time between Delivery Office and post office has increased this does not appear to affect people's satisfaction rating – the overall journey time has decreased significantly and convenience improved;
- As in previous studies opening times are less important than proximity to collection point; and
- 88% of locker bank users found the locker-bank easy to use and 92% thought it secure.

The above results show that there were high levels of user satisfaction and that car journeys were saved as a result of the scheme. However, it has not been possible to calculate an exact figure for this from the data provided.

The scheme manager reported that “unusually for an operational change project, the local managers reported very high levels of local customer satisfaction, they themselves really liked the scheme and fought hard to prevent it's suspension once the trial was completed. Indeed they paid locally to continue the scheme for six months with Headquarters funding, which is unheard of”.

Home Shopping Trial

The original intention was to explore the potential role that home shopping could play in reducing the need to travel and in particular car use, in line with objectives in the VIVALDI programme. The data collection method was established independently from the VIVALDI programme and the needs of the VIVALDI data collection programme. Individual vehicle trips or journeys were not tracked and a record was not made of the vehicles used before the scheme commenced, i.e. a baseline, and after it was introduced.

There is a record of the home delivery service vehicle trips for deliveries to all customers but these were not exclusive to the Companion trial and it has not been possible for Somerfield to derive how many other deliveries were made in the same home delivery trip. Thus it has not been possible to measure the impact of the scheme in terms of trip reduction or reducing the need to travel by individual carers, paid or unpaid. Furthermore, it has not been possible to make a comparison of the impact the Companion trial scheme had on the number of trips made by the Somerfield home delivery service. Even if this breakdown in the data were available, the limited number of participants in the trial (13) will make it difficult to draw any significant impacts in reducing the number of vehicles on the road network.

The process interview was held with the aim of providing an assessment of the steps, decisions, and actions taken during the home shopping trial; the obstacles and opportunities encountered; and the roles and contributions of the different parties of relevance to the scheme. TTR followed a structured set of questions that sought to address the following points of interest and questions:

- The origins of the trial. How it came about. How it was implemented.
- How it has progressed over time. What has changed or adapted. What challenges were encountered? How they were overcome. What has been learnt from the trial?
- The role of partners, including VIVALDI, within the trial. Contributions of various different parties.

Questionnaire's were designed and distributed to the trial participants by the implementation team.

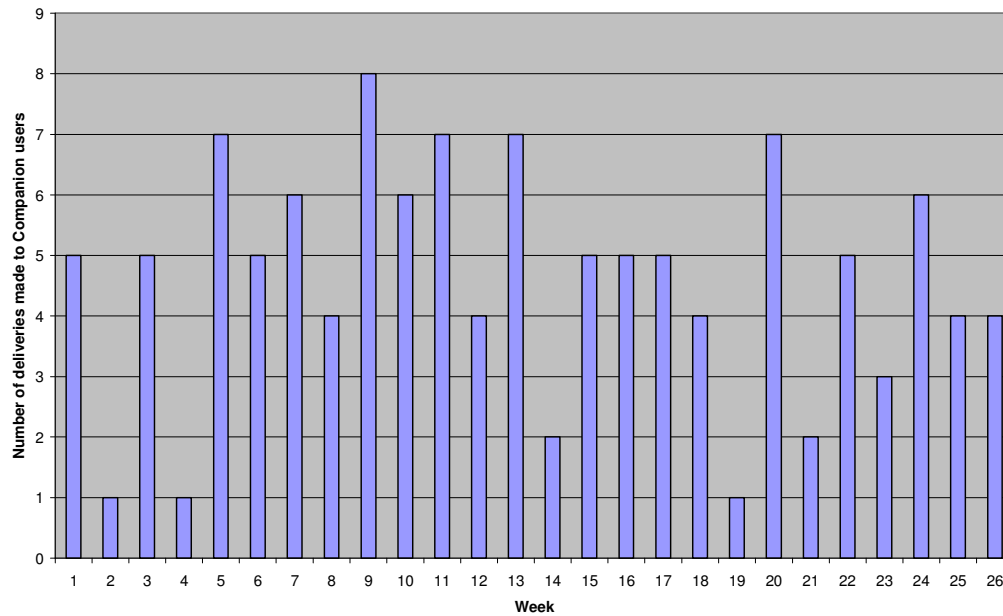
Scheme Usage

Data was collected for a 26-week period between the 14th December 2004 and 28th June 2005. The data provided by Somerfield supermarket accounts for the deliveries made to users in the trial who ordered their shopping using the Companion. It should be noted that the deliveries were included as part of the Somerfield home delivery service and it is not possible to specify how many other deliveries were made to non Companion users in the same vehicle trip.

The number of deliveries made to Companion users is shown in Figure 2.9.11-1. This shows the number of trial participants who ordered their shopping in any given week i.e. in week 1, five trial participants ordered their shopping using the companion and had it delivered to their place of residence by Somerfield home shopping delivery service.

An average of 4.6 deliveries have been made a week since the scheme was introduced. The fluctuation and variation in the number of deliveries made week by week has been reported by the implementation team to be due to variations such as Bank Holidays. Figure 2.9.11-1 shows that there were rarely a 'constant' number of deliveries made in successive weeks. An exception to this is the 5 deliveries made in weeks 15 to 17 inclusive and in the penultimate and last week of the trial, weeks 25 and 26. On more than 50% of the weeks in the trial 5 or more trial participants used the service; 15 out of the 26 weeks.

Figure 2.9.11-1 Somerfield Home Shopping Deliveries



Questionnaire Analysis

The 13 trial participants were asked to complete a questionnaire designed by the Implementation team to record why they were taking part in the trial and how they currently do their shopping.

Figure 2.9.11-2 and

Figure 2.9.11-3 show that most of the trial participants were over 70 years old and lived in sheltered accommodation.

Figure 2.9.11-2 Trial Participants' Age groups

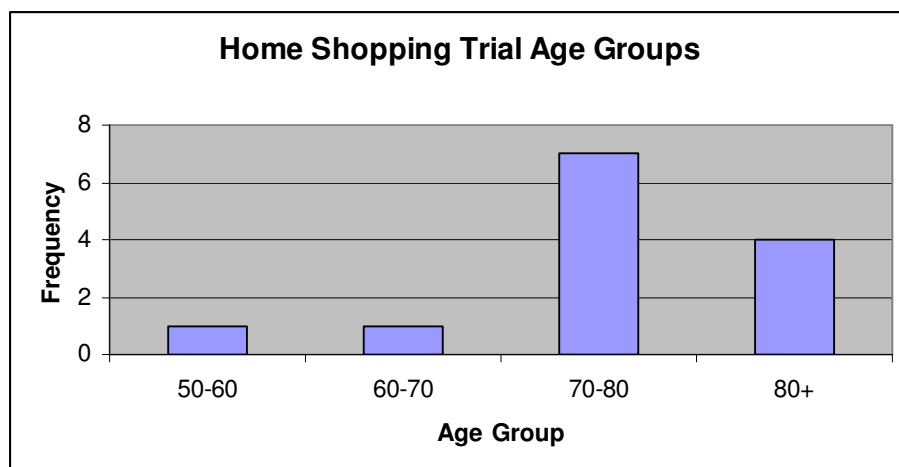


Figure 2.9.11-3 Trial Participants' Accommodation

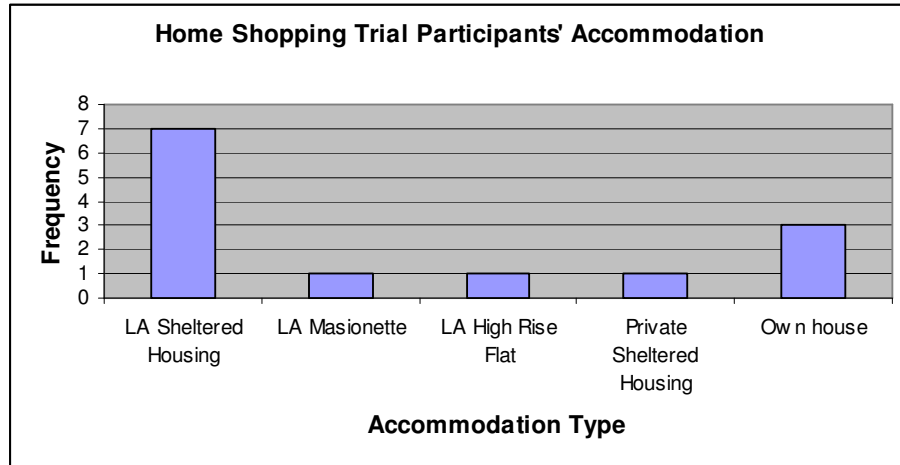
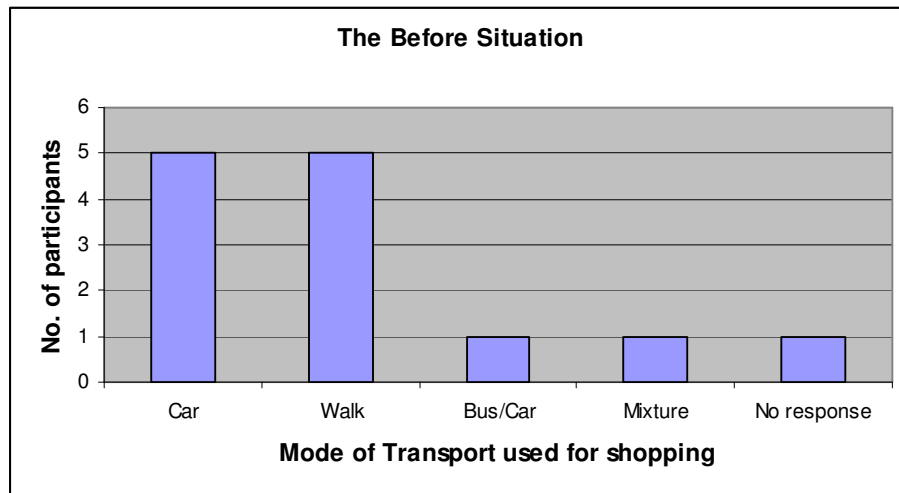


Figure 2.9.11-4 and Figure 2.9.11-5 show that the majority of the trial participants required support to carry out their weekly shopping and that the majority of shopping trips were either completed by foot or by car.

Figure 2.9.11-4 Frequency graph showing responsibilities for shopping



Figure 2.9.11-5 Modes of transport used for shopping trips before the trial



The trial participants were asked to state what they thought were the advantages and disadvantages of their current way of shopping. Table 2.9.11-2 shows that the participants particularly like the opportunity to be able to select their own shopping and often see it as a social activity. However they have also commented that they are heavily reliant on other people and often experience difficulties with heavy items or shopping loads.

Table 2.9.11-2 Stated Advantages and Disadvantages for current methods of shopping

Advantages to current way of shopping	Disadvantages to current way of shopping
Can look round shop and remember things	Don't like her to bring heavy things. HC job is for showering (daily)
Supports local shops	Restricted range
See his daughter - social	Niece's mother not well - doesn't like to bother her
Exercise for self	Carrying shopping upstairs to flat
Day out	Daughter awaiting knee replacement - not able to drive for 3 months
Get out	Daughter busy
Social	Costs £7.40 - 50% of cost of groceries
	Carrying shopping upstairs. Can't buy heavy things.
	Heavy items - juice, lemonade
	Don't like to rely on nephew. £5 delivery charge.
	Carrying shopping upstairs

The participants were asked whether they thought that the Companion that would be used to scan in their shopping requirements would be useful and if so why? Figure 2.9.11-6 and Table 2.9.11-3 show that most of the participants thought that the companion would be useful and that it would give them greater independence.

Figure 2.9.11-6 Participants' Initial Views on the usefulness of the Home Shopping Companion

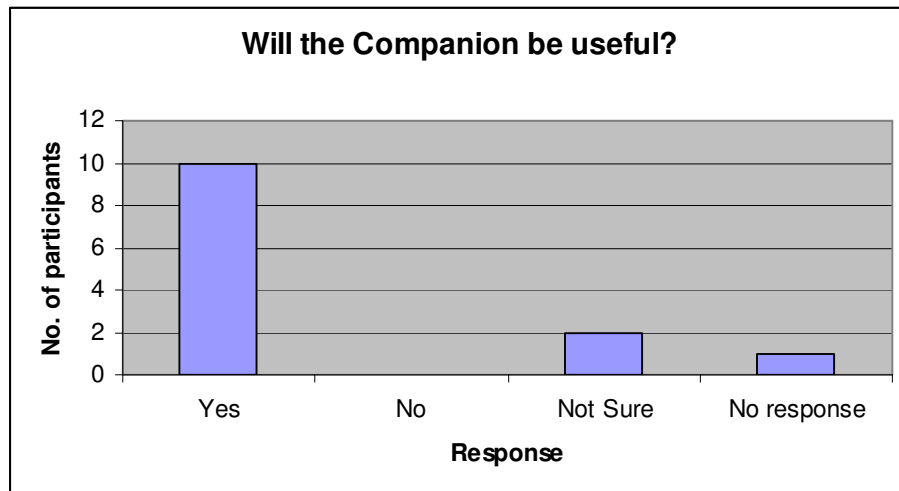


Table 2.9.11-3 Why participants feel that the Home Shopping Companion will be useful

Why?
"Will be a big help. If I see things I might want to buy more"
"interested in seeing how it works."
"HCA only allowed to carry 8 things, so I am restricted in what I can buy."
"Has had a fall - doesn't go out now."
"To buy heavy things."
"Because of daughter's knee op. Only goes out if taken - can't walk far."
"Independence"
"Cheaper"
"I will be able to go out for a coffee or to look for clothes instead of food."
"Doesn't want to rely on nephew."
"Will buy boring things from Somerfield. Will personally choose other things"

The 13 trial participants were asked to complete a questionnaire at some point during the trial period. The implementation team received 8 responses, of which 7 respondents stated that the new system was easy to use (1 participant did not respond to this question). The questionnaire mainly focused on the elements of the system and user satisfaction. The responses showed that all participants were managing to use the equipment successfully and had experienced very few difficulties. When asked whether the new system has increased or decreased car use 50% of participants stated that their car use had decreased as a result of the scheme.

Process

A process interview was held on Wednesday 20th July 2005 and the following opportunities, barriers and aspects of partnership working were discussed:

Opportunities

- Home shopping with the Companion gives individual users independence in terms of choice as well as access to a commercial shopping service. It became apparent that home shopping could play a key role in enabling more vulnerable members of society to retain their independence, which contributes towards improving social inclusion in the community and was therefore a key driver of the project.
- Home Shopping is useful because it enables users to gain access to shopping without having to visit a shop, reducing the need to travel.
- It improves the user's quality of life enabling them to shop for heavy items and to have time to do things other than shop.
- It allows those members of the community that don't have computers or easy access to computers, or a willingness to learn or 'phobia' about them, to continue shopping from home.
- The trial has created interest with a number of local authorities and voluntary bodies, such as Age Concern, in the United Kingdom.
- There has been a reduced need for car travel both with users and in the number of trips that are made by carers doing shopping trips for individuals. Whilst this is difficult to quantify, the demonstration does show a reduction in the basic need to travel.

Barriers

- A key barrier in the design stage of the process was the nature of the market for supermarket home deliveries. Home shopping played a smaller role in overall sales than had been anticipated, which meant that the supermarkets did not have the incentive to change their working practices on the scale required.
- The trial has required quite intensive one-to-one assistance in some cases. For example, working with one user who has dementia and forgets what to do from week to week. This has required the provision of very specific instructions to enable the user to use the Companion.
- There are cost implications for the planned 'next step' which is to issue 100-200 people with Companions.
- Funding is a major challenge for the future, beyond the lifetime of the VIVALDI programme. Funding has been secured to continue the trial for a period of twelve months.

Partnership working

The partnership has worked well but different partners have placed varying levels of priority on the scheme which has resulted in some problems and delays being encountered.

- Somerfield supermarket has supported the scheme from the outset. They were the only supermarket to indicate an interest in the scheme at its inception. They have been keen to progress with the trial but sometimes delays have been caused by the low priority of the Companion demonstration scheme on a day-to-day basis.
- Brunel University have been very efficient and have dealt with queries very quickly. One drawback has been the distance between the Bristol based trial and the university in London.

- The financial support from the VIVALDI programme has been essential. Part of the funding has supported the Bristol City Council Social Services team member's salary.

Conclusions

The results for the Community Delivery Points and Home Shopping trials have shown that there has been a reduction in car trips as a result of the two schemes, but it has not been possible to quantify the contribution towards the Integrated Package targets. However, it should be stated that both schemes, and in particular the Home Shopping trial, have provided social benefits to the end users.

The number of participants in the Home Shopping trial was limited (13 in total). It might be considered useful to maintain a record of the number of participants and to track the number of journeys that are not made as a direct result of people using the Companion. The social benefits to the end users and cost savings to home care assistants should not be underestimated. For the former group, there is a reduction in the need to travel and a trip or journey saved on each occasion that more than one user makes use of the home delivery service. Furthermore, Somerfield supermarket are reducing the need to travel, assuming that they make more than one home shopping delivery during any given trip, including those that have ordered shopping using the Companion. For the Companion trial participants, the saving will be in the time spent by home care assistants or others not having to carry out shopping duties for them.

2.9.11.2 Bristol – Travelsmart (11.3)

Measure Overview

The traditional approaches to achieving modal shift have been through the provision of transport services and infrastructure, pricing and longer-term land use policies. Although these measures are essential to increase walking, cycling and use of public transport as alternatives to car travel, their value is limited if people are unaware of the options available. It is now increasingly accepted that 'soft measures' are also required to improve individuals perceptions of the infrastructure and services available, if the full potential for behaviour change is to be realised.

Individualised Travel Marketing (ITM) campaigns have successfully been utilised as a technique for changing travel behaviour, in particular through the promotion of public transport. The TravelSmart programme in the UK, launched in 2001, seeks to provide powerful and innovative marketing and awareness campaigns in demonstration areas. The focus of TravelSmart in Bristol was the design and production of a personalised travel marketing campaign covering 5,000 people within targeted demonstration areas. Campaigns focused upon a broad range of complementary transport initiatives spanning Bristol City Council's transport strategy.

Individualised Travel Marketing (a component of the TravelSmart behaviour change programme) utilises personal contact with households to identify those households willing to reduce their car use before providing them with personalised information on alternative modes and incentives to try them.

The following methodology was used for Individualised Travel Marketing:

Contact and Segmentation Phase

The aim of this phase is to contact all households within the target groups and segment households into groups for later phases of the marketing campaign. Initial contact is made via a letter inviting households to participate in the scheme which is then followed by a telephone call.

Households are divided into groups according to their experience in using alternative modes of transport and their level of interest in changing their travel behaviour. The groups are summarised in Table 2.9.11-4 below:

Table 2.9.11-4 TravelSmart segmentation groups.

Group	Definition	Action
Group 'I'	Households interested in receiving information (not including public transport users, but including regular walkers and cyclists).	Offer alternative mode information and further services.
Group 'R' – With	Households with at least one person in the household using public transport regularly and requesting information.	Offer of reward and further information.
Group 'R' – Without	Households with at least one person in the household who regularly uses sustainable transport (including walking and cycling) but did not request further information.	Offer of reward only.
Group 'N'	Households that either refused to take part once contacted or were not interested in receiving further information.	No further contact.

Confirmation Phase

This phase aims to confirm and reinforce the behaviour of households making regular use of sustainable travel modes. Households in Groups R (with and without) and Group I are sent 'thank you' letters and a form offering a choice of TravelSmart-branded products (including a pen, travel mug or alarm clock). Gifts are delivered alongside requested information material.

Motivation Phase

This motivation phase aims to motivate household members to think about their travel choices, discuss their needs for information, and encourage them to request relevant information. The TravelSmart order form is mailed to all households in Groups 'I' and 'R – With'. A small incentive was included on both forms to encourage quick responses.

Information Phase

Assembly and hand-delivery of individualised information packages to households who requested information.

Convincing Phase

Households in need of further support on walking, cycling or public transport are offered a programme of personal advice and encouragement to enable them to make greater use of such modes. Encouragements include 'trial' tickets for public transport services, discount cards for local cycling shops, advice session by a walking expert and discounts at walking shops.

Travel Behaviour Surveys

These are conducted on a sample of the target population before and after the Individualised Travel Marketing campaign, together with a separate control group ensuring background changes are taken into account.

For each household, the survey consists of a household questionnaire and a set of individual diaries for all household members for a nominated day of the week (this helps to reduce respondent burden). Non-returned surveys are followed with further motivation by post and telephone.

The TravelSmart programme in Bristol was implemented in three parts:

TravelSmart 1

TravelSmart was implemented in the Bishopsworth and Hartcliffe areas of Bristol among a total target population of 5,000 people in two phases in Autumn 2002 and Autumn 2003. This project was designed to measure the impact of TravelSmart as well as improvements to the local bus service (made through measure 8.6) on an edge of city location, where baseline levels of walking and cycling were low.

TravelSmart 2

A second project was carried out in the Bishopston area among a target population of nearly 5,000 people in Spring 2003. This project was designed to measure the impact of TravelSmart in an area where car ownership was high and baseline levels of walking were also already high. Evaluation also included some spatial analysis of travel behaviour.

TravelSmart 3

A third project was completed in the Bedminster, Southville, and Windmill Hill areas of Bristol among a target population of 5,000 people in Spring 2005. This area was an edge of city centre location with a regular public transport service, and particularly good opportunities for walking and cycling due to direct routes to the city centre provided by footbridges and pedestrian/cyclist ferry services.

The design and implementation of TravelSmart aimed to meet the following measure objectives: encourage alternatives to the car; foster a cultural climate that is receptive to alternatives to the car; and lessen the dependency on the car especially at peak periods. The measure also aimed to positively impact on the following quantifiable targets as outlined in the Evaluation Plan (D4), within the integrated package of Social Inclusion in South Bristol:

- VT6: Increase employment opportunities by 5%
- VT8: Reduce mode share for cars by 5%
- VT18: Increase cycle trips by 30%
- VT19: Increase walking trips by 10%

- VT23: Increase the number accessing public transport (PT) information by 50%

Evaluation Results

TravelSmart 1 – Bishopsworth and Hartcliffe

This Individualised Travel Marketing campaign was conducted in two phases: Bishopsworth in Autumn 2002 (Phase 1) and Hartcliffe in Autumn 2003 (Phase 2), alongside measure 8.6 (new public transport contracts) to upgrade the local bus corridor. The Individualised Travel Marketing campaigns resulted in substantial increases in walking, cycling and use of public transport, leading to relative reductions in car trips of 9% in Bishopsworth and 12% in Hartcliffe. This contributes towards the VT8 target and positively impacts on the VT23, 18 and 19 targets.

Phase 1 – Bishopsworth

The short-term effects of TravelSmart (based on a before survey in March 2002 and after survey in March 2003, conducted 6 months after implementation) resulted in an increase in walking (10%), achieving the V19 target, an increase in public transport use (23%) and a reduction in the number of car driver trips (7%), contributing towards the 5% VT8 target.

Travel surveys conducted on a control sample (300 persons) in Headley Park (an adjacent residential area situated on the Showcase bus corridor) showed a 20% increase in public transport trips resulting from the service improvements alone, thus contributing towards the 50% VT23 target. When combined with the Individualised Travel Marketing campaign, this enhanced growth further by 13% resulting in an aggregate 35% increase in public transport trips. The service improvements alone resulted in a 4% reduction in car trips (1% car as driver and 3% as car passenger). Improvements in the service alone resulted in a 5% reduction in walking trips but this was offset by the increase in public transport use. When combined with the effect of TravelSmart there was a net walking increase of 10%, achieving the V19 target.

As a result of the Individualised Travel Marketing Campaign, there were slight increases in the distances travelled by Bishopsworth residents (16km compared to 15km) and travel time (52 minutes compared to 50 minutes), but there were no measurable impacts on the number of activities undertaken on a daily basis (1.4) or the number of trips travelled (2.4).

Phase 2 – Hartcliffe

The outcomes of Hartcliffe (Phase 2) were measured by a before survey (March 2003) and a post-implementation survey in June 2004. The results suggest a 11% increase in public transport use as a result of service improvements alone. When combined with the Individualised Travel Marketing campaign, this increased growth by an additional 12%, resulting in an aggregate 25% increase in public transport trips. In turn this contributed towards the VT23 target. There was a slight increase in the number of car trips made as a result of service improvements alone (4%); however, combined with the effect of TravelSmart, this resulted in a reduction of car as driver by 10% and a slight increase of car as passenger (2%). TravelSmart resulted in a 27% increase in the number of cycling trips and a 7% increase in the number of walking trips, contributing towards the VT18 and VT19 targets.

As a result of the campaign there were slight increases in the distances travelled by Hartcliffe residents (17km compared to 16km) and travel time (57 minutes compared to 56 minutes) but no differences between the number of activities (1.5) or the number of trips travelled (2.5).

Bishopsworth and Hartcliffe Comparison

The differences in outcomes between the two target areas may in part be explained by the more intensive approach to the early phases of the Individualised Travel Marketing process adopted during Phase 2 as a result of lessons learned during Phase 1. Due to the low proportion of households with available telephone records in Hartcliffe, the contact stage of Phase 2 was modified to include a door-to-door approach, contributing to higher response rates.

Phase 1 of the Individualised Travel Marketing campaign involved making contact with the target population of 1,081 households in Bishopsworth. Of these 80% responded and nearly 46% of respondents were interested in the offer of local travel information and advice through the TravelSmart campaign. As a result, personalised TravelSmart information packs were delivered to a total of 286 households in the target area.

Phase 2 of the Individualised Travel Marketing campaign involved making contact with the target population of 1,062 households in Hartcliffe. In this case, the telephone and postal contact used in Phase 1 was supplemented by a door-to-door approach combining contact and service phases. As a result a higher proportion of the target population (90%) responded, and nearly 56% of these households were interested in the offer of local travel information and advice through the TravelSmart campaign. Personalised TravelSmart information packs were delivered to a total of 490 households (46% of the target population compared with 26% in Bishopsworth).

The information materials on offer through the TravelSmart campaign included a new local travel map showing walking, cycling and public transport routes and a series of stop-specific bus timetables, both developed by Bristol City Council with support from Sustrans and First in Bristol. Households were also able to request a range of further TravelSmart services including personal advice sessions and incentives to encourage more walking, cycling and public transport use. These included four-week 'Rover Cards' provided by First in Bristol to enable selected households to try out local bus services free of charge. The level of response indicated high levels of hidden demand for information and personalised advice on local travel choices. In total more than 7,766 items of information and incentives (2,053 in Bishopsworth and 5,713 in Hartcliffe) were distributed during the programme, an average of just over 7 per participating household in Bishopsworth and 10 per participating household in Hartcliffe.

TravelSmart 2 – Bishopston

The second TravelSmart programme conducted in Bishopston during 2003-04 was successful in achieving significant changes in travel behaviour among the target population of nearly 2,000 households.

The Individualised Travel Marketing campaign resulted in substantial increases in walking, cycling and use of public transport, leading to relative reductions in car trips of 11%, and in car distances travelled of 13% (a net saving of 1.7 million car kilometres

per year among the target population). This significantly contributes to the VT8 target of 5%. Walking was increased by 5% and cycling by 42% contributing towards VT19 and VT18 respectively. Public transport use was increased by 15% contributing towards the VT23 target.

These changes were achieved without any constraint on daily mobility among the target population, and with no increase in daily travel time. The reductions in car use were spread across all trip types and throughout the day, but with the greatest changes during the morning and afternoon peaks.

These outcomes were measured by an analysis of travel surveys conducted before and nine months after the marketing activities. Interim surveys conducted ten weeks after the marketing showed similar results, with an overall 10% reduction in car trips.

There was some evidence from a spatial analysis of the survey findings that the behaviour change was greater in parts of the target area with relatively high baseline levels of walking, cycling and public transport use.

The first stage of the Individualised Travel Marketing campaign involved making contact with the target population of 1,937 households in the Bishopston, Redland and Ashley Down areas of the city. More than 90% of these responded, and nearly 70% of respondents were interested in the offer of local travel information and advice through the TravelSmart campaign. As a result, personalised TravelSmart information packs were delivered to a total of 885 households in the target area.

The information materials on offer through the TravelSmart campaign included a new local travel map showing walking, cycling and public transport routes and a series of stop-specific bus timetables, both developed by Bristol City Council with support from Sustrans and First in Bristol. Households were also able to request a range of further TravelSmart services including personal advice sessions and incentives to encourage more walking, cycling and public transport use. These included four-week 'Rover Cards' provided by First in Bristol to enable selected households to try out local bus services free of charge. Incentives positively contributed towards reaching the VT23 target.

In total more than 10,000 items of information and incentives were distributed during the campaign, an average of 11 per participating household.

TravelSmart 3 – Southville, Bedminster and Windmill Hill

The third TravelSmart programme conducted in the Southville, Bedminster and Windmill Hill areas of Bristol during 2005-05 was successful in achieving a shift towards more sustainable travel modes among a target population of 2,275 households.

The Individualised Travel Marketing campaign resulted in relative increases in walking trips of 7%, cycling trips (22%) and public transport trips (18%), contributing towards VT19, VT18 and VT23 targets respectively. The campaign involved making contact with 2,275 households with publicly available telephone numbers in the target area. A total of 90% of households responded, and 70% were interested in the offer of local travel information and advice through the TravelSmart campaign. In total, personalised information packs were delivered to a total of 963 households in the target area, and

more than 11,500 items of information and incentives were distributed during the campaign, an average of 9 per participating household.

Conclusions

The TravelSmart programme successfully achieved shifts towards more sustainable modes of transport (including public transport) without significantly altering journey times or route distances. The TravelSmart method, previously successfully applied in other parts of Europe, has now been successfully applied in the UK and proves the versatility of the method across different regions. The four local authorities in the Greater Bristol area are preparing a 'Smarter Choices' strategy within which an ongoing programme of Individualised Travel Marketing is likely to be a significant element. It is therefore expected that Individualised Travel Marketing will be embedded in the Joint Local Transport Plan for the 2006-2011 period. A new project is being prepared for 2005/06, including elements of marketing aimed at improving driver styles, and increasing Car Club membership, as well as improving air quality in this area (forming part of the Air Quality Management Area).

2.9.11.3 Bristol – Information (i+) kiosks / advice screens (12.2)

Measure Overview

i+ kiosks are stand alone electronic information kiosks that are Internet ready. The kiosks allow users to access the Internet and use email facilities as well as access to numerous information channels. i+ kiosks were first introduced in Bristol at locations with high footfall as part of a project titled 'Legible City'. This project implemented 18 i+ kiosks in July 2002. As part of the VIVALDI project it was proposed that a further 10 i+ kiosks would be installed in Bristol. The locations of the new kiosks had to match the objectives of the project and were chosen to be in areas that are associated with the project, despite many of these areas having a relatively low footfall in comparison with the signs installed as part of the Legible City project.

In total 28 i+ points are now installed in and around Bristol city centre. Table 2.9.11-5 lists the locations of these 28 points and classifies them into two groups: those funded by the Legible City Project and those funded as part of the VIVALDI. The table also provides the i+ installation date.

Table 2.9.11-5 i+ Kiosks located in Bristol

iPlus Point	Funding	Installation Date
Anchor Square, Bristol (79)	Legible City	July 2002
Bedminster Parade, Bristol (86)	Legible City	July 2002
Broad Quay, Bristol (75)	Legible City	July 2002
Broad Walk, Knowle, Bristol (87)	Legible City	July 2002
Central Podium, Bristol (77)	Legible City	July 2002
Central Promenade, Bristol (78)	Legible City	July 2002
Cityspace Reception (50)	Legible City	July 2002
Clare Street, Bristol (74)	Legible City	July 2002
College Green, Bristol (85)	Legible City	July 2002
Colston Avenue, Bristol (84)	Legible City	July 2002
Haymarket, Bristol (71)	Legible City	July 2002
High St, Shirehampton, Bristol (88)	Legible City	July 2002
High Street, Bristol (73)	Legible City	July 2002
Horsefair, Bristol (76)	Legible City	July 2002
Quay Head, Bristol (80)	Legible City	July 2002
Queens Rd, Bristol (81)	Legible City	July 2002
Redcliffe Way, Bristol (83)	Legible City	July 2002
Union Street, Bristol (72)	Legible City	July 2002
Bath Road Park and Ride, Bristol (216)	Vivaldi	November 2002
Gloucester Rd, Bristol (214)	Vivaldi	November 2002
Lawrence Hill, Bristol (218)	Vivaldi	November 2002
North Street, Bedminster, Bristol (212)	Vivaldi	November 2002
Portway Park and Ride, Bristol (215)	Vivaldi	November 2002
Queens Rd, Clifton, Students Union, Bristol (213)	Vivaldi	January 2003
St Peters Rise, Bishopsworth, Bristol (299)	Vivaldi	January 2003
Bristol Zoo Gardens, Northcote Road, BS8 3HA (302)	Vivaldi	January 2003
Clifton Down Shopping Centre (300)	Vivaldi	January 2003
Hareclive Road, Bristol (217)	Vivaldi	April 2003

The measure forms part of the Social Inclusion in an edge of a city community integrated package that was set the following objectives at the project inception:

VT23 – Increase the number of people accessing PT information by 50%

VT18 – Increase cycle trips by 30%

VT19 – Increase walking trips by 10%

VT13 – Increase the number of car share sites by 5

VT8 – Reduce mode share for cars by 5%

VT6 – Increase employment opportunities by 5%.

Evaluation Results

Information supplied

Monthly data was supplied from Cityspace Limited, the company which manages the i+ points. These reports contained usage data for each i+ point, and included additional information on the use of the Bristol Travel Channel when it was introduced in June 2003.

The following lists the monthly data that was supplied for each VIVALDI and Legible City i+ point during the period (July 2002 – December 2004):

- Number of uses (all Channels);
- Number of channels used;

- Total Usage Time (hrs);
- Number of Sessions on the Travel Channel (launched in June 2003); and
- Total Travel Channel Usage Time (hrs) (launched in June 2003).

The monthly reports provided by Cityspace also contained the following calculations:

- Average uses per day;
- Average channels per use;
- Average time per use (mins);
- Proportion of sessions on the Travel Channel (June 2003 onwards); and
- Proportion of time spent on the Travel Channel (June 2003 onwards).

The kiosks are completely open for use by the public and do not require any log-on activities. It was therefore not possible to collect information on the number of users.

Apart from the Bristol Travel Channel it was not possible to ascertain usage of the channels that were available on the i+ kiosks over the monitoring period and the number of channels available at each site. It was therefore not possible to establish in detail what the kiosks were being used for.

Data Coverage

Data was supplied by Cityspace Limited for each i+ point in Bristol from the date of implementation until the end of December 2004. Table 2.9.11-6 details the data coverage for each VIVALDI i+ point and the period for the i+ signs installed as part of the Legible City project. Continuous data was not available for some i+ points. This may have been due to software update times and machine reliability. The amount of missing data is identified in Table 2.9.11-7.

Table 2.9.11-6 i+ data coverage

Source	Site No.	Data Starts	Data Ends	Data (months)	Missing/Erroneous Data (months)
Legible City	All	July 2002	December 2005	30	10
Vivaldi	216	November 2002	December 2005	26	0
Vivaldi	214	November 2002	December 2005	25	2
Vivaldi	218	November 2002	December 2005	25	3
Vivaldi	212	November 2002	December 2005	26	1
Vivaldi	215	November 2002	December 2005	26	1
Vivaldi	213	January 2003	December 2005	20	7
Vivaldi	299	January 2003	December 2005	19	10
Vivaldi	302	January 2003	December 2005	19	6
Vivaldi	300	January 2003	December 2005	22	7
Vivaldi	217	April 2003	December 2005	21	2

Reliability

Table 2.9.11-7 contains details of periods of time where no usage data was available for analysis. The table shows that more data was missing for the VIVALDI i+ machines. Maintenance records were not provided to TTR so it is not possible to determine the

reasons for and differences in reliability, but they may be due to implementation difficulties, software update schedules, modifications in the design or vandalism at these locations.

Table 2.9.11-7 Reliability analysis

Source	Site No.	Missing Data (months inclusive)
Legible City	87	Dec 03 and Mar 04
Legible City	83	Sep 03 to Dec 03
VIVALDI	302	Feb 03 to Jun 03
VIVALDI	300	Feb 03 to Mar 03 and May 03 to Jun 03
VIVALDI	214	Jan 03
VIVALDI	218	Jan 03
VIVALDI	213	Feb 03 to Mar 03 and May 03 to Jun 03
VIVALDI	299	Feb 03 to Mar 03, May 03 to Jun 03 and Jan 04
Source	Site No.	Suspected Data Errors (month(s) inclusive (usage figure))
Legible City	83	Aug 03 (8) and Sep 04 (3)
Legible City	87	Apr 03 (6), Jan 04 (56) and Feb 04 (28)
Legible City	88	Sep 04 (3)
VIVALDI	302	Jan 03 (54)
VIVALDI	300	Jan 03 (54), Apr 03 (3) and Jul 03 (10)
VIVALDI	214	Dec 04 (10)
VIVALDI	217	Sep 04 (14), Dec 04 (6)
VIVALDI	218	Nov 02 (11) and Dec 04 (10)
VIVALDI	212	Dec 04 (10)
VIVALDI	215	Nov 02 (11)
VIVALDI	213	Jan 03 (54), Apr 03 (3), Jul 03 (10)
VIVALDI	299	Jan 03 (96), July 03 (10), Apr 04 (3), Feb 04 (9) and Dec 04 (9)

Table 2.9.11-8 to Table 2.9.11-18 display the information that was used for analysis for all the VIVALDI i+ points and show that a continuous stream of data for all 10 VIVALDI i+ points has only been achieved since July 2003. Since this date, reliability of the data for the VIVALDI kiosks has been relatively high. The Legible City machines that were installed in July 2002 have been very reliable with only 10 missing data entries in the same period.

The main analysis in this report has been restricted to the period of January 2003 – December 2004 to provide 2 years utilisation data for the Legible City kiosks and robust analysis of all VIVALDI kiosks from July 2003. Results shown in italics should be treated with caution as they are based on incomplete sets of data. In total, 28 i+ points are located in and around Bristol. Table 2.9.11-5 lists the locations of these 28 points and classifies them into two groups; those introduced as part of the VIVALDI project and those introduced previously by the Legible City project.

Table 2.9.11-8 Usage date availability for the Legible City i+ Kiosks

Month	site	79	86	75	87	77	78	50	74	85	84	71	88	73	76	80
Jan-03	31	990	929	1335	708	1083	1467	473	908	986	1301	806	1353	689	1004	1146
Feb-03	28	1693	1349	1802	787	1473	1694	638	1133	1515	1919	1162	1586	855	1563	1810
Mar-03	31	1844	1464	2145	853	1551	1517	619	1322	1802	2120	1433	1481	941	1541	1894
Apr-03	30	1362	1135	1487	671	1359	1994	511	757	1046	1557	1126	1210	844	1543	2010
May-03	31	1829	1022	1745	1669	1632	2062	617	868	1348	1451	1201	1931	999	1961	1977
Jun-03	30	1547	1231	1765	1177	1250	1222	476	1137	1196	1663	1278	1151	901	2032	1968
Jul-03	31	1969	959	1966	631	1632	563	627	1267	1596	1995	1430	1385	1028	1399	1727
Aug-03	31	2520	1398	2068	310	1862	916	603	1206	1674	1210	1703	1430	1244	1629	2670
Sep-03	31	1772	975	2017	848	1599	718	376	1271	1665	2393	1347	397	465	1626	2081
Oct-03	31	1527	1347	1804	806	1320	2485	375	1317	817	2164	1194	990	971	1391	1170
Nov-03	30	998	910	1173	132	2230	1525	140	865	993	2137	844	575	625	1003	1250
Dec-03	31	828	822	955		1060	1288	93	791	549	1167	870	782	550	1018	950
Jan-04	31	840	760	726	56	933	1482	151	631	989	1063	790	757	499	822	1029
Feb-04	29	1098	558	990	28	1032	1305	157	742	853	1363	437	648	567	669	1100
Mar-04	31	960	778	992		983	1368	220	582	742	1918	682	792	614	787	1093
Apr-04	30	1136	922	915		843	1304	204	679	629	1907	754	824	602	766	1165
May-04	31	1267	741	1030	200	914	723	149	585	840	1024	878	836	559	751	1188
Jun-04	30	990	553	732	166	980	590	108	642	853	857	796	703	503	706	1134
Jul-04	31	1489	895	647	155	1070	374	113	818	1126	1731	966	854	702	907	1651
Aug-04	31	1672	966	1011	307	1254	1503	122	810	1055	2237	1142	769	670	848	2253
Sep-04	31	1276	873	779	364	1008	1354	109	642	759	1734	1023		554	295	1898
Oct-04	31	1371	817	1087	449	1130	1496	83	1080	1360	1700	1228	605	831	1416	2045
Nov-04	30	1088	749	932	346	1207	1517	146	1024	1300	1286	1216	902	710	1190	1739
Dec-04	31	646	372	476	128	784	808	113	318	633	728	690	229	439	688	605



Table 2.9.11-9 Channel Usage date availability for the Legible City i+ Kiosks

Month	site	79	86	75	87	77	78	50	74	85	84	71	88	73	76	80
Jan-03	31	2042	1684	2573	906	2211	3028	680	1649	1991	2333	1441	1416	1078	2003	2232
Feb-03	28	3943	2922	4001	1053	3356	4968	561	2082	3173	4198	2246	3243	1496	3528	4421
Mar-03	31	4114	2690	4510	1025	3242	5461	436	2620	3544	4343	2687	2466	2042	3256	4064
Apr-03	30	3042	2084	2753	732	2949	6090	372	1247	1996	2894	1923	1765	1759	2878	4507
May-03	31	4019	1752	3240	1725	3372	6137	424	1231	1553	2433	2111	2405	2059	3261	4014
Jun-03	30	3806	2559	3570	1221	2622	3806	207	2271	2439	3680	2726	1886	2092	3142	4957
Jul-03	31	5181	2195	4436	1010	3444	1788	411	2613	3913	4517	2904	2431	2280	2784	4278
Aug-03	31	7445	4424	5366	614	4823	2332	575	2373	4473	2996	3831	2813	2782	3792	7242
Sep-03	31	4004	1730	3998	1009	3634	1493	287	2530	3377	3882	2351	886	878	3257	4404
Oct-03	31	4355	2935	4050	1274	3626	6142	316	3231	1930	4059	2310	2113	1946	3891	2737
Nov-03	30	3731	3108	4278	257	4873	6417	444	2826	3657	4052	2953	1469	2072	3691	4607
Dec-03	31	2451	2826	2968		3413	5418	311	2264	1892	2721	2521	2169	1495	3027	2593
Jan-04	31	2469	2371	2425		3278	6323	433	1800	2987	3227	2471	2029	1457	2755	2795
Feb-04	29	4230	2569	4715		4958	6587	559	2842	3449	4627	1900	2344	2013	2881	3841
Mar-04	31	2754	2676	3394		3036	5237	1042	1697	2147	3925	2112	2020	1590	2498	3078
Apr-04	30	3753	2603	3112		3121	5595	535	1862	2089	3248	2284	2328	1459	2870	3206
May-04	31	4877	3560	4128	783	3735	3480	354	1910	3268	3242	3091	2881	1924	3005	3698
Jun-04	30	2358	1484	2053	77	2587	2250	297	1503	2180	2268	2158	1981	1341	1804	2230
Jul-04	31	5115	4262	3141	869	4073	1916	467	2983	3727	5562	3731	2978	2284	3525	7099
Aug-04	31	4511	3178	3215	881	3572	5538	408	2100	2644	3922	3717	1807	1652	2302	7450
Sep-04	31	3003	2553	2453	1121	2902	4755	324	1572	1625	3281	3129	1899	1226	768	5743
Oct-04	31	4296	2940	3307	1225	4452	5750	260	2887	3251	3755	3770		2468	4542	5957
Nov-04	30	3651	1209	3791	998	4940	7001	435	3121	3967	4986	3809	2696	2015	3934	5265
Dec-04	31	3369	5327	2726	1734	3990	3310	361	3507	1573	1853	2943	886	1613	3937	3452



Table 2.9.11-10 Channel Usage date availability for the Legible City i+ Kiosks

Month	site	79	86	75	87	77	78	50	74	85	84	71	88	73	76	80
Jan-03	31	2042	1684	2573	906	2211	3028	680	1649	1991	2333	1441	1416	1078	2003	2232
Feb-03	28	3943	2922	4001	1053	3356	4968	561	2082	3173	4198	2246	3243	1496	3528	4421
Mar-03	31	4114	2690	4510	1025	3242	5461	436	2620	3544	4343	2687	2466	2042	3256	4064
Apr-03	30	3042	2084	2753	732	2949	6090	372	1247	1996	2894	1923	1765	1759	2878	4507
May-03	31	4019	1752	3240	1725	3372	6137	424	1231	1553	2433	2111	2405	2059	3261	4014
Jun-03	30	3806	2559	3570	1221	2622	3806	207	2271	2439	3680	2726	1886	2092	3142	4957
Jul-03	31	5181	2195	4436	1010	3444	1788	411	2613	3913	4517	2904	2431	2280	2784	4278
Aug-03	31	7445	4424	5366	614	4823	2332	575	2373	4473	2996	3831	2813	2782	3792	7242
Sep-03	31	4004	1730	3998	1009	3634	1493	287	2530	3377	3882	2351	886	878	3257	4404
Oct-03	31	4355	2935	4050	1274	3626	6142	316	3231	1930	4059	2310	2113	1946	3891	2737
Nov-03	30	3731	3108	4278	257	4873	6417	444	2826	3657	4052	2953	1469	2072	3691	4607
Dec-03	31	2451	2826	2968		3413	5418	311	2264	1892	2721	2521	2169	1495	3027	2593
Jan-04	31	2469	2371	2425		3278	6323	433	1800	2987	3227	2471	2029	1457	2755	2795
Feb-04	29	4230	2569	4715		4958	6587	559	2842	3449	4627	1900	2344	2013	2881	3841
Mar-04	31	2754	2676	3394		3036	5237	1042	1697	2147	3925	2112	2020	1590	2498	3078
Apr-04	30	3753	2603	3112		3121	5595	535	1862	2089	3248	2284	2328	1459	2870	3206
May-04	31	4877	3560	4128	783	3735	3480	354	1910	3268	3242	3091	2881	1924	3005	3698
Jun-04	30	2358	1484	2053	77	2587	2250	297	1503	2180	2268	2158	1981	1341	1804	2230
Jul-04	31	5115	4262	3141	869	4073	1916	467	2983	3727	5562	3731	2978	2284	3525	7099
Aug-04	31	4511	3178	3215	881	3572	5538	408	2100	2644	3922	3717	1807	1652	2302	7450
Sep-04	31	3003	2553	2453	1121	2902	4755	324	1572	1625	3281	3129	1899	1226	768	5743
Oct-04	31	4296	2940	3307	1225	4452	5750	260	2887	3251	3755	3770		2468	4542	5957
Nov-04	30	3651	1209	3791	998	4940	7001	435	3121	3967	4986	3809	2696	2015	3934	5265
Dec-04	31	3369	5327	2726	1734	3990	3310	361	3507	1573	1853	2943	886	1613	3937	3452



Table 2.9.11-11 Time used data availability for the Legible City i+ Kiosks

Date	Site	79	86	75	87	77	78	50	74	85	84	71	88	73	76	80	
Jan-03	31	36.51	33.54	53.49	24.5	46.29	67.53	9.65	33.3	41.04	46.96	30.68	50.66	21.09	38.41	43.08	2
Feb-03	28	56.21	54.97	69.54	22.08	56.63	73.11	6.4	34.72	74.35	57.77	37.15	60.71	24.88	57.37	62.88	3
Mar-03	31	56.41	43.23	74.55	20.45	64.19	59.87	5.18	43.27	57.22	61.35	44.31	48.31	27.43	53.31	64.21	4
Apr-03	30	44.7	38.84	52.75	14.87	56.7	71.18	4.81	22.58	34.39	50.22	34.88	34.45	24.11	61.87	70.81	2
May-03	31	55.71	31.33	62.73	77.08	62.95	72.53	6.24	22.57	31.29	77.58	32.66	79.19	29.13	77.2	66.26	3
Jun-03	30	50.84	46.62	60.53	48.86	44.74	45.49	3.49	39.63	37.53	56.82	38.81	34.25	28.15	86.36	69.81	3
Jul-03	31	66.78	45.4	79.45	22.23	68.13	25.62	6.62	43.17	62.24	71.17	44.22	48.11	34.14	38.6	59.95	3
Aug-03	31	82.32	74.57	82.52	10.25	69.66	32.69	7.29	42.51	60.42	46.15	49.3	37.19	36.75	46.6	95.32	3
Sep-03	31	57.92	47.13	105.95	21.99	66.8	31.11	5.39	40.43	60.36	83.98	54.91	15.39	15.28	50.23	76.51	4
Oct-03	31	57.24	58.31	85.83	26.51	63.07	131.74	6.09	51.62	30.36	83.24	44.65	40.82	33.32	62.2	46.5	3
Nov-03	30	46.93	58.84	78.18	10.14	142.63	126.43	6.63	45.49	50.95	100.14	57.81	28.45	33.55	55.72	66.6	3
Dec-03	31	35.66	50.47	60.36		64.08	106.99	4.32	33.96	28.96	55.2	47.36	36.72	34.29	55.52	44.27	2
Jan-04	31	37.11	45.11	43.68		59.56	116.62	5.84	29.25	54.94	59.13	44.43	29.92	29.53	49.26	46.72	2
Feb-04	29	48.29	33.5	64		69.46	96.65	6.74	33.17	41.21	64.7	24.78	22.65	34.32	45.54	46.25	3
Mar-04	31	43.75	45.43	65.01		64.26	102.42	9.18	29.56	38.92	85.13	37.39	35.65	41.8	60.86	53.01	3
Apr-04	30	55.37	50.34	54.58		68.04	94.62	8.06	32.01	33.66	90.39	46.25	31.66	41.93	60.22	58.79	2
May-04	31	64.32	44.86	64.75	17.8	67.94	52.75	5.68	29.18	43.99	54.17	49.49	31.15	36.88	60.29	54.89	4
Jun-04	30	43.42	28.89	41.21	13.09	61.9	53.74	4.17	34.84	43.66	45.45	43.38	26.71	31.47	53.76	56.78	2
Jul-04	31	79.06	58.61	42.14	13.92	62.71	26.07	4.55	42.75	60.76	85.75	52.19	35.35	41.8	75.15	111.52	2
Aug-04	31	89.84	61.3	59.56	22.61	77.04	113.45	4.84	36.25	49.08	113.13	71.21	28.53	36.41	68.53	160.97	6
Sep-04	31	66.41	59.52	47.58	28.46	71.83	97.64	4.34	30.23	34.89	73.92	70.7		34.58	23.29	166.58	4
Oct-04	31	94.95	60.61	80.26	31.29	103.26	126.64	4.64	67.63	74.94	101.17	84.06	37.07	59.81	108.22	174.01	5
Nov-04	30	91.62	45.15	78.71	22.33	110.97	157.93	9.63	78.02	104.24	98.17	96.31	61.64	51.27	104.64	158.13	8
Dec-04	31	53.88	32.51	38.4	9.1	73.05	80.53	7.04	21.64	45.59	51.72	49.83	13.93	31	62.78	46.95	3

Table 2.9.11-12 BTC Usage data availability for the Legible City i+ Kiosks

Month	site	79	86	75	87	77	78	50	74	85	84	71	73	76	80
Jun-03	30	140	91	116	37	89	88		109	100	146	123	81	115	185
Jul-03	31	261	123	172	38	187	55		138	235	262	173	108	210	205
Aug-03	31	339	162	174	21	215	121		140	232	141	222	131	285	365
Sep-03	31	304	85	207	59	195	75		152	201	339	232	51	265	240
Oct-03	31	265	234	236	80	181	312		195	97	361	235	160	261	198
Nov-03	30	279	201	218	31	580	300		179	158	189	259	150	260	240
Dec-03	31	133	138	147		278	207		252	98	172	147	66	176	134
Jan-04	31	218	129	132		180	297		122	182	214	160	108	206	193
Feb-04	29	296	93	205		190	254		178	198	225	95	109	169	228
Mar-04	31	253	164	201		165	270		128	163	219	140	113	204	275
Apr-04	30	262	174	185		144	278		128	129	118	155	78	210	263
May-04	31	335	153	194	28	191	150		114	199	177	155	103	152	262
Jun-04	30	226	132	161	4	265	132		122	184	174	155	107	164	248
Jul-04	31	348	202	203	29	183	106		175	230	313	216	120	218	417
Aug-04	31	358	183	312	47	232	425		209	235	229	256	113	174	616
Sep-04	31	243	151	191	47	179	344		155	146	274	216	103	81	468
Oct-04	31	241	116	243	62	231	397		201	232	221	262	102	327	361
Nov-04	30	235	115	211	77	215	351		233	216	255	230	130	256	251
Dec-04	31														



Table 2.9.11-13 Time spent on the BTC Channel data availability for the Legible City i+ Kiosks

Month	site	79	86	75	87	77	78	50	74	85	84	71	88	73	76	80
Jun-03	30	2.39	1.61	2.63	0.77	1.54	1.44		1.73	2.13	2.68	2.26	1.4	1.32	2.8	2.99
Jul-03	31	3.68	33.82	3.63	0.71	3.01	1.05		2.73	4.62	5.08	3.17	3.2	1.89	4.27	3.17
Aug-03	31	5.74	23.14	3.74	0.48	4.09	2.71		3.23	4.95	2.69	4.9	3.56	2.25	6.31	7.43
Sep-03	31	4.88	3.55	6.89	1.25	3.16	1.4		3.04	3.91	7.23	6.54	21.38	1.04	4.85	4.15
Oct-03	31	3.34	3.46	4.07	1.21	2.47	5.83		2.76	1.61	6.1	5.11	24.71	2.41	3.79	3.11
Nov-03	30	2.73	2.16	2.78	1.21	26.65	4.07		1.71	1.87	2.74	2.91	1.99	1.81	3.01	2.87
Dec-03	31	1.35	1.51	2.07		8.35	2.29		2.71	1.15	2.41	1.65	1.56	0.77	2.01	1.9
Jan-04	31	2.26	1.67	1.92		1.93	4.15		1.74	1.99	2.75	1.57	1.64	1.3	2.79	2.81
Feb-04	29	3.6	1.58	2.45		2.33	3.26		2.08	2.6	2.89	1.25	1.38	1.26	2.6	2.37
Mar-04	31	3.04	1.99	2.36		1.94	4		1.5	1.96	3.23	1.6	1.34	1.53	4.06	3.6
Apr-04	30	2.98	2.23	2.61		1.35	3.8		1.59	1.5	2.16	1.96	1.4	1.26	3.47	3.58
May-04	31	4.85	1.54	2.66	0.43	3.6	2.49		1.63	2.32	2.17	1.61	1.55	1.19	3.4	3.56
Jun-04	30	3.04	1.66	2.33	0.15	9.76	2.43		1.43	2.13	2.33	1.99	1.3	1.66	3.06	4.66
Jul-04	31	4.24	2.24	2.2	0.64	2.5	1.13		1.42	2.32	3.34	2.4	1.32	1.5	3.68	4.34
Aug-04	31	4.25	1.94	3.62	1.1	2.52	4.59		1.69	2.69	3.26	3.13	1.46	1.39	2.96	5.43
Sep-04	31	2.62	1.59	2.1	0.69	1.75	3.88		1.74	1.51	3.21	2.64		1.12	1.11	4.7
Oct-04	31	2.49	1.2	3.63	0.94	2.41	5.05		1.99	2.86	4.12	3.52	1.49	1.14	3.9	4.21
Nov-04	30	2.91	1.71	1.96	1.22	1.8	3.63		2	2.25	3.15	2.11	1.8	1.66	3.45	2.47
Dec-04	31															

Table 2.9.11-14 Usage date availability for the VIVALDI i+ Kiosks

Month	Site	(216)	(302)	(300)	(214)	(217)	(218)	(212)	(215)	(213)	(299)
Jan-03	31	21	0	0	0	0	0	21	21	0	0
Feb-03	28	524	0	0	835	0	29	824	846	0	0
Mar-03	31	1128	0	0	1341	0	417	2515	992	0	0
Apr-03	30	750	0	0	985	130	894	1595	842	0	0
May-03	31	857	0	0	182	811	1681	1568	922	0	0
Jun-03	30	814	0	0	927	1015	1520	1543	922	0	0
Jul-03	31	1003	776	0	1134	1323	1501	1549	978	0	0
Aug-03	31	1134	1620	241	1122	1234	1756	1587	1114	360	737
Sep-03	31	923	1196	805	1200	753	1640	1492	1033	1369	677
Oct-03	31	616	933	956	860	625	1229	1202	781	903	711
Nov-03	30	327	443	662	624	202	965	816	443	304	451
Dec-03	31	343	305	522	536	208	840	637	499	239	244
Jan-04	31	258	363	584	479	249	853	725	326	316	0
Feb-04	29	257	477	537	456	194	504	364	249	427	0
Mar-04	31	206	445	659	572	368	482	636	158	412	337
Apr-04	30	80	549	545	486	532	777	401	343	379	453
May-04	31	299	540	590	553	353	806	803	382	403	480
Jun-04	30	303	407	626	406	260	777	446	397	497	445
Jul-04	31	470	656	665	478	230	848	689	476	434	473
Aug-04	31	561	872	605	392	259	892	683	550	391	451
Sep-04	31	412	454	551	508	0	861	667	416	514	338
Oct-04	31	468	395	591	460	249	889	800	443	585	380
Nov-04	30	418	404	577	723	443	1145	780	349	569	624
Dec-04	31	312	181	399	0	0	0	0	249	175	0

Table 2.9.11-15 Channel Usage date availability for the VIVALDI i+ Kiosks

Month Site	(216)	(302)	(300)	(214)	(217)	(218)	(212)	(215)	(213)	(299)
Jan-03 31	77						77	77		
Feb-03 28	1431			2684		71	2496	1771		
Mar-03 31	2903			3515		977	6532	1645		
Apr-03 30	1567			2176	122	1465	3543	1323		
May-03 31	1505			407	1121	2585	3062	1406		
Jun-03 30	1506			2031	1263	2842	2628	1449		
Jul-03 31	2250	1531		2536	1580	2825	3218	1698		
Aug-03 31	2511	4673	307	2338	821	3534	2704	2066	784	1956
Sep-03 31	1118	2381	1222	1860	894	2532	2267	1462	2838	2670
Oct-03 31	1204	2437	2005	1193	1424	2998	2148	1465	2722	2093
Nov-03 30	1190	1968	1973	1951	894	2876	1914	1593	1199	830
Dec-03 31	1284	1078	1624	1750	1019	2528	1623	1806	804	639
Jan-04 31	869	1442	2308	1531	1179	2707	1661	1050	1081	
Feb-04 29	1320	3028	2610	2252	1468	1428	1247	1617	2171	
Mar-04 31	677	1803	1855	1649	1236	1333	1270	610	1430	1345
Apr-04 30	353	2671	1914	1468	1413	2434	1479	1229	1417	2154
May-04 31	1386	3153	2445	2040	1989	3295	2789	1747	2139	2299
Jun-04 30	909	1625	2024	995	787	2135	1154	1221	2223	1144
Jul-04 31	2764	2790	2769	1837	1209	3318	2420	2249	1973	2092
Aug-04 31	1887	3075	2036	943	910	2009	1480	1912	1280	1269
Sep-04 31	1212	1852	1559	1157		1940	1291	1355	1361	1026
Oct-04 31	1546	1875	1675	1327	840	2123	1895	1741	1848	1530
Nov-04 30	1371	1597	1656	2357	1575	3472	2299	1122	1886	3095
Dec-04 31	1416	979	1858					1458	1438	

Table 2.9.11-16 Time used data availability for the VIVALDI i+ Kiosks

Month	Site	(216)	(302)	(300)	(214)	(217)	(218)	(212)	(215)	(213)	(299)
Jan-03	31	1.47						1.47	1.47	0	0
Feb-03	28	18.47			29.18		0.37	26.7	38.98		
Mar-03	31	37.92			38.61		14.62	81.28	30.97		
Apr-03	30	21.16			30.87	2.27	26.65	49.25	25.35		
May-03	31	19.67			5.57	24.26	55.95	38.67	26.36		
Jun-03	30	17.36			29.23	41.59	55.89	34	28.19		
Jul-03	31	25.63	23.68		37.76	58.89	66.85	43.01	29.3		
Aug-03	31	30.05	55	4.08	33.99	57.06	53.25	40.47	34.57	10.42	35.68
Sep-03	31	22.95	37.31	23.88	40.78	25.8	54.21	37.43	34.96	44.88	44.76
Oct-03	31	21.67	38.11	38.47	25.13	27.87	56.05	35.39	30.53	43.51	26.12
Nov-03	30	17.53	31.83	38.24	35.64	14.32	48.58	32.94	34.22	18.96	16.59
Dec-03	31	18.08	20.47	35.45	28.01	15.3	44.92	26.78	29.97	13.82	13.78
Jan-04	31	15.62	24.21	34.61	22.87	17.82	46.49	28.87	19.29	19.98	
Feb-04	29	13.93	35.82	29.84	22.51	13.86	23.74	15.41	16.14	25.45	
Mar-04	31	15.18	31.2	40.19	26.3	23.78	24.47	57.2	10.2	26.64	31.69
Apr-04	30	5.46	41.38	30.82	24.29	34.16	39.21	28.16	28.58	26.2	35.76
May-04	31	22.69	34.37	37.35	29.94	22.19	38.36	48.64	35.55	34.13	37.99
Jun-04	30	19.39	25.22	41.84	19.2	13.03	37.88	27.47	33.41	59.52	32.67
Jul-04	31	40.46	37.44	42.38	24.82	13.71	40.71	44.95	42.27	38.11	33.97
Aug-04	31	43.8	57.62	42.6	20.37	15.39	40.09	41.62	52.83	31.61	35.34
Sep-04	31	30.26	32.87	35.55	24.18		40.52	38.79	36.75	32.11	28.55
Oct-04	31	31.66	33.78	39.82	26.85	17.35	46.23	46.43	42.76	39.75	32.08
Nov-04	30	26.62	31.77	43.71	50.52	58.64	84.08	48.1	39.56	42.24	58.27
Dec-04	31	18.38	9.24	28.45					19.02	12.01	

Table 2.9.11-17 BTC Usage data availability for the VIVALDI i+ Kiosks

Month	Site		(216)	(302)	(300)	(214)	(217)	(218)	(212)	(215)	(213)	(299)
Jan-03	31											
Feb-03	28											
Mar-03	31											
Apr-03	30											
May-03	31											
Jun-03	30		50			131	128	183	298	107		
Jul-03	31		101	166		214	691	313	290	134		
Aug-03	31		143	396	22	204	535	329	302	202	54	193
Sep-03	31		87	226	62	211	142	338	422	167	301	215
Oct-03	31		95	238	75	175	170	373	311	159	293	148
Nov-03	30		103	165	79	258	144	394	272	154	92	80
Dec-03	31		100	116	85	217	120	347	346	177	68	84
Jan-04	31		82	164	155	178	212	317	280	115	135	
Feb-04	29		62	213	122	197	157	198	175	87	191	
Mar-04	31		50	177	126	206	174	157	289	62	179	157
Apr-04	30		16	322	95	163	402	282	201	143	157	166
May-04	31		85	267	87	194	170	215	210	142	169	219
Jun-04	30		74	207	123	117	78	271	182	155	140	163
Jul-04	31		134	332	122	213	84	285	240	261	178	239
Aug-04	31		167	403	97	98	141	251	249	306	120	188
Sep-04	31		114	273	87	154		217	233	152	190	172
Oct-04	31		145	248	110	197	80	278	282	212	271	225
Nov-04	30		109	161	68	229	293	386	335	147	233	392
Dec-04	31											

Table 2.9.11-18 Time spent on the BTC Channel data availability for the VIVALDI i+ Kiosks

Month	Site	(216)	(302)	(300)	(214)	(217)	(218)	(212)	(215)	(213)	(299)
Jan-03	31										
Feb-03	28										
Mar-03	31										
Apr-03	30										
May-03	31										
Jun-03	30	0.77			2.13	1.79	3.27		4.61	1.91	
Jul-03	31	1.66	2.15		2.99	34.43	10.42		4.19	2.05	
Aug-03	31	1.88	4.81	0.45	2.94	47.72	5.77		5.15	3.16	0.55
Sep-03	31	1.02	2.74	1.11	2.96	1.81	4.3		6.24	3.65	3.75
Oct-03	31	0.86	2.66	1.06	2.55	1.2	3.4		3.74	2.37	2.9
Nov-03	30	1.01	1.37	0.91	2.23	0.65	2.95		2.17	1.66	0.64
Dec-03	31	0.86	1.18	1.12	1.4	0.59	2.5		2.04	1.68	0.59
Jan-04	31	2.66	1.61	1.35	1.49	0.93	2.13	2.14	1.06	1.4	
Feb-04	29	0.78	2.14	1.24	1.44	0.85	1.75	1.33	0.65	1.53	
Mar-04	31	5.89	1.96	1.65	1.6	0.89	1.05	35.47	0.74	1.73	1.96
Apr-04	30	0.15	3.03	1.22	1.26	18.42	1.82	2.27	1.99	1.22	2.07
May-04	31	1.26	2.65	1.28	1.68	0.82	1.54	3.31	1.95	1.71	2.2
Jun-04	30	1.14	2.36	1.46	1.16	0.33	2	2.75	2.36	1.3	2.3
Jul-04	31	1.34	3.74	1.52	1.77	0.44	2.44	3.55	2.8	1.57	3.22
Aug-04	31	2.48	3.76	1.31	1.34	0.72	2.49	3.74	3.67	1.03	2.17
Sep-04	31	1.39	2.77	1.22	1.35		2.46	3.48	2.24	1.89	2.19
Oct-04	31	1.21	1.92	1.24	1.52	0.37	2.62	3.02	1.99	1.94	1.16
Nov-04	30	1.24	1.22	0.75	1.88	21.7	3.13	2.73	13.51	1.57	2.14
Dec-04	31										

i+ Kiosk Utilisation

Figure 2.9.11-7 illustrates the number of uses per month for both the VIVALDI and Legible City i+ kiosks. The graph shows that after initial high interest the usage levels have dropped post implementation for both sets of kiosks.

Figure 2.9.11-7 Average number of uses per machine per month

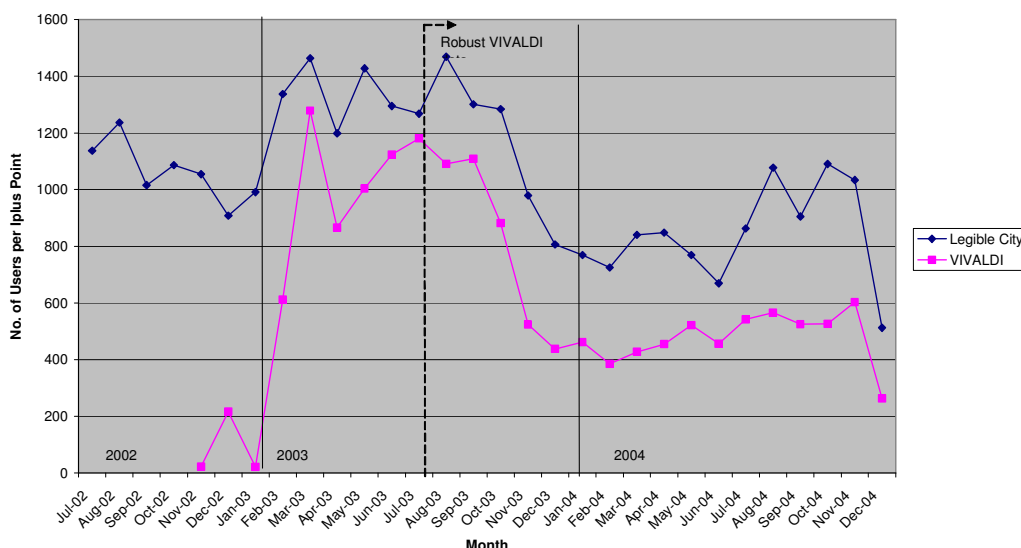


Table 2.9.11-19 and Table 2.9.11-20 contain the average number of uses per month and day respectively, for 2003, 2004 and for the combined two year monitoring period. It can be seen that on average the VIVALDI Kiosks are used over 600 times a month (20 times a day) compared to a utilisation rate of 1000 uses per month (35 times a day) for the legible city kiosks that are located in areas of higher footfall. It is difficult to detect any seasonal effect in terms of use from the data due to the downward trend of usage post implementation. Seasonal trends may be established from longer term evaluation.

Table 2.9.11-19 Average number of uses per month for each kiosk type

IPlus Kiosk Type	Average No. of Uses per month		
	2003	2004	2003/04
Legible City	1230.17	834.06	1031.56
Vivaldi	820.10	487.58	640.22

Table 2.9.11-20 Average number of uses per day for each kiosk type

IPlus Kiosk Type	Average No. of Uses per day		
	2003	2004	2003/04
Legible City	40.46	27.35	35.40
Vivaldi	26.90	15.90	20.73

Table 2.9.11-21 displays the average use per day at each of the i+ points. The results show that the most used VIVALDI i+ points are the kiosks located in North Street, Bedminster and in Lawrence Hill. These machines are being accessed approximately 30 times a day during the monitoring period and were more regularly used than half of the kiosks installed as part of the Legible City project.

Table 2.9.11-21 Average number of uses per day at each i+ point

iPlus Location	Type	Average use per day		
		2003	2004	2003/04
Colston Avenue, Bristol (84)	Legible Qty	57.75	47.95	52.84
Quay Head, Bristol (80)	Legible Qty	56.58	46.17	51.37
Anchor Square, Bristol (79)	Legible Qty	51.72	37.80	44.75
Central Promenade, Bristol (78)	Legible Qty	47.81	37.77	42.78
Broad Quay, Bristol (75)	Legible Qty	55.51	28.19	41.83
Central Podium, Bristol (77)	Legible Qty	49.45	33.16	41.30
Horsefair, Bristol (76)	Legible Qty	48.52	26.90	37.69
College Green, Bristol (85)	Legible Qty	41.61	30.43	36.01
Haymarket, Bristol (71)	Legible Qty	39.44	28.97	34.19
North Street, Bedminster, Bristol (212)	VIVALDI	42.05	20.88	31.92
Lawrence Hill, Bristol (218)	VIVALDI	37.34	26.37	31.85
High St, Shirehampton, Bristol (88)	Legible Qty	39.10	23.64	31.70
Queens Rd, Bristol (81)	Legible Qty	36.34	26.33	31.33
Bedminster Parade, Bristol (86)	Legible Qty	37.10	24.55	30.81
Gare Street, Bristol (74)	Legible Qty	35.18	23.37	29.27
Union Street, Bristol (72)	Legible Qty	31.48	23.54	27.51
Redcliffe Way, Bristol (83)	Legible Qty	32.09	21.94	25.86
High Street, Bristol (73)	Legible Qty	27.70	19.81	23.75
Gloucester Rd, Bristol (214)	VIVALDI	29.18	16.46	22.81
Bristol Zoo Gardens, Northcote Road, BS8 3HA (302)	VIVALDI	28.66	15.69	20.03
Giffon Down Shopping Centre (300)	VIVALDI	20.82	18.93	19.49
Portway Park and Ride, Bristol (215)	VIVALDI	25.73	11.85	18.78
Bath Road Park and Ride, Bristol (216)	VIVALDI	23.12	11.05	17.08
Broad Walk, Knowle, Bristol (87)	Legible Qty	25.72	7.21	16.89
Queens Rd, Clifton, Students Union, Bristol (213)	VIVALDI	20.75	13.94	15.95
Hareclive Road, Bristol (217)	VIVALDI	22.91	9.36	15.47
St Peters Rise, Bishopswood, Bristol (299)	VIVALDI	18.43	14.48	13.94
Cityspace Reception (50)	Legible Qty	15.20	4.58	9.88

Key: Year or period contains missing data

Time in operation

Figure 2.9.11-8 shows the average amount of time per day that the kiosks have been in use, post implementation. The graph demonstrates that the time spent on the machines has remained fairly constant and suggests that although there has been a drop in the number of uses over time the kiosks are being used for a longer length of time each use.

The results for the VIVALDI kiosks show an expected seasonal effect in terms of time spent at the kiosk for each use, with clear peaks and troughs in the data during the summer and winter periods respectively. There is less evidence of any seasonal effects for the Legible City kiosks.

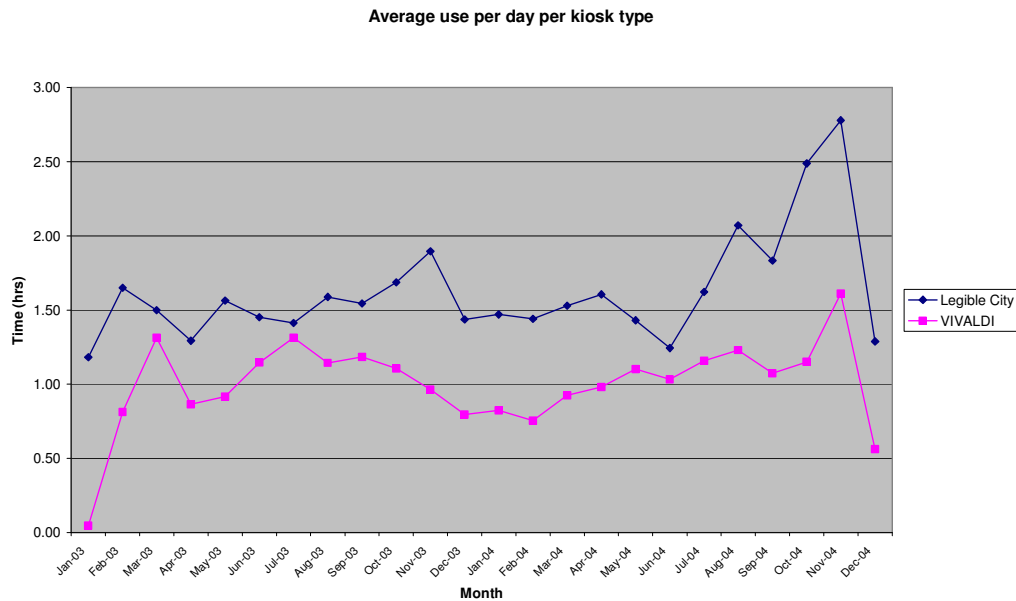
Figure 2.9.11-8 Average Use per day for both Kiosk types


Table 2.9.11-22 and Table 2.9.11-23 show the average number of hours that the kiosks are in use over a 24 hour period. The results show that the kiosks are only in operation for a small proportion of the day.

Table 2.9.11-22 Average daily use per day for each kiosk type

IPlus Kiosk Type	Average daily use (hours)		
	2003	2004	2003/04
Legible City	1.50	1.71	1.67
Vivaldi	1.01	1.06	1.03

Table 2.9.11-23 Average daily use per day for each i+ kiosk

iPlus Location	Type	Average Time in Use (hours)		
		2003	2004	2003/04
Central Promenade, Bristol (78)	Legible Qty	2.31	3.06	2.69
Quay Head, Bristol (80)	Legible Qty	2.10	3.10	2.60
Colston Avenue, Bristol (84)	Legible Qty	2.17	2.52	2.34
Central Podium, Bristol (77)	Legible Qty	2.21	2.43	2.32
Union Street, Bristol (72)	Legible Qty	0.87	1.34	2.21
Broad Quay, Bristol (75)	Legible Qty	2.37	1.86	2.11
Horsefair, Bristol (76)	Legible Qty	1.87	2.11	1.99
Anchor Square, Bristol (79)	Legible Qty	1.77	2.10	1.94
College Green, Bristol (85)	Legible Qty	1.56	1.71	1.63
Haymarket, Bristol (71)	Legible Qty	1.42	1.83	1.62
Bedminster Parade, Bristol (86)	Legible Qty	1.60	1.55	1.57
Lawrence Hill, Bristol (218)	VIVALDI	1.43	1.38	1.40
Redcliffe Way, Bristol (83)	Legible Qty	0.96	1.49	1.29
Gare Street, Bristol (74)	Legible Qty	1.24	1.27	1.26
North Street, Bedminster, Bristol (212)	VIVALDI	1.23	1.27	1.25
Queens Rd, Bristol (81)	Legible Qty	1.14	1.35	1.25
High St, Shirehampton, Bristol (88)	Legible Qty	1.41	1.06	1.24
Clifton Down Shopping Centre (300)	VIVALDI	0.92	1.22	1.13
High Street, Bristol (73)	Legible Qty	0.94	1.29	1.11
Bristol Zoo Gardens, Northcote Road, BS8 3HA (302)	VIVALDI	1.12	1.08	1.09
Queens Rd, Clifton, Students Union, Bristol (213)	VIVALDI	0.86	1.06	1.00
Portway Park and Ride, Bristol (215)	VIVALDI	0.94	1.03	0.99
St Peters Rise, Bishopsworth, Bristol (299)	VIVALDI	0.89	1.19	0.95
Gloucester Rd, Bristol (214)	VIVALDI	1.00	0.87	0.94
Hareclive Road, Bristol (217)	VIVALDI	0.97	0.69	0.82
Bath Road Park and Ride, Bristol (216)	VIVALDI	0.69	0.77	0.73
Broad Walk, Knowle, Bristol (87)	Legible Qty	87.00	0.52	0.72
Qityspace Reception (50)	Legible Qty	0.20	0.20	0.20

Key: Year or period contains missing data

Time Spent Per Use

Table 2.9.11-24 and Table 2.9.11-25 show the average time spent on the i+ kiosks each time they are used. The tables show that the average time spent per use has increased over the monitoring period. This indicates that the kiosks are probably being accessed by more regular users or that the kiosks have been populated with more channels and therefore retain interest for longer.

On average the VIVALDI machines have been used for a longer time per use. This could indicate that the VIVALDI machines are being used to obtain more detailed information. The four most used VIVALDI kiosks are located in St Peters Rise, the Student Union in Clifton, Clifton Down Shopping Centre and Bristol Zoo Gardens. All of these sites are in areas where the user is likely to have more time available to spend on the kiosk as they may be waiting for a public transport service or partaking in leisure activities.

Table 2.9.11-24 Average time per use for each kiosk type

IPlus Kiosk Type	Average use time (mins)		
	2003	2004	2003/04
Legible City	2.14	3.71	2.75
Vivaldi	2.30	4.12	3.09

Table 2.9.11-25 Average time per use for each i+ kiosk

iPlus Location	Type	Average Time Per Use (mins)		
		2003	2004	2003/04
St Peters Rise, Bishopswood, Bristol (299)	VIVALDI	2.91	4.92	4.09
Central Promenade, Bristol (78)	Legible Qty	2.90	4.86	3.77
Queens Rd, Clifton, Students Union, Bristol (213)	VIVALDI	2.49	4.56	3.76
Clifton Down Shopping Centre (300)	VIVALDI	2.64	3.87	3.48
Central Podium, Bristol (77)	Legible Qty	2.68	4.40	3.37
Bristol Zoo Gardens, Northcote Road, BS8 3HA (302)	VIVALDI	2.35	4.13	3.28
Horsefair, Bristol (76)	Legible Qty	2.32	4.71	3.17
Hareclive Road, Bristol (217)	VIVALDI	2.55	4.40	3.16
Portway Park and Ride, Bristol (215)	VIVALDI	2.20	5.21	3.15
Bedminster Parade, Bristol (86)	Legible Qty	2.58	3.78	3.06
Quay Head, Bristol (80)	Legible Qty	2.23	4.03	3.04
Broad Quay, Bristol (75)	Legible Qty	2.56	3.95	3.03
Redcliffe Way, Bristol (83)	Legible Qty	1.79	4.08	2.98
Haymarket, Bristol (71)	Legible Qty	2.15	3.79	2.85
High Street, Bristol (73)	Legible Qty	2.03	3.90	2.81
College Green, Bristol (85)	Legible Qty	2.25	3.37	2.72
Colston Avenue, Bristol (84)	Legible Qty	2.25	3.16	2.66
Lawrence Hill, Bristol (218)	VIVALDI	2.30	3.14	2.64
Anchor Square, Bristol (79)	Legible Qty	2.06	3.33	2.60
Bath Road Park and Ride, Bristol (216)	VIVALDI	1.79	4.21	2.57
Broad Walk, Knowle, Bristol (87)	Legible Qty	2.09	4.33	2.54
Gloucester Rd, Bristol (214)	VIVALDI	2.06	3.18	2.46
Union Street, Bristol (72)	Legible Qty	1.66	3.42	2.41
Queens Rd, Bristol (81)	Legible Qty	1.88	3.08	2.39
High St, Shirehampton, Bristol (88)	Legible Qty	2.16	2.68	2.35
North Street, Bedminster, Bristol (212)	VIVALDI	1.75	3.65	2.34
Qare Street, Bristol (74)	Legible Qty	2.12	3.26	1.26
Qtyspace Reception (50)	Legible Qty	0.78	2.68	1.22

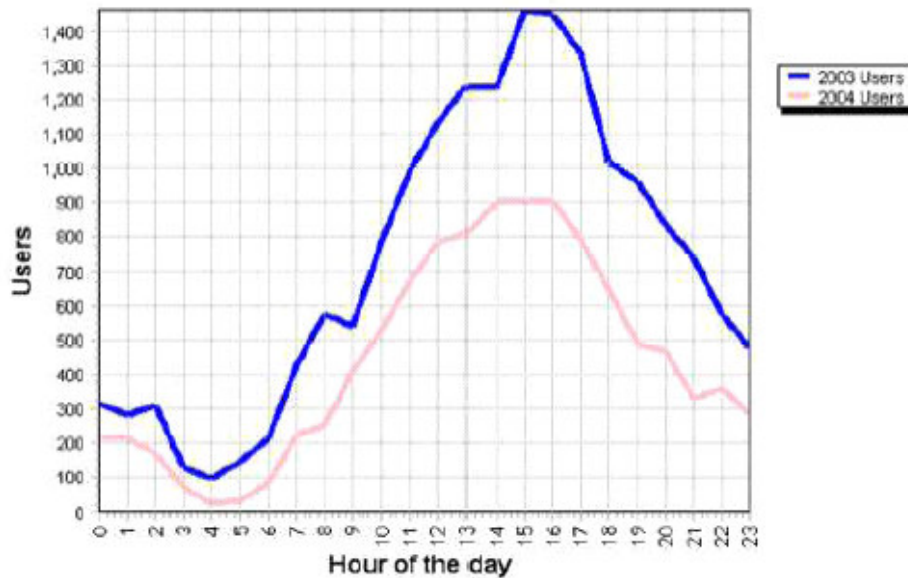
Key: Year or period contains missing data

i+ use by time of day

An analysis of the time of day that the i+ points were used (Monday to Friday) was provided by Cityspace Limited and can be seen in Figure 2.9.11-9.

Figure 2.9.11-9, the hourly analysis, shows that 56.9% of i+ point uses are between the hours of 0900 to 1700 with a peak between the hours of 1400 and 1600.

Figure 2.9.11-9 Number of uses by hour of the day (year on year)



Channel Usage

Table 2.9.11-26 and Table 2.9.11-27 show the average number of channels accessed per day and the number of channels used per use, for each year and the total monitoring period. The tables show that there has been a considerable increase in the number of channels that are accessed per day on the Legible City project kiosks, whereas the level of channel usage has remained fairly constant for the VIVALDI kiosks. This may be a result of more channels being introduced on the Legible City kiosks. However, this information was not available for analysis.

Table 2.9.11-28 shows that the average number of channels accessed during each use has increased for both kiosk types over the duration of the monitoring period and that more channels have been accessed in a single visit by users of the VIVALDI kiosks.

Table 2.9.11-26 Average number of channels used per day for each kiosk type

IPlus Kiosk Type	Average Number of Channels used per day		
	2003	2004	2003/04
Legible City	36.67	88.67	91.38
Vivaldi	59.48	56.67	57.88

Table 2.9.11-27 Average number of channels used each use per kiosk type

IPlus Kiosk Type	Average Number of Channels used per use		
	2003	2004	2003/04
Legible City	2.06	3.25	2.50
Vivaldi	2.24	3.68	2.87

Table 2.9.11-28 Average number of channels used per use for each i+ point

iPlus Location	Type	Average Channels used Per Use		
		2003	2004	2003/04
Bristol Zoo Gardens, Northcote Road, BS8 3HA (302)	VIVALDI	2.67	4.51	3.63
St Peters Rise, Bishopswood, Bristol (299)	VIVALDI	2.90	4.01	3.55
Central Promenade, Bristol (78)	Legible Qty	3.04	4.18	3.54
Queens Rd, Clifton, Students Union, Bristol (213)	VIVALDI	2.63	3.97	3.45
Clifton Down Shopping Centre (300)	VIVALDI	2.24	3.57	3.15
Bedminster Parade, Bristol (86)	Legible Qty	2.28	3.87	2.91
Central Podium, Bristol (77)	Legible Qty	2.30	3.68	2.86
Anchor Square, Bristol (79)	Legible Qty	2.55	3.21	2.83
Quay Head, Bristol (80)	Legible Qty	2.42	3.18	2.77
Broad Quay, Bristol (75)	Legible Qty	2.26	3.73	2.75
Bath Road Park and Ride, Bristol (216)	VIVALDI	2.20	3.88	2.74
Horsefair, Bristol (76)	Legible Qty	2.17	3.54	2.66
Gloucester Rd, Bristol (214)	VIVALDI	2.30	3.18	2.62
Haymarket, Bristol (71)	Legible Qty	2.08	3.31	2.61
Qare Street, Bristol (74)	Legible Qty	2.10	3.25	2.56
Portway Park and Ride, Bristol (215)	VIVALDI	1.89	3.99	2.55
College Green, Bristol (85)	Legible Qty	2.23	2.95	2.54
Redcliffe Way, Bristol (83)	Legible Qty	1.77	3.15	2.49
High Street, Bristol (73)	Legible Qty	2.17	2.90	2.48
Lawrence Hill, Bristol (218)	VIVALDI	2.02	2.97	2.41
Hareclive Road, Bristol (217)	VIVALDI	1.45	4.02	2.30
North Street, Bedminster, Bristol (212)	VIVALDI	2.10	2.71	2.29
Queens Rd, Bristol (81)	Legible Qty	1.98	2.71	2.28
Colston Avenue, Bristol (84)	Legible Qty	2.00	2.50	2.23
High St, Shirehampton, Bristol (88)	Legible Qty	1.76	3.01	2.20
Union Street, Bristol (72)	Legible Qty	1.86	2.63	2.19
Broad Walk, Knowle, Bristol (87)	Legible Qty	1.26	3.50	1.72
Qtyspace Reception (50)	Legible Qty	0.91	3.27	1.45

Key: Year or period contains missing data

Bristol Travel Channel Access

The Bristol Travel Channel (BTC) was introduced on most i+ kiosks in June 2003. The following tables detail the utilisation of this channel for both the i+ and VIVALDI i+ Kiosks. It should be noted that the location of the BTC was different on the Legible City and VIVALDI kiosks with it being located in a more prominent position on the VIVALDI kiosks as part of the requirements of the project.

Table 2.9.11-29 and Table 2.9.11-30 show the average number of BTC sessions per day and the relative proportion of all channels accessed for both kiosk types. The results show that the BTC is accessed more often on the VIVALDI machines and that the BTC represents a higher proportion of all channels used. The results also show that since its introduction in June 2003 the BTC has been used at a fairly constant level.

Table 2.9.11-29 Average Number of BTC Sessions per day for each kiosk type

IPlus Kiosk Type	Average Number BTC Sessions per day		
	2003	2004	2003/04
Legible City	5.21	5.95	6.01
Vivaldi	6.54	6.11	6.25

Table 2.9.11-30 BTC use as a proportion of all channels used for each kiosk type

IPlus Kiosk Type	Average Number of Channels used per day		
	2003	2004	2003/04
Legible City	0.06	0.07	0.06
Vivaldi	0.11	0.11	0.11

Table 2.9.11-31 provides the average daily access to the BTC for each i+ point.

Table 2.9.11-31 Average Bristol Travel Channel sessions a day per i+ point

iPlus Location	Type	Travel Channel Access Per Day		
		2003	2004	2003/04
Quay Head, Bristol (80)	Legible City	7.29	10.66	9.34
Lawrence Hill, Bristol (218)	VIVALDI	10.59	8.50	9.32
North Street, Bedminster, Bristol (212)	VIVALDI	10.42	7.96	8.92
Anchor Square, Bristol (79)	Legible City	8.00	8.97	8.60
Bristol Zoo Gardens, Northcote Road, BS8 3HA (302)	VIVALDI	7.06	8.24	7.82
Central Promenade, Bristol (78)	Legible City	5.39	8.94	7.55
Union Street, Bristol (72)	Legible City	4.68	4.36	7.35
Colston Avenue, Bristol (84)	Legible City	7.49	7.20	7.31
Hareclive Road, Bristol (217)	VIVALDI	10.43	5.85	7.14
Central Podium, Bristol (77)	Legible City	8.02	6.47	7.08
Horsefair, Bristol (76)	Legible City	7.31	6.43	6.77
Broad Quay, Bristol (75)	Legible City	5.91	6.66	6.37
Haymarket, Bristol (71)	Legible City	6.47	6.07	6.23
St Peters Rise, Bishopsworth, Bristol (299)	VIVALDI	4.68	6.96	6.14
Gloucester Rd, Bristol (214)	VIVALDI	6.56	5.79	6.09
College Green, Bristol (85)	Legible City	5.21	6.29	5.87
Queens Rd, Clifton, Students Union, Bristol (213)	VIVALDI	5.25	5.84	5.66
Clare Street, Bristol (74)	Legible City	5.42	5.25	5.32
Queens Rd, Bristol (81)	Legible City	4.47	5.85	5.31
Portway Park and Ride, Bristol (215)	VIVALDI	5.12	5.30	5.23
Bedminster Parade, Bristol (86)	Legible City	4.81	4.80	4.80
Redcliffe Way, Bristol (83)	Legible City	1.92	4.68	4.22
High St, Shirehampton, Bristol (88)	Legible City	3.79	4.41	4.13
High Street, Bristol (73)	Legible City	3.47	3.53	3.51
Bath Road Park and Ride, Bristol (216)	VIVALDI	3.16	3.09	3.12
Clifton Down Shopping Centre (300)	VIVALDI	2.10	3.55	3.09
Broad Walk, Knowle, Bristol (87)	Legible City	1.45	1.37	1.40

Key: Year or period contains missing data

Table 2.9.11-32 and Table 2.9.11-33 show the average time spent per day on the BTC and the relative proportion of time when compared to time spent on all channels respectively. The tables show that time spent on the BTC for both kiosk types has reduced over time. As the levels of BTC usage have not declined this could suggest that there are regular users of the BTC who, through familiarisation, are able to access the required information more efficiently. This reduction in time could also be attributed to any improvements in the BTC (although no information on maintenance and improvements was available for analysis).

Table 2.9.11-32 Average Time spent per day on the BTC for each kiosk type

IPlus Kiosk Type	Average Time on BTC per day (mins)		
	2003	2004	2003/04
Legible City	7.35	4.67	5.77
Vivaldi	7.46	5.45	6.09

Table 2.9.11-33 shows that the proportion of time spent on the BTC when compared with the use on other channels equates to 6% and 10% for the Legible City and VIVALDI kiosks respectively.

Table 2.9.11-33 Proportion of time spent on BTC for each kiosk type

IPlus Kiosk Type	Proportion of time spent on BTC		
	2003	2004	2003/04
Legible City	0.08	0.04	0.06
Vivaldi	0.11	0.08	0.10

The time spent on the BTC at each i+ kiosk can be found in Table 2.9.11-34.

Table 2.9.11-34 Average time spent on the Bristol Travel Channel per day by i+ point

iPlus Location	Type	Time Spent on BTC Per Day (mins)		
		2003	2004	2003/04
Hareclive Road, Bristol (217)	VIVALDI	28.60	8.94	15.42
Bedminster Parade, Bristol (86)	Legible City	19.33	3.46	9.65
Central Podium, Bristol (77)	Legible City	13.75	5.69	8.84
High St, Shirehampton, Bristol (88)	Legible City	16.13	2.89	8.36
Quay Head, Bristol (80)	Legible City	7.15	7.45	7.33
Colston Avenue, Bristol (84)	Legible City	8.07	5.82	6.70
Horsefair, Bristol (76)	Legible City	7.55	6.16	6.70
Portway Park and Ride, Bristol (215)	VIVALDI	7.85	5.89	6.65
Anchor Square, Bristol (79)	Legible City	6.73	6.48	6.58
Central Promenade, Bristol (78)	Legible City	5.24	6.86	6.23
Lawrence Hill, Bristol (218)	VIVALDI	9.10	4.18	6.10
Broad Quay, Bristol (75)	Legible City	7.20	4.97	5.84
Haymarket, Bristol (71)	Legible City	7.41	4.25	5.48
Queens Rd, Bristol (81)	Legible City	4.37	6.07	5.40
Bristol Zoo Gardens, Northcote Road, BS8 3HA (302)	VIVALDI	4.84	4.85	4.84
College Green, Bristol (85)	Legible City	5.65	4.31	4.83
Clare Street, Bristol (74)	Legible City	5.00	3.36	4.00
Redcliffe Way, Bristol (83)	Legible City	1.84	4.31	3.90
St Peters Rise, Bishopswood, Bristol (299)	VIVALDI	3.28	4.22	3.88
Union Street, Bristol (72)	Legible City	4.46	3.25	3.72
Gloucester Rd, Bristol (214)	VIVALDI	4.80	2.94	3.67
Queens Rd, Clifton, Students Union, Bristol (213)	VIVALDI	4.60	3.02	3.63
Bath Road Park and Ride, Bristol (216)	VIVALDI	2.25	3.49	3.01
High Street, Bristol (73)	Legible City	3.21	2.68	2.89
Clifton Down Shopping Centre (300)	VIVALDI	1.81	2.54	2.31
Broad Walk, Knowle, Bristol (87)	Legible City	1.84	1.44	1.62
North Street, Bedminster, Bristol (212)	VIVALDI	No data	11.39	n/a

Key: Year or period contains missing data

Conclusions

The evaluation of the VIVALDI i+ kiosks has enabled results to be produced for time in operation, the number of uses and details on the number of channels used. Detail has also been provided for the Bristol Travel Channel that was introduced as part of the project.

The results have shown that post implementation the number of times the machine is used is quite high for the first few months. After a period of approximately six months the level of use drops to approximately half its initial value. This may be as expected as the introduction of the kiosks is bound to create interest and cause people to investigate

its services. It will be interesting to see whether the current level of use is sustained or whether there is a general decline in use.

There is evidence to suggest that the current levels of use are sustainable. For example, while quite low, the average amount of time that the kiosks are in operation has remained fairly constant over the monitoring period. The results for the time spent per use support this claim as the average time spent per use has increased over the monitoring period.

The levels of use for the VIVALDI kiosks on average are approximately 30% less than the figures for the Legible City kiosks. However, this lower utilisation rate is to be expected due to the lower levels of footfall at the VIVALDI kiosk locations.

The results have shown that Bristol Travel Channel has been used more often on the VIVALDI than on the Legible City kiosks. This could be attributed to the fact that the BTC is more prominent on the VIVALDI kiosks and/or that the demand for travel information at the VIVALDI locations is greater. The level of use for the BTC has been sustained over the monitoring period but the amount of time spent per session has decreased. A possible explanation for this is that the BTC is being accessed by regular users who have become familiar with the channel and hence more efficient.

This demonstration has shown that the public will use on-street kiosks for information and although the level of use is disappointingly low, evidence suggests that there may be a sustained set of users of the kiosks and regular users of the BTC.

2.9.11.4 Bristol – Widening access (12.5)

Measure Overview

This measure aimed to widen participation and encourage e-learning through the implementation of a wireless hotspot providing equipment and Internet access to local residents, along with an on-line GIS database of community education opportunities.

The project implemented a wireless hotspot in an area around The Park Opportunity Centre in Knowle. As part of the implementation of this measure, support was provided to enable the Build-IT course to be run.

Participants in the course learned how to recycle old PCs donated by Bristol City Council and Avon and Somerset Constabulary. The initial stages of implementing the wireless hotspot began at this time, with research into the likely range and strength of the signal. Many of the participants in the Build-IT course live in the local area and assisted with the signal testing process.

As the project evolved and the students gained additional skills through the Build-IT course, they became increasingly involved in the signal testing and installation of wireless equipment in people's homes. Some technical support was also provided by Bristol Wireless, a non-profit making organisation that had carried out similar work in the Easton area of Bristol.

A promotional campaign was undertaken in the area surrounding the Park to encourage local residents to get involved in the process and to sign up to receive one of the newly recycled PCs. There was a great deal of interest in the local community and once the wireless hotspot was implemented, the volunteers working on it set up their own membership organisation, the “Knowle West Web” to develop the service after the VIVALDI demonstration phase ended.

The GIS based Learning Map was developed as a separate process by the Council’s GIS section. The map was designed using a GIS system that could be accessed over the Internet. It was designed to provide details of community education courses in the Knowle area and to show how the courses could be accessed using public transport. It was not possible to evaluate this part of the measure.

Evaluation results

The Widening Access scheme had 40 members by the end of the implementation period in July 2005.

The following results are based on the responses given in 23 questionnaires that were completed by users of the wireless hotspot scheme. The short questionnaire was designed to gain levels of user satisfaction, usage information and whether the use of the PC and access to the Internet has reduced their needs to travel.

Why people joined the scheme?

- Over half of the participants in the scheme applied to take part so that they could provide their family with a PC and access to the Internet;
- A quarter of participants wanted to be able to complete courses at home. A further quarter wanted Internet access so that they could complete on-line training courses. It may well be that the courses that they wished to complete are only available online or on computer disk and that having easy access to these formats has reduced the need to travel to participate. This may have made some training courses much more widely available.
- The need to travel may have been reduced further still by the 13% of participants who wanted to work at home, thus reducing the need to travel to work everyday.
- 35% of scheme members had not had the opportunity to use and learn from the Internet before. It could be hoped then that a positive experience through this scheme may enable members and their families to use the Internet for other reasons such as banking and shopping, further reducing the long term need to make short trips.

How did people hear about the scheme?

The majority of members (78%) had heard about the scheme through ‘word of mouth’, suggesting that were the scheme to be extended then a marketing strategy should be investigated.

Internet Usage

- The majority of participants stated that they used the Internet regularly throughout the day;
- 65% of the respondents stated that the whole family used the PC and Internet in their household;

- 78% of respondents used the Internet for emailing friends and relations;
- 30% used the Internet to obtain travel information. This suggests that Internet access may make it easier for people to travel by public transport, by having greater amounts of information regarding this available;
- 57% used the Internet for shopping; again this may lead to a reduced number of trips to the supermarket. 35% used Internet banking facilities and this may further reduce the need to make trips into town centres;
- 74% stated that they used the Internet for educational purposes, with 26% actually completing training on-line; and
- Nearly half stated that they used the Internet for sport/ entertainment and leisure purposes.

Changes in Travel Behaviour

Around a third of participants stated that the Internet reduced their need to travel to the bank. 39% claimed that the Internet reduced their need to travel to work and the shops. Nearly half claimed that journeys to educational classes and to visit family and friends were reduced. Over half claimed that trips to the library were reduced since they had access to the Internet.

All of the participants travelled regularly, with over a third indicating that they regularly walked. 43% stated that they used the bus or car to make journeys. Only 9% were regular car passengers, whilst 13% regularly cycled or used a taxi and 1 person regularly used a community bus.

User Satisfaction

- 83% of the participants were satisfied or highly satisfied with the scheme;
- 78% of the participants were satisfied or highly satisfied with the Internet service reliability;
- 70% of the participants were satisfied or highly satisfied with the Internet service speed;
- 70% of the participants were satisfied or highly satisfied with the assistance that they were provided with when setting up the system;
- 65% of the participants were highly satisfied with the level of support that they received from the Knowle West Web group;
- Over half of the participants were satisfied with the LINUX operating system; and
- 87% of participants stated that the scheme had met or exceeded their expectations.

2.9.12 Bristol - Improving Public Transport

The Local Objectives of the public transport measures were designed to improve the public transport services in the city in order to:

- Provide an enhanced alternative to the private car;
- Lessen dependency on the car;
- Reduce mode share by cars for trips from the outer areas to the centre;
- Increase patronage on key corridors;
- Reduce travel time along target corridors;
- Provide better information about and awareness of public transport services;
- Introduce electronic payment of fares on target corridors; and

- Reduce energy use and exhaust emissions from the public transport fleet, thereby ensuring that the transport system complements good health and well-being;

The table below shows the local evaluation objectives set and how they relate to the overall VIVALDI objectives and targets.

Table 2.9.12-1 Objectives of the better public transport package

No	Local objective	Target	Contribution to VIVALDI target (s)
LO21	Reduce mode share of cars on key transport corridors	Reduce mode share of cars by 5% on target corridors	VT8 Reduce mode share for cars by 5%
LO22	Increase PT patronage	Increase patronage on target routes by 20%	VT9 Increase patronage on key corridors by 20% VT10 Increase access to PT system
LO23	Reduce PT transit times	Reduce PT travel times on target routes by 15%	VT11 Reduce transit time from peri-urban areas to centre by 15%
LO24	Provide better PT information	Provide real time information on all target corridors Increase the access to trip planner systems by 50%	VT22 Real time information on all quality corridors VT23 Increase number accessing PT information by 50%
LO25	Introduce electronic payment	Collect 40% of fares electronically on target routes	VT24 Electronic payment 40% of all fares
LO26	Reduce energy use and emission from PT fleet	Reduce emissions from the bus fleet on key corridors by 8%	VT2 Reduce energy use and CO ₂ by 8% in demonstration area

To achieve these targets the following measures were implemented for the package:

- 8.6 New forms of public transport contracts (Showcase);
- 8.7 Improved Interchange;
- 8.7 Promoting Park & Ride;
- 8.7 Promoting Walk/Cycle and Ride;
- 8.7 Taxi Sharing;
- 12.2 Info Bus;
- 12.2 Trip Planner; and
- 12.3 Bus priority and RTPI.

The package also intended to include a demonstration of an electronic payment system. This measure could not be evaluated as it has not been fully implemented.

LO21 - Reduce mode share of cars on key transport corridors

Suitable modal split data was not available to detect the impact of the improved bus services on the key VIVALDI corridors. The results for LO22 do show that all routes have experienced an increase in demand that could be translated into the number of car journeys saved.

LO22 – Increase PT Patronage

The 76/77 Showcase bus route, 902 Portway Park & Ride and 904 Bath Road Park & Ride (P&R) services are all included within this integrated package. The Showcase and Bath Road P&R services were existing services in Bristol that have been significantly

improved and the Portway P&R is a new service. The routes have shown a patronage growth of 11%, 13% and 83% respectively.

LO23 – Reduce PT Transit Times

Transit times from outer areas to the city centre were recorded on two occasions in 2002 and 2004 for the Showcase bus route to identify any improvements. The results showed that the improvements to the service had reduced journey times to the centre for both the north and south route approaches to the city centre by 27% and 18% respectively.

LO24 – Provide better PT information

At stop Real Time Information (RTI) is available for the 76/77, 902 P&R and 904 P&R services. The new 902 service also includes audio and visual next stop on board information. The RTI has also been made available on the Internet and the evaluation has indicated that this service is being used by commuters to limit their waiting time at bus stops.

LO25 – Introduce electronic payment

Electronic 'Smartcard' payment systems could not be implemented within the timescale of the project.

LO26 – Reduce energy use and emissions from PT fleet

Clean Fuelled buses were operated on all of the bus corridors in this measure. The impacts of the clean fuelled buses have been evaluated as part of the promoting clean and efficient vehicles integrated package.

The following describes in detail the measure level results for this integrated package.

2.9.12.1 Bristol – Integrated pricing (7.2)**Measure Overview**

The activities carried out under this measure, as set out at inception stage, were to:

- Develop a pricing tariff structure including all public transport modes, parking, and road pricing using electronic ticketing; and
- Take forward the development and implementation of smartcard technology for multi-modal/multi-purpose uses to integrate transport modes and measures.

Smartcard equipment was to be installed on the Park & Ride buses of the 902 and 904 fleets and in 3 BCC operated car parks, encouraging the use of public transport by making payment easier for occasional users. This would have been accompanied by re-issuing all BCC concessionary passes on smartcards to help build the 'critical mass' of smartcard holders in the city and encourage a commercial bus-based smartcard scheme in the city. During the project, discussions were planned to decide on a complementary pricing structure for the different modes available on the new single payment medium.

Evaluation results

Consultancy advice was procured in October 2002, and tender documentation produced. The advice was to separate the procurement of the smartcards from the readers and back office equipment, which led to the development of the two sides of the project

proceeding at different paces (tenders let in April and September 2003, respectively). On the advice of the UK government's Department for Transport, another consultancy firm were taken on to overview the continuing delivery process.

The smartcards for 45,000 concessionary pass holders started their delivery to users in July 2003, and BCC took over day-to-day card production in February 2004. A number of delays were experienced in the successful delivery of the smartcard readers and back office equipment, the process being complicated by being undertaken at 3 depots (one of which was undergoing demolition at the time) owned by 2 different companies. The on-bus smartcard readers and back office software were delivered in July 2004, but a scheme for testing with BCC staff was not delivered until February 2005. Final fine-tuning of the back office software and data communication issues has continued until after the implementation phase of VIVALDI, delaying a full launch to the public.

It has not been possible to conduct a 'formal' evaluation of the smartcard scheme because the scheme has not yet been launched to the public. However, the scheme was tested during development, with a Factory Acceptance Test and 2 Site Assessment Tests carried out on the on-bus readers, recharging machines, and the back office. Each test highlighted areas where the equipment either worked well or needed further development, as defined against an agreed list of target performance for each element of the scheme.

Discussions took place within BCC to ascertain the pricing structure for the Park & Ride and parking elements of the smartcard scheme. It was agreed that a discount of 20% off the standard fare would be given for people using stored value payment on the Park & Ride services; in order to promote public transport use, only a 5% discount would be given for stored value users in car parks. However, resource issues of the equipment supplier meant that they could not assist the parking supplier within the timescales required and this element of the scheme was not taken forward.

In May 2003, elections in Bristol changed the ruling party of Bristol City Council, and the timescale for road pricing was amended. This element of the integrated pricing was therefore removed.

2.9.12.2 Bristol – New forms of public transport contracts (Showcase) (8.6)

Measure Overview

This measure involves improving public transport provision in two ways: implementing a step change in bus service quality through the introduction of a Showcase bus route; and providing the potential to stimulate 'clean vehicle' requirements in order to help reduce harmful emissions and exposure to air pollution.

The works included under this measure, linked to the Council's Showcase bus routes programme, were delivered through partnerships to implement a package of improvements to bus service 76/77 to produce a step-change in service quality. In terms of real time information and bus priority developments on Showcase and Park & Ride routes included:

- Extension of Real-Time Information at bus stops.

- Use of the information supplied to bus stop Passenger Information Points to serve other dissemination media (e.g. the Internet, Travel Advice Screens).
- Extension of Selective Vehicle Detection on identified corridors.

The measure is part of the Improving Public Transport integrated package that was set the following targets at the project inception:

VT8 – Reduce mode share for cars by 5%

VT9 – Increase patronage on key corridors by 20%

VT10 – To increase access to the PT system

VT11 – Reduce transit time from outer areas to the centre by 15%

VT22 – Real time information on all corridors

VT23 – Increase the number of people accessing PY information by 50%

VT24 – 40% of all fares to be electronic

VT2 – Reduce energy use and CO2 by 8% in the demonstration area.

Evaluation Results

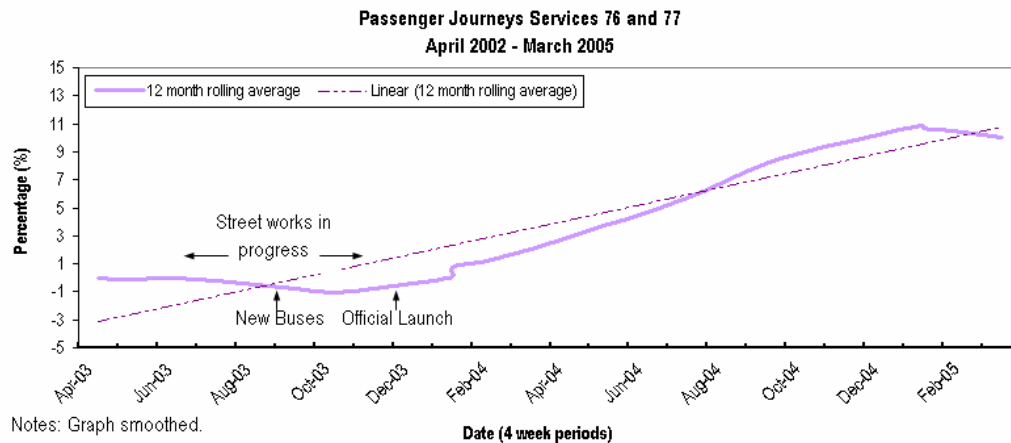
The project evaluation team requested the following information to evaluate the Showcase bus route:

- Before and after operational data from First regarding the Showcase bus route for the period April 2002 - March 2005. This is to enable the effects of construction and measure implementation to be analysed over a sufficient period for overall trends to be detected.
- Results of a planned comprehensive ‘before’ and ‘after’ journey time survey along the Showcase route in November 2002 and April 2004.
- A process interview with First and Bristol City Council was held on 11th October 2005 to cover a number of issues, including an:
 - Assessment of the steps, decisions and actions taken;
 - Assessment of obstacles and opportunities encountered; and
 - Assessment of the roles and contributions of the different parties of relevance.

Operational Data Analysis

Showcase bus route patronage data was collected over the period April 2002 – March 2005. The patronage data was provided by the operator, First, on the understanding that actual figures would not be presented but changes in patronage would be shown using a 12 month rolling average. The data reveals that an initial decline in patronage was experienced during the construction phase of the showcase bus route. A large number of infrastructure upgrades including new shelters, new buses the construction of new bus lanes and raised pavement kerbs were all introduced during 2003. It is noticeable that during this period, when considerable disruption to the traveller was likely, that there was a corresponding decline in bus patronage.

The data collected and analysed can be shown in Figure 2.9.12-1 and demonstrates that the patronage data from the 76/77 service experienced a decline during the construction phase of the Showcase route over the period April – December 2003. The lowest patronage figures were over the period August – December 2003 where a maximum decrease in patronage of 1% was experienced.

Figure 2.9.12-1 Patronage Data for the Showcase Bus Route


However, since construction finished and the Showcase bus route was launched in December 2003, the service has experienced a rapid growth in patronage. For the year 2004/05, over 2 million passenger journeys were recorded. In January 2005 passenger growth peaked at 10.8% (as indicated using a 12 month rolling average) above the baseline figure recorded in April 2003 before the construction work began. This demonstrates that in just over one year since its introduction the Showcase bus route has achieved its 10% target of increased patronage figures. This is quite an achievement as the overall trend in the UK (outside London) is a decline in bus patronage figures. It has therefore been confirmed that the provision of improved information, better priority for buses and improved waiting facilities are key factors in making a bus service an attractive option to potential passengers.

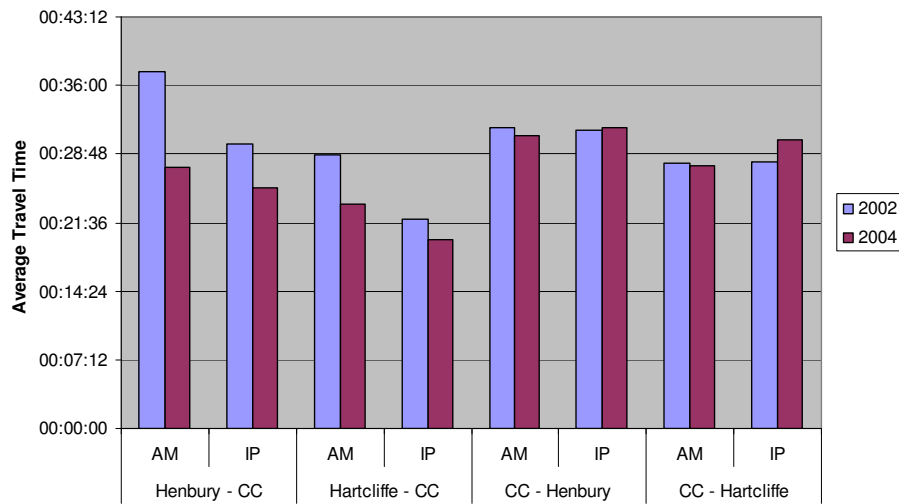
Journey Time Analysis (extracts from a Bristol City Council report)

Journey time data was collected by BCC in May 2002 (before) and November 2004 (after). Data was collected using observers travelling on buses recording times at set points along the route. Journey times were collected between Southmead and Hartcliffe. Journey times were sampled over a 12 hour survey period in 2004 but covered a shorter period in 2002 such that comparisons can only be made for am peak (defined as 07.00 - 10.00) and inter peak (defined as 10.00 - 16.00). The journey time includes run times (including times spent queuing at junctions) and stop dwell times.

Figure 2.9.12-2 presents an analysis of travel time data from before (2002) and after (2004) scheme implementation, presenting average journey times over the two key sections of route, as follows:

- Southmead - The Centre (i.e. the section north of the city centre); and
- Hartcliffe - The Centre (i.e. the section south of the city centre).

Figure 2.9.12-2 Summary of Before and After Observed Showcase Bus Travel Times



The 2004 journey times were compared with scheduled (i.e. timetabled) times and it showed that the observed times were significantly quicker than timetables, though it is noted that timetables include allowances for making up time to enable headways to be maintained.

On-Bus Passenger Survey

Surveys of passengers on the route were undertaken to establish the profile of users and how their travel behaviour and attitudes had been influenced by the Showcase scheme. The key conclusions on user profile can be summarised as:

- Most users surveyed were young (37% less than 29 years old) and from low social groups (43% from Group DE);
- 75% of users surveyed were female;
- 53% of users surveyed were not working;
- Only 26% of users surveyed had access to a car; and
- Only a third of journeys were journeys to work.

It should be noted that the sample of respondents is not unbiased and comprised only around 100 respondents, so these findings need to be viewed in context.

The research also sought to identify behavioural change. It identified that:

- 24% of the users sampled were using the bus more than previously; and
- a third of the increased usage passengers would otherwise have used a car (though noting that this set of increased usage passengers is a sample size of 27). Based on the proportion that this makes of the overall sample it was estimated that around 3% of users of the 76/77 service have decreased their car use.

On the basis that a third of the increased usage identified in the demand analysis above is drawn from car use, a rough estimate of the car trips reduction is around 30,000 vehicle kilometres per annum.

2.9.12.3 Bristol – Improved interchange (8.7)

Measure Overview

This measure aims to improve facilities and services for travel by and transfer between a range of non-car modes. Southmead Hospital has been the focus for implementing a range of access and interchange improvements to make it easier for people to access the site using non-car modes and to travel around the site. In addition, several facilities were upgraded at Clifton Down, a key site for interchange between transport modes.

At the outset of the project, Bristol City Council undertook a detailed accessibility audit of 17 locations. This process found that the Southmead Hospital site was “below average” for an accessible interchange location. As a result of the scope for improvement demonstrated through this process and the emerging access to healthcare agenda, Southmead Hospital was selected as a pilot site for interchange and access improvements.

Once Southmead Hospital had been selected, more detailed studies were undertaken in partnership with North Bristol NHS Trust, which as an organisation was keen to develop new access initiatives. This work identified that existing linkages between public transport and the site, and in particular travel options for getting around the site, could be improved. The location of the Hospital site also presented the opportunity to link in with the planned Showcase bus route improvements, as it is served by the 76/77 bus service.

A partnership agreement was signed between Bristol City Council, First and North Bristol NHS Trust, which formalised the parties’ commitment to developing access improvements and promoting sustainable modes of travel to and around the site.

Clifton Down is an important interchange location in the city centre, having the busiest suburban station on the Severn Beach railway line, good bus service provision and an adjacent district shopping centre.

Evaluation Results

Clifton Down

Works at Clifton Down comprised a package of improvements, particularly focused on enhancing bus-rail interchange. The scheme included the provision of new shelters, signage and seating. The site scored well (69%) in the ‘before’ audit but it was felt that further improvements would benefit this busy interchange. However, due to the quantitative rather than qualitative structure of the audit, the changes made did not improve the scoring for this interchange.

Southmead Hospital

The tables below compare the ‘before’ and ‘after’ audits and calculate a new score for the overall site.

Table 2.9.12-2 Bus stops – Infrastructure

Baseline	Previous	Present (+) /	New
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	rating	absent (-)	rating
Bus stop clearway orders	0	+	1
Bus stop cage markings	1	+	1
Flag at bus stop	1	+	1
Seating on bus stop	1	+	1
Information displays	0	+	1
Illumination in bus stop	1	+	1
New Sub-total			6/6

Improvements	Previous rating	Present (+) / absent (-)	New rating
Raised kerbs	1	+	1
Information displays visible from within shelter	0	+	1
Litter bin	0	+	1
New Sub-total			3/3

Desirable	Previous rating	Present (+) / absent (-)	New rating
All round visibility in bus stop	1	+	1
All round weather protection in bus stop	1	+	1
New Sub-total			2/2

Table 2.9.12-3 Bus stops – durable information

Baseline	Previous rating	Present (+) / absent (-)	New rating
Name of stop	1	+	1
Telephone enquiry service number	0	+	1
New Sub-total			2/2

Improvements	Previous rating	Present (+) / absent (-)	New rating
Direction of travel	0	-	0
New Sub-total			0/1

Desirable	Previous rating	Present (+) / absent (-)	New rating
Direction signs to major destinations eg hospitals	0	-	0
Direction signs to other bus stops or services	0	+	1
Direction signs to the nearest public telephone	0	-	0
New Sub-total			1/3

Table 2.9.12-4 Bus stops – perishable information

Baseline	Previous rating	Present (+) / absent (-)	New rating
Displays at accessible levels	0	+	1
Timetable displays	0	+	1
New Sub-total			2/2

Improvements	Previous rating	Present (+) / absent (-)	New rating
Departure lists at individual departure points	0	+	1
Timetable displays	0	+	1
New Sub-total			2/2

Desirable	Previous rating	Present (+) / absent (-)	New rating
Enquiry terminal	0	-	0
Real time information	1	+	1
Talking bus stops	0	+	1
New Sub-total			2/3

Table 2.9.12-5 Interchange – Infrastructure

Baseline	Previous rating	Present (+) / absent (-)	New rating
Good quality pavement	1	+	1
Unimpeded pedestrian access	1	+	1
Tactile paving	0	+	1
Access to all areas for people with disabilities	1	+	1
New Sub-total			4/4

Improvements	Previous rating	Present (+) / absent (-)	New rating
Adjacent dropped kerbs	1	+	1
Adjacent pedestrian crossing	1	+	1
Coloured tactile pavings	0	+	1
New Sub-total			3/3

Desirable	Previous rating	Present (+) / absent (-)	New rating
CCTV	0	-	0
Nearby accessible public toilet	0	-	0
Nearby public telephone	1	+	1
Nearby public toilet	1	+	1

Ticket purchasing facility	1	+	1
Visible clock	0	+	1
New Sub-total			4/6

Table 2.9.12-6 Interchange – additional facilities

Additional facilities	Previous rating	Present (+) / absent (-)	New rating
Taxi stand	0	-	0
Cycle lane	0	-	0
Bus lane	0	-	0
Cycle parking	0	+	1
Pedestrian crossings	1	+	1
PTWs parking	0	-	0
Waiting facilities	0	-	0
Car Parking	1	+	1
New Sub-total			3/8

Table 2.9.12-7 Results

Level	Points score
Baseline	14 / 14
Improvements	8 / 9
Desirable	9 / 14
Additional facilities	3 / 8
Overall total	34 / 45 points

Table 2.9.12-8 Scale

Scale	Overall result
0-9 Poor	
10-18 Below average	
19-27 Average	
28-36 Good	34 points (71%)
37-45 Very good	

To summarise the results show that the Southmead Interchange rating has improved from “Below average” to “Good”.

2.9.12.4 Bristol – Promoting Park & Ride (8.7)

Measure Overview

The Council operates three purpose built Park & Ride schemes. Two have been the focus of improvements through VIVALDI, located at the A4 Bath Road and A4 Portway. Planned improvements for these sites include enhanced cycling and walking links, improved capacity and new facilities (potentially providing both bus and rail links), introduction of an i+ information point (see 12.2 Information Kiosks/Advice Screens), VMS providing information about the service and smartcard payment (see 12.6 Integrated Electronic Payment and Pricing Structures).

The measure is part of the Improving Public Transport integrated package that was set the following targets at the project inception:

- VT8 – Reduce mode share for cars by 5%
- VT9 – Increase patronage on key corridors by 20%
- VT10 – To increase access to the PT system
- VT11 – Reduce transit time from peri-urban areas to the centre by 15%
- VT22 – Real time information on all corridors
- VT23 – Increase the number of people accessing PY information by 50%
- VT24 – 40% of all fares to be electronic
- VT2 – Reduce energy use and CO2 by 8% in the demonstration area.

Evaluation Results

To evaluate the two Park & Ride (P&R) services, patronage data was requested from April 2002 onwards so that trends could be detected up to the time of the service upgrades and after their implementation.

Information on the results from on-bus surveys undertaken in 2003 was also requested to provide information on:

- Usage (who uses the service, when, to go where, for what purpose etc);
- Use of other modes;
- Reasons for using the P&R;
- User reactions to recent upgrades; and
- User attitudes to clean fuelled buses and Smartcard payment.

The following provides details of the results that were shown.

Patronage (LO22)

Figure 2.9.12-3 P&R Patronage Growth Figures for the Portway (902) and Brislington Services (904)

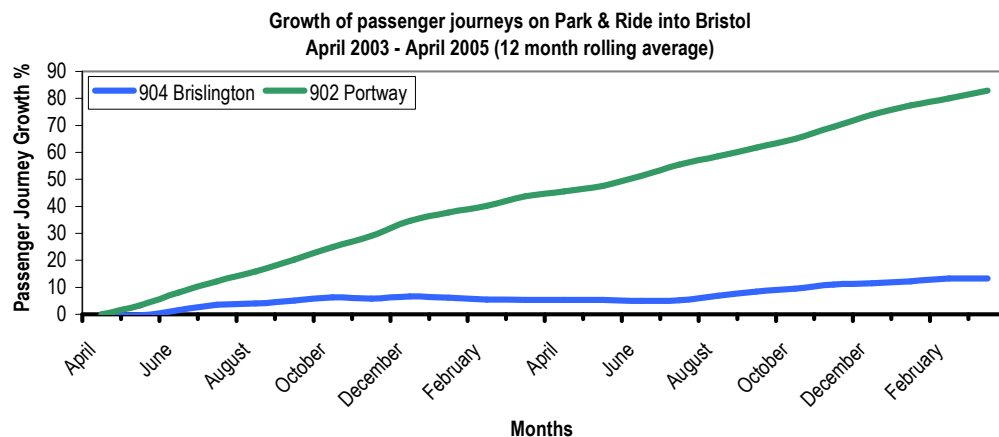


Figure 2.9.12-3 shows that there has been a 13.2% rise in passenger growth on the 904 Bath Road service since the start of VIVALDI. This achievement is particularly

impressive as the service was already established and had high patronage figures at the start of the project.

The 902 Portway P&R bus service is a relatively new service and Figure 2.9.12-3 shows that there has been a rapid growth of passengers using the service. In March 2005 the patronage figures were 82.8% greater than they were in April 2002. The service is now running at almost capacity with an equivalent patronage capacity to that of the 904 service, if you take into account that the 904 service is a double decker Bus.

On Bus Surveys

The following summarises the results that were obtained from the following on-bus surveys:

- Portway P&R (902) undertaken on the 11/06/03. In total 270 passengers were interviewed and 159 (59%) self completed questionnaires were returned.
- Bath Road P&R (904) undertaken on the 01/04/04. In total 1020 passengers were interviewed and 297 (29%) self completed questionnaires were returned.

O-D Data

Origin destination data was only collected from the 270 Portway (902) service passengers. Approximately 40% of the passengers started their journeys from outside the local area of the Park & Ride site. The site is located near the M5 Motorway which many passengers used to travel to the P&R site and complete their journey into the city by bus. Many passengers had travelled from nearby towns such as Weston-super-Mare and Portishead and some had travelled longer distances, from locations such as Taunton, Yeovil, Gloucestershire. One passenger had travelled from Manchester. The passengers were also asked where they were intending to alight from the service. The results showed that 93% of the passengers planned to alight in the central area of the city.

Table 2.9.12-9 902 Passenger P&R service Origin Data

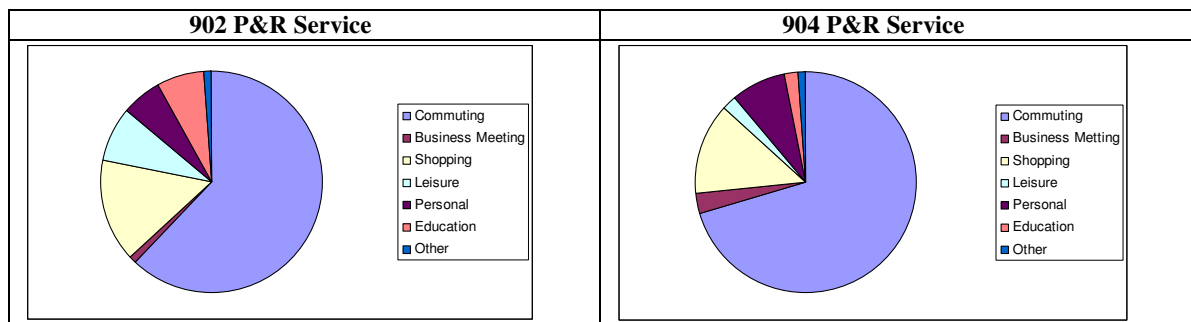
Location	Number of parties	
Shirehampton	111	41.11%
Avonmouth	21	7.78%
Roman Way	17	6.30%
Portishead	11	4.07%
Sea Mills	11	4.07%
Clevedon	10	3.70%
Lawrence Weston	10	3.70%
Shirehampton (upper)	10	3.70%
Weston-super-Mare	10	3.70%
Stoke Bishop	6	2.22%
Burnham on Sea	5	1.85%
Gloucestershire	5	1.85%
Thornbury/Wotton-u-Edge	5	1.85%
Bradley Stoke	4	1.48%
Pill	4	1.48%
Severn Beach/Pilning	4	1.48%
Bridgwater	3	1.11%
Devon	3	1.11%
Cardiff	2	0.74%
Newport	2	0.74%
Charfield	1	0.37%
Cheltenham	1	0.37%
City Centre	1	0.37%
Coombe Dingle	1	0.37%
Frampton Cotterell	1	0.37%
Lawrence Hill	1	0.37%
Magor	1	0.37%
Manchester	1	0.37%
Monmouthshire	1	0.37%
Patchway	1	0.37%
Stroud	1	0.37%
Taunton	1	0.37%
Westbury on Trym	1	0.37%
Whitchurch	1	0.37%
Worle	1	0.37%
Yeovil	1	0.37%
Total	270	100.00%

Journey Purpose

Table 2.9.12-9 and Figure 2.9.12-4 show the stated journey purposes of the passengers of both the 902 and 904 P&R services. The results show that the majority of the passengers were using the service to commute to their place of work.

Table 2.9.12-10 902 & 904 Passenger Journey Purpose

Journey Purpose	902 (%)	904 (%)
Commuting	62	69
Business Meeting	1	3
Shopping	15	13
Leisure	8	2
Personal	6	8
Education	7	2
Other	1	1

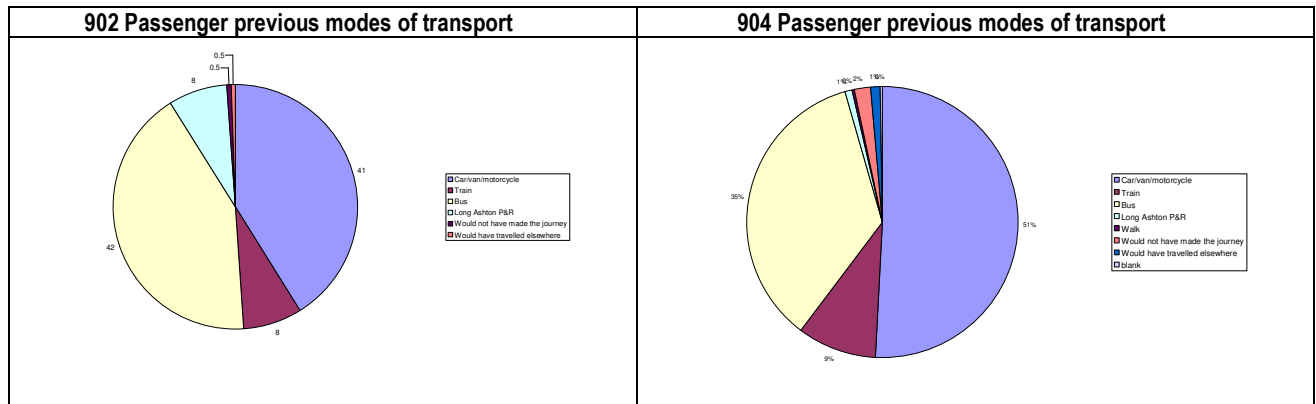
Figure 2.9.12-4 Passenger journey Purpose


Replaced Transport Mode

Both sets of passengers were asked to state what mode of transport they used before choosing to use either the 902 or 904 P&R services. Table 2.9.12-11 and Figure 2.9.12-5 show that 41% of the 902 and 51% of the 904 passengers stated that they would have used the car for their journey before deciding to use the P&R services. This represents a saving of almost 217 car journeys.

Table 2.9.12-11 Previous Transport Modes for the 902 & 904 Passengers

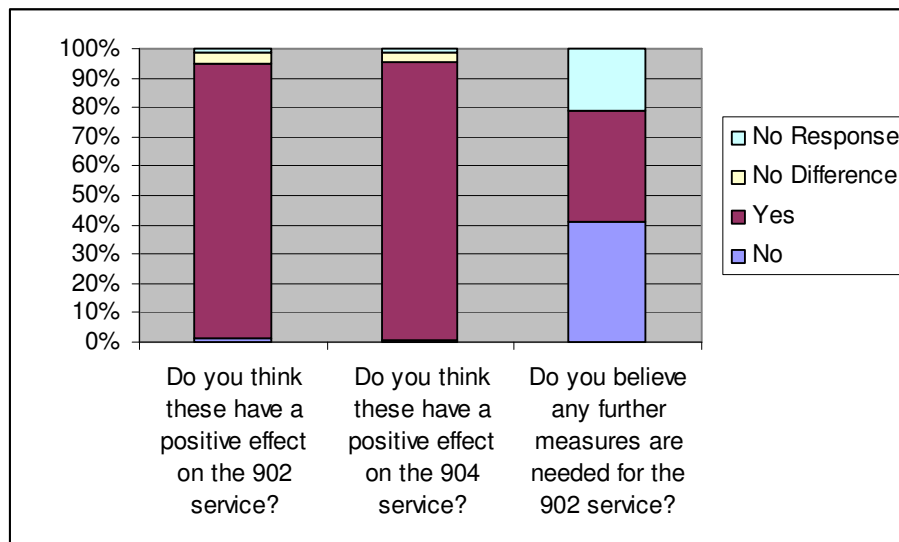
Previous Transport Mode	902 (%)	904 (%)
Car/Van/Motorcycle	41	51
Train	8	9
Bus	42	35
Long Ashton Park & Ride	8	1
Would not have made the journey	0.5	2
Would have travelled elsewhere	0.5	1

Figure 2.9.12-5 Previous modes of transport used by the P&R passengers


Acceptance (14) & Service Quality (17 & 19)

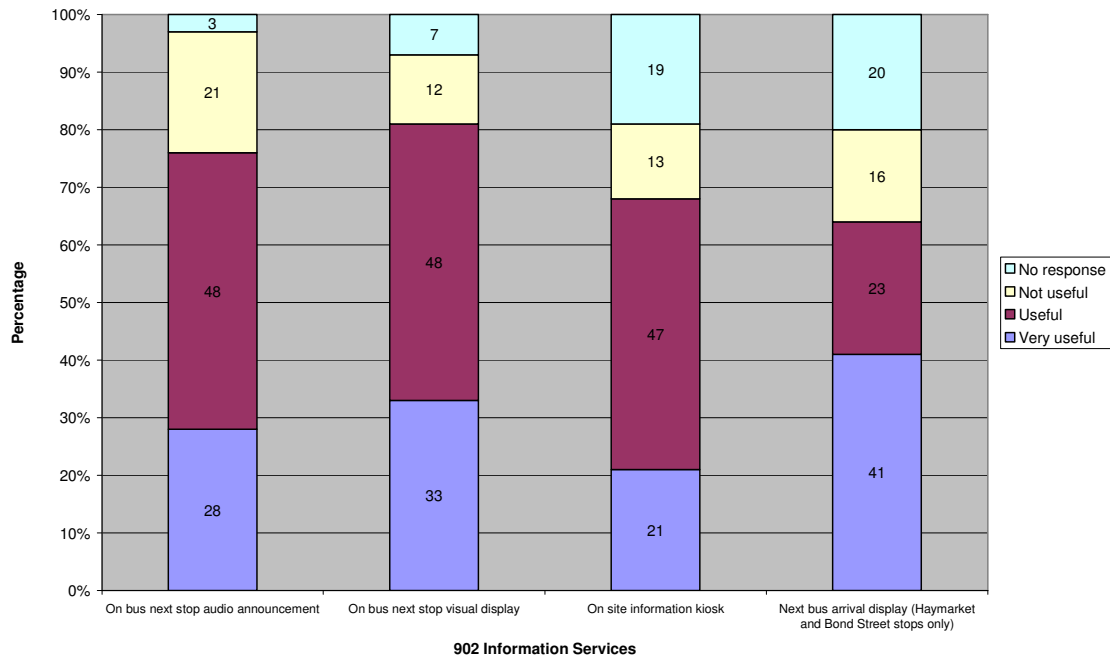
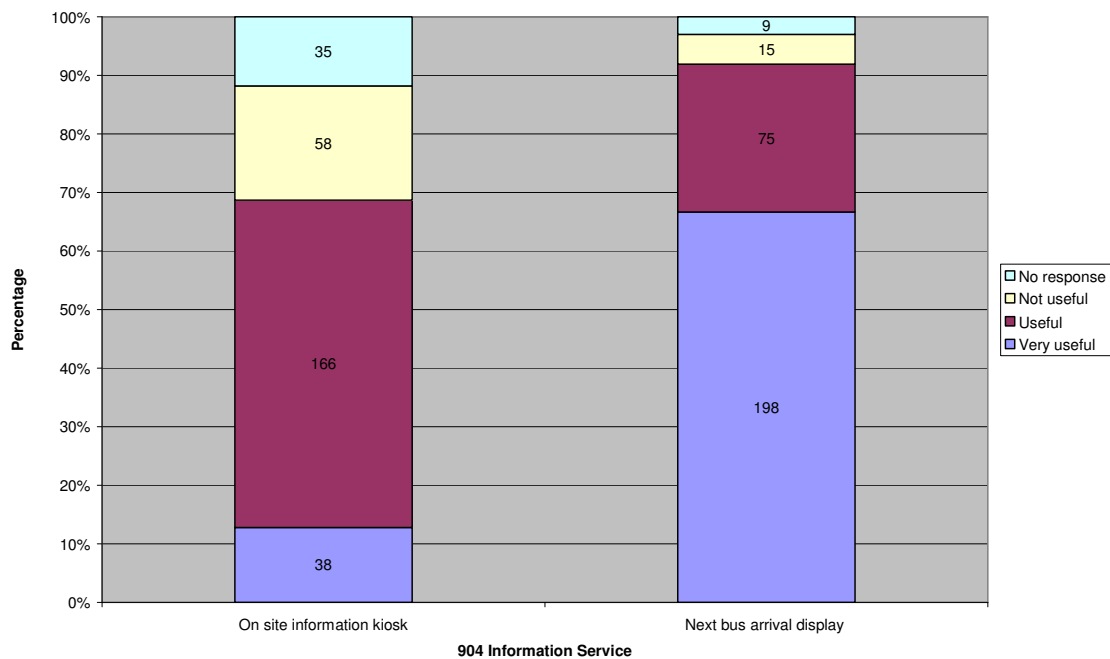
Bus Priority Measures

Bus priority measures such as bus lanes and traffic light control have been introduced on both Park & Ride routes. Passengers were asked whether they felt that these measures had had a positive effect on the service and the 902 passenger were also asked whether they believe further measures are required. Figure 2.9.12-6 shows 94% of both samples thought that the bus priority measures had a positive affect on the service. A total of 38% of the 902 sample believed that further measures were required (41% not required, 21% no response).

Figure 2.9.12-6 902 & 904 P&R Service Passenger Satisfaction of the Bus Priority Measures


The passengers were also asked to comment with regard to the usefulness of the various information services provided for the route. Figure 2.9.12-7 and

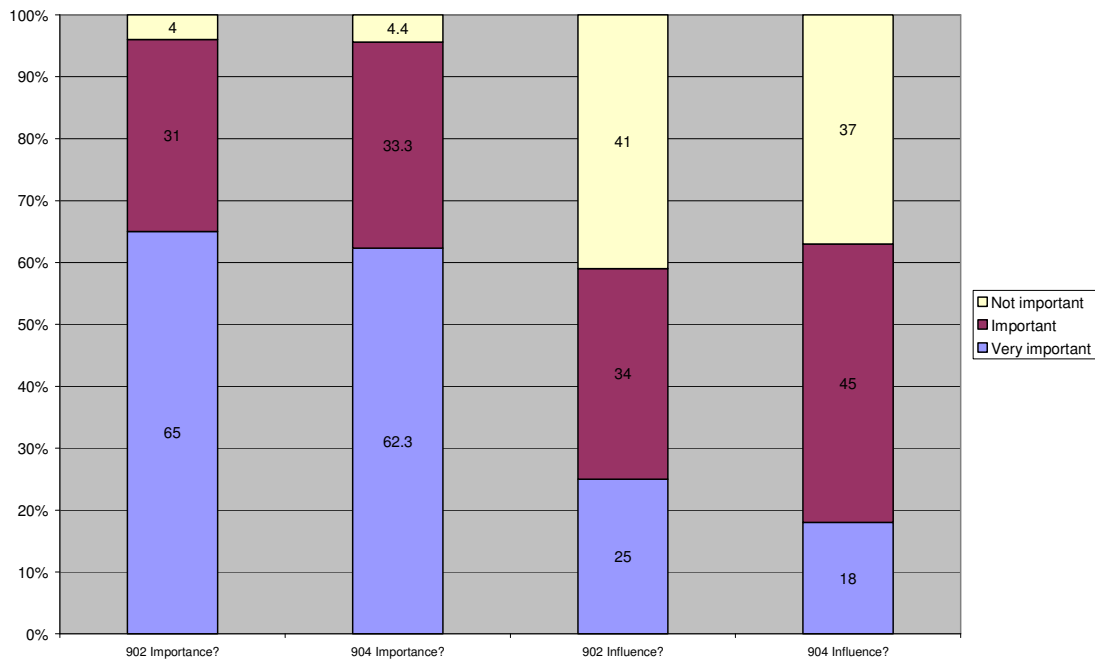
Figure 2.9.12-8 shows that there are high levels of satisfaction for the various information services for both the 902 and 904 routes and in particular high levels of satisfaction for the audio and visual information on board the 902 service.

Figure 2.9.12-7 Passenger Satisfaction of the 902 information services

Figure 2.9.12-8 Passenger Satisfaction of the 904 information services


Passengers were also asked about the importance of the service being operated using a ‘cleaner’ fuelled bus and whether it has influenced their decision to use the P&R service instead of their usual mode of transport. Figure 2.9.12-9 shows that

95% of both sets of passengers thought that the use of a ‘cleaner’ bus was either very important or important. Approximately 60% of both sets of passengers also stated that the clean fuelled bus was a very important or important factor that influenced their decision to choose the P&R services. This indicates a high level of awareness of air pollution issues amongst the passengers of these services.

Figure 2.9.12-9 Passenger Views on importance and influence of clean fuelled vehicles

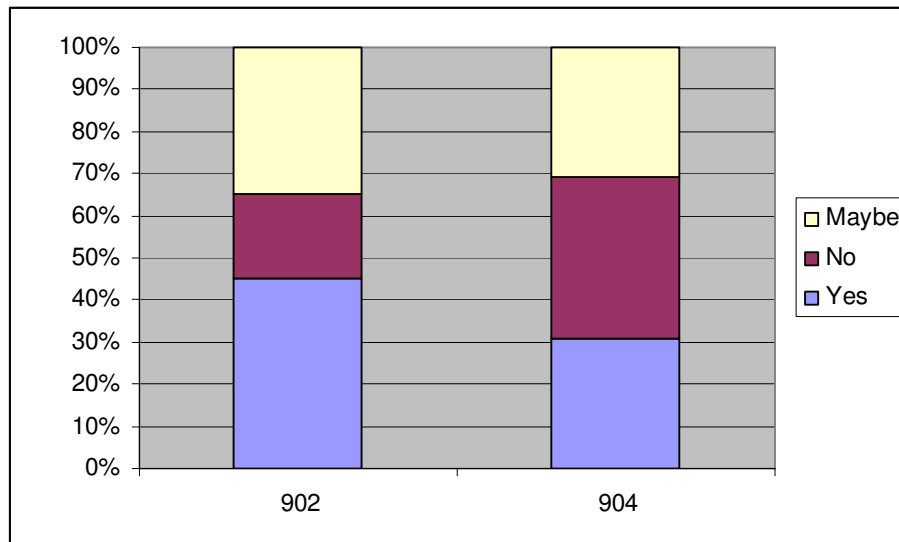


The final question in the questionnaire sought opinion on the use of a smartcard payment system. Table 2.9.12-12 and Figure 2.9.12-10 show that the response to the use of smartcards was mixed. A total of 45% and 31% of the 902 and 904 passengers surveyed stated that they would use a smartcard to pay for their P&R journeys. The high level of ‘Maybe’ responses from both surveys also indicates that there is potential for this level of interest to increase.

Table 2.9.12-12 Potential Smartcard Users

Would you use a Smartcard?	902 (%)	904 (%)
Yes	45	31
No	20	38
Maybe	35	31

Figure 2.9.12-10 Potential Smartcard Users



Conclusion

The evaluation results have shown that there has been a high increase in the number of passengers using the P&R services over the VIVALDI project timescale. In particular, patronage levels for the new Portway (902) P&R service patronage has increased by 82.8%.

On-bus surveys have shown that passengers value the information services provided on both P&R services and in particular the audio and visual on board stop announcements on the new 902 service. The surveys have also shown that passengers feel that the use of clean fuelled vehicles is important and for many of them it has influenced their decision to use the P&R services.

2.9.12.5 Bristol – Promoting walk / cycle and ride (8.7)

Measure Overview

The Council formed a partnership with the Mud Dock Café/Cycleworks with the intention of improving the facilities available to existing cyclists, particularly commuters, entering the central area either as a destination or as a point for further travel by other modes. As a result, the Cycle Resource Centre (CRC) was launched in December 2004.

It has been established at the site of the Mud Dock café and Cycleworks, which is situated on the edge of a 200 vehicle car park. A number of these car parking spaces have been relocated in order to accommodate the CRC. The centre is located at the hub of both tourist and leisure destinations and is within a short walking distance of substantial office developments. The location is also on the National Cycle Network (NCN) in Bristol.

The CRC provides cyclists with:

- Secure bicycle parking with on-site management from 7am – 7pm Monday to Friday; 8.30am – 6pm on Saturday; and, during spring and summer, 10am – 4pm on Sundays.
- Secure lockers for workday and cycling clothing.
- Shower and changing facilities.
- On-site service and repair facilities.
- Café and refreshments.
- Notice board, local cycling and transport information and meeting location.

Cycle parking and a locker costs are as follows:

One day	3.70€
One week	14.50€
One month	44.30
Six months	220.20€
One year	369.20€

Shower (Including soap and towel):

Per shower	3.70€
One week	14.50€
One month	44.30€
Six months	220.20€
One year	369.20€

Combined parking, locker and shower:

One year	590.80€
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The site is a central distribution point for cycling related activity and can also be used for promotional events, meetings and consultation exercises.

Other measures to improve facilities for bike/walk and ride include improvements to facilities for pedestrians and cyclists at Clifton Down and Southmead Hospital (described in 8.7 Interchange Facilities) and as part of the 76/77 Showcase bus route initiative (see 8.6).

The measure is part of the Improving Public Transport integrated package that was set the following targets at the project inception:

- VT8 – Reduce mode share for cars by 5%
- VT9 – Increase patronage on key corridors by 20%
- VT10 – To increase access to the PT system
- VT11 – Reduce transit time from peri-urban areas to the centre by 15%
- VT22 – Real time information on all corridors
- VT23 – Increase the number of people accessing PY information by 50%
- VT24 – 40% of all fares to be electronic
- VT2 – Reduce energy use and CO2 by 8% in the demonstration area.

Evaluation Results

The evaluation team met with the owner of the CRC and the Council representative on the 25th February 2005 to discuss data collection for the newly re-opened CRC. It was agreed that data on the number of registered users and usage figures would be collected

from the start of the scheme in December 2004. It was also agreed to conduct a users' survey in July 2005 to gain the views of users of the service and to hold a process evaluation interview to discuss the implementation of the CRC and how successful it has been.

Data on the number of registered users and usage was provided to the Evaluation team in September 2005. The CRC reported that they were not able to provide a weekly (or monthly) breakdown of this information due to the data being lost as a result of a computer and back-up failure.

This report is based on the operational experience of the CRC over the period 1st January 2005 to 15th September 2005.

The CRC has the capacity to store 30 bikes; after 9 months of operation the CRC have reported that the number of users has been less than expected. As of the 15th September 2005 there have been:

- 6 annual memberships;
- 6 six-monthly memberships;
- 11 monthly tickets;
- 7 weekly tickets; and
- 82 casual users.

In this period, the CRC has been used 995 times.

In total the shower facility, which has an additional cost, has only been used 98 times. This figure includes the use of the shower facility by people who used the centre to change and shower after a run during their lunchtime break. Females have only used the facility on 32 occasions and have never used the shower facility.

The CRC administered a User Survey by placing self-completion questionnaires in the CRC for users to complete. A low return rate of 10 responses was received and the following information was obtained.

The majority of the users who took part in the survey used the CRC either daily or 1-2 times a week (3 and 4 users respectively). Figure 2.9.12-11 shows the level of usage for the survey sample.

Figure 2.9.12-11 Survey Respondents usage frequency of the CRC

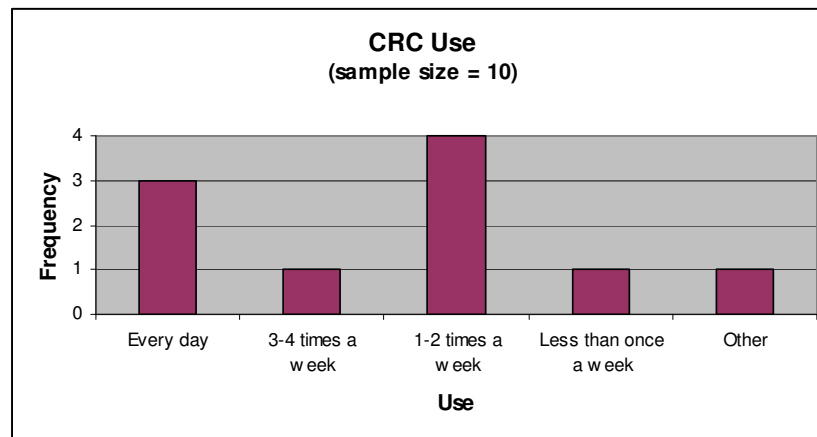
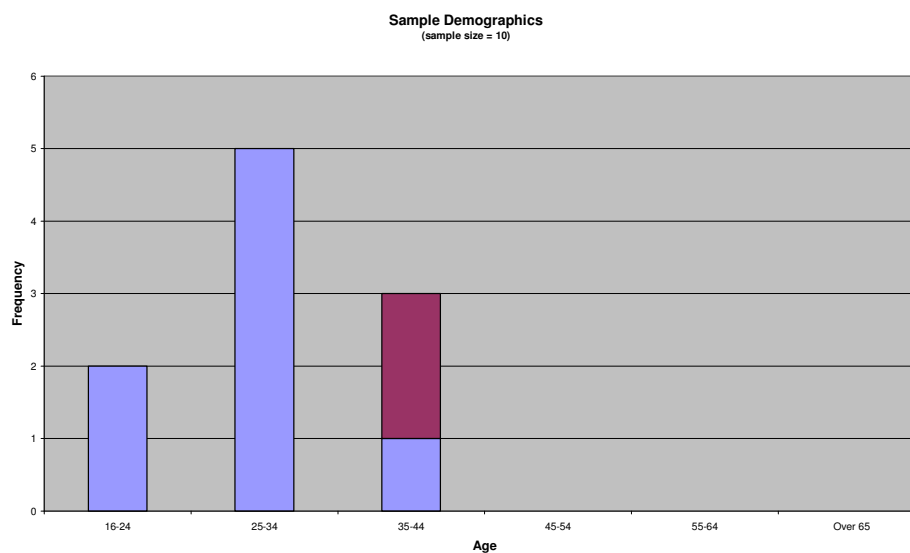


Figure 2.9.12-12 shows that the majority of the sample were aged between 25 and 34 with a male/female split of 8/2.

Figure 2.9.12-12 Demographic Profile of Users



Using postcode information supplied in the questionnaires it is estimated the majority of the respondents travel between 1-5 km to the centre. Figure 2.9.12-13 shows the estimated journey distances calculated for the sample. This information is also presented in map form to show the locations within the city that the users of the CRC travel from, see Figure 2.9.12-14.

Figure 2.9.12-13 Estimated Journey distances travelled to the CRC

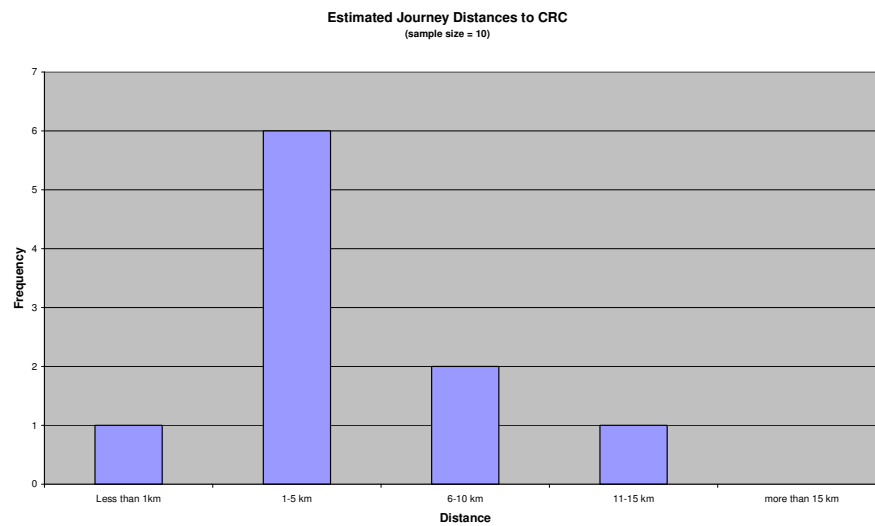
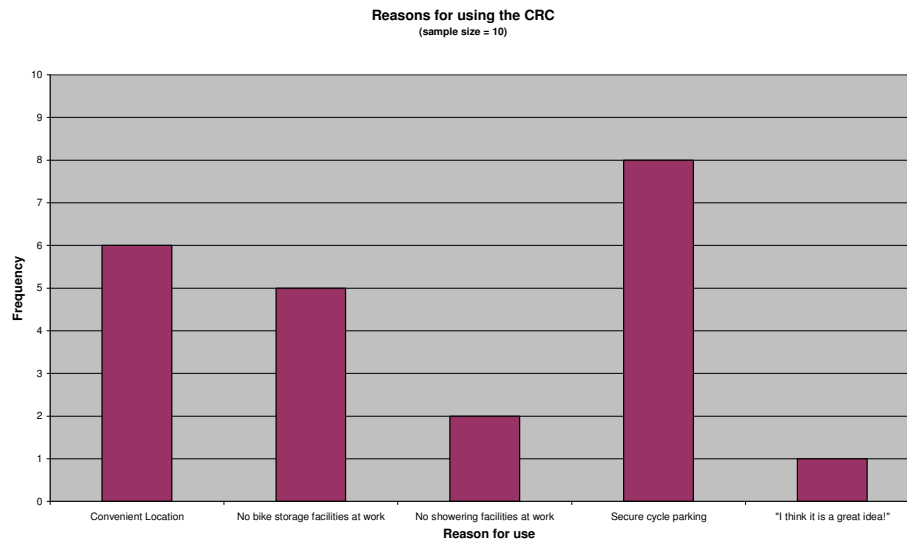


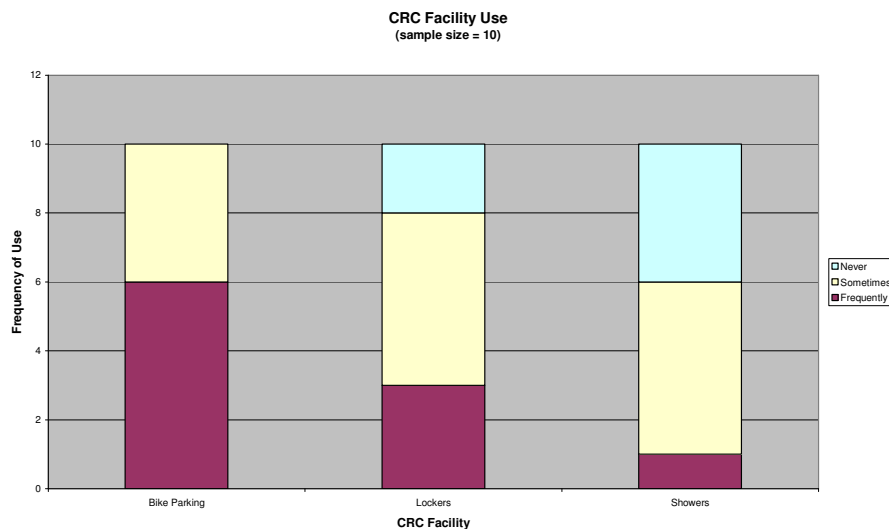
Figure 2.9.12-14 Map illustrating journeys made by CRC users



The majority of the sample have used the CRC for security reasons (8/10 users) although the convenience of the location and lack of suitable facilities at work were also popular reasons given. Figure 2.9.12-15 shows all the responses given by the users (respondents were allowed to choose more than 1 reason).

Figure 2.9.12-15 Reasons given for using the CRC


The facilities used by the respondents are shown in Figure 2.9.12-16. The graph shows that the majority of the sample use the CRC for bike parking and use of the lockers. Only one respondent stated that they use the shower facility regularly and 4 respondents have said that they would never use them. The reasons given for not using the showers were time, no requirement, too expensive and the final respondent stated that they “plan to use the facility sometime”.

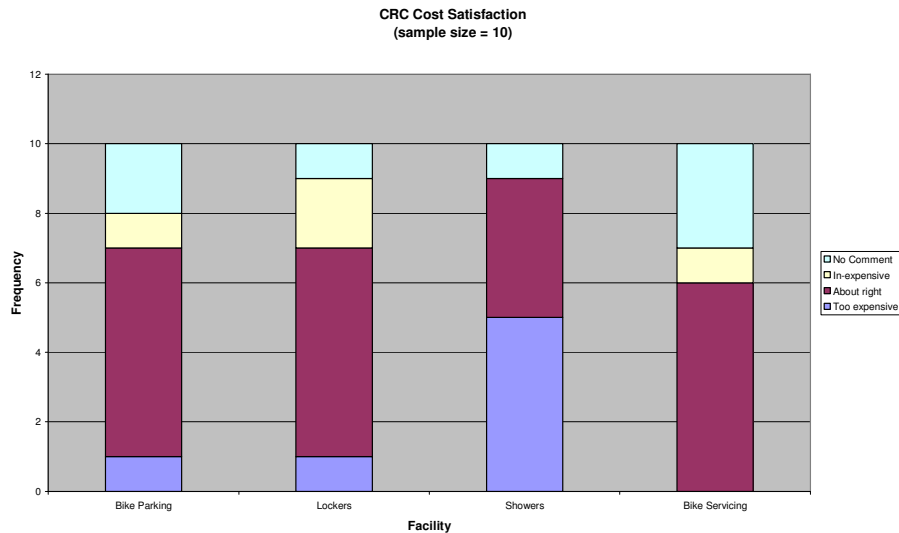
Figure 2.9.12-16 CRC Facility Use


The questionnaire asked respondents for their views on the cost of the services at the CRC. Figure 2.9.12-17 shows the responses that we received. It can be seen that in general most of the respondents are content with the price of the parking and locker facilities, but 50% (5) respondents thought that the shower facility was too expensive. The respondents were given the opportunity to state what they feel the cost of the services should be and the following range of responses were received:

- Bike parking and locker Facilities: 1.80-2.20€

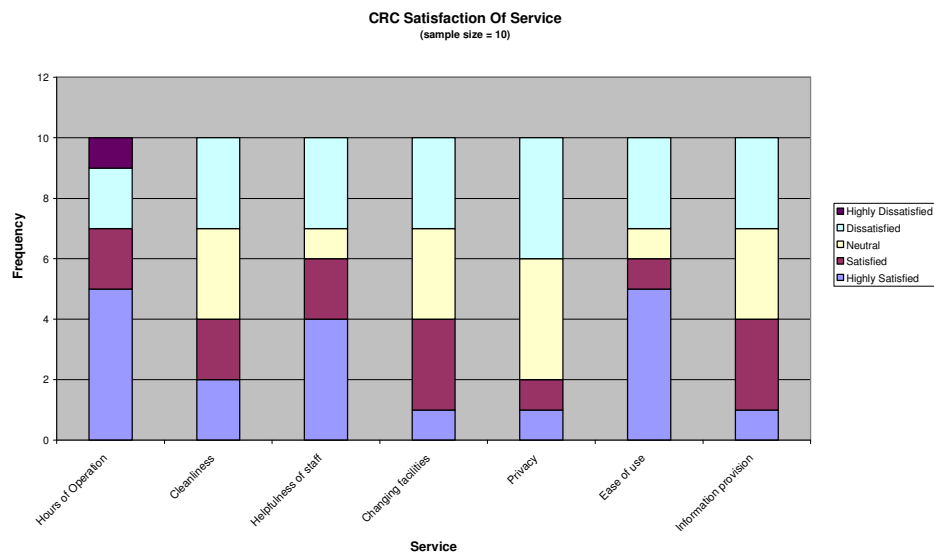
- Shower facilities: Free of charge-1.50€

Figure 2.9.12-17 CRC Cost Satisfaction



The respondents were also given the opportunity to provide comments of their satisfaction of the service received at the CRC and the response can be seen in Figure 2.9.12-18.

Figure 2.9.12-18 Users Satisfaction of the services provided by the CRC



The results show that at least 3 out of the 10 respondents indicated that they were dissatisfied with each of the above services.

Process Interview

A process interview was held on the 9th September 2005 and the implementation and performance of the scheme was discussed. The following describes the main points together with opportunities and barriers that were experienced during the implementation.

The Mud Dock Cafe, which operates the CRC, is a private organisation. Therefore, the cost of designing and running the centre has to be commercially viable. The project has shown that it is not commercially viable to implement a CRC on its own. The Bristol CRC has the support of the surrounding businesses (café, bike shop and workshop). The pricing structure for the centre is important to ensure that the correct balance is made so that users are attracted to the centre but that it does not run at a significant loss. Although the centre is relatively new, it seems that this will need to be changed to find an optimum solution.

Opportunities

- As part of the design change it was decided to move the workshop from the rear of the CRC to the front. This meant that the workshop staff could effectively manage the CRC and it was also felt that the visible staff presence would increase security at the centre. This also had a positive effect on the workshop as its visibility generated business that helps to support the operation of the CRC. The change also made the centre more visually attractive as the workshop activity could be seen through the glass frontage rather than a series of bikes parked for the day.
- The CRC has had a positive effect on business at the Mud Dock and on cyclists in Bristol in general by showing that the city is taking cycling seriously.

Barriers

- Following the design the first step was to conduct a ground survey to ensure that the ground was suitable for construction. The survey showed that the ground conditions were not suitable for the design of the CRC; therefore, it had to be redesigned to suit the conditions. This resulted in a 6 month delay in the project. This delay caused difficulties with the grant received from the DfT, as it took the project outside the permitted timescale for the receipt of payment. As this was the first CRC to be implemented in the UK, the DfT were keen to find a mechanism to still fund the project. A decision was made for DfT to pass on the funds to the Council, who would act as trustees for the funding and release payments to the Mud Dock when necessary.
- The architect who designed and supported the centre was a senior partner of his firm. However, due to difficulties with the project his directors applied pressure on him as soon as they had calculated how much time was being spent on the project. This situation was difficult to resolve as the company had invested in the centre and were effectively a partner.
- The owner of the CRC has recommended that anyone considering developing a similar scheme should ensure a design and build contract at a fixed price that has a partnership agreement made to ensure collective responsibility. The architect for this project was too emotionally involved and in the end this caused considerable problems. A packaged rather than a piecemeal approach will lead to greater

ownership of the project and will reduce problems caused by contractors protecting their own interests at the price of the project.

- There is plenty of free bicycle parking in Bristol and bike racks located outside the Mud Dock are always full. However, it is thought that the majority of these cyclists do not leave their bikes in the racks for more than a few hours and are not potential CRC users. It should also be noted that the bike racks in Bristol do not offer security and bike theft is a particular problem in Bristol.
- The CRC owner underestimated the impact that the construction of the CRC would have on his business. Not only was he part-funding the construction of the CRC, he was also having to bear reduced income from his businesses at the site. This problem was worsened by the delays in the construction of the centre.
- There was an issue over car parking spaces. The Mud Dock is adjacent to a 200 vehicle car park and the proposed site of the CRC was in the position of some parking spaces. Although this could be seen as a positive event, the project had to fund the relocation of the spaces to another area and fund the loss of revenue to the Council's Parking Services section while this activity was being carried out. It is estimated that this cost the project between (£10-20k or €15-30k).
- It is thought that the cost associated with using the CRC is a barrier to cyclists using the centre. Cyclists are not used to paying for facilities, whereas car drivers are used to paying for parking and budget for it.
- Many cyclists secure their bikes very close to the entrances of their place of work. It is also thought that the extra time needed to walk to work from the CRC and the extra time taken to have a shower will deter people from joining the scheme.

Conclusions

The expected quantified and verifiable results for this measure are outlined in the Inception Report (D2). The objective of the implementation of the CRC was to provide a range of services to encourage cycle use and improved cycle security. The CRC at the Mud Dock has certainly achieved this aim. However, the utilisation of the centre is far less than expected. The evaluated results for the first 9 months of operation have identified possible areas for improvement and the Mud-dock will continue to market the CRC and intend to review their pricing structure in order to increase usage.

2.9.12.6 Bristol – Taxi-Sharing (8.7)

Measure Overview

Buses and taxis have sometimes been viewed as competitive modes of transport, rather than as complementary services.

The Council supports bus services that cannot be operated on a commercial basis, but the majority of these are based around extending the operating hours of the commercial network. The Barton Hill, St. Philip's and St. Anne's area is poorly served by conventional public transport. Geographically, there is a densely populated residential area to the north and employment to the south, but these are divided by busy roads and waterways and with no public transport links between the two. The area also had relatively low levels of car ownership, which meant that residents were experiencing difficulties accessing local employment and services.

The Taxi-Sharing measure was designed to solve this problem by enabling local residents to access bus or rail services, or to travel within their local area, at a low cost. A pilot accessibility mapping process was undertaken, which demonstrated that there were low levels of accessibility to education, employment, health and other local services in the area.

The new service can only be used by people who are registered members of the Taxi-Sharing scheme. Membership of the scheme is free and is open to anyone aged over 16 living within the operating area of the service. To join the scheme, residents are asked to submit a simple registration form. They are then issued a membership card bearing a unique serial number, which must be quoted when booking travel on the service and shown at the time of travel.

As the Taxi-Sharing scheme area is geographically divided in half by busy roads, it was decided that service users would be given a guide as to approximately when the Taxi-Sharing service was likely to be in their area, based on a notional half hourly frequency. People were also advised that they should expect to be asked to share the taxi with other residents.

The service commenced in February 2005 and currently has over 130 members.

Evaluation Results

A mix of quantitative and qualitative data has been utilised in the evaluation of the taxi sharing scheme. The taxi operator Swiftline provided the Council with details of each trip undertaken by members of the scheme providing information on:

- Time;
- Date;
- Member;
- Pickup and destination; and
- Cost per journey.

This provided evaluation data for the period March – August 2005. In addition to the quantitative data collected a members' survey was undertaken in September 2005. Two postal surveys were designed and distributed to members who had used the scheme and members who had registered but not used the scheme. The aim of the surveys was to assess user satisfaction and identify the reasons why a large proportion of the membership were not using the service. A total of 9 user surveys and 39 non-user surveys were returned, representing a response rate of 38%.

A process interview was also conducted to add further context to the quantitative data, and to assess the steps, decisions, and actions taken; the obstacles and opportunities encountered; and the roles and contributions of the different parties of relevance.

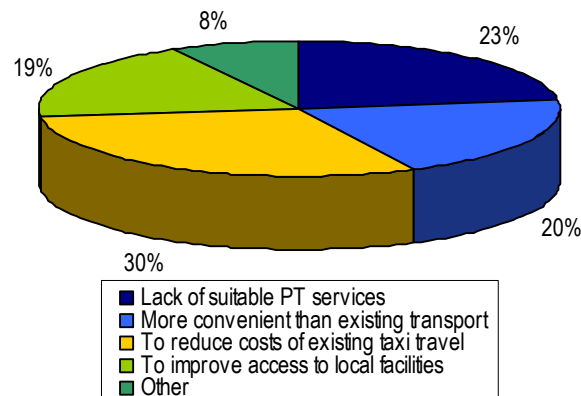
Demand for new services (LO28)

The scheme has proved successful in attracting a large membership base. After 6 months the scheme had 125 members. The number of members joining the scheme suggests that the marketing and awareness raising of the scheme has been successful. This comprised of a major leaflet campaign undertaken at the time of launch to introduce the scheme and invite residents of the area to become members. Door-to-door

deliveries of the leaflets were given out with a local paper, the Observer. A secondary leaflet drop was subsequently undertaken. There has been a noticeable increase in enquiries in response to these marketing efforts and new members joining the scheme. The scheme has also generated enquiries from residents outside the area wanting to know how they can take part.

The member survey identified the main reasons for joining the scheme as being to reduce the cost of existing taxi travel and due to a lack of suitable public transport services (see Figure 2.9.12-19). This highlights cost savings over a lack of suitable public transport services as being the primary reason for joining. Only five members identified previously using standard taxi services as their main mode of travel, highlighting the cost barrier associated with this mode.

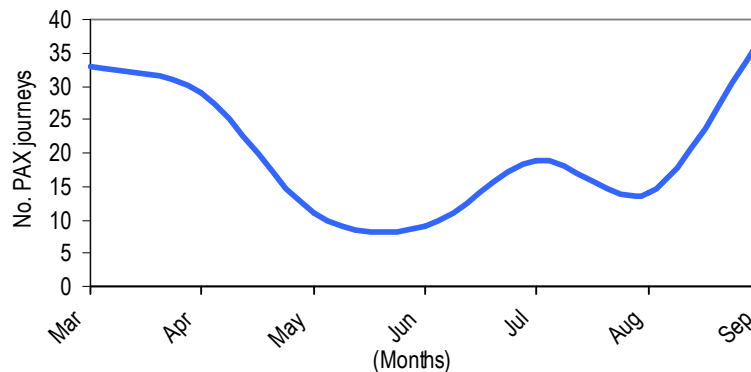
Figure 2.9.12-19 Main reasons for joining the taxi sharing scheme (all members)



Analysis of membership information has revealed that a high proportion of members are elderly, with 44% over 55 years of age. Several comments received in the member survey revealed that it was due to restricted personal mobility that these members have joined the scheme. This demonstrates that the scheme provides a socially necessary service, enabling elderly people and people with disabilities to access local services.

In the first six months of operation, the Taxi-Sharing scheme has been used for a total of 131 trips or 152 passenger journeys. This represents an average of 19 passenger journeys per month since launching. Usage has been highly variable each month, with as few as 8 journeys being conducted during June and as many as 37 journeys completed in September (see Figure 2.9.12-20). It appears likely that weather conditions are a significant factor in determining usage, particularly influencing members who would consider walking to their destination in good weather conditions.

Figure 2.9.12-20 Passenger Journeys per Month (Mar – Sep '05)



The scheme operates from 07:00 – 19:00 seven days a week. However, further analysis of the usage data reveals that 61% of journeys are undertaken between the hours of 13:00 – 16:00. A large proportion of these trips are accounted for by outward and return journeys occurring within this period. There is a relatively even split of journeys undertaken between Monday and Friday, but very few journeys (9%) are undertaken on a Saturday or Sunday. The scheme is used to complete a range of journey purposes including shopping, visiting friends and relatives, and accessing sport, entertainment, and leisure facilities.

Although the number of members who have joined the scheme is sizable, only a small proportion of members are actually using the scheme. Between March – September only 26 members have used the taxi sharing scheme to complete journeys within their local area. Of the total number of journeys, 50% have been completed by just three members who regularly use the service each month. However, even the most regular of users use the service relatively infrequently, the most single journeys undertaken by one user within a month being 15. This pattern of usage suggests that the taxi sharing service while used frequently by a small group of members, is more commonly used if the need arises in an emergency or specific circumstances.

The members survey indicates a high propensity to continue to use the taxi sharing service, or to use the scheme in the future. All of the services current users intend to continue to use the scheme and 30 non-users intend to use the service in the future. The main reason behind this pattern of usage and in particular non-use, as revealed by the members survey, is because members were uncertain of how the service operated. This included being unclear about the area covered by the scheme, and uncertainty of the booking arrangements. The operational area of the scheme is also identified as being restrictive. Due to this a number of locations were highlighted as destinations members would like to be served by the service. Most commonly this included the city centre for shopping purposes and the main train and bus stations so that onward travel could be undertaken. This identifies that although successful in raising awareness for the new scheme, the marketing campaign was not able to convey appropriately how the scheme was going to operate or could be used. This suggests that a follow up campaign is required.

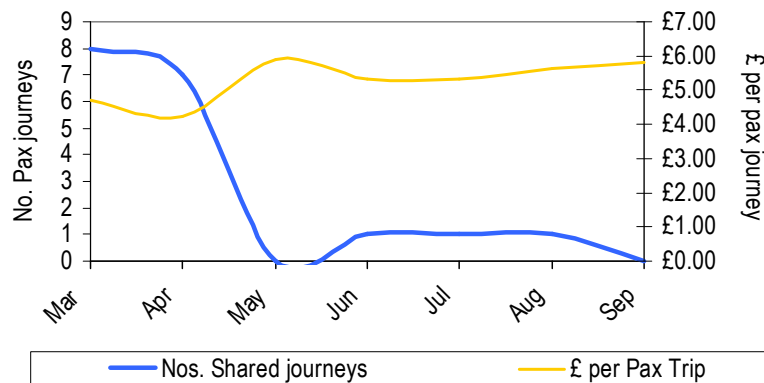
The taxi-sharing element of the scheme has not been as widely undertaken as intended, however this is a likely consequence of the current low number of members using the

service, so reflects the limited opportunities for sharing to be undertaken. Only 18 journeys have been shared by more than one member of the scheme, representing 14% of the journeys undertaken using the service. However, again this pattern of usage is dominated by a minority of scheme members with only four members having shared a journey on more than one occasion.

Operating Costs (2)

One of the objectives of the scheme was to test whether Taxi-Sharing is a cost effective way to meet unmet transport needs. Conventional supported bus services currently cost the Council between £0.28 and £5.81 per passenger journey, although the latest target criteria is £3.08². For a bus journey broadly equivalent to the Taxi-Sharing service a bus passenger would generally pay a fare of between £1 and £2 single fare, thus contributing to the operating costs. To date the Taxi-Sharing scheme has cost £785. This equates to £5.16 per passenger journey, of which the passenger pays a contribution of only £0.5 per journey. The passenger contribution has been set at a deliberately low level during the trial period, while the overall cost per trip is rather high. As shown in the Figure below, the cost per journey drops when there is more than one passenger because the operator receives more fares revenue to contribute towards operating costs. The rather low take up in this initial phase (with lessons on publicity and marketing) meant that the opportunities to combine passenger journeys by the scheme operators were rather low. Therefore the advantage of Taxi-Sharing is demonstrated. It is hoped that as usage of the scheme increases and sharing is further encouraged that the operating costs can be decreased.

Figure 2.9.12-21 Cost per passenger journey



Service Quality (17 & 19)

Service quality was assessed through the members survey, although due to the small numbers involved this only represents a sample of 9 current users. The survey showed that users of the Taxi-Sharing scheme are generally satisfied with most elements of the service, including booking a journey, quality of the vehicles, staff assistance and fare levels. One of the respondents commented that “As I am a non-driver and use schools that are a 25 minute walk away the introduction of this service has been great”.

² £1 = approximately 1.48€

However, some of the comments received reveal that information and knowledge of the service is a problem. One respondent commented that “When the initial information came out I did not feel there was a clear enough explanation and information on how the scheme works”. The comments also highlight that there are problems with the taxi drivers not being aware of the service. One respondent commented “Most of the drivers said that they did not know about the Taxi-Sharing service and how it works. Most of them have to ring someone in the office”. This highlights that there is more work required to improve members knowledge regarding the operating of the scheme and to ensure that all the drivers of the operating taxi company know the details of the scheme.

A number of suggestions were put forward to improve the current service. These included extending the service into the evenings, extending the area of operation, and providing better information relating to the service.

Process Evaluation

Through the process interview a number of opportunities and obstacles were identified. The main points are summarised below.

Opportunities

- The scheme has developed a core group of members who make regular journeys. However, the scheme also has many members who have joined but never used the service. It is thought that this comes down to uncertainty regarding how to use the scheme something that is soon to be addressed through marketing initiatives.
- There is now more awareness of this type of scheme within the taxi trade. It is therefore likely that there would be more interest if the Council were to tender for a new area of operation. It is also possible that with increased operator competition that operator charges could be reduced.
- The VIVALDI funding has been crucial to the scheme. The Council’s Public Transport team had long had interest in piloting such a scheme but had no funding available to implement such a new and unknown service. The funding has also meant that it has been possible to make the scheme cheap to use, 50p per journey, as an incentive to encourage people to make use of the service.

Barriers

- There has been confusion regarding booking arrangements and people did not fully understand how to use the service. Details were provided on all leaflets but alternative methods of engaging members and local residents are needed to better inform them about the service.
- The innovative nature of the scheme proved to be a barrier to its implementation, in that it deterred potential operators from tendering for the contract.
- The scheme has no visual presence in area, as taxis are non recognisable from normal Swiftline vehicles.

Conclusions

The evaluation of this measure has been affected by the limited time series of information available. The measure was only launched in February 2005 and as such only provides six months of evaluation data. This is insufficient to provide a detailed evaluation of this measure as the early months of operation can be subject to “teething”

problems and are only indicative of take up etc. Also as the scheme was new, there was no available before data to use in the evaluation of this measure.

It is recommended that the scheme be closely monitored outside of VIVALDI to complete a more robust evaluation of the impacts of the service and to ascertain whether a cultural change is adopted over time that is receptive to alternatives to the use of private cars and increased public transport use.

The Council have learnt several important lessons about trying to introduce a Taxi-Sharing scheme and have identified that taxi operators and users will be cautious about entering in to something new or unfamiliar. To implement a similar scheme, the local authority concerned would need to build an on-going dialogue with local operators so that they are aware of the scheme's objectives at the beginning of the process. This could involve face-to-face meetings and attending the taxi operators forum.

It is also evident that the scheme required a more targeted and coordinated marketing campaign. Engaging people is key, to make people aware of the scheme, to clearly set out how it can be used and to further encourage people to use it.

The scheme will continue to operate for a further 18 months until February 2007. There is a possibility that Taxi-Sharing schemes could be applied to other areas of the city. Consideration is being given to whether the scheme could replace the provision of existing supported bus services.

2.9.12.7 Bristol – City navigators (Info Bus) (12.2)

Measure Overview

The original City Navigators concept proposed the development of a team of trained staff to provide transport and tourist information to travellers via mobile devices. However, further investigation of this proposal, discussion with stakeholders and the changing focus of the way in which tourist information is provided have resulted in a revision in the means by which this initiative is to be progressed.

The creation of a mobile information vehicle termed the “Info-Bus” was seen as a way to satisfy the need for the provision of mobile transport information and services in Bristol. The scheme provides information to travellers at key sites such as public transport interchanges, strategic movement generators or sites where special events are held. A dedicated branded vehicle is used to provide information relevant to its location through a combination of staff, displays, paper-based material and electronic systems.

The key functions of the Info-Bus have been:

- Promoting public transport, walking and cycling information - through access to both paper-based and electronic information, including access to journey planning via the Internet-enabled terminals (see 12.7 Trip Planner Development).
- Providing transport information and services – information about a range of transport services provided by the Council and other organisations, e.g. demand responsive transport services, car club schemes, parking information and travel plan advice.

- Marketing campaigns – the vehicle is used to target locations where new schemes or initiatives are to be launched and events in which the Council participates, such as In Town Without Your Car and Bike to Work Day.
- Event management – a means to advise the public and affected organisations of events and resultant changes to traffic and parking, for example road closures.

Evaluation Results

Since its launch the Info Bus has been used at a number of events in Bristol. A log of each time the vehicle has been booked has been kept. This provides basic utilisation data for evaluation purposes.

In order to collect actual usage data a survey and log of users was kept while the vehicle attended the Bristol Harbourside festival. A total of 33 surveys were conducted face-to-face with users of the Info Bus using trained fieldwork staff. The results of the survey provided information on:

- Reasons for use;
- Mode information sought for;
- Other sources of travel information regularly used; and
- User satisfaction with the information provided and facilities available.

Info Bus Utilisation & Usage

During the period December 2003 – August 2005 the Info Bus has attended 17 varied events in Bristol. These include major events such as the Harbourside Festival, and using the vehicle at consultation events or as a demonstration vehicle at conferences held within the city. A list of events attended over the evaluation period is provided below.

Utilisation of the bus has been much lower than anticipated. Initial indications were that BCC departments would take the bus to a number of events, representing approximately a third to half a year. As highlighted utilisation has turned out to be much lower, representing no more than 2 - 3 weeks use each year. The process interview identified a number of factors that are acting as a potential barrier to the vehicles use by council staff including the technology, the vehicle itself and staffing events held on weekends.

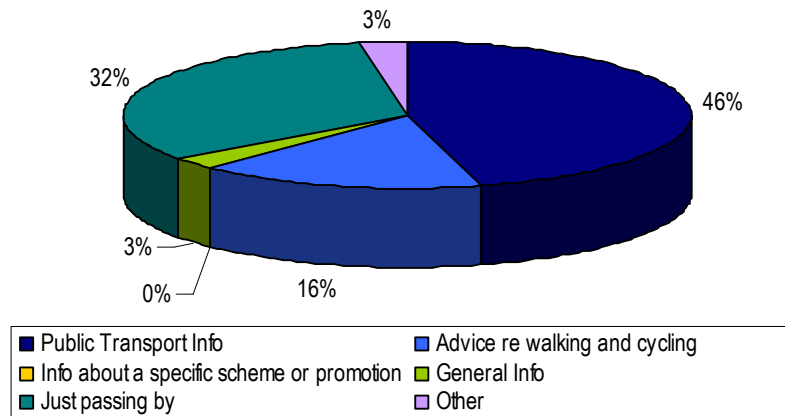
Table 2.9.12-13 Info Bus Utilisation

Date	Event	Purpose
2004		
14 th & 18 th January	Southville Home Zone	Scheme consultation
3 rd March	-	Info Bus Open Day advertising the new facility to Council colleagues
15 th March	-	Demonstration to European visitors
22 nd May	Docks heritage weekend	Travel awareness
13 th June	Bristol Car Show / Bristols Biggest Bike Ride	Travel awareness
16 th June	-	Travel Plan promotion in Temple Quay development
31 st July & 1 st August	Harbourside festival	Travel awareness
12 th August	Balloon fiesta	Travel awareness
4 th & 5 th September	Organic food festival	Travel awareness
18 th September	Streets Alive!	Travel awareness
28 th September	ICE conference	Demonstration to delegates
25 th October	Global climate change conference	Demonstration to delegates
2005		
21 st May	Transport of the Future event	Travel awareness
9 th June	Clean fuel vehicles exhibition	Travel awareness, travel plans at Temple Quay development
23 rd July	Harbourside festival	Travel awareness
22 nd September	Ashton Primary School	Road safety, workshops, travel awareness aimed at children and parents
12 th October	The Podium, Broadmead	Information about transport implications of new city centre development.

A total of 33 surveys were completed on a single day of surveying which was selected to coincide with the Harbourside Festival. Over the three days of the festival it is estimated that 200,000 people attended the event. In total between the hours of 10:00 – 17:00 it is estimated that 735 visitors visited the Info Bus.

The Info Bus can be used to obtain information through printed and interactive sources available on board the facility relating to all forms of transport and events occurring in Bristol. The main results from the survey indicate that:

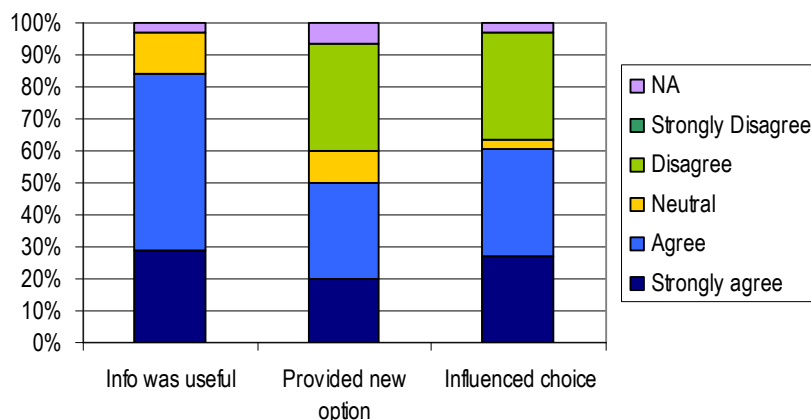
- The main reason for using the Info Bus, as stated by 17 respondents, was to gain information regarding public transport, accounting for 46% of responses. A further 12 respondents, representing slightly under a third of the sample, gave the reason that they were just passing by. Six respondents also used the Info Bus to get advice on walking and / or cycling. (Fig 1)
- Information was obtained relating to five modes, namely bus, train, Park & Ride, cycling and walking. 19 respondents (44%) obtained information on bus services and 11 respondents (26%) on cycling.
- Few respondents had heard of or seen the bus before passing it at the Harbourside Festival.
- Only six respondents had previously used the Info Bus before this occasion.
- Other commonly stated sources of travel information included First, Tourist Information points and the Travel Bristol Info Centre and web page.

Figure 2.9.12-22 Main reasons for using the Info Bus


User Satisfaction

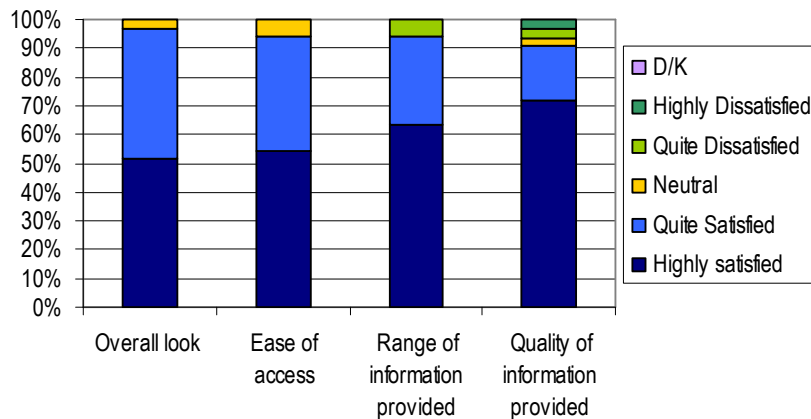
The survey also sought to identify levels of user satisfaction with the Info Bus. Overall, respondents were generally satisfied in their experience of using the Info Bus. The following points were highlighted by the survey:

- 26 respondents (80%) found that the information provided was useful in planning a new journey. (Fig 2)
- 15 respondents (50%) agreed that the information provided informed them of a service that they were previously unaware of, commonly with regard to bus, minibus or coach information. (Fig 2)
- 20 respondents (60%) agreed that the information provided had influenced the type of transport they were going to use, again commonly with regard to bus, minibus or coach information. (Fig 2)

Figure 2.9.12-23 User Satisfaction on Information Provided


The survey has revealed that over 90% of respondents noted that they were either highly or quite satisfied with the look of the bus and access to it, and with the quality and range of the information provided (Figure 2.9.12-24). Respondents receiving staff assistance were also satisfied with the service provided as were those who had used the paper based information available.

Figure 2.9.12-24 User Satisfaction of the Info Bus



The survey results indicate that the Info Bus is primarily used to get information on public transport, cycling and walking, and is found useful in planning new journeys, increasing awareness of transport services and influencing mode choice. Users are also extremely satisfied with the look of the bus, and also the range and quality of the information provided.

Process Evaluation

Through the process interview a number of opportunities and obstacles were identified. The main points are summarised below.

Opportunities

- The project would have stayed as an LTP aspiration rolled forward into successive plans without the VIVALDI funding.
- LTP priorities are consistent with the initiative objectives and assisted in gaining support for the project.
- Because systems worked well in the Info Bus they were transferred to the TravelBristol Info Centre. This also means that the information at both facilities can be updated at the same time.
- The bus attracts a lot of attention at events.
- Feedback has generally been good, but some minor problems have been highlighted, e.g. cold in winter.
- First have offered to take the bus on the back of a low loader to attend events outside of Bristol.

Obstacles

- Some of the characteristics of the delivered vehicle have been a barrier to its use. For example, the bus is left-hand drive, there is a need to tow a trailer and the procedure involved in starting up the Info Bus for use on site is complex. Users have also been unwilling to refuel the generator with LPG. This has meant that an agreement has had to be put in place to agree that BCC fleet services who maintain the vehicle and prepare it for events also refuel the generator.

- Staffing the bus can be problematic as many of the events that people identified that they would attend with the bus fall outside regular working hours, mainly at the weekends. Staff availability at these times has constrained the use of the bus.
- It is evident that some people are afraid of the technology and do not like setting up some elements. Training has been provided, and support is provided at events, but some people are still reluctant to use the bus.
- The public have been less keen to interact with the technology than anticipated. Some people just want to take away leaflets and are not concerned with learning how to use the trip planner etc.
- Securing expensive computer equipment such as the Plasma screen was an important consideration. IBI were invaluable in recommending and advising on potential solutions and delivering equipment that allowed all items to be locked down but maintainable.
- The vehicle requires a connection to a 32 amp socket instead of the conventional 13 amp socket. Not many of these sockets are available at venues. It had been planned that if regularly visiting the same location a connection would be installed for the bus at that location, thereby not requiring it to be connected to the generator. Unfortunately use of the bus has not been enough to justify the installation costs.

2.9.12.8 Bristol – Trip planner (12.2)

Measure Overview

The Intermodal Trip Planner (ITP) is an Internet product designed to give residents or visitors to Bristol access to high quality travel information for the bus rail and ferry services, as well as by bicycle or walking. The information provided is door-to-door using either address points or places of interest.

Work through VIVALDI has focused on the provision of multi-modal information covering all forms of public transport, cycling and walking within the urban context. The Intermodal Trip Planner (ITP) provides users with full door-to-door itineraries in either textual or graphic form with the option for the user to personalise search criteria. This recognises the need to provide information tailored to the individual traveller, particularly those whose mobility is constrained in some way (e.g. only able to use accessible low floor buses, limited walking distances).

Evaluation Results

To evaluate the ITP the levels of usage on the TravelBristol website (<http://www.travelbristol.org/>) were monitored. Monthly transaction logs were collected by BCC from the web site host for the period July 2003 – March 2005. The log files included a detailed breakdown of journeys requested by mode, origin, and destination. Using the monthly log files it was possible to monitor the following indicators:

- Total number of requests ('hits') and the number of completed requests;
- Proportion of requests per mode (Bus, Walking and Cycling);
- Proportion of trip requests with origins or destinations within the city centre clear zone.

Further in depth evaluation of the origin-destination data was conducted in order to identify the trips that people intended to make by mode and in particular journeys made to and from the Clear Zone (CZ). User satisfaction was assessed through the CZ public survey undertaken in June 2005. The survey asked respondents who had used the trip planner to identify their reasons for doing so and rate their satisfaction of using the system. This provided feedback from 44 users of the trip planner.

ITP Journey Requests

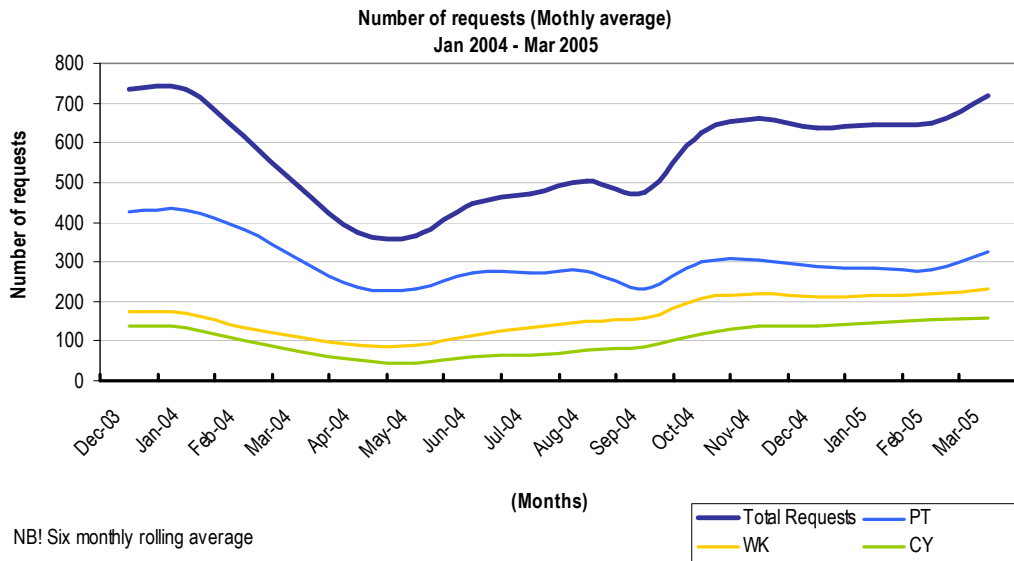
Since July 2003 the ITP has received 10,919 hits with 6,505 completed journey requests made within this period. This equates to an average of 600 journey requests per month of which about 56% lead to a successfully completed journey plan being produced.

Analysis of a six monthly rolling average shows that the number of hits decreased during early 2004, reaching a low of an average of 366 hits during March 2004. However, usage levels have been steadily rising since May 2004, reaching similar levels to those experienced at the end of 2003 and achieving an average of 719 hits by March 2005.

This pattern could be partly explained by the timing of the major marketing campaigns undertaken to raise awareness of the ITP. There have been two campaigns, the first at launch included a two page feature in the local newspaper (The Evening Post) and bookmarks distributed to public venues such as libraries, schools and doctors' surgeries.

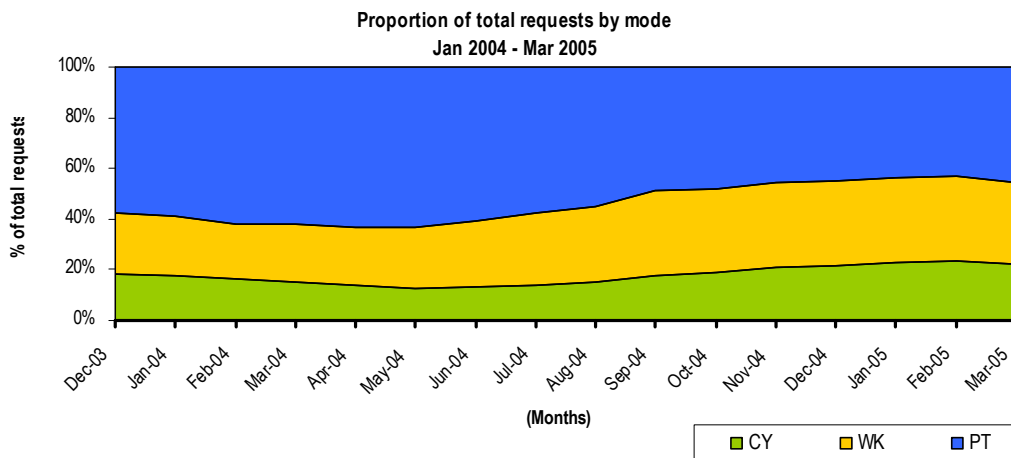
The second, undertaken in November 2004, included the production of materials to jointly promote the launch of the Travel Information Centre (see 12.2 Travel Information Centre) and ITP. This included the production of credit card sized materials which were also distributed through TravelSmart (See 11.3 Travel Awareness). The Travel Bristol web site which hosts the ITP has also been heavily promoted through the TIC, i+ kiosks, on-board local buses and at bus stops across the city.

Despite rigorous system testing some problems have been encountered by users who notified the council by email. The bus planner always gives the first available bus service which could end up being a once daily service. This has created a trust issue as the public do not feel that they can rely on a service which is only going to turn up once a day. A number of glitches with the walking and cycling planners have also been highlighted, such as providing details of unusable routes. These errors are attributable to the incomplete nature of the data available at the time of system development and some data accuracy problems.

Figure 2.9.12-25 Number of requests (Monthly average)


Proportion Of Requests Per Mode (PT, Walking And Cycling)

The ITP can produce trip plans for bus, walking and cycling trips. Between July 2003 and March 2005 the bus trip planner received 5,902 hits while the walking and cycling planners received 3,005 and 2,012 hits respectively. Although still accounting for the most significant proportion of ITP hits, the bus planner's use has declined. At its height, the bus planner accounted for over 60% of ITP hits; however, by early 2005, this had decreased to around 40% or an average of less than 300 hits per month. Conversely, there is growing use of the walking and cycling trip planners, the proportion of total hits on the walking planner increasing by 14% between December 2003 and December 2004.

Figure 2.9.12-26 Proportion of total requests by mode


Origin / Destination Analysis

As one of the VIVALDI target areas the city centre Clear Zone (CZ) has seen a number of measures introduced within it. It is therefore interesting to identify the proportion of requests originating or terminating in the CZ.

In total 3,222 trip requests had their origin or destination within the clear zone. On average this represents 14% of the total number of requests having their origin within the clear zone and 16% their destination.

More detailed O-D analysis using a year's worth of data from 2004 reveals common OD pairs. A total of 123 trip requests were for journeys starting and ending within the city centre area, suggesting that the trip planner is popular for planning journeys between the various attractions and facilities located within this area of the City. Other popular origins for trips into the CZ include Clifton, Bedminster, Redland, and Temple Meads railway station. Popular destinations for trips originating from the city centre include Clifton, Cotham, Montpelier, Redland and Temple Meads station.

Further O-D analysis using this data identifies the trips that people intended to make by mode. For each of the individual mode planners, the main journeys requested were for trips within the city centre area and between the following areas:

- Clifton;
- St George;
- Redland;
- Henleaze;
- Easton;
- Bedminster;
- Cotham; and
- Fishponds.

User Perception & Satisfaction

User satisfaction was assessed through the CZ public survey undertaken in June 2005. Of the 1,031 completed public surveys only 90 (8.7%) respondents had heard of the ITP, with only 44 survey respondents indicating that they had previously used the trip planner. Although the number of users identified by the survey as having used the ITP was low, over 90% who had used the service indicated that they were either satisfied or very satisfied with it. The survey also asked those members of the public who had heard of the ITP to rate what impact it would have on their travel into and around central Bristol. 56 respondents (43%) thought the ITP would bring about some improvement, although 46 respondents (36%) thought that it would have no impact.

Process Evaluation

The process evaluation identified a number of barriers that became apparent during measure implementation. These include:

- A lack of raw data such as incomplete electronic bus timetable information, incomplete walking and cycling networks;

- Not being able to host the ITP on the Council website, because as an interactive site it contravened Council firewall regulations;
- The ITP does not cater for journeys across other local authority boundaries particularly those to key trip generators on the urban fringe. The ITP would have been improved if it covered the wider Bristol area;
- At the time of development there was no suitable map base containing the required transport information. This created more work as a database of one-way streets and banned turns had to be created manually. Ordnance Survey have since produce an Integrated Transport Network layer which has all data such as one-way streets, banned turns and hills.
- The ITP was the first of its kind in the UK so a number of technical and other barriers had to be overcome including the views and aspirations of users and stakeholders.
- The data used by the ITP needs regularly updating and data errors correcting to maintain its usefulness to the user. The availability of on going funding can be restrictive to this process.
- The ITP after the development phase should be the responsibility of a dedicated team who should maintain the system, however this transfer of ownership remains to be fully completed.

Conclusions

This measure has successfully demonstrated the introduction of a multi modal trip planner. The growing number of users of the cycling or walking trip planners suggests that the ITP continues to be a useful resource. In particular the ITP is commonly used for planning short trips into and from the city centre, and other local centres such as Clifton and Bedminster.

2.9.12.9 Bristol – Bus priority and RTPI (12.3)

Measure Overview

The use of Real Time Passenger Information (RTPI) and bus priority measures in Bristol aims to help encourage the use of bus services through improved service reliability and information provision, and also to foster a culture receptive to this mode through use of high profile telematics systems. The benefits of the measures will be experienced by existing users of the specific bus services to be fitted with RTPI and subject to the bus priority measures. It may also help to persuade residents and visitors to Bristol, who are potential public transport users to switch to this mode. The works included under this measure, as set out at inception were to:

- Extension of RTPI (target 30 stops) to 2 project corridors linked to Council's Showcase Bus Routes programme.
- Broaden use of selective vehicle detection on identified corridors.
- Re-use of information supplied to bus stop passenger information displays to serve other dissemination media (e.g. internet, Travel Advice Screens).

The deployment of RTPI has enabled the information to also be available to serve other dissemination media other than bus stop displays. The Council has utilised this information to produce an internet based real time bus information service. The web

site was launched in December 2003 and can be accessed via the Travelbristol website (www.travelbristol.org). The web site displays exactly the same information as displayed on-street. The service is fully expandable to include information for all routes that are upgraded to include RTI.

The measure is part of the Improving Public Transport integrated package that was set the following targets at the project inception:

VT8 – Reduce mode share for cars by 5%

VT9 – Increase patronage on key corridors by 20%

VT10 – To increase access to the PT system

VT11 – Reduce transit time from peri-urban areas to the centre by 15%

VT22 – Real time information on all corridors

VT23 – Increase the number of people accessing PT information by 50%

VT24 – 40% of all fares to be electronic

VT2 – Reduce energy use and CO2 by 8% in the demonstration area.

The following section evaluates the use of the site that has contributed to the above targets and in particular VT11 and VT23.

Evaluation Results

Data was requested for RTI website usage over a 9 month period from 17th March 2004 to 23rd December 2004. Details were requested about information requests for the 82 bus stop locations featured in the web site on a month-by-month basis.

Data was supplied to the evaluation team on a month-by-month basis for the period 17th March 2004 to the 23rd December 2004 for the 82 bus stops featured on the web site. The monthly data files contained the following data for each web site ‘hit’:

Stop Name – The name of the bus stop where information was requested

Stopref – The reference code associated with the stop

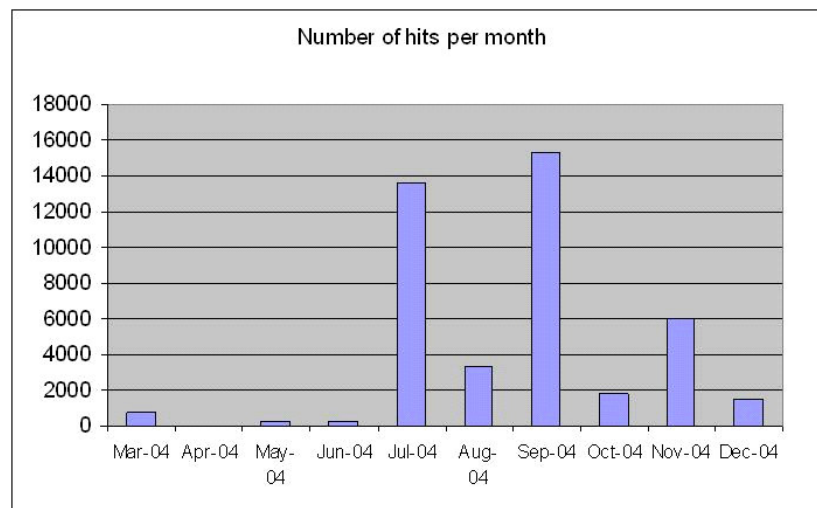
Date – Date of the request

Time – Time of the request

Hits – The number of hits in that session

Figure 2.9.12-27 shows a basic plot of the data received by month and shows that there is an erratic pattern in the number of ‘hits’ recorded in a given month.

Figure 2.9.12-27 Recorded hits of the RTPI Web site



Close inspection of the data (particularly for the July – November period) revealed a large number of clustered ‘outliers’. The clusters consisted of a large number of hits for the same bus stop over a short period of time (e.g. 100+ hits in a 10 minute period). This pattern was observed frequently for different bus stops but did not match the normal pattern of hits for the stops, which tended to be single hits. It was therefore thought that the clustered information was incorrect. A possible reason for this occurrence was that the clusters of hits are formed by a single user hovering a cursor over a particular bus stop information point. An explanation was sought regarding this issue from the data provider but no response was received in time for the evaluation. Therefore, an assumption has been made that each cluster of hits actually equates to a single request of information for that bus stop, and the data was ‘cleaned’. This process reduced the number of recorded hits over the period from 23,575 to 1,281.

The following results are based on ‘cleaned’ data that was collected over the 9 month period from 17th March 2004 to the 23rd December 2004.

Web Site Utilisation

Table 2.9.12-14 provides information on the number of times information was requested at each of the 82 bus stops.

Table 2.9.12-14 Web Site RTPI Utilisation

Stopname	Total number of hits	Percentage	Stopname	Total number of hits	Percentage
Anchor Road (Pi)	29	2.26%	Park Street (Pf)	36	2.81%
Ashley Down Rd (B)	11	0.86%	Parson St Station	4	0.31%
Ashley Down Rd (C)	7	0.55%	Parson St West St	6	0.47%
Bedminster Pde (B)	42	3.28%	Patchway Rbt	1	0.08%
Bedminster Pde (D)	35	2.73%	Patchway Roundabout	5	0.39%
Bishopsworth Lib.	10	0.78%	Pen Park Road	6	0.47%
Bishport Ave (A)	15	1.17%	Penn Street (Sr)	9	0.70%
Bond Street (Rb)	10	0.78%	Portway Riverleaze	4	0.31%
Bond Street (Rd)	13	1.01%	Portway Roman Way	7	0.55%
Bristol Zoo	7	0.55%	Portway Station Rd	6	0.47%
Broad Quay (Ck)	14	1.09%	Portway Woodwell Rd	4	0.31%
Broad Quay (Cn)	47	3.67%	Prince Street (Bq)	18	1.41%
Broad Quay (Co)	26	2.03%	Redcliff Hill (Tp)	7	0.55%
Cannon Street	1	0.08%	Redcliff Hill (Ts)	6	0.47%
Charlton Rd Junct	11	0.86%	Redcliffe Way (Tt)	15	1.17%
Chessel Street	3	0.23%	Rodway Road	4	0.31%
Churchways Ave (C)	11	0.86%	Rupert Street (Cb)	56	4.37%
Clifton Dwn Stn (B)	30	2.34%	Rupert Street (Hb)	17	1.33%
Clifton Dwn Stn (D)	38	2.97%	Sommerville Road	5	0.39%
Clifton Village	55	4.29%	Southmead Hosp (A)	22	1.72%
College Green (Pe)	33	2.58%	Southmead Hosp (B)	4	0.31%
Coniston Road Shops	4	0.31%	Sycamore Drive	13	1.01%
Dalby Ave East St	17	1.33%	Temple Meads (Te)	60	4.68%
Filton Church	18	1.41%	Temple Way (Oh)	26	2.03%
Filton College	20	1.56%	Temple Way (Ti)	13	1.01%
Filton Police Stn	8	0.62%	The Centre (Cg)	40	3.12%
Filton Road	16	1.25%	The Centre (Ci)	43	3.36%
Gipsy Patch Lane	17	1.33%	The Grove (Bm)	5	0.39%
Gipsy Patch Ln	3	0.23%	The Haymarket (Rf)	9	0.70%
Hareclive Road	2	0.16%	The Haymarket (Rg)	26	2.03%
Headley Park Avenue	1	0.08%	The Haymarket (Rj)	5	0.39%
Highbury Road	1	0.08%	The Parade	1	0.08%
Horfield Sports Cen	3	0.23%	Wilton Close	14	1.09%
Horsefair (Sm)	7	0.55%	Zetland Rd Jtn (C)	7	0.55%
Hotwells	54	4.22%	Zetland Rd Jtn (G)	6	0.47%
Kingsholm Road	4	0.31%	Average	15.62	1.22%
Lampton Avenue	7	0.55%	Total	1281	101%
Lenover Gardens	1	0.08%			
Marlwood Drive	9	0.70%			
Monk's Park Avenue	8	0.62%			
Muller Road Top (B)	20	1.56%			
Muller Road Top (C)	8	0.62%			
Nelson Street (Hc)	16	1.25%			
Nevil Road	18	1.41%			
Nine Tree Hill (A)	28	2.19%			
North Street (Rn)	24	1.87%			
Northville Road	9	0.70%			

The results show that over 31% of the requests were for 8 centrally located bus stops. Table 2.9.12-15 lists the 8 most popular stops whose locations include transport interchanges and local shopping areas. The most popular stop was Temple Meads (Te) which is outside the main railway station in the centre of Bristol. Rupert Street, Clifton Village and Hotwells were also popular stops.

Table 2.9.12-15 Most frequently requested bus stops

Stopname	Total number of hits	Percentage
Temple Meads (Te)	60	4.68%
Rupert Street (Cb)	56	4.37%
Clifton Village	55	4.29%
Hotwells	54	4.22%
Broad Quay (Cn)	47	3.67%
The Centre (Ci)	43	3.36%
Bedminster Pde (B)	42	3.28%
The Centre (Cg)	40	3.12%

Figure 2.9.12-28 shows that the peak hours for hits on the RTPi website are between 3pm and 5pm when over 23% of requests for information are made. This late afternoon peak suggests that people are checking the status of the buses before leaving work. The smaller morning peak suggests that some users check before they leave their house but less than in the afternoon. This might be because people have a set departure time in the mornings, or they do not have time to check the website before departing for work, or simply that they have easier access to the Internet at work.

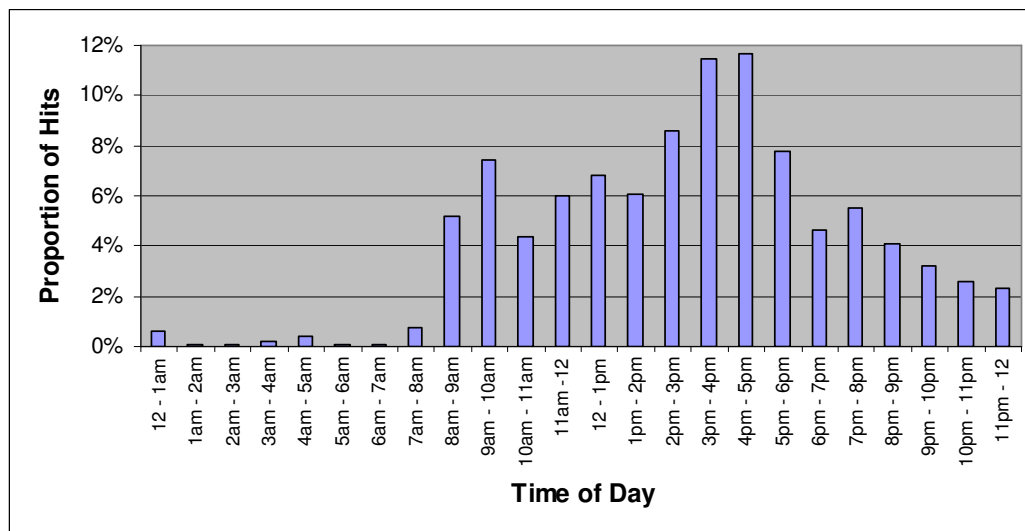
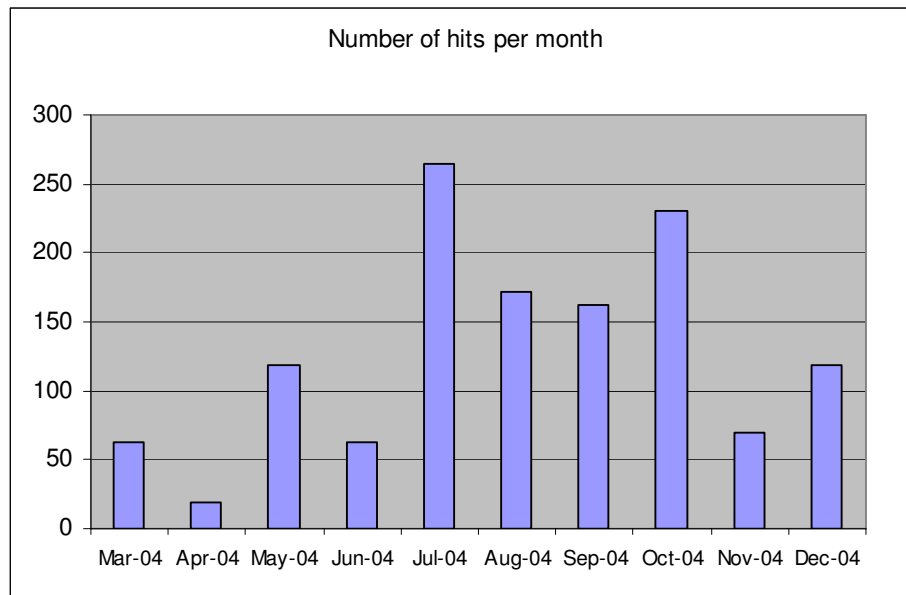
Figure 2.9.12-28 Proportion of hits by time of day


Figure 2.9.12-29 shows the total hits per month and that the site has been accessed the most during the period July to October. This coincided with the time of the launch of the TravelBristol web site that has a link to this service at www.travelbristol.org. The graph also shows that there have been at least 50 hits per month over the monitoring period.

Figure 2.9.12-29 Number of hits on the RTI website by month


Information Requests for the VIVALDI areas/PT corridors

Number of hits for stops inside the Bristol Clear Zone

The Bristol clear zone covers the city centre and contains a number of street improvements and public transport priority measures. Exactly 50% of the total hits received by the RTI website were for locations within the clear zone.

Over 9% of the hits for bus stops within the Clear Zone were for the bus stop at Temple Meads station that is used by two bus services that link to the city centre and Clifton illustrating the importance of bus links to the railway station. Other popular locations inside the Clear Zone included Rupert Street (9%), Hotwells (8%) and Broad Quay (just over 7%).

Table 2.9.12-16 Stops inside the Clear zone receiving hits

Stopname	Total Hits	Percentage	Stopname	Total Hits	Percentage
Anchor Road (Pi)	29	4.52%	Redcliff Hill (Ts)	6	0.93%
Bond Street (Rb)	10	1.56%	Redcliffe Way (Tt)	15	2.34%
Bond Street (Rd)	13	2.02%	Rupert Street (Cb)	56	8.72%
Broad Quay (Ck)	14	2.18%	Rupert Street (Hb)	17	2.65%
Broad Quay (Cn)	47	7.32%	Temple Meads (Te)	60	9.35%
Broad Quay (Co)	26	4.05%	Temple Way (Oh)	26	4.05%
Cannon Street	1	0.16%	Temple Way (Ti)	13	2.02%
College Green (Pe)	33	5.14%	The Centre (Cg)	40	6.23%
Horsefair (Sm)	7	1.09%	The Centre (Ci)	43	6.70%
Hotwells	54	8.41%	The Grove (Bm)	5	0.78%
Nelson Street (Hc)	16	2.49%	The Haymarket (Rf)	9	1.40%
Park Street (Pf)	36	5.61%	The Haymarket (Rg)	26	4.05%
Penn Street (Sr)	9	1.40%	The Haymarket (Rj)	5	0.78%
Prince Street (Bq)	18	2.80%	The Parade	1	0.16%
Redcliff Hill (Tp)	7	1.09%	Total	642	100.00%

Number of hits for areas along the showcase bus route

The 76/77 Showcase bus route operated by First runs from Henbury/Southmead to Hartcliffe via Bristol city centre and Bedminster (see measure 8.6). The stops along the Showcase bus route contributed 25% of the total hits received by the RTI website during the data collection programme.

Table 2.9.12-17 shows the Showcase bus stops that were accessed over the monitoring period.

Table 2.9.12-17 Stops alongside the Showcase bus route receiving hits

Stopname	Showcase NS	Total Hits	Percentage
Bedminster Pde (B)	Showcase route	42	12.96%
Bedminster Pde (D)	Showcase route	35	10.80%
Bishopsworth Lib.	Showcase route	10	3.09%
Broad Quay (Ck)	Showcase route	14	4.32%
Broad Quay (Cn)	Showcase route	47	14.51%
Broad Quay (Co)	Showcase route	26	8.02%
Muller Road Top (B)	Showcase route	20	6.17%
Muller Road Top (C)	Showcase route	8	2.47%
Southmead Hosp (A)	Showcase route	22	6.79%
Southmead Hosp (B)	Showcase route	4	1.23%
The Centre (Cg)	Showcase route	40	12.35%
The Centre (Ci)	Showcase route	43	13.27%
Zetland Rd Jtn (C)	Showcase route	7	2.16%
Zetland Rd Jtn (G)	Showcase route	6	1.85%
Total		324	100.00%

Number of hits for stops along the 904 Brislington (Bath Road) Park and Ride bus route

The 904 Bath Road Park & Ride service stops at seven locations in and around the city centre. Bus stops located along the route of this service accounted for 11% of the total hits received by the RTI website during the monitoring period.

There are seven stops on the scheduled Park & Ride service route. Table 2.9.12-18 shows that only 5 of these stops have received hits during the monitoring period. The ‘Old Market (Oh)’ and ‘The Centre (Cn)’ bus stops did not receive any hits.

Table 2.9.12-18 Stops alongside the Bath Rd Park and Ride bus route receiving hits

Stopname	Bath Rd Park and Ride	Total Hits	Percentage
Bond Street (Rb)	Bath Rd - P/R	10	7.41%
Temple Meads (Te)	Bath Rd - P/R	60	44.44%
Temple Way (Oh)	Bath Rd - P/R	26	19.26%
Temple Way (Ti)	Bath Rd - P/R	13	9.63%
The Haymarket (Rg)	Bath Rd - P/R	26	19.26%
Total		135	100.00%

Number of hits for areas along the 902 Portway Park & Ride route. The 902 Portway Park & Ride service stops at seven locations in and around the city centre (see measure 8.7). Bus stops located along the route of this service accounted for 7% of the total hits received by the RTI website during the monitoring period.

Table 2.9.12-19 Stops alongside the A4 Park and Ride bus route receiving hits

Stopname	Portway Park and Ride	Total Hits	Percentage
Anchor Road (Pi)	Portway - P/R	29	31.18%
Bond Street (Rb)	Portway - P/R	10	10.75%
Redcliffe Way (Tt)	Portway - P/R	15	16.13%
Temple Way (Tl)	Portway - P/R	13	13.98%
The Haymarket (Rg)	Portway - P/R	26	27.96%
Total		93	100.00%

In conclusion, the monitoring programme for the RTI website indicates that in a 9 month period 1281 hits were recorded, an average of 142 hits a month. However, it should be pointed out that due to suspected errors in the data, a large amount of information had to be removed from the analysis.

The website has predominantly been used to check centrally located bus stops during the after-noon/evening peak travel period. This suggests that it is used mostly by office workers checking bus times before leaving work, in order to minimise waiting times at the bus stop.

2.9.13 Bristol – Developing New Mobility Services

The Local Objectives for this package of measures was to provide new alternatives to the private car and focus on the development of city car clubs and demand responsive transport services. In particular this package of measures was designed to:

- Provide quality alternatives to the car and encourage their use;
- Ensure the transport system addresses the needs of mobility impaired travellers; and
- Reduce energy use and emissions from new mobility service vehicles.

The table below sets out the local evaluation objectives and describes how they relate to the overall VIVALDI objectives and targets.

Table 2.9.13-1 Objectives for new mobility services

No	Local objective	Target	Contribution to VIVALDI target (s)
LO27	Provide alternatives to the car	Increase car share sites by 5 Increase car share membership by 50	VT 13 Increase number of car share sites by 5
LO28	Ensure the transport system meets the needs of the mobility impaired	Increase use and patronage of the DRTS system	VT25 100% increase in DRTS trips
LO29	Reduce energy use and emissions new mobility services	Reduce energy use and emissions from the new car share vehicles by 8% Reduce energy use and emissions from the new DRTS vehicles by 8%	VT2 Reduce energy use and CO ₂ by 8% in demonstration area VT14 All new car share sites with clean vehicles

To achieve these targets the following measures were implemented for the package:

- 8.3 Demand responsive transport routes; and
- 9.1 Car Club developments.

LO27 – Provide alternatives to the car

VIVALDI target (VT13) is to increase the number of car share sites by 5. The city car club development measure has exceeded this target with 19 car share sites situated throughout Bristol. Car club membership has far exceeded the original target of 50 new members with membership reaching 200 in March 2005.

LO28 – Ensure that the transport system meets the needs of people with restricted mobility

Since the launch of the demand responsive Transport service in area K9 in Bristol, the project has observed a 188% increase over the period of evaluation. This has followed the general pattern of take up experienced by new BDAR areas of operation. In the same period BDAR membership in all areas excluding area K9 increased by 14.7% from 9,240 to 10,598. Increases in K9 membership have been reflected in steadily increasing patronage figures. Between Jan 03 – Jun 05 area K9 has completed a total of 9,306 passenger journeys and an increase of 145% during this period.

LO29 – Reduce energy use and emissions for new mobility services

The purchase and use of LPG minibuses for the service, compared to using diesel fuel for medium sized vehicles, not only reduced estimated PM emissions, but also produced significant percentage (and actual) reductions in NO_x.

The following describes in detail the measure level results for this integrated package.

2.9.13.1 Bristol – Demand responsive transport routes and technology (Dial-a-Ride) (8.3)

Measure Overview

Bristol Dial-a-Ride (BDAR) is a charitable not for profit organisation, which provides a demand responsive transport service for mobility impaired travellers. It focuses on access and providing a door to door service across Bristol and sets out to provide people with disabilities with equal opportunity to access public transport.



The works completed under VIVALDI included:

- The expansion of Dial-a-Ride into the previously unserved area of Westbury-on-Trym, Henleaze and Stoke Bishop wards to the north of the City (BDAR area K9); and
- Operating area K9 with a new LPG vehicle and the wider deployment of such vehicles (see 5.1).
- Piloting a new booking and scheduling system (see 12.4).

The measure is part of the developing new mobility services that was set the following targets at the project inception:

VT13 – Increase the number of car share sites by 5;

VT25 – 100% increase in DRTS trips;

VT2 – Reduce energy use and CO2 by 8% in the demonstration area; and

VT14 – All new car share sites with clean vehicles.

Evaluation Results

A mix of quantitative and qualitative data has been utilised in the evaluation of the DRTS routes and technology measure. Operational data including vehicle mileages, fuel issued and fuel consumption, patronage, membership and service reliability have all been collected with the support of BDAR between January 2003 – March 2005. In addition, qualitative data on vehicle reliability was collected through the fleet manager. This provided information on the type of problems experienced and how each problem was overcome.

Two passenger forums were held during the period of evaluation. The first assessed initial reactions to the service and the second aimed to assess the ongoing passenger satisfaction towards the service. A process interview with the BDAR director and fleet manager was also conducted to add further context to the quantitative data, and to assess the steps, decisions, and actions taken; the obstacles and opportunities encountered; and the roles and contributions of the different parties of relevance.

As area K9 was a new area of operation at the commencement of the VIVALDI demonstrations there was no available before data to use in the evaluation of this measure. Instead, where possible the development of area K9 has been compared with established milestones, experience and knowledge gained by BDAR from its operation in other areas in the city. This data provides the context to the results presented for area K9.

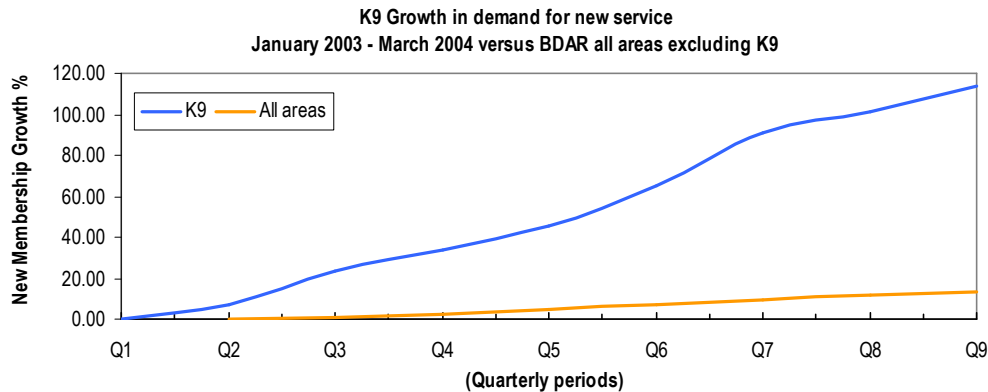
A new booking and scheduling system was piloted and tested but not implemented into operational service by BDAR (see measure 12.4). It was originally intended that this element would be evaluated to see what impact it had on efficiency and passenger trips.

In addition to the two K9 passenger ‘have your say’ sessions conducted in October 2003 and March 2005, BDAR also supplied the results of their annual members survey. This provided additional information relating to passenger satisfaction levels, further adding to the evaluation results.

Demand for new services (LO28)

Since the launch of area K9 in August 2002 membership has increased steadily. In the first quarter of 2003 membership had reached 350 and by the end of the second quarter in 2005 it had increased to 1,008. This represents an increase of 188% over the period of evaluation and follows the general pattern of take up common to new BDAR areas of operation (BDAR areas reaching 800 members within approximately 18 months of operation, and 1,000 within 2-2 ½ years). In the same period BDAR membership in all areas excluding area K9 increased by 14.7% from 9,240 to 10,598.

Figure 2.9.13-1 Growth in Demand for New Services



BDAR Patronage (LO28)

Increases in K9 membership have been reflected in steadily increasing patronage figures. During the period January 2003 – June 2005 area K9 has completed a total of 9,306 passenger journeys. Patronage ranged from 622 for the period January – March 2003 to 1,523 passenger journeys from April to June 2005. This represents an increase of 145% during this period.

BDAR services are used for a range of essential journey purposes. The most common trip purposes are shopping, social and health related trips, accounting for approximately 80% of all trips undertaken.

Bookings not met and service reliability (18)

METEOR indicator 18 Service Reliability requires the evaluation of the accuracy of timekeeping. BDAR is a demand responsive service and as such is not subject to timetabling. BDAR are unable to collect such data but do keep a log of refusals by reason, which does allow some quantification of the number of times K9 members were refused a journey. It is possible to identify from the reason types whether these are features of service reliability or bookings that were unable to be met.

The table below shows that there are extremely few occasions where journeys are refused because of service reliability reasons. More frequently passengers are refused journeys because they specifically wish to travel at an exact time and this requirement can not be met because the bus in area K9 is already booked for another journey, or because the BDAR member has already made one trip in that week and priority is always given to those who have not already used the service that week, or even because the schedule is already full (BDAR operate on a first come first served basis). This pattern is a reflection of growing area membership and patronage levels.

Table 2.9.13-2 Service Reliability

		Q1 Jan - Mar 03	Q2 Apr - Jun 03	Q3 Jul - Sep 03	Q4 Oct - Dec 03	Q5 Jan - Mar 04	Q6 Apr - Jun 04	Q7 Jul - Sep 04	Q8 Oct - Dec 04	Q9 Jan - Mar 05
Number of bookings unmet	Exact time required	0	25	27	15	21	81	78	72	18
	No outward available	0	0	0	0	2	0	3	0	0
	No return available	0	0	1	0	0	1	7	3	6
	Second trip	0	2	1	7	13	20	12	10	3
	Vehicle full	0	0	0	0	0	0	4	0	0
	Schedule full	0	19	22	30	13	39	105	92	65
Service Reliability	Vehicle out of service	0	0	0	0	1	0	0	12	0
	Service out of operation	0	0	0	0	0	1	0	0	0
	Reduced service	0	0	4	1	2	17	6	0	22
	No Service	0	0	0	0	0	0	0	0	0

Fuel Consumption (3)

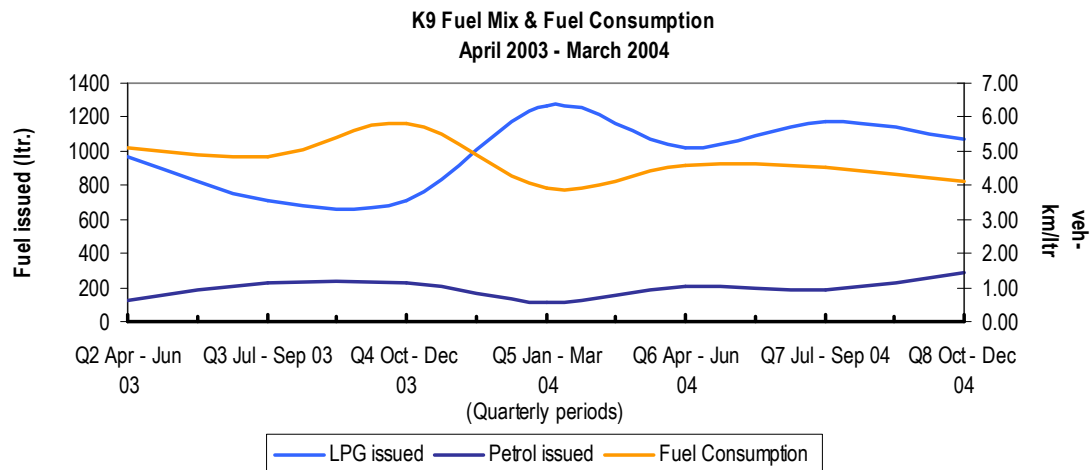
To evaluate fuel consumption it is necessary to collect data on fuel issued and vehicle kilometres driven. To provide a set of comparison figures against which to evaluate the LPG bus (a Mercedes Benz 314 Sprinter), a diesel Renault Master LM35D bus was operated in the same area undertaking the same duties for the period February and April 2005. The vehicle was selected from the BDAR fleet as it was the nearest equivalent vehicle in terms of age, although it should be noted that this vehicle is approximately one year younger than the vehicle to which it was being compared and has a slightly smaller seating capacity.

Over the period from January 2003 to December 2004 the petrol / LPG vehicle operating in area K9 covered over 41,512km, or on average 5,189km per quarter. Over the same period 6,924 litres of LPG and 1,368 litres of petrol have been issued. On average the fuel mix or ratio of petrol issued to LPG is 1:5.9, although in the period from January 2004 - March 2004 it was 1:11.

Every month the LPG vehicle has to be run on petrol for a given minimum distance. This takes place within normal use of the vehicle. This is because the petrol must not remain in the tank for longer than 3 months.

Fuel consumption over the period January 2003 - December 2004 varied between 3.9 and 5.8 km/ltr, recording an average of 4.7 km/ltr. In comparison the diesel bus operated in area K9 between Feb and Apr 2005 recorded a fuel consumption figure of 7.58 km/ltr. This figure provided by the diesel vehicle, although of a different make and model, suggests that the LPG/petrol vehicle is significantly less fuel efficient. However, this can be accounted for by the fact that LPG has a lower energy density compared to diesel, so the fuel consumption measured in litres can be expected to be higher. There is also the required use of the fuel powered saloon heater, which has an impact on the amount of fuel used.

As shown in the graph below there is an apparent correlation between fuel consumption and the fuel mix i.e. as the amount of LPG used increases the fuel consumption also increases.

Figure 2.9.13-2 BDAR Fuel Consumption


Fuel Costs of Operating (2)

The price of fuel has risen significantly in the UK between Jan 2003 and Apr 2005. In this period the average monthly price of a litre of diesel has increased from £0.76 to £0.90, while petrol prices have risen from £0.75 to £0.85 per litre³. While LPG has remained much cheaper than petrol or diesel, due to lower rates of fuel duty imposed by the UK government, prices of LPG have also increased. Between Q3 2004 and Q4 2004 LPG prices increased by 13 per cent (DTI, 2005). In August 2005, the average forecourt price of LPG in the UK was £0.40 per litre.

Due to the lower price of LPG it is estimated that over the monitoring period BDAR have saved over £550 in fuel costs through operating the LPG / petrol vehicle in area K9 (estimated using figures from a Renault Master LM35D for Feb – Apr 2005).

On average the fuel costs of operating the LPG / petrol vehicle in area K9 is £0.09 per vehicle km. This compared to a figure of £0.11 per vehicle km for the period Feb – Apr 2005 recorded by the diesel replacement vehicle.

Maintenance, repair costs and vehicle reliability (2 & 18)

There have been a number of reliability problems with the petrol/LPG minibus operating in area K9. This has included a problem with the fuel system which resulted in a serious petrol vapour leak, the exhaust system twice becoming seriously detached from the vehicle requiring breakdown assistance to be summoned on both occasions, and the fuel powered saloon heater continues to cause problems. The vehicle has cost £3,665 in maintenance and repair costs between January 2003 and December 2004. This does not necessarily reflect the true figure of the overall cost of operating the vehicle, as some of the work carried out has been done under the Manufacturer's Warranty. There have also been some body repairs carried out, but these costs have not been included in the figure stated. In addition to this, there have been some costs incurred for the installation (and subsequent removal) of the satellite navigation equipment.

³ Please note that £1 = approximately 1.47€

A local company that services the LPG system has pointed out certain inadequacies in the installation of the system. There is very little clearance between the ground and the LPG tank when the vehicle is fully loaded. If the vehicle were to make contact with a speed hump or other such obstruction, it could result in serious damage.

In addition to the mechanical problems, the type of engine has not proved popular with some drivers. Drivers have reported that the vehicle stalls more easily, which requires extra driver concentration. However, the power of the LPG vehicle is adequate, only slightly lower than the petrol equivalent. In addition, the engine is much quieter than its diesel equivalent, which is a positive benefit for the passengers.

Service Quality (17 & 19)

Two passenger forums were held during the course of the project. The first was held on 13th October 2003 with 17 members from the K9 area in attendance, representing a consistent cross section of Dial-a-Ride membership. The second group was held on 22nd March 2005 with 15 members of the scheme. The groups were moderated by trained facilitators and tape recorded for analysis purposes. Topic guides for each of the group were designed to address key questions and topic areas such as:

1. Current use of BDAR;
2. Reasons for using BDAR;
3. Levels of satisfaction with BDAR;
4. Use of other modes of transport; and
5. Areas for improvement.

The main conclusions from the two groups in relation to METEOR indicators 17 and 19 are summarised below:

- Users of BDAR in area K9 are extremely satisfied with the service provided and are keen to stress the importance of having a safe mode of transport that provides them with some freedom and independence.
- Members find it a valuable lifeline that allows them to travel safely and in comfort, to make door to door journeys that would be difficult, and in some cases not possible, without the service.
- Some constructive suggestions on how to improve the service included:
 - Extension of booking period to 1 hour;
 - Moving the booking time forward;
 - Advance bookings for standard journeys;
 - Producing a BDAR Newsletter; and
 - Extending the hours of service to cover evenings and weekends.

BDAR also conduct an annual passenger survey. The last survey was conducted in October 2004 and received a response from 410 members of the service, across all operational areas. It also revealed high levels of user satisfaction:

- 80% of passengers rated the service as 'Excellent' and a further 16% rated it 'Good';
- 87% of passengers rated staff as 'Excellent' in terms of their friendliness, helpfulness, knowledge and efficiency; and
- 100% of passengers reported that they felt safe when using the service.

BDAR is a passenger led organisation that adds considerable expertise and a unique perspective to the way that they operate and use its services.

Emissions (8-11)

Please see measure 5.1 for the emissions calculations for the LPG minibus used for operating area K9.

Process Evaluation

Through the process interview a number of opportunities and obstacles were identified. The main points are summarised below.

Opportunities

- During the project an agreement with Bristol City Council's Contract Services section was reached, thereby allowing BDAR to use their LPG refuelling point and vehicle washing facilities. However, this is some distance from the designated VIVALDI area which makes it difficult to use as scheduled refuelling breaks have to be put in during the week to enable refuelling at this depot to take place.
- Further opportunities to develop a clean fuel vehicles "Fleet Managers Group", as part of VIVALDI, could have been explored to enable experiences to be shared and managers to work through some of their technical problems jointly.

Obstacles

- There was a delay in vehicle delivery of 6-7 months, in BDAR's experience caused by the LPG vehicle being retrofitted rather than coming direct from the manufacturer's production line. Dealing with several parties in the supply of the vehicle was thought to have complicated the process as it was felt that when things go wrong, people can try to shift the responsibility onto another party. BDAR were fortunate in that they had a spare back-up vehicle which could be used in the short term so that they did not have to delay the operational start date.
- The network to support LPG use in Bristol is lacking particularly in terms of LPG refuelling facilities and garages that will service the vehicles. BDAR had hoped that more LPG outlets would open during the course of the VIVALDI project but this has not occurred as anticipated.
- A number of issues regarding refuelling were identified. These included:
 - The variation in systems from vehicle to vehicle and the different types of nozzle at the fuelling stations.
 - Overspill from the system when refuelling can go over clothing and hands.
 - Refuelling using LPG can take roughly twice the time to refuel with petrol. Further time can be lost if the driver has to get into two queues, one for petrol and then again for LPG.

Conclusions

Bristol Dial-a-Ride were very pleased to join the VIVALDI partnership and were keen as part of their five year Business Plan 2001- 2006 to pursue new technology to improve efficiency, to explore and experiment with clean fuel vehicles as part of their Environmental Policy and open up a new area of service with some revenue support. However, without VIVALDI funding assistance the measures pursued within the programme could not have been considered.

BDAR were able to use the new area (K9) as a test bed to try out suggestions and alternative ways of operating. At the start of VIVALDI, BDAR had 13 years of experience in delivering quality accessible transport services to disabled and older people living in Bristol and had 8 operational areas within the city. Thus, BDAR were able to draw upon considerable experience and follow an established pattern of service development.

2.9.13.2 Bristol – Car club development (9.1)

Measure Overview

Following formal tendering, in September 2002 the Council awarded a four-year contract to national car club operators Smart Moves Ltd to run the car club in Bristol under the brand name City Car Club. The contract with Smart Moves stipulates targets for growth in membership and the expansion of the scheme to other districts of the city. There was an aim to have 20% of cars using alternative fuels by year 3 of the contract. Once the four year contract has expired it is anticipated that the club will become financially independent.

The City Car Club was officially re-launched on 5 February 2003 and now has over 220 members, a fleet of 24 vehicles and operates in eight city districts.

A system has been introduced which allows members to book the car via the Internet or telephone and the car club's control centre sends details of the booking to the car's onboard computer via GSM mobile phone. Each driver has their own smart card and PIN number, making it much easier and more secure to use the cars. The technology means that a member cannot access the car if they have not booked to use it. If the car is not booked they can access the car and book it via the on-board unit (OBU), likewise if you want to extend your booking you can do so via the OBU as long as there are no other bookings made already. The new system also records the mileage and hire charges that are sent out with the member's bill and members can always see how much time is left on their booking and how many miles they have driven.

As part of this project, the Council has developed a mechanism to designate parking bays on the highway for the sole use of car club vehicles (Figure 2.9.13-3). A new type of legal order had to be created to permit this. The provision of on-street bays has been very important in raising the profile of the car club and the guarantee of a parking space also increases the appeal of the car club, particularly in heavily built up areas. The Council has implemented 19 on-street parking bays for car club vehicles in a number of clusters around the city centre. A further two off-street bays have been provided through developments and the car club operator has negotiated the use of a three off-street bays associated with businesses including two major hospitals.



Figure 2.9.13-3 City Car Club car and parking bay

At Southmead (8.7) and Frenchay hospitals the car club operator has provided a car as part of the hospitals' Travel Plans to encourage greater use of sustainable modes. Staff are able to use the cars during the day as pool cars and can use them as private members at evenings and weekends. The cars are also available for use by local residents during evenings and at weekends.

Another important opportunity for broadening the Car Club scheme is to ensure that new residential developments consider the needs of these vehicles. The local development plan is currently being amended and the power for the Council to secure Car Clubs as part of new residential developments is included in these proposals. There are signed planning agreements with developers in place to support the development of the Car Club scheme through the introduction of new vehicles, payment of membership for residents or provision of parking schemes in association with 7 new housing developments. Car Club membership was marketed to individuals who were considering buying a property in one of the new housing developments, so that they would be aware of the scheme and its benefits from the outset.

In addition, incentives for public transport use have been provided by First, whereby all Car Club members are offered season tickets at a discounted rate. In addition the complementary nature of the Car Club and public transport was reinforced by the use of on-bus internal advertising for a 6-month period in 2004. Bus stop and other city centre poster sites were also used to promote the scheme to new members through campaigns in 2004 and 2005.

The City Car Club aimed to meet the following measure objectives: lessen the dependency on the car especially at peak periods; provide quality alternatives to the car; and encourage their use and foster a climate that is receptive to alternatives to the car. The measure also aimed to achieve the target of increasing the number of car share sites by 5% (VT13) as outlined in the Evaluation Plan (D4).

Evaluation Results

User, service and vehicle information was collected on a monthly basis using the pre-existing membership system and via three annual surveys of car club members (2003-2005). An information survey was also carried out in 2005, targeting people who had

requested information about the car club but had not become new members. In addition to information collected in the surveys (length of membership, use of car club vehicle and mode choice), monthly data was collected specifically on service and vehicle information, car utilisation rates and public transport incentives.

As of June 2005, eighteen vehicles were available to car club members. The number of car sites has exceeded the VT13 target (5 sites). The location of each vehicle, vehicle type and where vehicles are parked are shown in Table 2.9.13-3.

Table 2.9.13-3 Car locations and type

District	Street/Location	Vehicle Details	On/Off Street
Redland	Kensington Road	Vauxhall Corsa	On
Cotham	Cotham Road	Vauxhall Corsa	On
Kingsdown	Clevedon Terrace	Vauxhall Corsa	On
Knowle	Norton Road	LPG/Petrol Astra Estate	On
Totterdown	Hill Avenue	Vauxhall Corsa	On
Southville	Milford Street	Vauxhall Corsa	Off
Southville	Southville Centre	LPG/Petrol Astra	Off
Easton	Bloy Street	Kia Kelisa	On
Whitehall	Prospect Place	Vauxhall Corsa	On
Clifton	Clifton Park	Ford Focus	On
Hotwells	Albermarle Road	Vauxhall Corsa	On
St Andrews	Effingham Road	Vauxhall Corsa	On
St Werburgh's	Mina Road	Vauxhall Corsa	On
Ashley Down	Ashley Down Road	Toyota Corolla	On
Ashley Down	Seymour Avenue	Vauxhall Corsa	On
Southmead	Southmead Hospital	Vauxhall Corsa	Off
Frenchay	Frenchay Hospital	Vauxhall Corsa	Off
St Pauls	Brunswick Court	Vauxhall Corsa	On

Two dual-fuel vehicles are located at Southville centre and Norton Road, Knowle. Car club activity moved into new target areas of Cotham, Hotwells and Easton during 2003 and into Southmead and Frenchay Hospitals, and Ashley Down, Clifton and Whitehall during April and July 2004 respectively.

Utilisation rates refer to the number of membership bookings made per vehicle during a 24 hour period. Average usage rates have fallen since 2002 as shown in Figure 2.9.13-4, although the decrease may be accounted for by an increase in the number of available vehicles and locations, resulting in a spread in utilisation. An additional reason may be that it takes time for usage at new locations to grow, so expanding by 6 or 7 locations at a time will lower the overall utilisation rate for a few months.

Trends in utilisation across months have remained static with peaks occurring across school holiday periods. However, utilisation rates are not consistent across all vehicle locations. Table 2.9.13-4 shows the rates for the six-month period from January to June 2005. The Clifton car is consistently the most utilised at an average level of 28% in 2005 and the vehicle at Frenchay is the lowest at 9% for the same six-month period.

Car Club Monthly Utilisation Rates (October 2003-June 2005)

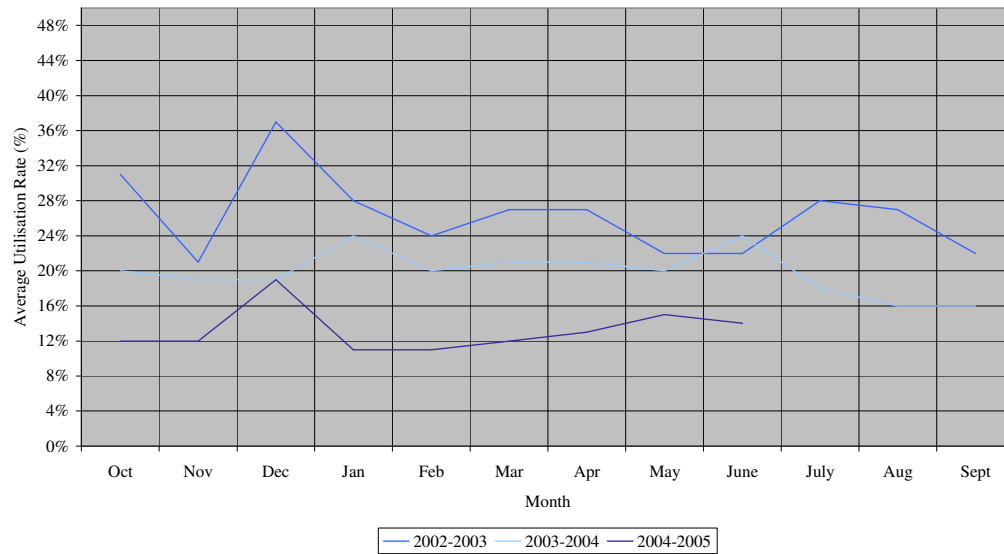

Figure 2.9.13-4 Average utilisation rates October 2002- June 2005

Table 2.9.13-4 Vehicle utilisation rates (January 2005-June 2005)

District	Location	Date Opened	Utilisation %					
			January	February	March	April	May	June
Ashley Down	Ashley Down Road	23-11-04	1.08	1.12	0.00	1.94	5.11	2.57
	Seymour Avenue	03-07-04	7.12	12.80	17.34	15.76	20.36	21.74
Clifton	Clifton Park	30-10-05	33.00	22.84	29.30	24.24	22.78	15.76
Cotham	Cotham Road	19-09-03	12.03	13.47	12.10	14.58	9.68	21.81
Easton Frenchay	Bloy Street	19-09-03	9.54	12.35	10.15	15.35	24.53	7.85
	Frenchay Hospital	01-09-04	4.84	4.99	4.10	7.50	5.78	16.04
Howells	Albermarle Row	04-02-04	14.79	8.71	13.31	12.92	23.59	12.01
Kingsdown	Clevedon Terrace	15-02-01	7.26	16.44	14.78	15.35	13.04	15.90
Knowle	Norton Road	01-07-00	9.48	4.76	28.02	12.92	25.87	11.88
Redland	Kensington Road	10-11-01	11.90	6.99	4.63	12.85	18.95	21.46
Southmead	Southmead Hospital	07-02-04	2.49	2.38	1.61	4.24	7.86	6.32
Southville	Milford Street	23-09-04					15.12	11.32
	Southville Centre	10-11-01	15.64	22.54	17.26	21.45	22.38	31.18
St Andrews	Effingham Road	01-05-03	6.32	22.02	14.31	15.21	15.86	13.50
St Pauls	Brunswick Court	17-01-05	0.56	2.75	1.28	2.57	12.30	9.51
St Werburghs	Mina Road	30-10-03	6.59	8.93	10.75	17.78	12.90	13.47
Totterdown	Hill Avenue	01-07-00	23.72	17.86	15.05	12.64	16.06	18.19
Whitehall	Prospect Place	01-08-04	6.79	13.10	9.34	16.98	12.16	19.79

When asked about the variance in usage across sites, the manager of the Bristol City Car Club suggested that vehicle type, vehicle location and local marketing schemes may all affect it. Some members may require a larger vehicle than those on offer for trips such as collecting or moving furniture. Vehicles located in areas with low levels of membership, such as Ashley Down, are unlikely to experience high rates and if local marketing is poor then this will also affect usage levels. Currently the car club is utilised more frequently in the evenings and during weekends rather than during office hours, this is reflected by the low number of existing business users requesting vehicles during office-hours.

First offered discounted bus travel (10% discount) for car club members across a range of ticket types (Table 2.9.13-5). The uptake of purchasing discounted transport tickets has been limited. This could partly be explained by the number of car club members who now walk or cycle rather than use the car (28%) compared to those who use the bus (17%), based on membership feedback from the 2004 membership survey. Other issues such as practicability and lack of awareness were not investigated as part of the survey.

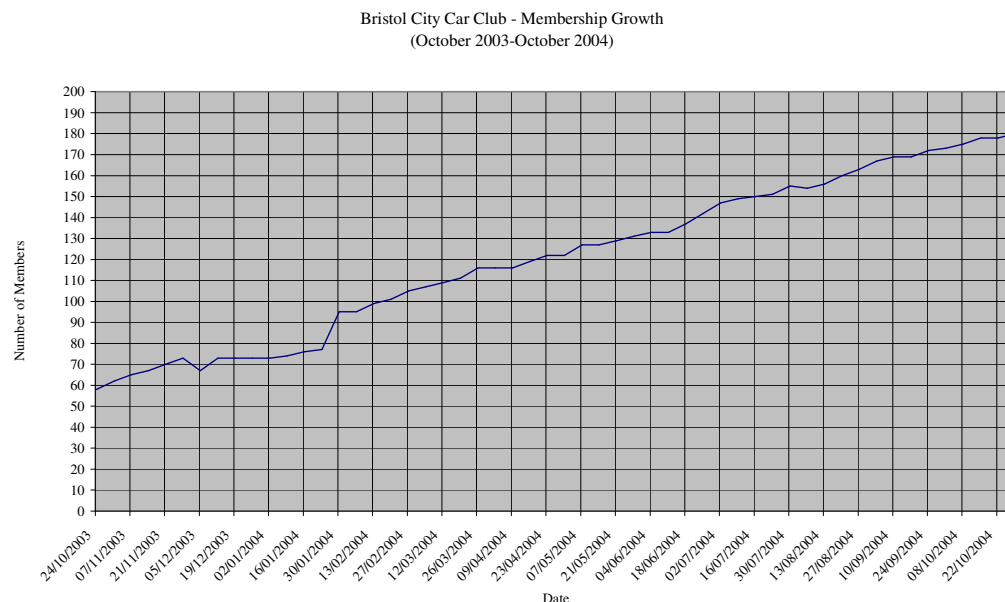
Table 2.9.13-5 Public transport incentive utilisation (March 2003-May 2005)

Week Ending	First Week Zone 1	First Week Zones 1&2	First Month Zone 1	First Month Zones 1&2	First Journey Ten	Greater Bristol Ten	ATG Ticket
19-03-2004	0	4	2	0	2	3	
23-04-2004	0	4	3	0	2	2	
28-05-2004	0	0	1	0	2	0	
27-06-2004	0	6	0	0	2	4	
22-08-2004	0	4	1	1	1		1
19-11-2004	0	0	0	0	2		0
26-11-2004	0	0	0	0	1		0
17-12-2004	0	0	0	0	3		0
06-05-2005	0	1	0	0	0		0
20-05-2005	0	0	1	0	0		0
Total	0	19	8	1	15	9	1

Member surveys investigated a number of aspects of car club membership and key results are reported.

Membership

Membership has far exceeded the original target of 50 new car club members (Local Objective 27) across an increased number of car locations by approximately 120 members. In March 2005 the membership figure was approximately 200. Figure 2.9.13-5 shows membership growth for the twelve month period October 2003-October 2004.


Figure 2.9.13-5 Bristol City Car Club membership growth for the twelve month period October 2003-October 2004

In August 2004, SmartMoves standardised and increased annual membership rates and hourly rates for all four of its city car clubs (Bristol, Brighton, Edinburgh and London). This resulted in three members of the Bristol City Car Club leaving during this period

and a further five members registering complaints. Sixteen other members left the Bristol club during 2004 as they could not justify continued membership.

User satisfaction from the October 2004 survey suggested that charge rates were not excessive. The convenience, reliability and accessibility of vehicles were generally thought worth the cost of membership, although members wished for an increase in the number of available vehicles. Eighty-two members were surveyed in June 2005 and when asked if they would remain members of the club 93% stated that they would.

Approximately 75% of respondents in 2005 had been members for 2 years or less (Figure 2.9.13-6), and only 5% had been members for four or more years.

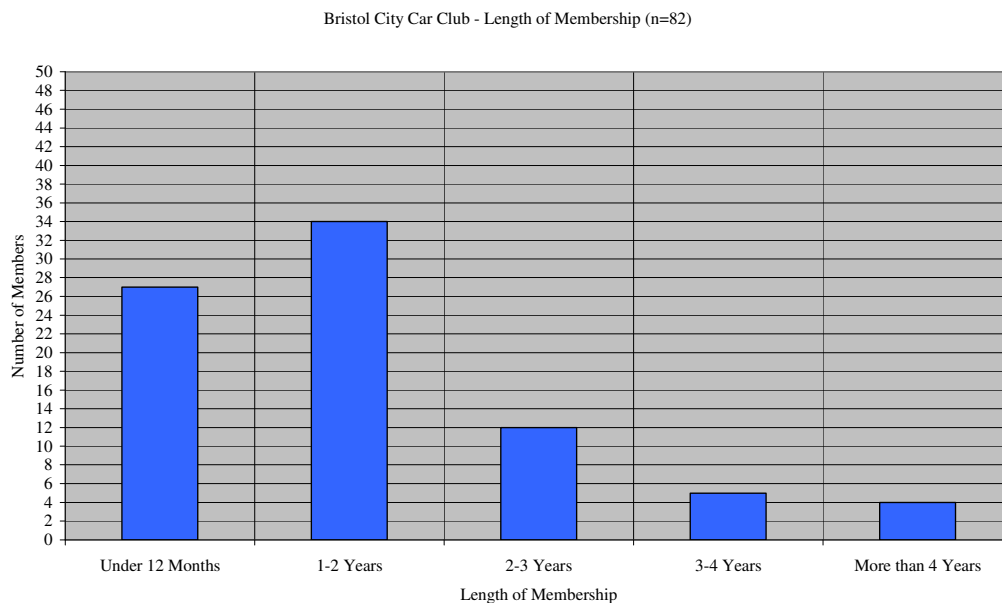


Figure 2.9.13-6 Length of membership of eighty-two car club members (June 2005)

Car club vehicles are primarily used for shopping and leisure (34.1% and 32.9% respectively) with only 16% of members using vehicles for work.

Socio-demographics of Bristol City Car Club Members

Of the eighty-two members surveyed in June 2005, 90% of members identified themselves as White British. Interestingly no members identified their ethnicity as Indian, Pakistani, Bangladeshi, Black Caribbean or Black African even though some of the vehicle sites are located within mixed ethnicity areas. There was a relatively even gender split with 57.3% of members being male and 42.7% of members being female. Over 70% of members were employed with 18.3% of members stating that they were self-employed and 2.4% as students. The remaining members (6.1%) were unemployed. The age profile of surveyed members can be seen in Table 2.9.13-6:

Table 2.9.13-6 Age range of surveyed Bristol Car Club Members (June 2005)

Age Range	Frequency	Percent
17-24	1	1%
25-34	20	24%
35-44	31	38%
45-54	24	29%
55+	6	7%
Total	82	100%

Mode Choice

Approximately 60% of members had access to a car prior to joining the car club and over half of these (32%) have now given-up this car since joining the club. Only 7% of members now own two or more private vehicles and 61% of members do not own a vehicle. 19% considered buying a private vehicle before joining the car club, so membership of the club has partly contributed towards lower purchasing rates of private vehicles.

With the exception of coach, motorbike, Park & Ride and taxis, members have increased their use of alternative modes more than they have reduced them (Table 2.9.13-7). Rail travel for example has seen an increase of 20.7% compared to a reduction of 4.9%. It would be difficult to extrapolate a cause-effect relationship between joining a car club and alternative mode choice as other external factors may also be present. The figures however are encouraging.

Table 2.9.13-7 Mode choice since joining the car club (June 2005)

Mode	Increased Use %	Reduced Use %	No Change %
Bus	20.7	17.1	62.2
Train	20.7	4.9	74.4
Coach	2.4	3.7	93.9
Bicycle	29.3	11.0	59.8
Motorbike	2.4	0	97.6
Walking	37.8	0	62.2
Taxi	19.5	20.7	59.8
Park and Ride	0	0	100
Other	1.2	4.9	93.9

Time

Bristol City Car Club vehicles are primarily used between the hours of 10:00-14:00 (47.6%). Thirty-two per cent of members use vehicles between 06:00-10:00 and 18% of members primarily use vehicles between 14:00-22:00.

Information Survey (June 2005)

In addition to collecting information from members, 62 people who requested information about the Bristol City Car Club but did not join the club were asked questions about their enquiry and the reasons why they decided not to join. 90% of enquires were made during the last 18 months (January 2004-June 2005), with only 10% of people making an enquiry during 2002-2003. Table 2.9.13-8 shows where people first heard about the car club:

Table 2.9.13-8 Source of enquiry information (June 2005)

Media	Frequency	Percent (%)
Local Press	7	11
Friend	11	18
Family	2	3
Leaflet	15	24
Poster	8	13
National Press	4	7
SmartMoves Web Site	3	5
Work Colleague	2	3
Bristol City Information Bus	2	3
Other Council Promotion	1	2
Other	5	8

The table shows that 42% of people either heard about the car club via a friend or through a car club leaflet.

The primary reason for not joining the car club was price (48% of enquirers). However, 31% of enquirers stated that the location of vehicles was also a reason why they decided not to join the club at the current time. 86% of people requesting information stated that they would consider joining in the future.

Private Car Displacement

A 2004 annual survey across all SmartMoves UK's car clubs suggested that 64% of members either sold or disposed of their private vehicle as a result of joining the club. Of the 82 members surveyed in Bristol in June 2005, 32% of members have sold or disposed of their private vehicle as a result of joining the club. In addition, 34% of members stated that joining the car club was a cheaper option to owning a second car. This suggests that private vehicles have not only been displaced, but that the purchasing of a second private vehicle has been prevented.

Conclusion

Since the City Car Clubs re-launch in 2002, membership has exceeded the originally set target. The club has increased internal effectiveness through SmartMoves restructuring the Bristol office and transferring some responsibilities to a central head office, enabling the Bristol office to concentrate on the promotion of the club and subsequent recruitment of members. Further, marketing and promotional activities have been successful in the recruitment and profiling of the car club. Although a delay in obtaining on-street parking was initially experienced, the advent of on-street parking has been advantageous to the club as vehicles are situated more conveniently for members and have greater visibility.

New tariff structures were introduced at the beginning of April 2003 to address the problem of how longer bookings are charged. The result was the introduction of an €18 per month charge and the end of the low user tariff. These changes have improved the system for the operator and members (although one member left the club as a result of the low user tariff being dropped).

A recent report by the Department for Transport (DfT, 2004)⁴ investigating alternative modes to the car commented on the Bristol City Car Club:

“The Bristol City Car Club is the second largest car club in the UK with 160 members and 11 cars in April 2004. It is managed by Smart Moves (who also manage other car clubs in the UK including Edinburgh and London), working in partnership with Bristol City Council. The club plans to expand to 1,000 members and 50 cars by 2006, and although this has been delayed by some problems, there is public interest in the club and expansion is planned in response to calls from neighbourhoods for new car stations. The many other transport initiatives underway in Bristol complement the car club, as joining the club requires members to assess the other options available to them for getting around.”

⁴ Department for Transport (2004). Smarter Choices – Changing the Way We Travel (Volume 2 Case Study Reports). *Department for Transport*, London.

2.9.14 Kaunas – New Public Transport Services (8.1)

Measure Overview

The main measures undertaken to improve public transport services are split between this measure and the ‘Access and Security Improvements’ measure (see 8.8 below). This measure concentrated on the impact of modifying the public transport route system and in particular on the reduction of some routes, better management of others, the methods of attracting new passengers, and what effect this has had on the number of cars in the city. This included:

- Creation of new city public transport route and schedule databases – through the implementation of the “PIKAS” software programme system.
- A study of passenger flows in the city public transport system (changes caused by decrease and increase of passenger flows influenced by new location of attraction centres or relocation of old ones)
- Improvement of organisation and quality of public transport services with emphasis on social and environmental concerns of citizens

The main objective of this measure is to modify the public transport system to satisfy the public needs related to transport, safety, comfort and economy, and attract new passengers to use PT services. Options included measures to improve the efficiency of the public transport system by means of improvement of quality and image of the public transport fleet, and the provision of high quality services for passengers and PT operators.

Local Objectives

The VIVALDI measures implemented in Kaunas aimed to achieve:

- A modified PT network
- Elimination of micro-bus transport in the city centre
- An increase in the attractiveness of PT transport (traffic control, new transport means, development of information system)
- A new ticketing system

The key objectives of public transport network modification and implementation of the new ticketing strategy were:

- To promote public transport as the main means of transportation in the city
- To stop the decrease of passengers in public transport
- To ensure reliable and convenient public transport services
- To prepare the background to the development of ITS in the city
- To improve working conditions for the drivers
- To install bus priority on the main streets of the city
- To shorten travel duration
- To reduce perceived waiting time
- To decrease air pollution in city centre
- To simplify ticket vending and control in PT
- To provide easy access to travel information
- To provide information within the transport means and information centres

These objectives and their contribution to the overall VIVALDI objectives are summarised in the table below.

No	Local objective	Target	Contribution to VIVALDI target (s)
LO1	To promote PT as main transport mode in city	Stop decrease in passenger numbers	VT9 - Increase patronage on key corridors by 20%
LO2	Ensure reliability of PT service	Install bus priority on all main routes Reduce travel times Reduce waiting times	VT10 - Increase access to PT system VT11 - Reduce transit time from peri-urban areas to centre by 15%
LO3	Provide better PT information	Increase access to PT information services	VT23 - Increase number accessing PT information by 50%
LO4	Improve city centre air quality	Contribute to air quality objectives	VT3 - Meet national air quality objectives

During the implementation of the project, 309 new ticket punchers were installed on buses and 460 validators were installed on trolleybuses. The number of tickets used on trolleybuses increased by 45 percent from 2001 to 2004. A small increase was also achieved on buses. During the analysed period, the number of tickets used in buses increased by almost 8 percent.

The redevelopment of the Public Transport (PT) system using the PIKAS software is seen as a success and Kaunas now has a system of integrated public transport service providers that also includes the operator of the micro bus/taxi services. Public transport users can now access all PT information regarding routes, times and providers via a single internet site.

The project has also implemented 367 new bus shelters and approximately 1300 cylindrical holders to display timetable information for the PT services in Kaunas.

The redevelopment of the PT system has led to an increase of nearly 30 percent in the number of new, high quality minibuses in the city. There has also been a decrease in the number of minibuses by more than 18 percent and a 30 percent reduction in the number of minibus routes leading to a slight decrease in the length of routes. These changes are believed to have had a positive impact on total emissions.

Kaunas is the first city in Lithuania to present timetables of minibus taxis together with timetables of buses and trolleybuses on the public transport website pages. The website has had an average hit rate of 700 hits per day and over 5,000 per week, and some 21,000 per month. It became possible to obtain information on public transport by SMS message from spring 2005; however, for the meantime, there is no statistical data on the number of people using this service.

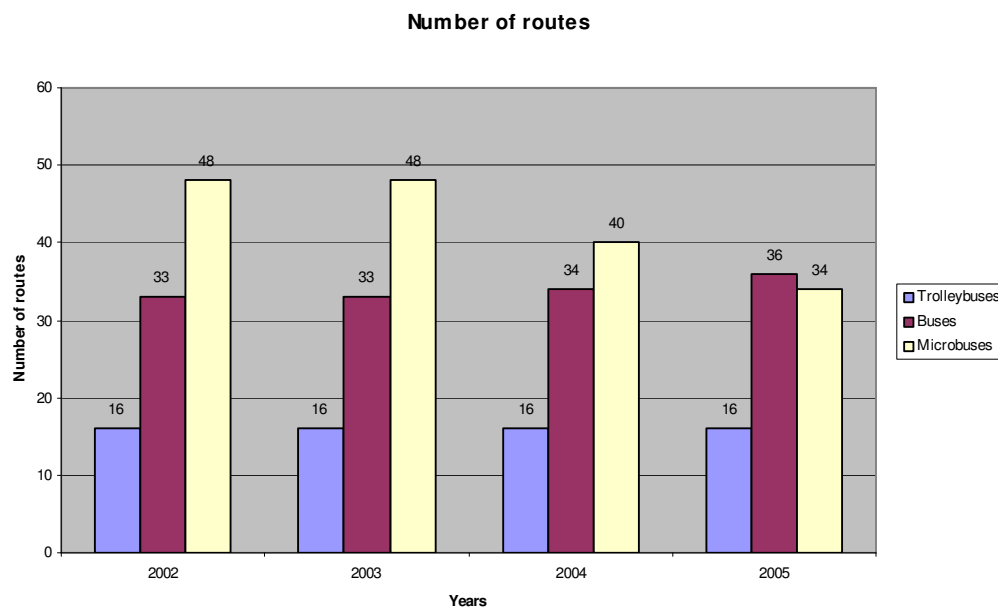
Evaluation Results

During implementation of VIVALDI, the PIKAS transport management system was introduced in Kaunas. Its main aim was to improve the effectiveness of public transport management, and in doing so attract more passengers. In order to evaluate the impact of the project activities on the urban transport system, changes of the following indicators were analysed:

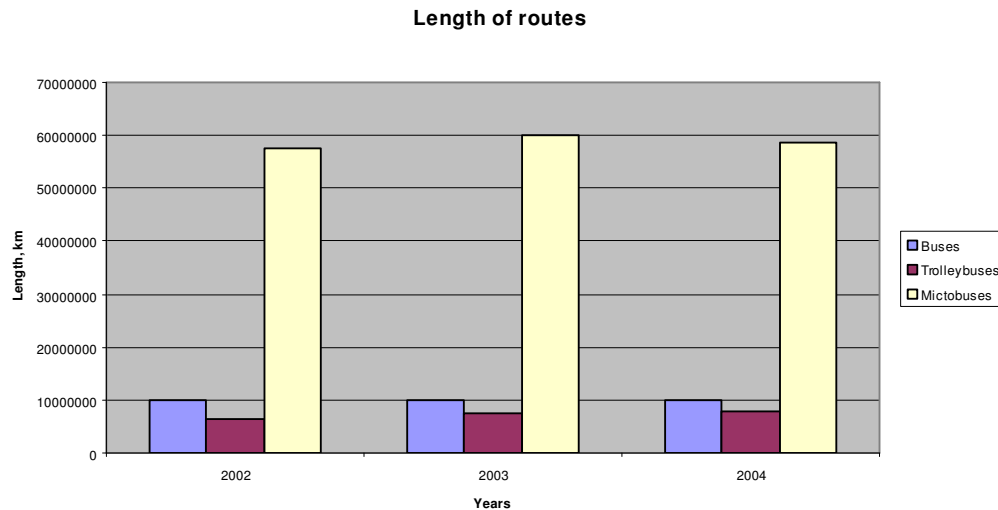
- Number of routes
- Length of routes
- Income, costs and profit of carriers
- Number of transport units in routes
- Use of fuel and electricity
- Number of passengers transported
- Number of private cars
- Number of accidents

The change in the number of public transport routes in Kaunas in 2002-2005 is presented below. An analysis of the number of routes showed that until 2004 minibuses constituted the majority and trolleybus routes the minority. From 2002 to 2005, the number of trolleybus routes had not changed (16), since 2004, the number of bus routes started to increase, and the number of minibus routes started to decrease. Thus, in 2005, the number of bus routes was bigger than minibus routes. During the last few years, the number of bus routes increased by 9% (4 new routes), the number of minibus routes reduced by almost 30% (14 routes cancelled).

Figure 2.9.14-1 Number of public transport routes in Kaunas in 2002-2005

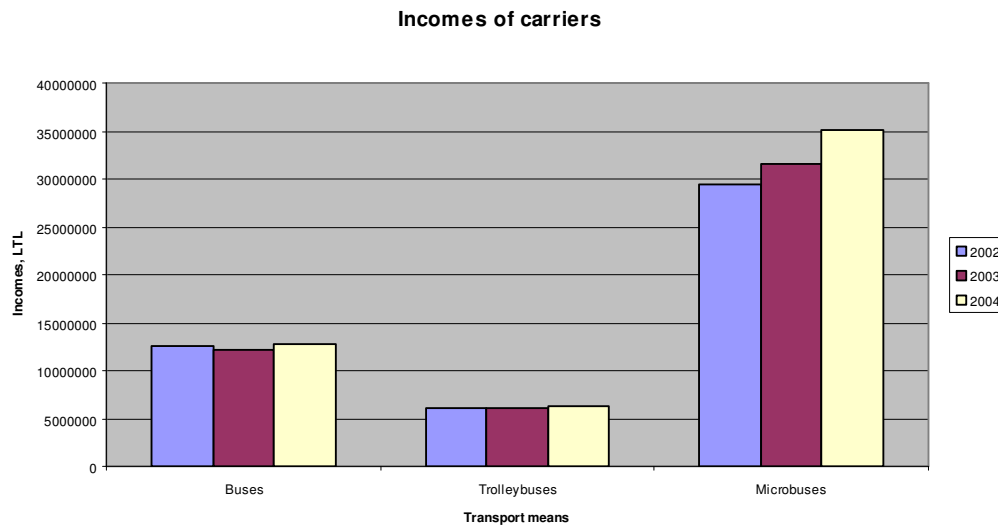


From 2002 to 2004 the length of Kaunas public transport routes also changed (see Figure 2.9.14-2). The Kaunas public transport system is made so that trolleybuses serve the central part of the city, buses reach industrial and residential districts, and minibus taxis reach Kaunas suburbs. Thus, minibus routes are the longest.

Figure 2.9.14-2 Length of public transport routes in Kaunas in 2002-2004


From 2002 to 2004, the length of bus routes increased by 1%, for trolleybus it increased by almost 18%. The length of minibus routes slightly increased in 2003 but in 2004 a decrease in the length of routes of minibuses was noticed again; the overall increase was of just under 2%.

When evaluating the impact of the project on Kaunas public transport system, important indicators are income, costs and profit of public transport carriers.

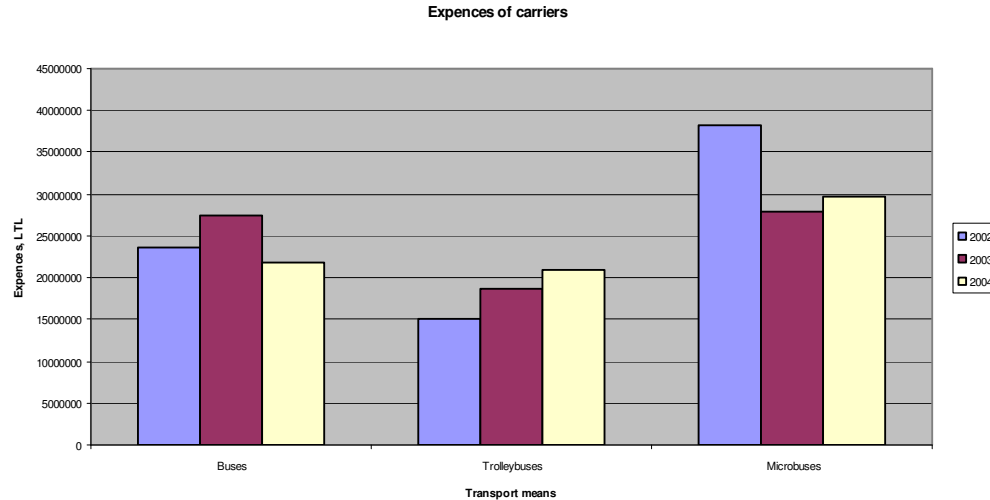
Figure 2.9.14-3 Income of Kaunas public transport carriers in 2002-2004


The analysis of financial indicators for Kaunas public transport carriers showed that in 2002-2004 minibus taxi enterprises got the biggest income, trolleybuses the smallest (see Figure 2.9.14-3).

From 2002 to 2004, the income of minibus taxi enterprises was constantly growing and in 3 years increased by almost 19%. In 2003 there was a small decrease of income for

bus and trolleybus enterprises, but it is possible to state that the overall income of buses increased by 1.6%, and of trolleybuses by 5%.

Figure 2.9.14-4 Costs of Kaunas public transport carriers in 2002-2004

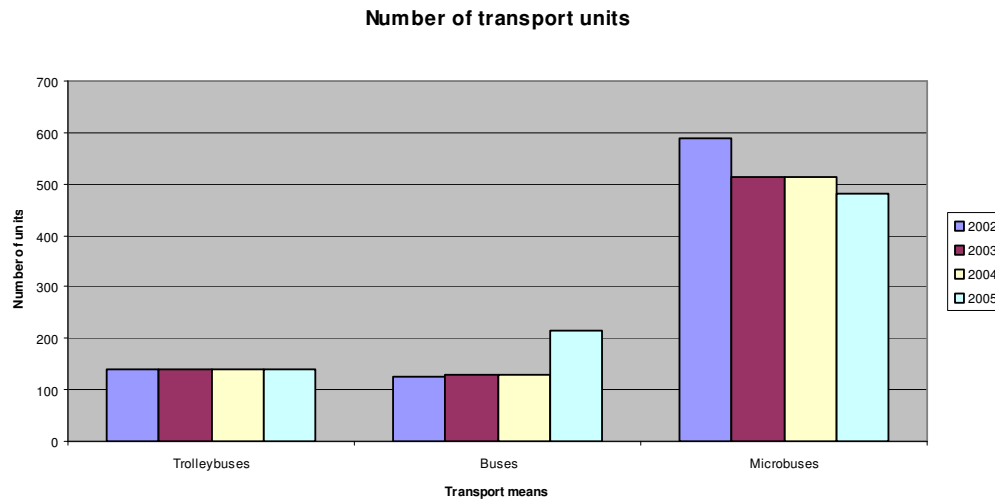


In 2002-2004, minibus companies experienced the biggest costs. During the three analysed years, the costs of trolleybuses increased by almost 39%. In 2003, the increase in costs of buses was noticed, however, it is possible to state that from 2002 to 2004, the costs of buses decreased by almost 8%. During this time, the costs of minibuses decreased by about 22%.

With regard to actual profits and losses, companies agreed to discuss the figures although we do not have the actual figures available for inclusion in this report. All Kaunas public transport carriers worked with negative profit until 2003. However, from 2003 minibuses started to improve the operating performance and from 2003 to 2004 showed an increase in profits of more than 41%. One of the reasons for this can be attributed to the negotiation of a new contract with the municipality. By the contract, minibuses were obliged to renew their fleet; with all vehicles being no more than ten years old, which meant that a lot of companies needed to buy new vehicles.

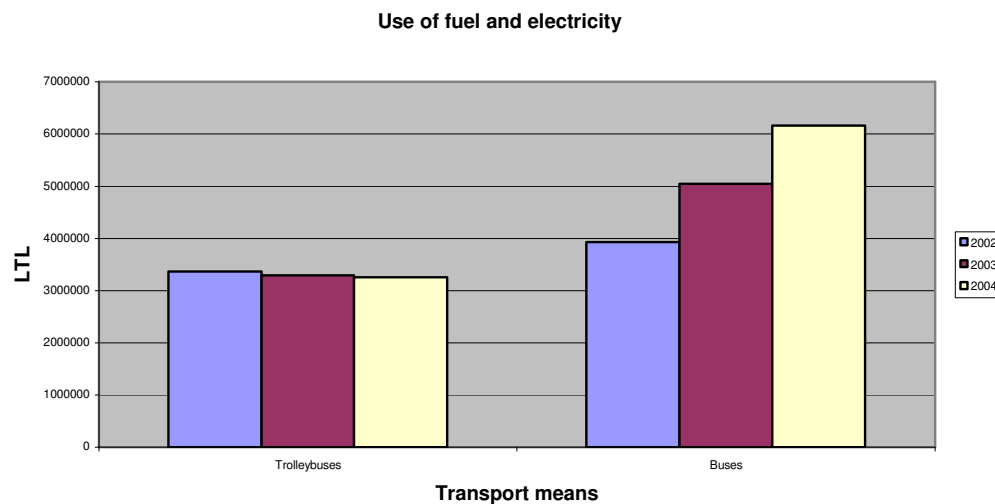
In order to do this through accessing bank loans, minibus companies needed to show their true revenues in order to get the necessary amount of loan from the bank for purchasing new vehicles. Beforehand, it was difficult to keep a record of income of such small businesses or to know what their revenues were.

From 2002 to 2004, the losses of trolleybuses increased by almost 60%. But in the opposite direction, the losses incurred by the Autobus Company reduced by 60% between 2003 and 2004. The reason for this may be attributed to the fact that in this period the method of calculating the split between the two companies was amended for the income from selling common single tickets. The losses incurred by the trolley bus company were one of the reasons for the service tariff not being increased for 5 years.

Figure 2.9.14-5 Number of transport units used in routes in 2002-2005


Analysis of the transport units used in routes showed that minibuses made the biggest number (Figure 3.2.44.5). From 2002 to 2005 number of trolleybuses did not change, number of buses increased by more than 72%, and number of minibuses reduced by more than 18%.

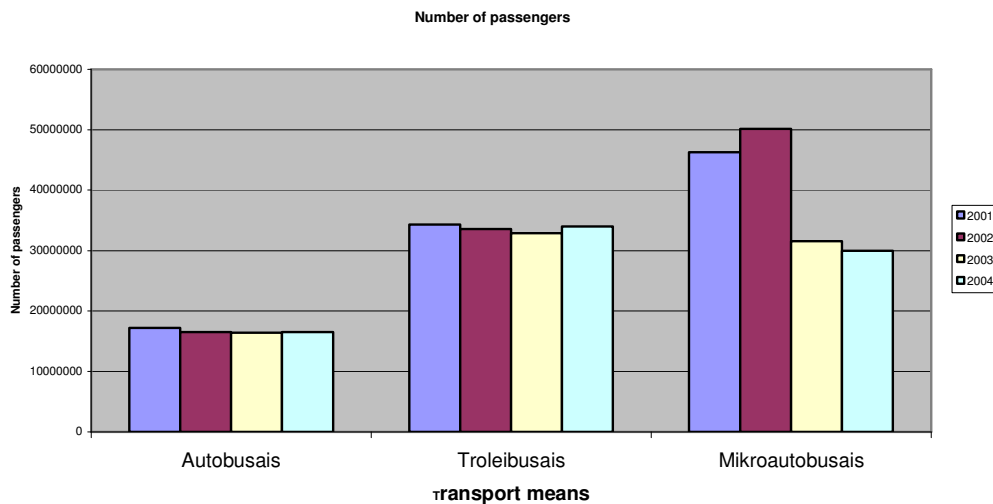
The amount of fuel (buses) and electricity (trolleybuses) used depends on the length of routes and number of units in use. From 2002 to 2004, the amount of electricity used by trolleybuses decreased by about 4% (Figure 2.9.14-6); the amount of fuel used by buses increased by almost 57%. In 2002, the annual distance travelled was 5.6 million km, and in 2005 it is expected to be 11 million km.

Figure 2.9.14-6 Use of fuel and electricity in Kaunas public transport in 2002-2004


Until 2004, minibus taxis transported the largest number of passengers but in 2004 it was noted that more passengers had chosen to travel by trolleybus (Figure 2.9.14-7). One of the reasons for that was the increase of payment for a minibus taxi trip by 50%.

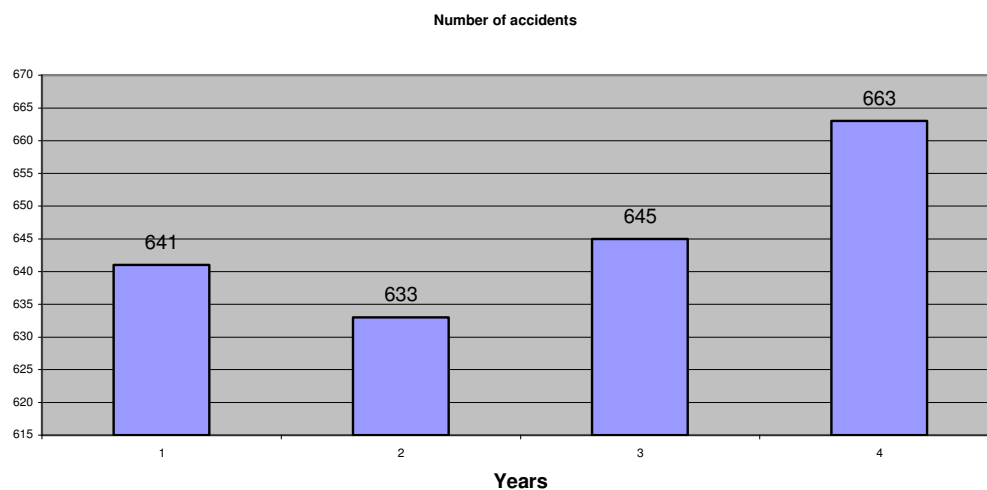
From 2001 to 2004, the number of passengers going by bus decreased by 4%, by trolleybus by 1%, and by minibuses by 35%.

Figure 2.9.14-7 Number of passengers using public transport in Kaunas in 2001-2004



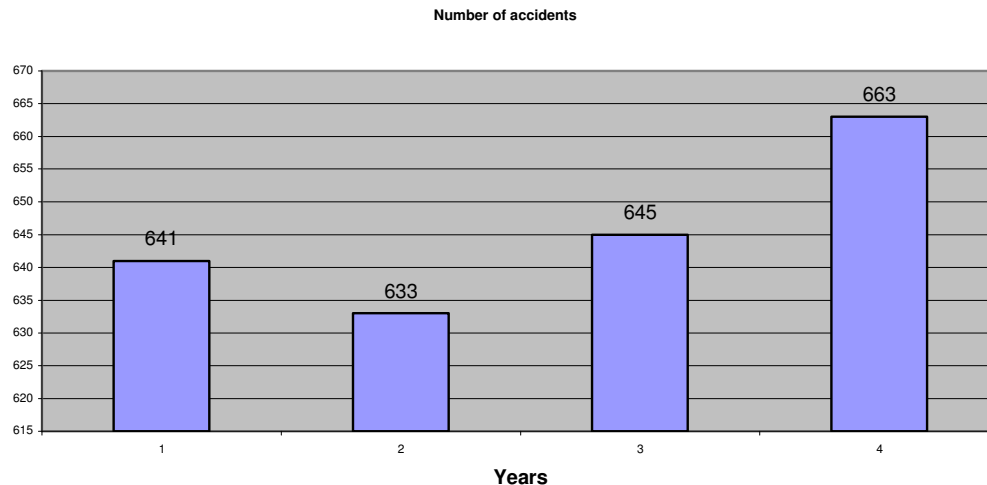
Changing human behaviour needs a lot of effort and time. In Kaunas, activities related to modernisation of the transport system and popularisation of public transport started comparatively recently, so the number of private cars was increasing. From 2000 to 2004, the number of private cars per 1,000 Kaunas inhabitants was constantly increasing by almost 26%. However, it needs to be borne in mind that there were other economic and social changes going on during this period, namely becoming a member state of the EU which for some, brought new opportunities to leave and earn money in other EU countries. This 'new wealth' would have found its way to helping the increase in the number of new cars on the roads.

Figure 2.9.14-8 Number of private cars per 1000 Kaunas inhabitants in 2000-2004(x axis: 1 – year 2000, 2 – year 2001, 3 – year 2002, 4 – year 2003, 5 – year 2004)



The number of accidents in the city increased because of the increased intensity of traffic flows. Despite a small decrease of accidents in 2002, the number of accidents increased by 3%. The economic growth was substantial during these years and the number of private cars also increased. The vicious circle between economic growth and transport growth has been identified as one of the key obstacles for sustainable urban development in Europe. (6th Environmental Action Programme of the EU, White Paper on Transport, Commission Communication –“Towards a Thematic Strategy on the Urban Environment”).

Figure 2.9.14-9 Number of accidents in Kaunas in 2001-2004 (x axis: 1 – year 2001, 2 – year 2002, 3 – year 2003, 4 – year 2004)



Conclusions

Public transport routes have been managed in such a way that they more closely reflect passenger usage. There is also now a clear line of feedback from the passenger to the transport division at the City municipality and this aids the constant monitoring and evaluation of the PIKAS management system. Passengers would like to see more of the newer buses on popular routes – something that is planned with the purchase of further SOLARIS buses in 2006.

Car usage – no real impact can be made here: for a number of external economical reasons, people now have more disposable income and are attracted by the idea of owning their own mode of transport. It is nevertheless important to persevere and continue to improve efforts to make public transport the most attractive form of city transport.

2.9.15 Kaunas – Access and Security Improvements (8.8)

Measure Overview

The aim of the activities implemented in this part of the project was to assure convenient accessibility to the information about services provided by public transport. During the project, the infrastructure of stops was renewed, vehicles adapted to the

needs of disabled people and special information on public transport was also presented for disabled people.

Evaluation Results

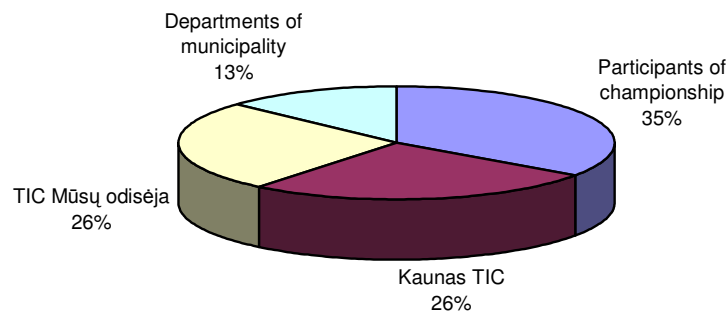
Evaluation of the results of this activity was performed analysing the following indicators:

- Number of new/renovated public transport stops
- Number and distribution of public transport maps where main sightseeing places were indicated
- Number of cylinder-type timetable devices at public transport stops
- Number of public transport maps at public transport stops
- Number of articles on public transport in the local press
- Number of visitors to the Internet pages on public transport
- Number of people getting SMS messages on public transport information

During implementation of the project, 367 new bus stops were arranged for passengers of public transport. In 2003, 800 cylinder-type devices for public transport timetables were made and fitted, however, only 500 of them remained in working order. In 2004, those damaged were renovated or repaired and replaced where spares were available – those beyond repair. The number of holders was also increased meaning that there are now around 1,300 cylinder-type devices for timetables of public transport.

All new stops have information stands with Kaunas public transport maps. In July 2005, nearly five thousand maps were designed and printed of the Kaunas Public Transport routes with the main tourism sites indicated. Thirty-five percent of these maps were distributed to the participants of the European Youth Athletics Championship (a prestigious event given to Kaunas in 2005), 52% to Kaunas tourism information centres, and 13% were distributed to the municipality administration departments, which have international relations (see Figure 2.9.15-1).

Figure 2.9.15-1 Distribution of Kaunas public transport schemes with indication of the main sightseeing places



During the implementation of the VIVALDI project, the public were informed about project activities, new public transport services, and there were discussions about urgent problems of the public transport and possible solutions (articles for all of these initiatives appeared in the Kauno Diena newspaper, and other local and national papers, as well as on the Municipality's website).

Internet pages (www.kaunas.lt/transportas) on Kaunas public transport were also created during the implementation of the project. All information related to public transport was presented – from routes, timetables, and ticket prices to regulations. Kaunas is the first city in Lithuania to present timetables of minibuses together with timetables of buses and trolleybuses on the public transport Internet pages. Here it is also possible to find instructions on how to get information on public transport departure from any stop by SMS.

Internet pages on Kaunas public transport were opened in May 2005. About 125,000 visitors visited the site in the last 5 months. It became possible to get information on public transport by SMS message also from spring 2005, however for the meantime there are no data on the number of people using this service.

Society – Awareness & Acceptance (13 & 14)

A full research document on the Public Transport market research conducted in Kaunas can be found at the following website (www.kaunas.lt/transportas). The survey concentrated on the public transport measures introduced in Kaunas and the public perception of the results.

Figure 2.9.15-2 shows that 83% thought transport stops were comfortable and the older the respondent, the more satisfied he/she is with the convenience of them (see Figure 2.9.15-3). This tendency can best be explained through historical, cultural and generational differences: older generations have witnessed the change of the quality of the transport stops. Remembering the “soviet-type” stops, they tend to positively value current changes. The younger generations did not witness (or witnessed to a lesser degree) the earlier conditions of transport stops, and thus are now free to be critical about them; besides, the younger generations are more internationally mobile and use their international experience as ground for more strict evaluations.

Figure 2.9.15-2 Convenience of public transport stops / shelters

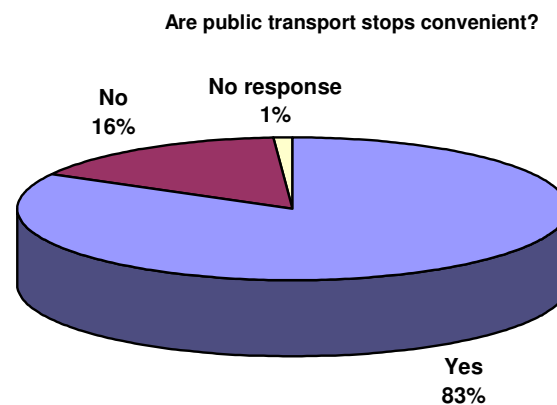
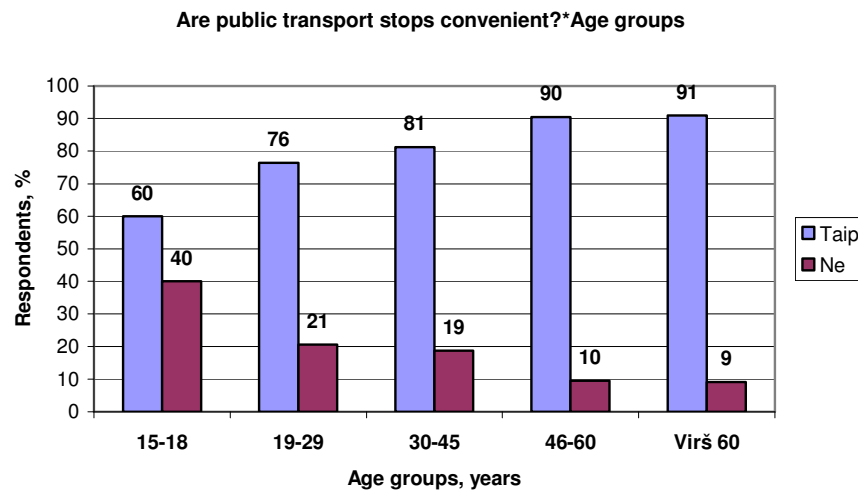


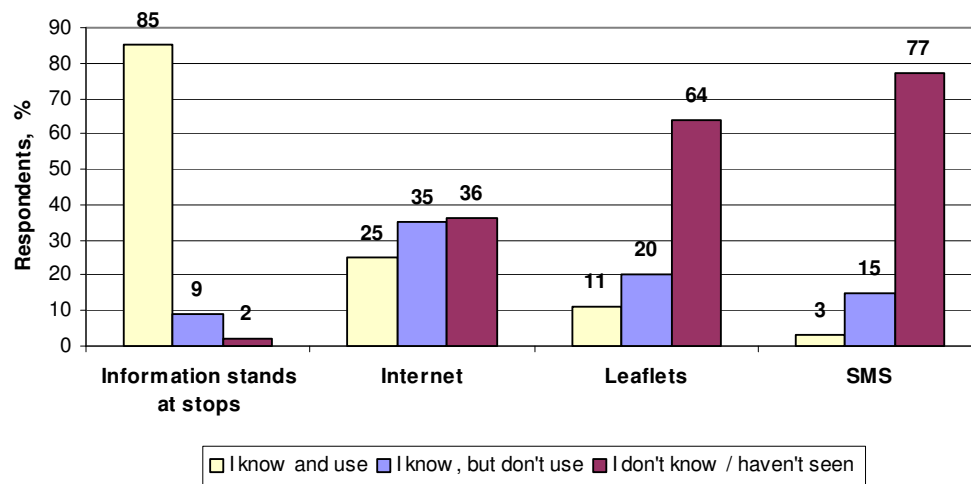
Figure 2.9.15-3. Convenience of public transport stops / shelters according to age groups



On the question of public transport – quality and availability – we have the following results presented in Figure 2.9.15-4. Information sources are presented according to the numbers of respondents knowing and using them.

Figure 2.9.15-4 Public transport routes and schedules and use of the information

Do you know that information about public transport routes and schedules is available...



Sources of information

Information stands at stops. As seen in Figure 2.9.15-4, 94% of respondents knew about information stands at the stops, and 85% of respondents used it. This is obviously the most available source of information for all public transport users, however there are still 9% who know of it but did not use it. This indicates that the information could be made more attractive, or simply there could be some people who are ignorant to any kind of information.

Internet. 60% of respondents knew that information about public transport routes and schedules were available on the Internet; however, only 25% used this information source. The higher percentage of those who know about, but don't use information on Internet could be explained either by limited access to Internet of certain groups of people (e.g. pensioners), or lack of knowledge in exactly which Internet pages people could find this information.

Leaflets. The remarkable difference between those who use (11%) and those who know about but don't use (20%) leaflets as a source of information indicates the low availability of this mean of information to the public. Leaflets are a source of information which could be specifically targeted at those social groups that do not have access to the Internet or do not have mobile phones (e.g. pensioners, low income), therefore the recommendation is to decide in which way it is best to disseminate leaflets (e.g. a schedule of public transport issued at selling places together with monthly ticket – this could also encourage people to buy monthly tickets).

SMS. The majority of people (77%) do not know about the possibility to receive schedules by SMS. This indicates that among all means of information, this is the most unusual one, and it is not "used" in the daily routine of public transport passengers. The dissemination of this information could be organized in cooperation with mobile phone provides for example through their Internet pages or newsletters.

Table 2.9.15-1 Knowledge and Use of PT information according to the age group

Age groups	Knows and uses indicated means of information about public transport routes and schedules			
	Information stands	Leaflets	Internet	SMS message
15-18	60*	0	20	0
19-29	91	9	47	3
30-45	81	25	19	13
46-60	86	5	14	0
Over 60	82	9	5	0

* % of respondents in the age group, who marked that know and use indicated means of information

There are noticeable differences in the pattern of use of various means of information by various age groups. Information stands are most commonly used by student age people (19-29), this group are also the most active users of Internet information (47%). This age group could be the most in need of information about public transportation, because students are dependent of lecture time schedules. Plus, this age group usually have access to IT, therefore free information on the Internet, is very convenient.

The age group of 30-45 is distinguishable for the high percentage of SMS usage, compared to other age groups. People of this age are usually workers that both can afford paying for SMS message and need exact information because of the lack of time. However the purpose would be to disseminate information about Internet information in this group, as the percentage of use of this information is rather low (19%). The age

group of 46-60 mainly use information stands in stops, and the usage of leaflets is rather low; therefore the means discussed above about the dissemination of leaflets could be targeted at this group. The same recommendation to improve leaflets information is applicable to the age group over 60. Moreover, the usage of information stands in this age group should also be improved.

Table 2.9.15-2 PT Routes and Schedules – according to Respondents Education

Education of Respondent	Knows and uses indicated means of information about public transport routes and schedules			
	Information stands	Leaflets	Internet	SMS message
Higher	93*	7	30	3
Unfinished higher	89	11	47	5
Special secondary	88	8	12	0
Secondary	90	30	20	0
Basic	33	11	11	11
Primary	50	0	0	0

% respondents in the age group, who marked that they know and use indicated mean of information

Figure 2.9.15-4 indicates that information stands as sources of information are widely used by all groups of education, except basic and primary. These two groups more often indicated that they know but do not use this source. Possibly they are not in need of exact schedules, because the majority of these two groups are people of ages over 60. There were no clear tendencies in the usage of other means of information (leaflets, Internet and SMS), except that people with unfinished higher education frequently use Internet, which corresponds to the age groups of students, as discussed above.

Respondents were given the open question: “How, in your opinion, is it possible to more effectively present for inhabitants information on routes and schedules? With most of the respondents giving a mention to the following:

- Information about immediate changes to be issued in the press
- Trolleybus schedules to be posted on the trolleybuses
- Better protection for schedules at bus stops
- A special publication with layout of public transport routes, schedules, and network of stops to be produced and available through as many local outlets as possible.

Kaunas City Administration is continuously improving the access to information, and as has previously been mentioned, are planning a major promotional campaign in the new year to target specific target groups of users – based on much of the research we have produced – which will lead towards increased campaigning and identification of most relevant means of information to different target groups. In summary, it could be stated that Kaunas inhabitants thought that layout of public transport routes, schedules and stops were convenient.

2.9.16 Kaunas – Integrated ticket system of public transport (7.2)

Measure Overview

This measure generated a public transport ticketing strategy in Kaunas that covered a number of concerns and problems including, production, vending, distribution, marketing, price level, discounts and other financial and technical issues. The measure also aimed to include development of an e-ticketing system that would allow transport companies to deliver a more economical system as well as plan and organize their activities more effectively. The main measures undertaken to implement new public transport pricing included the following:

- Development of a common ticket format
- Introduction of fixed term tickets
- Implementation of flexible tariff structure
- Revision of ticket distribution and sale procedures

The aim is to produce a viable system for putting in place a unification of the single and monthly bus and trolley journey tickets, ticket validating machines, and ticket vending machines. Ideally, the price of each ticket should be in relation to the distance travelled or the duration of the journey. The idea of “zoning” the city into a network of three distinct zones was explored; each ticket sold is for a single journey of a minimum of one zone and a maximum of three zones with the price dependent upon the number of zones travelled.

The objective of this measure was to develop a strategy for production, selling, and distribution of tickets, as well as the formation of tariff structure, discount scheme and other financial mechanisms.

Evaluation Results

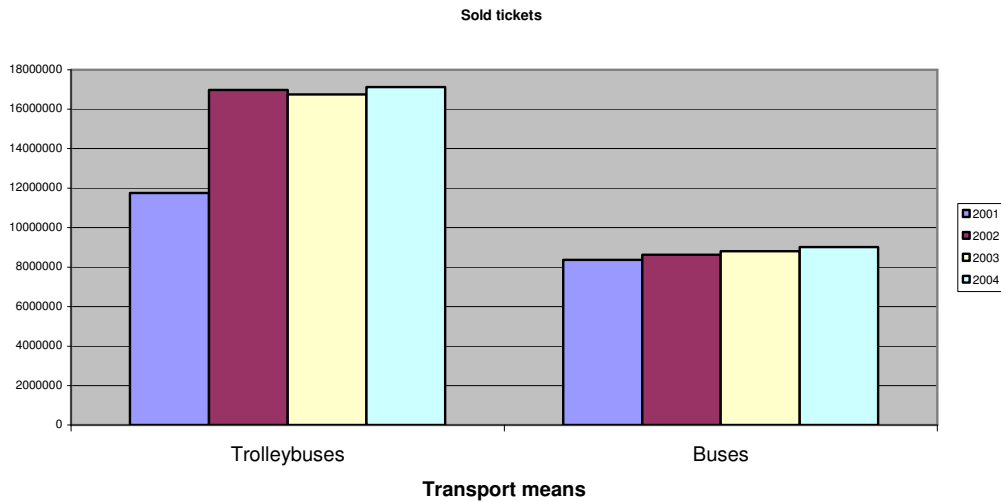
The following indicators were used to evaluate this activity: number of new ticket punchers installed and number of tickets sold.

In order to create an effective public transport ticket system, several studies were prepared during the implementation of the project. In 2003 researchers from Vilnius Gediminas Technical University prepared the research work “Analysis of Kaunas public transport ticket system, reasoning for its improvement, and improvement of public transport management”, and a vision of Kaunas public transport monitoring and ticket system was prepared in 2004. Implementation of some of the measures foreseen in these documents has already started.

During implementation of the project, 309 new ticket punchers were installed in Kaunas buses and 460 in trolleybuses.

The number of public transport tickets sold in Kaunas in 2001-2004 is presented in Figure 2.9.16-1. During this time the biggest number of tickets were used in trolleybuses. From 2001 to 2004, the number of tickets used in trolleybuses increased by 45%. A small increase in number was also noticed in buses, almost 8%.

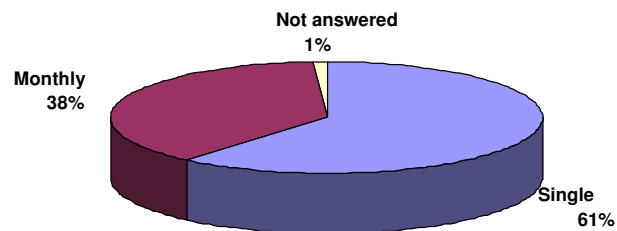
Figure 2.9.16-1 Number of public transport tickets sold in Kaunas in 2001-2004



The following chart shows a split of ticket usage based on a public survey we carried out in September 2005. The majority of users are still predominantly single journey ticket passengers.

Figure 2.9.16-2 Tickets Types bought

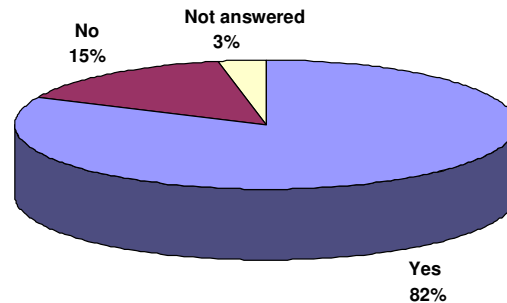
What type of tickets do you buy most often ?



The new ticket punchers are a success as people like the convenience. Where people felt they were not convenient, reasons given were that the punchers were fixed too high or they would not mark crumpled or wet tickets.

Figure 2.9.16-3 Convenience of Ticket puncher machines

Are ticket punchers of the new type (electronic) convenient?

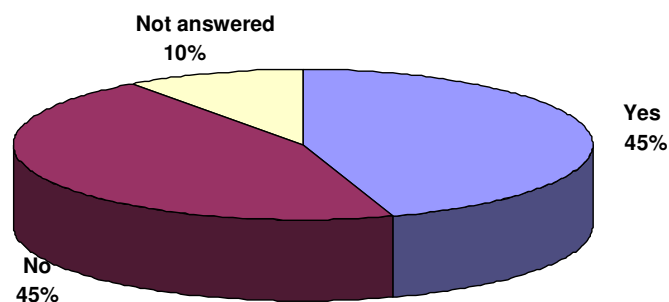


As part of the efforts to change the ticketing system to one system geared towards e-ticketing, a number of people were asked about their perception of changing the style of ticketing. It can be seen that the most favourable evaluation to the convenience of electronic cards came from respondents of the age group 19 to 29 years.

This is very useful because it is aimed to initiate a marketing campaign targeting students and young professionals to ascertain their opinions on more specific aspects of the e-ticketing system. If those of an already positive opinion can welcome the planned changes and be encouraged to promote the benefits to others, the launch of e-ticketing in Kaunas will be a success.

Figure 2.9.16-4 Paper Tickets v Electronic Cards

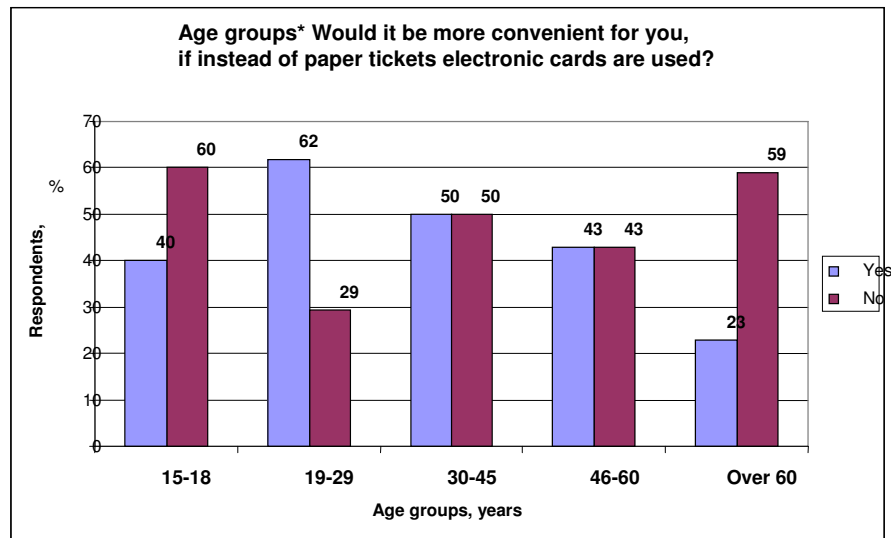
Would it be more convenient for you, if instead of paper tickets electronic cards are used?



When commenting their negative answers respondents gave the following opinions:

- Consumers were used to paper tickets
- Innovations were scary and it might be difficult till they got used to it
- Monthly tickets were the most convenient.

Figure 2.9.16-5 Ticket preference by age



The potential for ‘scaling up’ this measure is fairly substantial and highly realistic and it will be done through the development and implementation of an e-ticketing system. Based on international experience and feedback through VIVALDI (and associated activities with other programmes), we believe that the development of electronic tickets is imperative in order to allow the Kaunas transport companies to organize their activities more effectively and save money while diminishing the expenditure related to ticket production, realization and analysis.

E-ticketing must not add to any inconvenience that passengers currently experience; on the contrary, e-tickets should offer a convenient and comfortable method of payment which in turn should increase the prestige of the usage of public transport and attracts more passengers.

The way in which such a system is planned to operate is as follows (although by no means the finished result):

- A terminal is a cash register, which also collects information received from electronic equipment of ticket validation established in a convenient place for the passenger in the vehicle. This information is then transferred to the payment centre where it is collected and analysed.
- Software at the payment centre creates the possibility to separate and sort the information received from different transportation means. It is possible to implement a common system of electronic tickets that serves all public transport companies in the city and even the country, i.e. having a card a passenger may choose any bus, trolleybus or train that has the validation equipment in which the payment for the trip is carried out automatically.
- Thus, for the passenger, a more convenient overall system of payment for travelling is created. It is also very important that it does not limit the freedom of pricing of the separate transport companies.

Also completed was a study of the feasibility and practicalities of implementing an e-ticketing system. This will feed into a planned marketing campaign to address the

potential issues relating to customers having to get used to a 'credit-card' style travel ticket – when in fact many people of a lower social standing do not currently have a debit or credit card. As well as this generic marketing campaign, there is a more focused one planned to concentrate on increasing the attractiveness of public transport for the city's 40,000 students

2.9.17 Kaunas – Integration of taxis and minibuses into the public transport system (8)

Measure Overview

The aim of the taxi/micro-bus integration in Kaunas was to increase public transport reliability, accessibility and attractiveness. It also seeks to address the wider issue related to the disorganised development of city transport.

Much of the work related to this measure was political, and concentrated on activities based around negotiation and changing administrative processes. The main measures undertaken to integrate taxi/micro-bus include the following:

- Preparation of terms of reference on the basis of optimised and co-ordinated traffic schedule and passenger flows
- Gradual integration procedures of taxi/micro-buses into general public transport system
- Installation of information facilities in the city stops providing schedules and route plans

The integration of taxi/micro-bus services into the general regulation and control system of the city public transport system aimed to increase the sustainable mobility of public transport. It would also increase the integration of transport management systems, including related information systems and passenger services. This would also ensure that the Municipality increases the responsibility of private companies to promote sustainability, cost-effectiveness and to generally participate in a positive improvement of public transport's image.

Evaluation Results

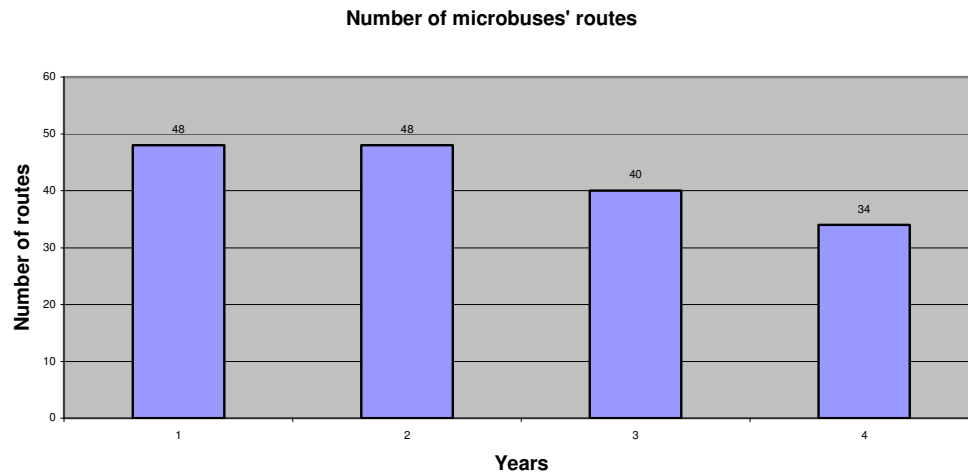
The following indicators were used to evaluate the results of this activity:

- Number of minibuses
- Length of minibus routes
- Number of minibuses on routes
- Number of passengers transported by minibuses

Due to the fact that transport is one of the main sources of air pollution and noise in Kaunas, it is necessary to regulate its flow paying special attention to the city centre and residential areas. The Kaunas public transport system is made in such a way that trolleybuses serve the central part of the city, buses go to the residential and industrial areas, and minibus taxis reach the suburbs. In order to create sustainable, effective and environmentally friendly public transport system it is necessary to coordinate work (routes, schedules, etc.) of all three kinds of Kaunas public transport.

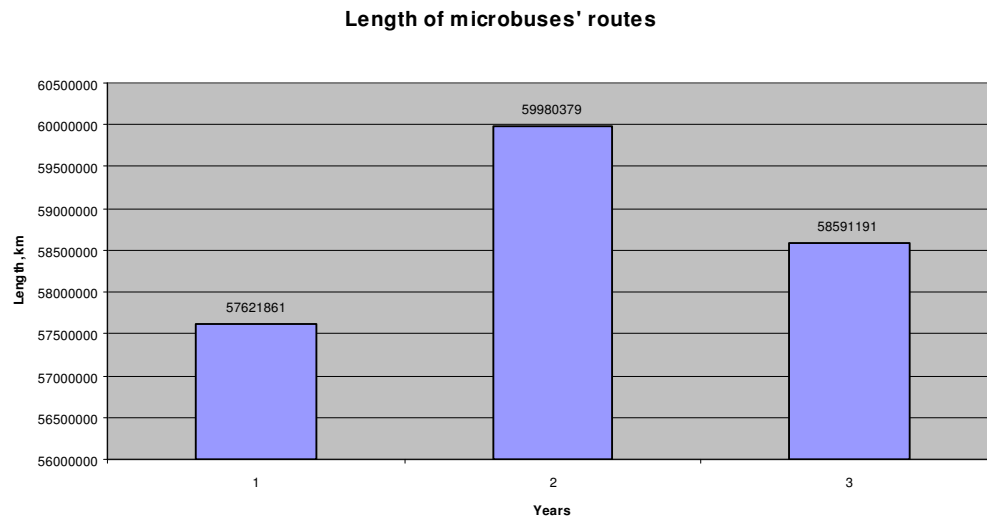
The PIKAS software was used to calculate new optimised and co-ordinated traffic timetables that included private carriers into the public transport system. Routes of minibuses, their length as well as number of vehicles used were optimised. From 2002 to 2005, the number of minibus routes in Kaunas decreased by almost 30% (See Figure 2.9.17-1).

Figure 2.9.17-1 Number of minibus routes in Kaunas in 2002-2005 (x axis: 1 – year 2002, 2 – year 2003, 3 – year 2004, 4 – year 2005)



In 2003, the length of minibus routes increased slightly, but in 2004 a decrease of the length of routes of this kind of public transport was noticed. From 2002 to 2004 length of minibus routes increased by almost 2% (see Figure 2.9.17-2).

Figure 2.9.17-2 Length of minibus routes in Kaunas in 2002-2004 (x axis: 1 – year 2002, 2 – year 2003, 3 – year 2004)



From 2002 to 2005, the number of minibuses decreased by more than 18%.

Figure 2.9.17-3 Number of minibus used on routes in Kaunas in 2002-2005(x axis: 1 – year 2002, 2 – year 2003, 3 – year 2004, 4 – year 2005)

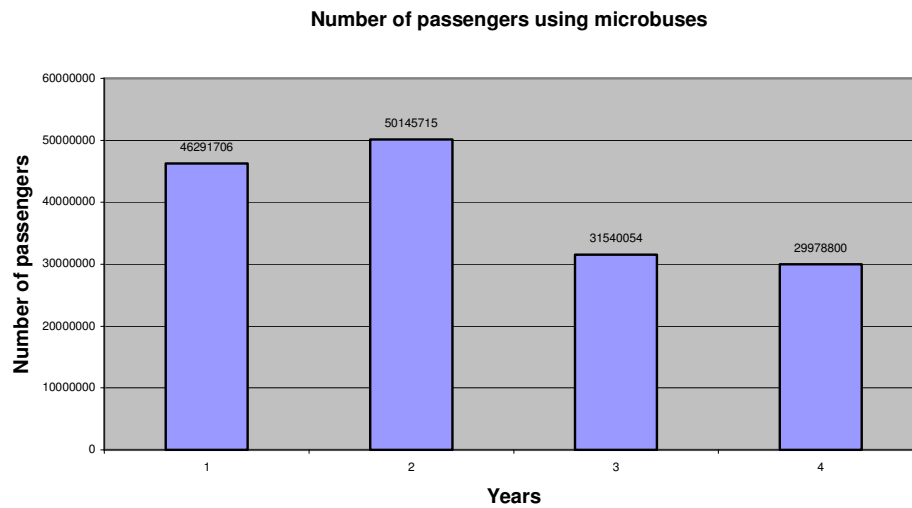
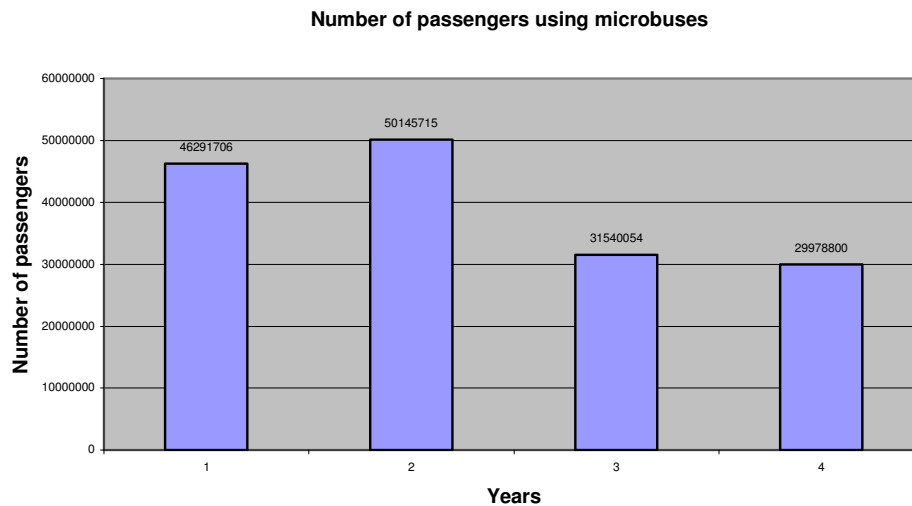


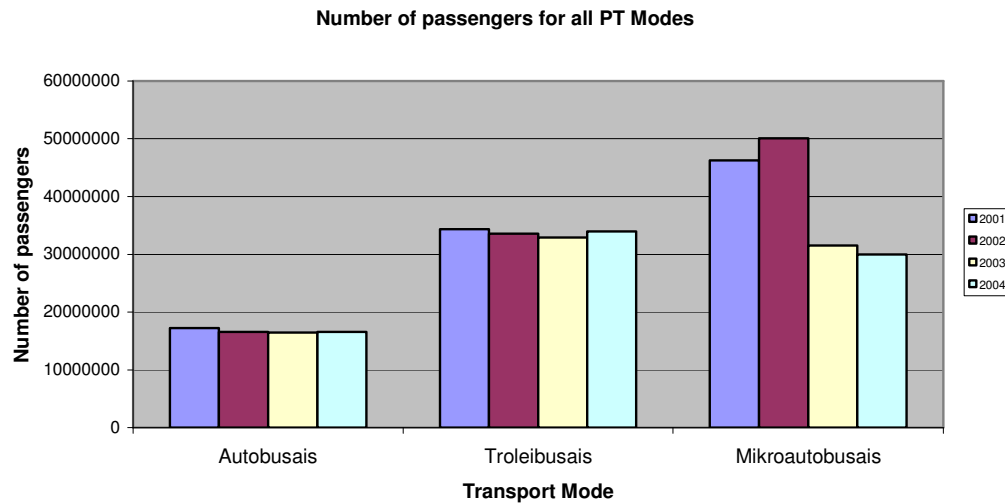
Figure 2.9.17-4 Number of passengers transported by minibuses in Kaunas in 2001-2004 (x axis: 1 – year 2001, 2 – year 2002, 3 – year 2003, 4 – year 2004)



Analysis of the number of passengers transported by minibuses showed a slight increase of the number of passengers transported by minibuses in 2002, but from 2001 to 2004 the number of passengers transported by minibuses in Kaunas decreased by almost 35% (see Figure 2.9.17-4).

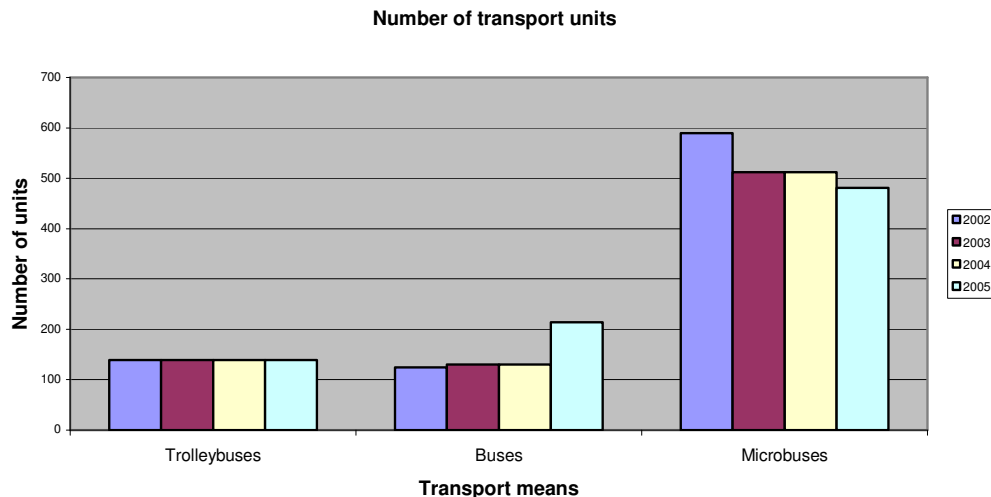
As better management of the routes came into practice and as more minibus companies were forced to upgrade their fleet, the actual number of minibus routes in Kaunas also decreased by almost 30% (see Figure 2.9.17-5).

Figure 2.9.17-5 Number of passengers using public transport in Kaunas in 2001-2004



Clearly the reduction of the routes for minibuses (as well as the reduction in actual numbers of minibuses – Figure 2.9.17-5)) may well coincide with the delivery of the new SOLARIS autobuses and the additional services that have been added for these. Figure 2.9.17-6 shows the numbers of all public transport vehicles, indicating that there has been a relatively high jump in the number of buses (72% increase) against a relatively steep drop in the number of minibuses.

Figure 2.9.17-6 Number of transport units used in routes in 2002-2005



The amount of fuel (buses) and electricity (trolleybuses) used depends on the length of routes and number of public transport units in use. From 2002 to 2004, the amount of electricity used by trolleybuses slightly decreased by about 4%. The amount of fuel used by buses increased by almost 57%. This was in keeping with the increase in vehicles and routes for the PT companies (in 2002 annual mileage was 5.6 million km and in 2005 it is expected to be 11 million km).

The analysis of air quality monitoring data in recent years showed the increase of air pollution caused by transport in some parts of Kaunas city. However, due to the technical, economical and planning measures introduced, concentrations of some air pollutants have been considerably reduced (e.g. concentrations of nitrogen oxide in the city centre were reduced almost by 50% in 2001-2002).

Public survey results on the integration of minibuses produced the following results.

- Over 50% thought that numbers of minibuses in Kaunas are optimal with only 12% believing that numbers should be increased. However it must also be noted that 18% of respondents had no opinion or did not answer the question, and that the term “optimal” is very subjective and indicates more the general satisfaction with numbers of minibuses in Kaunas.
- A majority of respondents (57%) thought that, when trying to unify minibus and trolleybus/bus tickets, a compromise has to be found. 10% of respondents thought that price has to remain the same, 27% of respondents thought that price has to be reduced to be in line with the prices of other transport.
- Recommendation: to work on the project with respect to participatory governance principles; to have a public debate with various stakeholders and a comprehensive opinion survey before deciding on the ticket prices.

2.9.18 Nantes – Collective passenger transport stimulation

2.9.18.1 Clean and efficient buses/Fuel supply infrastructures (5.1/5.3)

Overview

Two major factors influenced the willingness of the urban area to implement a policy regarding the promotion of a non-polluting fleet:

- 1) The implementation of the first tramline in 1985
- 2) The experimentation of CNG buses within JUPITER-2 project.

Moreover, opinion polls conducted regarding the perception of public transport indicated that it was necessary to enhance the overall image of bus travel, which was low in comparison to that of the modern tram.

After experimentation within JUPITER-2 of new CNG buses (1 in 1997, 2 more in 1998, 7 more in 1999), 20 more standard buses were purchased in 2000. Three bus routes were entirely equipped with CNG buses in 2001.

Table 2.9.18-1 Local Objectives vs. VIVALDI Objectives

Local Objectives	VIVALDI Objectives
LO 1.1: Provide public transport service with non-polluting vehicles for 70% of total mileage and 90% of total trips by the end of 2005. To reduce pollution emissions of bus fleet by 40% (CO, HC, NO _x)	VT2: Reduce energy use and CO ₂ by 8% in demonstration area VT3: Meet national air quality objectives
LO 1.2: Renew the bus fleet buying 155 new CNG buses (125 standard, 30 articulated)	VT1: 250 Clean Vehicles across the sites
LO 1.3: Renew the bus fleet, in order to achieve an average bus fleet age of 5 years, at the end of VIVALDI	

This large-scale measure covers the overall urban area and in particular the city centre. It should be noted that the new bus fleet would be implemented mainly in the south east of the urban area, due to the many different measures planned in this area.

The southeast area is in fact targeted as a priority sector in terms of traffic improvements and different integrated measures will be implemented, including: the creation of two new train stations, promotion of integrated fares enabling urban fare holders to use regional trains within the urban area, a trial of a hybrid bus-tram system and the implementation of new clean vehicles.

This political choice also matches operational constraints: the large renewal of the fleet creates the need for a new refuelling station. The first compressed gas station, installed during JUPITER-2, is located in the northwest of the urban area. There is the need for a second station in the southeast of the urban area to match the operational needs of the CNG bus fleet.

The improvement of the bus fleet would not only answer public needs in terms of silence, comfort, vibration and pollution but also in terms of customer's perceived

“image”. Measures are being taken to make improvements to the inside of the buses so that the gap between the image of trams and buses is reduced.

The new interior design of the CNG buses was finalised in 2001 by designer Avant-Première. A prototype was exhibited during the GART congress in November 2001, in order that customers could give their opinions on the new design.

All the new buses consist of:

- Low floor access
- Easy access due to the ramp and the kneeling system of the bus
- Provision of two wheel chair spaces
- Electronic information display both outside and inside



Figure 2.9.18-1 New CNG buses interior fittings



Figure 2.9.18-2 Ramp and kneeling system

After a European call for tenders, two types of vehicles were selected:

HEULIEZ GX 317 CNG

Standard bus – 100 passengers

Renault engine - 185 kW

9 gas tanks – 350 km autonomy

Cost per unit - 237 k€



Figure 2.9.18-3 HEULIEZ GX 317 CNG bus

VOLVO 7000 CNG

Articulated bus – 150 passengers

Volvo engine - 215 kW

12 gas tanks – 350 km autonomy

Cost per unit - 369 k€



Figure 2.9.18-4VOLVO 7000 CNG bus

The scheduled delivery for the new buses was:

Bus type	Manufacturer	Quantity	Delivery date
GX 317	RVI	50	2002 / 07-08
GX 317	RVI	42	2002 / 11-12
GX 317	RVI	33	2003 / 05-07
GX 317	RVI	5	2004 / 05

V 7000	VOLVO	20	2003 / 04-05
V 7000	VOLVO	11	2003 / 11-12

Some deviation occurred from the initial schedule for the delivery and operating, due to several factors:

- Official probation by the Department of Industry,
- The requirement for of certain parts of the injection system to be adapted to European standards (R110),
- Problems linked to new engine.

CNG Standard buses (HEULIEZ GX 317):

Initially 50 buses were to be delivered between April and July 2002 and 42 more between December and October. The first buses were ready in April but not approved. They were finally delivered in August and put into operation in September 2002.

In December 2002, of the 67 CNG standard buses delivered to SEMITAN, 62 were commissioned and put in service (the commissioning was agreed from a technical point of view). However, 5 remained un- commissioned so SEMITAN could not deliver the remaining vehicles ordered and planned for service in 2002 (25 CNG buses).

The reliability rate of the new buses was unsatisfactory: around 30% of the buses were regularly out of order because of engine failures. Problems were linked to the new engine type, developed by Renault (injection system in conformity with Euro-3 standard). In parallel HEULIEZ was also working to solve problems linked to debugging the gas temperature probe and acceleration cut-off or engine juddering. Symptoms of these problems were permanent or intermittent judder, choking or sudden loss of power. The gas temperature probe (general motors), originally fitted on the prototype and used during the test period, was not functioning correctly on the vehicles in service. It was replaced in all vehicles by a BOSCH sensor, with exactly the same specification.

Official approval problems also occurred. Initially, HEULIEZ wished to obtain buses probation, following the R110 (new European norm for CNG buses). Facing administrative and technical difficulties due to the interpretation of the R110 by the French Department of Industry, HEULIEZ decided to abandon the R110 approval for the new GX 317 CNG buses and to use the previous standard. However, HEULIEZ was still obliged to validate components of the new gas and supply system linked to Euro-3 standard. Two of these components were not validated: the engine hose pipe and the relief valve. The manufacturer had to find two similar components that were validated. SEMITAN maintenance staff were not convinced that substitutes would be as reliable or have similar performance level to the originals.

To solve the technical problems IRISBUS (HEULIEZ shareholders) engineers and an Australian team who had developed the software that control the engine worked together. Further interactions with Grenoble city, who were encountering the same problems, resulted in a solution. SEMITAN was obliged to keep older GX 44 buses in order to be able to operate the network in September 2003. In March 2004, the SEMITAN maintenance committee stated that the solutions proposed by IRISBUS seemed to be suitable, in order to stabilize the situation in the standard buses.

Retrofitting of the buses took place during summer 2004. The commissioning of all the HEULIEZ GX 317 was completed after that.

CNG articulated buses (VOLVO 7000):

Although due to be delivered in February 2003, the first 30 Volvo 7000 CNG ordered by SEMITAN were stored in Poland, where they had been manufactured. The decision concerning the official registration by the French Department of Industry, necessary to import and to use these vehicles, was a very long process, whereas TÜV had done their approval in Germany a long time before.

The first VOLVO 7000 vehicles were put in operation in Nantes on July 2003. But some electronic problems appeared in 2004: unexpected and uncontrolled accelerations. The drivers and the health and safety committee took these problems very seriously. Internal and external audits had to be conducted during the next six months, as the unions threatened to immobilize the vehicles. A decision was made in May 2005 to authorize the fleet to carry on running if two modifications were made. The commissioning of all the VOLVO 7000s was completed after that.

The staff training and associated measure to run the bus fleet started from February 2002 and ended in December 2004. Depot managers organized training for drivers, maintenance employees and technical staff.

So, the integration of the new buses was progressed and the first year of full operation was 2004 for the all buses included in the VIVALDI project. The maps below show the evolution of the part of the urban public transport network operated with CNG buses. Three bus routes were operated with CNG buses in 2001 (11, 21 and 56), nine more in 2002 (31, 40, 54, 59, 73, 79, 81, 87, and 90) and fifteen more in 2004 (24, 25, 26, 27, 28, 29, 32, 36, 37, 38, 39, 51, 52, 58 and 80).

Figure 2.9.18-5 CNG buses routes, 2001

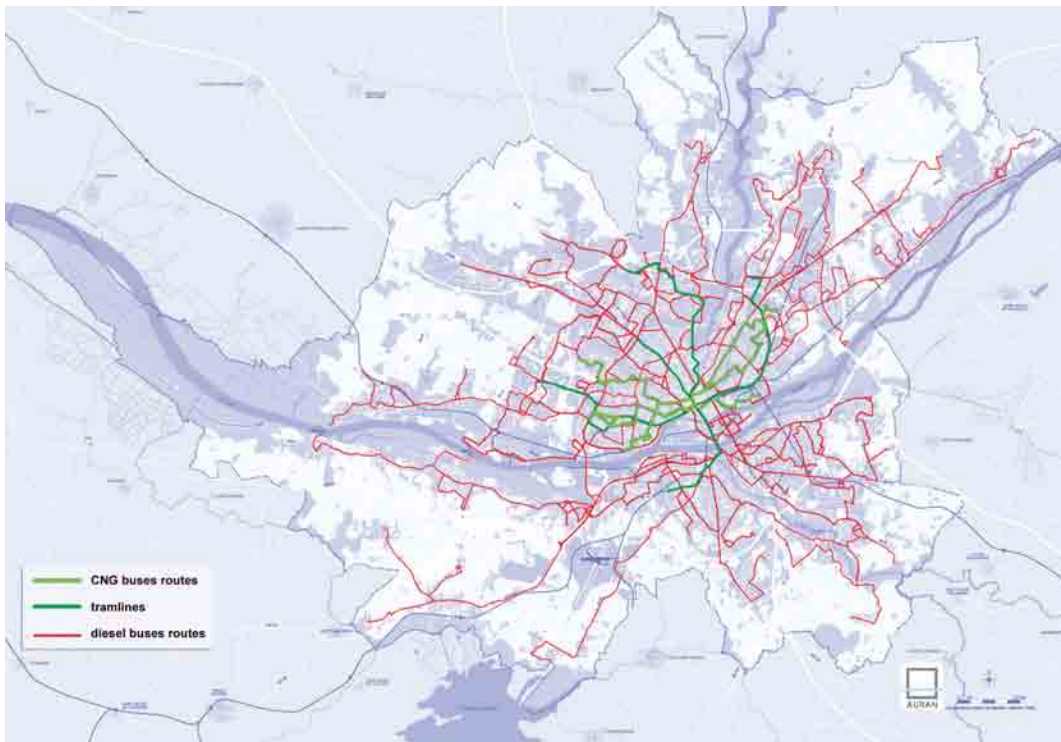


Figure 2.9.18-6 CNG buses routes, 2002

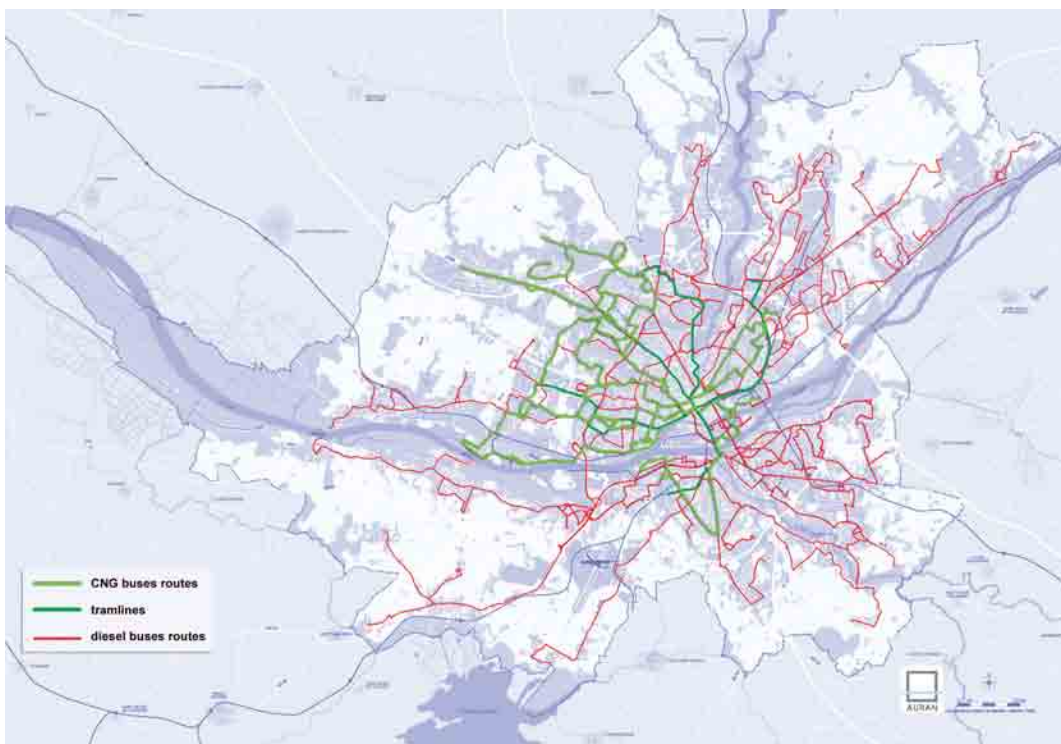
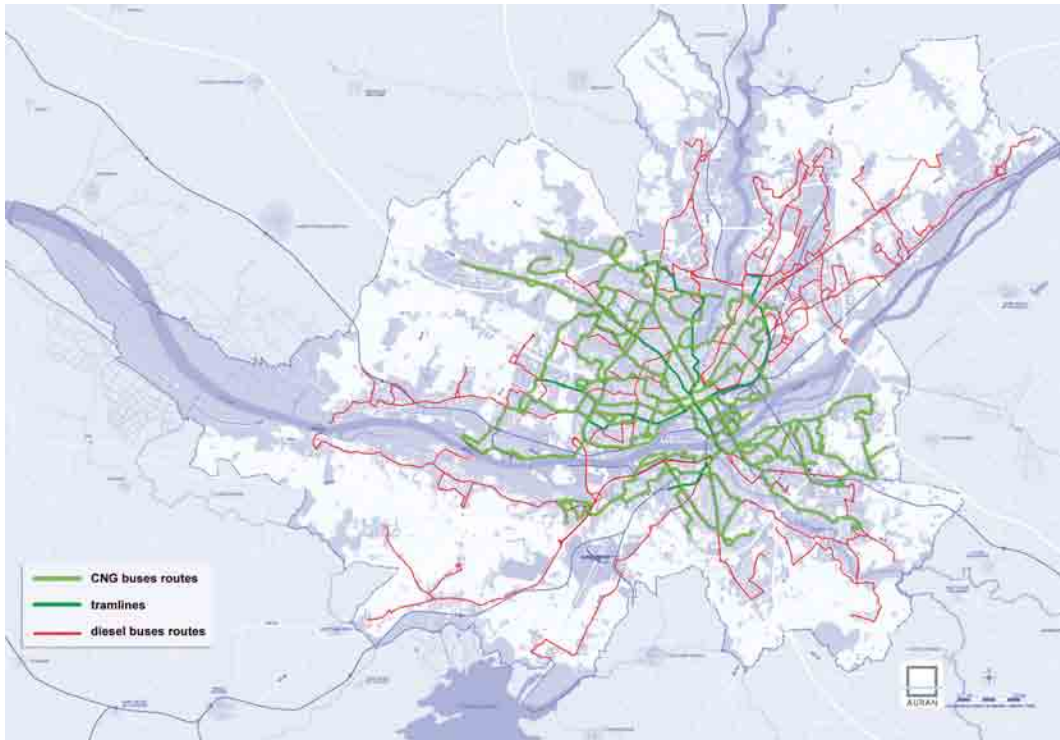


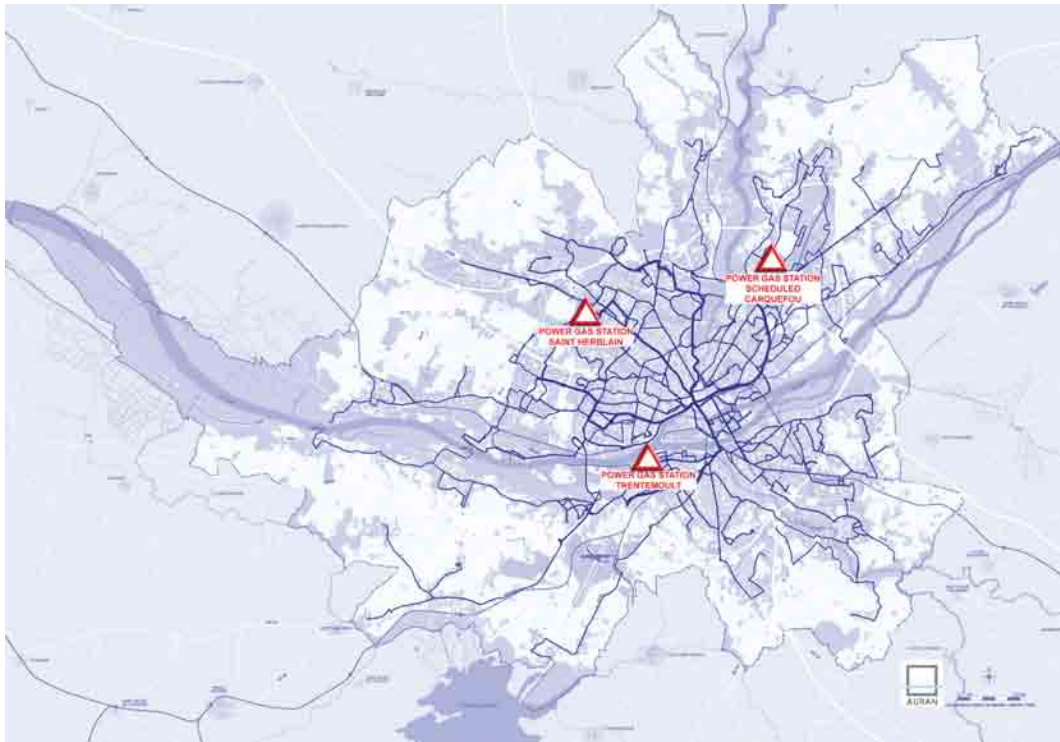
Figure 2.9.18-7 CNG buses routes, 2004



The need for a new fuelling station arose with the decision made by Nantes Métropole to expand the CNG buses fleet. The first fuelling station had been implemented in St Herblain depot in the northwest of the urban area. This depot could not accommodate such a large fleet, and the bus routes chosen to be served by the CNG buses were running in the southeast of the area.

The experience conducted in St Herblain enabled SEMITAN to gain know-how in this field and showed that the solution of being the owner of the fuelling station could be more economically efficient for Nantes Métropole. So the decision was taken to build a new gas fuelling station in the Trentemoult depot in the south of the urban area.

Figure 2.9.18-8 Power gas stations location



Design specifications:

- Temporary fuelling station, rented by SEMITAN, to operate the buses that were delivered for training and to operate routes that would be equipped with new CNG buses, before the delivery of the new gas station.
- Gas bought from a gas provider at real market price, delivered from the gas network at a 16 bars pressure (instead of 200 on previous fuelling station)
- Drive fluids (gas pipes, electricity, low currents and telephone cables) from the delivery posts to the fuelling station.
- A 4 km gas pipeline from the nearest 16 bars gas network to Trentemoult depot
- Concrete platform for compressors
- Siding (boarding) of the future gas station
- Gas and electricity connection to command equipments or compression equipments,
- No surge tank (the one existing in St Herblain depot was not often used)
- Distribution network of the compressed gas to the buses parking places
- Lighting protection for the entire depot
- Implementation of automatic opening doors and portholes
- Implementation of gas detectors with automatic alert transmission systems towards central safety services

Implementation aspects:

- Call for tenders in 2000 and 2001, works began in 2001 and ended in August 2002.
- Compression station was realized by GN-Vert/Eurotec.

- Cost: 216,500 €
- The new fuelling gas station was opened up in June 2003.



Figure 2.9.18-9 Gas station



Figure 2.9.18-10 Rezé gas power station

Results

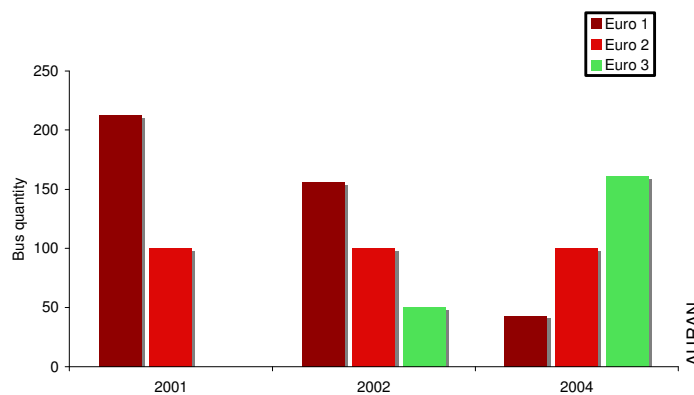
State of the bus fleet

As shown in the table below, the SEMITAN bus fleet has been greatly renewed during VIVALDI. The objective of an average bus fleet age of 5 years is reached in 2004 and will decrease further over the next three years. Bus fleet renewal is also done with an increasing of the number of clean buses.

Table 2.9.18-2 SEMITAN bus fleet evolution

Bus Fleet SEMITAN source					
Energy	Bus type	Euro standard	2001	2002	2004
Diesel	MG36	Euro 1	2	0	0
	GX44	Euro 1	126	80	10
	GX317	Euro 2	52	52	52
	O305G	Euro 1	27	19	0
	GX187	Euro 1	57	57	33
	GX417	Euro 2	18	18	18
	Total		282	226	113
CNG	GX217	Euro2	30	30	30
	GX317	Euro3	0	50	130
	V7000	Euro3	0	0	31
	Total		30	80	191
Total Fleet			312	306	304
Average fleet age			9,8	9,6	5,5

Figure 2.9.18-11 SEMITAN bus fleet – Euro standard evolution



Impacts on energy consumption and pollutants emissions

Assumptions and basic data

The impacts on energy consumption and pollutants emissions, for the new CNG buses and the new gas station have been carried out with some assumptions made after a large bibliographical search. The evaluation has been made with a comparison between a simulation of the current situation with a “do nothing scenario”, with the following assumptions:

The new CNG buses are allocated to the routes for a full year and the CNG buses allocated to a route are always the same type, for all years. For example, if a bus route is operated with a GX 217 type in 2002, it is assumed to be operated with the same type in 2004, even though there are new GX317 buses in the fleet.

Table 2.9.18-3 Bus route allocation

Bus route allocation			
Route	Depot	S type / A type	CNG type
11	SH	S	GX217 VOLVO
21	SH	S	GX217 VOLVO
24	TT	S	GX317 RVI
25	SH	A	VOLVO 7000
26	TT	A	VOLVO 7000
27	TT	S	GX317 RVI
28	TT	A	VOLVO 7000
29	TT	A	VOLVO 7000
31	TT	S	GX317 RVI
32	TT	S	GX317 RVI
36	TT	S	GX317 RVI
37	TT	S	GX317 RVI
38	TT	S	GX317 RVI
39	TT	S	GX317 RVI
40	SH	S	GX317 RVI
51	TT	S	GX317 RVI
52	TT	S	GX317 RVI
54	SH	S	GX317 RVI
56	SH	S	GX217 VOLVO
58	TT	S	GX317 RVI
59	SH	S	GX317 RVI
73	SH	S	GX317 RVI
79	SH	S	GX317 RVI
80	SH	S	GX317 RVI
81	SH	S	GX317 RVI
87	SH	S	GX317 RVI
90	SH	S	GX317 RVI

Depot : SH=Saint Herblain, TT=Rez² Trentemoult
S type / A type : S=standard, A=articulated

Run kilometres are real kilometres run by buses during a year for each route, or for the entire network.

Table 2.9.18-4 Run kilometres

Run kilometres			
Route	2001	2002	2004
11	586 433	588 560	548 185
21	455 526	455 678	472 971
24	285 192	286 008	296 174
25	486 421	482 745	505 490
26	264 320	259 542	259 448
27	165 227	156 647	175 681
28	252 591	258 827	279 583
29	279 019	294 216	307 670
31	413 068	414 047	427 482
32	528 169	531 013	567 440
36	365 270	347 670	352 479
37	259 257	194 168	206 235
38	145 376	147 777	144 695
39	143 092	143 184	139 420
40	245 893	242 848	66 312
51	284 689	284 933	284 619
52	373 771	373 885	386 141
54	315 837	314 602	307 079
56	419 201	423 454	428 330
58	141 249	141 868	138 688
59	172 166	174 990	180 998
73	175 246	177 751	220 649
79	121 831	122 912	123 963
80	157 228	168 093	197 379
81	422 318	417 208	440 404
87	336 905	347 009	359 397
90	180 990	180 865	202 201

= Operated with CNG buses

The energy consumption is the average annual consumption measured by SEMITAN.

Table 2.9.18-5 Average annual consumption

Average annual consumption SEMITAN source						
year	2001		2002		2004	
bus type	diesel fuel liters/100 km	kWh/100 km	diesel fuel liters/100 km	kWh/100 km	diesel fuel liters/100 km	kWh/100 km
diesel standard	39,8	406,0	41,0	418,2	43,5	443,7
diesel articulated	57,6	587,5	57,6	587,5	57,6	587,5
bus type	nm3 gaz/100 km	kWh/100 km **	nm3 gaz/100 km	kWh/100 km **	nm3 gaz/100 km	kWh/100 km **
CNG standard VOLVO	66	712,8	66	712,8	66	712,8
CNG standard RVI	-	-	54	583,2	54	583,2
CNG articulated VOLVO	-	-	-	-	79	853,2
tramway	-	550	-	550	-	550

diesel fuel NCV - kWh/l (IEA source) ----- 10,2

gas (Alg'ria) NCV - kWh/nm3 (IEA source) ----- 10,8

** out of gas compression - kWh/nm3 (ADEME source) -----> 0,16

Energy prices are the real average annual prices for SEMITAN.

Table 2.9.18-6 Average annual prices

Average annual prices (€)				
SEMITAN source				
	Diesel fuel (litre)	Gas St Herblain (nm3 delivered)	Gas Rez [~] (nm3 delivered)	tram electricity (kWh)
2001	0,6180	0,4919	-	0,05
2002	0,6098	0,4819 (*)	0,4819 (*)	0,05
2004	0,6894	0,4424 (*)	0,2930 (**)	0,05

(*) GNVert contract

(**) gas+elec+TIPP, out of depreciation allowance for the gas power station

Rez [~] gas power station depreciation allowance ----->	135 000	€ each year
(2 M€ in 15 years)		
Rez [~] gas power station maintenance ----->	135 000	€ each year

Pollutant emissions come from ADEME studies (COROLLER & PLASSAT – 2003: “Comparative study on exhaust emissions from diesel and CNG powered urban buses”). Green house gases are carbon dioxide (diesel buses and CNG buses) and methane (CNG buses).

Table 2.9.18-7 Buses pollutants ratios

diesel buses pollutants ratios		
Pollutant	base : RVI AGORA bus	
	diesel standard	diesel articulated
CO (g/kWh)	0,63	0,63
HCs (g/kWh)	0,193	0,193
NOx (g/kWh)	4,85	4,85
Particles (g/kWh)	0,0675	0,0675
GHG (g/kWh)	257	257

GHG = Green House Gas (CO₂)

ADEME source

CNG buses pollutants ratios			
Pollutant	base : VOLVO CNG buses and RVI AGORA CNG bus		
	GX217 VOLVO	VOLVO 7000	GX317 RVI
CO (g/kWh)	0,07	0,07	0,64
HCs (g/kWh)	0,63	0,63	1,00
incl. HCNM	0,018	0,018	0,083
incl. CH ₄	0,61	0,61	0,91
NOx (g/kWh)	1,60	1,60	1,76
Particles (g/kWh)	0,0030	0,0030	0,0043
GHG (g/kWh)	201	201	232

GHG = Green House Gas (CO₂+CH₄)

ADEME source

Global monetary evaluation is made with real energy costs and monetary equivalents for pollutant emissions coming from ADEME studies (PLASSAT – 2005).

Table 2.9.18-8 Pollutants social cost ratios

pollutants social cost ratios	
Pollutant	Social cost Û / ton
CO	3,50 Û
HCNM	2 000,00 Û
NOx	8 200,00 Û
Particles	126 900,00 Û
GHG	46,00 Û

GHG = Green House Gas (CO₂+CH₄)

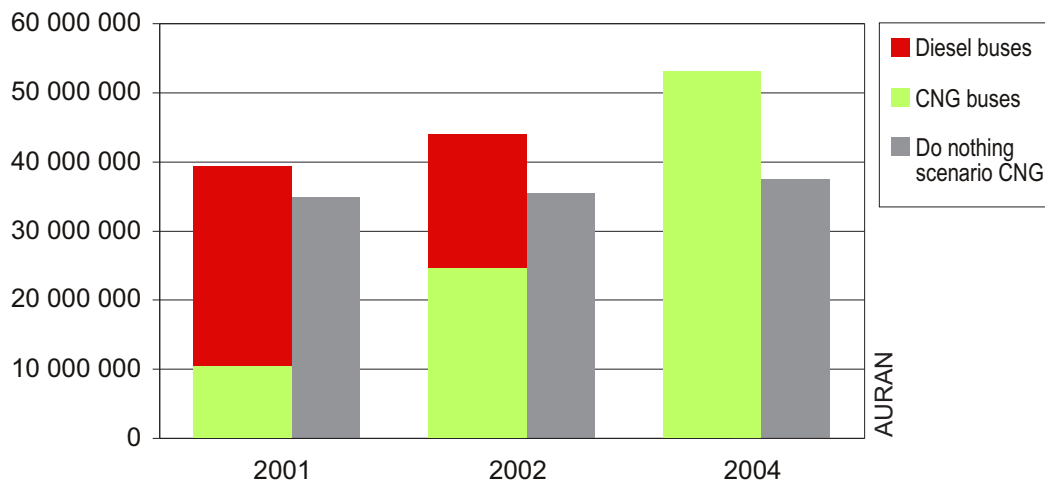
ADEME source

This evaluation only takes account of the fuel consumption delivered at the depot. Energy consumption or pollutant emissions due to electricity, gas or diesel fuel extraction, production and transport to the depot have not been included in this evaluation.

These results only concern the 27 bus routes that have changed from diesel buses to CNG buses. Between 2001 and 2004, the total of run kilometres (about 8 million) on these routes has only increased about 0.5%.

Energy consumption has increased by 35% between 2001 and 2004 (see fig below), in particular due to the lower efficiency of gas engines compared to diesel engines. This increase would have been only 8% with diesel buses on the 27 routes currently operated with CNG buses.

Figure 2.9.18-12 Energy consumption (kWh), with gas compression



Energy kWh (with gas compression)

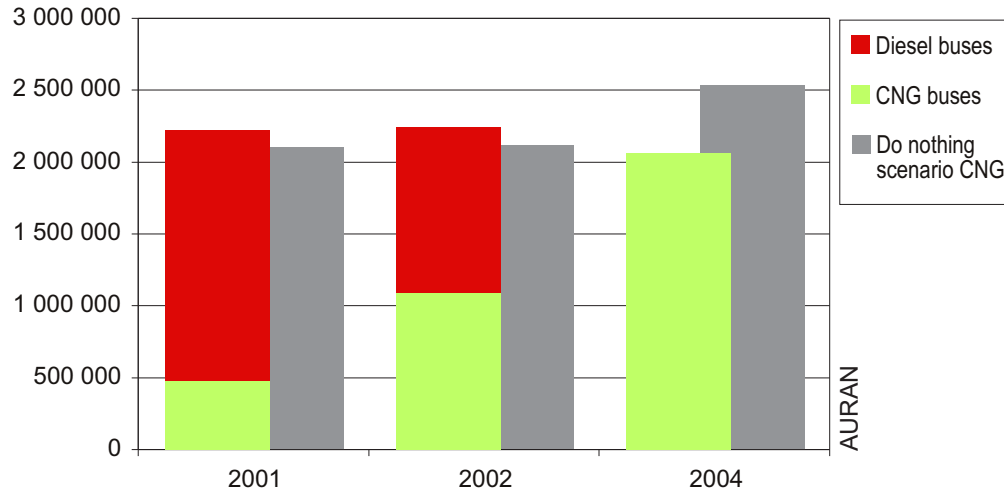
BUS ROUTES	CONSO 2001	CONSO 2002	CONSO 2004
11	4 242 022	4 257 408	3 965 351
21	3 295 089	3 296 192	3 421 283
24	1 157 764	1 196 085	1 752 876
25	2 857 821	2 836 223	4 376 735
26	1 552 933	1 524 861	2 246 405
27	670 756	655 098	1 039 750
28	1 484 023	1 520 660	2 420 741
29	1 639 292	1 728 578	2 663 930
31	1 676 891	2 450 496	2 530 009
32	2 144 155	2 220 696	3 358 337
36	1 482 850	1 453 956	2 086 112
37	1 052 480	812 011	1 220 581
38	590 168	618 003	856 363
39	580 896	598 795	825 143
40	998 225	1 437 272	392 461
51	1 155 723	1 191 590	1 684 489
52	1 517 361	1 563 587	2 285 337
54	1 282 172	1 861 940	1 817 416
56	3 032 329	3 063 097	3 098 368
58	573 414	593 292	820 811
59	698 925	1 035 661	1 071 219
73	711 429	1 052 002	1 305 889
79	494 585	727 442	733 663
80	638 283	702 965	1 168 168
81	1 714 442	2 469 204	2 606 487
87	1 367 700	2 053 738	2 127 055
90	734 747	1 070 431	1 196 706
CNG buses	10 569 440	24 774 883	53 071 686
Diesel buses	28 777 035	19 216 402	-
total	39 346 475	43 991 284	53 071 686

Do nothing scenario CNG, Energy kWh

BUS ROUTES	CONSO 2001	CONSO 2002	CONSO 2004
11	2 380 683	2 461 358	2 432 297
21	1 849 251	1 905 645	2 098 572
24	1 157 764	1 196 085	1 314 124
25	2 857 821	2 836 223	2 969 855
26	1 552 933	1 524 861	1 524 309
27	670 756	655 098	779 497
28	1 484 023	1 520 660	1 642 606
29	1 639 292	1 728 578	1 807 623
31	1 676 891	1 731 545	1 896 738
32	2 144 155	2 220 696	2 517 731
36	1 482 850	1 453 956	1 563 949
37	1 052 480	812 011	915 065
38	590 168	618 003	642 012
39	580 896	598 795	618 607
40	998 225	1 015 590	294 226
51	1 155 723	1 191 590	1 262 855
52	1 517 361	1 563 587	1 713 308
54	1 282 172	1 315 666	1 362 510
56	1 701 786	1 770 885	1 900 500
58	573 414	593 292	615 359
59	698 925	731 808	803 088
73	711 429	743 355	979 020
79	494 585	514 018	550 024
80	638 283	702 965	875 771
81	1 714 442	1 744 764	1 954 073
87	1 367 700	1 451 192	1 594 644
90	734 747	756 377	897 166
CNG buses	-	-	0
Diesel buses	34 708 756	35 358 604	37 525 525
total	34 708 756	35 358 604	37 525 525

Energy costs have decreased by 7% between 2001 and 2004 (see fig below), due to the lower cost of natural gas compared to diesel. Energy cost would have been increased by 21%, assuming the 27 routes currently operated with CNG buses were operated with diesel buses. The implementation of CNG buses has permitted a money saving of 19% compared to a full diesel buses situation.

Figure 2.9.18-13 Energy cost (euros)



Energy cost (euros)

BUS ROUTES	CONSO 2001	CONSO 2002	CONSO 2004
11	190 388	187 194	160 061
21	147 888	144 930	138 100
24	70 147	71 507	46 861
25	173 150	169 562	176 667
26	94 089	91 163	60 054
27	40 640	39 165	27 796
28	89 914	90 912	64 715
29	99 322	103 342	71 216
31	101 600	107 746	67 636
32	129 911	132 763	89 780
36	89 843	86 924	55 769
37	63 768	48 545	32 631
38	35 757	36 947	22 894
39	35 195	35 799	22 059
40	60 481	63 195	15 842
51	70 023	71 238	45 032
52	91 934	93 478	61 095
54	77 685	81 868	73 360
56	136 095	134 681	125 066
58	34 742	35 470	21 943
59	42 347	45 537	43 240
73	43 104	46 255	52 712
79	29 966	31 985	29 614
80	38 672	42 026	47 153
81	103 875	108 568	105 211
87	82 867	90 301	85 859
90	44 517	47 066	48 305

CNG buses	474 371	1 089 326	2 060 671
Diesel buses	1 743 550	1 148 839	-
total*	2 217 921	2 238 166	2 060 671

* with depreciation and maintenance of Rez power gas station

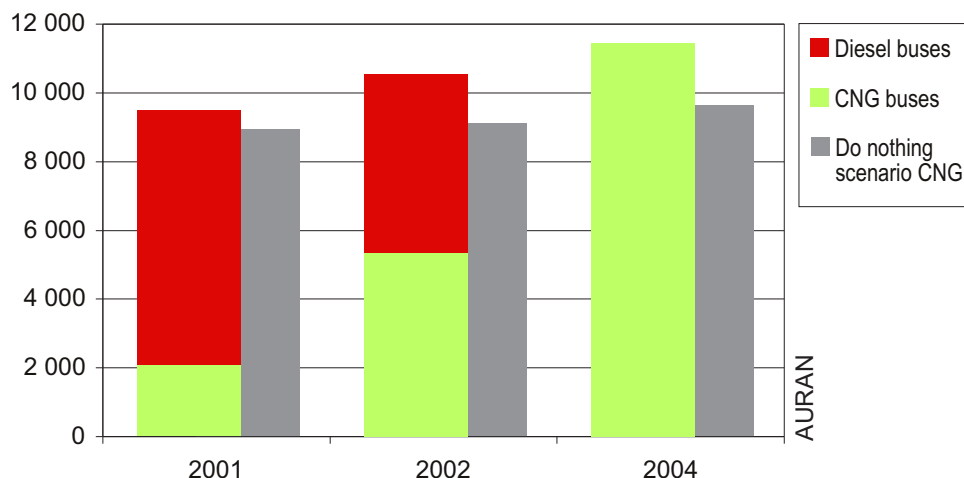
Do nothing scenario CNG, Energy cost (euros)

BUS ROUTES	CONSO 2001	CONSO 2002	CONSO 2004
11	144 241	147 151	164 395
21	112 043	113 928	141 839
24	70 147	71 507	88 819
25	173 150	169 562	200 727
26	94 089	91 163	103 025
27	40 640	39 165	52 685
28	89 914	90 912	111 021
29	99 322	103 342	122 174
31	101 600	103 519	128 197
32	129 911	132 763	170 169
36	89 843	86 924	105 705
37	63 768	48 545	61 848
38	35 757	36 947	43 392
39	35 195	35 799	41 811
40	60 481	60 716	19 886
51	70 023	71 238	85 354
52	91 934	93 478	115 799
54	77 685	78 656	92 090
56	103 108	105 871	128 451
58	34 742	35 470	41 591
59	42 347	43 751	54 279
73	43 104	44 441	66 170
79	29 966	30 730	37 175
80	38 672	42 026	59 192
81	103 875	104 310	132 072
87	82 867	86 758	107 779
90	44 517	45 220	60 638

CNG buses	-	-	-
Diesel buses	2 102 942	2 113 890	2 536 284
total	2 102 942	2 113 890	2 536 284

Green-house gas emissions have increased by 21% between 2001 and 2004 (see fig below), due to the increase of energy consumption. This evolution would have been only 8% with diesel buses on the 27 routes currently operated with CNG buses. In the case of diesel buses, green house gas emissions would have been reduced by 16% compared to the current situation. But this fact against CNG buses could be balanced by less car use.

Figure 2.9.18-14 Green house gas emissions (tons)



Green house gas emissions (kg)

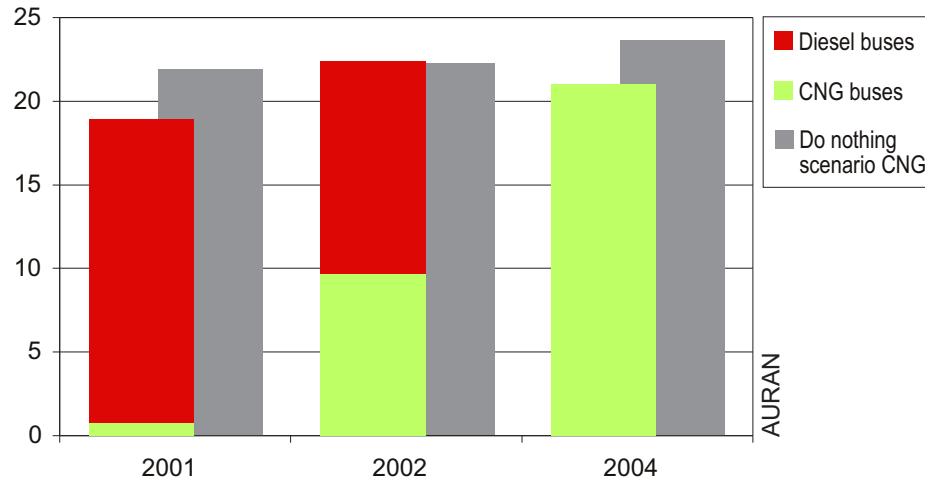
BUS ROUTES	GHG 2001	GHG 2002	GHG 2004
11	840 199	843 246	785 400
21	652 644	652 863	677 639
24	297 545	307 394	400 731
25	734 460	728 909	866 881
26	399 104	391 889	444 936
27	172 384	168 360	237 701
28	381 394	390 810	479 466
29	421 298	444 245	527 633
31	430 961	560 216	578 393
32	551 048	570 719	767 760
36	381 092	373 667	476 913
37	270 487	208 687	279 041
38	151 673	158 827	195 776
39	149 290	153 890	188 639
40	256 544	328 579	89 722
51	297 021	306 239	385 096
52	389 962	401 842	522 458
54	329 518	425 664	415 485
56	600 600	606 694	613 680
58	147 368	401 842	187 648
59	179 624	236 766	244 895
73	182 837	240 501	298 543
79	127 108	166 303	167 725
80	164 039	180 662	267 059
81	440 612	564 492	595 877
87	351 499	469 512	486 273
90	188 830	244 715	273 583
CNG buses	2 093 443	5 339 551	11 454 951
Diesel buses	7 395 698	5 187 981	-
total GHG (tons)	9 489	10 528	11 455

Do Nothing CNG, Green house gas emissions (kg)

BUS ROUTES	GHG 2001	GHG 2002	GHG 2004
11	611 836	632 569	625 100
21	475 258	489 751	539 333
24	297 545	307 394	337 730
25	734 460	728 909	763 253
26	399 104	391 889	391 747
27	172 384	168 360	200 331
28	381 394	390 810	422 150
29	421 298	444 245	464 559
31	430 961	445 007	487 462
32	551 048	570 719	647 057
36	381 092	373 667	401 935
37	270 487	208 687	235 172
38	151 673	158 827	164 997
39	149 290	153 890	158 982
40	256 544	261 007	75 616
51	297 021	306 239	324 554
52	389 962	401 842	440 320
54	329 518	338 126	350 165
56	437 359	455 117	488 429
58	147 368	152 476	158 147
59	179 624	188 075	206 394
73	182 837	191 042	251 608
79	127 108	132 103	141 356
80	164 039	180 662	225 073
81	440 612	448 404	502 197
87	351 499	372 956	409 824
90	188 830	194 389	230 572
CNG buses	-	-	-
Diesel buses	8 920 150	9 087 161	9 644 060
total GHG (tons)	8 920	9 087	9 644

Carbon monoxide emissions have increased by 11% between 2001 and 2004 (see fig below). This increase would have been 8% with diesel buses on the 27 routes currently operated with CNG buses. But, in case of diesel buses, carbon monoxide emissions would have been increased by 13% compared to the current situation.

Figure 2.9.18-15 Carbon monoxide (tons)



Carbon monoxide (g)

BUS ROUTES	CO 2001	CO 2002	CO 2004
11	292 607	293 668	273 522
21	227 289	227 365	235 994
24	729 391	753 534	1 105 464
25	1 800 427	1 786 821	301 899
26	978 348	960 663	154 953
27	422 576	412 712	655 726
28	934 934	958 016	166 978
29	1 032 754	1 089 004	183 753
31	1 056 441	1 545 422	1 595 568
32	1 350 818	1 399 039	2 117 958
36	934 196	915 992	1 315 621
37	663 062	511 567	769 768
38	371 806	389 342	540 071
39	365 965	377 241	520 382
40	628 882	906 425	247 508
51	728 106	750 702	1 062 335
52	955 938	985 060	1 441 264
54	807 768	1 174 246	1 146 166
56	209 164	211 287	213 720
58	361 251	985 060	517 650
59	440 323	653 147	675 571
73	448 200	663 452	823 568
79	311 589	458 767	462 689
80	402 118	442 868	736 713
81	1 080 099	1 557 221	1 643 799
87	861 651	1 295 204	1 341 442
90	462 891	675 075	754 711

CNG buses	729 060	9 661 278	21 004 794
Diesel buses	18 129 532	12 717 619	
total CO (tons)	18,859	22,379	21,005

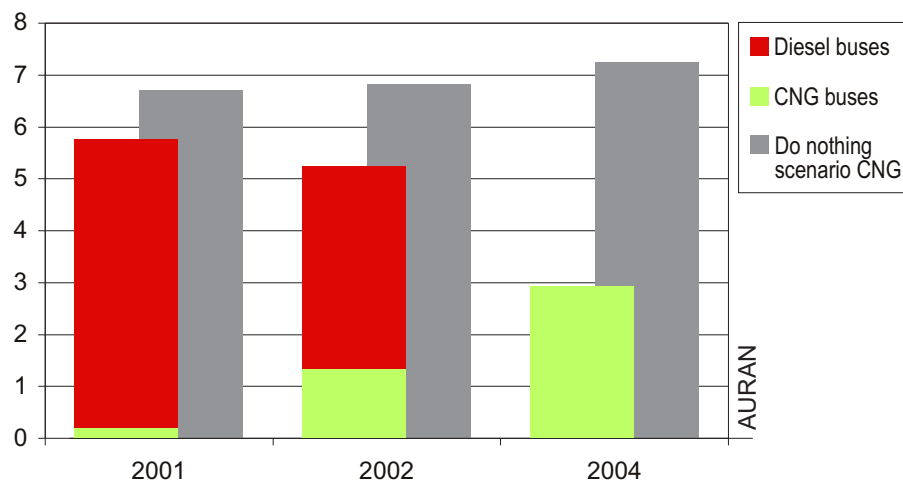
Do Nothing CNG, Carbon monoxide (g)

BUS ROUTES	CO 2001	CO 2002	CO 2004
11	1 499 831	1 550 655	1 532 347
21	1 165 028	1 200 557	1 322 101
24	729 391	753 534	827 898
25	1 800 427	1 786 821	1 871 009
26	978 348	960 663	960 315
27	422 576	412 712	491 083
28	934 934	958 016	1 034 842
29	1 032 754	1 089 004	1 138 802
31	1 056 441	1 090 873	1 194 945
32	1 350 818	1 399 039	1 586 171
36	934 196	915 992	985 288
37	663 062	511 567	576 491
38	371 806	389 342	404 467
39	365 965	377 241	389 722
40	628 882	639 822	185 363
51	728 106	750 702	795 598
52	955 938	985 060	1 079 384
54	807 768	828 869	858 381
56	1 072 125	1 115 657	1 197 315
58	361 251	373 774	387 676
59	440 323	461 039	505 946
73	448 200	468 313	616 782
79	311 589	323 831	346 515
80	402 118	442 868	551 735
81	1 080 099	1 099 201	1 231 066
87	861 651	914 251	1 004 626
90	462 891	476 518	565 214

CNG buses	-	-	-
Diesel buses	21 866 517	22 275 920	23 641 081
total CO (tons)	21,867	22,276	23,641

Non-methane hydrocarbons emissions have decreased by half between 2001 and 2004 (see fig below). This would have been an increase by 8% with diesel buses on the 27 routes currently operated with CNG buses. In case of diesel buses, non-methane hydrocarbons emissions would have been increased by 150% compared to the current situation.

Figure 2.9.18-16 Hydrocarbons (tons)



Hydrocarbons (g)

BUS ROUTES	NMHC 2001	NMHC 2002	NMHC 2004
11	75 242	75 515	70 334
21	58 446	58 465	60 684
24	223 448	230 844	143 365
25	551 559	547 391	77 631
26	299 716	294 298	39 845
27	129 456	126 434	85 039
28	286 416	293 487	42 937
29	316 383	333 616	47 251
31	323 640	200 422	206 925
32	413 822	428 594	274 673
36	286 190	280 613	170 620
37	203 129	156 718	99 829
38	113 903	119 275	70 040
39	112 113	115 568	67 487
40	192 657	117 552	32 099
51	223 055	229 977	137 772
52	292 851	301 772	186 914
54	247 459	152 285	148 643
56	53 785	54 331	54 956
58	110 669	301 772	67 133
59	134 893	84 705	87 613
73	137 306	86 041	106 806
79	95 455	59 496	60 005
80	123 189	135 672	95 542
81	330 887	201 952	213 180
87	263 966	167 972	173 968
90	141 806	87 549	97 877

CNG buses	187 473	1 346 285	2 919 170
Diesel buses	5 553 968	3 896 032	
total NMHC (tons)	5,741	5,242	2,919

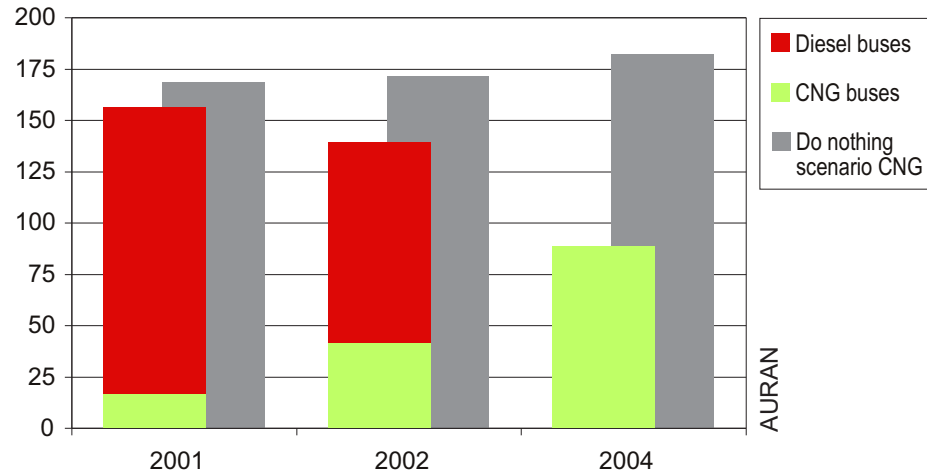
Do Nothing CNG, Hydrocarbons (en g)

BUS ROUTES	NMHC 2001	NMHC 2002	NMHC 2004
11	459 472	475 042	469 433
21	356 906	367 790	405 024
24	223 448	230 844	253 626
25	551 559	547 391	573 182
26	299 716	294 298	294 192
27	129 456	126 434	150 443
28	286 416	293 487	317 023
29	316 383	333 616	348 871
31	323 640	334 188	366 070
32	413 822	428 594	485 922
36	286 190	280 613	301 842
37	203 129	156 718	176 607
38	113 903	119 275	123 908
39	112 113	115 568	119 391
40	192 657	196 009	56 786
51	223 055	229 977	243 731
52	292 851	301 772	330 668
54	247 459	253 923	262 964
56	328 445	341 781	366 797
58	110 669	114 505	118 764
59	134 893	141 239	154 996
73	137 306	143 467	188 951
79	95 455	99 205	106 155
80	123 189	135 672	169 024
81	330 887	336 739	377 136
87	263 966	280 080	307 766
90	141 806	145 981	173 153

CNG buses	-	-	-
Diesel buses	6 698 790	6 824 211	7 242 426
total NMHC (tons)	6,699	6,824	7,242

Nitrogen oxide emissions have decreased by 43% between 2001 and 2004 (see fig below). This evolution would have been an increase of 8% with diesel buses on the 27 routes currently operated with CNG buses. In case of diesel buses, nitrogen oxides emissions would have been doubled (+106%) compared to the current situation.

Figure 2.9.18-17 Nitrogen oxides (tons)



Nitrogen oxide (g)

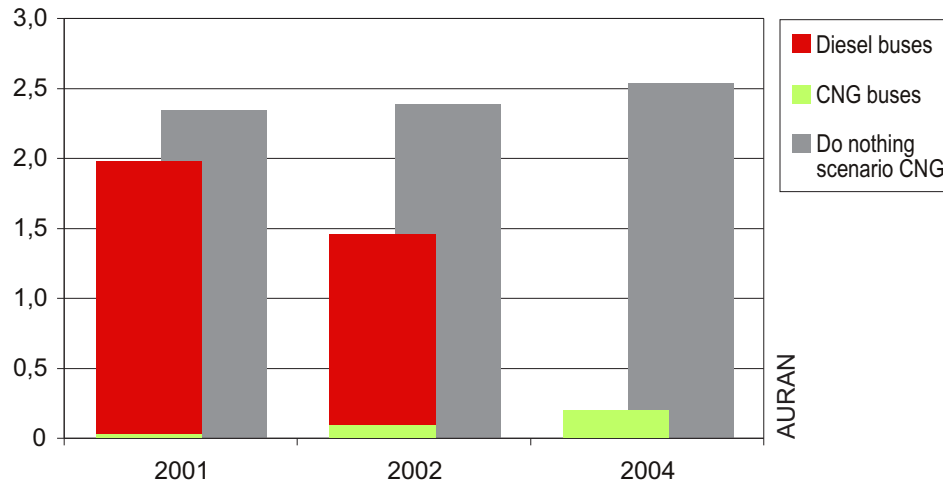
BUS ROUTES	NOx 2001	NOx 2002	NOx 2004
11	6 688 151	6 712 409	6 251 940
21	5 195 177	5 196 916	5 394 140
24	5 615 156	5 801 014	3 040 025
25	13 860 430	13 755 684	6 900 545
26	7 531 724	7 395 577	3 541 777
27	3 253 164	3 177 224	1 803 246
28	7 197 510	7 375 203	3 816 643
29	7 950 568	8 383 603	4 200 065
31	8 132 921	4 249 911	4 387 812
32	10 399 151	10 770 377	5 824 386
36	7 191 823	7 051 686	3 617 957
37	5 104 527	3 938 251	2 116 862
38	2 862 317	2 997 317	1 485 196
39	2 817 347	2 904 158	1 431 051
40	4 841 392	2 492 670	680 648
51	5 605 259	5 779 211	2 921 420
52	7 359 203	7 583 397	3 963 475
54	6 218 534	3 229 176	3 151 957
56	4 780 898	4 829 408	4 885 018
58	2 781 060	7 583 397	1 423 538
59	3 389 787	1 796 153	1 857 821
73	3 450 429	1 824 493	2 264 812
79	2 398 738	1 261 608	1 272 396
80	3 095 672	3 409 380	2 025 961
81	8 315 044	4 282 356	4 520 448
87	6 633 343	3 561 811	3 688 966
90	3 563 523	1 856 456	2 075 456
CNG buses	16 664 226	41 293 368	88 543 560
Diesel buses	139 568 621	97 905 479	
total NOx (tons)	156,233	139,199	88,544

Do Nothing CNG, Nitrogen oxide (g)

BUS ROUTES	NOx 2001	NOx 2002	NOx 2004
11	11 546 315	11 937 586	11 796 640
21	8 968 869	9 242 380	10 178 076
24	5 615 156	5 801 014	6 373 502
25	13 860 430	13 755 684	14 403 796
26	7 531 724	7 395 577	7 392 898
27	3 253 164	3 177 224	3 780 558
28	7 197 510	7 375 203	7 966 639
29	7 950 568	8 383 603	8 766 971
31	8 132 921	8 397 991	9 199 178
32	10 399 151	10 770 377	12 210 997
36	7 191 823	7 051 686	7 585 154
37	5 104 527	3 938 251	4 438 064
38	2 862 317	2 997 317	3 113 757
39	2 817 347	2 904 158	3 000 242
40	4 841 392	4 925 613	1 426 998
51	5 605 259	5 779 211	6 124 844
52	7 359 203	7 583 397	8 309 542
54	6 218 534	6 380 978	6 608 171
56	8 253 664	8 588 790	9 217 426
58	2 781 060	2 877 466	2 984 489
59	3 389 787	3 549 270	3 894 977
73	3 450 429	3 605 270	4 748 245
79	2 398 738	2 492 987	2 667 616
80	3 095 672	3 409 380	4 247 488
81	8 315 044	8 462 105	9 477 252
87	6 633 343	7 038 279	7 734 026
90	3 563 523	3 668 431	4 351 254
CNG buses	-	-	-
Diesel buses	168 337 469	171 489 228	181 998 799
total NOx (tons)	168,337	171,489	181,999

Particulate emissions have decreased by 90% between 2001 and 2004 (see fig below). This would have been an increase by 8% with diesel buses on the 27 routes currently operated with CNG buses. In case of diesel buses, particulate emissions would have been close to 13 times higher than the current situation.

Figure 2.9.18-18 Particles (tons)



Particles (g)

BUS ROUTES	Part. 2001	Part. 2002	Part. 2004
11	12 540	12 586	11 722
21	9 741	9 744	10 114
24	78 149	80 736	7 427
25	192 903	191 445	12 939
26	104 823	102 928	6 641
27	45 276	44 219	4 406
28	100 172	102 645	7 156
29	110 652	116 679	7 875
31	113 190	10 383	10 720
32	144 730	149 897	14 230
36	100 092	98 142	8 839
37	71 042	54 811	5 172
38	39 836	41 715	3 629
39	39 210	40 419	3 496
40	67 380	6 090	1 663
51	78 011	80 432	7 138
52	102 422	105 542	9 683
54	86 547	7 889	7 701
56	8 964	9 055	9 159
58	38 705	105 542	3 478
59	47 177	4 388	4 539
73	48 021	4 458	5 533
79	33 384	3 082	3 109
80	43 084	47 450	4 950
81	115 725	10 463	11 044
87	92 320	8 702	9 013
90	49 595	4 536	5 071

CNG buses	31 245	91 377	196 447
Diesel buses	1 942 450	1 362 602	
total Part. (tons)	1,974	1,454	0,196

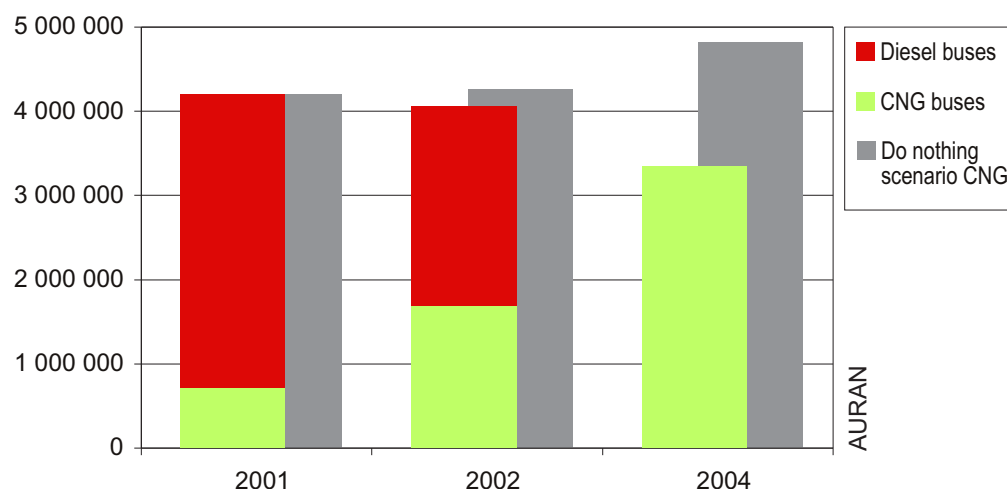
Do Nothing CNG, Particles (g)

BUS ROUTES	Part. 2001	Part. 2002	Part. 2004
11	160 696	166 142	164 180
21	124 824	128 631	141 654
24	78 149	80 736	88 703
25	192 903	191 445	200 465
26	104 823	102 928	102 891
27	45 276	44 219	52 616
28	100 172	102 645	110 876
29	110 652	116 679	122 015
31	113 190	116 879	128 030
32	144 730	149 897	169 947
36	100 092	98 142	105 567
37	71 042	54 811	61 767
38	39 836	41 715	43 336
39	39 210	40 419	41 756
40	67 380	68 552	19 860
51	78 011	80 432	85 243
52	102 422	105 542	115 648
54	86 547	88 807	91 969
56	114 871	119 535	128 284
58	38 705	40 047	41 537
59	47 177	49 397	54 208
73	48 021	50 176	66 084
79	33 384	34 696	37 127
80	43 084	47 450	59 115
81	115 725	117 772	131 900
87	92 320	97 955	107 639
90	49 595	51 055	60 559

CNG buses	-	-	-
Diesel buses	2 342 841	2 386 706	2 532 973
total Part. (tons)	2,343	2,387	2,533

Global social cost, including energy and pollutant emissions, has decreased by more than 20% between 2001 and 2004 (see fig below). This would have been an increase by more than 14% with diesel buses on the 27 routes currently operated with CNG buses. In case of diesel buses, global social cost would have been +44% higher than the current situation.

Figure 2.9.18-19 Global social cost (euros)



Global social cost (euros)

		2001	2002	2004
energy	CNG buses	474 371,11 ¤	1 089 326,28 ¤	2 060 671,12 ¤
	diesel buses	1 743 549,79 ¤	1 148 839,38 ¤	- ¤
GHG	CNG buses	96 298,40 ¤	245 619,33 ¤	526 927,74 ¤
	diesel buses	340 202,11 ¤	238 647,13 ¤	- ¤
CO	CNG buses	2,55 ¤	33,81 ¤	73,52 ¤
	diesel buses	63,45 ¤	44,51 ¤	- ¤
NMHC	CNG buses	374,95 ¤	2 692,57 ¤	5 838,34 ¤
	diesel buses	11 107,94 ¤	7 792,06 ¤	- ¤
NOx	CNG buses	136 646,65 ¤	338 605,62 ¤	726 057,20 ¤
	diesel buses	1 144 462,70 ¤	802 824,93 ¤	- ¤
Particles	CNG buses	3 965,04 ¤	11 595,69 ¤	24 929,16 ¤
	diesel buses	246 496,89 ¤	172 914,20 ¤	- ¤
total	CNG buses	711 658,71 ¤	1 687 873,30 ¤	3 344 497,08 ¤
	diesel buses	3 485 882,88 ¤	2 371 062,21 ¤	- ¤
total		4 197 541,58 ¤	4 058 935,51 ¤	3 344 497,08 ¤

Do Nothing CNG, Global social cost (euros)

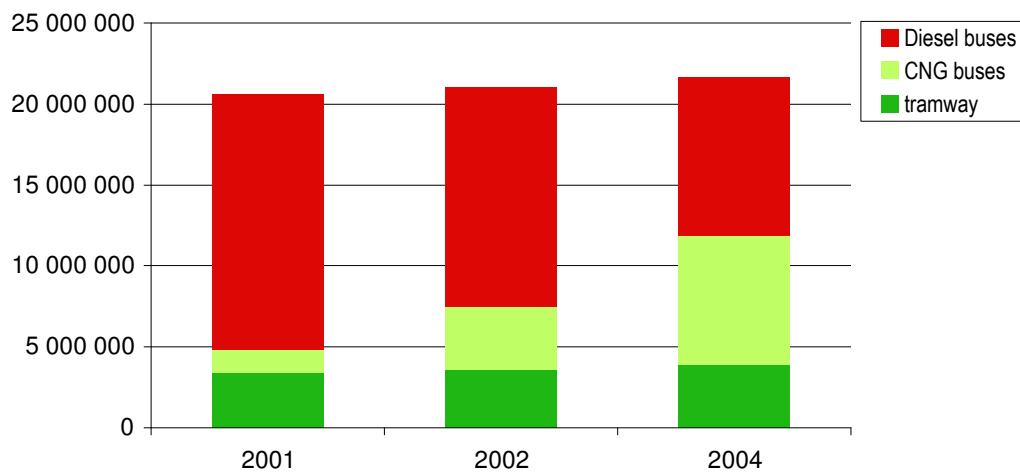
		2001	2002	2004
energy	CNG buses	- ¤	- ¤	- ¤
	diesel buses	2 102 942,30 ¤	2 113 889,86 ¤	2 536 284,05 ¤
GHG	CNG buses	- ¤	- ¤	- ¤
	diesel buses	410 326,92 ¤	418 009,41 ¤	443 626,76 ¤
CO	CNG buses	- ¤	- ¤	- ¤
	diesel buses	76,53 ¤	77,97 ¤	82,74 ¤
NMHC	CNG buses	- ¤	- ¤	- ¤
	diesel buses	13 397,58 ¤	13 648,42 ¤	14 484,85 ¤
NOx	CNG buses	- ¤	- ¤	- ¤
	diesel buses	1 380 367,24 ¤	1 406 211,67 ¤	1 492 390,15 ¤
Particles	CNG buses	- ¤	- ¤	- ¤
	diesel buses	297 306,53 ¤	302 872,96 ¤	321 434,27 ¤
total		4 204 417,11 ¤	4 254 710,29 ¤	4 808 302,82 ¤

Global urban public transport network

Run kilometres have increased by 5.1% between 2001 and 2004 (see fig below). But this depends on the type of rolling stock; there is an increase of 14.3% by trams, an increase close to 5.5 times more with CNG buses and a decrease for diesel buses by 38%.

Run kilometres operated with clean vehicles (tram and CNG buses) have increased by 145.4%. Clean vehicles in 2004 represented more than half of all run kilometres (54.8%).

Figure 2.9.18-20 Run kilometres

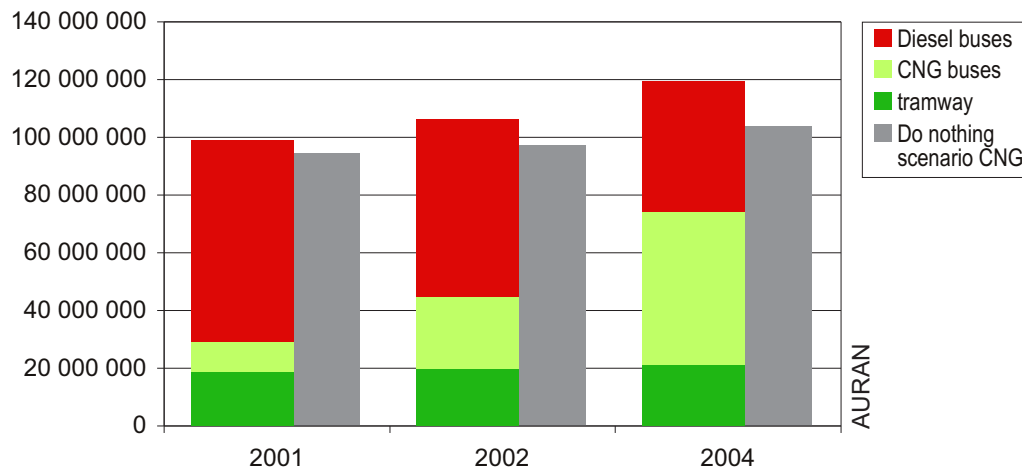


Run kilometers

Global network	2001	2002	2004
CNG standards	1 461 159	3 859 924	6 666 922
CNG artic'l's	-	-	1 352 191
Diesel standards	12 692 841	10 813 076	8 589 078
Diesel artic'l's	3 081 000	2 767 000	1 194 809
tramway	3 380 000	3 598 000	3 862 000
CNG buses	1 461 159	3 859 924	8 019 113
Diesel buses	15 773 841	13 580 076	9 783 887
total buses	17 235 000	17 440 000	17 803 000
total clean	4 841 159	7 457 924	11 881 113
total network	20 615 000	21 038 000	21 665 000

Energy consumption has increased by 20.9% between 2001 and 2004 (see fig below), in particular due to the lower efficiency of gas engines compared to diesel engines. This would have been only 10.4% with diesel buses on all bus routes.

Figure 2.9.18-21 Energy (kWh)



Energy (kWh), with gas compression

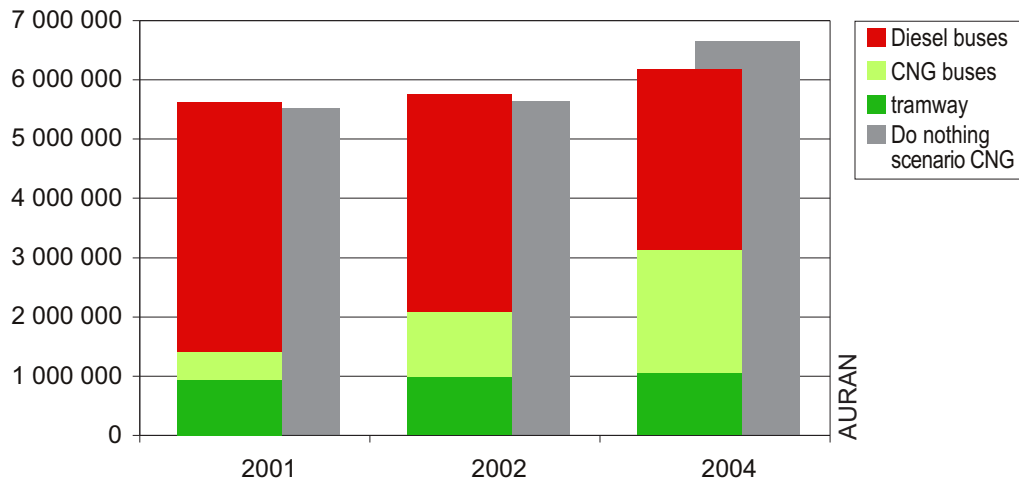
Global network	2001	2002	2004
CNG standards	10 569 440	24 774 883	41 363 875
CNG articulated	-	-	11 707 811
Diesel standards	51 527 857	45 220 284	38 109 739
Diesel articulated	18 101 491	16 256 678	7 019 742
tramway	18 590 000	19 789 000	21 241 000
CNG buses	10 569 440	24 774 883	53 071 686
Diesel buses	69 629 349	61 476 962	45 129 481
total buses	80 198 788	86 251 845	98 201 167
total clean	29 159 440	44 563 883	74 312 686
total network	98 788 788	106 040 845	119 442 167

Do nothing scenario CNG, Energy (kWh)

Global network	2001	2002	2004
CNG standards	-	-	-
CNG articulated	-	-	-
Diesel standards	57 459 578	61 362 486	67 690 872
Diesel articulated	18 101 491	16 256 678	14 964 134
tramway	18 590 000	19 789 000	21 241 000
CNG buses	-	-	-
Diesel buses	75 561 070	77 619 164	82 655 006
total buses	75 561 070	77 619 164	82 655 006
total clean	18 590 000	19 789 000	21 241 000
total network	94 151 070	97 408 164	103 896 006

Energy costs have increased by 9.8% between 2001 and 2004 (see fig below). Energy cost would have been increased by 20.7%, if all the bus routes had been operated with diesel buses. The implementation of CNG buses has permitted a money saving of 7.2% compared to a full diesel situation.

Figure 2.9.18-22 Energy cost (euros)



Energy cost (euros)

Global network	2001	2002	2004
CNG standards	474 371	1 089 326	1 418 019
CNG articulated	-	-	372 653
Diesel standards	3 121 982	2 703 464	2 575 770
Diesel articulated	1 096 737	971 894	474 452
tramway	929 500	989 450	1 062 050
CNG buses	474 371	1 089 326	2 060 671
Diesel buses	4 218 719	3 675 358	3 050 222
total buses	4 693 090	4 764 684	5 110 893
total clean	1 403 871	2 078 776	3 122 721
total network	5 622 590	5 754 134	6 172 943

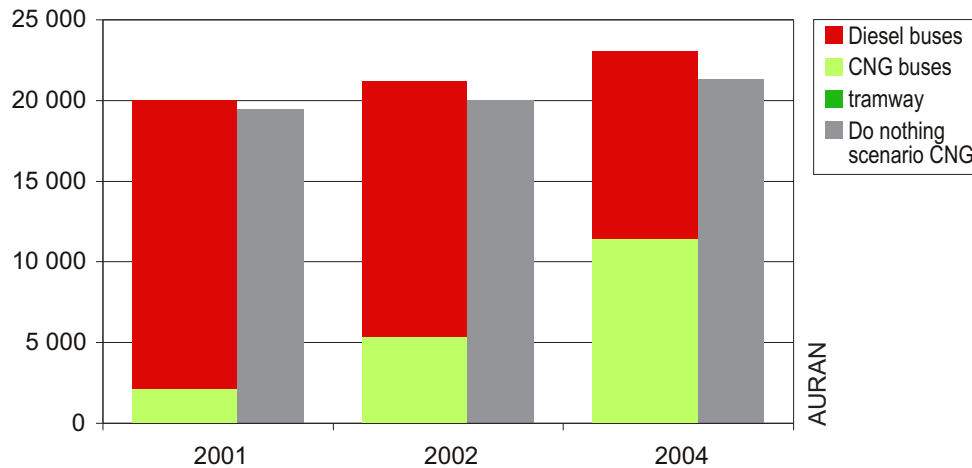
* with depreciation and maintenance of Rez[®] power gas station

Do nothing scenario CNG, Energy cost (euros)

Global network	2001	2002	2004
CNG standards	-	-	-
CNG articulated	-	-	-
Diesel standards	3 481 374	3 668 514	4 575 107
Diesel articulated	1 096 737	971 894	1 011 399
tramway	929 500	989 450	1 062 050
CNG buses	-	-	-
Diesel buses	4 578 112	4 640 408	5 586 506
total buses	4 578 112	4 640 408	5 586 506
total clean	929 500	989 450	1 062 050
total network	5 507 612	5 629 858	6 648 556

Green-house gas emissions have increased by 15.3% between 2001 and 2004 (see fig below). This would have been only 9.4% with diesel buses on all bus routes. In case of diesel buses, green house gas emissions would have been reduced by 7.9% compared to the current situation.

Figure 2.9.18-23 Green house gas emissions (tons)



Green house gas emissions (kg)

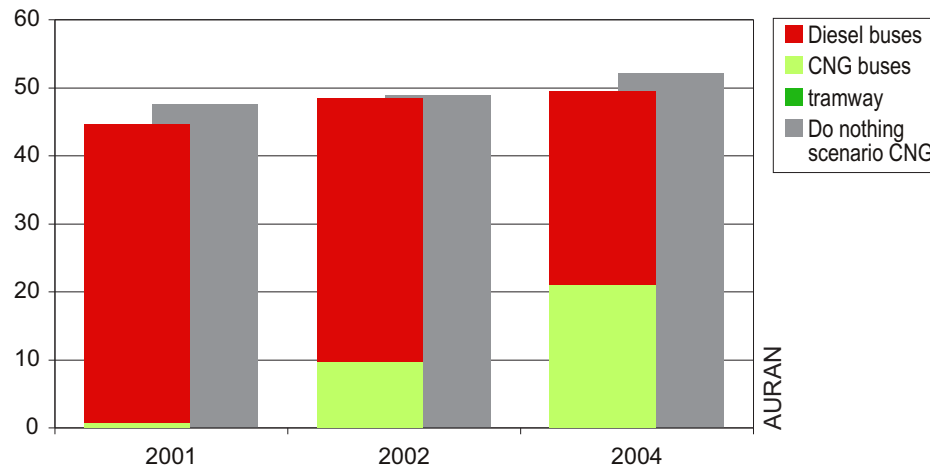
Global network	2001	2002	2004
CNG standards	2 093 443	5 339 551	9 136 035
CNG articulated	-	-	2 318 916
Diesel standards	13 242 659	11 621 613	9 794 203
Diesel articulated	4 652 083	4 177 966	1 804 074
tramway	-	-	-
CNG buses	2 093 443	5 339 551	11 454 951
Diesel buses	17 894 743	15 799 579	11 598 277
total buses	19 988 186	21 139 130	23 053 228
total clean	2 093 443	5 339 551	11 454 951
total network	19 988 186	21 139 130	23 053 228

Do Nothing CNG, Green house gas emissions (kg)

Global network	2001	2002	2004
CNG standards	-	-	-
CNG articulated	-	-	-
Diesel standards	14 767 112	15 770 159	17 396 554
Diesel articulated	4 652 083	4 177 966	3 845 783
tramway	-	-	-
CNG buses	-	-	-
Diesel buses	19 419 195	19 948 125	21 242 337
total buses	19 419 195	19 948 125	21 242 337
total clean	-	-	-
total network	19 419 195	19 948 125	21 242 337

Carbon monoxide emissions have increased by 10.8% between 2001 and 2004 (see fig below). This would have been 9.4% with diesel buses on all bus routes. But, in case of diesel buses, carbon monoxide emissions would have been increased by 5.3% compared to the current situation.

Figure 2.9.18-24 Carbon monoxide (tons)



Carbon monoxide (g)

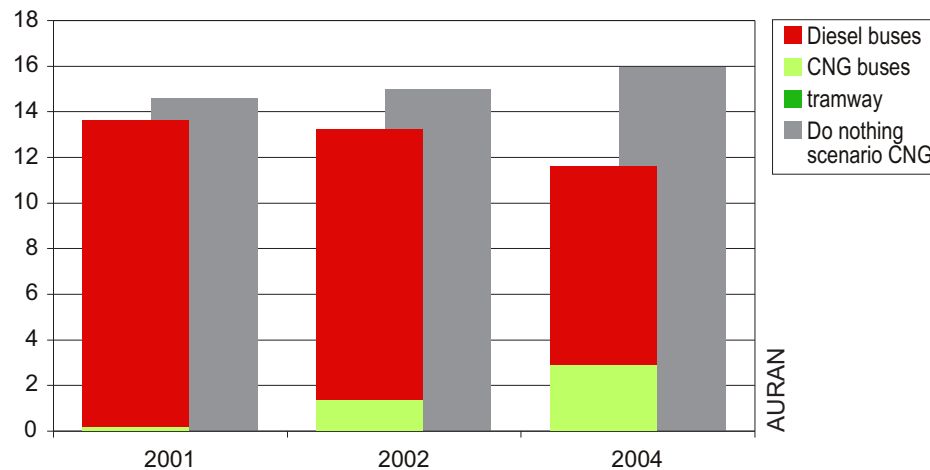
Global network	2001	2002	2004
CNG standards	729 060	9 661 278	20 197 211
CNG articulated	-	-	807 583
Diesel standards	32 462 550	28 488 779	24 009 136
Diesel articulated	11 403 939	10 241 707	4 422 437
tramway	-	-	-
CNG buses	729 060	9 661 278	21 004 794
Diesel buses	43 866 490	38 730 486	28 431 573
total buses	44 595 549	48 391 764	49 436 367
total clean	729 060	9 661 278	21 004 794
total network	44 595 549	48 391 764	49 436 367

Do Nothing CNG, Carbon monoxide (g)

Global network	2001	2002	2004
CNG standards	-	-	-
CNG articulated	-	-	-
Diesel standards	36 199 534	38 658 366	42 645 249
Diesel articulated	11 403 939	10 241 707	9 427 405
tramway	-	-	-
CNG buses	-	-	-
Diesel buses	47 603 474	48 900 074	52 072 654
total buses	47 603 474	48 900 074	52 072 654
total clean	-	-	-
total network	47 603 474	48 900 074	52 072 654

Non-methane hydrocarbons emissions have decreased by 14.7% between 2001 and 2004 (see fig below). This would have been an increase of 9.4% with diesel buses on all the bus routes. In case of diesel buses, non-methane hydrocarbons emissions would have been increased by 37.2% compared to the current situation.

Figure 2.9.18-25 Hydrocarbons (tons)



Hydrocarbons (g)

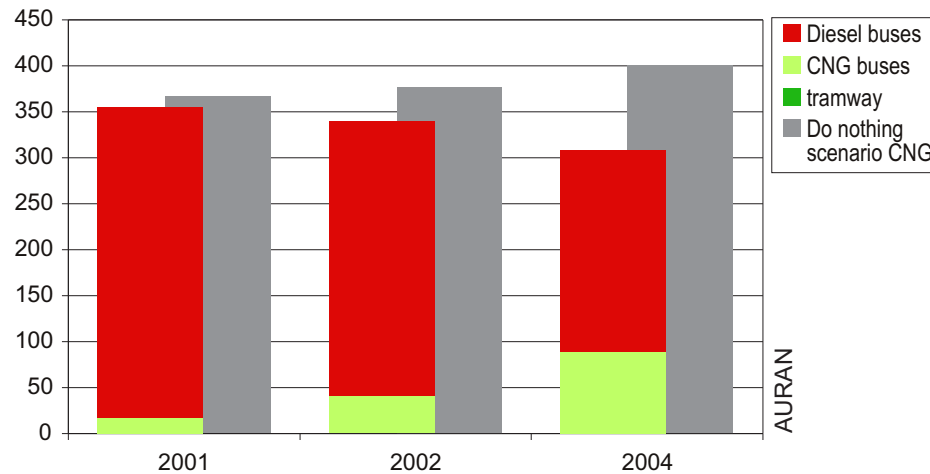
Global network	2001	2002	2004
CNG standards	187 473	1 346 285	2 711 506
CNG articulated	-	-	207 664
Diesel standards	9 944 876	8 727 515	7 355 180
Diesel articulated	3 493 588	3 137 539	1 354 810
tramway	-	-	-
CNG buses	187 473	1 346 285	2 919 170
Diesel buses	13 438 464	11 865 054	8 709 990
total buses	13 625 937	13 211 339	11 629 160
total clean	187 473	1 346 285	2 919 170
total network	13 625 937	13 211 339	11 629 160

Do Nothing CNG, Hydrocarbons (g)

Global network	2001	2002	2004
CNG standards	-	-	-
CNG articulated	-	-	-
Diesel standards	11 089 699	11 842 960	13 064 338
Diesel articulated	3 493 588	3 137 539	2 888 078
tramway	-	-	-
CNG buses	-	-	-
Diesel buses	14 583 286	14 980 499	15 952 416
total buses	14 583 286	14 980 499	15 952 416
total clean	-	-	-
total network	14 583 286	14 980 499	15 952 416

Nitrogen oxides emissions have decreased by 13.3% between 2001 and 2004 (see fig below). This would have been an increase of 9.4% with diesel buses on all bus routes. In case of diesel buses, nitrogen oxides emissions would have been increased by 30.4% compared to the current situation.

Figure 2.9.18-26 Nitrogen oxide (tons)



Nitrogen oxide (g)

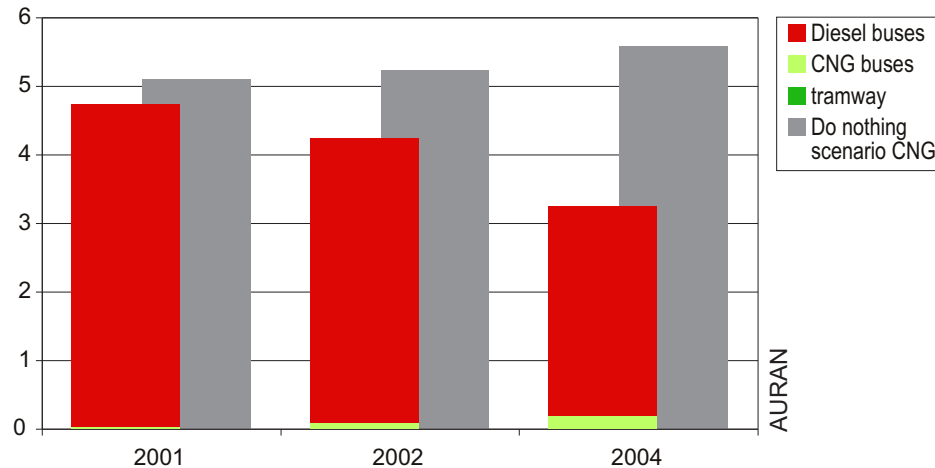
Global network	2001	2002	2004
CNG standards	16 664 226	41 293 368	70 084 531
CNG articulated	-	-	18 459 030
Diesel standards	249 910 108	219 318 377	184 832 235
Diesel articulated	87 792 232	78 844 890	34 045 748
tramway	-	-	-
CNG buses	16 664 226	41 293 368	88 543 560
Diesel buses	337 702 340	298 163 267	218 877 982
total buses	354 366 567	339 456 635	307 421 543
total clean	16 664 226	41 293 368	88 543 560
total network	354 366 567	339 456 635	307 421 543

Do Nothing CNG, Nitrogen oxide (g)

Global network	2001	2002	2004
CNG standards	-	-	-
CNG articulated	-	-	-
Diesel standards	278 678 955	297 608 057	328 300 729
Diesel articulated	87 792 232	78 844 890	72 576 052
tramway	-	-	-
CNG buses	-	-	-
Diesel buses	366 471 188	376 452 947	400 876 781
total buses	366 471 188	376 452 947	400 876 781
total clean	-	-	-
total network	366 471 188	376 452 947	400 876 781

Particulate emissions have decreased by 31.5% between 2001 and 2004 (see fig below). This would have been an increase of 9.4% with diesel buses on all bus routes. In case of diesel buses, emissions would have been increased by 70.1% compared to the current situation.

Figure 2.9.18-27 Particles (tons)



Particles (g)

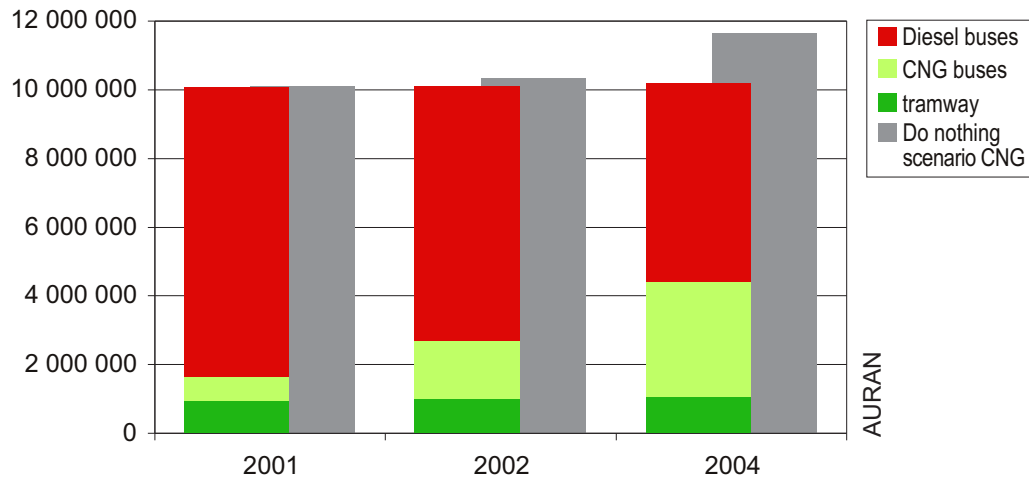
Global network	2001	2002	2004
CNG standards	31 245	91 377	161 837
CNG articulated	-	-	34 611
Diesel standards	3 478 130	3 052 369	2 572 407
Diesel articulated	1 221 851	1 097 326	473 833
tramway	-	-	-
CNG buses	31 245	91 377	196 447
Diesel buses	4 699 981	4 149 695	3 046 240
total buses	4 731 226	4 241 072	3 242 687
total clean	31 245	91 377	196 447
total network	4 731 226	4 241 072	3 242 687

Do Nothing CNG, Particles (g)

Global network	2001	2002	2004
CNG standards	-	-	-
CNG articulated	-	-	-
Diesel standards	3 878 522	4 141 968	4 569 134
Diesel articulated	1 221 851	1 097 326	1 010 079
tramway	-	-	-
CNG buses	-	-	-
Diesel buses	5 100 372	5 239 294	5 579 213
total buses	5 100 372	5 239 294	5 579 213
total clean	-	-	-
total network	5 100 372	5 239 294	5 579 213

Global social cost, including energy and pollutant emissions, has only increased by 1.1% between 2001 and 2004 (see fig below). This would have been an increase of 15.6% with diesel buses on all bus routes. In case of diesel buses, global social cost would have been increased by 14.4% compared to the current situation.

Figure 2.9.18-28 Global social cost (euros)



Global social cost (euros)

Global network		2001	2002	2004
energy	tramway	929 500,00 U	989 450,00 U	1 062 050,00 U
	CNG buses	474 371,11 U	1 089 326,28 U	2 060 671,12 U
	diesel buses	4 218 719,35 U	3 675 358,00 U	3 050 221,98 U
GHG	tramway	- U	- U	- U
	CNG buses	96 298,40 U	245 619,33 U	526 927,74 U
	diesel buses	823 158,16 U	726 780,65 U	533 520,72 U
CO	tramway	- U	- U	- U
	CNG buses	2,55 U	33,81 U	73,52 U
	diesel buses	153,53 U	135,56 U	99,51 U
NMHC	tramway	- U	- U	- U
	CNG buses	374,95 U	2 692,57 U	5 838,34 U
	diesel buses	26 876,93 U	23 730,11 U	17 419,98 U
NOx	tramway	- U	- U	- U
	CNG buses	136 646,65 U	338 605,62 U	726 057,20 U
	diesel buses	2 769 159,19 U	2 444 938,79 U	1 794 799,46 U
Particles	tramway	- U	- U	- U
	CNG buses	3 965,04 U	11 595,69 U	24 929,16 U
	diesel buses	596 427,59 U	526 596,29 U	386 567,85 U
total	tramway	929 500,00 U	989 450,00 U	1 062 050,00 U
	CNG buses	711 658,71 U	1 687 873,30 U	3 344 497,08 U
	diesel buses	8 434 494,75 U	7 397 539,39 U	5 782 629,50 U
total		10 075 653,46 U	10 074 862,69 U	10 189 176,57 U

Table 2.9.18-9 Do Nothing CNG

Do Nothing CNG, Global social cost (euros)

Global network		2001	2002	2004
energy	tramway	929 500,00 0	989 450,00 0	1 062 050,00 0
	CNG buses	- 0	- 0	- 0
	diesel buses	4 578 111,86 0	4 640 408,48 0	5 586 506,02 0
GHG	tramway			
	CNG buses			
	diesel buses	893 282,96 0	917 613,76 0	977 147,49 0
CO	tramway			
	CNG buses			
	diesel buses	166,61 0	171,15 0	182,25 0
NMHC	tramway			
	CNG buses			
	diesel buses	29 166,57 0	29 961,00 0	31 904,83 0
NOx	tramway			
	CNG buses			
	diesel buses	3 005 063,74 0	3 086 914,17 0	3 287 189,60 0
Particles	tramway			
	CNG buses			
	diesel buses	647 237,23 0	664 866,36 0	708 002,12 0
total	tramway	929 500,00 0	989 450,00 0	1 062 050,00 0
	CNG buses	- 0	- 0	- 0
	diesel buses	9 153 028,98 0	9 339 934,91 0	10 590 932,32 0
total		10 082 528,98 0	10 329 384,91 0	11 652 982,32 0

Rezé gas station

The implementation of a new gas station at the Trentemoult depot was a necessary addition. The only difference between the first gas station at the St Herblain depot and the new one was the implementation mode: For the first Gas station there was a contract with the GN-Vert company; The second was built and owned by Nantes Métropole who had contracts with electricity and gas suppliers.

The evaluation of the new station is based on a comparison of energy costs between the current situation and a “do nothing scenario” (in which the second gas station would be: under contract with GN-Vert). This comparison is summarised in following table.

Table 2.9.18-10 Rezé power gas station evaluation

Current situation

	2001	2002	2004
total CNG standards	474 371,11 0	1 089 326,28 0	1 418 018,51 0
total CNG articulated	- 0	- 0	372 652,61 0
total Diesel standards	3 121 981,94 0	2 703 463,64 0	2 575 770,01 0
total Diesel articulated	1 096 737,41 0	971 894,36 0	474 451,96 0
tramway	929 500,00 0	989 450,00 0	1 062 050,00 0
total GNG (*)	474 371,11 0	1 089 326,28 0	2 060 671,12 0
total Diesel	4 218 719,35 0	3 675 358,00 0	3 050 221,98 0
total bus	4 693 090,47 0	4 764 684,27 0	5 110 893,10 0
total clean	1 403 871,11 0	2 078 776,28 0	3 122 721,12 0
total network	5 622 590,47 0	5 754 134,27 0	6 172 943,10 0

* with Rezé power gas station depreciation

“Do nothing scenario” Rezé power gas station

	2001	2002	2004
total CNG standards	474 371,11 0	1 089 326,28 0	1 669 651,31 0
total CNG articulated	- 0	- 0	472 585,35 0
total Diesel standards	3 121 981,94 0	2 703 463,64 0	2 575 770,01 0
total Diesel articulated	1 096 737,41 0	971 894,36 0	474 451,96 0
tramway	929 500,00 0	989 450,00 0	1 062 050,00 0
total GNG	474 371,11 0	1 089 326,28 0	2 142 236,66 0
total Diesel	4 218 719,35 0	3 675 358,00 0	3 050 221,98 0
total bus	4 693 090,47 0	4 764 684,27 0	5 192 458,63 0
total clean	1 403 871,11 0	2 078 776,28 0	3 204 286,66 0
total network	5 622 590,47 0	5 754 134,27 0	6 254 508,63 0

In the current situation, energy costs increased by 9.8% between 2001 and 2004; In the “do nothing scenario”, energy cost increase by 11.2%. The difference between the current situation and the “do nothing scenario” is only 1.3% in favour of the current situation.

Impacts on patronage, customers and population

Patronage has increased by 15.7%, on urban public transport, between 2001 and 2004 (see Table 2.9.18-11). But, if the tramlines have increased by 32.6%, patronage of the bus network has decreased by 1.4%.

Table 2.9.18-11 Patronage evolution

Patronage					
SEMUTAN source					
	2001	2002	2004	2001-2004 evolution	
all routes	81 471 000	83 872 000	94 231 000	12 760 000	15,7%
tramlines	40 966 900	45 024 600	54 302 200	13 335 300	32,6%
bus routes	40 504 100	38 847 400	39 928 800	-575 300	-1,4%

Excluding the case of bus route 40, (which is different because it was replaced by the extension of the tramline 3 in April 2004), only three bus routes operated with CNG buses have seen their patronage decreasing between 2001 and 2004 (see Table 2.9.18-12). Globally, the 26 bus routes currently operated with CNG buses have increased their patronage by 7.2% representing close to 1.5 million trips.

Table 2.9.18-12 Patronage evolution on CNG buses routes

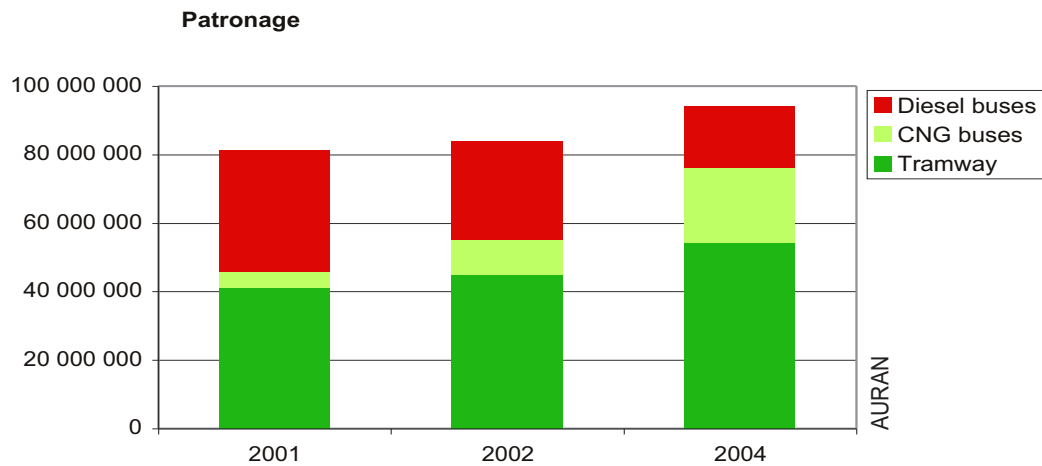
Patronage					
SEMITAN source					
Route	2001	2002	2004	2001-2004 evolution	
11	1 345 948	1 310 068	1 389 797	43 849	3,3%
21	1 807 901	1 871 012	1 912 052	104 151	5,8%
24	866 614	848 147	901 798	35 184	4,1%
25	1 552 911	1 622 083	1 659 426	106 515	6,9%
26	807 964	849 616	817 023	9 059	1,1%
27	402 592	394 430	431 639	29 047	7,2%
28	926 255	869 534	853 548	-72 707	-7,8%
29	594 910	610 304	627 977	33 067	5,6%
31	1 074 777	1 058 142	1 099 009	24 232	2,3%
32	1 763 535	1 859 792	2 207 228	443 693	25,2%
36	606 313	588 525	654 043	47 730	7,9%
38	270 069	259 640	299 606	29 536	10,9%
39	194 926	173 769	196 109	1 184	0,6%
40	568 678	589 688	**	**	**
37	315 116	255 785	328 825	13 709	4,4%
51	722 168	660 844	623 867	-98 302	-13,6%
52	1 381 510	1 333 715	1 421 017	39 506	2,9%
54	1 188 260	1 191 984	1 165 360	-22 901	-1,9%
56	1 670 027	1 807 629	1 992 694	322 667	19,3%
58	245 421	274 745	283 828	38 406	15,6%
59	310 736	325 927	343 002	32 266	10,4%
73	370 443	412 301	459 342	88 899	24,0%
79	118 749	139 036	167 750	49 001	41,3%
80	262 683	281 730	331 406	68 724	26,2%
81	746 581	708 095	759 876	13 295	1,8%
87	317 159	349 455	364 619	47 460	15,0%
90	346 260	386 828	377 565	31 305	9,0%
Total	20 778 507	21 032 824	21 668 407	889 900	4,3%
Total without bus route 40	20 209 829	20 443 136	21 668 407	1 458 578	7,2%

Bus route operated with CNG buses
 "ChronoBus" route

Table 2.9.18-13 Clean routes patronage evolution

Patronage			
SEMITAN source			
	2001	2002	2004
tramlines	40 966 900	45 024 600	54 302 200
CNG buses routes	4 823 900	10 150 200	21 668 400
Diesel buses routes	35 680 200	26 697 200	18 260 400
Total urban network	81 471 000	81 872 000	94 231 000
Total clean routes	45 790 800	55 174 800	75 970 600

Figure 2.9.18-29 Patronage evolution



Patronage on clean urban PT routes (tramlines and CNG buses routes), has increased from 56.2% to 80.6% between 2001 and 2004.

Monitoring the impacts

Regular surveys are implemented in the “New SEMITAN quality contracts and improvement of PT perceived quality” process (see 3.2.1.2.2). Comments about the qualities of the new CNG buses include:

- More comfortable
- Less noise
- Less vibrations
- No black smoke
- No bad smell

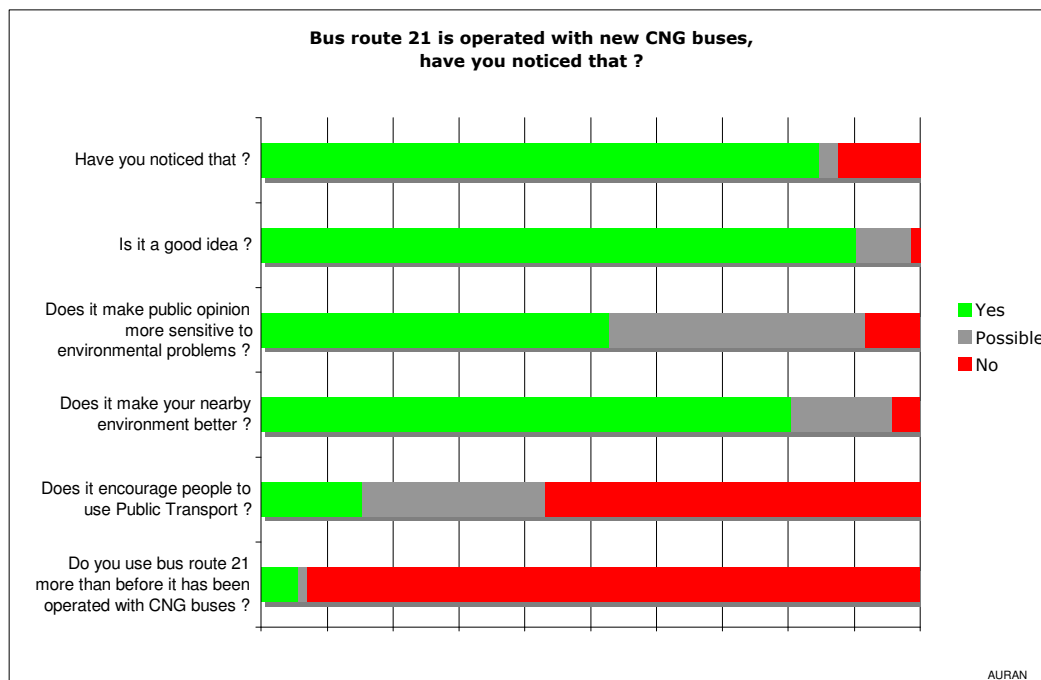
One of these surveys involved, 72 customers of bus route 21, who are familiar with the situation before and after the introduction of new CNG buses on the route.

Answers provided to question 1 of the survey show that the majority of customers have noticed the implementation of new CNG buses and they think that it was a good idea, notably for environmental reasons. But it is not the vehicle type that makes them use more public transport. For passengers it is the high frequency of buses provided on route 21 and good accessibility from the bus stops, which encourage them to use public transport more.

Table 2.9.18-14 Bus route 21 customers survey – Question 1

Bus route 21 is operated with new CNG buses, have you noticed that ?				
SEMATAN source				
	Yes	No	Possible	Total
Have you noticed that ?	61	9	2	72
Is it a good idea ?	65	1	6	72
Does it make public opinion more sensitive to environmental problems ?	38	6	28	72
Does it make your nearby environment better ?	58	3	11	72
Does it encourage people to use Public Transport	11	41	20	72
Do you use bus route 21 more than before it has been operated with CNG buses ?	4	67	1	72

Figure 2.9.18-30 Bus route 21 customers survey – Question 1

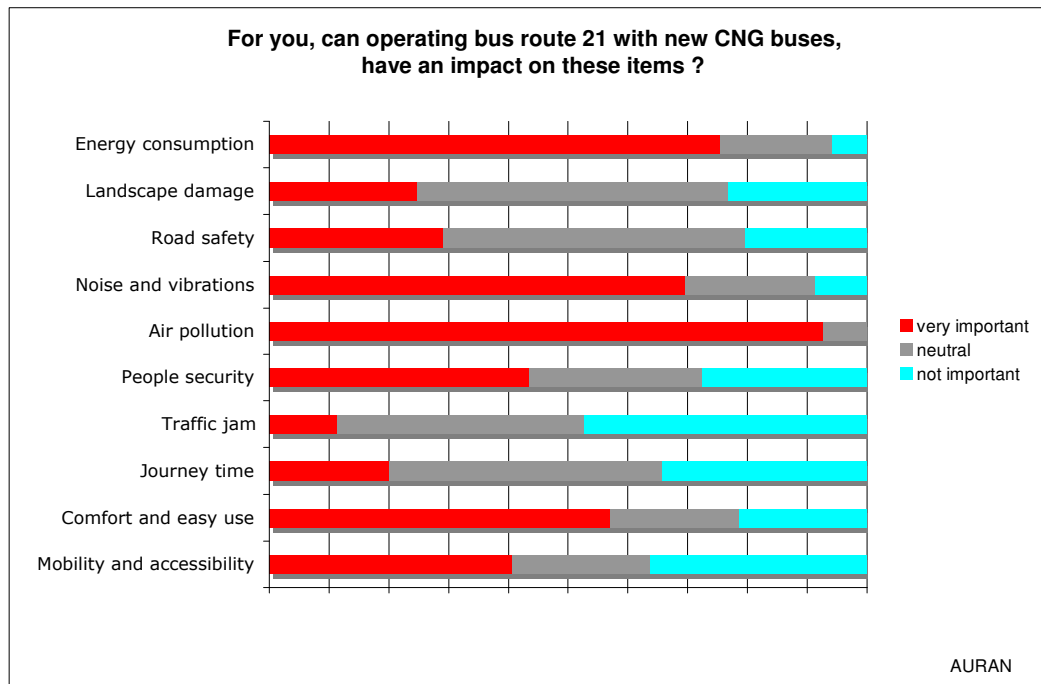


In answer to question 2, passengers of route 21 demonstrate that they are well informed: with low-floor buses at their service already, they consider that new CNG buses improve their comfort without modification to their accessibility or journey time. For them, best impacts concern air pollution, noise, vibrations and energy consumption. Only a minority of them fear possible gas damage.

Table 2.9.18-15 Bus route 21 customers survey – Question 2

For you, can operating bus route 21 with new CNG buses, have an impact on these items			
SEMİTAN source			
Item	very important	neutral	not important
Mobility and accessibility	28	16	25
Comfort and easy use	40	15	15
Journey time	14	32	24
Traffic jam	8	29	33
People security	30	20	19
Air pollution	64	5	0
Noise and vibrations	48	15	6
Road safety	20	35	14
Landscape damage	17	36	16
Energy consumption	52	13	4

Figure 2.9.18-31 Bus route 21 customers survey – Question 2

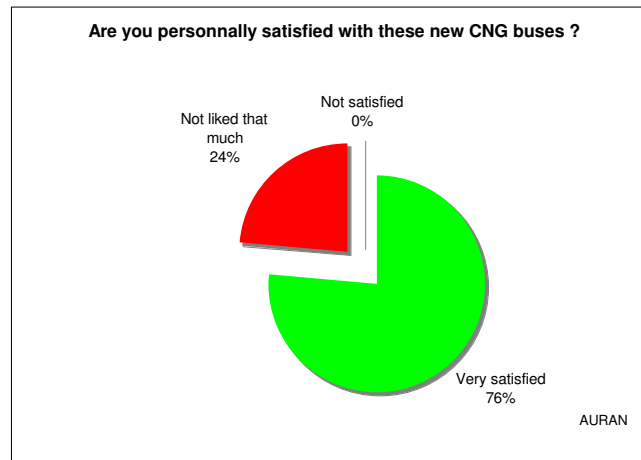


Answers to question 3 shows that no customers are unsatisfied regarding the implementation of CNG buses on route 21. More than three quarters are very satisfied.

Table 2.9.18-16 Bus route 21 customers survey – Question 3

Are you personally satisfied with these new CNG buses ?		
SEMİTAN source		
	Quantity	%
Very satisfied	55	76,39
Not liked that much	17	23,61
Not satisfied	0	0,00
Total	72	100,00

Figure 2.9.18-32 Bus route 21 customers' survey – Question 3

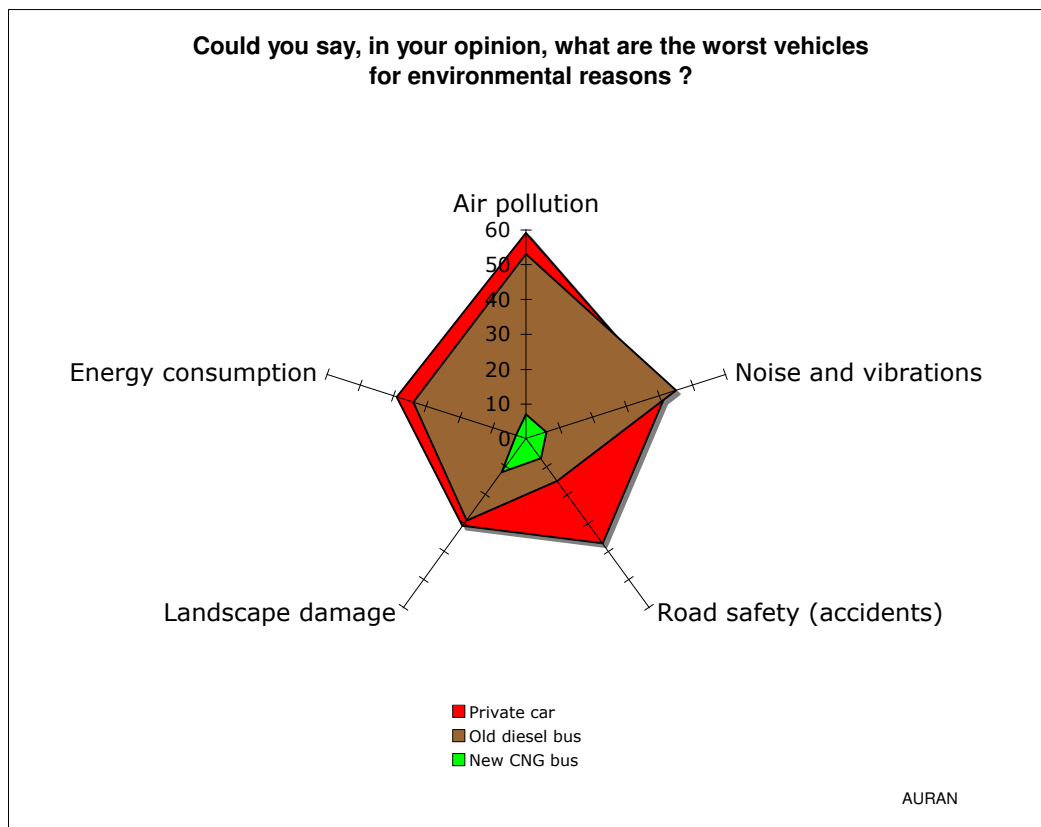


Answers to question 4 show that CNG buses are thought to have low impacts on the environment.

Table 2.9.18-17 Bus route 21 customers survey – Question 4

Could you say, in your opinion, what are the worst vehicles for environmental reasons ?				
SEMITAN source	Private car	Old diesel bus	New CNG bus	Total (multiple answers)
Air pollution	59	53	7	119
Noise and vibrations	42	45	6	93
Road safety (accidents)	37	15	7	59
Landscape damage	31	29	12	72
Energy consumption	39	34	3	76

Figure 2.9.18-33 Bus route 21 customers' survey – Question 4

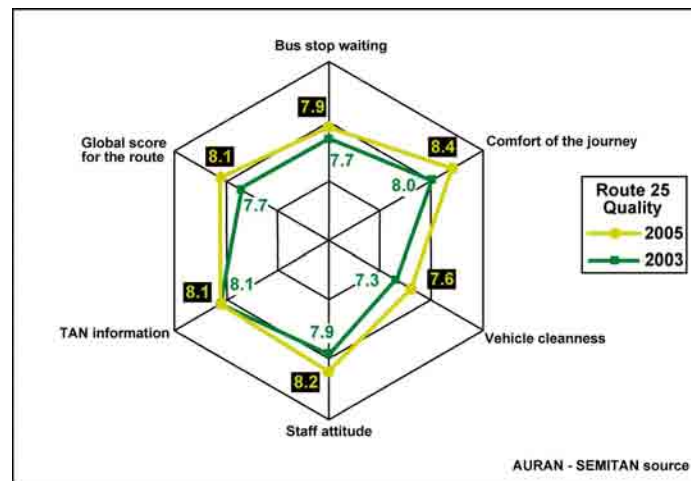


On another hand, “Chronobus” route 25 can be taken as an example of the combined effects of both quality measures and new CNG vehicles: customer satisfaction increased on all criteria. The most spectacular progress concerns the “comfort of the journey” that moves from 8.0 to 8.4, linked with “accessibility” (from 7.0 to 8.4).

Table 2.9.18-18 “Chronobus” route 25 quality evolution

Ligne 25	2005	2003	Comments
Bus stop waiting	7.9	7.7	Relative stability. Appreciable progress for certain criteria: information readability (from 8.4 to 8.8), bus stop cleanliness (from 7.2 to 7.6) waiting time (from 6.8 to 7.2).
Comfort of the journey	8.4	8.0	Appreciable progress. Notably accessibility (from 7.0 to 8.2), simplicity of bus stop identification (from 8,2 to 8,7, impression of security/other passengers (from 8.0 to 8.4) bus inboard information quality (from 8.2 to 8.5)
Vehicle cleanness	7.6	7.3	Significant progress on all criteria.
Staff attitude	8.2	7.9	Linear progress. Relative stability of under-criteria.
TAN information	8.1	8.1	Global stability. Progress on criteria about disrupted situation (+0.3 in both cases)
Global score for the route	8.1	7.7	Noticeable progress of the global satisfaction about the route

Figure 2.9.18-34 “Chronobus” route 25 quality evolution



To conclude, these surveys and other analysis show that of the new customers of CNG bus, 5% previously travelled by car; 20% of new tram customers previously travelled by car. From an environmental point of view, if It is assumed that an average journey for ex-car users were about 5 km long, with a CO₂ emission of around 140g/km, there Is a saving of 1,918 tons of greenhouse gases, between 2001 and 2004. This is more than the evaluated difference between the new CNG buses and a “do nothing” scenario. So It can be said that the global greenhouse gasbalance sheet is correct.

Impacts on SEMITAN operation

Beyond the issues encountered with drivers about the new CNG VOLVO 7000 (see above), driver and technical staff training is easier.

Problems encountered with new CNG buses are under manufacturer's guarantee, and only the first thirty GX217 bought between 1998 and 2000 give an appreciation of CNG vehicle maintenance, it seems a little bit more expansive than for diesel. But this may change over time for the following reasons:

- CNG engines continue to be more reliable
- Engine parts will become cheaper
- SEMITAN CNG knowledge is improving
- The continued growth of the fleet. Nantes Métropole continues to buy CNG buses, over the existing fleet (191 units today): about 60 units more in the year 2008).

Synthesis

Measures implemented under Integrated Package 1 have permitted:

- To be on the way to reach local objective L.O. 1.1, to have 70% of mileage and 90% of trips made with non-polluting vehicles, by the end of 2005. At the end of 2004 the results on these indicators were respectively 54.8% and 80.6%. The Tramline 2 extension and CNG bus purchasing currently scheduled (60 units) will allow this objective to be reached.
- To renew the bus fleet with 161 new CNG buses purchased. The local objective L.O. 1.2 to buy 155 new CNG buses has been surpassed.
- To be close to the local objective L.O. 1.3 to have an average bus fleet age less than 5 years, at the end of VIVALDI project. At the end of 2004 the average bus fleet age was 5.5 years, and the CNG buses purchasing currently scheduled (60 units) will surely allow reaching this objective.

New CNG buses have also permitted increases in patronage in combination with other measures about street layouts, PT fares. But they have also permitted the reduction of pollutant emissions of the fleet, especially for non methane hydrocarbons, nitrogen oxides and particulates which are very bad for health. Greenhouse gas emission growth has been compensated by the observed modal shift, which has increased with car traffic reduction since spring 2005.

2.9.19 Nantes – Soft measures

Overview of package

All these measures aim to increase the use of collective modes and soft modes (company mobility plans, cycle and ride). The main targets are commuters (especially for the parking policy and the company mobility plans) but also visitors and residents. Overall, the main objective of the Urban Mobility Plan approved in 2000 by Nantes Métropole representatives is to have a better modal split in favour of public transport and soft modes in 2010. The ambition is to reach the following modal split (LO 2.1):

- 18% public transport in 2010 (vs. 14.8% in 1998),
- 50% private car (vs. 57,0% in 98),
- 32% walking and cycling.

Table 2.9.19-1 Local objectives vs. VIVALDI objectives

Local Objectives	VIVALDI Objectives
LO 2.1 : 18,0% public transport market share in 2010 (vs. 14.8% in 98) 50,0 % private car market share (vs. 57,0% in 98) 32,0 % walking and cycling market share	VT4 : Reduce car traffic in managed area by 10% VT9 : Increase patronage on key corridors by 20% VT18 : Increase cycle trips by 30% VT19 : Increase walking trips by 10%
LO 2.2 : Obtain a “service certification” for 6 bus routes under NF EN 13816 standard. By the end of 2008 80% of SEMITAN customers will travel on certified routes	VT10 : Increase access to PT system
LO 2.3 : UCN mobility plan: increase PT use from 20% to 30% and decrease the car share from 65% to 50%	VT9 : Increase patronage on key corridors by 20% VT18 : Increase cycle trips by 30% VT19 : Increase walking trips by 10% VT20 : Travel plans in all organization in target areas
LO 2.4 : Parking policy : to have a better use of car park spaces (with a better turn-over with visitors and no commuters)	
LO 2.5 : Parking policy : to suppress car park spaces for other modes and public spaces	VT7 : Reduce parking space in area by 10% VT15 : Regain urban space by replacing about 1000 private cars
LO 2.6 : Parking policy : to promote the residential parking and use of soft modes and public transport by downtown inhabitants	VT9 : Increase patronage on key corridors by 20% VT18 : Increase cycle trips by 30% VT19 : Increase walking trips by 10%
LO 2.7 : Parking policy : to increase the frequentation of park and ride and public transport system, especially by commuters and visitors	VT9 : Increase patronage on key corridors by 20% VT18 : Increase cycle trips by 30%
LO 2.8 : Parking policy : modal share under 50% car's users for commuters	

2.9.19.1 Nantes – Marketing and travel awareness campaigns (8.6)

Through an annual marketing and communication plan, SEMITAN regularly communicates with existing and potential public transport customers. Despite the diversity of the communication themes that must be covered, SEMITAN pays attention to “brand management” and regularly controls the effects of the communication actions on the image of the service among the public.

Within VIVALDI, three marketing and travel awareness campaigns are directly linked with the development of “Chronobus” routes or new CNG vehicles, the implementation of the railway link in the southeast area, and with the fare strategy facilitating hard measures implemented on VIVALDI areas (i.e. annual fare for students)

The main participants are SEMITAN and Nantes Métropole. The target groups are students, commuters and residents concerned by new fares and new bus route concept: “Chronobus”. Target groups are defined action per action.

Launch of a new student annual fare: the “PassCampus”

Before 2002, frequent users could only purchase a monthly ticket, associated to a personal card. Personal cards were available at all SEMITAN selling points and monthly tickets had to be purchased each calendar month from retailers, SEMITAN selling points and automatic machines. The number of monthly tickets sold to students

has decreased since 1996. The period between 2000 and 2002 also showed a decrease, as shown on the figures below.

Figure 2.9.19-1 Campus monthly tickets sales – Evolution 1992-2000

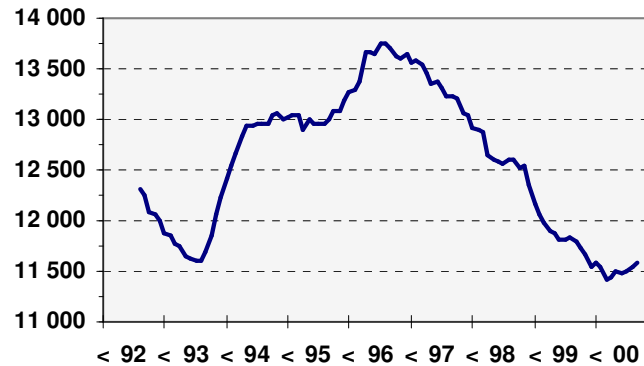
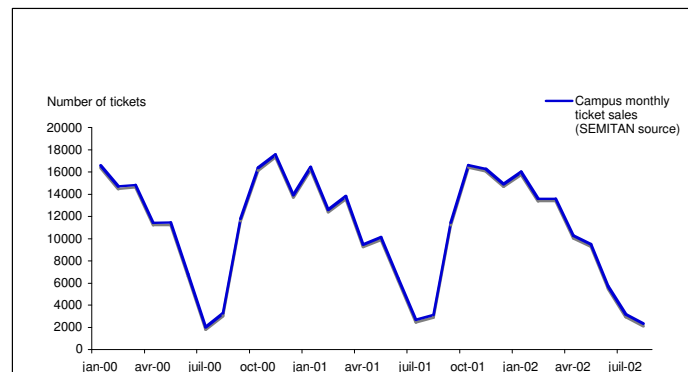


Figure 2.9.19-2 Campus monthly tickets sales – Evolution 2000-2002



The decision to implement an annual fare was taken at the end of 2001, in liaison with Nantes Métropole’s decision to remodel the Tertre Campus site. Technical aspects were prepared early 2002 (procurement of new card, preparation of electronic registration of customer names).

Figure 2.9.19-3 Pass Campus card



In the case of the “PassCampus”, the target groups were students (18 to 26 years old) already going to university, and “A level” pupils preparing for their arrival at university in the new school year. Participants involved were SEMITAN marketing service, sales

and information service, partners linked with youth information (CRIJ, CROUS), other partners willing to promote their own services (i.e. FNAC), and advertising agency Nouvelle Vague, under contract with SEMITAN for a 4-year period (2001-2004).

The objectives are:

- An easier life for customers,
- Avoid a monthly trip to purchase the ticket,
 - Opportunity to buy through mail,
 - A choice of payment method (standing order or cash),
 - Automatic renewal,
- Specific advantages,
 - First subscription gifts,
 - Reduction in costs of other city services (golf, pool, cinema...),
 - Partnership with other economic partners (banks, cinemas...
- A feeling of individualized relationship,
 - Usual bus routes and timetables sent directly to homes,
 - Information sent to homes in case of long term modification of bus or tram routes,
 - Invitation to specific operations or dedicated surveys.

The first promotion campaign of the “PassCampus” has been carried out following the schedule showed on Table 2.9.19-2, between July and October 2002.

Table 2.9.19-2 PassCampus 2002 Promotion schedule

Medias	July	Aug	Sept	Oct
Posters and bill boards				
In universities and engineers schools				
During all school term start				
Where student live, eat, sleep (CRIJ, CROUS, RU, Cité U)				
In buses and trams				
Leaflets				
Distributed by hostess in University & scientific and business schools				
Displays in main students life space (CRIJ, CROUS, RU, cité U)				
Transports centre near Commerce station				
Information clients TAN				
Summer Tan express				
Proposition of combining PassCampus and FNAC card for students				
Press				
Press articles PresseOcean, OuestFrance, Nantes Passion,				
Radio reports and interviewees (NRJ, Fun, Chérie,Prun',RFLO)				
Editorial advertising: (l'Indic)				
Press ads in students « going out » press: Puslomatic (30 000 ex) et Kinorama (10000 ex)				
Other measures				
Advertising paper towels in University restaurants				
Stands TAN (Student-forum)				
Sweepstake on Radio Prun': 3 PassCampus/ FNAC card to win				
Partnerships				

Medias	July	Aug	Sept	Oct
FNAC (FNAC card offered with PassCampus)				
Sweepstake on Radio Prun'				

In 2003, these activities were undertaken, including a mail-shot to invite previous annual fare-holders to renew with the new PassCampus. This process was carried out again in 2004, following the schedule in Table 2.9.19-3.

Table 2.9.19-3 PassCampus 2002 Promotion schedule

Medias	June				July				August				September				October			
Posters																				
- Universities and schools																				
- Student life places																				
- Buses and trams																				
- Tram stations																				
Leaflets																				
- Distribution on sites																				
- Displays in student life places																				
- Displays in SEMITAN info centres																				
Direct marketing																				
- Mailings to previous holders																				
Press																				
- Articles after press conferences																				
- Pulsomatic ads																				
- Kinorama ads																				
- Programme Scopitone ads																				
Others																				
Paper towels in University restaurants																				
Partnerships																				
FNAC																				
Gaumont-Pathé																				
N.G.E																				
Société Générale																				
Olympic																				

Figure 2.9.19-4 Examples of mailing and flyer for PassCampus



Figure 2.9.19-5 Examples of additional benefits: Partnership or gifts offered in return for subscription



Evaluation Results - The PassCampus

Increasing and winning the loyalty of student-customers

Campus monthly ticket sales have been decreasing for several years. The launch of the new yearly ticket PassCampus, in September 2002, has not changed this trend, but the cumulated sales of yearly and monthly tickets for students have once again started to grow.

Figure 2.9.19-6 PassCampus and Campus monthly tickets sales

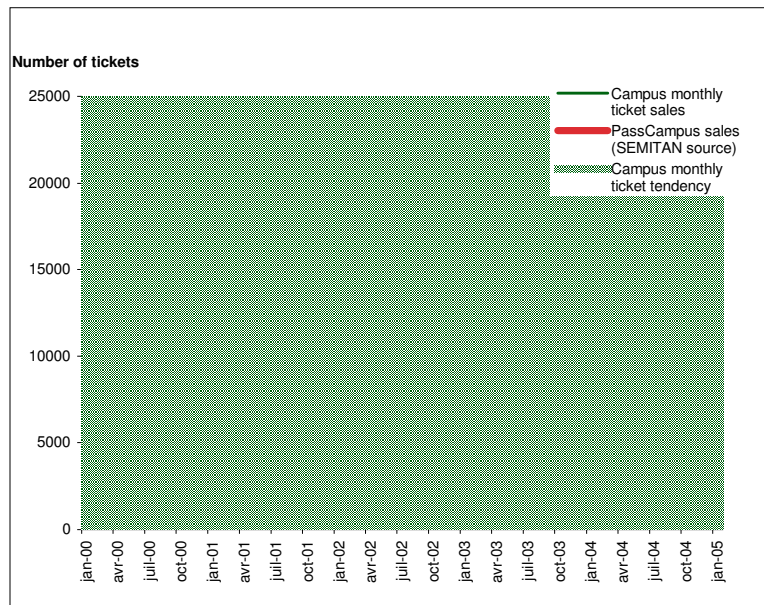
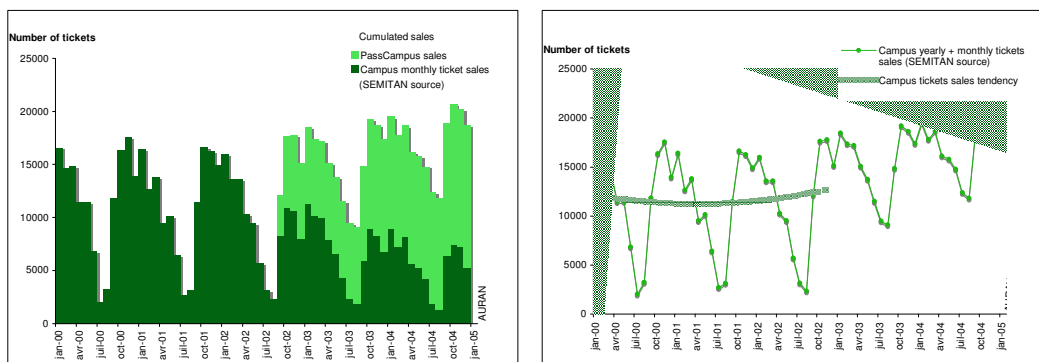


Figure 2.9.19-7 Campus tickets cumulated sales



Urban public transport network customers, with a Campus yearly or monthly ticket total of around 20,000 at the end of 2004. They represent 43% of the total student population in Nantes (47,000 students). An analysis of the 11,834 PassCampus sold in September 2004 showed:

- 1,555 have been customers since 2002 (22% of the 7,176 recorded in 2002)
- 3,371 have been customers since 2003 (33% of the 10,295 recorded in 2003)
- 452 were moving from a previous PassRapido (for A level pupils) offer
- 6,456 were new subscribers in 2004

Campus monthly ticket sales looked cyclical: there is a big difference between autumn and winter sales compared to summer sales. Beyond the increase of student customers, PassCampus has permitted to win their loyalty and in the same way, to decrease fare evasion (see below). PassCampus is thought to have increased the targeted customers by about a third.

Geographical examination of PassCampus holders' homes shows that the majority lived within the ring road in 2003, but that the locational spread of holders continues to grow.

Figure 2.9.19-8 PassCampus holders geographical repartition (2003)

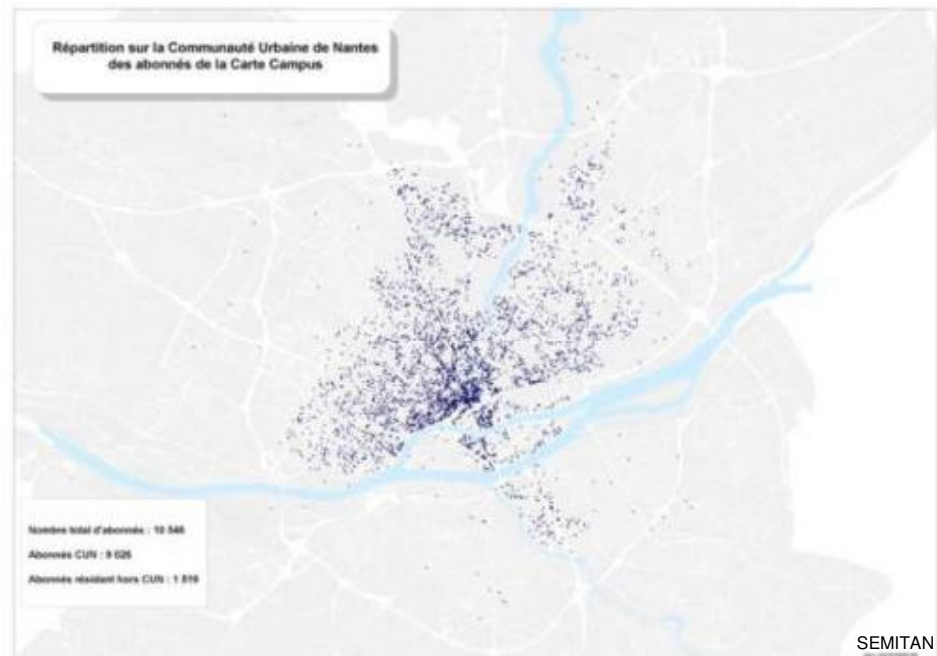
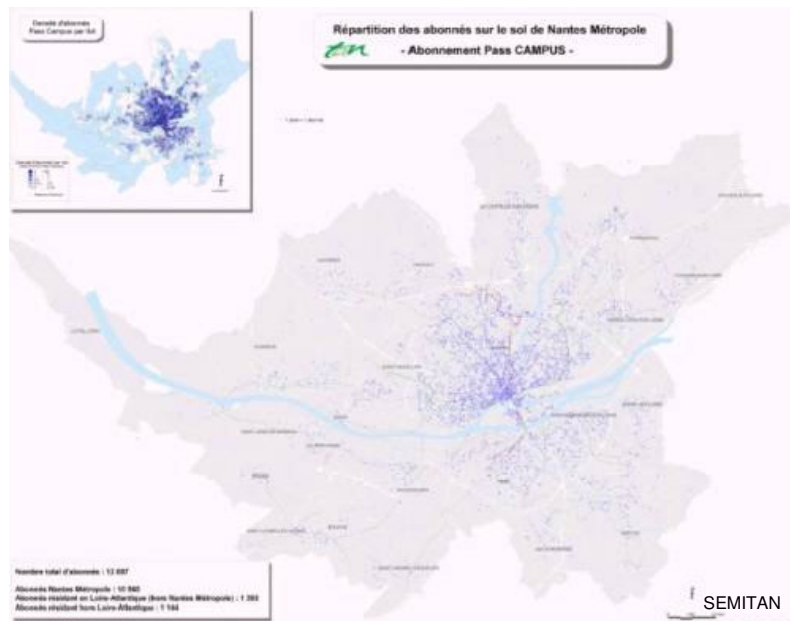


Figure 2.9.19-9: PassCampus holders geographical repartition (2004)



Impact on car usage

A survey has been conducted among students located on campus areas (66 on Chantreterie campus and 142 on Tertre campus). 48% were PassCampus holders. A very large majority of them were located on the Tertre campus area. Among those PassCampus fare holders, 48% have direct access to a private car and do not use their cars less regularly than before the PassCampus began. Altogether, the car trips number in yearly Pass holders' population has decreased by 6%.

Fare evasion

Permanent and easy access to the PT network combined with payment facilities offered with the PassCampus, form a part of the fare strategy to limit fare evasion. The fraud rate is calculated annually through a field survey. The sample is composed of typical trips on the network, and all customers are asked to present their ticket to surveyors. Between 2000 and 2003, the fraud rate has been divided between three groups for young customers:

- From 15% to 5% for 16-18 year-olds
- From 13% to 4.7% for under 16 year-olds

And divided by 2 for the older customers:

- From 19% to 8% for 19-25 year-olds
- From 13% to 6.5% for 26-39 year-olds

New distribution channels

Nantes urban public transport network now integrates many annual fares: PassPrimo for young pupils, PassRapido for schoolboys and high school pupils, PassCampus for students, PassDiamant for old people, and PassPartout for the others.

New annual fares like PassCampus have obliged SEMITAN to integrate tasks that they previously undertook themselves. They have to go to retailers or ticket machines to buy or to renew their ticket. Now, just before the Pass' anniversary date, previous holders receive a proposal of re-subscription for the next year at home. The procedure is simple, papers are pre-filled and if no changes have occurred, customers only have to sign and

send back their contract. Using the database, SEMITAN can identify if the customer is in situation to change status. In this case, the mail contains the proposal for the next annual fare available (PassCampus proposed to high school pupils who previously used PassRapido, PassPartout proposed to over 26 years-old people who previously used PassCampus).

It was important, for SEMITAN, to be able to meet the demand of card production in a short time scale. A “distant selling office”, dealing with mail orders, has been created to carry out this requirement. The creation of this new office enables a split in the charges between SEMITAN distribution channels, as shown in the following table (situation in September 2005).

Table 2.9.19-4 SEMITAN annual fares distribution channels

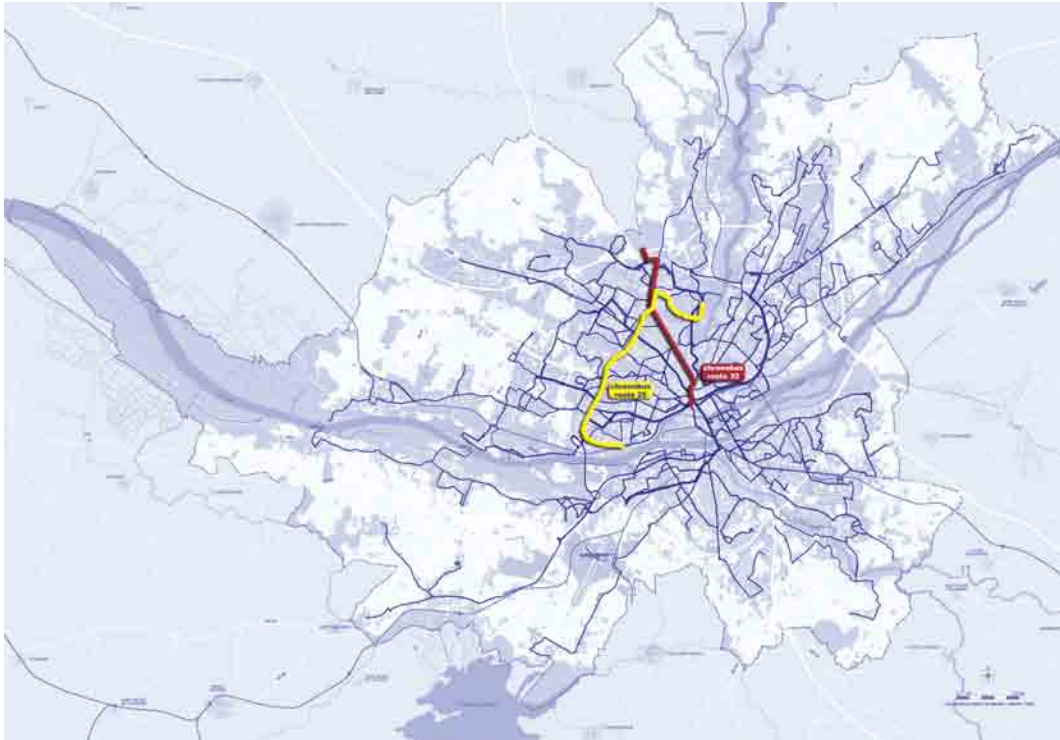
Mail order office	City tickets and information shops
PassPrimoRapido (during summer time)	
Proposal to existing PassCampus (summer)	New PassCampus customers (September-October)
From Pass Campus to PassPartout	New PassPartout customers (in real time)
People over 65 years-old have the choice between both channels	

Each ticket launch (including media plans) represents 25,000 to 30,000 € (including 6,500 to 8,000 € for direct marketing). The new distribution channels implemented required an equivalent of 3 full time jobs.

Creation of a new bus route concept: “Chronobus” on bus routes 25 and 32

The creation of this new concept of “Chronobus” route was to give the passengers of some main bus routes on the urban network a guarantee of frequency, regularity, comfort and short ride time. This required a new kind of buses: CNG buses with low floor, kneeling system and on-board information systems (see above), as well as some changes in the layout of streets: bus lanes, bus priority, staff training for new operating conditions, quality certification, and promotion campaigns.

Figure 2.9.19-10 “Chronobus” routes



Bus route 25

9 articulated buses instead of 10 articulated buses (- 1 units)

Operating range: 6h00 - 20h30

Peak hour frequency: 10'

Figure 2.9.19-11 “Chronobus” route 25 – implementation of reserved bus lanes



Figure 2.9.19-12 “Chronobus” route 25 map



Figure 2.9.19-13 “Chronobus” route 25 – Chantenay terminus



Bus route 32

13 standard buses instead of 11 articulated buses (+ 2 units)

Operating range: 5h00 - 21h00

Peak hour frequency: 6' instead of 9'

Figure 2.9.19-14 “Chronobus” route 32 – implementation of alternate reserved bus lanes



Figure 2.9.19-15 Chronobus” route 25 map



The bus route 32 layouts cost about 115 000 €.

The certification was obtained in January 2003 for the bus route 32, and in January 2004 for bus route 25. The promotion of the new service, planned early for 2003, was implemented from September to October 2003 for the “Chronobus” route 32. The table below shows the schedule for “Chronobus” promotion.

Table 2.9.19-5 Typical schedule for “Chronobus” promotion

	Decision on routes to be certified	Improvement process	Successful certification	Works on street to improve bus traffic	Bus route new version in service
Internal communication	Concerned staff, managers	Regular information on progresses	"Event for the first route and annual gathering for all routes	Drivers	
	M ₀		M ₀ +12		M ₀ +18
Intuitional communication			Locally (i.e. press conference)		Locally + nationally
Promotion and marketing			Level 1: towards existing customers + basic information at stops		Level 2: promotion to non users living on the area

The cost of the advertising campaign for the new “Chronobus” route 32 was 32 000 €.

SEMITAN bought advertising space in local news paper and inserted a specific coloured double page (110 000 copies).

Figure 2.9.19-16 Advertising campaign



A direct marketing campaign concerning around 8,000 people living 300m either side of the “Chronobus” route was undertaken. They each received mail-shot that included a letter, folder, memo-card and a free trial ticket. This action had been inspired by previous TAPESTRY experimentation on bus routes 21-23 in Nantes.

Figure 2.9.19-17 Marketing campaign material



Moreover, SEMITAN used its free advertising locations such as bus directional electronic information and posters on-board buses.

The communication process developed for route 32 was carried out again a year later for route 25.

Evaluation Results - “Chronobus” routes and marketing campaigns

“Chronobus” route 32

The “Chronobus” route 32 has required 13 new CNG standard buses instead of 11 diesel articulated buses previously used, which is 2 units more to provide a new peak hour frequency of 6 units instead of the previous 9 units. Annual run kilometres have increased about 35,000 km (+ 6.9%); driving hours has increased by 6%; and patronage have increased by 25% between 2001 and 2004. There are now about 450,000 trips more each year.

“Chronobus” route 25

The “Chronobus” route 25 has needed only 9 new CNG articulated buses instead of 11 diesel articulated buses previously used, for the same frequency and operating range. So it makes an economy of one unit. This is due to the reserved bus lanes laid out that have permitted better frequency (see below). Patronage has increased by 6.9% between 2001 and 2004. It’s about 110 000 trips more each year.

Regularity and time saved

Real Time Performance Measurement (RTPM) system, with Automatic Location Vehicles (AVL) system and automatic data recording, has been implemented on all tramlines and bus routes. This system allows making measures before and after changing operating conditions. The figures below show how running has changed for “Chronobus” route 32 and route 25.

Figure 2.9.19-18 “Chronobus” route 32 regularity evolution

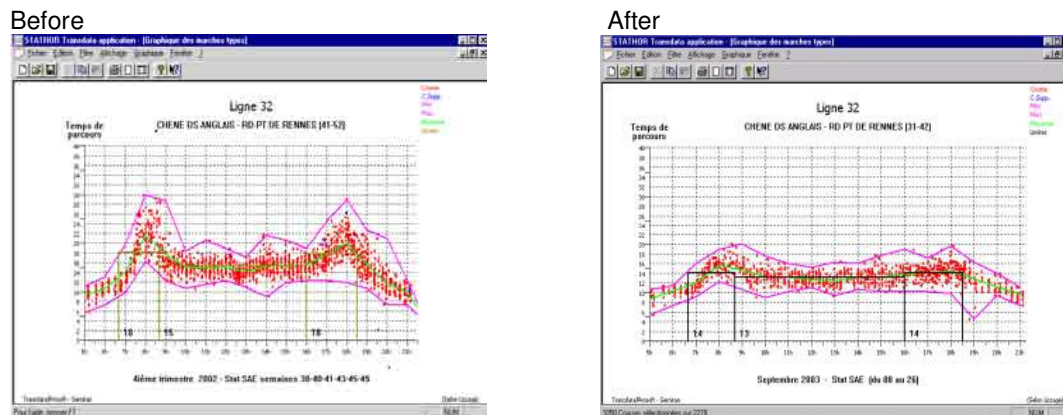


Figure 2.9.19-19 Chronobus” route 25 regularity evolution


As shown in the table below, reserved bus lanes and crossroad bus priorities carried out between 2001 and 2004, have permitted the “Chronobus” routes to save time on each journey during peak hours: around 7 minutes for route 32, and around 11 minutes for route 25. For these two routes, average journey times during off-peak hours are less than a half hour.

Table 2.9.19-6 Journey time evolution

Journey time SEMITAN source						
bus route	2001		2002		2004	
	Morning peak-hour way1 - way2	Evening peak-hour way1 - way2	Morning peak-hour way1 - way2	Evening peak-hour way1 - way2	Morning peak-hour way1 - way2	Evening peak-hour way1 - way2
32	34 - 33	40 - 40	32 - 33	40 - 39	27 - 29	33 - 32
25	37 - 42	44 - 50	36 - 40	42 - 48	37 - 36	40 - 39

Perceived quality by customers

Perceived quality is measured with a before-and-after survey. The before-survey at the initialisation of the quality process and the after-survey two years later. The surveys consist of face-to-face interviews, on board or at bus stops, along the routes. The sample size is around 300 people per route, chosen at random with quotas by day (Tuesday, Wednesday, Saturday) and by hour (peak and off-peak). The main results are summarized in the following table.

Table 2.9.19-7 Perceived quality results

Route	Measure implemented	2003 Overall satisfaction and grade	2005 Overall satisfaction and grade	Is the quality of your route better, worse, the same than last year ?	
2 (tram)	Frequency increased between 700 and 900 PM NF certification	95% 7.8	95% 7.8	Same better	88% 8%
12	NF certification	93% 7.6	95% 7.9	Same Better	92% 5%
25	Became Chronobus (1)	89% 7.7	93% 8.1	Same Better	66% 28%
56	NF certification	94% 8.0	98% 7.9	Same Better	72% 27%
32	Became Chronobus	82% 7.6 (2001)	99% 8.3 (2004)	Not asked	

SEMITAN source

“Chronobus” routes have recorded the best progress in perceived quality. Almost all the main criteria are progressing. For example, for bus route 25, the score of “accessibility” criteria increased from 7.0 to 8.2, and “waiting time at the bus stop” from 6.8 to 7.2 (see 3.1.2.3).

2.9.19.2 Nantes – New forms for PT contracts and operations (8.6)

It was anticipated that a high level of satisfaction among customers, would increase customer numbers. Final public transport users were the target group, considering that quality standards and references will give them more confidence in the transport system reliability, and therefore more likely to use public transport services. A three part committee was created, consisting of SEMITAN (P.T. operator), Nantes Métropole (local transport authority) and consumers associations. Auditors were involved in the probation agreement process. Subcontractors were appointed to conduct the “mystery shopper” observation and customers scheduled interviews to measure perceived quality.

Towards new quality contracts and improvement of perceived quality, SEMITAN is implementing, a contractual and customer-oriented process involving a large number of staff. Integrated in the new contract between the operator and the local transport authority since 1995, the process of improving service quality is conducted at different levels:

“Technical quality” maintenance was ISO 9001 approved. Next step was to obtain a “service certification” for bus routes under AFNOR standard NF EN 13.816.

“Contractual quality” service quality is measured to check if the services meet the requirements of the local transport authority. The methods used were: the “mystery shopper’s process” and punctuality and regularity controls through the AVL system.

“Perceived quality” Perceived quality was measured regularly using surveys among regular and occasional customers. New expectations were also identified through this process.

Regular debriefing and training was provided to all staff.

The objective was to have a NF EN 13.816 approval for one route in 2002, and five others by the end of VIVALDI project. By the end of 2008, 80% of SEMITAN customers will travel on certified routes (LO 2.2).

The NF EN 13.816 standard guarantees that welcome service, comfort, equipment availability, information, facility cleanliness, bus and tram cleanliness, service regularity and punctuality, control and safety, are all considered in the scheduled audit by AFAQ / AFNOR CERTIFICATION. Table 2.9.19-8 shows the potential differences between routine indicators used and those required by NF EN 13.816 standard. Most of these indicators are measured through the use of real time performance measurement

(RTMP) with AVL system, automatic data storage or “mystery shopper” surveys (MSS). Table 2.9.19-9 shows the level of references, requirements and objectives to achieve.

Table 2.9.19-8 NF EN 13.816 Standard

Routine indicators used		Standard requirements	
Accuracy of bus timekeeping	Measured in evening peak hour on 1 point	Timekeeping and regularity	Measured all day long and on the whole route
Tramway regularity	Measured on evening peak hour on one point	Timekeeping and regularity	Measured all day long and on whole route
Bus service not supplied	Breakdown, lack of drivers, accidents	Bus reliability	
Tramway service not supplied	Breakdown Lack of drivers Lack of rolling stock Accident	0 0 0 0	
Information	At stop On board vehicle Information shops Telephone information	Id. Id. Info. about service supply Distant info.	
Greeting (welcoming customers)		Drivers attitude and behaviour	
Facilities	On board facilities defined by Direction des Transports Terrestres	Id id	
Cleanliness	Vehicle Tramway stops	Id id	
Comfort/atmosphere	Vehicle charge (evening peak hour) Adapted speed Temperature, light Serenity	Charge rate Driving comfort	All day long
Customers claims		id	

Table 2.9.19-9 Standard References

Indicators	Standard references	Requirement	Objective	Unacceptability
Bus timekeeping	80%	75%	85%	65%
Tramway regularity	Must be better than buses	77%	87%	67%
Rolling stock reliability	99%	98%	99.5%	95%
Fare evasion (control rate)		1.4%	2%	1%
Information	90%	88%	98%	78%

Indicators	Standard references	Requirement	Objective	Unacceptability
Customer welcoming on board	85%	90%	98%	78%
Facilities	90%	90%	98%	80%
Cleanliness	80%	80%	98%	80%
Comfort/atmosphere	Load 80%(bus) 90%(tram) Driving 90%	90%	98%	80%
Customer claims	-	80%	90%	70%

In January 2003, the bus route 32 received NF EN 13.816 approval by AFNOR. The four other routes of the urban P.T. network to be certified during VIVALDI project were tram route 2 and bus routes 12, 25 and 56.

Figure 2.9.19-20 NF EN 13.816 approval by AFNOR



2.9.19.3 Nantes – Cycle/ride share (8.10)

To encourage the use of soft modes for urban mobility, Nantes Métropole has developed actions targeted specifically at visitors, residents, students and commuters in the centre of Nantes or in the campus areas.

The main participants in these actions were departments of Nantes Métropole:

- Mobility department,
- Technical studies department,
- Urban services department.

Other participants have been also involved in these actions, for example SEMITAN, NGE (Silo-Park operator), “VéloCampus” association, “Place au Vélo” association and ADEME (French Government environment agency).

Two main actions were implemented during the VIVALDI project:

1. Bike and ride services

Two ranges of enclosed bike park spaces (closed boxes for 10 bicycles) have been set up in Pirmil and La Beaujoire P.T. connecting points. These boxes have been temporarily set up, to see if they were used. If it is successful, new fixed boxes will be set up permanently. The temporary boxes will be tested in others PT connecting points. The use of these boxes would be free for P.T. users with a monthly or annual fare pass.

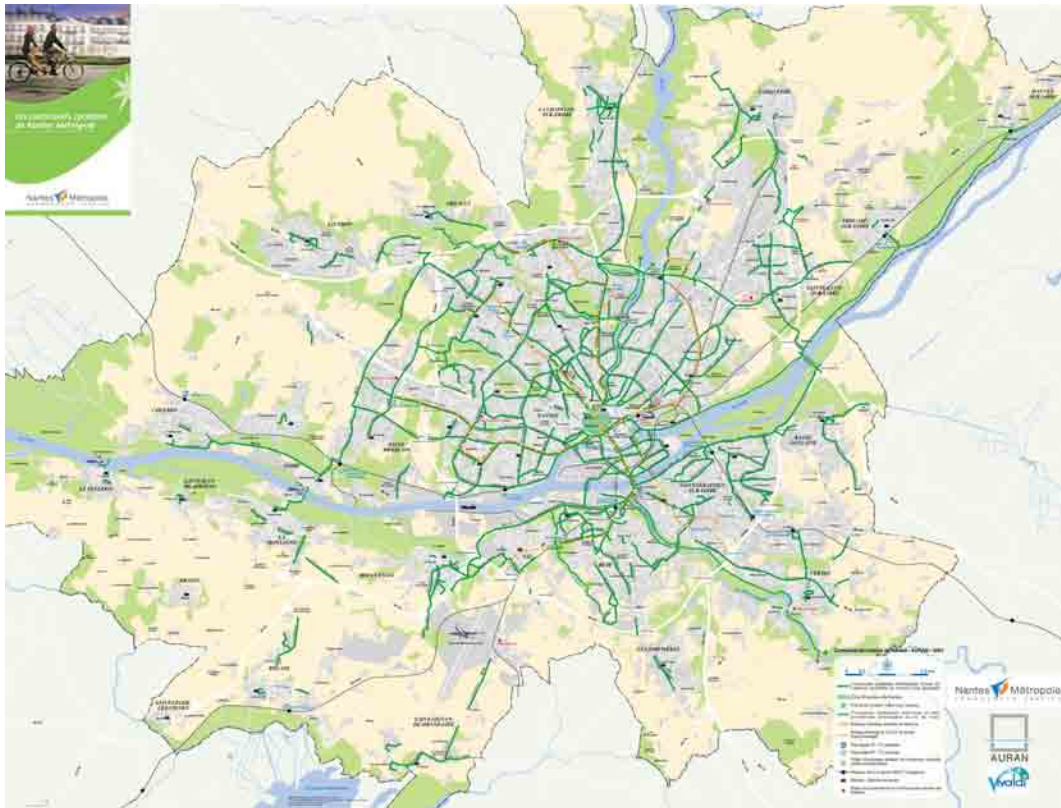
On each of the three stations located on the Nantes-Vertou railway link (see I.P. 4), 20 enclosed bike park spaces have been created (closed boxes for 20 bicycles). Users can have a free access by card if they have a monthly or annual public transport ticket. 12 free bike park spaces are also available.

Figure 2.9.19-21 Cycles parks at Vertou station



A general map with the cycling network available in the Nantes Métropole area has been created. It integrates parking facilities and some tips for cycling. In parallel, each Nantes Métropole local delegation will implement a bicycle parking map, in agreement with the Nantes bicycle association “Place au Vélo”.

Figure 2.9.19-22 Nantes Métropole cycling network map



2. Rent a bike service

To demonstrate a public “rent a bike service”, three cases for organisational and payment solutions were discussed:

- A bicycle rent network using existing P&R (with SEMITAN) and multi-storey car parks (with NGE),
- The previous solution plus a "Cycle centre" in the centre of Nantes for the promotion of cycling,
- Automatic and electronic controlled rent of bicycles in different places on Nantes Métropole area. The number of available bicycles at the different rental points has to be balanced, to allow an even distribution across the city.

The first solution was chosen and an experimental phase implemented. 200 bicycles are available in the 8 public multi-storey car parks in the centre of Nantes.

Items which need to be finalised include:

- The possibility of returning the bicycle to another car park, rather than the one where that the bicycle is rented from;
- A paying service;
- A communication campaign;
- A reduced fee for the PT users.

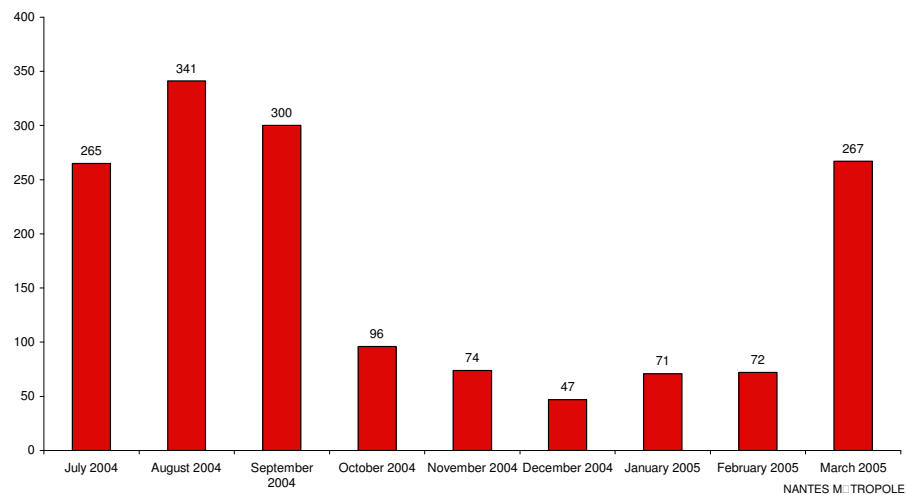
Legal aspects have been examined for the rent a bike service. A public renting service can be offered because there is no private offer currently.

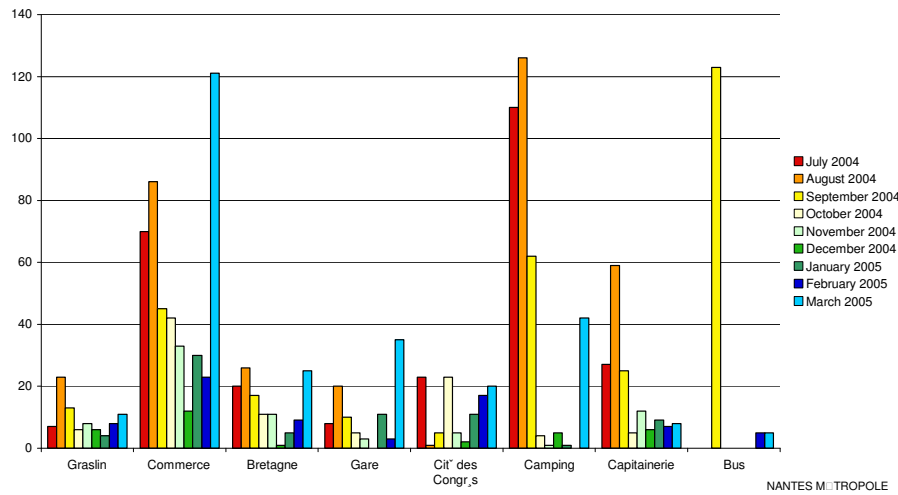
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Figure 2.9.19-24 Rent bike service location


Evaluation Results - The promotion of cycling

Since the action “Ville à vélo” started, an average of around 300 bikes have been rented per month. As shown in the figures below, bikes rented during wintertime are less numerous than during better weather months. The most active renting points are the camping site and Commerce: the biggest connecting point on the PT network.

Figure 2.9.19-25 Number of bikes rented, all renting points cumulated

Figure 2.9.19-26 Number of bikes rented by renting point



2.9.19.4 Nantes – Travel Plan Strategies (11.5)

As the main authority for mobility policy in the urban area, Nantes Métropole has to set an example to the other big companies and institutions concerning mobility plans. Therefore, Nantes Métropole has prepared its own company mobility plan and promotes this issue to other companies and institutions to encourage their employees to choose public transport and soft modes, and to use their car more sustainably.

Figure 2.9.19-27 Nantes Métropole house organ about Mobility Plan



The implementation of this mobility plan, which affects around 2300 employees on 53 different sites, required many discussions with unions. Negotiations have also taken place between several departments of Nantes Métropole;

1. Urban development office,
2. Mobility department: mobility study management,
3. Public Transport department: consultation, inputs,
4. Communication department: internal communication,
5. Human resources department: management help, implementation of the plan, link with the unions,
6. Technical means department: implementation of the plan, in charge of Nantes Métropole vehicles fleet.

External partners were also involved, for example, SEMITAN and Altermodal for the study of the plan, and Agence Verte for the communication process.

Nantes Métropole company travel plan was implemented in May 2002 with a study about Nantes Métropole site accessibility. The result of which identified that some sites on the outskirts of the city still have accessibility problems.

In June 2002, a survey regarding employees' mobility habits was carried out, in order to establish the modal split of their journeys, according to the different Nantes Métropole sites. The survey showed that P.T. use was high in the centre of the city and low in the outskirts.

At the end of the diagnosis (end 2002), the production of the mobility plan started in 2003. A consultation of employees on the mobility plan took place towards the end of 2003. The first measures of the Nantes Métropole mobility plan were implemented in March 2004. These measures were:

- A 50% tariff rebate on annual P.T. fare Passport for employees
- Suppression of 98 employees parking spaces; only 38 spaces will be available
- P.T. tickets easily available for professional trips (meetings...)

- Employees located in Nantes Métropole delegations sites, which have a poor P.T. service in their sector encouraged to car pool. Nantes Métropole plans to use software, which could be shared with other companies involved
- New safe bicycle parking spaces at work for commuters and visitors, and an employee bicycle fleet
- Intranet website about the mobility plan and free access to computers at Nantes Métropole sites, which have poor computer access.

In order to have a better implementation of these measures, Nantes Métropole and the City of Nantes have decided to employ a common mobility coordinator.

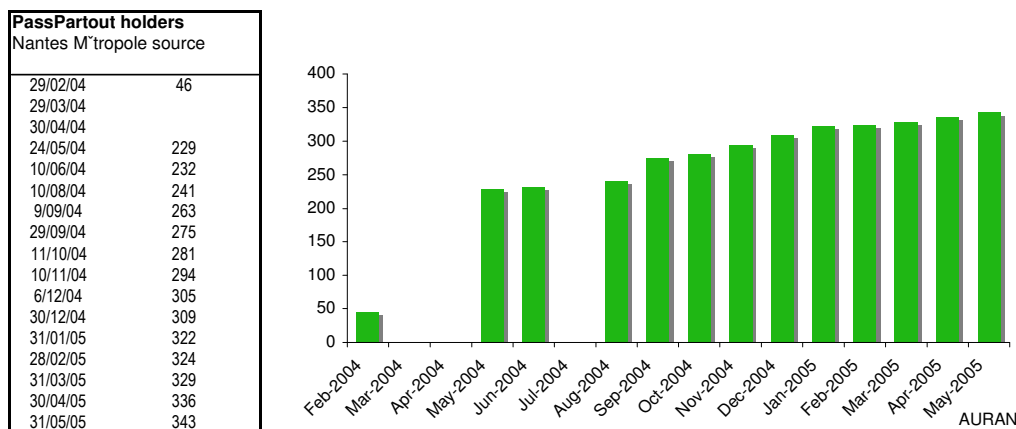
Evaluation results - Nantes Métropole mobility plan

Actions decided in Nantes Métropole mobility plan are about:

- Promoting PT use with an incentive PassPartout ticket discount
- Dissuading commuters from using the car
- Promoting cycling and walking

PassPartout holders have increased since the mobility plan signature early in 2004: strongly during the first months, then with an average monthly rate about 3.4%. PassPartout holders have increased by half between May 2004 and May 2005. At this last date PassPartout holders represented 14% of all Nantes Métropole employees. A survey of their behavioural evolution is being carried out.

Figure 2.9.19-28 Evolution of PassPartout holders among Nantes Métropole employees



Incentive actions to promote cycle usage have concerned parking spaces. In February 2005, Nantes Métropole equipped two of its office sites in the city centre with safe parking spaces: 42 at Champ de Mars site and 14 at Magellan site.

Nantes Métropole has also provided bicycles for its employees use at different sites. The following table shows the situation and the use.

Table 2.9.19-10 Cycles at Nantes Métropole employees disposal

Cycles at disposal				
Nantes M ^{etropole} source				
15/04 - 15/06 2005 period				
location	Number of cycles	Number of borrowings	Total using time	Average borrowing time
City centre sites				
Champ de Mars	5	128	249	2
Magellan	3	35	71	2
Outlying sites				
Water supply department	3			
Sewerage department	2			
P TM le du Vignoble	1			
P TM le de l'Aubini ^{re}	2			
P TM le Erdre - Fleuriaye	1			
P TM le Erdre et Cens	3			
P TM le Nantes - Loire	2			
P TM le Nantes - Cens	1			
P TM le Loire - Ch ['] zine	1			
P TM le Loire et S ['] vre	1			
Total	25			

The parking space suppression for a large number of employees' cars means that employees need to make a special request if they need a temporary parking space for a particular reason. The following table summarized demands made since the start of the mobility plan to May 2005.

Table 2.9.19-11 Nantes Métropole employees requests for temporary car parking facilities

Temporary car parking permissions		
Nantes M ^{etropole} source		
Reason of the request	Number of permissions	Permission length
Professional needs	3	1 year
	1	3 weeks
Medical needs	2	1 year
	1	6 months
	1	6 weeks
	1	3 days
Request rejected	1	

Actions to encourage car-pooling actions are still under implementation.

2.9.19.5 Nantes –Travel Plan Strategies –company travel plans (11.2)

Nantes Métropole has started to develop company mobility plans after its initial experience with the main public hospital in the centre of the city (Hôtel Dieu). The targets of this measure are employees of companies and local authorities, specifically located in the centre of the city. The objective is to convince them to change their behaviour. The main partner of Nantes Métropole in this action is the ADEME (French Government environment agency)

To promote company mobility plans, Nantes Métropole has developed a methodology to start the process and to provide its help:

- Contacts by mail, phone etc. with companies' human resources department;
- Meeting with the interested company, to explain the global mobility policy implemented in the urban area by Nantes Métropole (objectives, measures, results...), and to introduce what a mobility plan is and which measures can be implemented in such a process;

- Technical help to prepare the mobility plan study (diagnosis, surveys...). The company can produce this study itself or pay a consultancy, with financial help from Nantes Métropole (40% of the global cost – max 25 000 €) and ADEME (40% of the global cost);
- Company diagnosis and survey with employees, discussions with Nantes Métropole about mobility problems and possible solutions and improvements;
- Definition of measures and programme by the company (Nantes Métropole consulted),
- Organisation of a debate with employees during the preparation of the company mobility plan.

Figure 2.9.19-29 Nantes Métropole brochure to explain mobility plans interest to companies



At the end of 2003, Nantes Métropole council decided to give a 15% rebate on the annual PT fare “PassPartout” for the employees of companies that decide to sign a mobility plan with Nantes Métropole. The company mobility plan must integrate measures to improve PT use, cycling use or walking, and to reduce car dependency for commuters, with quantified objectives and with a commitment to a PT use increase among employees. The plan must also integrate financial help from the company to employees, at least equal to the Nantes Métropole help of 15% on the annual PT fare “PassPartout”.

Since 2004, Nantes Métropole has engaged a consultant to encourage companies in this. Contact, meetings, exhibitions... are proposed to develop an approach of mobility plan implementation.

Figure 2.9.19-30 Exhibition about mobility plans in “Hôtel Dieu” hospital



Figure 2.9.19-31 Signature of a company mobility plan for “La Poste”



Figure 2.9.19-32 Meeting about “Nantes Habitat” company mobility plan



Developing mobility plans for companies

At the end of June 2005, as result of the Nantes Métropole promotion campaign, 16 company mobility plans were active, representing close to 16,000 employees, and 19 were being studied, representing about 5,400 employees. Currently, 35 companies representing around 18,500 employees are making preliminary approaches.

Table 2.9.19-12 Company mobility plans progress

Company Mobility Plans progress								
Nantes M ^é tropole source								
	Number of companies				Number of employees			
	Plan under way	Plan being studied	Preliminary approaches	Total	Plan under way	Plan being studied	Preliminary approaches	Total
Feb-2004	-	9	1	10	-	14 184	1 400	15 584
Jun-2004	5	9	7	21	12 800	3 324	2 850	18 974
Oct-2004	5	17	17	39	12 800	4 850	5 100	22 750
Dec-2004	5	22	19	46	12 800	6 350	5 750	24 900
F ^é v-2005	10	24	28	62	14 445	7 350	10 140	31 935
Jun-2005	16	19	35	70	15 948	5 386	18 417	39 751

Figure 2.9.19-33 Company mobility plans progress – Number of companies

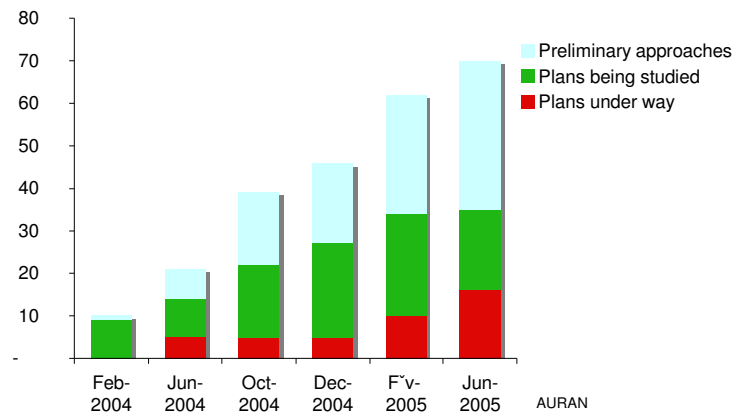
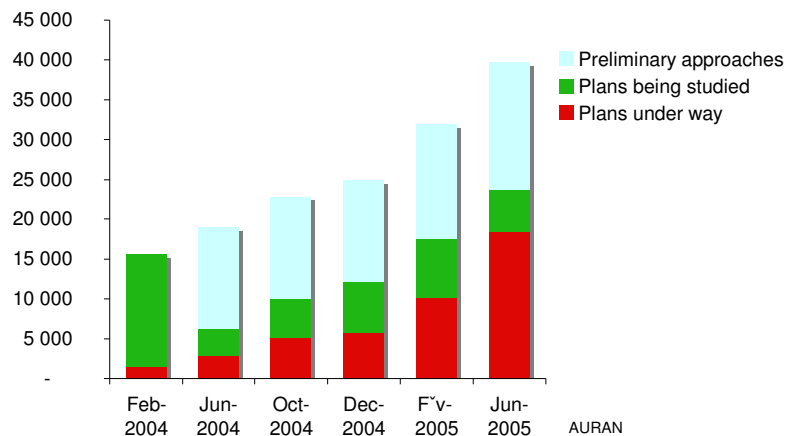


Figure 2.9.19-34 Company mobility plans progress – Number of employees



One of the main measures featuring in a company mobility plan is the increase of “PassPartout” fare holders as an indicator of the employees loyalty to P.T. usage. At the end of May 2005 there were 2,843 “PassPartout” holders. After the first period with a high subscription rate, the increasing between May 2004 and May 2005 was about 132%, an average monthly increasing rate about 7.3%.

Table 2.9.19-13 Evolution of “PassPartout” P.T. fare holders

"PassPartout" holders evolution							
Nantes M ^{et} ropole source							
Date	H ^ô pital Dieu	Nantes	R ^{ég} ion	City of	La Poste	CRAM	Total of
	hospital	M ^{et} ropole	Pays de la Loire	Nantes			"PassPartout"
							subscription in
							mobility plans
29/02/04		46		101			0
29/03/04	61						750
30/04/04			10				1030
24/05/04	319	229	22	657			1227
10/06/04	347	232	24	673			1281
10/08/04	408	241	28	705			1387
9/09/04	456	263	39	751			1515
29/09/04	488	275	41	761			1571
11/10/04	518	281	42	774			1621
10/11/04	573	294	47	797			1717
6/12/04	599	305	48	808	72		1838
30/12/04	624	309	49	830	295		2112
31/01/05	652	322	50	866	317		2213
28/02/05	677	324	52	877	337		2294
31/03/05	704	329	56	890	351		2357
30/04/05	739	336	57	919	362	57	2464
31/05/05	772	343	57	932	369	270	2843

Figure 2.9.19-35 Global evolution of P.T. fare holders under mobility plans

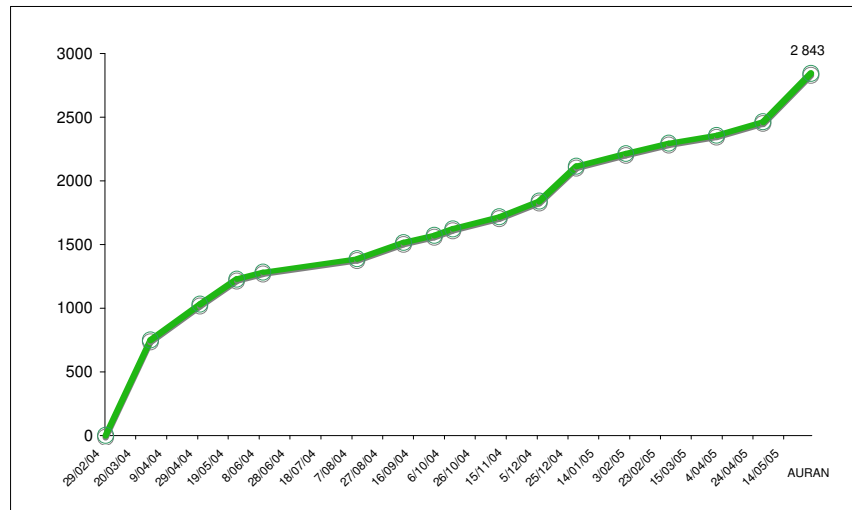
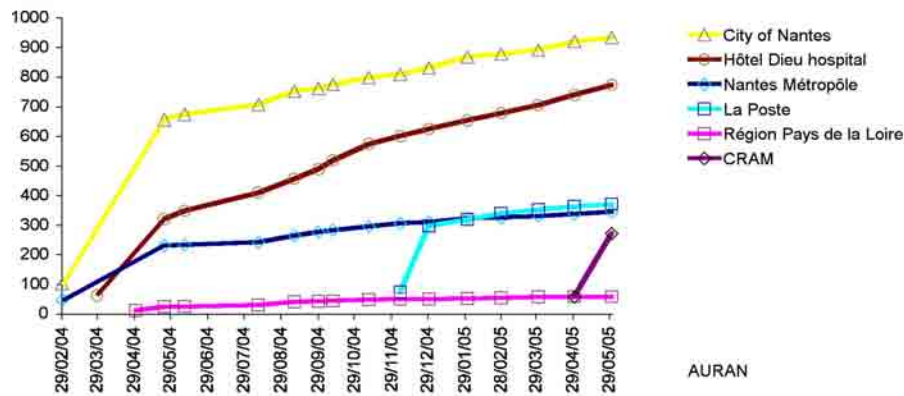


Figure 2.9.19-36 Evolution of "PassPartout" PT fare holders in different organizations

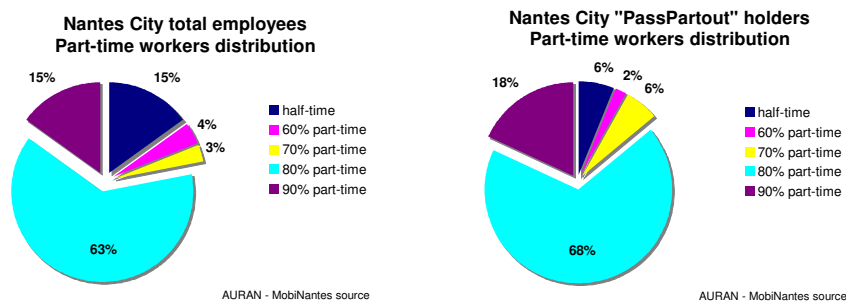


In order to identify behavioural changes since the start of its mobility plan, the City of Nantes has undertaken a survey among its employees PassPartout holders. This was in the form of a self-managed questionnaire, sent to 818 named people at their workplace, during spring 2005. With a return of 542 questionnaires, the response rate was 66%.

The main results are:

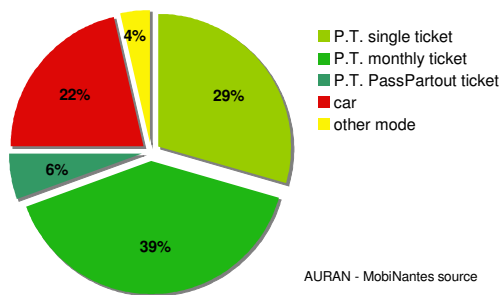
- Part-time workers are 16% of the total employees of the city. 21% of these are “Passport” holders.
- But the distribution of “PassPartout” holders varies with work-time: 90%, 80%, and 70% part-time workers are over-represented, and 60% and half-time workers are clearly under-represented.
- The monetary saving of this new P.T. fare is not well perceived by the lower part-time workers.

Figure 2.9.19-37 “PassPartout” holders and Work-time



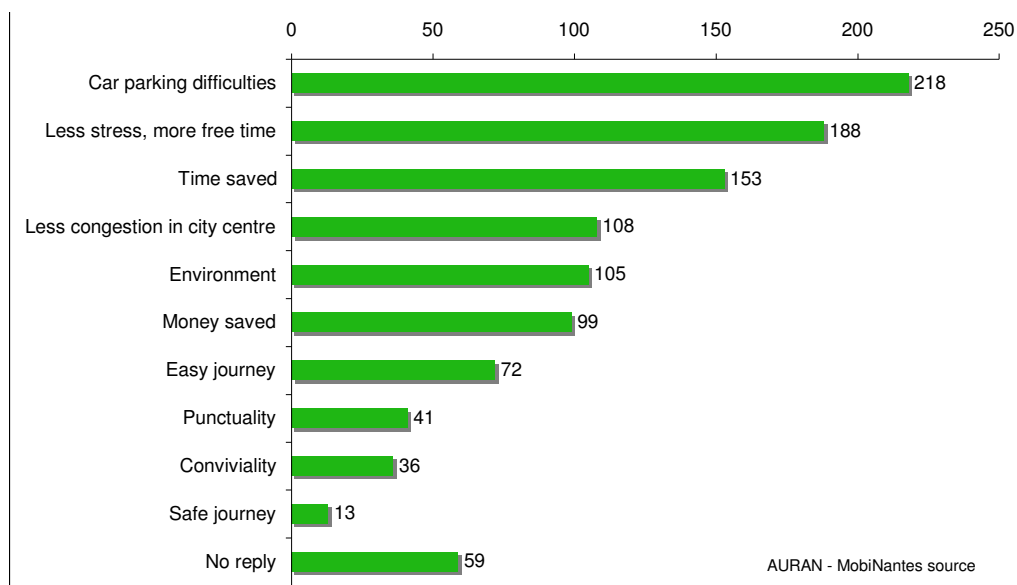
22% of “PassPartout” fare holders were daily car users before the mobility plan. Therefore, around 200 people have stopped using their car in a year. This represents 60% of the aimed objective in the mobility plan. Among the “PassPartout” holders who used public transport before the mobility plan, a large majority used a monthly ticket.

Figure 2.9.19-38 “PassPartout” holders and used mode before mobility plan



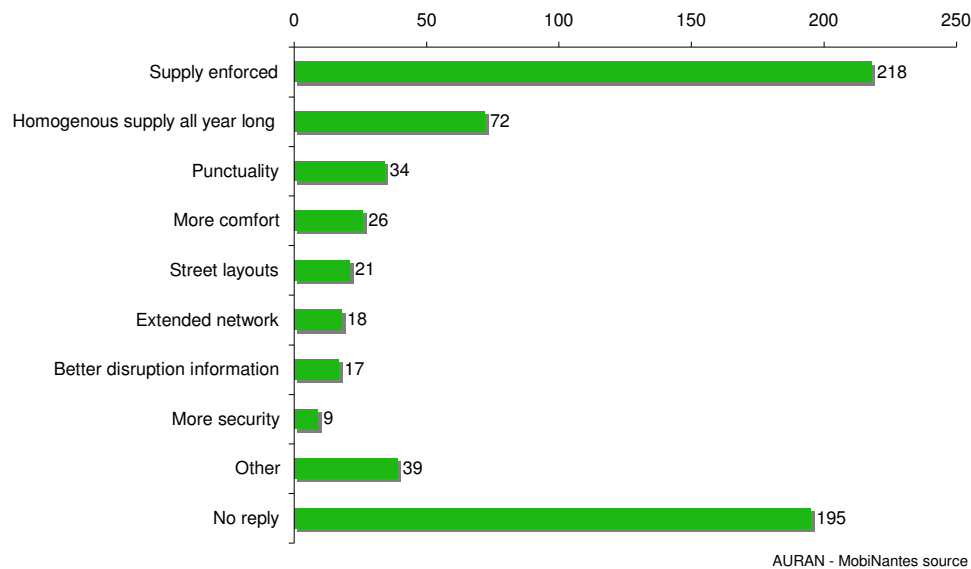
49% of “PassPartout” holders state that their choice was linked to the difficulty of finding parking spaces; 20% say that their motivation is to save money and 11% say that this type of fare gives added value and convenience with unlimited trips over the year and no need to buy tickets regularly. Amongst the advantages of using Public Transport, “PassPartout” holders cite reasons of less stress with no traffic jams or car parking difficulties.

Figure 2.9.19-39 “PassPartout” holders and reasons to use Public Transport



“PassPartout” holders want P.T. improvements regarding frequency and operating ranges, especially during school holidays.

Figure 2.9.19-40 PassPartout” holders and requests about Public Transport improvements



2.9.19.6 Nantes – Land use planning - New parking policy (11.5)

The car parking policy is currently one of the most important tools for local transport authorities for mobility regulation. The targeted users for the VIVALDI project are the commuters, visitors and inhabitants of the centre of Nantes. Nantes Métropole and Nantes City are the local authorities in charge of this policy. The partners involved in the project were AURAN (Town planning and development agency), SAMOA (semi-public company in charge of the “Ile de Nantes” urban project), SARECO and TRANSITEC (private consultants).

Before the implementation of the first measures, two studies were carried out:

- The first involves the parking policy necessary with the “Ile de Nantes” urban project, close to the centre of Nantes;
- The second study involves parking policy in the centre of Nantes.

They have been carried out by SARECO and TRANSITEC for a global amount of 166 000€ (100% financed by Nantes Métropole with VIVALDI subsidies).

Objectives of the parking policy have been fixed in the Urban Mobility Plan:

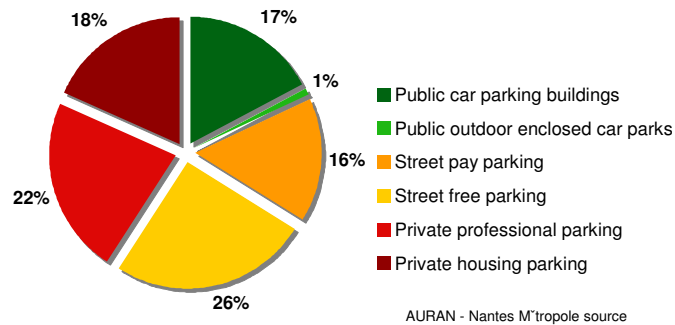
- Make public spaces car free, because unlawful parking is disturbing for pedestrians who have to use car lanes because the pavement is blocked by parked cars.
- Help people who have to use city centre functions (administrations, retailers, doctors, services...), and need a parking space near their destination, and can’t find it because of cars parked in the same place all day.
- Help city centre residents who live in old buildings without parking spaces, to find one near their home.

The studies begun in January 2002, under the conduct of two steering committee composed of representatives of Nantes Métropole and City of Nantes, partners and

consultants. They focused on the fact the car park spaces were not used as they should be: a lot of commuters used them all day without payment and it was not easy for visitors and residents to park.

Figure 2.9.19-41 City centre car parking capacity in 2002

City centre parking capacity	
Nantes M ^{et} ropole source	
Parking type	Parking spaces 2002 situation
Public car parking buildings	5560
Public outdoor enclosed car parks	300
Street pay parking	5140
Street free parking	8200
Private professional parking	7300
Private housing parking	6000
Total Public	19200
Total Private	13300
Total	32500



In January 2003, a proposal for a new parking policy was carried out and the first measures implemented were as follows:

- Police control reinforcement against unlawful parking in the city centre, with a new squad of 33 policemen and 3 officers especially created.

Figure 2.9.19-42 Police control reinforcement against unlawful parking



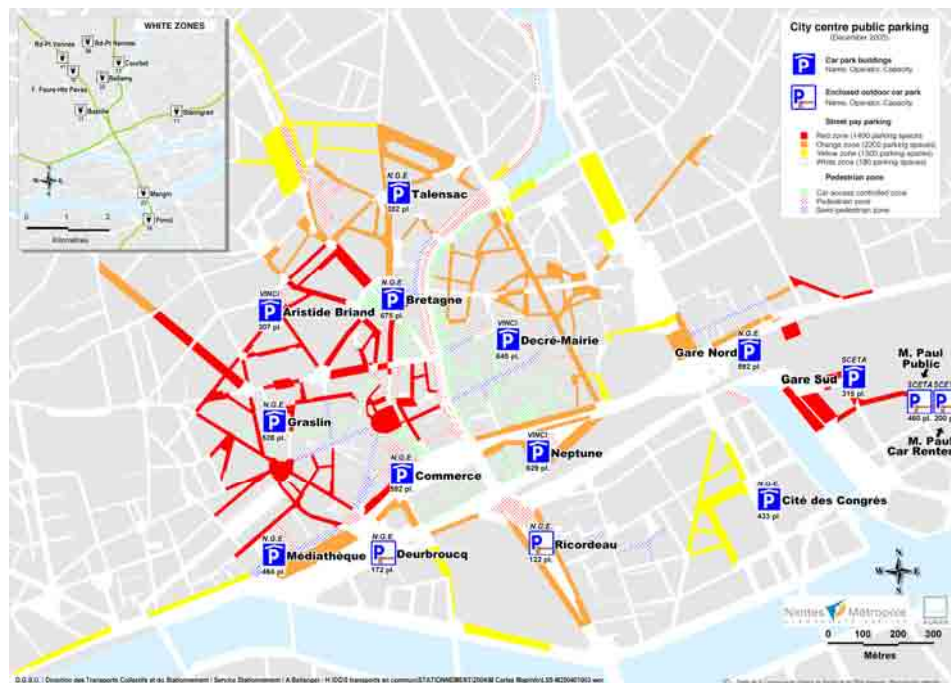
- First steps in the modification of parking standards in urban project areas (Ile de Nantes or GPV Malakoff - Pré Gauchet) to decrease the number of car parking spaces in office buildings: the new standard is 1 parking space for 150 m² of gross floor area, with a new obligation of bicycle parking spaces (1m²/50m²). The standard for housing will be 1 car parking space for 90m² of gross floor area. These standards constitute a minimum required. A maximum could be decided, but this would require modification of the Urban Mobility Plan (French law), and this decision is still not planned. The idea with these new standards is to control car use, and build, under public authority control, new parking lots in urban projects to complete the restricted parking in buildings. These new parking lots could be shared between inhabitants and commuters.
- New street parking fees in favour of residents and visitors to dissuade commuters from travelling into the centre by car and to prefer using Park and Ride and Public Transport. The new fees were decided by Nantes City in 2003: one for specific professionals who need their car for working: doctors, care workers, maintenance, urgency services (annual card 22€ + 0,20€ per 20 minutes with a 2 hours limit). Another one for residents (free annual card + 2€ in red or orange zone, 1€ in yellow zone)

- New fees in multi-storey car parks: the commuter's fee will increase each year to promote residential users and visitors.
- Launching of studies about outdoor parking with access control: the objective is to have a better control of the use of the main car parks near the city centre,
- First measures to suppress car parking spaces (about 100 car parking spaces in 2003).

In 2003, car-parking regulation in Nantes city centre was organized around the following means:

- Park and Ride on tramlines, for people who want to leave their car near a tram station and go to city centre. Close to 2,700 parking spaces were available in 2003: more than 1 000 in guarded car parks and more than 1,650 in free access car parks.
- Parking buildings for visitors and residents. More than 5,560 parking spaces were available in 2003 in these parking buildings.
- Enclosed outdoor pay parking, for visitors and residents. Organized on public space, about 960 parking spaces were available in 2003, of which 200 are reserved for rental cars at the central railway station.
- Street pay parking spaces for visitors, services and residents. There were about 5,080 pay parking spaces in the streets of Nantes city centre, in 2003.

Figure 2.9.19-43 Nantes city centre pay parking 2003 organization



At the end of 2003 the railway link Nantes-Vertou opened with 3 Park and Ride (see 3.4.1.2.1) at Vertou, St Sébastien Frêne Rond and Pas Enchantés stations with a total of 270 parking spaces. Vertou station P+R was extended in October 2004 with 60 new parking spaces.

In 2004, a new Park and Ride opened: Orvault-Morlière P+R on tramline 3 extension (see 3.6.1.2.2), and another one existing P+R: Beaujoire, has become a guarded P+R. The total capacity was around 1,600 parking spaces after the increase.

To consolidate the P+R improvements, a new Park and Ride opened in January 2005, at Bourdonnières in the Southeast area, with 460 parking spaces. Three others opened in September 2005: one on the tramline 2 extension at Neustrie in the Southwest, with 170 parking spaces and two on the Navibus route at Trentemoult on the South bank of river Loire with 90 and 65 parking spaces. There are now over 4 000 parking spaces at Park and Ride sites.

Figure 2.9.19-44 Park and Ride offer in 2005 (promotional brochure from Nantes City)



During 2004, parking policy for the centre of the city has continued to be designed and new measures have been carried out in the first semester of 2005:

- Five new enclosed outdoor pay parking sites have been implemented: Baco with 238 spaces, Duchesse Anne with 120, Tourville with 167, Gare Sud canal with 311 and Bellamy with 70 spaces. More than 900 parking spaces, double the previous number, of this type are now available.
- A strong modification of street pay parking: suppression of orange and white zones. This last one is replaced by a blue zone without fees but only with a limited parking time, controlled by disk. Extension of the red zone to 4 100 p.s. that cover more than the old orange zone, and extension of the yellow zone to 3,080 spaces. Parking fees have changed and police control reinforced.
- Nantes City has published a guide to have a better use of the new parking arrangements in the city centre.

Figure 2.9.19-45 Nantes City parking guide



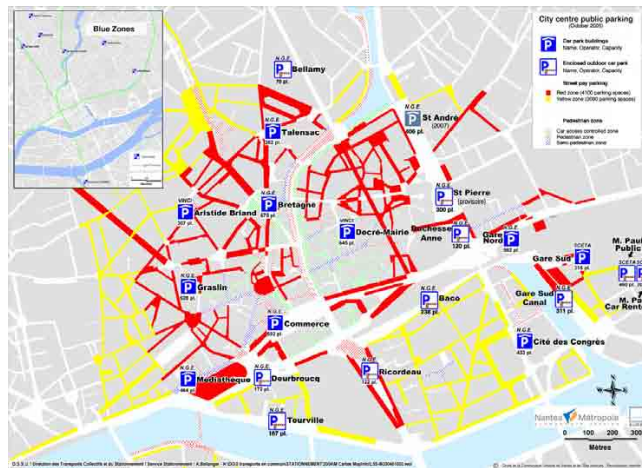
Figure 2.9.19-46 Nantes city centre pay parking 2005 organization



Evaluation Results - New parking policy and strategy

Parking offer evolution

Nantes Métropole strategy is to favour P+R usage especially for commuters, to reduce car flows and parking demand in the city centre. In this area, Nantes Metropole also wants to favour cars turnover on street pay parking. It has been decided to expand Park and Ride capacity, enclose outdoor pay car parks, street pay parking and corresponding fees.

Figure 2.9.19-47 Nantes City centre - Pay parking location


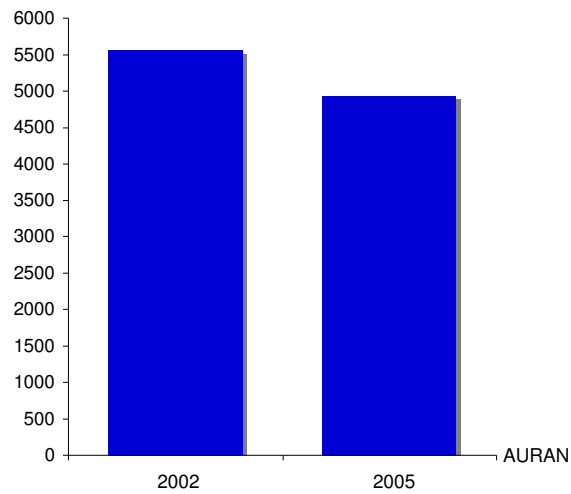
Capacity of parking buildings in Nantes City centre has been reduced by 11% between 2002 and 2005, as shown in the following figure.

Table 2.9.19-14 Nantes City centre - Parking buildings evolution

City centre Parking buildings		
Nantes M ^{et} ropole source		
	Capacity	Operator
Commerce	592	NGE
Graslin	528	NGE
Bretagne	675	NGE
Gare Nord	592	NGE
Gare Sud	315	SCETA Parc
M ^{et} diathèque	464	
Talensac	382	NGE
Jules Verne - Cit ^é des Congr ^{ès}	433	NGE
Neptune (*)	629	VINCI
Aristide Briand	307	VINCI
Decré - Moulin Mairie	645	VINCI
Total 2002	5562	
Total 2005 (*)	4933	

* Parking closed in October 2004

Figure 2.9.19-48 Parking buildings evolution



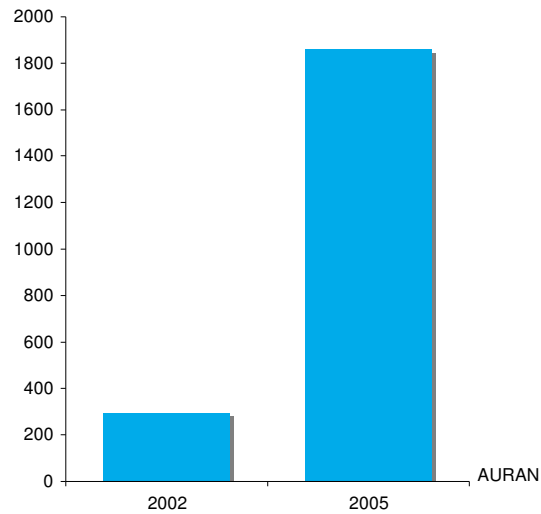
Capacity of enclosed outdoor pay parking in Nantes City centre has multiplied by more than 6.3, between 2002 and 2005, as shown on the following figure.

Table 2.9.19-15 Nantes City centre - Enclosed outdoor pay parking evolution

Enclosed outdoor pay parking		
Nantes M ^{etropole} source		
	Capacity	Operator
Ricordeau	122	NGE
Deurbroucq	172	NGE
Marcel Paul public (*)	460	NGE
Marcel Paul car renters (*)	200	NGE
Baco (*)	238	NGE
Duchesse Anne (*)	120	NGE
Tourville (*)	167	NGE
Bellamy (*)	70	NGE
Gare Sud canal (*)	311	NGE
Total 2002	294	
Total 2005 (*)	1860	

* Parking opened since 2002

Figure 2.9.19-49 Enclosed outdoor pay parking evolution

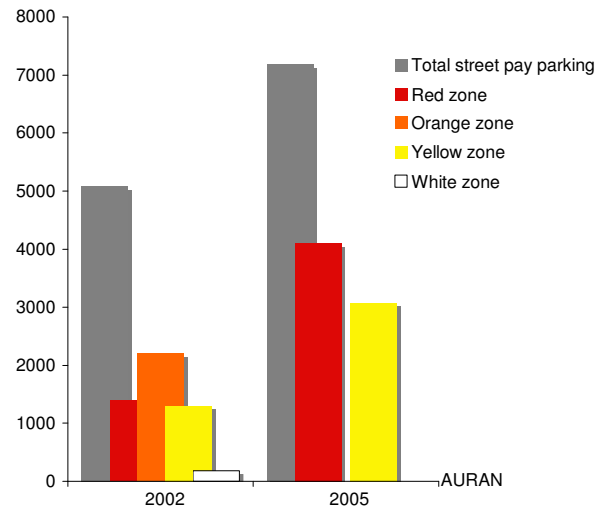


Citywide, street pay parking spaces have been increased by more than 41%, between 2002 and 2005, as shown in the figure below.

Table 2.9.19-16 Nantes City centre - Street pay parking spaces evolution

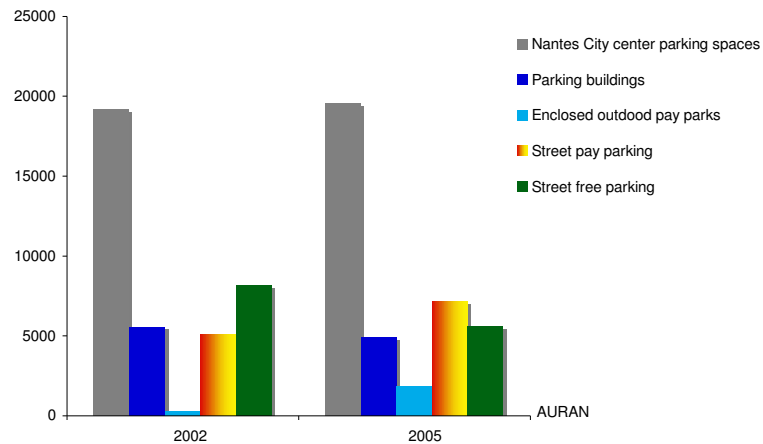
Nantes city centre street pay parking		
Nantes M ^{et} ropole source		
	2002	2005
Red zone	1400	4100
Orange zone	2200	0
Yellow zone	1300	3080
White zone	180	0
Total 2005	5080	7180

Figure 2.9.19-50 Street pay parking spaces evolution



Citywide development of public parking spaces in Nantes City centre shows that there has been a strong increase of pay parking spaces (+27%) and a decrease of free parking spaces in public space.

Figure 2.9.19-51 Nantes City centre public parking offer evolution



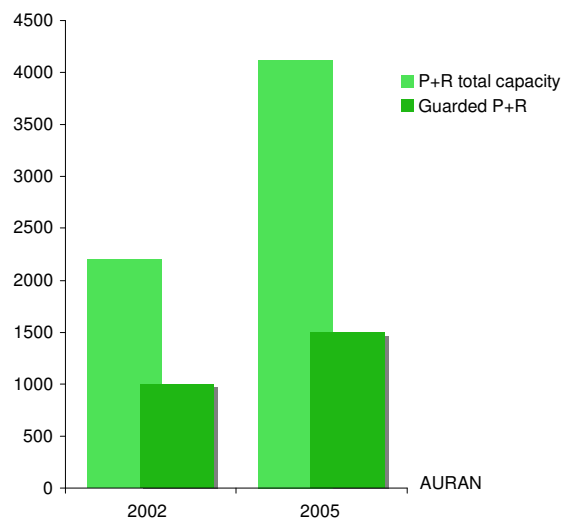
Park and Ride capacity has almost doubled (+87.6%), between 2002 and 2005, as shown in the following figure. Guarded P+R, included in those, have increased by a half (+49.8%) during this time

Table 2.9.19-17 Nantes City Park and Ride offer evolution

Park and Ride			
Nantes Métropole/SEMİTAN source			
	Capacity	Guarded	Operator
Haluchère	230	230	SEMİTAN
Recteur Schmitt 1	100	100	SEMİTAN
Recteur Schmitt 2	50		
Le Cardo	200	200	SEMİTAN
François Mitterrand	200	200	SEMİTAN
Huit Mai	200	200	SEMİTAN
Plaisance (**)	73	73	SEMİTAN (**)
Pirmil	200		
Goudy	250		
Trocardière	240		
Benoît Frachon	200		
René Cassin	65		
Gare de Mauves	32		
Gare de Bouaye	25		
Gare de St Herblain-Basse Indre	100		
Gare de Couëron	30		
Gare de Vertou Nord (*)	140		
Gare de Vertou Sud (*)	43		
St Sébastien Frêne Rond (*)	60		
St Sébastien Pas Enchanté's (*)	80		
Orvault-Morlière (*)	302	302	SEMİTAN
Morlière - Paquélais (*)	82		
Beaujoire (*)	360	130	SEMİTAN
Bourdonnières (*)	420		
Neustrie 1 (*)	140	140	SEMİTAN
Neustrie 2 (*)	40		
Trentemoult 1 (*)	90		
Trentemoult 2 (*)	65		
Gare de Thouaré (*)	100		
Total 2002	2195	1003	
Total 2005 (*)	4117	1502	

* Parking opened since 2002

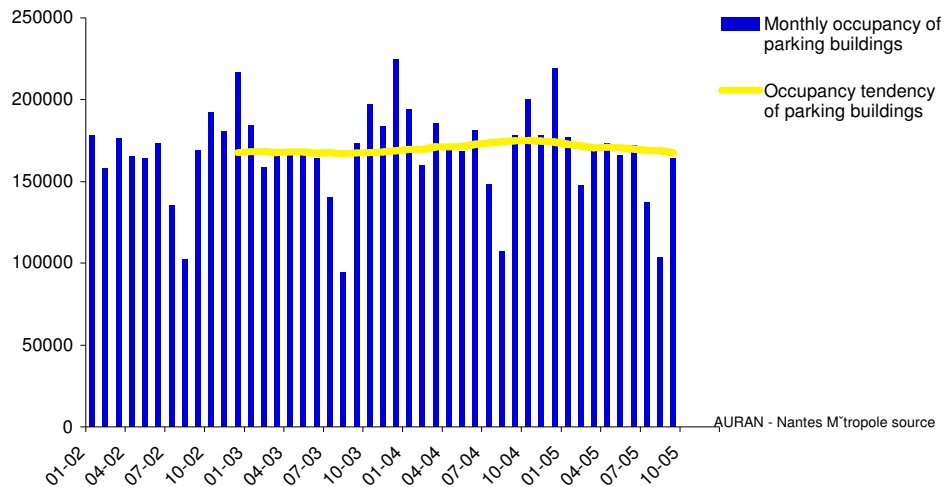
** Guarding removed since 2004 on this parking

Figure 2.9.19-52 Park and Ride offer evolution


Parking occupancy development:

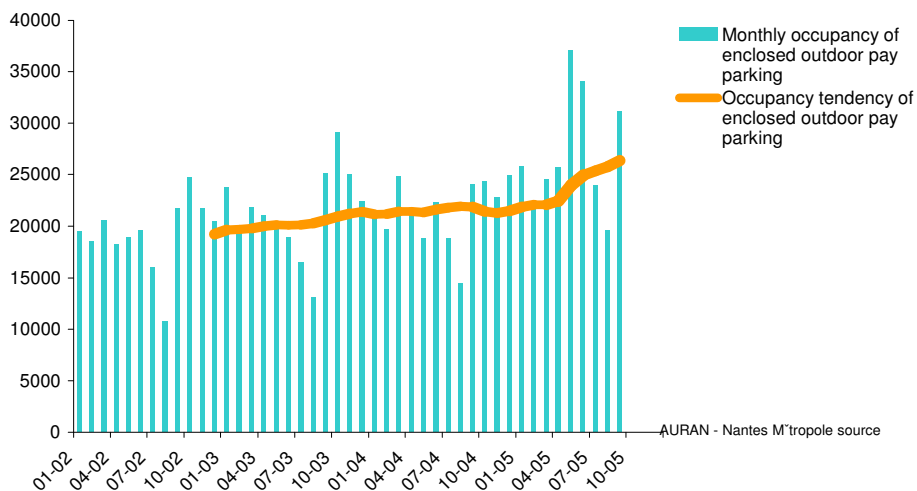
Parking buildings occupancy is steady citywide, as shown in the following chart.

Figure 2.9.19-53 Parking buildings occupancy evolution

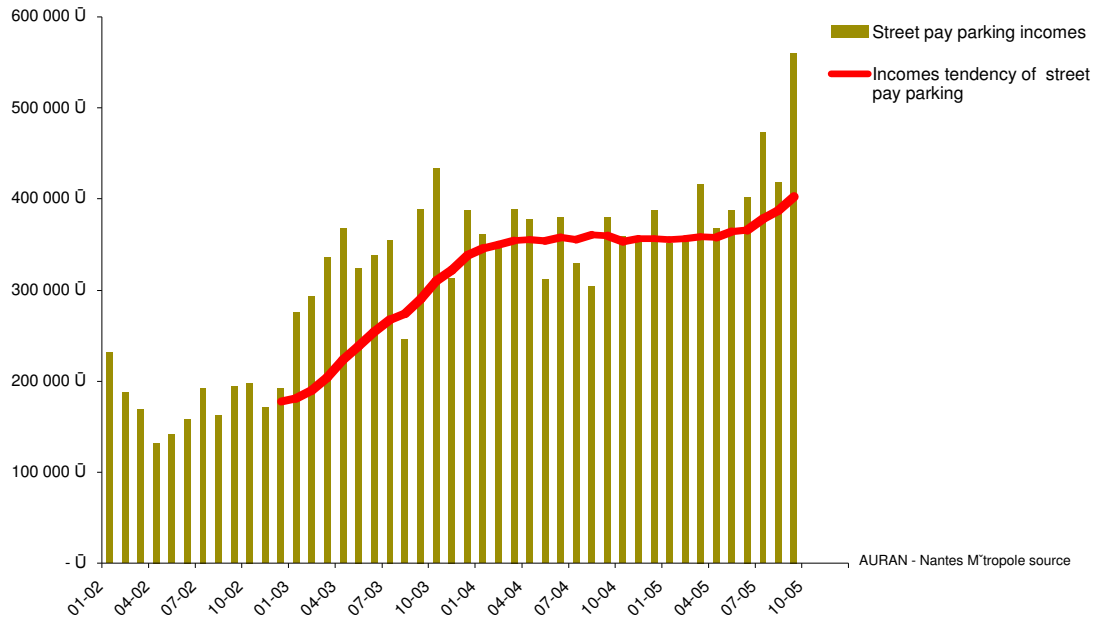


Enclosed outdoor pay parking occupancy has increased between 2002 and 2005, and more strongly in the period since Spring 2005, in relation to new parking regulation decided by Nantes Métropole and Nantes City.

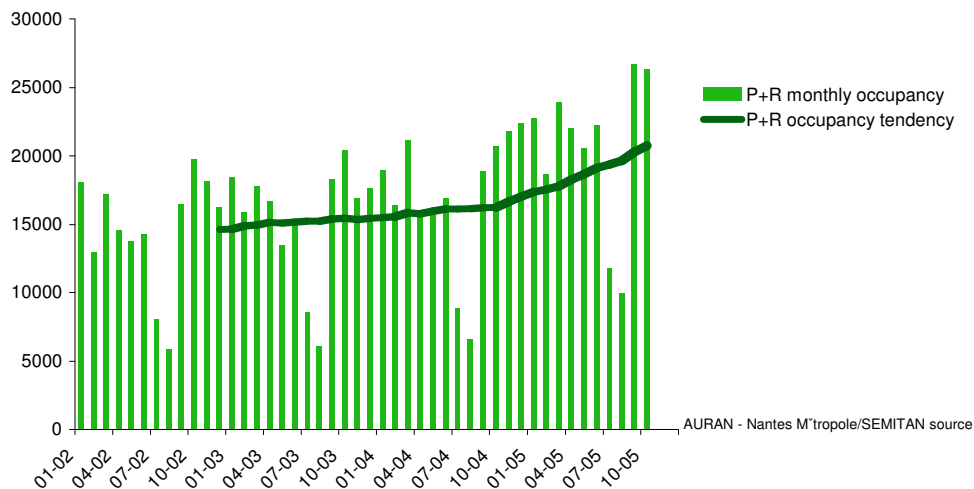
Figure 2.9.19-54 : Enclosed outdoor pay parking occupancy evolution



Street pay parking income has increased after the beginning of police enforcement. Then a steady period has come, and again the start of a new growth period because of the new regulation since Spring 2005.

Figure 2.9.19-55 Street pay parking incomes evolution


Park and Ride occupancy shows a constant progression, but since the opening of new sites in 2004 and the start of car flow restrictions, in particular in the Southeast, the patronage of these sites is growing more rapidly. The last site opened at Neustrie on the tramline 2 extension and was overcrowded in its first operating week, requiring an immediate extension.

Figure 2.9.19-56 Park and Ride occupancy evolution


2.9.19.7 Nantes – Travel information centre (12.2)

Multimodal information, travel information centre and booking

Nantes urban area has always taken into consideration the need to integrate transport systems. Most of outskirts connecting points are designed to host tramlines, urban buses and interurban buses.

This policy is developed and reinforced with the regional railway operators and authorities. Actions conducted in this field are integrated and linked with:


- The fare integration between regional trains serving the urban perimeter.
- The development of train links between Vertou and Nantes in the southeast area.

The people specifically targeted in this action are urban public transport users and the commuters who come outside Nantes Métropole.

Regarding multimodal information and promotion, a working group meets four times a year to study annual surveys the usage evolution of the concerned links, and to propose joint promotion actions (annual budget of 42 000 €). The participants to this group are Nantes Métropole, Department of Loire Atlantique, Region Pays de la Loire, SEMITAN and SNCF.

During 2004, advertising campaigns have been conducted to promote new services and fares.

Figure 2.9.19-57 Communication campaign



This picture reflects the communication action conducted in 2004 announcing:

- * The fare integration that allow using an urban bus or tram TAN ticket, for travelling with regional trains within the urban Public Transport area.
- * The increasing of supplied services on the rail link between Vertou and Nantes.

The campaign was composed of:

- * Direct marketing in residents' mailboxes,
- * Posters on board buses and trams,
- * Radio and Press ads,
- * Leaflets distribution on market places and on cars wind screens (when parked in the city centre)

* The cost for this campaign was 42 000 €. Costs were divided between P.T. authorities

Bus priority and RTPI

The tramway network extension made it necessary to equip the central traffic control with a new AVL system. This modification, which was initially implemented on the tramway network, is currently being carried out. Real time passenger information systems are implemented at each tram station. In terms of the bus network, solutions were also sought to renew the aging AVL system, not only for a regulation question but also to be able to provide real time information at bus stops. Currently bus routes are

only providing passenger information on the main connecting points. Information provided is scheduled timetable but not real time information.

To improve real time information at bus stops, one pilot bus route has been equipped with a GPS system. This system, particularly its efficiency from a traffic control point of view and the accuracy of real time information on board vehicles, has been tested. However the full extension of this system has not been possible during the course of VIVALDI project. Two main reasons drove Nantes Métropole and SEMITAN to postpone the implementation of real time information at bus stops:

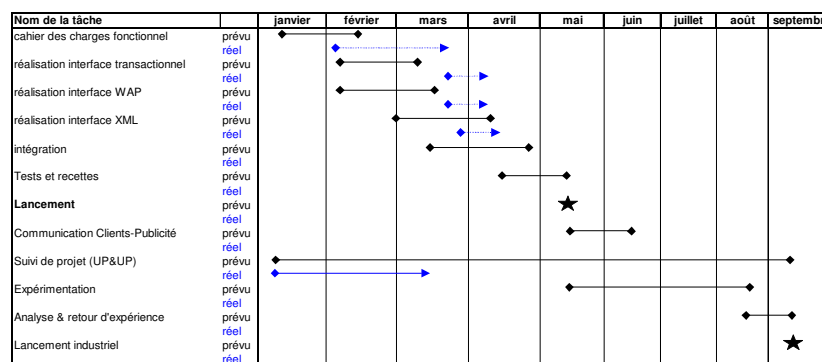
- The decision to modernize the AVL system itself was postponed. The strong interrelation between on board systems and bus stops systems mean that it is irrelevant to anticipate bus stop information panels.
- The extension of real time information displays at bus stops has been considered too costly and the implementation of new GPS systems on major bus routes was delayed for similar reasons.

To overcome this situation and provide information to customers, SEMITAN, in association with private companies: C3D and TRANSDEV (French Public Transport group operator), has worked to create a new system for real time passenger information available on mobile phones: MOBITRANS.

People targeted with this new product are at the forefront of public transport users and mobile phones users, with a developed taste for new information technologies. The level of expectation of these people towards information is increasing with time and has become more visible in Nantes, due to the implementation of such systems at tram stations. User needs have been identified through surveys conducted on their perception of the quality of public transport.

The main participants involved in this implementation were: C3D, TRANSDEV, SEMITAN, Up&Up, Mobivillage (a start up company in charge of system development), Lumiplan (current SEMITAN provider for real time information D.A.T.S. treatment), and the three mobile phone operators (Bouygues Telecom, S.F.R. and Orange). The 2003 implementation plan is described in the following table.

Figure 2.9.19-58 MOBITRANS implementation plan



This implementation planning has been respected and MOBITRANS is currently functioning. The first action to promote this new service took place in autumn 2003.

Figure 2.9.19-59 MOBISTRANS launching



MOBISTRANS system currently provides:

- The two next departures of any bus or tram route from any stop on the urban network,
- Warning messages about potential route disruptions (i.e. temporary diversions).
- The location of the nearest bus stops or tram stops from a given address.

Figure 2.9.19-60 MOBITRANS system



The “mobility workshops”

To build the basis of the implementation of a “mobility centre” or a “house for mobility”, Nantes Métropole has launched “the mobility workshops” in July 2004. This involved a sample group of citizens and is closely linked to active local democracy movements developed by Nantes Métropole, in particular to gain a better understanding of its citizens’ behaviour.

About 20 citizens has been selected on the basis of criteria including gender, age, status, home location and usual trip behaviour to be involved in workshops about mobility. From July to October 2004, lead by a moderator, they discussed and shared experiences and points of view about their mobility habits and explained their reasons for only choosing particular travel modes.

During three two-day sessions, they also met representatives from associations, interest groups and organizations or specialists working on mobility and transportation, to provide points of view and information.

A steering group composed of Nantes Métropole politicians, technical staff, SEMITAN and a scientific committee composed of experts in communication, town planning and mobility have attended the working groups.

Finally the group set out a series of proposals for Nantes Métropole:

- Focus on newcomers, to provide a guide about mobility and transportation rules and offers,
- Develop trip planner tools, in particular to compare different modes,
- Not only propose the Internet to communicate, but use other media too,
- Give advice to retailers about parking and accessibility,

- Organize trips in the city with children and their parents
- Adapt the ways to go to school for cyclists and pedestrians,
- Support car-pooling between schoolchild parents,
- Inform on all the modes for travelling, and about sharing public space,
- Inform about environmental impact of car usage,
- Encourage Children to talk to the parents about mobility issues,
- Support car-pooling and provide car-pooling tools,
- Create a mobility smart card, with free credit for trying new modes,
- Develop home deliveries,
- Create a working group between retailers and Nantes Métropole, to better organize parking for deliveries,
- Replace professional parking spaces with financial support from companies to P.T. pass,
- Raise understanding amongst pedestrians, cyclists and car users that they have to use the same space,
- Better explain the different types of parking,
- Improve the cycling network and create a route guide for cyclists,
- Build new safe bicycle parks,
- Allow cyclists to board buses and trams with their bicycle anytime,
- Inform car drivers about the needs of elderly and disable people,
- Provide real time information at bus stops,
- Provide better information in case of disruption

Then focusing more on the concept of “mobility information centre”, the group has proposed:

- A place where information and services are provided and shared between institutions and associations,
- Develop a place that meets the needs of people looking for information, but also consider increasing contact with people in schools, companies etc.
- Information must be present at times when people are likely to consider changing their travel habits (eg house moving, new birth).

In June 2005, a final meeting closed this mobility workshops session.

Evaluation Results - Multimodal information and booking

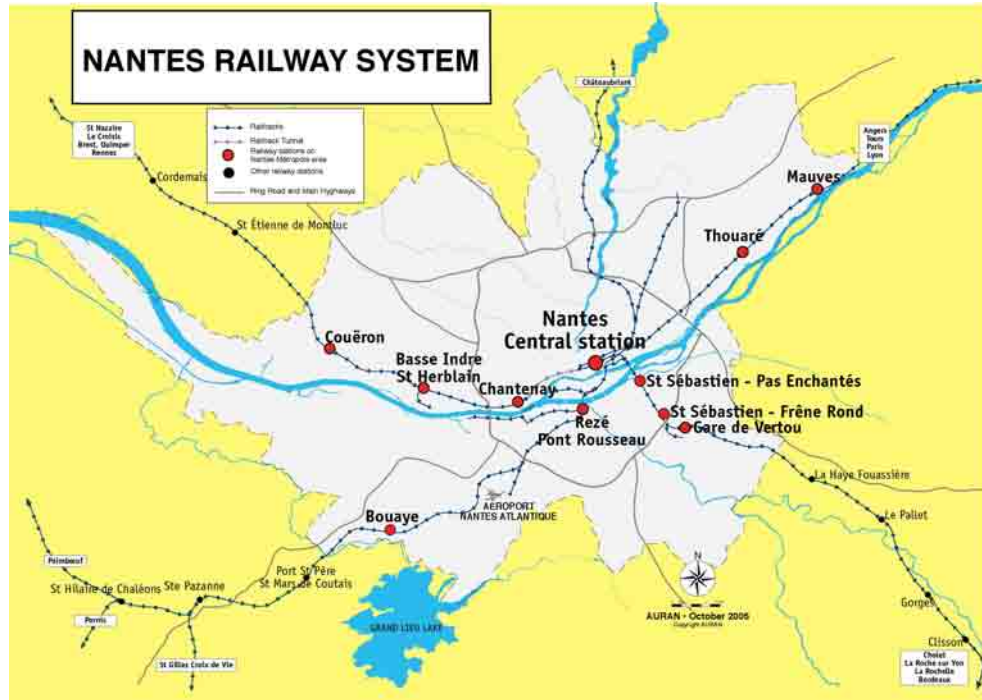
Nantes - Fare integration between regional trains and urban P.T. network

New fare integration between regional transportation and urban transportation has been monitored with surveys conducted on board trains serving 10 stations inside the urban Public Transport network area (apart from Nantes Central station).

The survey methodology covers Tuesdays and Thursdays over a two-week period. Passenger flows are identified while getting on board in the 10 urban stations towards Nantes and alighting in the 10 same stations while arriving from Nantes. During the last survey, in November 2004, customers boarding on surveyed trains towards Nantes completed a self-managed questionnaire to give more information about their profile

and their behaviour. 1,555 questionnaires were collected and analysed for a total of 2,524 people counted.

Figure 2.9.19-61 Railway stations in Nantes Métropole area

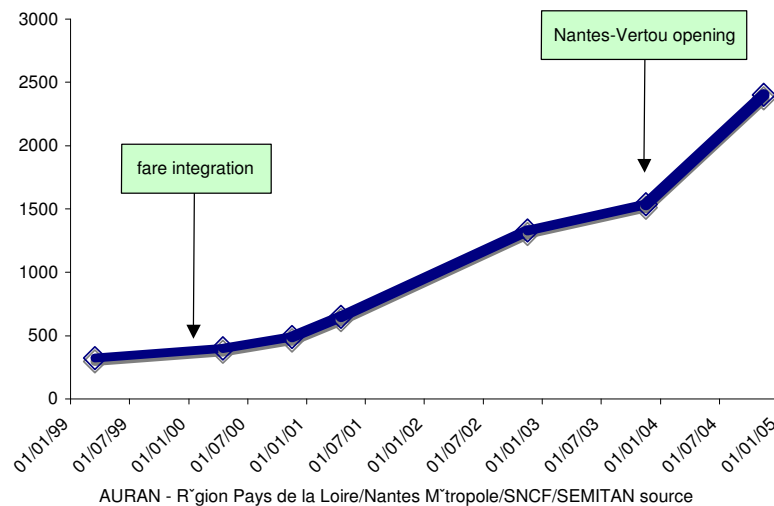


The results are summarized as follows:

The overall traffic in the 10 stations has grown by more than half in one year. On the new rail link between Nantes and Vertou, where more supplies and two new stations have been implemented at the end of 2003, the customer response is more significant: the traffic has nearly tripled between 2003 and 2004. People using regional trains inside the urban area use urban TAN fares for 75% of journeys. The remaining 25% are SNCF (operating company) agents or people who continue their journey with another train from Nantes Central station, for a large majority of them (8/10).

Table 2.9.19-18 Patronage evolution in rail stations in Nantes Métropole area

Boarding and alighting passengers							
R ^g ion des Pays de la Loire/Nantes M ^é tropole/SNCF/SEMITAN source							
Station	Mar-1999	Apr-2000	Nov-2000	Apr-2001	Nov-2002	Nov-2003	Nov-2004
Basse Indre - St Herblain	29	27	40	46	101	62	78
Bouaye	17	28	47	36	122	149	167
Chantenay	14	13	11	13	7	26	58
Cou'ron	59	91	100	129	259	277	313
Mauves				76	191	215	244
Rez ^é - Pont Rousseau	21	18	16	20	49	71	66
St S ^é bastien - Pas Enchant ^é s	0	0	0	0	0	0	215
St S ^é bastien - Fr ^é ne Rond	0	0	0	0	0	0	214
Thouar ^é	47	111	110	144	293	323	328
Vertou	136	112	166	184	307	414	717
Total	323	400	490	648	1329	1537	2400

Figure 2.9.19-62 Urban rail patronage evolution in Nantes Métropole area


- About three quarters of the customers are daily users; 90% are customers several times a week.
- 90% of people use train for compulsory journeys: to go to work or study.
- 80% of return trips are made by train, but only half people say that they never (or only because of special circumstances) use another mode for the return journey.
- One third of people arriving at their boarding station walk and 56% come by car (driver or passenger).
- People leave Nantes Central station by walking for 45% of journeys, 31% by tram, 4% by bus, 8% by tram + bus and 10% take an other train.
- 65% of people did the same journey the year before. Only 27% of them used regional trains, but 19% only used car and this rate is 35% for the new stations on the Nantes - Vertou link and 26% for this last station.
- The majority of users are women (55%) and balanced between young people (under 25 years old) and active people (26 to 60 years old). No data is available for users over 60 years old.

Nantes - New technologies in Public Transport information services: MOBITRANS

The context for developing MOBITRANS service has allowed potential barriers to be quickly overcome:

- A project group was organised with all major competencies associated.
- The strong willingness from top management to see this project to come to light in a very short time.
- Financial partnership at different levels.
- Contributions from mobile phones operators, despite their reluctance for sharing information in a field with a high level of competition
- Previous strong and coherent work on database structures and availability in SEMITAN
- The very early decision taken in the project to remain as simple as possible in the design specifications.

24 meetings were organised, 1,700 emails exchanged and the overall budget reached 110,000 €.

The implementation process has permitted results regarding human resources, image and strategic vision:

- Project contributors valorisation,
- New methods and techniques for learning,
- Strong cooperation between structures,
- Good communication tools, both internally and externally.

MOBITRANS is relying on three telecom operators that have strong communication and marketing capacities.

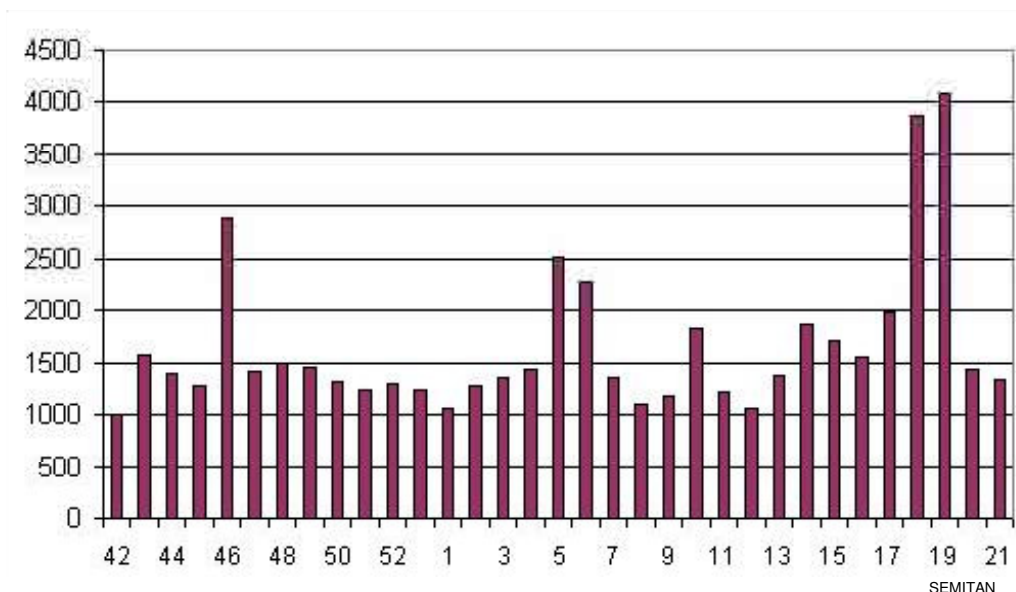
Users interviewees and a round table conference with 7 people was organised to discover how the new service has been perceived. The following table summarises the results:

Table 2.9.19-19 MOBITRANS perception

Positive points	Negative points
Information delivered is considered useful, relevant, reliable	In competition with other information systems (tram real time information) which are immediately available, paper information, Internet,
Ergonomics is judged easy, agreeable, user friendly.	Typing difficulties for first users: need to be an expert in both fields telephone usage and transport usage
MOBITRANS as such allows to better organization one's journey, to anticipate the time occupation. It helps adjusting last minute rendezvous (i.e. people meeting at connecting points)	A fear about communication costs
MOBITRANS matches the idea of modernity: mobility, immediate available information, combine usage of mobile phone and mobile Internet	Associated with relative bad image of WAP systems
It represents a way to confirm a personal status: young, modern, and clever.	

An average of 1,650 connections per week are identified on MOBITRANS (250 to 300 daily). These figures remain stable despite the fact that only one communication action has been conducted in September 2003. The following table shows the number of connections by week between August 2004 and May 2005.

Figure 2.9.19-63 MOBITRANS connexions



In 2004, the SEMITAN Internet site was entirely redesigned. This action had strong relationship with MOBITRANS: the overall Internet site feeds information about disruption, provided route by route, on MOBITRANS screens. SEMITAN preferred not to promote MOBITRANS while the Internet site was “under construction” and the links between the two services not stabilized.

Synthesis

The local objective of a better modal split in favour of Public Transport (LO 2.1), with a share of 18% in 2010 (v.s. 14.8% in 1998) is certainly not achievable with only the measures of this integrated package. It will require the all types of measures implemented in VIVALDI project, and evaluated at the city level.

The local objective to have six bus routes certified under NF EN 13816 standard in 2008, with 80% of SEMITAN customers travelling on certified routes is almost complete, due to the very good results obtained on bus routes 32 and 25 under VIVALDI project.

Increasing P.T. use from 20% to 30% and decreasing of the car share from 65% to 50%, for Nantes Métropole employees, constituting the local objective LO 2.3, must be continued with an ongoing internal survey. But the results obtained by Nantes City show that the aim is obtainable.

Local objectives LO 2.4 to 2.8, regarding parking policy and car drivers and owners responses, seem to be reached but need more time to evaluate the effects of the most recent decisions.

2.9.20 Nantes – Distribution of Goods

Overview of package

‘Goods distribution’ is one of the items identified within the Urban Mobility Plan and has to be discussed, due to the SRU law on town planning, housing and transport. However, until now nothing very structured has been implemented with regards to the Nantes urban area. Within the VIVALDI project, the main objective was to harmonise the rules about goods distribution in the whole city (transit and parking for lorries) (LO 3.1).

Table 2.9.20-1 Local objectives vs VIVALDI objectives

Local Objectives	VIVALDI Objectives
LO3.1 : To harmonise the laws about goods distribution in the whole city (transit and parking of lorries)	

2.9.20.1 Nantes - City logistics scheme/freight village (10.1)

Measure Overview

Nantes Métropole has approached this problem by consulting partners in logistic activities; in the urban area, for example, freight companies, retailers, Chamber of Commerce. Nantes Métropole did not receive any complaints from the freight companies about traffic or parking difficulties and problems are localised in specific areas, particularly in the centre of the town.

Nantes Métropole has collected all the rules about heavy vehicles transit and goods distribution. The main problem is the lack of unified regulation. This is due to the history of relations between communes in the urban area. Each commune had its own regulation on goods transit and distribution; therefore, there are 24 different regulations in the Nantes Métropole area. Even if companies are able to disclose their own regulations on this subject, Nantes Métropole now has the capacity to harmonise these regulations and to improve the structure of goods distribution, especially in link with the parking policy. This work is still being progressed.

Evaluation Results

No quantified results can be produced at this stage. A process is engaged to harmonise rules for heavy-duty traffic or deliveries in the urban area, but currently it is not complete.

2.9.21 Nantes – Collective passenger transport stimulation

Overview of package

The main objective for this urban area is to improve and promote new public transports facilities, alternatives to car use and lessen the dependency on the car. The specific target group are commuters from the south suburban areas and south-eastern inhabitants. The projects which are being implemented in this area aims to:

- Restrict the car traffic (LO 4.1),
- Extend the public transport offer (LO 4.2) with the introduction of a new rail service and a new bus corridor,
- Build new connecting points to integrate public transport systems,
- Promote an integrated strategy for parking and public transport (LO 4.3) with 4 new park and ride sites,
- Encourage high occupancy of vehicles (LO 4.4).

Table 2.9.21-1 Local objectives vs VIVALDI objectives

Local Objectives	VIVALDI Objectives
LO 4.1 : Restrict the car traffic	VT4 : Reduce car traffic in managed area by 10% VT9 : Increase patronage on key corridors by 20% VT18 : Increase cycle trips by 30% VT19 : Increase walking trips by 10%
LO 4.2 : extend the public transport offer	VT4 : Reduce car traffic in managed area by 10% VT9 : Increase patronage on key corridors by 20% VT10 : Increase access to PT system VT11 : Reduce transit time from peri-urban areas to centre by 15%
LO 4.3 : Promote an integrated strategy for parking and public transport	VT4 : Reduce car traffic in managed area by 10% VT9 : Increase patronage on key corridors by 20% VT10 : Increase access to PT system
LO 4.4 : Encourage high occupancy of vehicles	VT4 : Reduce car traffic in managed area by 10%

Despite the important flows insured by all modes (of which car traffic = 55 000 v/day) on the southeast area, this south-east urban area currently does not benefit from any strong and structuring collective transport system that would link it to the city centre. This sector is where the public transport market share is currently the lowest one of the Nantes urban area, concerning both journeys towards city centre and intra-zone trips.

This sector should have a strong demographic growth in the next 10 years, referring to prospective studies conducted by AURAN in the framework of the Urban Mobility Plan preparation. Thus, beyond the initial project to build the extension of the third tramway route to the southeast sector, complementary studies indicate that a credible alternative to car traffic could be optimised by the implementation of an integrated and global project.

Nantes Métropole elective representatives decided to combine the following projects:

- The creation of a new railway link between the communities of Vertou, St Sebastien and Nantes with the creation of new railway stations, park and ride and connections with the bicycle network,
- The remodelling of RN801 motorway. This large urban-through highway is located in an urban area inside the ring road, linking this one to the “Isle of Nantes”. The project includes restriction of a number of car lanes, speed limits and the creation of new inter-district links. Using this remodelled RN801, a new guided-bus corridor was created: the BusWay, linking the communes of Nantes, St Sebastien and Vertou. It will constitute the public transport route 4. Park and ride and connections with the bicycle network will be created along this new guided-bus route in the southeast area and a shuttle bus will connect this Bus-Way with tram route 2 and the tram route 3 extended at Pirmil station.

Figure 2.9.21-1 Transport strategy for the Southeast corridor



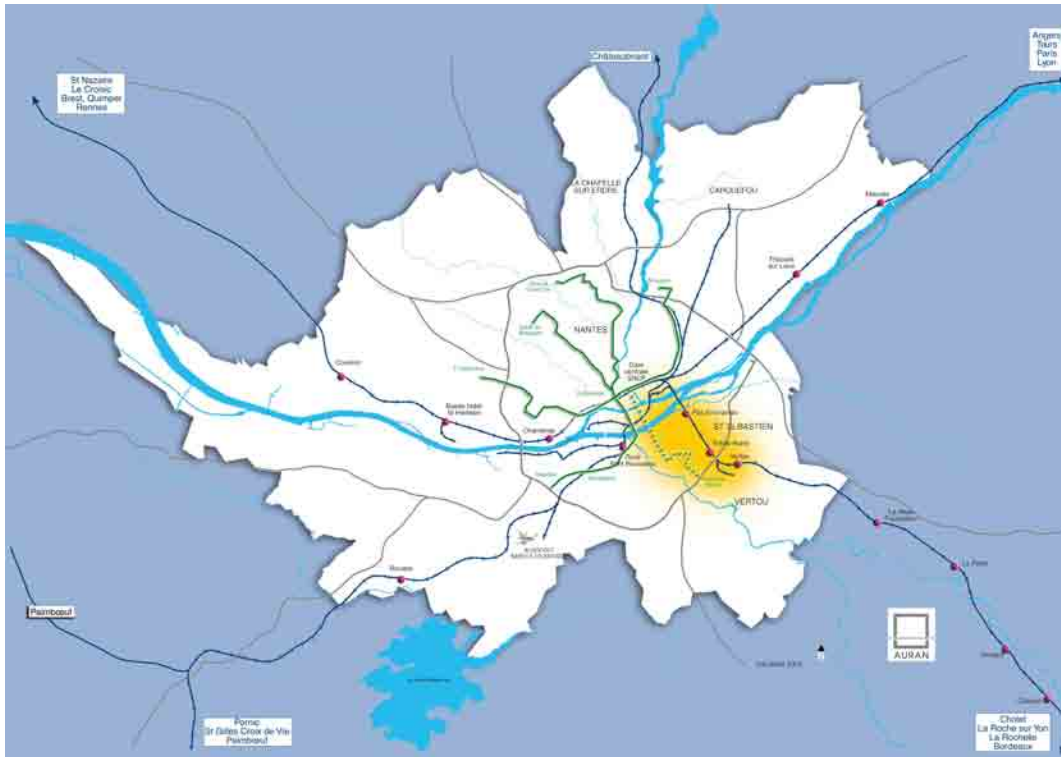
2.9.21.1 *Nantes – New interchange facilities (8.7)*

The specific target group for this project are the commuters and the visitors from the southeast suburban areas and the inhabitants of the southeast urban sector of Nantes Métropole. Many partners were involved in this project: Nantes Métropole, as urban transport authority; Region Pays de la Loire, as regional railway transport authority; Department Loire Atlantique, as interurban transport authority; the French Government, as national rail transport authority; RFF, as rail tracks network owner; SNCF, as rail public transport operator; Communes of Vertou, St Sébastien and Nantes on the territory where the rail tracks are; SEMITAN as urban public transport operator; and AURAN as advisor and feasibility study creator.

The design specifications of the project were:

- The use of the existing rail tracks, that ensures the national link between Nantes and Bordeaux, and on which circulate national trains and regional trains.
- The implementation of a scheduled railway link between the cities of Vertou, St Sébastien and Nantes, using existing regional trains stopping at the Vertou railway station and creating new rail services between Vertou and Nantes. The goal was to have 19 round trips each day (a train each 30min. in peak hours, 6 days a week).
- The creation of two new railway stations on the territory of St Sébastien city: Frêne Rond and Pas Enchantés,
- The refurbish of the Vertou railway station,
- The implementation of parking facilities for commuters who come by car or by bicycle:
 - 150 parking spaces at Vertou railway station (with extension possible),
 - 60 parking spaces at St Sébastien Frêne Rond station,
 - 80 parking spaces at St Sébastien Pas Enchantés station,
 - 20 enclosed parking spaces for bikes (closed boxes for 20 bicycles). Users have a free access by card, if they have a public transport monthly or annual ticket,
 - 12 free park spaces for bikes.
- The connection with the existing urban and interurban bus stops, close to the three railway stations,
- The possible extension of the link towards the existing Clisson railway station (a city in the southeast about 20 km from Vertou railway station).

Figure 2.9.21-2 Railway stations in the SouthEast



After the first feasibility studies in 1998, the partners signed an agreement for implementation of the project in early 1999. After that, detailed studies were carried out and the public consultation was at the end of 2001. The works began in April 2002 and ended in September 2003. After a two month period for security tests and staff training, a partial service opened: 19 round trips each day for the Nantes-Vertou link, and 10 round trips for the two other railway stations (“Frêne Rond” and “Pas Enchantés”). The 14 December 2003, the service was 19 round trips each day for each railway station.

Figure 2.9.21-3 New “St Sébastien – Pas Enchantés” station



Figure 2.9.21-4 Cycles parking spaces in Vertou station



Figure 2.9.21-5 Information systems



Figure 2.9.21-6 Nantes-Vertou timetable

Nantes*Vertou

N'oubliez pas de vous reporter aux renvois ci-dessous:
du 03/07/2005 au 10/12/2005

	Lun à Sam	Lun à Ven	Sam	Lun à Sam 1	Sam	Lun à Ven	Sam	Lun à Ven 1	Sam	Lun à Ven	Sam	Lun à Ven 2	Sam	Lun à Sam 3	Lun à Ven 4	Lun à Sam 3	Lun à Ven 5
NANTES	07.08	07.12	07.28	07.56	08.13	08.32	08.59	09.51	10.03	10.28	10.59	11.34	11.50	12.36	12.36	12.57	14.36
St-Sébastien - Pas Enchantés	07.17	07.33	08.01	08.18	08.37	09.04	09.57	10.08	10.33	11.04	11.39	11.55	12.41			13.02	14.41
St-Sébastien - Frêne Rond	07.21	07.37	08.05	08.22	08.41	09.08	10.01	10.12	10.37	11.08	11.43	11.59	12.45			13.06	14.45
VERTOU	07.15	07.24	07.40	08.08	08.25	08.44	09.11	10.03	10.15	10.40	11.11	11.46	12.02	12.48	12.51	13.09	14.48
		♣♣	♣♣	♣♣	♣♣	♣♣	♣♣	♣♣	♣♣	♣♣	♣♣	♣♣	♣♣	♣♣		♣♣	♣♣

	Sam	Lun à Sam 6	Sam 7	Lun à Ven	Sam	Lun à Ven	Sam	Lun à Ven	Sam	Lun à Ven	Sam	Lun à Ven	Lun à Ven 8	Lun à Ven 1	Lun à Jeu 9	10	Sam
NANTES	15.05	16.00	16.00	16.45	16.56	17.09	17.30	17.45	18.00	18.22	18.45	18.45	19.04	19.17	19.24	19.26	20.00
St-Sébastien - Pas Enchantés	15.10	16.05	16.05	16.50	17.01	17.15	17.36	17.50	18.05	18.27	18.51	18.51	19.09	19.22	19.30	19.31	20.05
St-Sébastien - Frêne Rond	15.14	16.09	16.09	16.54	17.05	17.19	17.40	17.54	18.09	18.31	18.55	18.55	19.12	19.26	19.33	19.34	20.09
VERTOU	15.17	16.12	16.12	16.57	17.08	17.21	17.42	17.57	18.12	18.34	18.57	18.57	19.14	19.29	19.36	19.36	20.12
	♣♣	♣♣	♣♣		♣♣	♣♣		♣♣	♣♣		♣♣	♣♣	♣♣	♣♣		♣♣	♣♣

	Lun à Ven	Lun à Sam	Sam	Sam
NANTES	20.30	21.45	22.45	23.45
St-Sébastien - Pas Enchantés	20.35	21.50	22.50	23.50
St-Sébastien - Frêne Rond	20.39	21.54	22.54	23.54
VERTOU	20.42	21.57	22.57	23.57
	♣♣	♣♣	♣♣	♣♣

	Dim et Fêtes	Dim et Fêtes	Dim et Fêtes	Dim et Fêtes	Dim et Fêtes	Dim et Fêtes	Dim et Fêtes	Dim et Fêtes	Dim et Fêtes	Dim et Fêtes	Dim et Fêtes	Dim et Fêtes	Dim et Fêtes	Dim et Fêtes	Dim et Fêtes
NANTES	08.13	09.26	10.03	11.50	12.36	13.35	15.05	16.00	16.56	17.30	18.03	18.45	19.22	20.17	
St-Sébastien - Pas Enchantés	08.18	09.31	10.08	11.55	12.41	13.40	15.10	16.05	17.01	17.36	18.08	18.50	19.27	20.22	
St-Sébastien - Frêne Rond	08.22	09.35	10.12	11.59	12.45	13.44	15.14	16.09	17.05	17.40	18.12	18.54	19.31	20.26	
VERTOU	08.25	09.37	10.15	12.02	12.48	13.47	15.17	16.12	17.08	17.42	18.15	18.57	19.34	20.29	
	♣♣	♣♣	♣♣	♣♣	♣♣	♣♣	♣♣	♣♣	♣♣	♣♣	♣♣	♣♣	♣♣	♣♣	

♣ Desserte assurée par autocar TER Pays de la Loire. Tarification SNCF.

♣ Train autorisé au transport gratuit des vélos.

- 1 Circule à partir du 29 août 2005.
- 2 Ne circule pas les 17, 18, 19, 20, 21, 24, 25, 26, 27 et 28 octobre 2005.
- 3 Ne circule pas les 17, 18, 19, 20, 24, 25, 26, 27 et 28 octobre 2005.
- 4 Circule du 17 au 28 octobre sauf le 21 octobre 2005.
- 5 Ne circule pas les 3, 4, 5, 6, 7, 10, 11, 12, 13 et 14 octobre 2005.
- 6 Circule à partir du 29 août 2005. Ne circule pas du 3 au 7 octobre et du 10 au 14 octobre 2005.
- 7 Circule jusqu'au 27 août 2005.
- 8 circule jusqu'au 26 août.
- 9 Circule à partir du 12 septembre 2005. Ne circule pas le 10 novembre 2005.
- 10 Circule à partir du 29 août 2005. Circule aussi le 10 novembre 2005.
- 11 Ne circule pas le 14 août 2005.
- 12 Ne circule pas les 14 juillet et 11 novembre 2005.

♣ Ces horaires sont donnés sous réserve de toute modification. 552 049 447 RCS Paris.

Figure 2.9.21-7 Vertou-Nantes Timetable

Vertou*Nantes																	
N'oubliez pas de vous reporter aux renvois ci-dessous du 03/07/2005 au 10/12/2005																	
	Lun à Ven	Lun à Ven	Lun à Sam	Lun à Sam 1	Lun à Ven 8	Sam	Lun à Ven	Lun à Ven	Sam	Lun à Ven	Sam	Lun à Sam 1	Sam	Lun à Ven	Sam	Lun à Sam 2	Lun à Ven
VERTOU	05.51	06.30	07.05	07.31	07.35	07.52	07.57	08.31	08.35	09.09	09.21	09.39	10.36	10.57	11.23	12.15	13.15
St-Sébastien - Frêne Rond	05.54	06.33	07.08	07.35	07.39	07.55	08.00	08.34	08.38	09.12	09.24	09.42	10.39	11.00	11.26	12.18	13.18
St-Sébastien - Pas Enchantés	05.57	06.36	07.12	07.38	07.43	07.58	08.03	08.37	08.41	09.15	09.27	09.46	10.42	11.03	11.29	12.21	13.22
NANTES	06.02	06.41	07.17	07.43	07.48	08.03	08.08	08.42	08.46	09.20	09.32	09.51	10.47	11.08	11.34	12.26	13.27
	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺
	Sam 13	Lun à Sam 2	Lun à Sam 5	Sam	Lun à Ven 14	Sam	Lun à Ven	Lun à Ven	Sam	Lun à Jeu 15	Sam	Lun à Jeu 16	Lun à Ven 1	Lun à Ven 1	Sam	Lun à Ven 1	Sam
VERTOU	13.15	14.09	15.35	16.35	16.49	17.23	17.45	17.56	18.22	18.29	18.43	18.43	18.59	19.21	19.23	19.59	20.50
St-Sébastien - Frêne Rond	13.18	14.12	15.38	16.38	16.52	17.26	17.48		18.25				19.02	19.24	19.26	20.02	20.53
St-Sébastien - Pas Enchantés	13.22	14.15	15.41	16.41	16.55	17.29	17.52		18.28				19.06	19.28	19.29	20.05	20.56
NANTES	13.27	14.20	15.46	16.46	17.00	17.34	17.57	18.04	18.33	18.37	18.50	18.50	19.11	19.33	19.34	20.10	21.01
	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺
	Lun à Ven	Sam	Sam														
VERTOU	21.22	22.07	23.07														
St-Sébastien - Frêne Rond	21.25	22.10	23.10														
St-Sébastien - Pas Enchantés	21.28	22.13	23.13														
NANTES	21.33	22.18	23.18														
	☺	☺	☺														
	Dim et Fêtes	Dim et Fêtes	Dim et Fêtes	Dim et Fêtes 17	Dim et Fêtes	Dim et Fêtes	Dim et Fêtes	Dim et Fêtes	Dim et Fêtes	Dim et Fêtes	Dim et Fêtes	Dim et Fêtes	Dim et Fêtes 17	Dim et Fêtes 18			
VERTOU	08.35	10.36	12.15	13.15	14.09	15.35	16.35	17.26	17.42	18.54	19.06	19.59					
St-Sébastien - Frêne Rond	08.38	10.39	12.18	13.18	14.12	15.38	16.38	17.29	17.45	18.57	19.09	20.02					
St-Sébastien - Pas Enchantés	08.41	10.42	12.21	13.21	14.15	15.41	16.41	17.33	17.48	19.00	19.13	20.05					
NANTES	08.46	10.47	12.26	13.26	14.20	15.46	16.46	17.38	17.53	19.05	19.17	20.10					
	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺					

☺ Train autorisé au transport gratuit des vélos.

- 1 Circule à partir du 29 août 2005.
- 2 Ne circule pas les 17, 18, 19, 20, 21, 24, 25, 26, 27 et 28 octobre 2005.
- 5 Ne circule pas les 3, 4, 5, 6, 7, 10, 11, 12, 13 et 14 octobre 2005.
- 8 circule jusqu'au 26 août.
- 13 Circule à partir du 3 septembre 2005.
- 14 Circule à partir du 29 août 2005. Ne circule pas les 3, 4, 5, 6, 7, 10, 11, 12, 13 et 14 octobre 2005.
- 15 Circule jusqu'au 25 août 2005.
- 16 Circule aussi le 13 juillet 2005.
- 17 circule à partir du 4 sept.
- 18 Ne circule pas les 14 juillet et 14 août 2005.

☑ Ces horaires sont donnés sous réserve de toute modification. 552 049 447 RCS Paris

Financial aspects:

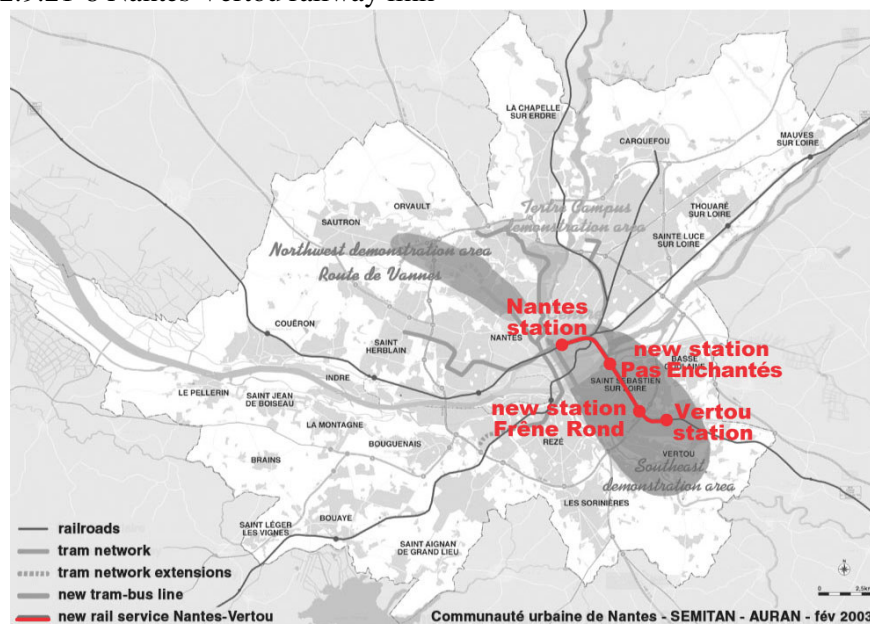
- Takings:
 - Total implementation costs: 16.5 M€

- Studies: 3.2 M€
- Properties: 0.5 M€
- Works: 11.8 M€
- Exploitation costs:
 - Additional exploitation costs for SNCF-RFF (railway operators): 0.32 M€
 - Additional costs for SEMITAN-Nantes Métropole: 0.04 M€
 - Additional exploitation takings: 0.147 M€
- Receipts
 - Nantes Métropole and VIVALDI project: 5.44 M€
 - Region Pays de la Loire: 5.1 M€
 - Department Loire Atlantique: 1.5 M€
 - SNCF: 0.4 M€
 - French State: 4.4 M€
- Annual socio/economic/environmental savings: 2.157 M€

New railway link between the cities of Vertou, St Sébastien and Nantes – Evaluation Results

The creation of the a new railway link between Nantes and Vertou, with two new stations (“St Sébastien – Pas Enchantés” and “St Sébastien – Frêne Rond”), has significantly developed train usage for commuters between outskirts and Nantes city centre.

Figure 2.9.21-8 Nantes Vertou railway link



In one year, passengers nearly tripled and are still increasing, especially with car traffic restrictions in the Southeast due to the BusWay works.

An annual survey regarding fare integration between regional trains and urban public transport (last issue in November 2004) gave information about customers' behaviour. The results are summarized as follows:

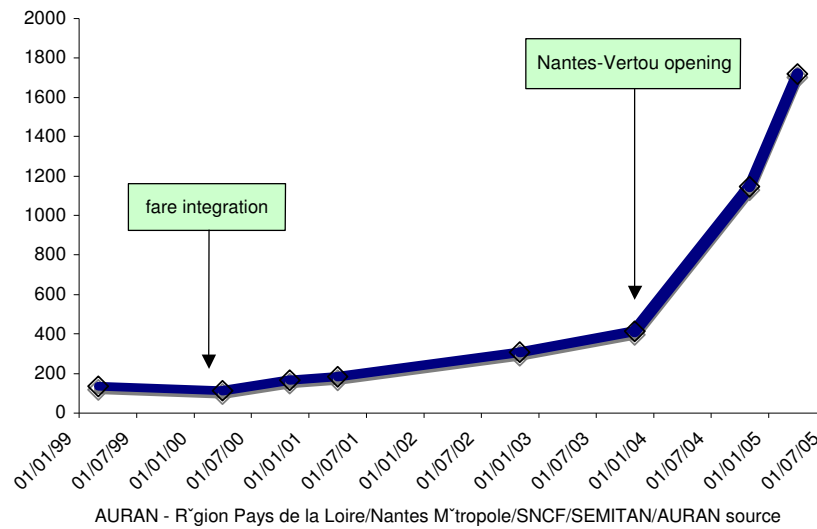
- Overall traffic has nearly tripled in one year. The patronage of Vertou station has almost doubled in a comparison with before the route.
- People using regional trains on the route use urban TAN fares for 73% of journeys. 12% are SNCF (operating company) agents. The remaining are people who have SNCF tickets for continuing their journey with another train from Nantes Central station.
- About 70% of the customers are daily users, and 82% use the route several times a week.
- 84% of people use the train for journeys to go to work (49%) or study (35%).
- Trains are used for 81% of return trips, but only 54% of the people say that they never use another mode for returning. This acts as a warning message about customers' loyalty and competition from other modes, in particular the car.
- 28% of people walk to their station and 62% travel by car (driver or passenger). The situation is very different between Vertou at the end of the route (walking: 14%; by car: 76%) and the other stations (walking: 53%; by car: 37% - cycling 6%). Very few people travel by bus.
- 52% of people did the same journey the year before. Only 24% of them used regional trains, but 29% only used car.
- Women are the majority of users (55%), Young people (under 25 years old) are 41% and active people (26 to 60 years old) 55%.

Because the situation is changing very quickly on this new link, AURAN conducted a small-scale survey in April 2005, in order to find out how many people were boarding during morning peak hours on the three stations Vertou, St Sébastien – Frêne Rond and St Sébastien – Pas Enchantés. The results, extended by using daily passenger rates from the survey of November 2004, show a new increase of patronage on the route.

Table 2.9.21-2 Patronage evolution on Nantes – Vertou railway link

Boarding and alighting passengers								
R'gion des Pays de la Loire/Nantes M'tropole/SNCF/SEM/TAN source (*) AURAN source								
Station	Mar-1999	Apr-2000	Nov-2000	Apr-2001	Nov-2002	Nov-2003	Nov-2004	Apr-2005
St S'bastien - Pas Enchant's	0	0	0	0	0	0	215	(*) 395
St S'bastien - Frêne Rond	0	0	0	0	0	0	214	405
Vertou	136	112	166	184	307	414	717	920
Total Nantes Vertou	136	112	166	184	307	414	1146	1720

Figure 2.9.21-9 Patronage evolution on Nantes – Vertou railway link



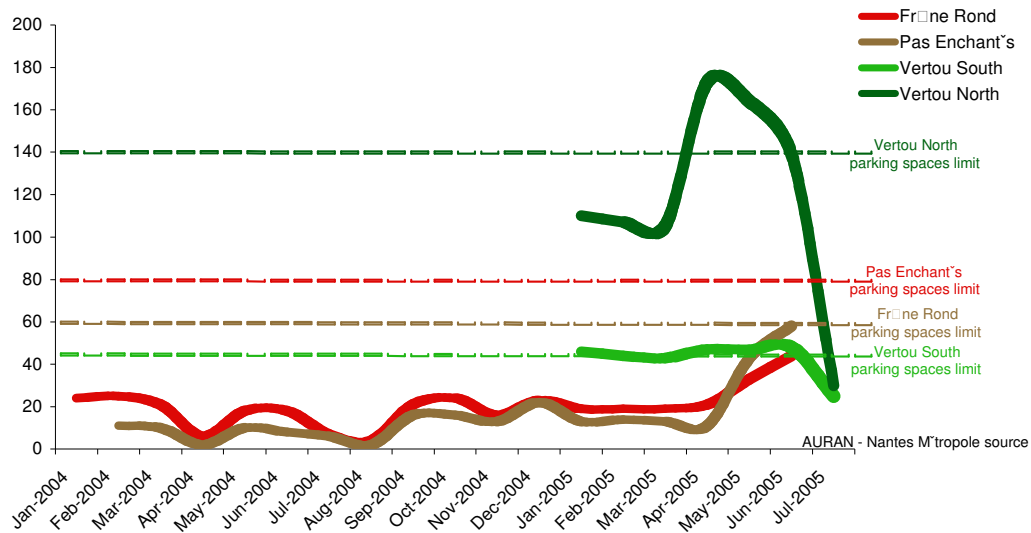
Park and Ride use on Nantes – Vertou railway link

The previous analysis, based on a survey carried out in November 2004, has shown that people who use car and trains on the same journey were more numerous at Vertou station than at the two other stations. Park and Ride (P+R) usage could give another view of this behaviour.

The figure below shows that the use of St Sébastien – Pas Enchantés P+R and St Sébastien – Frêne Rond P+R was very low compared to their capacity until April 2005. This date corresponds with the start of strong restrictions for car traffic in the Southeast, because of the BusWay works. Since this date, the use of these two P+R sites have greatly increased.

Since the route opening, Vertou P+R has been overcrowded, and the extension of the North P+R from 80 parking spaces to 140 has been implemented immediately after opening. The reduction in July is linked to the number of commuters, as shown previously.

Figure 2.9.21-10 Nantes – Vertou railway link Park and Ride use

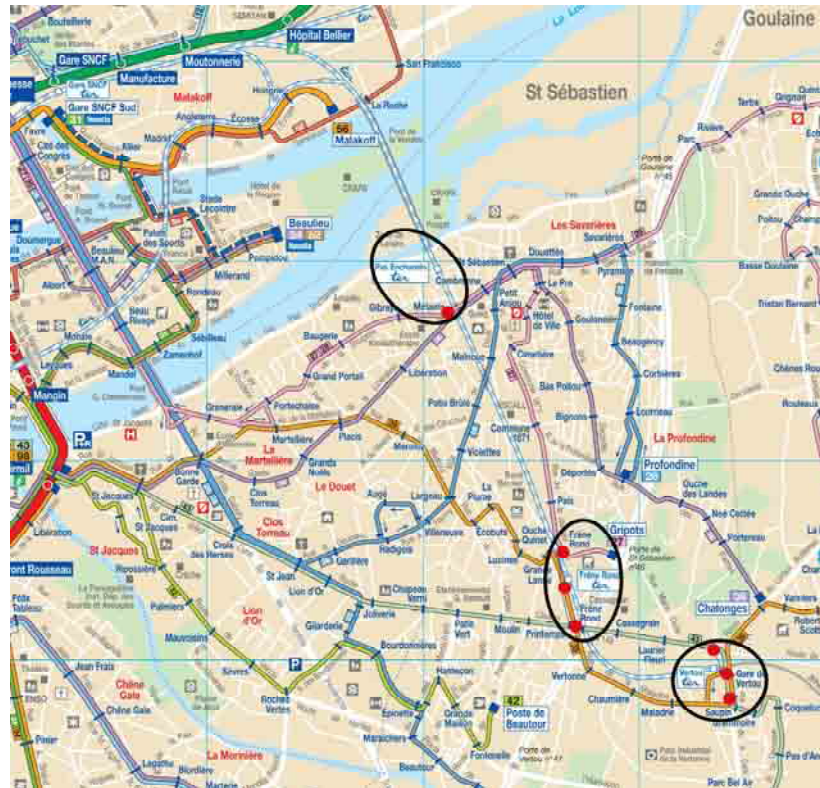


Bus – train combined use on Nantes – Vertou railway link

Another important point to note is the apparent lack of combined use between bus and train. Nantes – Vertou railway link, very few people travel to their station by bus, (only about 5%).

It seems that the opening of the railway link is boosting bus usage on bus stops close to the railway station. It may be the result of the train customers' attitude that appear to have changed their transport mode for their return trip. For the new stations "St Sébastien - Pas Enchantés" and "St Sébastien – Frêne Rond", the proportion of return trips made by bus or tram and bus combined, can reach 20 to 25%.

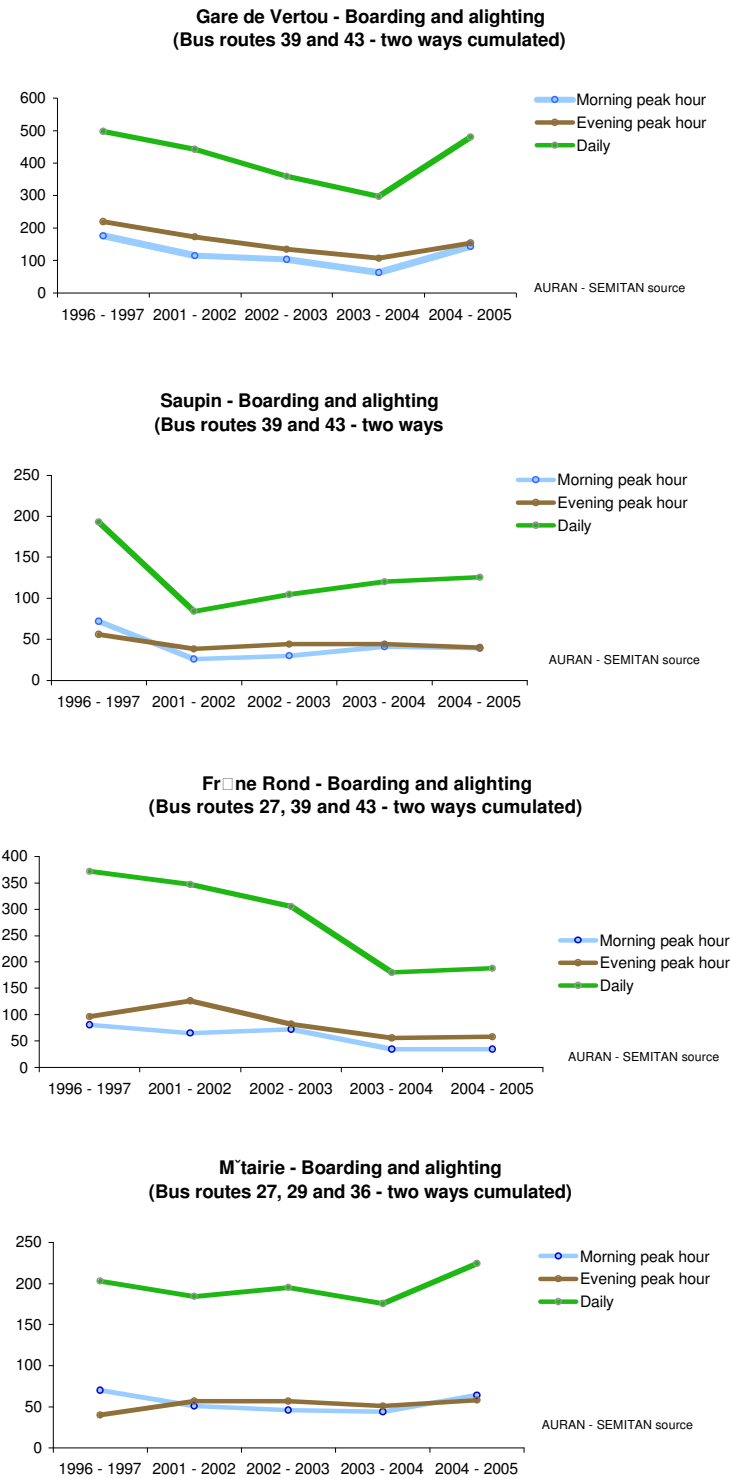
Figure 2.9.21-11 Bus stops location close to railway stations on Nantes – Vertou link



To facilitate the access to the new train service, SEMITAN had adapted the bus timetables for the routes in connection with the train stations. Two bus stops are located close to Vertou train station: one named “Gare de Vertou” and another one named “Saupin”, with two bus routes stopping at these stops (39 and 43).

These two stops have recorded a growth of 200 more daily boarding between 2003 and 2004, enabling the loss of patronage that had been observed during the three previous years, to be reversed. Similar effects are observed on the stops located around the two new stations in St Sébastien, although in lower proportions.

Figure 2.9.21-12 Boarding and alighting on bus stops close to Nantes – Vertou railway link stations



2.9.22 Nantes – Access restrictions – University campus

Overview of package

The Tertre University campus is located in the north of the city, between the ring road and the 19th century boulevards along the waterfront of the River Erdre, which is a protected green area. Of the 46,000 students of Nantes, more than 20,000 are located on this campus site. Tramway route 2 has served this site since 1993. However, car usage remains very high and there is little space is lacking to insure to this protected green zone. During the last ten years, different studies have been carried out on site, which suggest a total re-development of the area is needed. The major diagnosis elements were the following:

- Out of scale and sterilising car parks,
- Enclosed buildings and discontinuous growth, without any hierarchy in urban design,
- Lack of opening on the Erdre river space, mediocrity of common spaces and street approaches,
- Transport and road services are inaccessible and crowded.

To answer these questions, a decision was taken to implement a global project to remodel public spaces, to improve relations between territory, mobility and buildings. The main objectives for this VIVALDI project package involving the Tertre campus are the following:

- To improve accessibility of the site and buildings and the link with the tram stations (LO 5.1),
- To improve the link between the University site, the River Erdre and the neighbourhood (LO 5.2),
- To constitute quality public spaces, improve the functional organisation of the site and introduce new service activities for students (LO 5.3),
- To increase modal split in favour of soft modes and PT. In term of modal split, the objective are (LO 5.4):
 - From 21,5% currently to 10% in 2012 for students using car for commuting,
 - From 76% currently to 50% in 2012 for teachers and university staff using car for commuting.

In line with these objectives, the number of parking spaces available on the Tertre campus will decrease from 2 000 in 1999 to 1 700 currently, and to 1 600 in 2006 then 1 300 in 2012 (LO 5.5).

Table 2.9.22-1 Local objectives vs VIVALDI objectives

Local Objectives	VIVALDI Objectives
LO 5.1 : To improve accessibility of the site and buildings and the link with the tram stations	VT9 : Increase patronage on key corridors by 20% VT10 : Increase access to PT system
LO 5.2 : To improve the link between the University site, the River Erdre and the neighbourhood	VT9 : Increase patronage on key corridors by 20% VT10 : Increase access to PT system
LO 5.3 : To constitute quality public spaces, improve the functional organisation of the site and introduce new service activities for students	VT9 : Increase patronage on key corridors by 20% VT10 : Increase access to PT system VT18 : Increase cycle trips by 30% VT19 : Increase walking trips by 10%

LO 5.4 : increase modal share in favour of soft modes and PT : from 21,5% student car users currently to 10% in 2012 and from 76% teacher and university staff car users currently to 50% in 2012	VT4 : Reduce car traffic in managed area by 10% VT12 : To obtain a modal shift for students in the Nantes demonstration zones doubling the use of public transport and two wheelers
LO 5.5 : the number of parking places available is decreasing and will decrease next years : 2000 in 1999, 1700 currently, 1600 in 2006 and 1300 in 2012	VT7 : Reduce parking space in area by 10% VT15 : Regain urban space by replacing about 1000 private cars

2.9.22.1 Nantes - Access controlled University zone - Remodelling of campus (6.5)

Measure overview

The designing of a new layout for the Tertre campus site is a measure to make students, teachers and employees of the University change their behaviour. They constitute the main target group of this measure. The main partners involved in this action are:

- Nantes Métropole,
- Nantes City,
- University of Nantes,
- French Education Ministry,
- SEMITAN,
- AURAN,

All these partners are involved in a working group, which proposed actions, on the basis of the master plan designed by AURAN in 2000.

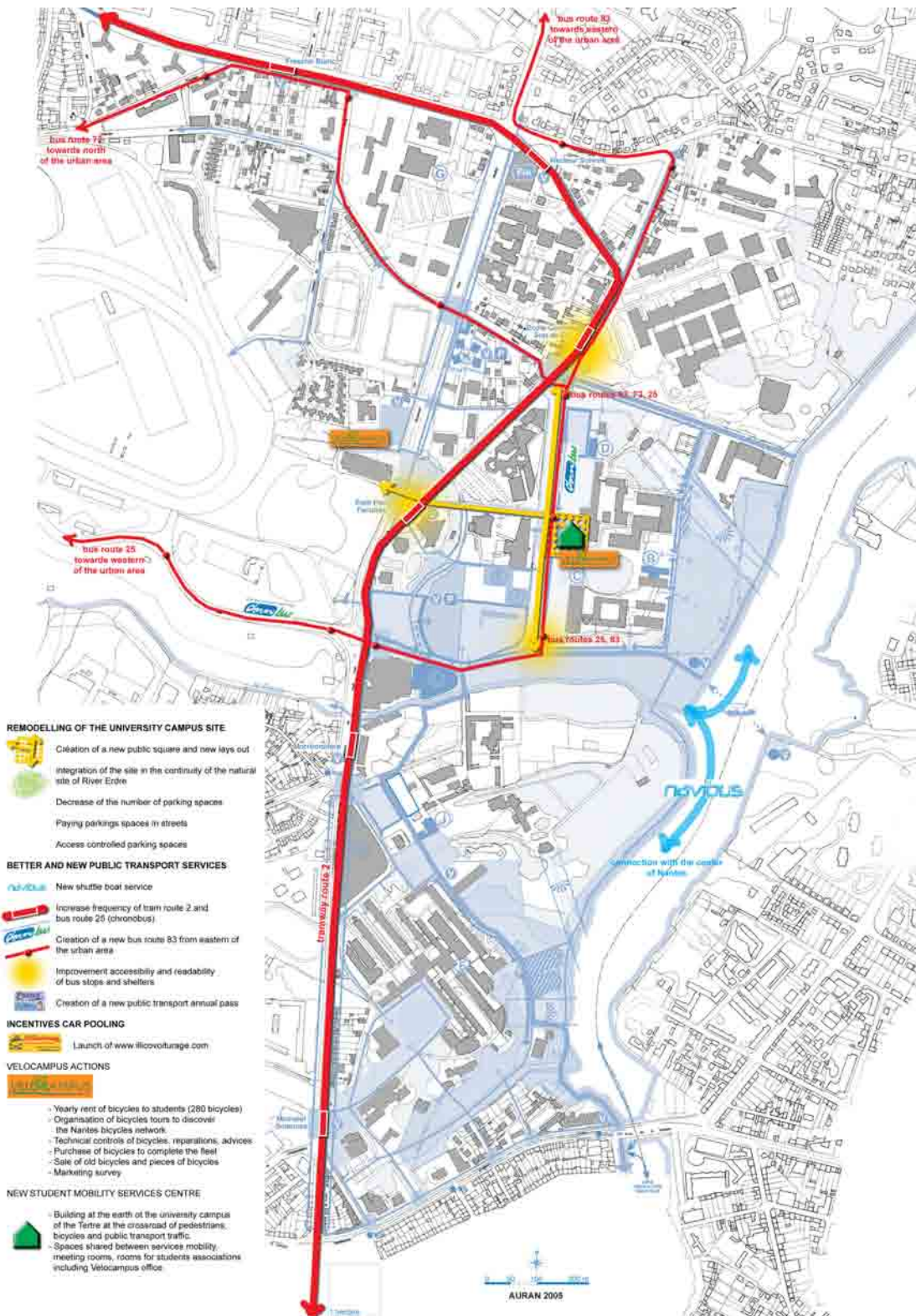


Figure 2.9.22-1 University campus master plan

At the centre of the Tertre campus there was a large space in front of the university buildings. This space was mainly a giant car park: more than 2,000 cars could park there. A new layout of this space, like a large esplanade for pedestrians, with new trees

and plantations, was carried out in 2002. About 300 parking spaces have been removed. The Censive du Tertre Street that crosses the site from north to South, is now a low speed zone. At the centre of the esplanade, new accommodation has been built and from this point, a new shopping area links the esplanade to the tramline station. New street furniture and 200 bike racks were installed on the esplanade and in the shopping area. To reduce the speed of cars, make safe the crossing for pedestrians and to make access for buses, new roundabout and cross walk has been created on the Guy Mollet Boulevard, that also make new access to the campus possible. The cost of this new layout is 5.2 M€. French State has brought 1.3 M€ and Nantes Métropole (with the CIVITAS contribution) 3.9 M€.



Figure 2.9.22-2 Tertre campus master plan

Figure 2.9.22-3 Tertre campus – previous situation before layouts and current situation

Previous



Current



Previous



Current



Previous



Current



Figure 2.9.22-4



The 1 700 parking spaces on the site could be removed in the future because of the construction of new buildings for the university. To discover how the needs for parking spaces in the future could be satisfied, a study in accordance with the Urban Mobility Plan has been carried out. The main conclusions of this study are:

- The mobility of students by car will decrease from 17% today to 10-11% in 2012, but it's necessary to build new parking spaces for replacing parking spaces deleted on public space. The total number of parking spaces needed in 2012 will be 1 400 parking spaces instead of 1 700 today.
- It's necessary to have specific rules to operate car parking on the site,
- It's necessary to modify the parking implementation rules, for the new buildings, to modify the repartition between parking spaces on public space (decreasing) and parking spaces in private buildings (increasing).

For the first point, a new public car park “Fresche Blanc” was created in 2005, with 130 parking spaces. It was built with a new student residence that includes 298 flats.

The cost of this car park for Nantes Métropole is 3.553 M€. The second point is still being discussed. For the third point, new rules have been designed and ordered by Nantes Métropole that are summarized in the following table:

Table 2.9.22-2 Town planning regulation in the University area
New rules for parking spaces implementation in new buildings

Use of the building	Number of parking spaces to build (GFA = gross floor area)	
	Rules before	Rules since 2004
Apartment buildings, student dwellings...	1 per 60 m ² GFA	1 per 90 m ² GFA
Single house	1 per 85 m ² GFA	1 per 90 m ² GFA
Special housing (old people, disabled people, youth...)	1 per 100 m ² GFA	1 per 150 m ² housing GFA 1 per 300 m ² other GFA
Hotels, motels...	1 per 100 m ² GFA	1 per 150 m ² housing GFA 1 per 300 m ² other GFA
Stores	* 0 if GFA < 300 m ² * If 300 m ² < GFA < 1000 m ² : 1,5 per 50 m ² GFA > 300 m ² * If GFA > 1000 m ² 2 per 50 m ² GFA > 1000 m ²	* 0 if GFA < 300 m ² * If 300 m ² < GFA < 1000 m ² : 1,5 per 50 m ² GFA > 300 m ² * If GFA > 1000 m ² 2 per 50 m ² GFA > 1000 m ²
Offices	1 per 50 m ² GFA	1 per 150 m ² GFA
Warehouses, shops...	1 per 200 m ² GFA	1 per 300 m ² GFA
Schools	* Primary school, middle school: 1 per 100 m ² GFA * High school: 1 per 75 m ² GFA	1 per 300 m ² GFA
Lounge, cafeteria, foyer, exhibition hall, meeting room...	Nothing	no parking space required
Other types (cultural building, hospital, university, research centre, library, stadium...)	1 per 50 m ² GFA	1 per 300 m ² GFA

	Construction mode	
	Rules before	Rules since 2004
All buildings	50% parking spaces inside the buildings in case of housing or office buildings	All parking spaces inside the buildings, for all kind of use, except for PWD parking spaces and deliveries
	Bicycle and motorized two wheels (GFA = gross floor area)	
	Rules before	Rules since 2004
All buildings	Nothing	Garage directly linked to the outside 1 m ² per 50 m ² GFA < 5000 m ² 1 m ² per 100 m ² GFA > 5000 m ²

Future discussions regarding plans until 2012 are currently taking place between Nantes Métropole and the University to continue the implementation of new layouts on the campus, for cyclists and pedestrians, and a new operating system for car parks.

2.9.22.2 Nantes - Access controlled University zone - New PT services (8.1)

Measure overview

The river Erdre is a protected green area. Tramway route 2 ensures a very efficient link between the Tertre campus and the centre of the city, but the link between the two banks of the river in the campus area is not as good. In 1997, Nantes Métropole had carried out an experiment with a boat (16 persons and 8 bicycles), crossing the river in the campus area. This new service took 72,000 passengers in 2001. It was decided, according the Urban Mobility Plan, to implement a design process to use the waterways for public transport.

In 2002, AURAN carried out a study about the possibility to develop waterbus services on the rivers Loire, Erdre and Sèvre. It was thought particularly relevant to have a waterbus between the central railway station and the Tertre campus on the river Erdre.

In June 2003, Nantes Métropole decided to create two new public transport services on waterways: the one mentioned above, and another on the river Loire between Trentemoult on the south bank and Gare Maritime on the north bank in connection with the tramline 1.

The target groups in the case of the Erdre waterbus, are campus students and workers, as well as all people travelling between the main railway station and the city centre or the suburbs around the River Erdre. The main partners for implementing these new services are:

- Nantes Métropole, as urban transport authority,
- Département Loire Atlantique, as local authority on the Erdre waterway,
- SEMITAN, as urban transport operator,
- AURAN, as advisor.

Other partners joined later, because of the operating mode chosen to operate the waterbus, or because of implementation issues.

During the end of 2003, 2004 and the first half of 2005, SEMITAN carried out calls for tenders to operate the two new waterbus routes decided by Nantes Métropole, and to renew the operator of the river Erdre ferry in the Tertre campus area. And also to build the waterbus stops along the river. Nantes Métropole had to develop a new process to explain the project to the public and work with safety services including firemen and civil security.

In 2004, Nantes Métropole and SEMITAN chose the company to operate the waterbuses on the river Erdre. The specifications required having a boat powered by a non-polluting engine, with a hull that makes very few waves, and especially designed to have quick and easy loading and unloading for about 90 passengers and 10 bikes. The result was delivered in June 2005, and immediately tested. The new waterbus service is called the “Navibus”.

Figure 2.9.22-5 Study of a new passenger boat for the river Erdre

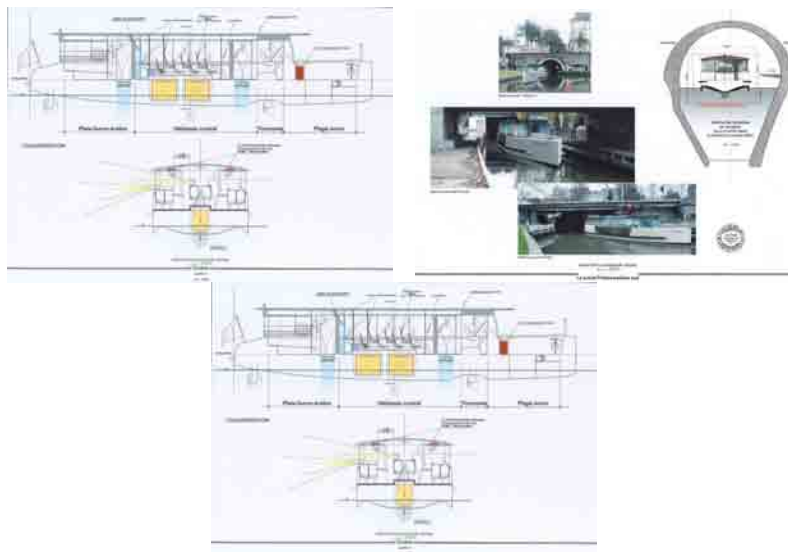
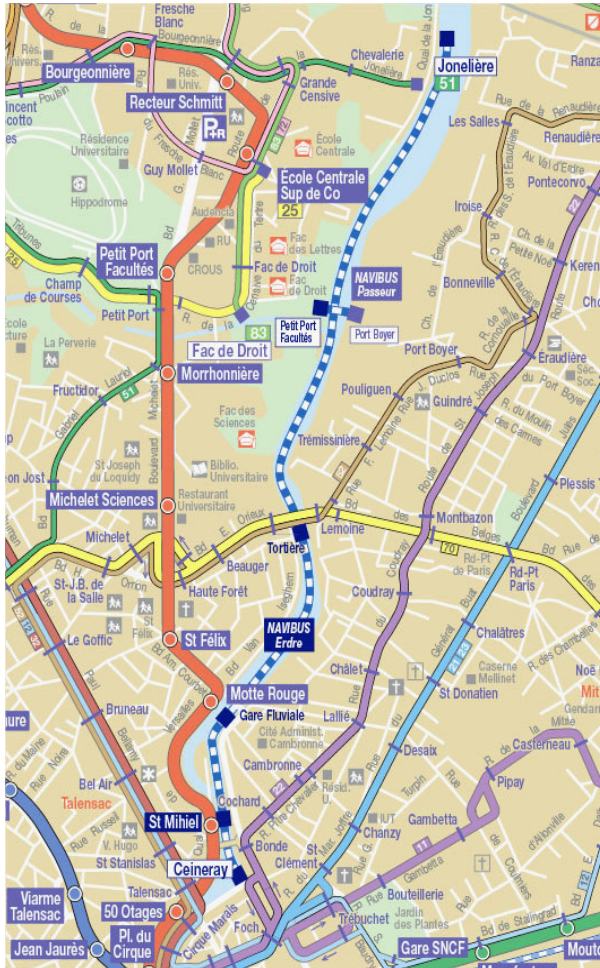


Figure 2.9.22-6 Navibus route



Since September 2005 the boat ran on an experimental hourly service between the city centre and “Jonelière”, cycling through Tertre campus stop. The link with the main railway station will be built soon.

Figure 2.9.22-7 : Navibus Tertre campus station



Navigation Erdre	Land à Vendre "Jour Jour"	CENSAZ vers JONELIERE	Navigation Erdre	Land à Vendre "Jour Jour"	JONELIERE vers CENSAZ
Calennay	751 900 1001 1149 1307 1420 1547 1709 1832 1941		Jonelière	712 830 948 1110 1229 1348 1504 1626 1744 1862 2000	
Saint-Michel	756 910 1030 1156 1312 1430 1552 1710 1833 1946		Petit Port Unif	722 840 958 1120 1239 1358 1514 1636 1754 1912 2030	
Gare Fluviale	845 901 919 1041 1159 1317 1430 1587 1716 1833 1951		Tortière	730 848 1006 1128 1240 1404 1522 1644 1802 1920 2038	
Tortière	850 907 1049 1207 1325 1440 1601 1723 1841 1999		Gare Fluviale	738 856 1014 1136 1254 1412 1532 1652 1810 1928 2046	
Petit Port Unif	791 817 935 1057 1215 1333 1451 1613 1731 1849 2007		Saint-Michel	742 860 1018 1140 1258 1416 1534 1656 1814 1932 2050	
Jonelière	710 836 944 1106 1224 1342 1500 1622 1740 1858 2016		Calennay	746 904 1022 1144 1302 1420 1538 1700 1818 1936	

Navigation Erdre	Samedi "Jour Jour"	CENSAZ vers JONELIERE	Navigation Erdre	Samedi "Jour Jour"	JONELIERE vers CENSAZ
Calennay	904 1022 1140 1518 1636 1754 1912		Jonelière	826 940 1100 1219 1439 1557 1716 1833 1991	
Saint-Michel	909 1127 1143 1409 1527 1641 1758 1917		Petit Port Unif	836 950 1110 1229 1449 1607 1726 1843 2001	
Gare Fluviale	756 914 1032 1150 1410 1528 1646 1804 1924 2032		Tortière	840 1020 1138 1257 1457 1616 1733 1851 2009	
Tortière	854 1022 1040 1156 1416 1536 1654 1812 1930		Gare Fluviale	851 1008 1127 1245 1465 1623 1741 1859 2017	
Petit Port Unif	812 930 1046 1206 1426 1544 1702 1820 1938		Saint-Michel	855 1010 1131 1249 1469 1627 1745 1903 2021	
Jonelière	821 939 1057 1216 1435 1553 1711 1829 1947		Calennay	859 1017 1136 1313 1531 1749 1907	

Navigation Erdre	Land à vendre "Jour Jour"	CENSAZ vers JONELIERE	Navigation Erdre	Land à vendre "Jour Jour"	JONELIERE vers CENSAZ
Calennay	751 900 1001 1149 1307 1420 1547 1709 1832 1941		Jonelière	712 830 948 1110 1229 1348 1504 1626 1744 1862 2000	
Saint-Michel	756 910 1030 1156 1312 1430 1552 1710 1833 1946		Petit Port Unif	722 840 958 1120 1239 1358 1514 1636 1754 1912 2030	
Gare Fluviale	845 901 919 1041 1159 1317 1430 1587 1716 1833 1951		Tortière	730 848 1006 1128 1240 1404 1522 1644 1802 1920 2038	
Tortière	850 907 1049 1207 1325 1440 1601 1723 1841 1999		Gare Fluviale	738 856 1014 1136 1254 1412 1532 1652 1810 1928 2046	
Petit Port Unif	791 817 935 1057 1215 1333 1451 1613 1731 1849 2007		Saint-Michel	742 860 1018 1140 1258 1416 1534 1656 1814 1932 2050	
Jonelière	710 836 944 1106 1224 1342 1500 1622 1740 1858 2016		Calennay	746 904 1022 1144 1302 1420 1538 1700 1818 1936	

Navigation Erdre	Dimanche et férié "Jour Jour"	CENSAZ vers JONELIERE	Navigation Erdre	Dimanche et férié "Jour Jour"	JONELIERE vers CENSAZ
Calennay	1400 1518 1636 1754 1912		Jonelière	1430 1557 1715 1833 1951	
Saint-Michel	1440 1622 1841 1750 1917		Petit Port Unif	1440 1627 1735 1843 2001	
Gare Fluviale	1410 1529 1646 1804 1922		Tortière	1457 1616 1733 1851 2009	
Tortière	1410 1536 1654 1812 1930		Gare Fluviale	1500 1627 1745 1903 2021	
Petit Port Unif	1429 1544 1702 1820 1938		Saint-Michel	1500 1627 1745 1903 2021	
Jonelière	1420 1553 1711 1829 1947		Calennay	1515 1631 1749 1907	

Figure 2.9.22-8 Navibus time table



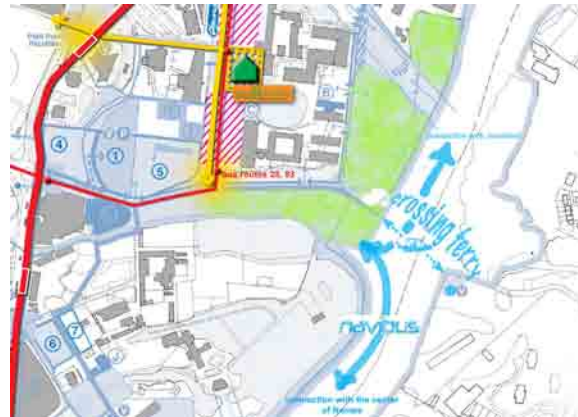
Figure 2.9.22-9 Navibus

Evaluation results

Two waterbus services exist on Tertre campus:

- The new Navibus that links the campus site to “Jonelière” area where there are student residences,
- A ferry that link the two Erdre riverbanks in an area where doesn’t exist any bridge over an average distance of 1 km towards the South and 2 km towards the North.

Figure 2.9.22-10 : Waterbus services on Tertre campus area



Each year, around 80,000 passengers and 1 200 bicycles are ferried by the crossing ferry.

The Navibus is a very new experimental service, launched in July 2005. With only one boat, the frequency is every 80 minutes and the operating hours are from 6h45 to 20h20. Since the 18 July 2005, the Navibus has carried close to 25,000 passengers and 450 bicycles, with 250 to 300 passengers as a daily average.

The waterbus service on the river Loire, from “Gare maritime” and “Trentemoult” (around 10 minutes ride), with a 20mn frequency, only available at peak hours, was launched on 17 June 2005. From this date until the end of October, more than 80,000 passengers and 3,800 bicycles were ferried, with a 600 passenger daily average.

So these waterbuses clearly answer the demand of people moving along or across the rivers in Nantes.

2.9.22.3 Nantes - Access controlled University zone - Creation of a new bus route

Measure overview

The tramline 2 is very crowded during rush hours. A lot of students coming from the east of the city use the tramline 1 then the tramline 2 to reach the Tertre campus. The new bus route 83 offers to these students to come to the campus directly from the east bank of the river Erdre without transit in the city centre, especially using the multiple connections point “Haluchère”.

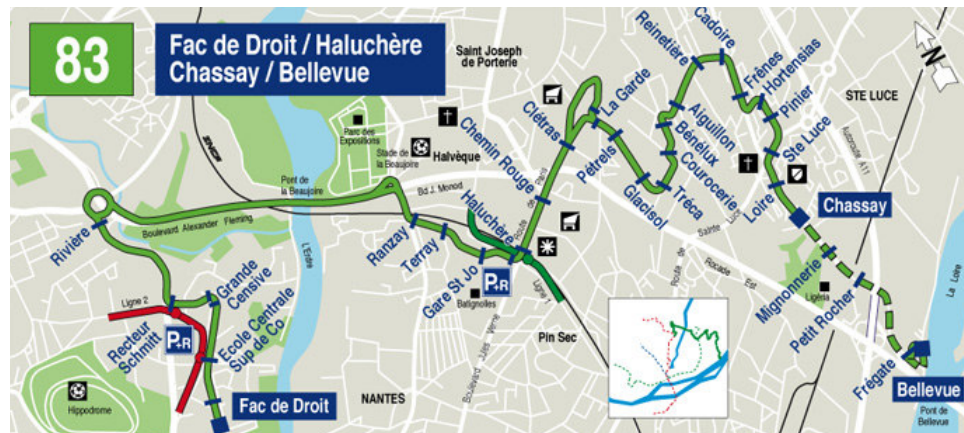


Figure 2.9.22-11 Bus route 83

83		Lundi à Vendredi "Jour Bleu"		FAC DE DROIT vers CHASSAY / BELLEVUE (STE LUCE)		83		Lundi à Vendredi "Jour Bleu"		BELLEVUE (STE LUCE) / CHASSAY vers FAC DE DROIT	
Fac de Droit	004	001	706	723	737	755	811	828	843	858	918
Ecole Centrale	005	002	708	724	738	756	812	829	844	859	919
La Garde	006	003	709	725	739	757	813	830	845	860	920
Bellevue	007	004	710	726	740	758	814	831	846	861	921
Chassay	008	005	711	727	741	759	815	832	847	862	922
Bellevue	009	006	712	728	742	760	816	833	848	863	923
Bellevue	010	007	713	729	743	761	817	834	849	864	924
Bellevue	011	008	714	730	744	762	818	835	850	865	925
Bellevue	012	009	715	731	745	763	819	836	851	866	926
Bellevue	013	010	716	732	746	764	820	837	852	867	927
Bellevue	014	011	717	733	747	765	821	838	853	868	928
Bellevue	015	012	718	734	748	766	822	839	854	869	929
Bellevue	016	013	719	735	749	767	823	840	855	870	930
Bellevue	017	014	720	736	750	768	824	841	856	871	931
Bellevue	018	015	721	737	751	769	825	842	857	872	932
Bellevue	019	016	722	738	752	770	826	843	858	873	933
Bellevue	020	017	723	739	753	771	827	844	859	874	934
Bellevue	021	018	724	740	754	772	828	845	860	875	935
Bellevue	022	019	725	741	755	773	829	846	861	876	936
Bellevue	023	020	726	742	756	774	830	847	862	877	937
Bellevue	024	021	727	743	757	775	831	848	863	878	938
Bellevue	025	022	728	744	758	776	832	849	864	879	939
Bellevue	026	023	729	745	759	777	833	850	865	880	940
Bellevue	027	024	730	746	760	778	834	851	866	881	941
Bellevue	028	025	731	747	761	779	835	852	867	882	942
Bellevue	029	026	732	748	762	780	836	853	868	883	943
Bellevue	030	027	733	749	763	781	837	854	869	884	944
Bellevue	031	028	734	750	764	782	838	855	870	885	945
Bellevue	032	029	735	751	765	783	839	856	871	886	946
Bellevue	033	030	736	752	766	784	840	857	872	887	947
Bellevue	034	031	737	753	767	785	841	858	873	888	948
Bellevue	035	032	738	754	768	786	842	859	874	889	949
Bellevue	036	033	739	755	769	787	843	860	875	890	950
Bellevue	037	034	740	756	770	788	844	861	876	891	951
Bellevue	038	035	741	757	771	789	845	862	877	892	952
Bellevue	039	036	742	758	772	790	846	863	878	893	953
Bellevue	040	037	743	759	773	791	847	864	879	894	954
Bellevue	041	038	744	760	774	792	848	865	880	895	955
Bellevue	042	039	745	761	775	793	849	866	881	896	956
Bellevue	043	040	746	762	776	794	850	867	882	897	957
Bellevue	044	041	747	763	777	795	851	868	883	898	958
Bellevue	045	042	748	764	778	796	852	869	884	899	959
Bellevue	046	043	749	765	779	797	853	870	885	900	960
Bellevue	047	044	750	766	780	798	854	871	886	901	961
Bellevue	048	045	751	767	781	799	855	872	887	902	962
Bellevue	049	046	752	768	782	800	856	873	888	903	963
Bellevue	050	047	753	769	783	801	857	874	889	904	964
Bellevue	051	048	754	770	784	802	858	875	890	905	965
Bellevue	052	049	755	771	785	803	859	876	891	906	966
Bellevue	053	050	756	772	786	804	860	877	892	907	967
Bellevue	054	051	757	773	787	805	861	878	893	908	968
Bellevue	055	052	758	774	788	806	862	879	894	909	969
Bellevue	056	053	759	775	789	807	863	880	895	910	970
Bellevue	057	054	760	776	790	808	864	881	896	911	971
Bellevue	058	055	761	777	791	809	865	882	897	912	972
Bellevue	059	056	762	778	792	810	866	883	898	913	973
Bellevue	060	057	763	779	793	811	867	884	899	914	974
Bellevue	061	058	764	780	794	812	868	885	900	915	975
Bellevue	062	059	765	781	795	813	869	886	901	916	976
Bellevue	063	060	766	782	796	814	870	887	902	917	977
Bellevue	064	061	767	783	797	815	871	888	903	918	978
Bellevue	065	062	768	784	798	816	872	889	904	919	979
Bellevue	066	063	769	785	799	817	873	890	905	920	980
Bellevue	067	064	770	786	800	818	874	891	906	921	981
Bellevue	068	065	771	787	801	819	875	892	907	922	982
Bellevue	069	066	772	788	802	820	876	893	908	923	983
Bellevue	070	067	773	789	803	821	877	894	909	924	984
Bellevue	071	068	774	790	804	822	878	895	910	925	985
Bellevue	072	069	775	791	805	823	879	896	911	926	986
Bellevue	073	070	776	792	806	824	880	897	912	927	987
Bellevue	074	071	777	793	807	825	881	898	913	928	988
Bellevue	075	072	778	794	808	826	882	899	914	929	989
Bellevue	076	073	779	795	809	827	883	900	915	930	990
Bellevue	077	074	780	796	810	828	884	901	916	931	991
Bellevue	078	075	781	797	811	829	885	902	917	932	992
Bellevue	079	076	782	798	812	830	886	903	918	933	993
Bellevue	080	077	783	799	813	831	887	904	919	934	994
Bellevue	081	078	784	800	814	832	888	905	920	935	995
Bellevue	082	079	785	801	815	833	889	906	921	936	996
Bellevue	083	080	786	802	816	834	890	907	922	937	997
Bellevue	084	081	787	803	817	835	891	908	923	938	998
Bellevue	085	082	788	804	818	836	892	909	924	939	999
Bellevue	086	083	789	805	819	837	893	910	925	940	1000
Bellevue	087	084	790	806	820	838	894	911	926	941	1001
Bellevue	088	085	791	807	821	839	895	912	927	942	1002
Bellevue	089	086	792	808	822	840	896	913	928	943	1003
Bellevue	090	087	793	809	823	841	897	914	929	944	1004
Bellevue	091	088	794	810	824	842	898	915	930	945	1005
Bellevue	092	089	795	811	825	843	899	916	931	946	1006
Bellevue	093	090	796	812	826	844	900	917	932	947	1007
Bellevue	094	091	797	813	827	845	901	918	933	948	1008
Bellevue	095	092	798	814	828	846	902	919	934	949	1009
Bellevue	096	093	799	815	829	847	903	920	935	950	1010
Bellevue	097	094	800	816	830	848	904	921	936	951	1011
Bellevue	098	095	801	817	831	849	905	922	937	952	1012
Bellevue	099	096	802	818	832	850	906	923	938	953	1013
Bellevue	100	097	803	819	833	851	907	924	939	954	1014
Bellevue	101	098	804	820	834	852	908	925	940	955	1015
Bellevue	102	099	805	821	835	853	909	926	941	956	1016
Bellevue	103	100	806	822	836	854	910	927	942	957	1017
Bellevue	104	101	807	823	837	855	911	928	943	958	1018
Bellevue	105	102	808	824	838	856	912	929	944	959	1019
Bellevue	106	103	809	825	839	857	913	930	945	960	1020
Bellevue	107	104	810	826	840	858	914	931	946	961	1021
Bellevue	108	105	811	827	841	859	915	932	947	962	1022
Bellevue	109	106	812	828	842	860	916	933	948	963	1023
Bellevue	110	107	813	829	843	861	917	934	949	964	1024
Bellevue	111	108	814	830	844	862	918	935	950	965	1025
Bellevue	112	109	815	831	845	863	919	936	951	966	1026
Bellevue	113	110	816	832	846	864	920	937	952	967	1027
Bellevue	114	111	817	833	847	865	921	938	953	968	1028
Bellevue	115	112	818	834	848	866	922	939	954	969	1029
Bellevue	116	113	819	835	849	867	923	940	955	970	1030
Bellevue	117	114	820	836	850	868	924	941	956	971	1031
Bellevue	118	115	821	837	851	869	925	942	957	972	1032
Bellevue	119	116	822	838	852	870	926	943	958	973	1033
Bellevue											

Figure 2.9.22-13 Public transport use and student population in Tertre campus area

P.T. use on Tertre campus v.s. students population						
SEMITAN / University of Nantes sources						
	School year			Evolution		
	1997-98	2003-04	2004-05	1997-98 / 2003-04	2003-04 / 2004-05	1997-98 / 2004-05
Students population	18800	18700	17900	-0,53%	-4,28%	-4,79%
Daily boarding and alighting	30000	28200	27200	-6,00%	-3,55%	-9,33%
Daily trips by student	1,60	1,51	1,52	-5,50%	0,76%	-4,77%

This demonstrates that between 2003 and 2005, the patronage decreased less than the number of students.

This can be explained by:

- Youngest students are those who are decreasing, in favour of the oldest who are more car owners and users.
- A lot of student residences have been built on the campus site or close to it, so walking and cycling are competitive with Public Transport on these short journeys.
- Because of demographics and urban development, more students' families are located out of the city centre than previously and also beyond the ring road, in areas where P.T. is not so efficient. Therefore, students will be more reliant upon cars.
- Because of the increase of lodging prices, students are more than before located in outskirts, and more frequently use flat sharing. So two consequences can happen: more car trips with car-pooling or more peripheral bus-routes (like bus route 25) use instead of radial P.T. routes.

The maps (see 3.2.2.1) that show the development of the PassCampus holders' location partially reflect these facts.

2.9.22.4 Nantes - Access controlled University zone - new Public Transport pass (8.6)

Measure overview

In order to improve the use of the urban Public Transport network, Nantes Métropole and SEMITAN have offered a new annual pass for students: the "PassCampus". It's not a special measure for the Tertre campus, but it's a mean to increase P.T. usage at this site. See 3.2.1.2.1.1.

Evaluation results

The evaluation of the new annual fare PassCampus was carried out earlier (see 3.2.2.1), but a result closely concerning Tertre campus students may be recalled here.

A survey was conducted among 208 students located on the campus areas (66 on Chantrerie campus and 142 on Tertre campus). PassCampus holders were 48%. A very large majority of them were located on the Tertre campus area. Among those PassCampus fare holders, 48% have direct access to a private car and use their car for

regular daily trips, less often than before the PassCampus began. Altogether, the number of car trips in a year amongst pass holders has decreased by 6 %.

2.9.22.5 Nantes – Cycle/Ride share - car-pooling (9.3)

Measure overview

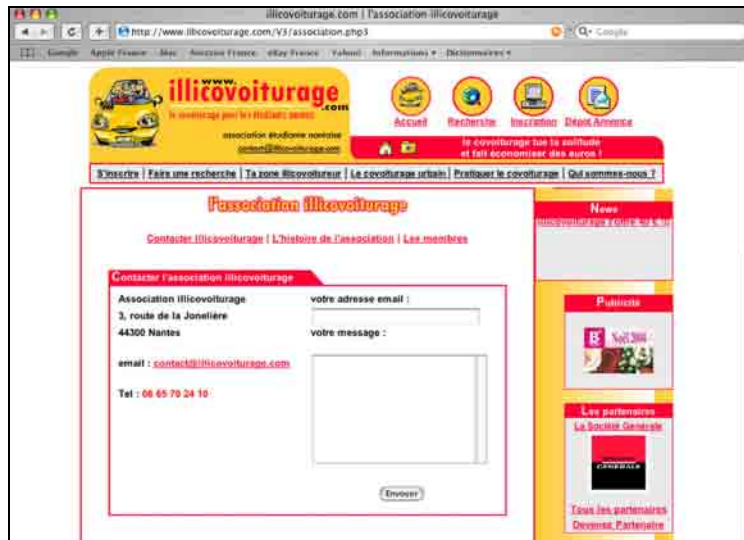
A student association, named “Illicovoiturage” has employed Nantes Métropole to develop an Internet carpooling service for students. According to the objectives of the Urban Mobility Plan, Nantes Métropole supported this association to launch the service. The target group was students who came to Tertre campus by car. Illicovoiturage partners for this operation were:

- Nantes Métropole,
- University of Nantes,
- ADEME (French government environmental agency),
- SMEBA (Mutual insurance company for students),
- Société Générale (private bank),
- Spot Mediacom (advertising agency)

The project was implemented in 2002, with the creation of the website. In January 2003 the website opened with the support of a promotion campaign during spring 2003. The campaign included press articles, 160 posters, 48 000 napkins in student restaurants and 2,000 flyers on cars parked near the university campus. The website provided two services: to find a car with driver for a trip as passenger, or to propose a trip by car as driver. The main trips targeted are daily commuting from home to university and at the weekend back to families, but many other trips could be proposed, the aim is to reduce car using by multi-using.

The cost for launching the operation in 2003 was about 7 000 €, with subsidies from Nantes Métropole (2 000 €), University of Nantes (3 500 €), ADEME (1 500 €) and a part of the promotion campaign covered directly by SMEBA.

Figure 2.9.22-14 Illicovoiturage Internet site



2.9.22.6 Nantes – Access controlled University zone – Vélocampus (9.3)

Measure overview

In accordance with the objectives of the Urban Mobility Plan, Nantes Métropole has decided to support a student association that offers cycling services on the Tertre campus. The targeted people are the students of this site but also all the students of Nantes. The Vélocampus partners are:

- Nantes Métropole,
- University of Nantes,
- City of Nantes,
- Région Pays de la Loire.

The Vélocampus association ensures tasks like:

- Promoting cycling to students,
- Renting bikes to students on a yearly basis,
- Purchasing new bicycles to renew the 300 previously available,
- Organising bicycle tours for students, to discover Nantes bicycle network,
- Controlling and repairing bicycles, advising students about bicycle maintenance,
- Selling old bicycles, bicycles parts or anti-thefts,

Vélocampus signed a global multi-annual convention with Nantes Métropole and receive annual subsidies. Vélocampus participates in the Nantes Métropole “soft modes committee”, which discusses actions to increase cycling in the Nantes area.

Figure 2.9.22-15 **VELOCAMPUS** bike type



Evaluation Results

The students' car-pooling association Illicovoiturage, which launched an Internet site to improve usage, has now about 1 000 regular users.

The bike rent service implemented by the students association Vélocampus, has been a great success. The total number of bikes rented during the last school year is shown in the table below. Stolen bikes represent around 1% and appear with good weather time it seems.

Table 2.9.22-3 Vélocampus bikes rent service – school year 2004-2005 results

V'locampus bikes rent service - school year 2004 - 2005												
V'locampus source												
Month of bike rent	Aug-2004	Sep-2004	Oct-2004	Nov-2004	Dec-2004	Jan-2005	Feb-2005	Mar-2005	Apr-2005	May-2005	Jun-2005	Jul-2005
Number of bikes rented by month	14	100	104	26	10	12	10	6	4	12	6	5
Bikes rented cumulated	14	114	218	244	254	268	278	284	288	300	306	311
Number of renting months	12	11	10	9	8	7	6	5	4	3	2	1
Number of bikes by month	77	89	33	24	19	4	8	18	9	8	2	1
Number of bikes cumulated	77	166	199	223	242	246	254	272	281	289	291	292
Number of stolen bikes										2	1	1

2.9.22.7 Nantes - Access controlled University zone - New student services centre (6.5)

Measure overview

With the new layout of the Tertre campus, the construction of a new student services centre offers a broad range of services at a strategic point. In particular mobility services for travelling on the urban P.T. network, cycling with Vélocampus or carpooling with Illicovoiturage. The target groups are the students crossing the Tertre campus site. The main partners for carrying out the student services centre are:

- Nantes Métropole,
- University of Nantes,
- CROUS,
- Students representatives,

The project planned to have the capacity to inform the students on all things for their everyday life in one place. The program was approved in March 2002 and the student services centre opened in September 2005.

Figure 2.9.22-16 Student services centre



Package-level evaluation results

Characteristics of the journeys towards the North area of Nantes

Characteristics of daily journeys towards the North area of Nantes can be analysed with mobility surveys. The amount of journeys (about 100 000) has slightly decreased, by 2.7% between 1997 and 2002.

The modal split between the all modes shows that the car's share is around 50%, so less than the average value for the all Nantes Métropole territory (62%). This is in favour of Public Transport that has a share of around 23%, instead of 14% for the all Nantes Métropole territory. Between 1997 and 2002, Public Transport share has decreased in the North area for school journeys, but P.T. journeys have more than doubled for work and personal activity purposes and highly increased for leisure journeys.

Car share has not changed between 1997 and 2002 in the North area for education journeys, whilst walking and cycling has increased their share. It may be the fact that more students have their home located on the campus site or very close to it. A lot of student residences in this area have been built in recent years.

Cycling has also increased its share greatly for work purposes for journeys towards Nantes North.

Figure 2.9.22-17 Evolution of daily journeys made by Nantes Métropole inhabitants towards Nantes North area

Journeys towards Nantes North area in 2002							
AURAN - 2002 mobility survey source							
Journey motive	Daily journeys		Modal split				
	Number	Structure	P.T.	Walking	Cycling	Moped/Motorbike	Car
Home return	35 404	32,6%	19,2%	25,3%	3,4%	1,4%	50,7%
Work	18 845	17,4%	14,6%	4,9%	3,7%	0,9%	75,8%
Education	27 842	25,7%	46,9%	17,3%	3,3%	1,6%	30,9%
Purchasing	5 118	4,7%	7,8%	58,0%	2,1%	0,1%	32,0%
Leisure	12 264	11,3%	12,5%	30,7%	1,1%	0,8%	54,9%
Personal activities	9 027	8,3%	4,3%	18,2%	0,8%	0,8%	75,9%
Total	108 500	100,0%	23,0%	21,3%	2,9%	1,2%	51,7%

Journeys towards Nantes North area in 1997							
AURAN - 1997 mobility survey source							
Journey motive	1997 Daily journeys		Modal split				
	Number	Structure	P.T.	Walking	Cycling	Moped/Motorbike	Car
Home return	42 460	38,1%	17,2%	23,7%	1,9%	1,6%	55,6%
Work	12 562	11,3%	10,4%	9,1%	2,8%	0,2%	77,4%
Education	31 950	28,6%	50,6%	16,2%	1,5%	0,7%	31,0%
Purchasing	7 520	6,7%	6,0%	39,2%	5,7%	1,2%	47,9%
Leisure	7 706	6,9%	11,6%	38,9%	2,3%	0,7%	46,4%
Personal activities	9 331	8,4%	1,8%	33,3%	4,0%	0,0%	61,0%
Total	111 529	100,0%	23,6%	22,8%	2,4%	1,0%	50,3%

Journeys towards Nantes North area - evolution 1997 - 2002							
AURAN - 1997 and 2002 mobility survey source							
Journey motive	Daily journeys evolution		Daily journeys evolution by mode				
	North area	Urban area	P.T.	Walking	Cycling	Moped/Motorbike	Car
Home return	-16,6%	-2,8%	-7,2%	-11,0%	47,7%	-28,2%	-23,8%
Work	50,0%	-17,2%	110,6%	-19,0%	100,0%	584,0%	46,8%
Education	-12,9%	-3,9%	-19,2%	-7,0%	85,8%	97,7%	-13,0%
Purchasing	-31,9%	-3,0%	-11,7%	0,6%	-74,5%	-	-54,5%
Leisure	59,1%	-2,1%	71,8%	25,6%	-24,9%	64,9%	88,3%
Personal activities	-3,3%	0,0%	137,2%	-47,1%	-80,6%	-	20,4%
Total	-2,7%	-3,8%	-5,2%	-9,3%	18,9%	18,3%	0,0%

Parking and car usage

Studies carried out regarding parking on the Tertre Campus allowed evaluation of demand and scheduling of the evolution and the building of new parking spaces, to replace those removed by the construction of new buildings.

Table 2.9.22-4 Scheduled evolution of parking spaces on Tertre Campus

Parking spaces on Tertre Campus							
Nantes M ^{et} ropole source							
	Start of the new school year						
	2002	2004	2005	2006	2008	2010	2012
Parking spaces demand	1776	1749	1729	1686	1648	1423	1311
Parking spaces offer	1706	1706	1671	1591	1611	1481	1331
Balance	-70	-43	-58	-95	-37	58	20

A survey carried out by SARECO as part of the studies regarding students car parking, has shown that the number of students travelling by car to Tertre campus has decreased from 22% to 17%, after the new layouts and parking restrictions (300 parking spaces removed) implemented on the site.

Air pollutants development

In the Tertre campus area, only one monitoring point exists, located in the North of Nantes city in the “Chauvinière” suburb. Three pollutants are being monitored at this

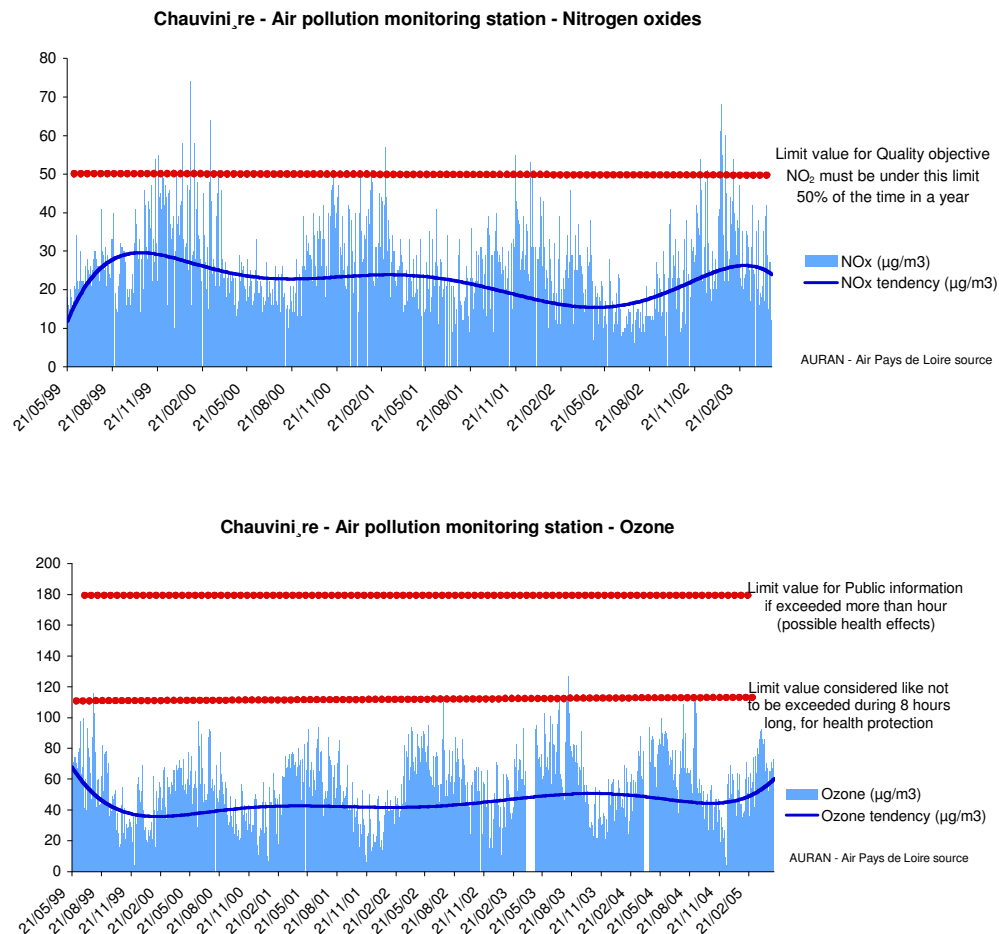
point: Ozone, Nitrogen oxides and Particles. This monitoring point stopped monitoring for Nitrogen oxides in spring 2003.

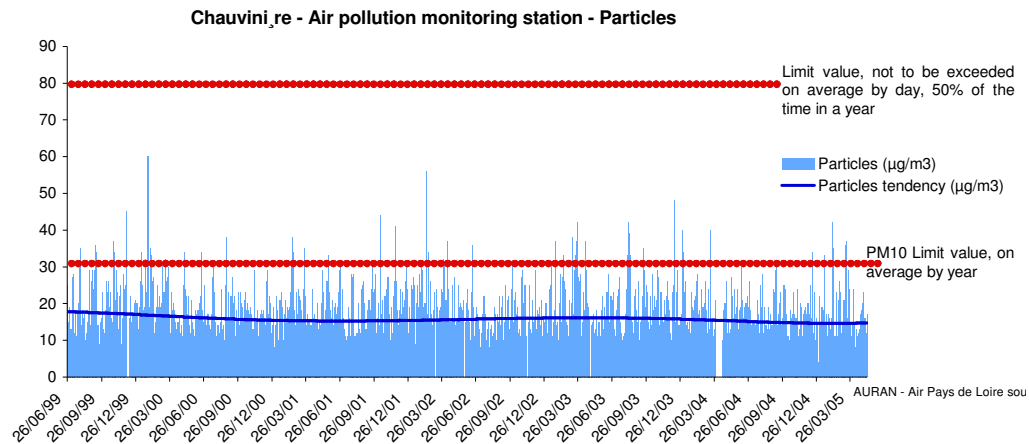
Figure 2.9.22-18 North air quality monitoring point location



All pollutants are below critical values. Ozone peaks appear during summertime, when there are higher temperatures and more sun. Nitrogen oxides peaks appear during wintertime, when traffic volumes are higher.

Figure 2.9.22-19 Air pollution in Tertre campus area





Synthesis

The new layouts on the Tertre campus site have renewed the quality of public spaces. It has permitted an improvement of accessibility to all buildings, and ensures a comfortable link with the two stations of the tramline 2, and also with the two bus stops on the site, as required by the local objectives LO 5.1 and LO 5.3.

The implementation of the new waterbus service “Navibus” has enabled the layout between the campus and the waterbus station to be improved. It has enforced the link over the Erdre river towards the East bank neighbourhoods as required in local objective LO 5.2.

The modification of the modal split in favour of alternative modes on the Tertre campus site seems to be on the way: car share has not increased in the North area for education purposes and has decreased for work purposes. Walking and cycling share has increased for education, and public transport and cycling has increased for work purposes. Parking space restrictions have enabled a reduction in car share for journeys made by students to the faculties (from 22% to 17%). So the local objectives LO 5.4 for 2012 seem to be realistic, if the local objective LO 5.5 to decrease parking spaces available on the campus site is continued.

2.9.23 Nantes – Access restrictions

Objectives and targets

The remodeling of Vannes road, with five main objectives, underline the urban project on this sector:

- Create through road status for this section of road (LO 6.1),
- Ensure functionality and vocation of commercial sector (LO 6.1),
- Ensure identity of urban sectors (LO 6.1),
- Develop inter districts links (LO 6.1),
- Implementation of public transport modal split (LO 6.2).

Three distinct projects are carried out :

- A road remodelling programme (Route de Vannes) in 3 phases,
- An extension of tramline 3 towards northwest, route that has been put in service in September 2000 (not included in VIVALDI),
- In link with the 2 projects above, a multi-modal station is being set up at the junction of the line 3 and the Vannes road, and will include a 300 places park and ride car park, a single-ticket bus-tram interchange and a ground-level car park with 90 places.

The integration of these three projects enable the development of a coherent and consistent programme built on following objectives about mobility:

- Develop an innovative connecting point (bus-tram-private car) including other functions such as shops and housing (LO 6.3)
- Give a more readable and attractive character to the LRT system alongside the through road, while enhancing accessibility and safety for pedestrian (LO 6.4),
- Create an improvement of bus traffic, comfort and accessibility for customers at stops on Route de Vannes (LO 6.5)
- Enable the development of multimodality between the private car /public transport through a real accessibility and strong incentive to car traffic to use a new park and ride site (LO 6.6),
- To study and experiment from the beginning of the works phase with a better coordination of goods delivery on the sector.

Table 2.9.23-1 Local objectives versus VIVALDI objectives

Local Objectives	VIVALDI Objectives
LO 6.1 : Give to this road segment its through road identity, Insure functionality and vocation of commercial sector, Insure identity of crossed urban sectors and sequences, Develop inter districts transversal links	
LO 6.2 : Implementation of Public transport modal split	VT4 : Reduce car traffic in managed area by 10% VT9 : Increase patronage on key corridors by 20% VT10 : Increase access to PT system
LO 6.3 : To develop an innovative connecting point (bus-tram-private car) enlarging to other functions than transport including shops and housing	VT10 : Increase access to PT system
LO 6.4 : Give a more readable and attractive character to the LRT system alongside the through road, while enhancing accessibility and safety for pedestrian	VT10 : Increase access to PT system
LO 6.5 : Create on Route de Vannes conditions for an improvement of bus traffic, comfort and accessibility for customers at stops	VT9 : Increase patronage on key corridors by 20% VT10 : Increase access to PT system
LO 6.6 : Enable the development of multimodality private car /public transport through a real accessibility and strong incentive to car traffic to use a new park and ride site	VT4 : Reduce car traffic in managed area by 10% VT9 : Increase patronage on key corridors by 20% VT10 : Increase access to PT system

2.9.23.1 Nantes – Corridor restriction – Vannes Road (6.6)

Measure overview

The project for remodelling the Vannes road, historical axis from the city centre towards Brittany, and now broad shopping avenue inside the ring road (shopping surface about 127 000 m²), started in 1999-2000 with the preliminary studies. The project concerns part of Vannes road that is about 3.7 km long (about 134 000 m²).

Figure 2.9.23-1 Vannes road project location

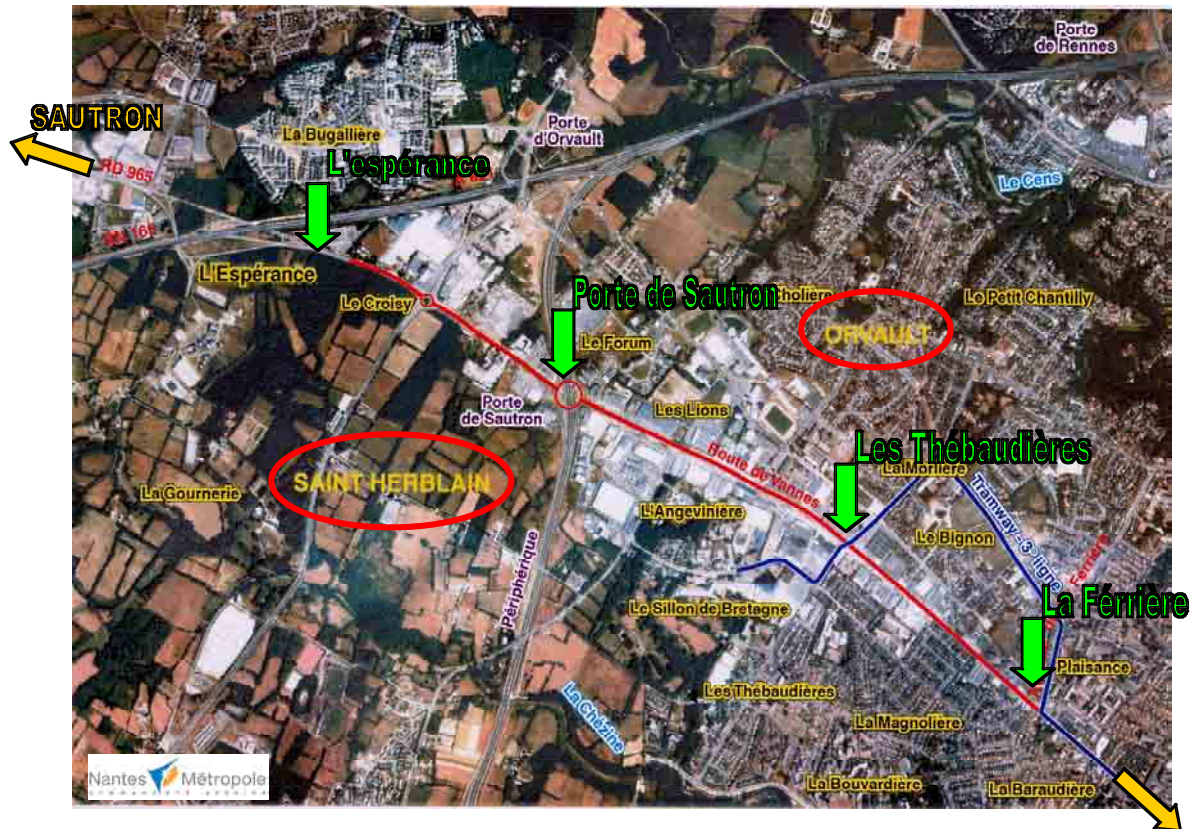


Figure 2.9.23-2 Typical Vannes road landscape



People targeted by this large project are commuters crossing the site and shopping visitors and also inhabitants and workers of the area. Numerous partners have been involved in the project since the start:

- Nantes Métropole as the public authority on town planning, roads, public transport...
- Orvault city and St Herblain city (Vannes road is the border between the two cities),
- Department of Loire Atlantique as road authority,
- French roads Ministry,

- Association of the retailers located alongside the Vannes road,
- SEMITAN as public transport operator,
- TETRAC/SCE/MAGOS as architects and engineers in charge of the project,
- AURAN as preliminary studies initiator and advisor.

A steering group under Nantes Métropole followed the project advancement. The diagnosis highlighted several points:

- The site is a multipurpose four lane highway through dense suburb bearing heavy traffic, with long distance traffic, urban traffic and local traffic, mixed with a big regional shopping centre function and a lot of services around.
- Poor public perception
- Complicated accessibility to shops,
- Poor links between the suburbs on each side of the road,
- Difficulties for cycling or walking,

Figure 2.9.23-3 : Vannes road current environment



The project of remodelling the Vannes road lead by Nantes Métropole to improve the quality of urban spaces along this road and to offer better Public Transport services and soft modes facilities, in combination with the ring road and shopping area. Car traffic restriction on Vannes road was only possible if Public Transport was available to go to the centre of the city. The creation of a strategic connecting point, with park and ride facilities, a high-performance bus/tram connection and the integration of housing and shopping functions, had to promote Public Transport for car users, especially commuters, who travel from the Northeast of Nantes Métropole and suburban areas. The improvement of bus routes in this area and the scheduled extension of tramline 3 also helped to implement these objectives.

After the preliminary studies, the design of the project started with TETRARC/SCE/MAGOS master-builder and a first draft was proposed at the end of 2001. The main concepts of the project were:

- Give through road status to the road,
- Ensure the vocation and the functionality of the shopping centre,
- Ensure the identity of urban areas,
- Develop inter-districts links,
- Implement a main Public Transport connecting point.

This project is divided in four geographical sectors that will determine "road and urban sequences". From the outskirts towards the city centre, it will successively cross:

- A transition area between the motorway to the start of the shopping area,
- A shopping promenade,
- A shopping square,
- An urban boulevard,

The main principles of the remodelling project are:

- Assign freight traffic to a central two-way road
- Assign local traffic to side lanes,
- Create more roundabouts along the Vannes road,
- Implement pedestrian facilities on both sides of the road and dandify pedestrian crossings,
- Implement cycling facilities on both sides,
- Assign bus routes on the central road, with efficient connections at the crossing point with the tramline 3.
- Improve the landscape to give a new image and a clear vision of the functions, in particular shopping, with a new road lighting concept for night times.

Figure 2.9.23-4 : Vannes road - Urban sequences projected

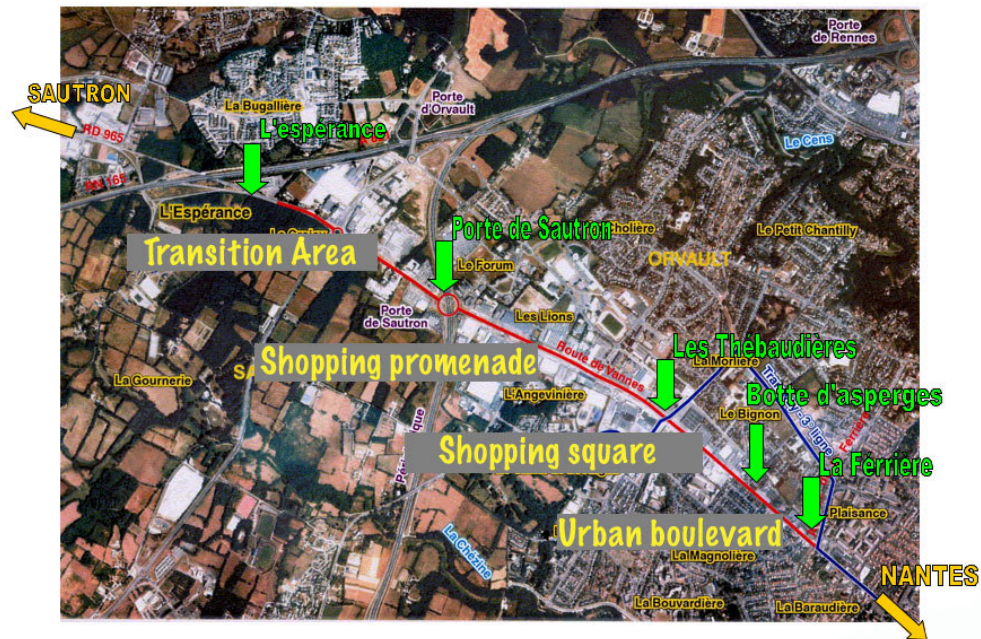
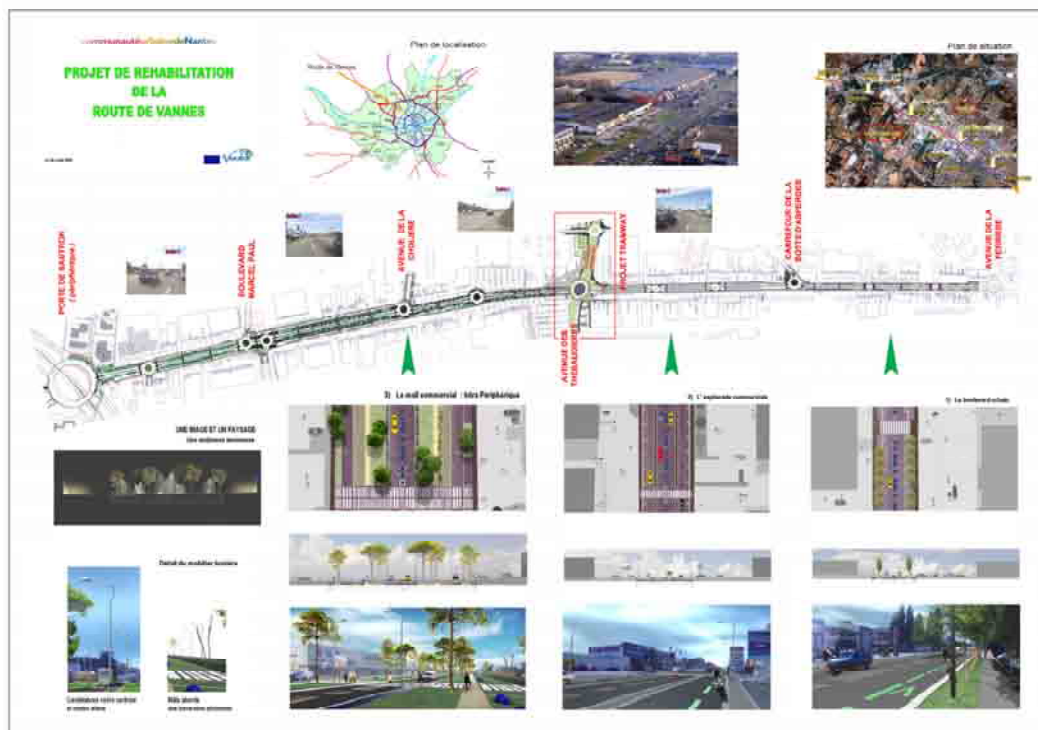


Figure 2.9.23-5 Vannes road - Detailed project



The project studies were carried out in 2002, in order to implement the legal public consultation process. Some problems occurred in obtaining all stakeholders' agreement, in particular with the French roads Ministry. It has taken more than one year to smooth over the difficulties, with some technical adjustments in the project and a new schedule.

Every year, the French "Ligue urbaine et rurale", holds a national competition for urban design projects. In 2003, the Vannes road project received an award in this competition.

The legal public consultation process was launched in January 2004.

The implementation works started in 2004 with the building of new drainage and sewage networks, then road works and public space layouts have started in Summer 2005. They are still progressing.

The cost of the project is 19 205 000 € (100% financed by Nantes Métropole with VIVALDI assistance).

Multi-Modal station at the junction of the tramline 3 and Vannes road

The development of the tram network has led to the commissioning of tramline 3 in 2000. The Vannes road project produced the idea to have an efficient multi-modal connecting point at the crossing of the two projects. People who are affected by this project are the commuters and the inhabitants of the surrounding areas and the visitors or the workers of the shopping centre.

The main partners involved in this project were:

- Nantes Métropole as Public Transport authority,
- SEMITAN as delegate for the building of the extension of the tramline 3,
- Orvault City and St Herblain City,
- French transport Ministry
- CONFORAMA as initial owner of the site,
- FORMA 6/SOGREHA-PRAUD, as master-builder.

The implementation of Orvault-Morlière connecting point was decided upon in 2001. The legal public consultation process was launched during autumn 2002. The choice of architect occurred at the end of 2002 and the public utility of the project was declared in March 2003. Works started in January 2004, and the commissioning of the connecting point began in September 2004.

The connecting point includes a Park and Ride site of 302 parking spaces accessible directly from the Vannes road. It also includes 10 bicycle parking spaces. At the ground level, private parking with 98 spaces is reserved for the shop centre CONFORAMA, the previous owner of the parcel of land on which the P+R has been built. It is the first case in Nantes of a such public-private-partnership.

The cost of this operation was 4,2 M€.

Figure 2.9.23-6 Orvault-Morlière connecting point and P+R



Evaluation results

The remodelling works of Vannes road project started in 2004 and significantly since Summer 2005. It's not possible to evaluate this operation at present because we currently are in a very disrupted situation and without a vision of how the new layout will affect travel behaviour. The pictures below give a vision of the current state of the site.

Some technical elements of the project have been carried out on the Vannes road since the beginning of the works of the tramline 3 extension. Some are permanent like the new roundabout crossed by tramline 3 at Orvault-Morlière connecting point, and some are temporary, like roundabouts or road signage. Therefore, it is not a good situation to have a significant evaluation about car traffic restrictions on the Vannes road. We must wait the end of the works to do that.

Figure 2.9.23-7 New roundabout on Vannes road



Figure 2.9.23-8 Vannes road current situation



currently

tomorrow



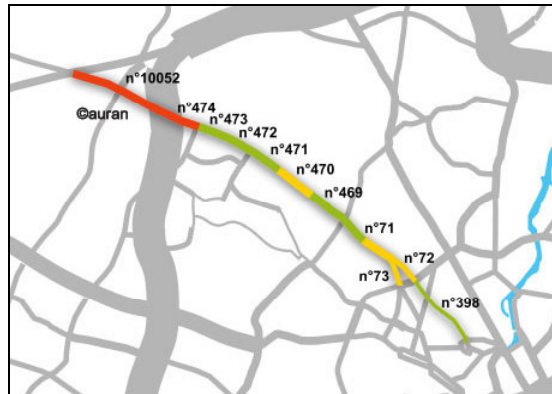
Traffic evolution

Table 2.9.23-2 Vannes road area - Traffic evolution

Section number	Street	Daily traffic two ways mixed 1999	Daily traffic two ways mixed 2004
10052	Rte de Vannes	24 400	27 450
474	Rte de Vannes	24 400	33 578
473	Rte de Vannes	29 400	24 529
472	Rte de Vannes	29 400	21 433
471	Rte de Vannes	24 400	18 189
470	Rte de Vannes	24 400	23 297
469	Rte de Vannes	24 000	19 334
71	Rte de Vannes	21 810	17 493
73	Bd Boulay Paty	10 950	10 035
72	Bd Jean 23	11 960	10 668
396	Rue des Hauts Pav's	8 190	7 734
398	Rue du Poitou	13 000	8 327

Nantes M^{étropole}/Department of Loire Atlantique/ French roads Ministry source

Figure 2.9.23-9



In five years, car traffic has been stable or has decreased on Vannes road. Although not all layouts scheduled are effective, the measures already implemented like the tramline 3, Orvault-Morlière P+R and other operations linked have made effective restriction for car traffic towards city centre.

Air pollutants evolutions

There is no air pollution monitoring station in the Vannes road area. The nearest one is located at Chauvinière and it is the station that has been used in Tertre campus evaluation (see 3.5.2.7).

Characteristics of the journeys towards the Northwest corridor

Characteristics of the daily journeys towards the Vannes road area can be analysed using results of travel surveys. The amount of these journeys (close to 100,000) is significantly increasing: 8.6% between 1997 and 2002. Journeys for shopping and leisure purposes are the more numerous (after the first motive: return to home); even those for shopping are decreasing between 1997 and 2002. This is in relation with the importance of the shopping area in this site.

The modal split between the all modes shows that car is over 68%, which is more than the average value for the all Nantes Métropole territory (62%). Public Transport has a share about 11%, instead of 14% for the all Nantes Métropole territory. Between 1997 and 2002, Public Transport share has been stable, but increased strongly for work purposes (multiplied by 2.5) to the detriment of the car, and decreased for education motive.

Car share significantly increased between 1997 and 2002 in the Northwest area, in particular for education purposes. The share of the two modes walking and cycling has decreased. Cycling is close to 0% for journeys towards Southeast area.

Table 2.9.23-3 Evolution of daily journeys made by Nantes Métropole inhabitants towards Vannes road area

Journeys towards Vannes road area in 2002							
AURAN - 2002 mobility survey source							
Journey motive	Daily journeys		Modal split				
	Number	Structure	P.T.	Walking	Cycling	Moped/Motorbike	Car
Home return	41 327	43,7%	11,3%	20,4%	0,4%	2,0%	65,9%
Work	8 855	9,4%	14,2%	5,8%	1,7%	0,9%	77,3%
Education	9 496	10,0%	27,4%	19,9%	1,1%	4,7%	46,8%
Purchasing	14 622	15,4%	7,0%	20,4%	0,0%	0,3%	72,3%
Leisure	10 402	11,0%	7,0%	19,8%	0,5%	0,7%	72,1%
Personal activities	9 940	10,5%	0,8%	17,3%	0,0%	0,4%	81,5%
Total	94 642	100,0%	11,0%	18,6%	0,5%	1,6%	68,4%

Journeys towards Vannes road area in 1997							
AURAN - 1997 mobility survey source							
Journey motive	1997 Daily journeys		Modal split				
	Number	Structure	P.T.	Walking	Cycling	Moped/Motorbike	Car
Home return	36 373	41,7%	11,3%	24,6%	3,0%	1,9%	59,1%
Work	8 894	10,2%	5,5%	4,6%	0,9%	0,0%	88,9%
Education	9 273	10,6%	31,9%	23,3%	5,9%	7,4%	31,6%
Purchasing	16 080	18,5%	5,3%	27,0%	1,3%	0,9%	65,6%
Leisure	8 387	9,6%	6,9%	13,9%	2,3%	0,8%	76,2%
Personal activities	8 130	9,3%	10,8%	11,2%	1,7%	0,0%	76,2%
Total	87 137	100,0%	11,3%	20,6%	2,6%	1,8%	63,7%

Journeys towards Vannes road area - evolution 1997 - 2002							
AURAN - 1997 and 2002 mobility survey source							
Journey motive	Daily journeys evolution		Daily journeys evolution by mode				
	RN 801 area	Nantes M'tro area	P.T.	Walking	Cycling	Moped/Motorbike	Car
Home return	13,6%	-2,8%	13,4%	-5,8%	-84,5%	15,3%	26,7%
Work	-0,4%	-17,2%	156,8%	26,0%	80,7%	-	-13,4%
Education	2,4%	-3,9%	-12,1%	-12,4%	-80,1%	-34,2%	51,8%
Purchasing	-9,1%	-3,0%	21,2%	-31,3%	-	-73,0%	0,3%
Leisure	24,0%	-2,1%	26,0%	76,5%	-74,2%	15,2%	17,3%
Personal activities	22,3%	0,0%	-91,0%	88,6%	-	-	30,8%
Total	8,6%	-3,8%	5,0%	-1,9%	-78,8%	-6,6%	16,6%

P.T. urban network and P+R use in Orvault-Morlière area

SEMITAN counting surveys show that there is a constant increase of the tramline 3 patronage, since it opened.

Figure 2.9.23-10 Tramline 3 - Patronage evolution

Tramline 3 - average daily trips on week days	
SEMITAN source	
Counting period	trips by day
September 2003	28 200
May 2004	32 000
Autumn 2005	36 000
Summer 2002	12 100
Summer 2003	13 100
Summer 2004	21 900

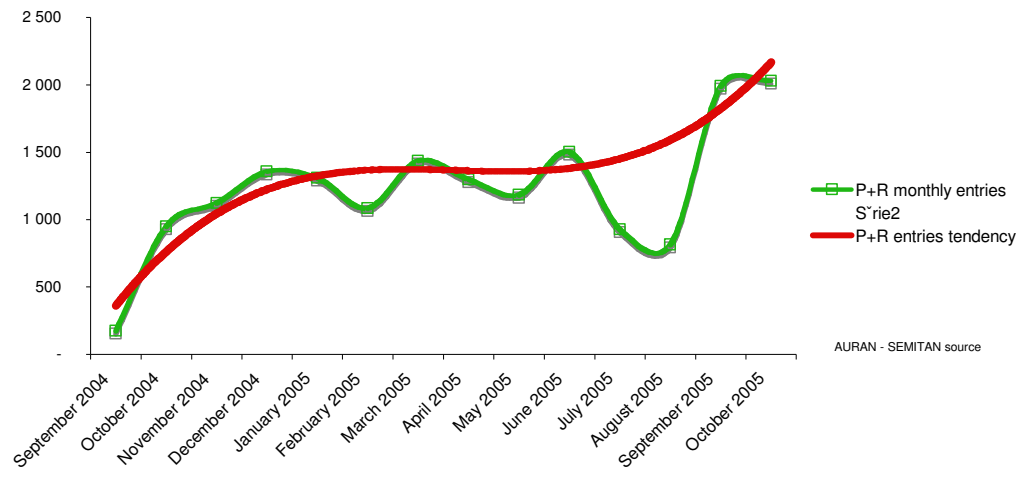
Just two months after the tramline 3 opening, SEMITAN organized a survey of 300 people, for quality monitoring (see 3.2.1.2.2) of this tramline. This survey has shown that commuters have changed their behaviour: 13% of them were just car users before the tramway (11% as drivers and 2% as car passengers). This figure is now higher, if we consider the increasing of the patronage of the P+R on the line.

Activity of Orvault-Morlière P+R has doubled in only one year. The graph below reflects the different periods of commuters' time: the activity decreases during holidays. It also shows that new P+R users change their behaviour with the new school year and maybe also with car park restrictions in the city centre (see 3.2.2.6).

Table 2.9.23-4 Orvault-Morlière P+R activity

Orvault-Morlière P+R activity	
SEMITAN source	
month	monthly entries
September 2004	173
October 2004	951
November 2004	1 123
December 2004	1 357
January 2005	1 311
February 2005	1 086
March 2005	1 438
April 2005	1 299
May 2005	1 184
June 2005	1 503
July 2005	928
August 2005	814
September 2005	1 992
October 2005	2 028

Figure 2.9.23-11 Orvault-Morlière P+R entries evolution



The average daily entries was about 60 vehicles and it is now more than 100 vehicles, which is one third of the P+R capacity only one year after its opening.

Synthesis

The following local objectives cannot be evaluated at this stage:

Give through road status to this section of road (LO 6.1),
 Ensure functionality and vocation of commercial sector (LO 6.1),
 Ensure identity of urban sectors and sequences (LO 6.1),

- Develop inter districts links (LO 6.1),
- Give a more readable and attractive character to the LRT system alongside the through road, while enhancing accessibility and safety for pedestrians (LO 6.4),
- Create on Route de Vannes conditions for an improvement of bus traffic, comfort and accessibility for customers at stops (LO 6.5)

If the implementation of Orvault-Molière connecting point with its P+R site is successful, regarding the local objective LO 6.2, and partly the local objective L.O. 6.3, this will be because enlargement of the site to include shopping functions has worked: there is a link with the shop CONFORAMA and this operation is an example of Private-Public-Partnership. But enlargement to housing functions doesn't exist.

Incentives to make car traffic use the Orvault-Morlière P+R site are not very effective and need Vannes road to be remodelled on the section after the P+R site towards city centre. So the local objective LO 6.6 is only partly reached because accessibility to P+R is growing.



2.9.23.2 Nantes – Corridor restrictions – South East corridor (6.6)

The target group in this project are commuters and visitors from the southeast suburban areas and the inhabitants of the southeast urban sector of Nantes Métropole. Many partners were involved in this project:

- Nantes Métropole, as urban transport authority,
- SEMITAN as urban public transport operator and project manager by delegation from Nantes Métropole,
- SAMOA, as project manager for the “Ile de Nantes” urban project,
- Communes of Vertou, St Sébastien and Nantes on the territory of which the rail tracks are,

- AURAN as advisor about urban mobility.

The project of remodelling the RN801 motorway has followed the development of the P.T. project in the southeast. At the beginning of the project, it was planned to extend tramline 3 from the centre of Nantes, towards Vertou city, by using the rail tracks of tramline 2 between the Centre of Nantes and Pirmil station, and then extend towards the southeast. This project was cancelled at the beginning of 2002 due to large costs, too many works, technical difficulties and low patronage. It was then decided to create a new guided bus-tram route 4 on RN801 motorway. This project was considered less expensive and more efficient than the first one. After two unsuccessful calls for tenders in 2003 and 2004, to find the right vehicle (a guided bus-tram, which was cost efficient, reliable, and certified under French regulations...), the current project uses the route defined for the second one phase, but the vehicles are articulated buses, developed with a new concept: the BusWay. The bus runs on a reserved right-of-way lane, which ensures speed and comfort, with a good quality urban layout.

Figure 2.9.23-12 Evolution of the P.T. project in the southeast area

From a tramway project by extension of tramline 3 from Pirmil station, to the BusWay project on RN801 motorway



The current project of remodelling RN801 motorway goes with the BusWay route 4 project. It will include from the ring road (Porte de Vertou) and the centre of Nantes:

- The modification of the motorway, to form a boulevard with only one car lane per direction and cycling lanes,
- The creation of a roundabout in place of Bourdonnières interchange, with an access to the Park and Ride (250 parking spaces) linked to the BusWay station,
- The creation of a place, at Clos Torreau station,
- The creation of a roundabout at Bonne Garde station with a new access to the streets around,
- The creation of a roundabout in place of Graineraie interchange, with an access to the Park and Ride (250 parking spaces) linked to the BusWay station,
- The remodelling of all the space in the “Ile de Nantes”.

Figure 2.9.23-13 Part of the project to remodel RN801

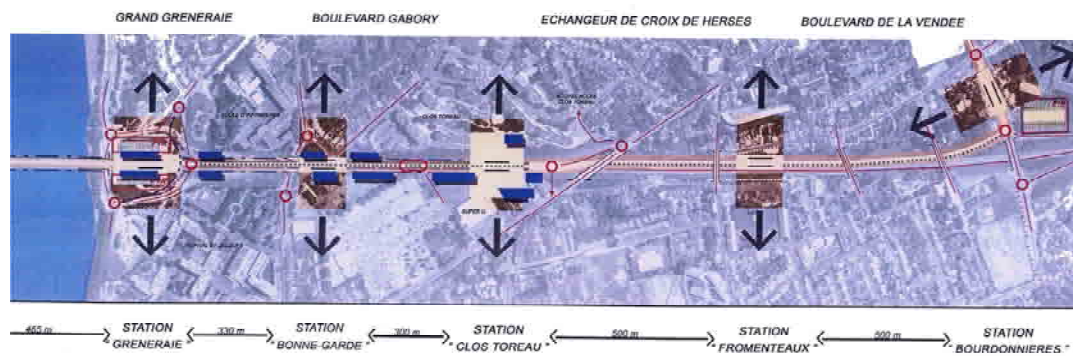


Figure 2.9.23-14 Cross section in 2003



Figure 2.9.23-15 Cross section of the project



Feasibility studies were carried out at the beginning of 2003. The public consultation took place in 2004 and work begun at the start of 2005. The expected end of the work is September 2006, when the BusWay route 4 will be brought into service.



Figure 2.9.23-16 Carnot – Bonduelle future layout



Figure 2.9.23-17 Gréneraie future layout



Figure 2.9.23-18 Bourdonnières future layout

Journeys towards the Southeast corridor – Evaluation Results

Characteristics of the daily journeys towards the RN801 area can be analysed with mobility surveys results. The amount of these journeys (about 100 000) is slightly decreasing: -1.9% between 1997 and 2002. Work journeys, which are the most numerous, have also decreased between 1997 and 2002, in favour of journeys for purchasing and leisure motives.

The modal split between the all modes shows that car is around 65%, which is more than the average value for the all Nantes Métropole territory: 62%. Public Transport has a share of around 13%, instead of 14% for the all Nantes Métropole territory. Between 1997 and 2002, Public Transport share has increased in the Southeast area for journeys made.

Car sharing has increased between 1997 and 2002 in the Southeast area for all journey purposes, even for education; in particular for leisure motive to the detriment of P.T. and cycling. The share of the two modes walking and cycling has decreased. But cycling has increased his share very significantly for education motive, for journeys towards Southeast area.

Table 2.9.23-5 Evolution of daily journeys made by Nantes Métropole inhabitants towards RN 801 area

Journeys towards RN801 area in 2002							
AURAN - 2002 mobility survey source							
Journey motive	Daily journeys		Modal split				
	Number	Structure	P.T.	Walking	Cycling	Moped/Motorbike	Car
Home return	41 073	40,5%	13,3%	18,1%	3,4%	0,9%	64,3%
Work	16 253	16,0%	12,4%	9,2%	3,3%	1,7%	73,4%
Education	8 446	8,3%	25,8%	17,1%	8,3%	2,1%	46,6%
Purchasing	12 996	12,8%	7,2%	27,9%	1,5%	1,4%	61,9%
Leisure	10 952	10,8%	12,2%	17,9%	1,6%	1,2%	67,0%
Personal activities	11 729	11,6%	9,4%	22,4%	0,5%	0,4%	67,4%
Total	101 449	100,0%	12,8%	18,3%	3,0%	1,2%	64,6%

Journeys towards RN801 area in 1997							
AURAN - 1997 mobility survey source							
Journey motive	1997 Daily journeys		Modal split				
	Number	Structure	P.T.	Walking	Cycling	Moped/Motorbike	Car
Home return	38 420	37,1%	14,4%	23,0%	3,5%	1,3%	57,9%
Work	19 383	18,7%	13,3%	9,2%	2,1%	4,7%	70,7%
Education	12 125	11,7%	11,0%	16,7%	2,3%	1,7%	68,3%
Purchasing	11 209	10,8%	7,2%	22,7%	1,6%	1,7%	66,7%
Leisure	6 285	6,1%	19,4%	15,7%	12,4%	8,9%	43,6%
Personal activities	16 037	15,5%	7,7%	25,4%	2,5%	1,3%	63,2%
Total	103 459	100,0%	12,3%	19,6%	3,3%	2,5%	62,4%

Journeys towards RN801 area - evolution 1997 - 2002							
AURAN - 1997 and 2002 mobility survey source							
Journey motive	Daily journeys evolution		Daily journeys evolution by mode				
	RN 801 area	Nantes M'tro area	P.T.	Walking	Cycling	Moped/Motorbike	Car
Home return	6,9%	-2,8%	-1,3%	-15,8%	5,5%	-24,0%	18,7%
Work	-16,1%	-17,2%	-22,0%	-15,9%	32,3%	-70,1%	-12,9%
Education	-30,3%	-3,9%	64,0%	-28,6%	145,6%	-12,1%	-52,4%
Purchasing	15,9%	-3,0%	15,7%	42,9%	10,0%	-6,0%	7,5%
Leisure	74,3%	-2,1%	9,9%	99,3%	-77,4%	-76,2%	167,8%
Personal activities	-26,9%	0,0%	-10,8%	-35,3%	-86,5%	-78,6%	-22,0%
Total	-1,9%	-3,8%	2,6%	-8,0%	-9,1%	-53,8%	1,5%

Remodelling of RN801 motorway and PT projects – Evaluation Results

The remodelling of RN801 is closely linked to the BusWay implementation. Work started in early 2005. The following pictures give a vision of the current state of the site.

Figure 2.9.23-19 RN801 Cross section evolution

Previous situation



Current situation



In the previous situation, it was a two-way road with two lanes by direction, separated by a double concrete barrier with shrubs. On the right way (towards city centre) was a

reserved bus lane. In the current situation, the right way is under works and only reserved for roadwork's traffic. General traffic is on a two-way road on the left side, so with a single lane by direction.

Figure 2.9.23-20 Current state of Busway and RN801 works



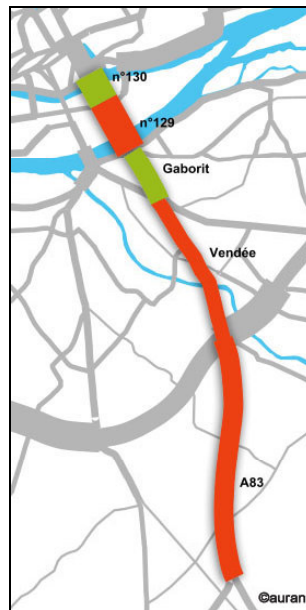
Traffic evolution

Table 2.9.23-6 RN 801 area - Traffic evolution

Section number	Street	Daily traffic two ways mixed 1999	Daily traffic two ways mixed 2004
	A83	45 250	55 800
	Bd de Vendée	29 100	33 600
	Bd Emile Gabory	38 000	33 600
129	Pont Clemenceau	58 600	62 238
130	Pont Briand	51 640	47 047

Nantes M^{étro}pole/Department of Loire Atlantique/ French roads Ministry source

Figure 2.9.23-21 RN 801 area - Traffic evolution



In 5 years, average daily traffic has increased by 23% outside the ring road, and by 15% inside the ring road. Decreasing is the tendency near the centre of the city (around - 10%), except on the south bridge over the river Loire (+ 6%). Since March 2005 the traffic during peak hours has decreased by around 40%. So the average daily traffic is around 25,000 vehicles a day.

Air pollutants evolutions

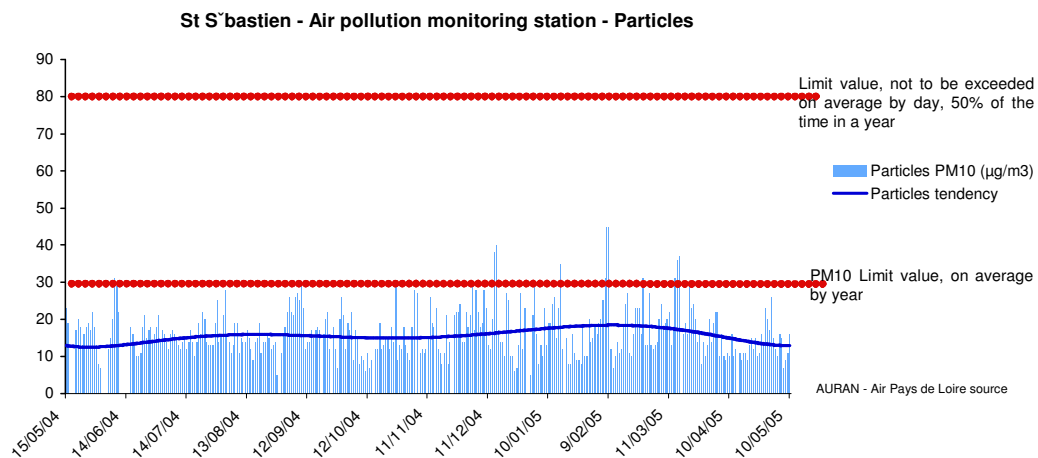
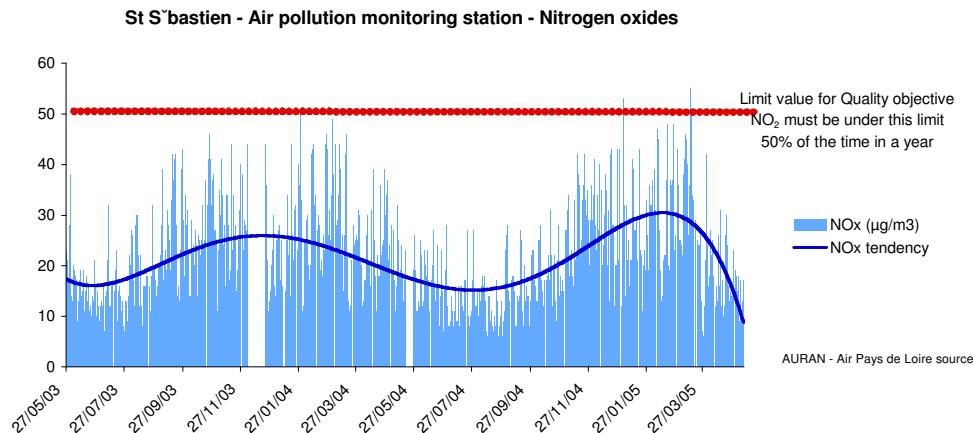
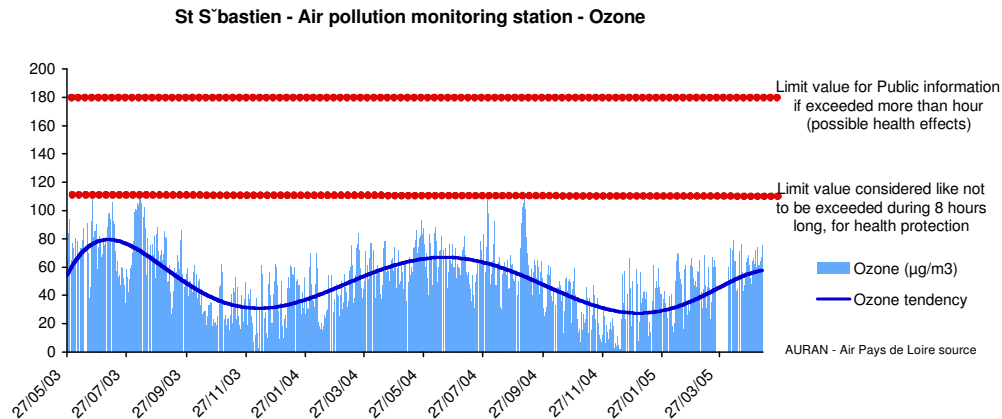
There is only one data collection site in the Southeast area, located in St Sébastien city. Three pollutants are being monitored at this point: Ozone, Nitrogen oxides and Particles.

Figure 2.9.23-22 Southeast air quality monitoring point location



All pollutants are below critical values. Ozone peaks appear during summertime, when there is higher temperatures and more sun. Nitrogen oxides peaks appear during wintertime, when traffic volumes are higher.

Figure 2.9.23-23 Air pollution in Southeast area



Synthesis

Actions of VIVALDI Project in the Southeast area are not complete. The remodelling of RN801 and the implementation of the BusWay, with its P+R site, is still being carried out. However, some effects of the implementation of the project can already be seen: Traffic restrictions on RN801 combined with a new P.T. offer has led to a car traffic decrease during rush hours, and increased P.T. use.

Local objective LO 4.1 to restrict the car traffic has already been reached. Local objectives LO 4.2 and LO 4.3 are progressing with good results with the railway link Nantes – Vertou, waiting for the BusWay services to be available. Local objective LO 4.4 needs the global system in the Southeast to be fully complete to be regarded as reached.

3 CITY LEVEL EVALUATION

The following sections outline the City Evaluation undertaken at each of the VIVALDI demonstration sites.

3.1 Aalborg – City-Level Evaluation

3.1.1 Do-nothing Scenario

In the VIVALDI project Aalborg implements a series of measures with the aim of reducing emissions and energy consumption in the transport sector. An important part of the VIVALDI project is to quantify or estimate the impacts of these measures.

The measures are introduced as a full-scale demonstration. Hence, they are fully operational rather than taking place in a controlled experimental environment. Therefore when the measures are evaluated it is important to take into account how the situation would have evolved had no action taken place. This is the role of the do-nothing scenario.

To establish the do-nothing scenario Aalborg has decided to use the EMME-2 traffic model and combine it with other data sources to enable calculations of emissions and energy consumption. The TEMA2000 energy and emissions model developed by the Danish Ministry of Transport is the key data source.

The principles of the modelling process are described in more detail in a separate technical note in Annex 1.

A structural reform will change the Danish municipalities by 2007. In the case of Aalborg three neighbouring municipalities will be part of Aalborg. However, for the purpose of VIVALDI evaluation this change is not important and therefore the figures in the following relate to the current Aalborg Kommune only.

Socio-demographic data

As the centre of the Region, Aalborg is expected to grow in the coming years - both in relation to population and number of workplaces within the municipality. In Table 3.1.1-1 an overview of the development in some of the key socio demographic features of Aalborg is shown.

Table 3.1.1-1 Various socio demographic data for Aalborg

Area	Aalborg Kommune		
Year 2000-2015	596.59 km²		
Source: Aalborg Kommune			
Population	Inhabitants	Density	
Year 2000	161,700	271 inh./km²	
Forecast 2005	164,000	275 inh./km²	
Forecast 2015	171,100	287 inh./km²	
Source: Aalborg Kommune			
Housing / employment	Households	Workplaces	
Year 2000	78,000	94,700	
Forecast 2005	80,600	97,300	
Forecast 2015	86,000	102,700	
Source: Aalborg Kommune			
Car ownership	Private vehicles	Veh./inhabitant	Veh./household
Year 2000	48,430	0.30	0.62
Forecast 2005 ¹	49,360	0.30	0.61
Forecast 2015 ¹	51,660	0.30	0.60
Source: StatBank Denmark 2004			
¹⁾ Forecast based on trend between 2000 and 2003			

Transportation data

In recent years public transport has experienced a loss in passenger numbers of about 2% per annum. At the same time car traffic has continued to grow. Hence, public transport's share of motorised passenger transport decreases and the efficiency of the public transport system deteriorates. If nothing is done it is unlikely that these trends in transportation and modal choice will change.

Table 3.1.1-2 Assumptions regarding the development in occupancy rates

Average occupancy rates	Private cars	Buses ²
Year 2000	1.55 persons/vehicle	15-20 persons/vehicle
Forecast 2005	1.49 persons/vehicle ¹	14-18 persons/vehicle
Forecast 2015	1.35 persons/vehicle ¹	11-15 persons/vehicle
Source: Private cars: 'Personer pr. bil', The Danish Road Directorate 2002. Buses: Aalborg Kommune		
Notes: ¹⁾ Forecasts are based on the trend between 1992 and 2001		
²⁾ No census available. Figures are rough estimates based on the decrease in ticket sales.		

Table 3.1.1-3 Key transportation figures of the do-nothing forecast

Annual mileage	Private cars	Buses ¹
Year 2000	920 mio. km /year	9.8 mio. km/year
Forecast 2005	1,025 mio. km/year	10.1 mio. km/year
Forecast 2015	1,270 mio. km/year	10.6 mio. km/year

Note: ¹⁾ A minor increase in the service is assumed throughout the period

Annual transport	Private cars	Buses
Year 2000	1,430 mio. pers.km /year	150-200 mio. pers.km /year
Forecast 2005	1,530 mio. pers.km /year	140-180 mio. pers.km /year
Forecast 2015	1,710 mio. pers.km /year	120-160 mio. pers.km /year

Share of motorised transport	Private cars	Buses
Year 2000	88-91%	9-12%
Forecast 2005	89-92%	8-11%
Forecast 2015	91-93%	7-9%

The loss in public transport person kilometres will contribute to the growth in car traffic. Depending on the extent to which bus journeys are replaced by new car journeys the decrease in public transport can be responsible for up to 6-8% of the growth in private vehicle kilometres.

As mentioned in the previous sections the new structure in public transport has lead to an immediate decrease in bus and coach journeys by 11%. There is no evidence of increases in car traffic due to the declining number of bus passengers. In the light of increasing fuel prices, the most likely alternative for some people is probably not the car, but rather cycling or walking.

Therefore the impact of the decline in passenger numbers is likely to only affect the above figures for buses. Providing the decline is not merely short term, buses' share of passenger transport by 2015 would be around 1% lower than indicated.

Environment

The gradual replacement of the oldest part of the vehicle fleet will lead to significant environmental improvements. In terms of private cars there is plenty of scope for improvement as a large proportion of the fleet is still not fitted with catalytic converters. In public transport - where the service is subject to tenders every 4-6 years - compliance with recent EURO standards is part of the tenders. Today the bus fleet is EURO IV and it is likely that EURO V - that reduces NOx emissions further - will be included in coming tenders. The impact on emissions of EURO V for buses is not included in the following calculations.

The analysis shows that the amount of energy used for transportation will continue its growth in Aalborg. A consequence of the decreasing occupancy rates in public transport is that the amount of energy used per person kilometres in public transport will eventually be no better than for private cars. So it is really important to break this trend.

Table 3.1.1-4 Age of Danish vehicles

Vehicle fleet (2000)	Private cars
Average age	8.2 years
Vehicles older than 10 years ¹	36%

Source: Dansk Automobilforhandler Forening (www.daf.dk)

Notes: ¹⁾ In October 1989 stricter emission standards requiring catalytic converters were implemented in Denmark. Hence 36% of the fleet was registered ahead of this date

Table 3.1.1-5 Results on energy in do-nothing scenario

Energy consumption	Private cars	Buses ¹
Year 2000	2,950 TJ/year	216 TJ/year
Forecast 2005	3,200 TJ/year	222 TJ/year
Forecast 2015	3,475 TJ/year	234 TJ/year

Note: ¹⁾ The current bus fleet in Aalborg already comply with EURO IV standard. No further improvements of standards for buses are included in the calculations.

Energy efficiency	Private cars	Buses
Year 2000	2.1 MJ/personkm	1.1-1.5 MJ/personkm
Forecast 2005	2.1 MJ/personkm	1.2-1.6 MJ/personkm
Forecast 2015	2.0 MJ/personkm	1.5-2.0 MJ/personkm

Table 3.1.1-6 Results on bus emissions in do-nothing scenario

Bus emissions [tonnes/year]	CO	HC	NO _x	CO ₂	PM	SO ₂
Year 2000	13	6	89	15,821	0.7	216
Forecast 2005	13	6	91	16,246	0.7	222
Forecast 2015	14	6	96	17,129	0.7	234

Note: ¹⁾ The current bus fleet in Aalborg already comply with EURO IV standard. No further improvements of standards for buses are included in the calculations.

Environmental efficiency buses [mg/personkm]	CO	HC	NO _x	PM	SO ₂
Year 2000	64-85	28-38	450-600	3.5-4.6	2.6-3.5
Forecast 2005	71-94	31-42	500-670	3.8-5.1	2.9-3.8
Forecast 2015	87-115	38-51	610-820	4.7-6.2	3.5-4.7

Note: ¹⁾ The current bus fleet in Aalborg already comply with EURO IV standard. No further improvements of standards for buses are included in the calculations.

Table 3.1.1-7 Results on car emissions in do-nothing scenario

Priv.car emissions [tonnes/year]	CO	HC	NO _x	CO ₂	PM	SO ₂
Year 2000	3,868	408	465	213,196	16.4	2.99
Forecast 2005	2,191	158	175	230,793	15.2	2.99
Forecast 2015	965	62	61	250,326	17.9	2.96

Environmental efficiency private cars [mg/personkm]	CO	HC	NO _x	PM	SO ₂
Year 2000	2,711	286	326	11.5	2.1
Forecast 2005	1,435	103	115	10.0	2.0
Forecast 2015	564	36	35	10.5	1.7

3.1.2 City Level Results

Car Sharing

The impacts of the car sharing scheme may be as high as 1% of current annual energy consumption for transport in Aalborg. The primary reason for this is that the purchase of a car is postponed or abandoned by the users, relieving the transport system of a high annual mileage.

In practice, a large proportion of this mileage would have been accumulated outside the municipality boundaries. Hence, it is not on the urban road network that 1% of the energy is saved, but this figure is an estimate of the overall impact of the current car sharing scheme.

The car sharing scheme in Aalborg still has growth potential in the long run. So far the number of memberships and the actual mileage travelled in the shared cars has not quite reached budgeted levels. It seems likely that consolidation rather than expansion will be a key issue in relation to car sharing in Aalborg.

Therefore, it is assumed that the city level impact of car sharing is reflected by the above calculations.

Public Transport

There are major uncertainties attached to the assessment of the impacts of the public transport initiatives in VIVALDI. The measures were implemented immediately after major changes in fares and network structure that lead to a 6-7% loss in passenger numbers.

In 2004 fares were raised by 7.1% - an increase that, due to price elasticity, was likely to result in 2.1% less passengers. Therefore it can be estimated that 5% of the decline in passenger numbers is related to the change in the structure of public transport.

It is well known that a change in structure will lead to an immediate loss of passengers. Some lose their bus connections and will no longer use public transport, but others gain improved bus connections that make public transport more attractive to them. However, it takes time before they become aware of this option. Consequently, losing passengers happens more quickly than acquiring new ones.

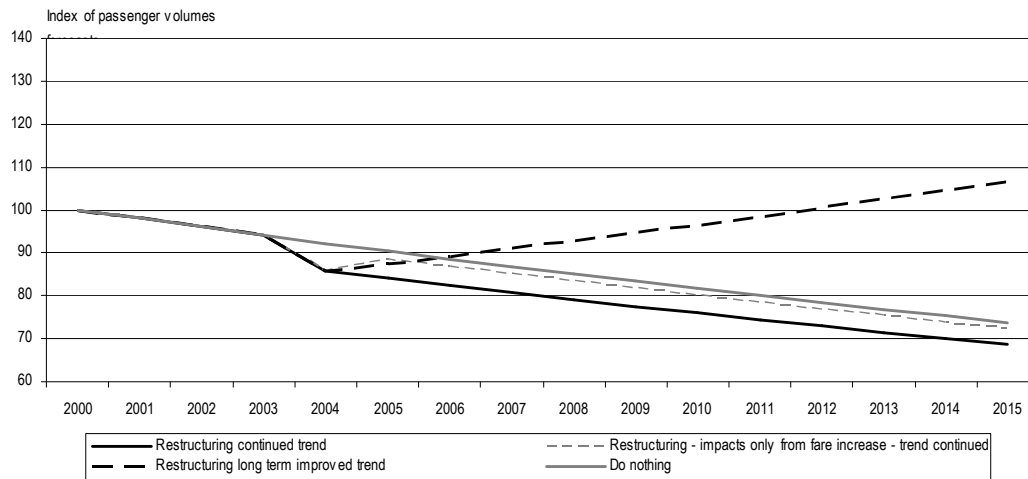


Figure 3.1.2-1 Span of likely developments in public transport passenger numbers

A number of different scenarios can be established to show likely developments in public transport after the restructuring scheme. In Figure 3.1.2-1 these scenarios are compared with our do nothing scenario.

The worst case scenario would be a continuation of trends of decreasing passenger numbers from the level reached immediately after the fare increase and restructuring scheme. By following this trend, public transport would have >30% less passengers by 2015 compared to the year 2000.

Another scenario reflects the situation where we regain the passengers lost due to the restructuring scheme, but keep the impact of the fare increase in the long term. In this situation we will see an increase in passenger development in the short run, but within one or two years we will return to the trend of decreasing passenger numbers and end up slightly below our do nothing situation in 2015.

The third alternative would be a positive development in passenger numbers due to the fact that bus services now reflect demand much better both in terms of the network, the frequency and the quality of transportation.

In Figure 3.1.2-2 we see the results of photo cell registrations on two selected bus lines - the Metro 2 and the urban bus line 13. These lines are selected as it is the same vehicles that have been operated on the line throughout the registration period, and these vehicles have only been used on these lines. Therefore the figures should give a fair indication of the development in passenger numbers.

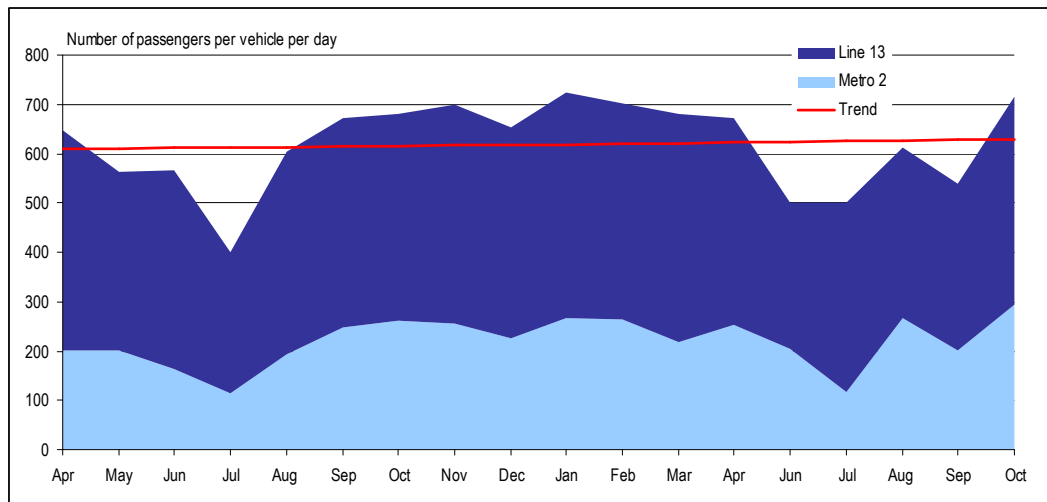


Figure 3.1.2-2 Average of daily boardings per PT vehicle based on photo-cell registrations on two selected buslines

Since the implementation of the new public transport plan we have seen an increase in passenger numbers on these two lines of about 2% p.a. Therefore, if we look at Figure 3.1.2-2, it seems that we can rule out the worst case scenario.

However, one and a half years after the implementation of the radical changes in public transport we cannot be sure whether the increase in passengers will continue (as shown in Figure 3.1.2-2) or whether there will be a return to the decreasing trend once the short term impact of the new structure (shown in pale blue) has worn off.

Based on Figure 3.1.2-2 and the positive feedback we have received in the evaluation of VIVALDI it seems likely that a result somewhere between the do nothing scenario and trend line for the long term improvement can be realised providing we continue to stimulate public transport and avoid further dramatic increases in fares.

Table 3.1.2-1 Estimated maximum changes in environmental efficiency of public transport due to the VIVALDI measures and other improvements in Aalborg

Change in environmental efficiency in buses [mg/personkm]	CO	HC	NO _x	PM	SO ₂
Forecast 2005	+7.1	+3.1	+50.3	+0,4	+0.3
Forecast 2015	-32.2	-14.4	-228.4	-1.7	-1.3

The maximum estimated environmental impact of the combined public transport measures in Aalborg is shown in Table 3.1.2-1. Because of the immediate loss of passengers, the environmental efficiency of the public transport system in 2005 is about 6-8% worse than that calculated for the do nothing scenario.

However, providing the positive trends in the number of passengers continue, we will end up with a public transport system in 2015 that is about 21-28% more efficient than

that projected in the do nothing scenario. This calculation builds on the do nothing projection and is based on the assumption that the increase in passenger numbers can be handled within existing public transport capacity - i.e. more passengers per bus but no increase in the amount of buses.

If so, the public transport system will eventually be able to cut up to 3-5% of the projected growth in car traffic during this period if this increase is achieved by attracting car users to public transport. This will lead to a reduction in annual emissions from car traffic of 0.9-1.3% in 2015 compared to the do nothing scenario.

Table 3.1.2-2 Changes in car emissions compared to do-nothing scenario

Priv.car emissions [tonnes/year]	CO	HC	NO _x	CO ₂	PM	SO ₂
Do-nothing 2015	965	62	61	250,326	17.9	2.96
Min. calculated impact	-9.1	-0.6	-0.6	-2,354	-0.2	-0.03
Max calculated impact	-12.1	-0.8	-0.8	-3,139	-0.2	-0.04

Aalborg will continue its work to realise the full potentials of the instruments and measures implemented in VIVALDI. But it is important to notice that even with a successful scheme we will only be able to slightly reduce the growth in car traffic. This growth continues to be a major challenge to the city that has to be addressed in the coming years.

3.2 Bremen City-Level Evaluation

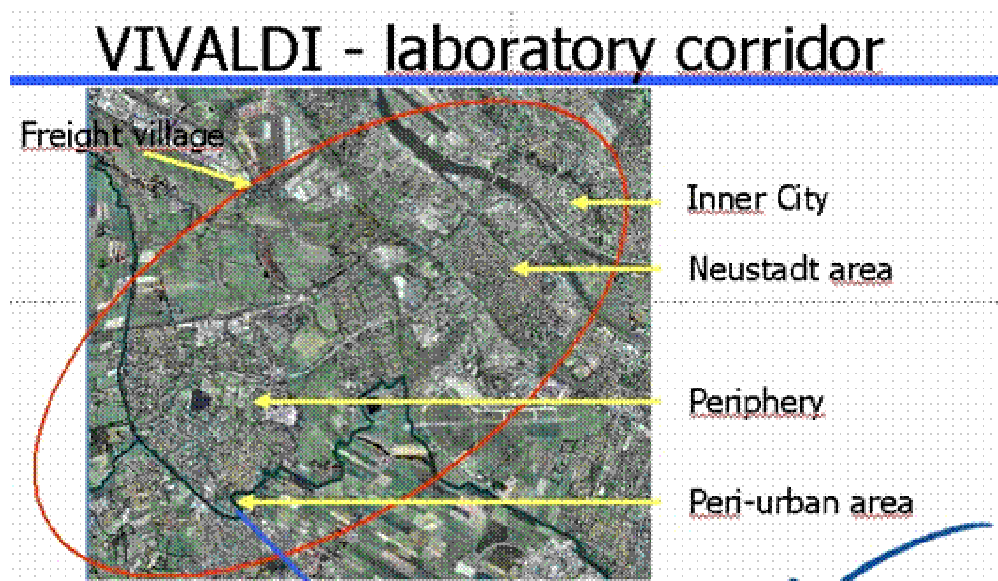
The results at the city level are much harder to calculate than those at the measure level. This is because many measures do not have the sufficient scope to show an impact on the whole city. An “up-scaling” of the measures is not possible in most cases, because either it would not be reasonable or it would be only wishful thinking. However, the single measures are combined and integrated and will have thereby a stronger impact.

3.2.1 Integration of the Measures

The VIVALDI measures are integrated in four ways: by common transport providers, by sharing a common area of implementation (“laboratory”), by belonging to common measure fields of the CIVITAS strategies and by the “integrated packages” of the VIVALDI evaluation.

In Bremen the main partners are the PT provider BSAG, the Car-Sharing organisation/Car Club cambio, and the Senator for Construction, Environment and Transport (transport ministry). Cambio plays an active role in 4 measures, the BSAG is centrally involved in 4 measures, and together both cooperate in 2 work-packages. The City transport ministry is in charge of two measures and is supporting all other remaining measures. Lastly, the regional natural gas supplier SWB and the local energy agency are central partners in one work- package.

The spatial integration of the measures into one confined area has only partially succeeded. The main reason is that most of the important measures did not have a city wide scope from the beginning as they focus on the VIVALDI corridor. Two of these are planning measures (8.4/9.2) having no real impact within VIVALDI. The remaining measures deal with soft modes (6.3/11.4).



Furthermore, the measures can be grouped by the measure fields of the CIVITAS strategies. From this perspective, the emphasis is put on Bremen, on workpackages 8 “Stimulation of collective modes” and 9 “New forms of vehicle use and ownership”, in which Bremen implements two measures each. Apart from these work-packages, Bremen has one measure in each of eight CIVITAS measure fields.

A more intensive integration of the measures is represented by the integrated packages. These are combined in VIVALDI for evaluation purposes, in particular for cities such as Bristol, which have a high number of measures. In Bremen, the 10 measures have been integrated into 6 packages (see table below). This has been very useful for the two very small measures “residential traffic management” (6.3) and “integration with urban development” (9.2) which could be assigned to the integrated packages of “Cycling” and “car sharing” respectively.

Table 3.2.1-1 Measures and Integrated packages

WP	measure	Integrated package
5.2	Clean and efficient vehicles	CNG Fleet
10.1	City logistic scheme/freight village	City logistics
6.3	Residential traffic management	Cycling
11.4	Walking and cycling measures	Cycling
12.2	Travel Information Centre	Information & ticketing
7.2	Integrated transport pricing system	Information & ticketing
8.4	Hybrid tram system	New tram
8.5	PT and Car sharing	Car sharing
9.1	Car sharing / City car club development	Car sharing
9.2	Integration with urban developments	Car sharing

3.2.2 Integration at City Level

There are two main ways to describe the impacts of the VIVALDI-project measures at city level. Firstly, in cases where the respective measure has a spatial focus, the local impact can be up-scaled to the whole city; secondly, by combining the impacts of different measures in a target area, for example the common city-wide impacts of several measures on emissions.

However, as the measures are very different in terms of size, measurable impacts, spatial unit of implementation (city or not city-wide) and suitability for up-scaling, a systematic overview about the measures’ impacts at city level cannot be given. In the following text the impacts of all measures will be described under the headings of the impact areas of economy, energy, environment and transport. This may give a more comprehensive impression of measures’ impacts at the city level.

In particular, the impacts in the areas of energy and environment are presented in detail in the following section, because they have not been discussed earlier in this report.

3.2.3 Economy

The field of economy is the most sensitive of the impact areas. Operators have been understandably reluctant to deliver data on costs and revenues. Most information has been gathered by process interviews. Statements refer mainly to relative changes.

Cambio, which is mainly involved in WP 8.1 and WP 9.1, has had remarkable growth in terms of new clients. This resulted in an increase of sale.

Table 3.2.3-1 Growth of cambio Bremen turnover (measured by trips)

2002 to 2003:	9.5%
2003 to 2004:	1.9%
2004 to 2005 (extrapolated)	4.5%

It is very hard to estimate to what extent this growth has been caused by the VIVALDI measures. Acknowledging the success with the target groups of PT and business users, cambio officials stated that at least 50% of the growth resulted from the impact of VIVALDI.

Furthermore, additional staff could be employed (1.5 full time). A very positive economic impact stems from the introduction of the business tariff that has made the utilisation of the cambio car fleet more efficient.

The BSAG is the main operator in the WP 7.2, 8.4, and 12.2. The integrated transport pricing system BoB-ticket (7.2) has only been running since June 2005 and the new hybrid tram (8.4) is a planning measure. Therefore, there are no calculations of the economic effects of these measures available. However, for the BoB-ticket, a clear target was set in terms of revenues: the investment costs in the system should be depreciated within 5 years. Looking at the current success of this measure this target is likely to be reached.

The new hybrid tram (WP 8.4) is appreciated by BSAG for two economic reasons. Trams are more attractive than buses and will significantly increase patronage and revenues. The other point is that an extension of an existing tramline considerably enlarges the area served by PT without having a comparable increase of operating costs.

For the ITIC (WP 12.2) the economic impact is very hard to determine. The impact of better and more helpdesks on patronage and revenues could not be measured. However, it can be said that the ITIC is an important factor for raising user satisfaction and therefore contributes to growth in the operators' revenues. Another important economic impact is that the consultancy needs staff. As a BSAG official stated, the VIVALDI measure at least means that no one has been dismissed.

Concerning CNG cars, there are some citywide impacts to note. Through the stimulation of the CNG car market by the VIVALDI campaign, it is probable that additional fuelling stations will be built in Bremen. There is also likely to be a positive economic impact on car-related services such as garages (converting services) and car trading. On the user side, survey data shows that CNG car buyers have depreciated their

relatively high purchase costs within two or three years of usage. The incentive programme supported by VIVALDI made selling the new technology much easier. Through the three-year campaign, the acceptance of CNG vehicles has risen and will stimulate further selling activities without monetary incentive programmes.

3.2.4 Energy

In the area of Energy, ascertainable impacts could be found for the measures about Car-Sharing (WP 8.5, WP 9.1) and CNG cars (WP 5.2). For the remaining measures the impacts either cannot be known at this stage (hybrid tram) or are too small to be detected.

3.2.4.1 CNG car fleet

3.2.4.1.1 Method of measurement

By the measures of WP 5.2, a citywide CNG-driven car fleet has been developed. CNG car owners, whose car purchase had been supported by VIVALDI, were obliged to fill in tank diaries for two years. In total, for 144 cars 10805 fill ups over 29 months (from 4/2003 to 8/2005) have been registered in the tank books. For 61 of the 144 CNG cars these tank books have been completed correctly and sufficiently (more than 80 fill ups). For the remaining 83 the fuelling patterns have been extrapolated. The analysis of these 144 tank books shows the following results in terms of fuel consumption:

The average fuel consumption of the CNG fleet is 7.1 CNG kg/100 km. According to the type of car there are considerable differences ranging from 5.5 kg/100km to 10.8 kg/100km. As with other fuels the consumption of CNG depends on individual driving patterns. There are differences of up to 3 kg CNG per 100 km according to the way of driving.

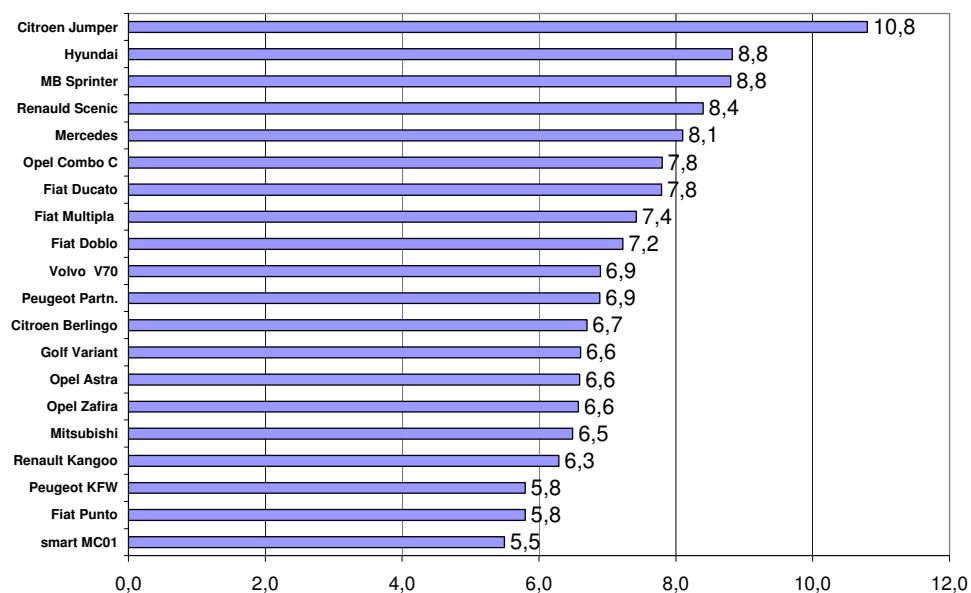


Figure 3.2.4-1 Average CNG consumption (kg/100km) by car type

The average mileage of the cars running on CNG amounts to 25,812 km per year. This is much more than the mileage of average car usage in Germany, which is around 12,000 km per year. The CNG fuel price being relatively low compared to diesel (-35%) and notably to petrol (-55%), causes CNG-driven cars to be preferred by drivers with a high mileage. This applies foremost to the business users. (No before – after comparison has been made. It cannot be determined whether the CNG car owners drive more using their CNG cars, than they have done before with their conventional cars.)

Normally, a CNG car can run on both petrol and CNG. According to the data from the tank diaries, 90% of all car km have been driven on CNG. Again, because of the price advantage of CNG, drivers prefer it. Driving with petrol indicates that CNG fuelling stations were not available.

It was not possible to measure the fuel efficiency of the CNG car fleet. However, it can be calculated by conversion factors. When the cars run on CNG they consume 281 mega joules per 100 km; when they run on petrol they consume 291 mega joules, which is 3.6% more.

(The CNG fuel consumption is 10% higher under real life conditions than car makers claim. It was assumed that the fuel consumption of petrol and diesel is also 10% higher than stated by the manufacturers.)

Table 3.2.4-1 Performance and fuel consumption of the CNG car fleet per year

owners	
Business (%)	65
Private (%)	35
mileage	
mileage average (vkm /a)	25,812
<i>thereof</i>	
business usage average (vkm/a)	30,096
private usage average (vkm/a)	19,644
fuel	
proportion CNG/petrol (%)	90 / 10
CNG (kg/a)	239,020
CNG efficiency (GJ/a) (1000 kg = 39.46 GJ)	9432
petrol (litres/a)	36,940
petrol efficiency (GJ/a) (1000 litres = 31.6 GJ)	1167
fuel consumption (kg CNG/100 km)	7.1
CNG efficiency (MJ/100 km) (1 kg = 39.46 MJ)	281
fuel consumption (petrol litres/100 km)	9.2
petrol efficiency (MJ/100 km) (1 litres = 31.6 MJ)	291

Source: BVÖ; data based on tank diaries for 144 CNG cars

3.2.4.2 Cambio car fleet

Cambio's car fleet consists of 101 cars, most of which are small cars such as the 58 Opel Corsa and are not older than 2 years. There is no data available on the actual fuel consumption of the Bremen cambio car fleet as yet, but according to the small size of most of the cars, the fuel consumption is likely to be below average. This applies particularly to the Opel Corsa, which is one of the most eco-friendly cars in Germany.

Cambio officials said too that manufacturer's accounts of fuel consumption are inferior to actual fuel consumption in practise.

Table 3.2.4-2 Cambio car fleet by car type

Car type	Number of cars	kW
Opel Astra Kombi 'G'	12	62
Opel Astra Kombi 'H'	6	77
Opel Corsa 'C' 3-doors	58	44
Ford KA	2	44
Opel Combo	12	66
Opel Zafira	2	74
Renault Kangoo	3	43
Ford Transit- Bus 'FT300L'	1	74
Ford Transit- Transporter 'FT 240K'	3	63
Volvo Kombi V40	2	90

However, the main impact of the cambio measures in the field of energy is not due to fuel-efficient vehicles, but to an alternative way of organising car use. Car sharing services increase the utilisation of cars and thereby reduce the number of cars. Moreover they tend to change the car travel habits of car users. On average, they drive less after they have joined the service.

In the following section it will be roughly estimated how many vehicle kilometres have been saved due to the VIVALDI project. For this calculation, two factors are necessary: (a) The average amount of km which are saved because an average car sharing client drives less and (b) the increase in membership of cambio Bremen.

(a) The user survey of the combined offer of public transport and car sharing (see above) found that the clients drive about 2,500 km less per year by car than they would have done without joining the service. The same target group showed a decrease of 1500 km in a similar survey in 1998. The assumption can be made that on average, 2000 car km savings per client and year is realistic.

Table 3.2.4-3 Car-Kilometres per year by subscribers (mean)

<i>car km per year:</i>	2003 (N=112)	1998 (N=103)
Before subscribing	4.559	5060
After subscribing	2.079	3433
Savings	2480	1627

(b) Within the three year VIVALDI time span, the number of cambio clients (contractual partners) went up in Bremen by 700 and the number of persons entitled to drive by 1,000.

Table 3.2.4-4 Growth indicators for cambio membership

	clients	persons
31.05.2002	1803	2488
31.05.2005	2500	3498
Growth (N)	697	1010
Growth (%)	39%	41%

How many km have been reduced?

Given that each client reduces his yearly mileage by 2000 km, then the vehicle km savings per year amounts to $(700/3 * 2000 =) 467,000$ km. As car sharing clients usually do not drive much (see above) they have been likely to use petrol-driven cars. Hypothetically, an average petrol consumption of 8 litres per 100 km can be assumed. This leads to the conclusion that about $(4,670 * 8 =) 37,360$ litres of petrol have been saved per year and 136,000 per the 42 months of VIVALDI period, because of the VIVALDI measures.

3.2.5 Environment (Emissions)

3.2.5.1 CNG car fleet

3.2.5.1.1 Methods of measurement

For the calculations of emissions and emissions reductions the following factors have been used. (It does not include the emissions that are generated by manufacturing and transport of the fuel – tank to wheel.)

Table 3.2.5-1 Emission factors by fuel type (g/km)

	petrol-driven car Euro 4	diesel-driven car Euro 4	CNG-driven car
NO _x	0.036	0.341	0.08525
micro particles	0	0.016	0.00016
CO ₂	178.994	158.063	134.35

The calculation of the emissions of the CNG fleet is based again on the tank books for 144 CNG cars in a timespan of 29 months. In the following table the emissions of the 144 CNG-driven cars are compared to 4 different fleets, each characterised by a specific ratio of cars running on petrol and diesel. Fleet composition (1) is made up of 100% petrol-driven cars; composition (2) consists of 100% diesel-driven cars. Fleet composition (3), consisting of new cars running to 80% on petrol and to 20% on diesel, equates to the existing German car fleet. Composition (4) is the most realistic; it reflects what CNG car buyers would have bought instead of their CNG car. (Please note that comparable quantities are always new cars, which comply with the EURO 4 norm. That means that the reduction is actually more intensive than calculated).

Table 3.2.5-2 Reduction CNG fleets emissions compared to other fleet compositions

emission reduction	kg	%
CO ₂ reduction		
(1) compared 100% petrol (kg)	-145.201	-22
(2) compared to 100% diesel (kg)	-69.561	-12
(3) compared to 80% petrol and 20% diesel (kg)	-130.073	-21
(4) compared to 60% petrol and 40% diesel (kg)	-99.817	-17
micro particles		
(1) compared 100% petrol (kg)	0	0
(2) compared to 100% diesel (kg)	-57	-99
(3) compared to 80% petrol and 20% diesel (kg)	-11	-96
(4) compared to 60% petrol and 40% diesel (kg)	-34	-98
NO _x		
(1) compared 100% petrol (kg)	+ 160	+123
(2) compared to 100% diesel (kg)	- 942	-76
(3) compared to 80% petrol and 20% diesel (kg)	-60	-17
(4) compared to 60% petrol and 40% diesel (kg)	-501	-63

CO₂ emission

Cars running on CNG have substantially (-22%) lower CO₂ emissions than cars running on petrol. In comparison to diesel cars the reduction amounts to 12%. In the most realistic comparison the reduction amounts to 17%.

Micro particles (PM10)

Concerning micro particles (PM 10), cars running on CNG are much cleaner than those running on diesel which are an important source of micro particles in cities, having a tremendous impact on health.

NO_x

CNG cars emit 76% less nitrous oxides (NO_x) than cars running on diesel. This is particularly important, because cars running on diesel are also the main polluters in terms of NO_x. Compared to petrol, CNG cars emit 123% more NO_x, but, as CNG-driven cars replace mostly diesel cars, in reality a 63% reduction of NO_x is observable.

For both pollutants the Clean Air Directive is setting clear limits for cities. CNG propulsion is one module for sustainable urban transport plans against air pollution. In Bremen the politicians strongly support this measure.

3.2.5.2 Up-scaling CNG promotion measures

The figures on emission reductions are based on 144 cars for 29 months. What would be the figures per year and how will they change if the CNG car fleet will increase in size? The following simple calculations will convert the figures into yearly data for 4 different sizes of car fleets: the VIVALDI car sample of 144 cars; the likely amount of CNG cars at the end of 2005 in Bremen; and the likely amount of CNG cars at the end of 2010 as estimated by the CNG car experts differentiating between a scenario with and without future campaign activities (compare table “Experts’ view on the number of CNG cars in Bremen in 2010” in section 3.2.9). In the table below these converted figures are shown. These figures are rough estimations, but the assumptions on the future scale of CNG cars are based on experts’ knowledge.

Table 3.2.5-3 Up- scaling emission reductions due to CNG car fleet* (kg/year)

	VIVALDI CNG car sample	2005	2010	2010 with further campaign
cars/year	144	300	1175	2518
CO ₂ reduction	-102,688	-213,933	-837,906	-1,795,614
micro particles reduction	-35	-73	-286	-612
NO _x reduction	-516	-1075	-4210	-9023

* in comparison to fleet made of 60% petrol and 40% diesel cars

In terms of a do-nothing scenario, it can be assumed that 250 CNG cars are due to VIVALDI and that further campaign activities will result in about 1400 CNG cars until 2010.

Enerdata has calculated in the do-nothing scenario that 393,654 tons of CO₂ are emitted each year in Bremen by private cars. Provided that in the year 2010 1400 cars (60% petrol and 40% diesel) are replaced by CNG cars because of further campaigns this would lead to a annual reduction of 958 tons of CO₂ or of 0.24%. The reduction for NO_x would sum up to 0.73% and for micro particles to about 1.36%.

Table 3.2.5-4 Citywide emission reduction due CNG car measures in 2010 (t/year)

	CO ₂	CO	NO _x	PM
Private car	393,654	3,318	655	24
reduction (2010)	385.21	-	-1.93	-0.13
% reduction	0.10		0.30	0.55

3.2.5.3 Comparison with Items

	CO ₂	CO	NO _x	PM
Private car	393654	3318	655	24
reduction (2010)	-957.71	n.a.	-4.81	-0.33
% reduction	-0.24	n.a.	-0.73	-1.36

In the ITEMS scenario (enerdata) the following up-scaling conditions have been made for the CNG measures (for the year 2005): 10% of new cars and 200 new urban buses are CNG driven and no difference on annual travel in town is assumed between baseline year 1999 and target year 2005. It is the view of the Bremen experts that the assumptions of the share and number of CNG vehicles are totally unrealistic. However, for simulation purposes, it might be useful to consider the impact of such a scenario on the environment of the city. This shows that NO_x and PM emissions can be reduced significantly if CNG is used on a really wide scale. The emissions of NO_x would decrease under this condition by 4.6%. (The "impact-scenario" table displays the relative deviations of the macro emission indicators between the scenario associated with the CNG measure and the do-nothing scenario).

Table 3.2.5-5 ITEMS impact scenario for CNG emissions

	kilo per pers	kilo per kpkkm	tons per km2
CO ₂	-0.9%	-0.9%	-0.9%
NO _x	-4.6%	-4.6%	-4.6%
CO	2.3%	2.3%	2.3%
PM	-4.5%	-4.5%	-4.5%

*source: enerdata

3.2.5.4 Cambio fleet (emissions)

The emissions of the cambio fleet according to manufacturers' accounts are shown below. Nearly all cars meet the Euro 4 exhaust emission standard. The 4 vehicles which have relatively high CO₂ emissions are a mini bus and transporters.

Table 3.2.5-6 Key emission indicators of the cambio car fleet Bremen

Car type	Number of cars	kW	CO ₂ Emission kg/100km	exhaust emission standard	noise (dB)
Opel Astra Kombi 'G'	12	62	142	Euro 3/D4	72
Opel Astra Kombi 'H'	6	77	156	EURO 4	71
Opel Corsa 'C' 3-doors	58	44	115	EURO 4	71
Ford KA	2	44	140	EURO 4	72
Opel Combo	12	66	151	EURO 4	72
Opel Zafira	2	74	180	Euro 3/D4	73
Renault Kangoo	3	43	165	Euro 3	74
Ford Transit- 'FT300L'	1	74	210	Euro 3	74
Ford Transit- 'FT 240K'	3	63	212	?	72
Volvo Kombi V40	2	90	171	Euro 3	73

The average CO₂ emission of the car sharing fleet is 133g/km which is far below the German average of some 180g/km and meets the figure required through the standards set by the "blue angel" criteria for environmentally friendly mobility services. The yearly mileage of the cambio fleet in Bremen is 2.2 mio km, which comes up to CO₂ reduction of 103,000 kg/year only through operating with modern vehicles.

As with the CNG car fleet, emissions reduction can be calculated by means of the saved vehicle kilometres due to cambio membership. As calculated before, the mileage savings per year amount to 467,000. For the calculation of emissions the reference quantity should be a corresponding mileage covered by petrol-driven cars, as the car sharing fleet consists of up to 96% petrol driven cars, and the clients have mostly driven on petrol before joining cambio. The reduction of CO₂ is a similar size to the reduction caused by the current CNG fleet.

Table 3.2.5-7 Yearly reduction of emissions due to the Car-Sharing measures (kg)

NO _x	17
micro particles	0
CO ₂	83590

3.2.5.5 Up-scaling car sharing measures

Although experts said that there is potential for up-scaling the car sharing measures, this is likely to be less than that for the CNG fleet. Experts predict a growth in membership of about 70% between 2005 and 2010 if there is further support by political measures, and 35% without this support. Provided each new client will drive about 2000 km less per year due to membership, 1.750.000 vkm will be driven less than in 2005 because of the political support for car sharing. This will be a reduction of car km per year of less than 0.1%.

Table 3.2.5-8 Cambio membership growth and related vehicle km savings

	clients	persons
2005 (base)	2500	3498
Growth 2010 (+35%)	875	1224
Growth 2010 with policy support (+70%)	1750	2449
Growth compared to do-nothing (70%-35%=) 35%	875	1224
<i>km savings due to policy measures</i>	<i>1.750.000</i>	<i>2448600</i>

The impact of this growth on emissions savings is shown below. In 2010 there is likely to be 313 less tons/year of CO₂ than in 2005 due to supporting measures for car sharing. This amounts to a small proportion of 0.08% of all CO₂ transport emissions in Bremen per year.

Table 3.2.5-9 Up-scaling emission reductions due to *cambio* Bremen car fleet* (kg/year)

	2010	2010 with further campaign
CO ₂ reduction	313240	626480
micro particles reduction	0	0
NO _x reduction	63	126

* in comparison with a fleet of 100% petrol-driven cars

Table 3.2.5-10 Citywide emission reduction due Car-Sharing measures in 2010 (t/year)

	CO ₂	CO	NO _x	PM
	t/year	t/year	t/year	t/year
Private car	393654	3318	655	24
reduction (2010)	-313	-	-0.06	
% reduction	0.08		0.010	

3.2.5.6 Comparison with Items

In the ITEMS model the impact of the car sharing measure has been modelled under the condition of a decrease of car availability. It was assumed that through car sharing the availability of cars for all (!) trips from home to work should decline from 95% to 80%. According to this model this would lead to a reduction of all car km per year within the whole city by 3.0%. Under this condition the emissions reduction amounts to figures presented in the table below.

Table 3.2.5-11 ITEMS impact scenario for car sharing missions

	kilo per pers	kilo per kpkkm	tons per km2
CO ₂	-1.7%	-1.2%	-1.7%
NO _x	-0.5%	0.0%	-0.5%
CO	-2.6%	-2.0%	-2.6%
PM	-0.4%	0.2%	-0.4%

The differences between the ITEMS model calculation and the calculation made by the University of Bremen are because of the different assumptions made.

3.2.6 Society

Transport is essential for the integration and functioning of a modern society. Everybody depends on the existing transport systems. The impacts on society are a central area for the evaluation of the Bremen VIVALDI measures. In order to measure these impacts, one can differentiate between different target groups (those concerned/affected) and the kind of relations that exist between the specific measures and the target groups. The Bremen VIVALDI measures are targeted at a wide range of groups and organisation. They are listed in the table below:

Table 3.2.6-1 Target groups of the measures

WP	measure	Target groups (persons/groups that are targeted/concerned/affected by the measures)
5.2	Clean and efficient vehicles	potential car buyers, residents, car traders, fleet managers
6.3	Residential traffic management	cyclists & pedestrians
7.2	Integrated transport pricing system	irregular PT users
8.4	Hybrid tram system	PT users, residents, road users
8.5	PT and Car-Sharing	PT user and prospective Car-Sharing clients
9.1	Car-Sharing / City car club development	New prospective Car-Sharing clients such as business people and suburban dwellers
9.2	Integration with urban developments	Prospective Car-Sharing clients, urban dwellers
10.1	City logistic scheme/freight village	shopkeepers, traders, companies situated on sensible spots
11.4	Walking and cycling measures	cyclists & pedestrians
12.2	Travel Information Centre	PT users

The relations between the measure and the target groups can be described in terms of awareness, acceptability, involvement, acceptance and accessibility.

3.2.6.1 Awareness

For people to be able to use a specific type of transport they have to be aware of it. Awareness raising is particularly necessary for measures that follow new or unconventional strategies and are therefore not widely known. This applies in VIVALDI to the campaign for CNG cars, the car sharing measures and the pricing measures. All measures have been accompanied by marketing and advertising campaigns. On a broad citywide scale, intense marketing activities (newspapers, poster advertising, Internet) have been carried out for the CNG and the pricing measures. Car sharing advertisements have been more specific to special target groups in confined areas around new car sharing stations. The basic message of all marketing campaigns

has been that the prospective buyer or user will have advantages in terms of cost savings or higher convenience. The environmental advantage has been promoted as a side effect of all measures.

Table 3.2.6-2 Measures and awareness activities

WP Nr.	(integrated) measure(s)	awareness activities		
		city-wide	target groups	specific areas
5.2	CNG fleet	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
8.5;9.1	Car-Sharing			<input checked="" type="checkbox"/>
7.2	<i>BoB-ticket</i>	<input checked="" type="checkbox"/>		(<input checked="" type="checkbox"/>)

The results of these awareness-raising activities have been very good. The campaign for CNG car measures helped to improve knowledge about the pros and cons of CNG vehicles and the related allowances amongst a growing part of the population. The campaign has been most successful in terms of convincing people to buy a CNG driven car, when it has focused on car traders and fleet managers. A strategy of direct marketing has also been undertaken by the car sharing service. Many potential business clients have been won by such personal advertisement activities. The BoB-ticket has been advertised on posters at the PT stops and on displays on trams. An analysis of the efficiency of these advertisements found that every third person in Bremen knows of the new ticket and that the response to this advertisement was better than to previous campaigns.

The remaining Bremen VIVALDI measures need less or no awareness raising activities. In the case of the new trams, these projects are well known in the affected area, because of their high impact and long planning process. In case of the ITIC, its central location ensures that it will be known by the public, so no intense marketing has been required.

3.2.6.2 Acceptability and involvement

The building or infrastructure measures, which were supported by VIVALDI, usually cause significant changes for many residents in the affected areas. These measures can cause disruption during the construction phase in terms of noise, dirt and access restrictions. In addition, not everybody who is affected welcomes the further consequences of the measures. The new trams are to some extent discussed controversially. They have to gain acceptability, which can be reached by involving those concerned and giving them very detailed information about the potential outcome. The evaluation of the tramline 4 and the planning of lines 1 and 8 shows the importance of these steps and that they have been quite successful.

Other measures like the reconstruction and rebuilding of the Langemarckstraße have not been controversial as such. The main task here is to optimise the construction work in such a way that nuisances can be kept to a minimum.

3.2.6.3 Acceptance

The measurement of user acceptance has been the core area of the Bremen measure evaluation and has been described above. Therefore, it will only be briefly summarised at this point. After the Bremen measures have been implemented they have been widely accepted by the target groups. This is true for tramline 4, where the users are more satisfied than they were with the buses that they had previously used. For the measures concerning the promotion of CNG cars the campaign has been estimated as important and useful by the general public and the various target groups. The *BoB-ticket* has already become a big seller, which indicates high levels of satisfaction. The Car-Sharing measures have also been well received by the users. The enlargement of the offer to new target groups has been accepted by the users despite the fact that demand in the urban fringe is not high enough to run the business economically. City logistics is a problematic area for structural reasons. The assessments of the soft measures for cyclists turned out to be very positive. By these measures cycling has become safer, faster and more convenient.

3.2.6.4 Accessibility

In Bremen, no measure has been specially designed to improve accessibility as a strategy against social exclusion. However, the soft measures as well as the new tram lines contribute to this aim, by making the residential area more attractive and at the same time improving accessibility and connections within the whole city and the urban fringe. The issue of accessibility has been important for the acceptance of the CNG cars. Because there are only two CNG fuelling stations, their accessibility is restricted and needs to be improved (which will be the case in 2006).

Accessibility is also an important issue for the car sharing service. For a customer of such a service the distance to a car sharing station is a crucial point. If the distance is too far then access is constrained. Through the VIVALDI strategy of setting up car sharing stations both in the city centre (for business users) and the urban fringe (for suburban residents) the accessibility of these target groups could be improved.

3.2.7 Digression: Awareness and Acceptance of Car Sharing – Results of a Citywide Survey

The VIVALDI measures are to a high degree responsible for the noticeable growth of the car sharing service in terms of membership, station and CS cars. Moreover various marketing activities should raise awareness amongst the general public. However, no clear picture about the actual awareness on car sharing exists. Therefore, within VIVALDI the question of what people in Bremen actually know about car sharing should be answered. It has been suggested that that because of the VIVALDI measures, the public awareness of car sharing should be higher in Bremen than in comparable German cities.

3.2.7.1 Method of measurement

The University of Bremen carried out a representative survey of car sharing in Bremen in summer 2004. 1,200 residents in Bremen have been phoned by interviewers and 294 computer aided telephone interviews have been carried out completely. In order to

ensure that the sample was representative, the cases were weighted by gender and age. The following section will give some results of the survey about:

- Name recognition of and knowledge of car sharing
- Experiences with and attitudes towards car sharing
- Potential analysis
- Comparison to a nation wide survey

3.2.7.2 Name recognition of and knowledge of car sharing

Most people in Bremen are familiar with the terms ‘StadtAuto’ and ‘car sharing’. 57% of the population knows at least one of these terms. The expression ‘*cambio*’, which is the common label, since the Bremen CS organisation merged with other companies from other cities in 2000, is not as well known. Nearly 77.6% have not heard of *cambio*. The words StadtAuto and Car-Sharing are widely used in public. They also provide an idea of what they involve, whereas *cambio* seems still an unusual description.

Table 3.2.7-1 Name recognition

	known		have heard about		don't know		Total respondents	
	Count	%	Count	%	Count	%	Count	%
StadtAuto	153	52,0%	70	24,0%	71	24,0%	294	100,0%
CarSharing	147	50,0%	79	27,0%	68	23,0%	294	100,0%
cambio	43	14,5%	21	7,3%	230	78,2%	294	100,0%

University of Bremen. Table created on 01.12.04

The interviewees, who have heard at least one of the three expressions for car sharing, should assess how well they know of it. More than half of them said, that they know about car sharing to some extent.

Table 3.2.7-2 How well do you know about car sharing?

	Count	%
I know quite well what Car Sharing is	79	27,1%
I know the term and I have an idea what Car Sharing is	95	32,6%
I have heard the expression, but don't know what it is	80	27,6%
I never heard the term Car Sharing	37	12,7%
Total respondents	291	100,0%

University of Bremen. Table created on 01.12.04

In order to check whether this self-appraisal is correct, we asked 7 questions about how car sharing is used. For instance, questions on when to book, where to park, how much to pay, what cars to choose etc. We found out that about one fifth of the Bremen adult population knows sufficiently what car sharing is. The level of knowledge about car sharing correlates significantly with this:

- Level of education (p=0.000)
- Occupational status (p=0.009); full time employment (pos), Housewife/-man (neg)

- Level of car availability ($p=0.029$; neg. correlation)
- Extent of private car use ($p=0.022$; neg. correlation)
- Extent of bicycle use ($p=0.023$)
- Extent of PT use ($p=0.006$)

Table 3.2.7-3 Questions about car sharing (% of affirmative responses)

	Count	%
Do you know, if there is a Car Sharing Organisation in Bremen / Bremerhaven?	192	89,7%
Did you know, that CSO offer different types of cars.	128	59,7%
Did you know, that you can book a car at any time?	126	59,2%
Did you know, that you can book cars of CSO for hours, days, or months?	128	60,1%
Did you know, that you have to park the car at the same station you have taken it?	72	33,8%
Do you know any Car Sharing stations?	91	42,6%
correct costs estimation*	45	20,9%
Total respondents	214	100,0%

Multiple response; * the majority (55,2%) overestimate the costs of Car Sharing University of Bremen. Table created on 01.12.04

Table 3.2.7-4 State of knowledge

	Count	%
high level (4 to 7 right answers)	60	20,5%
medium level (3 right answers)	40	13,5%
low level (less than 3 right answers)	194	66,0%
Total respondents	294	100,0%

University of Bremen. Table created on 01.12.04

3.2.7.3 Experiences with and attitudes towards car sharing

Nearly half of the Bremen population have had experiences with informal car sharing, either by car pools or by sharing (lending) cars with (from) neighbours and friends. In particular, younger persons do so. The experience of these practices has no impact on their level of knowledge about the formal professional car sharing.

Table 3.2.7-5 Experiences with common car use

	Count	%
car pooling (i.e. with your fellow-workers etc.)	73	25,0%
car sharing with neighbours/friends/relatives (i.e. fetching children; bulk buying	60	20,6%
professional Car Sharing	10	3,4%
others	2	,6%
No	169	58,0%
Total respondents	291	100,0%

Multiple response

University of Bremen. Table created on 01.12.04

The interviewees should agree to or disagree with statements on car sharing⁵. In general, car sharing is seen very positively. It is a practical, modern, up-to-date scheme. However, willingness to become a member/client of a car sharing organisation/company is limited. Less than one third can imagine joining a car sharing organisation.

Table 3.2.7-6 Positive statements for car sharing

	agree		disagree	
	Count	%	Count	%
I regard Car Sharing as an up-to-date offer	250	87,9%	34	12,1%
I would appreciate if many persons would use car sharing	249	92,8%	19	7,2%
Car Sharing is a good alternative to the private car	197	69,0%	89	31,0%
I can imagine to become a client of a CSO	86	29,8%	203	70,2%
I regard Car Sharing as a practical thing	244	87,6%	34	12,4%

University of Bremen. Table created on 01.12.04

The highest barrier for car sharing is based on the fact that the majority are satisfied with their current travel modes. Therefore, most people have no need to change their travel practices, which would be necessary to some extent if they were to use the service. Again, car sharing is assessed in general quite well: most people think that it works smoothly and is not too complicated or time-consuming. However, regarding their personal mobility situation, most people prefer to have their own car and see no benefit in car sharing.

⁵ We used a four-point scale, ranging from “strongly agree” to “strongly disagree”. In each case the two agreement statements and the two disagreement statements are summarized to “agree” and “disagree”.

Table 3.2.7-7 Negative statements for car sharing

	agree		disagree	
	Count	%	Count	%
It is hard to imagine, that Car Sharing works smoothly	113	39,9%	171	60,1%
Car Sharing is only something for environmentalists	60	20,7%	231	79,3%
Car Sharing is not an option, because I cannot do it without my own car	175	61,0%	112	39,0%
Car Sharing is too complicated and time-consuming	72	28,7%	179	71,3%
I am quite satisfied with my current modes of travel	280	95,4%	14	4,6%
There is no benefit for me in Car Sharing	198	68,5%	91	31,5%

University of Bremen. Table created on 01.12.04

Nearly 60% admit not knowing enough about car sharing, but only about 20% said that they would like to have further information about car sharing.

Table 3.2.7-8 Information and car sharing

	agree		disagree	
	Count	%	Count	%
My knowledge on Car Sharing is insufficient to consider it as an option	165	58,0%	119	42,0%
I would like to have more information about car sharing	64	21,8%	229	78,2%

University of Bremen. Table created on 01.12.04

Many of those who would consider CSO membership relate this to a change in car ownership. More than half of them stated that they would not buy a second or third car, if there were a car sharing station nearby. 17.7% can imagine not buying a first car and 17.6% would get rid of their car.

Table 3.2.7-9 Provided you live next to a car sharing station, could you imagine, that your household

	Count	%
abstains from purchasing a car?	19	22,3%
abstains from purchasing another car?	36	42,4%
abolishes a car?	13	15,2%
abolishes the second or third car?	4	4,9%
nothing like that	27	30,9%
Total respondents	86	100,0%

Multiple response; basis: the 29,8%, who can imagine to become a member of a CSO

University of Bremen. Table created on 01.12.04

3.2.7.4 Potential analysis

In order to reduce the multiple dimensions of “subjective” attitudes towards car sharing and car usage a factor analysis was produced. 6 factors have been identified that are the

basis for a cluster analysis which can provide evidence for the potential car sharing clients. Taking their attitudes into consideration 47% of the adult population can be regarded as potential car sharing clients or at least open-minded towards car sharing. However, we have to take into account that this rate will decrease if further “objective” barriers against car sharing as a daily need for a car or an annual mileage above 10,000 km are considered. Anyhow, the results from the potential clients show some interesting dependencies on the socio-demographic characteristics. Car sharing is particularly suitable for:

- Persons between 25 and 45 years old,
- Persons with university diploma,
- Persons in households with a monthly net-income below 2,500 Euro

Table 3.2.7-10 Potential car sharing clients by socio-demographic characteristics

		potential CarSharing clients		no potential CarSharing clients	
		count	%	count	%
gender	male	55	41,3	78	58,7
	female	76	52,9	68	47,1
age	18 up to 25 years	14	42,8	19	57,2
	25 up to 45 years	57	55,5	46	44,5
	45 up to 60 years	29	42,0	40	58,0
	> 60 years	32	41,2	45	58,8
graduation	elementary school	19	42,2	26	57,8
	secondary school	31	48,2	33	51,8
	university entrance diploma	35	41,3	50	58,7
	post graduate	45	58,3	32	41,7
occupational status	pupil, student, unemployed, military duty	23	50,3	22	49,7
	fulltime employed	36	45,8	42	54,2
	parttime employed	26	55,4	21	44,6
	housewife / houseman	14	44,7	17	55,3
	retired	24	38,4	39	61,6
	other	7	57,8	5	42,2
number of household-members	1 person	36	56,0	28	44,0
	2 persons	53	48,4	56	51,6
	3 persons	19	43,5	25	56,5
	4 and more persons	24	37,0	40	63,0
monthly household net-income	500 to 1.000 €	14	46,8	16	53,2
	1.000 to 1.500 €	17	58,6	12	41,4
	1.500 to 2.000 €	31	59,9	21	40,1
	2.000 to 2.500 €	18	51,0	18	49,0
	2.500 to 3.000 €	24	43,7	31	56,3
	3.000 € and more	27	39,8	41	60,2

significance:

age classes (25-45 years, other 0,029); graduation (postgraduate, other 0,030); household net-income (up to 2.500 €, more than 2.500 € 0,034)

3.2.7.5 Comparison with a nation-wide survey

The highest barrier for car sharing is based on the fact that the majority of people are satisfied with their current travel modes. Thus, most people have no need to change their travel practices, which would be necessary to some extent if they were to use the service. Again, car sharing is assessed in general quite well: most people think that it works smoothly and is not too complicated or time-consuming. However, regarding their personal mobility situation, most people prefer to have their own car and see no benefit in car sharing.

Table 3.2.7-11 Knowledge on car sharing in Germany and Bremen (1)

	Germany	Bremen
I know quite well what Car Sharing is	19%	27,1%
I know the term and I have an idea what Car Sharing is	28%	32,6%
I have heard the expression, but don't know what it is	24%	27,6%
I never heard the term Car Sharing	29%	12,7%
Total respondents	1000	291

University of Bremen. Table created on 01.12.04

The extent of knowledge about car sharing has been measured in both surveys in different ways. Whereas in the German-wide survey, the respondents should explain in their own words what car sharing is; in Bremen 7 control questions were asked.

Table 3.2.7-12 Knowledge on car sharing in Germany and Bremen (2)

Germany		Bremen	
very good explanation	5%	very high level (7 of 7 right answers)	3.6%
good explanation	10%	high level (4 to 7 right answers)	16.9%
explanation to some degree	18%	medium level (3 right answers)	13.5%
no/poor explanation	67%	low level (less than 3 right answers)	66.0%
	N=1000	Total respondents	N=294

University of Bremen. Table created on 01.12.04

In both surveys the print media are the most often mentioned sources of knowledge about car sharing. In the Germany-wide survey 37% of the population had heard about car sharing through advertisements. This proportion is smaller for the Bremen population (18.8%). For them, the word-of-mouth advertisement is more important (34.0%). Moreover, the existing car sharing stations are relatively well known in Bremen (23.9%). One can conclude that in Bremen (and elsewhere) an existing car sharing system is the best advertisement. It is visible in the city and can be recommended by its users.

Table 3.2.7-13 Source of knowledge

	Germany	Bremen
print media	72.0%	52.5%
advertisements	37.0%	18.8%
acquaintances, friends, relatives	23.0%	34.0%
Radio, TV; Internet, Cinema	11.0%	23.0%
information materials /desks of your local CSO	10.0%	2.3%
infomaterial/advertisements of German Railway DB (Deutsche Bahn)	5.0%	1.7%
(design of) Car-Sharing stations	-	23.9%
others	1.0%	4.4%
Total of responses	159.0%	160.6%

multi-response question

University of Bremen. Table created on 01.12.04

3.2.8 Transport

In general, the VIVALDI measures intend to improve the transportation system by introducing new services/products or improving existing ones by technological, spatial or organisational means. The following table aims to give an overview of the different ways in which the measures aimed to improve the quality of the transport service. Most VIVALDI measures have a spatial aspect. They extend an existing service to other areas (hybrid tram 8.4; CS development 9.1) or enhance the situation in an area by reallocating and rebuilding road space (Cycling 11.4). Other measures affect very specific areas that require new forms of logistics (10.1) or new residential areas for which Car-Sharing stations are planned (9.2). The technological dimension is also important for several measures. The CNG promotional campaign (5.2) tried to increase the use of a new technology by raising the acceptance of it. The BOB ticket (7.2) is based on an already existing electronic ticketing system but required in particular new programming work. In the new information centre for public transport (ITIC 12.2), information technology is used at terminals for self-service or as an information source at the helpdesk. Another important dimension of service improvements is shown by the effects of organisational changes. Several measures benefit from the synergy effects of the cooperation of different partners. An efficient network between campaigners, CNG providers and car traders has been established to stimulate the market for CNG driven cars (5.2). Public transport operators cooperate together or with the car sharing business in order to give the user a wide-ranging service in terms of the served area (7.2) or the offered product (9.1).

Table 3.2.8-1 Dimensions of the transport service improvements

WP	measure	Technology	Space	Organisation
5.2	Clean and efficient vehicles	CNG propulsion		support network
6.3	Residential traffic management		access management	
7.2	Integrated transport pricing system	post paid e-ticketing system		cooperation of three PT operators

8.4	Hybrid tram system		extension suburban area	
8.5	PT and car sharing	new contactless chip card		cooperation PT and CS service
9.1	Car sharing / City car club development		city centre, urban fringe	
9.2	Integration into urban developments		new residential areas	
10.1	City logistic scheme/freight village		sensitive spots	Bundling freight transport
11.4	Walking and cycling measures		reallocation, rebuilding	
12.2	Travel Information Centre	IT based helpdesks and terminals		cooperation between PT, CS and DB (railway)

3.2.8.1 Service reliability

Normally the reliability of a service, an offer or a product should be ensured before it is promoted. This is also the case for the transport measures supported by VIVALDI. However, if something new is to be introduced, there is a risk that things will not work as intended. In a technical sense this affects the reliability of the vehicle, the transport system or related services and tasks. For the success of the CNG car it has been crucial to ensure that the cars are reliable and that there are enough and reliable fuelling stations. In particular the second aspect has not been satisfactory until now although the number of planned CNG cars could be reached. The evaluation also gives some evidence that the new CNG-driven cars need more maintenance and repair than comparable conventionally propelled cars.

The extension of a new tramline changes the public transport system in the affected area. The new infrastructure and vehicles must function successfully. Apart from small readjustment problems this change worked out fine for new tramline 4. Because of the shift from bus to tram the PT service has become more reliable in terms of punctuality and frequency.

For the PT pricing measures reliability is also an essential. For example, it must be ensured that the BOB ticket card could be cancelled in case of loss or inability to pay. No problems and errors have been encountered so far concerning these issues.

The car sharing system also has to be reliable in terms of organisation, technology and service. Car sharing has existed in Bremen for 15 years. In this time it has grown from a grassroots organisation to a fully developed business. It is also technically mature using advanced information technology. One VIVALDI measure promoted the new contactless chipcards, AutoCard and Bremer KartePlus, which are fully functional. Reliability means to that a car is available at the requested time and is fully maintained. As the car sharing cars are constantly maintained and none of the cars are older than 4 years, there are very few problems recorded regarding the quality of the cars. Customer surveys indicate high levels of satisfaction concerning this item (almost 95 % of first booking wishes could be fulfilled). However, reliability, availability and also accessibility (see above) have been further improved by the VIVALDI measures. The strategy to raise reliability by implementing new stations with at least 3 cars each proved to be successful, especially in the city centre.

3.2.8.2 *Quality of service*

The quality of the services and products promoted by VIVALDI are primarily measured by the acceptance and assessments of the users. For some measures data from the operators could be added on the perceived quality of the measure.

The quality of the CNG campaign has been assessed as excellent by various target groups. However, as experts stated, the quality of the service on the whole depends in particular on the actions of the car industry and the CNG providers. To extend the range of CNG cars offered and to install more CNG fuelling stations are remaining tasks for the future to fully achieve a market breakthrough for alternative fuels.

The quality of the service of the new tramline 4 has been rated as better than the quality of the previous bus system. Tram users stated that the trams are more punctual, faster and have more seats available. Concerning safety and driving comfort, the tram makes a significant better showing than the bus.

For the *BOB ticket* no data on how users assess the new form of boarding and paying is available at this stage. However, the marketing campaign received good marks. Compared to other PT advertisement campaigns it is one of the most successful. The service of the Intermodal Information Centre has been rated compared to the previous information centre. Visitors assess the new service as being clearly more attractive and functional.

The quality of the car sharing service has been asked for by annual Internet customer surveys. In most aspects the users are very satisfied with the service, which often exceeds their expectations (ratings between excellent and good). The only weak point is that the availability of cars is sometimes restricted at weekends. The high quality of the car sharing service has been confirmed by the VIVALDI evaluation of the combined offer (WP 8.5). On a scale from 1 (very good) to 6 (very bad) the car sharing service cambio has received an average value of 1.83.

The quality of the cycling measures has been acknowledged by the majority of the affected residents and cyclists. VIVALDI surveys provide evidence to show that by these measures people can walk and cycle safer, faster and more conveniently.

3.2.8.3 *Usage*

The VIVALDI measures should encourage the use of sustainable transport systems. The targets which are set for the indicators in this impact area have mostly been achieved.

The target number of 250 CNG cars has been clearly reached. However, the users consist mainly not of private users as planned, but of business users.

The PT operators set the target of 15,000 BOB tickets to be sold by the end of 2005 and 20,000 - 25,000 by the end of 2006. Considering the current sales figures (10,642 in Oct. 2005) these targets appeared to be realistic. BSAG officials said that the *BOB-tickets* have sold better than expected.

Tramline 4, the usage of which has been measured in the VIVALDI evaluation of WP 8.4, raises the number of PT passengers clearly in the affected area. The tram does significantly increase the number of PT users and the frequency of PT journeys. Passenger counts indicate a significant growth, which however varies a lot at the various stops of the line.

VIVALDI measures contributed a lot to the growth of cambio, the car sharing company. The number of cars has been increased within VIVALDI from 80 to 100. The number of clients (contractual partners) went up by 700 (+39%) and the number of persons entitled to drive by 1000 (+41%) within the 3 year VIVALDI time span (5/2002 to 5/2005). However, the growth of clients is not followed by growth in car mileage. This is good for the environment but unfavourable for the business.

The VIVALDI attempts to enhance city logistics unfortunately failed to a large extent. Simply because the automotive industry has not produced affordable CNG trucks, the plan to deliver goods on CNG-driven trucks had to be dropped. Moreover, the city centre in particular is a very difficult business area where city logistics companies face strong competition from bigger carriers and very small single vehicle offers damage this market.

Walking and cycling are modes that are less dependent on infrastructure than hard modes such as driving and PT usage. However, improvements in this transport sector show a positive effect on the frequency of cycle use. Up to 10% of the residents in the areas affected by the VIVALDI measures stated that they would cycle more because of the improved cycling conditions.

To sum up, the VIVALDI measures have a considerable impact on the use of the sustainable transport systems by the addressed target groups in the affected areas although the total citywide effect is relatively small. In the realm of car sharing and PT the VIVALDI measures improve existing transport systems. To what extent the citywide growth of these systems is due to VIVALDI remains an unanswered question. For measures which support new or non-established transport offers / products like the promotion of CNG driven cars and city logistics the market share is very small. However, the first steps have been made. The up-scaling surveys showed that in the future, Car-Sharing and the CNG-car market will grow significantly, but they will still need further political support.

And finally it should be stated that all measures in Bremen are going to continue after VIVALDI ends in January 2006.

3.3 Bristol – City-Level Evaluation

As part of the VIVALDI project Bristol has introduced 29 demonstration measures across the city to address the objectives set for each of their 6 integrated packages. Each integrated package of measures was themed to address the objectives of the CIVITAS programme and each measure has contributed to those targets. The project has shown many positive and interesting results and important lessons learnt that can be used to inform other European cities considering similar approaches. It is our view that the effects of the measures have made an impact on the target areas within the city. However, due to the size of the demonstrations compared to that of the city it is extremely difficult to produce significant statements that can be applied to the city of Bristol as a whole.

The wider impact of some measures can be assessed by up-scaling the measures to a city level. This however can only be achieved for certain measure types and it is important that any up-scaling is in line with local political objectives. Bristol has identified the measures that it feels can be up-scaled to a city level, together with the local objectives. The following summarises the details that were submitted to METEOR for further consideration.

Integrated Package	Measure	Description of actions	Motivation & level of up-scaling
Clean & Efficient Vehicles	City Fleet Vehicles	The Council vehicle fleet is operated with the primary purpose to provide home to school trips, to meet the special travel requirements for the Social Services Department, and to procure pool vehicles for other Departments within the Council. Prior to VIVALDI, 22 Liquefied Petroleum Gas (LPG) fuelled vehicles were operated within the municipal fleet whilst the remainder of transport services vehicles were diesel powered. During the lifetime of the project this introduced 73 additional LPG vehicles, 5 electric and 1 hybrid diesel vehicles into the Council's municipal fleet of cars, vans and coaches.	As a continuation of this scheme the Council has adopted a policy that all new vehicles introduced into the fleet use LPG or other clean fuel technology.
	School Wig-Wag Signs	The VIVALDI project has replaced mains powered school wig wag road warning signs with Solar Powered signs at 21 locations in Bristol.	Following successful operation of these signs the use of solar power will be the technology of choice to be deployed for all new appropriate highway signs. 20 speed advisory signs have already implemented in 2005.
City Centre Clear Zone	Freight Logistics Scheme	VIVALDI has introduced a pilot scheme utilising freight consolidation to reduce the numbers of delivery vehicles entering the Broadmead city centre shopping area of Bristol. This retailing area comprises some 325 retail units and receives over 100,000 deliveries per year. The pilot uses vehicles meeting Euro III standard and currently serves 33 retail units and has saved 1187 trips into the City Centre.	The Council would like to extend the scheme to serve 50-75 retail units.

Improving Public Transport	New forms of public transport contracts (Showcase)	The showcase bus route that has been introduced as part of VIVALDI has shown an increase in patronage levels of up to 12%.	The council, working with others in the Greater Bristol sub-region, are planning on introducing 3 more showcase bus routes during the period 2006 - 2011. However a major scheme bid has been submitted to Government which if successful would increase this number to 10.
Developing New Mobility Services	Car Club development	<p>The car club scheme currently has around 220 members served by 20 vehicles.</p> <p>The VIVALDI project introduced an LPG vehicle as part of the Car Club fleet.</p>	<p>There are plans to extend Car Club to 1,000 members served by 50 cars by 2007.</p> <p>There are currently plans to extend the number of LPG or other clean fuel vehicles in the Car Club fleet (target 10-20%) as the scheme expands.</p>

3.3.1 Do-nothing Scenario Results

The VIVALDI project in Bristol invested a large amount of resource providing the necessary data for the ITEMS (Do Nothing) model. This data was manipulated by METEOR and returned to Bristol to verify that it was appropriate as input data. Unfortunately, this data was not appropriate and did not match the original data set provided by Bristol. Many anomalies were resolved through email correspondence but this proved to be a time consuming process. At the Evaluation Managers meeting in Prague it was decided that cities had the option of not using the ITEMS model for their evaluation. It was also stated the METEOR ITEMS team would undertake city site visits to resolve any difficulties that the local evaluation managers were having with the model. Bristol has not received a visit and hence was unable to progress this any further. The city therefore has no confidence in the model and any results produced. A decision has therefore been made not to use the ITEMS model for the evaluation in Bristol.

The do-nothing analysis in Bristol has been conducted at the measure level where appropriate. This has been achieved by either using models to calculate differences in the observed data for the do-nothing scenario, collecting control data or by collecting baseline data for attitudes and awareness.

As a result the do-nothing calculations for Bristol are included in the measure level evaluation results.

3.3.2 City Level Results (including core indicator results)

A requirement of the project is to produce City Level results for each of the METEOR indicators. Where possible METEOR indicators have been collected to evaluate the impacts of the measures implemented in the City of Bristol.

Due to the size and geographical dispersion of the measures implemented in Bristol, combining the results by indicator will provide little insight to the achievements made and results can at most only be combined at the integrated package level. The following describes the METEOR impact indicators that were collected for the city as a whole. The achievements have been compared to the indicators stated in the evaluation plan to highlight any difficulties or changes that prevented some indicators from being collected.

3.3.3 Economy

Economic indicators have been extremely difficult to collect in Bristol. This has primarily been for commercial reasons as many of the services and facilities are operated by private companies and such information is seen as being commercially sensitive in the UK. The following describes the economic data intended for collection for each integrated package and summarises the achievements that were made and the reasons why the data could not be, or was not, collected.

Table 3.3.3-1 Clean-Fuelled Vehicle Integrated Package Impacts and Indicators

Area	Category	Sub-category	Indicator	LO	M	Comments
Economy	Costs	Operating costs	Operating costs per PKM	-	2	Not possible

The bus operating companies declined the request to provide the information required for the economy indicators due to the information being commercially sensitive. Patronage growth is a good indicator for economic improvements for a public transport service. It would have been difficult to compare such figures as the majority of operating cost is related to labour rates that will vary significantly across the Member States.

Operating costs were made available for the Greenfuel private vehicle LPG conversions. The results showed that the average costs per km for the sample was 0.08€ per km.

Table 3.3.3-2 Clear Zones Integrated Package Impacts and indicators

Area	Category	Sub-category	Indicator	LO	M	Comments
Economy	Employment	Numbers employed	Number of jobs in area	LO8	-	Not Collected
		Attitudes to employment opportunities	Attitude to employment	LO8	-	Not Collected
	Property	Commercial rental values	Rental values Euro/sqm	LO7	-	Not Collected
		Business attitudes to area	Business attitudes to area	LO7	-	CZ Business Survey
	Business vitality	Employers attitudes to area	Retail vacancy rates	LO7	-	Not Collected
		Retail success	Turnover indicator	LO7	-	Not Collected
			Prime yields	LO7	-	Not Collected
			Retailer attitudes	LO7	-	Not Collected

The indicators set for the Clear Zone did not include the economy costs and benefits indicators (1 and 2) as a set of more specific local indicators have been used to measure the economic impacts of the measures.

The above table shows that the proposed local economic indicators were not collected. This was due to the scale of the actual implementation and the re-development of the

main shopping and business district in the area, as outlined in the evaluation results section.

Table 3.3.3-3 Improving safety and access in the inner city Integrated Package: Impacts and Indicators

Area	Category	Sub-category	Indicator	LO	M	Comment
Economy	Property	Residential Property Values	Property values asking prices from estate agents	LO14	-	

The planned indicator collection for this integrated package did not include METEOR economy indicators, but a Local Indicator relating to the property values of the houses inside the VIVALDI Home Zone. This data was unable to be collected in the timescales of the project due to the construction at the site during that period.

Table 3.3.3-4 Developing Social Inclusion in South Bristol

Area	Category	Sub-category	Indicator	LO	M	Survey ID
Economy	Employment	Employment	Level of Employment	LO20	-	Not Collected

The focus of the package of measures was to enhance accessibility and reduce the need for travel; therefore the indicators related to economy, society, transport and process took priority. The indicators used for developing social inclusion did not include METEOR economy (1-2) indicators as these were not expected to be affected by the introduction of the package of measures.

It was intended that basic ward statistics held by the City Council and other organisations would be used to look at changes in employment levels and other contextual factors. Due to the scale and timing of the measures achieved it is not possible to show any direct effects of these measures on the ward statistics.

Table 3.3.3-5 Providing better public transport integrated package impacts and indicators

Area	Category	Sub-category	Indicator	LO	M	Comments
Economy	Benefits	Operating revenues	Operating revenues per pkm		1	Not Collected
	Costs	Operating costs	Operating costs per pkm		2	Not Collected

Economic data could not be provided as it was considered commercially sensitive by the bus operating companies.

Table 3.3.3-6 Impacts and indicators for integrated package: new mobility services

Area	Category	Sub-category	Indicator	LO	M	Comments
Economy	Benefits	Operating revenues	Operating revenues per pkm	-	1	Not Collected
			Operating revenues per trip	-	1	Not Collected
	Costs	Operating costs	Operating costs per pkm	-	2	Not Collected
			Operating costs per trip	-	2	Not Collected

Operating costs and revenues were not able to be collected for commercially sensitive reasons. The project collected fuel costs of operating the Demand Responsive Transport Service LPG / Petrol vehicle that operated in the Bristol VIVALDI demonstration area (K9). This figure was calculated to be £0.09 per vehicle km for the

evaluation period. This compared to a figure of £0.11 per vehicle km for the period Feb – Apr 2005 recorded by the diesel replacement vehicle.

3.3.4 Energy

The following describes the METEOR energy indicators that were planned and collected as part of VIVALDI evaluation for each integrated package.

Table 3.3.4-1 Clean-Fuelled Vehicle Integrated Package Energy Impacts and Indicators

Area	Category	Sub-category	Indicator	LO	M	Comments
Energy	Energy consumption	Fuel Consumption -	Fuel efficiency – per VKM	LO2	3	Collected
			Fuel Mix	-	4	

Retrofitted Buses

Analysis of the fuel consumption figures between January 2002 – March 2005 for the First Bristol retrofits shows that there has been a slight increase in fuel consumption on the Volvo Olympians and Dennis Tridents after being fitted with particulate traps in February 2003. In 2002, prior to the retrofits, fuel consumption on the Tridents averaged 1.88 Km-ltr, and in 2004 this figure had dropped to 1.82 km-ltr. Similarly the Olympians' consumption figures fell from 2.03 Km-ltr in 2002 to 1.91 Km-ltr in 2004, see Measure 5.1 for full details.

Hybrid City Fleet Vehicles

Between November 2004 and August 2005 the Hybrid Toyota Prius has covered a total of 13,110 km. The vehicle was used to complete 126 trips on council business, equating to an average trip length of 104km. Within the evaluation period the hybrid Toyota Prius was refuelled with 682.1 litres of petrol. This equates to an average fuel consumption figure of 19.2 km/ltr.

Electric City Fleet Vehicles

Between May 2004 and July 2005 the two electric G-Wiz cars based at Wilder House covered a total of 3,593km. The two vehicles completed 350 trips on council business, equating to an average trip length of 11.3km. This reflects the use of these vehicles, providing travel between council sites and within a tightly defined area within the city, a duty these vehicles are well suited to perform. The G-Wiz cars have consumed 502 kw/h of electricity. This figure is based on the manufacturers claim that the vehicle can complete 64.4km per full charge and that this requires 9kw/h of electricity.

LPG City Fleet Vehicles

Comparing the LPG vehicles with their respective control groups highlighted that they are less fuel efficient than their diesel equivalent. For example, the average fuel consumption of the 17 LPG / Petrol Renault Kangoo's was 9.07 km/ltr while their diesel equivalents (9 in control group) recorded a figure of 13.05 km/ltr. This is a trend repeated for each of the vehicle groups with fuel consumption figures between 2.03 – 4.59 km/ltr less for the LPG / petrol vehicles as compared to their diesel equivalents.

The results showed that a significant factor influencing fuel consumption appeared to be the ratio of petrol to LPG used by each vehicle. Generally, taking into account that a number of other factors affect fuel consumption, it appears that as the proportion of LPG increases, fuel consumption increases. It is noticeable that while some drivers

regularly refuel using LPG and use significantly higher proportions of LPG over petrol, others have used very low amounts of LPG.

Greenfuel LPG Conversions

The fuel consumption figures calculated for a sample of the Greenfuel engine conversions gave an average fuel consumption of 7.91 Km/Ltr.

School Wig-Wag warning signs

In total, 50 solar powered school wig wag warning signs were implemented across 21 locations in Bristol. This resulted in Power Savings of 42,573.6MJ (11,826 KWh) over the 3 year period following implementation.

Table 3.3.4-2 Clear Zone Integrated Package Impacts and indicators

Area	Category	Sub-category	Indicator	LO	M	Comments
Energy	Energy consumption	Fuel Consumption -	Fuel efficiency – per VKM		3	Not collected
			Fuel Mix		4	Not collected

It was intended to collect energy consumption data for the city centre orbital hybrid bus. Since the new service launched on the 20th June 2005 the hybrid bus has only completed 3 weeks in service out of the 11 weeks monitoring data was collected. As a result no data has been collected for analysis.

Table 3.3.4-3 Improving safety and access in the inner city integrated package: Impacts and Indicators

Area	Category	Sub-category	Indicator	LO	M	Comment
Energy	N/A	N/A	N/A		-	

The indicators used for improvements to safety and access for the inner city did not include energy indicators.

Table 3.3.4-4 Developing Social Inclusion in South Bristol

Area	Category	Sub-category	Indicator	LO	M	Survey ID
Energy	N/A	N/A	N/A			

The indicators used for developing social inclusion did not include energy indicators.

Table 3.3.4-5 Providing better public transport integrated package: impacts and indicators

Area	Category	Sub-category	Indicator	LO	M	Comments
Energy	Energy consumption	Fuel Consumption -	Fuel efficiency – per VKM	LO26	3	Not Collected
			Fuel Mix	-	4	Not Collected

Energy data was not collected for the clean fuel Park & Ride services as this analysis was concentrated on the clean and efficient buses measure (5.1).

Table 3.3.4-6 Impacts and indicators for new mobility services

Area	Category	Sub-category	Indicator	LO	M	Comments
Energy	Energy consumption	Fuel Consumption -	Fuel efficiency – per VKM	LO29	3	8.3
			Fuel Mix	-	4	8.3

LPG Bristol Dial-A-Ride vehicle

Fuel consumption over the period January 2003 - December 2004 varied between 3.9 and 5.8 km/ltr, recording an average of 4.7 km/ltr. In comparison, a control diesel bus operated in area K9 between February – April 2005 recorded a fuel consumption figure of 7.58 km/ltr. This figure provided by the diesel vehicle suggests that the LPG/petrol vehicle is significantly less fuel efficient in terms of volumetric fuel consumption.

The results also showed that there is an apparent correlation between fuel consumption and the fuel mix i.e. as the amount of LPG used increases the fuel consumption decreases, see measure 5.1 for full details.

3.3.5 Environment

Air quality measurements have not been undertaken as part of the VIVALDI project as it is thought that the size of the demonstrations would not have a significant effect on city level air quality results.

The JET model has been used to calculate the emissions saving associated with the clean-fuelled vehicle demonstrations in VIVALDI. JET is a spreadsheet model developed within the JUPITER project as a tool to estimate the changes in energy and emissions from transport measures. The functions in JET take into account:

- Type of fuel
- Average traffic speed
- Distance travelled by each type of vehicle
- Fitting of catalytic converters

The air pollutants for which total emissions are estimated are:

- Carbon Monoxide (CO)
- Nitrogen Oxides (NOx)
- Volatile Organic Compounds (VOC)
- Total Particulate Matter (TPM)
- Carbon Dioxide (CO₂)

The model was run using the data collected on vehicle mileage and fuel issued for each of the groups of vehicles. The table below presents a summary of the emissions calculations produced using JET.

Noise perception has also been measured as part of a number of surveys within the project.

The following provides the Environmental indicators that have been collected for each integrated package.

Table 3.3.5-1 Clean-Fuelled Vehicle Integrated Package: Impacts and Indicators

Area	Category	Sub-category	Indicator	LO	M	Comments
Environment	Pollution /noise	Air Quality	CO levels	LO2	5	JET Model
			NOx Levels	LO2	6	
			PM levels	LO2	7	
		Emissions	CO2	LO2	8	
			CO	LO2	9	
			NOx	LO2	10	
			PM	LO2	11	
	Noise	Perception	-	-	12	CZ Survey

Emissions

Table 3.3.5-2 Retrofitted Bus Total Emissions Calculations (tonnes per year) – Point of use

Pollutant	Before	After	Difference	% Change
CO	6.44	0.64	-5.81	-90
NOx	25.7	25.7	0	0
VOC	1.74	0.17	-1.56	-90
TPM	1.03	0.05	-0.98	-95
CO2	2466.58	2515.92	49.33	2

Table 3.3.5-3 Hybrid City Fleet vehicle total emissions – tonnes per year

Pollutant	Before	After	Difference	% Change
CO	0.0672	0.0299	-0.0373	-55.46
NOx	0.0015	0.0007	-0.0008	-55.46
VOC	0.0011	0.0005	-0.0006	-55.46
TPM	0.000	0.000	0.000	0.00
CO2	4.41	1.96	-2.44	-55.46

Electric

Calculations have been made by comparing the G-Wiz electric car to a small diesel engine car. They have been carried out for emissions at point of use (zero for an electric car) and also for the full life-cycle, in order to estimate impacts from electricity production.

Table 3.3.5-4 Electric City Fleet vehicle total emissions (at point of use) – tonnes per year

Pollutant	Before (diesel)	After (electric)	Difference	% Change
CO	0.0024	0.0000	-0.0024	-100.00
NOx	0.0020	0.0000	-0.0020	-100.00
VOC	0.00037	0.00000	-0.00037	-100.00
TPM	0.00025	0.00000	-0.00025	-100.00
CO2	0.59	0.00	-0.59	-100.00

Table 3.3.5-5 Electric City Fleet vehicle total emissions (full life cycle) – tonnes per year

Pollutant	Before (diesel)	After (electric)	Difference	% Change
CO	0.0024	0.0001	-0.0023	-94.88
NOx	0.0024	0.0006	-0.0017	-72.41
VOC	0.00132	0.00047	-0.00085	-64.52
TPM	0.00026	0.00004	-0.00021	-83.75
CO2	0.66	0.26	-0.40	-60.76

The estimates show that the G-Wiz car not only delivers zero emission at point of use, which is relevant for local air quality objectives, but also makes significant percentage reductions in all key pollutants, including climate change gases, when examined with the full life cycle analysis.

The results of making the alternative assumption – that the business as usual is a petrol engined car – results in slightly different results. The lifecycle emissions show significant reductions in CO, VOC and importantly CO₂. However, because petrol burns relatively cleanly and is compared to power station emissions in the full life-cycle analysis (a proportion of which will be coal fired), there are minimal reductions in NO_x and a large percentage increase from what is probably a very small amount of PM.

Naturally, at point of use the after results for the G-Wiz car emissions are zero, which means they are cleaner than a petrol equivalent.

Table 3.3.5-6 Electric City Fleet vehicle total emissions (at point of use) – tonnes per year

Pollutant	Before (petrol)	After (electric)	Difference	% Change
CO	0.0106	0.0000	-0.0106	-100.00
NOx	0.0003	0.0000	-0.0003	-100.00
VOC	0.00022	0.00000	-0.00022	-100.00
TPM	0.00000	0.00000	0.00000	0.00
CO2	0.61	0.00	-0.61	-100.00

Table 3.3.5-7 Electric vehicle total emissions (full life cycle) – tonnes per year

Pollutant	Before (petrol)	After (electric)	Difference	% Change
CO	0.0107	0.0001	-0.0106	-98.83
NOx	0.0007	0.0006	0.0000	-1.09
VOC	0.00226	0.00047	-0.00179	-79.23
TPM	0.00002	0.00004	0.00002	93.91
CO2	0.69	0.26	-0.43	-62.61

Table 3.3.5-8 City Fleet LPG vehicle total emissions – tonnes per year

Pollutant	Before (diesel)	After (lpg/petrol)	Difference	% Change
CO	0.33	1.20	0.87	264.21
NOx	0.28	0.05	-0.23	-81.21
VOC	0.052	0.027	-0.024	-47.16
TPM	0.034	0.000	-0.034	-100.00
CO2	81.64	86.41	4.77	5.84

Table 3.3.5-9 Greenfuel LPG vehicles total emissions – tonnes per year

Pollutant	Before	After	Difference	% Change
CO	3.54	1.98	-1.55	-43.94
NOx	0.09	0.16	0.07	78.94
VOC	0.062	0.079	0.017	27.86
TPM	0.000	0.000	0.000	0.00
CO2	214.76	165.32	-49.45	-23.02

Table 3.3.5-10 Clear Zone Integrated Package Impacts and indicators

Area	Category	Sub-category	Indicator	LO	M	Comments
Economy	Employment	Numbers employed	Number of jobs in area	LO8	-	Not Collected
		Attitudes to employment opportunities	Attitude to employment	LO8	-	Not Collected
	Property	Commercial rental values	Rental values Euro/sqm	LO7	-	Not Collected
		Employers attitudes to area	Business attitudes to area	LO7	-	CZ Business Survey
	Business vitality	Retail success	Retail vacancy rates	LO7	-	Not Collected
			Turnover indicator	LO7	-	Not Collected
			Prime yields	LO7	-	Not Collected
			Retailer attitudes	LO7	-	CZ Business Survey
Energy	Energy consumption	Fuel Consumption -	Fuel efficiency – per VKM		3	Freight Centre
			Fuel Mix		4	Not collected
Environment	Pollution/noise	Air Quality	CO levels	LO6	5	Modelled
			NOx Levels	LO6	6	
			PM levels	LO6	7	
		Emissions	CO2	LO6	8	
			CO	LO6	9	
			NOx	LO6	10	
			PM	LO6	11	
		Noise	Perception		12	CZ Surveys
Society	Acceptance	Awareness	Awareness level		13	CZ Surveys
	Access	Acceptance	Acceptance of CZ measure		14	
		Spatial access	Perception of access to CZ by PT		15	
Transport	Transport system	Traffic levels	VKM per mode	LO4	21	Not Collected
		Mode split by trip	Average mode split PAX	LO4	26	Not Collected
			Average mode split VKM	LO4	27	Not Collected
	Safety	Freight movements	VKM	LO4	21	Freight Centre
		Car park space	Number of spaces	LO5	-	Not Collected
		Transport safety	Accident numbers		20	Not Collected
Process		Interview with key stakeholders				Completed

Emissions

City Centre Hybrid Orbital Bus

The City Centre hybrid bus has not been in service sufficient time to robustly evaluate the emissions savings of the vehicle. The vehicle has been operational for 3 weeks which is insufficient to produce robust evaluation results.

Using claims made by the bus manufacturer Eneco it is possible to provide some indicative savings generated by the usage of the Hybrid bus on the 500 service. Eneco have tested bus emissions against a “standard” route (Known as “Route 159”) defined by the Energy Savings Trust and is regarded as typical of urban routes. When tested on against a bus with a conventional diesel engine, the Hybrid powered bus achieved:

- A 33% reduction in fuel consumption;
- A 100% reduction in HC emissions;
- A 100% reduction in CO emissions;
- A 38% reduction in NOx emissions; and
- A 85% reduction in PM emissions.

Noise

The Clear Zone Public Survey showed that 50.4% of the survey sample were dissatisfied with the traffic noise levels in the city.

Table 3.3.5-11 Improving safety and access in the inner city: Impacts and Indicators

Area	Category	Sub-category	Indicator	LO	M	Comment
Environment	Noise	Noise perception	Noise perception	-	12	Collected – residents surveys
	Environmental Quality	Perception of Quality	Perception of Quality	LO15	-	
	Land Use	Change in public space	Use of streets (i.e. % of kerbside used for parking in the Home Zone)	LO10	-	
			Ratio of parking space permitted in new developments	LO10	-	

Noise

The residents of the Home Zone were asked to give their post implementation views on noise levels in the area and 26 out of 28 respondents stated that it was no longer a concern.

Change in public space

Although some residents have concerns about the Home Zone, the overall acceptance level by residents in the completed streets remains high. 90% of residents who were surveyed maintain that the Home Zone is still a good idea for the Dings. In addition, 48% of surveyed residents believe that people driving through the Home Zone are more considerate as a result of the completed streets. This feedback is an initial reaction to the completed streets as the whole scheme is not yet complete.

Table 3.3.5-12 Developing Social Inclusion in South Bristol

Area	Category	Sub-category	Indicator	LO	M	Survey ID
Energy	N/A	N/A	N/A			

Environmental indicators were not collected for this work package.

Table 3.3.5-13 Providing better public transport impacts and indicators

Area	Category	Sub-category	Indicator	LO	M	Comments
Environment	Pollution/noise	Air Quality	CO levels	LO26	5	Not Collected
			NOx Levels	LO26	6	
			PM levels	LO26	7	
		Emissions	CO2	LO26	8	
			CO	LO26	9	
			NOx	LO26	10	
			PM	LO26	11	

Environmental data was not collected for the clean fuel park and ride services as this analysis was concentrated on the clean and efficient buses measure (5.1).

Table 3.3.5-14 Impacts and indicators for new mobility services

Area	Category	Sub-category	Indicator	LO	M	Comments
Environment	Pollution/noise	Emissions	CO2	LO29	8	8.3
			CO	LO29	9	8.3
			NOx	LO29	10	8.3
			PM	LO29	11	8.3

The results for new mobility services are summarised in the table highlighting emissions for the Bristol Dial-a-Ride LPG vehicle.

Table 3.3.5-15 Bristol Dial-a-Ride LPG Vehicle Total Emissions Calculations (tonnes per year) – Point of use

Pollutant	Before	After	Difference	% Change	
CO		0.03	0.09	0.06	203.61
NO _x		0.03	0.01	-0.02	-74.92
VOC		0.01	0.00	0.00	-29.42
TPM		0.00	0.00	0.00	0
CO ₂		7.54	7.98	0.44	5.86

3.3.6 Society

The following section analyses levels of awareness and acceptance of the VIVALDI measures within each integrated package. The results have been obtained from the numerous surveys that have been conducted in Bristol throughout the project.

Table 3.3.6-1 Clean-Fuelled Vehicle Impacts and Indicators

Area	Category	Sub-category	Indicator	LO	M	Comments
Society	Acceptance	User awareness	Awareness level	-	13	CZ Survey
		User acceptance	Acceptance of measure	-	14	

The large public survey conducted as part of the evaluation of the Clear Zone sought public awareness and acceptance of the use of clean-fuelled buses in Bristol.

The survey showed that 16.3% of the sample was aware of the clean fuelled buses being used in Bristol. When compared with the before study this represents an increase of 5%. A total of 8.8% stated that they also use this service and 79.4% of these people stated that they were satisfied with the vehicles.

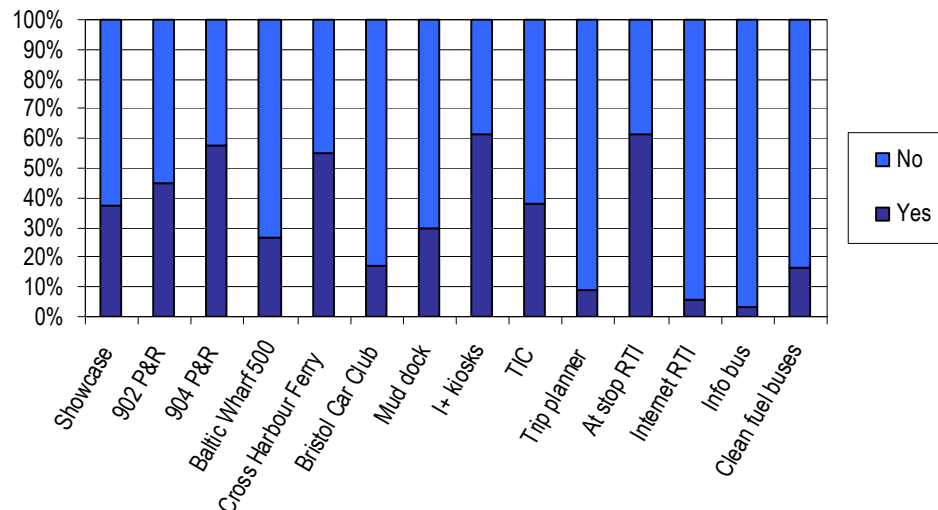
Table 3.3.6-2 Clear Zones Impacts and indicators

Area	Category	Sub-category	Indicator	LO	M	Comments
Society	Acceptance	Awareness	Awareness level		13	CZ Surveys
		Acceptance	Acceptance of CZ measure		14	
	Access	Spatial access	Perception of access to CZ by PT		15	

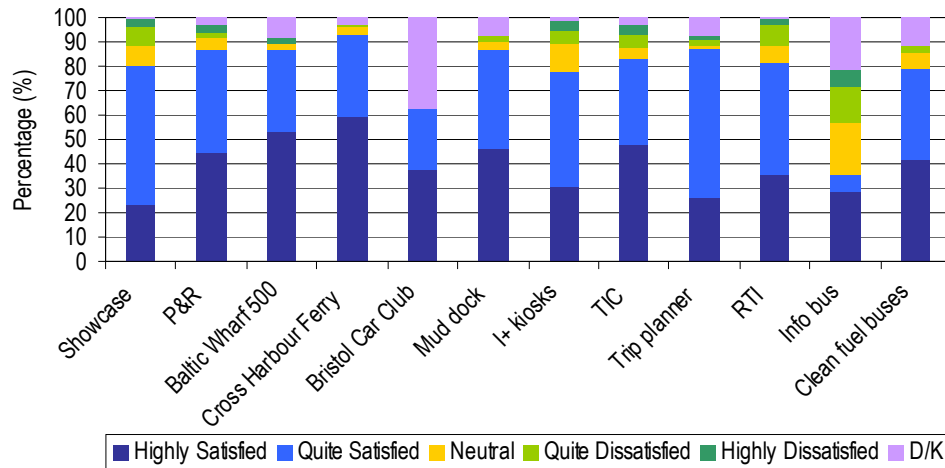
The public and business Clear Zone Surveys sought the opinions of the many measures that have been introduced as part of the VIVALDI project. The following graphs show the awareness levels of each of the majority of the Bristol VIVALDI measures.

The degree to which the public are aware of the VIVALDI measures ranged between 61% having heard about or seen the at stop Real Time displays and i+ kiosks, to only 3% having knowledge of the Info Bus and 8% of the trip planner.

Figure 3.3.6-1 Public Awareness of VIVALDI Measures



The respondents that had used the services were also asked whether they were satisfied with the services they had used and the following results were obtained.

Figure 3.3.6-2 Public Satisfaction with VIVALDI Measures


The results show that in general there is a high level of user satisfaction for the measures implemented.

Table 3.3.6-3 Improving safety and access in the inner city: Impacts and Indicators

Area	Category	Sub-category	Indicator	LO	M	Comment
Society	Acceptance	Awareness	Awareness level	LO15	13	Collected
		Acceptance	Acceptance level	LO15	14	Collected
	Accessibility	Spatial accessibility	Perception of accessibility to residences/businesses within HZ	LO15	15	Collected
			Perception of access to PT services	LO15	15	
			Walking / cycling / car clubs relative cost	LO9	16	

The following summarises the awareness and acceptance levels that were achieved for the measures contained in the improving safety and access in the inner city integrated package.

Home Zones

- Consultation with residents prior to remodelling of streets showed 82% of local residents supported the Home Zone concept.
- 93% of residents supported the Home Zone newsletter designed to keep residents informed during the consultation and implementation process.
- 33% of local businesses believed the Home Zone would have a positive impact on their business once completed.
- 92% of residents in Dings Walk were satisfied with the new street design and commented that there had not been any surprises in how the street looked.
- 76% of residents in completed streets rated their street as more attractive and 41% as more safe post implementation.
- 80% of local businesses stated that the completed Home Zone streets were good for the Dings area as a whole and 33% believed that the Home Zone would have a positive impact on their business.

Community Travel Workers

- Community Travel Workers (CTW) were integral to raising awareness in the Home Zone. CTW successfully engaged 74% of the 115 households in the Dings area and contributed to overall acceptance of completed streets of 92%.
- The following qualitative results from the Dings suggests that local residents were pleased with the involvement of Community Travel Workers:
 - “Leaflets and meetings were regular”
 - “We’re really grateful”
 - “I liked people calling round as I couldn’t attend meetings because of work”

Walking and Cycling Measures

- 30% of Dings residents were aware of the Bristol-Bath Cycle Path and 70% were not, although 94% indicated that they would use the path now that they know about it.

Table 3.3.6-4 Developing Social Inclusion in South Bristol

Area	Category	Sub-category	Indicator	LO	M	Comments
Society	Acceptance	Awareness	Awareness level of PT information	LO16	-	CZ Survey
	Accessibility	Spatial accessibility	Perception of PT accessibility	-	15	CZ Survey
			Perception of access to goods and services	LO19	-	
	Security Education	Security Perception of training and education opportunities	Perception of PT security Perception	- LO20	17 -	Not Collected

The following provides awareness and acceptance levels that were achieved for the measures contained in the developing social inclusion in South Bristol integrated package.

Home Shopping Trials

As these trials were site specific public awareness was not sought for this measure. However, user acceptance was high for both the community delivery points and the home shopping trials.

- 84% thought that the convenience of the community delivery points had made collection of their items easier and 76% thought collection is more convenient than before.
- Responses to a user questionnaire of the Home Shopping trial showed that all participants were satisfied with the scheme and were managing to use the equipment successfully.

Travelsmart Campaign

- As a result of the Individualised Travel Marketing Campaign and system improvements (Showcase Bus corridor) there has been a 23% increase in public transport use In Bishopsworth and an 11% increase in Hartcliffe.
- 15% increase in public transport patronage in Bishopston.
- 18% increase in public transport patronage in Southville, Bedminster and Windmill Hill as a result of TravelSmart.

The above results show that there has been public awareness and acceptance of these services has improved.

i+ Information Kiosks

The Clear Zone public survey showed that 61.2% of the respondents were aware of the i+ information kiosks and that 31.4% had used them. The survey also showed that 77.4% of the people who had used the kiosks were satisfied with their performance.

Widening Access

Public awareness of the Widening Access scheme was not measured due to the size of the scheme. However, when members were asked how they heard about the scheme the majority of respondents replied that it was through 'word of mouth' within the Knowle West Community. The members were also asked to register their satisfaction of the scheme and 83% of the participants stated that they were satisfied or highly satisfied.

Table 3.3.6-5 Providing better public transport impacts and indicators

Area	Category	Sub-category	Indicator	LO	M	Comments
Society	Acceptance	User awareness	Awareness level	-	13	CZ Survey
		User acceptance	Acceptance of measure	-	14	CZ Survey
	Accessibility	Spatial Accessibility	Perception of access to PT	-	15	CZ Survey
		Economic Accessibility	Cost to PT relative to income	-	16	Not Collected

The following provides awareness and acceptance levels that were achieved for the measures contained in the providing better public transport integrated package.

Showcase Bus Route

The Clear Zone survey showed that 37.2% of respondents were aware of the Showcase bus route and 37% actually used the service. The service users showed a high level of acceptance as 80% stated that they were either highly satisfied or satisfied with the service.

902 and 904 Park & Ride (P&R) bus services

The Clear zone Public survey illustrated a high level of awareness of 44.8% and 57.4% of the Portway (902) and Bath Road (904) P&R bus services. The survey also indicated that 7.9% and 11.36% used the services respectively. P&R service users were also asked to provide their level of satisfaction for the services and the combined response equalled 87.3%.

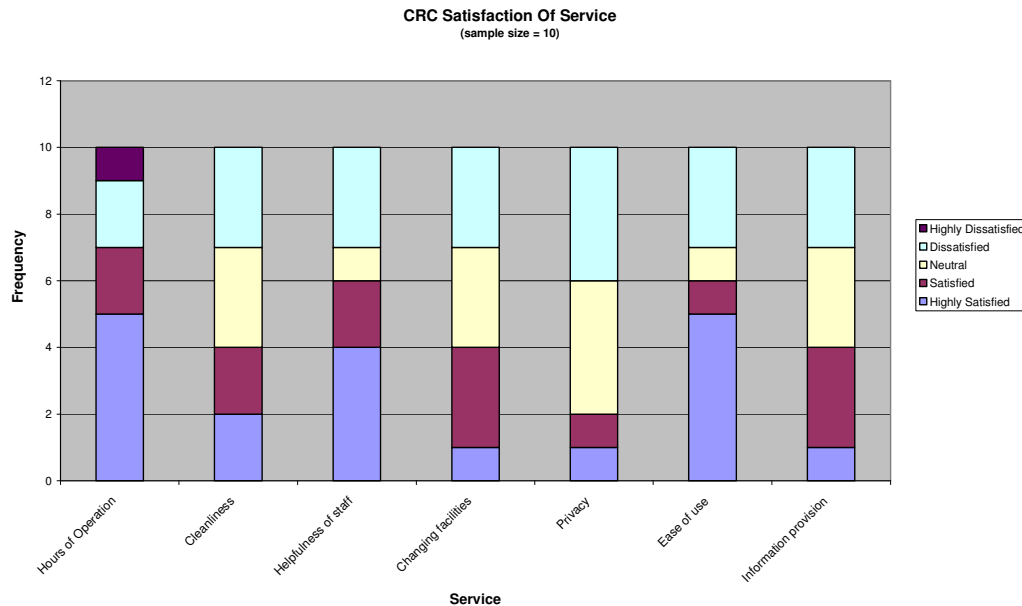
High levels of user satisfaction for the information facilities provided for both services was also high and the fact that the routes were being operated by clean fuel vehicles showed to be important to the users and a strong influence in their decision to use the service.

Cycle resource centre

Awareness of the Mud Dock facilities where the cycle resource centre is based were sought as part of the Clear Zone Public Survey. The survey showed that 30% were aware of the Mud Dock facility and 11.2% had used it. The satisfaction level of the stated users of the service was 86.5%.

A user survey was also conducted at the Cycle resource centre and the 10 responses received showed the following.

Figure 3.3.6-3 Cycle Resource Centre Survey Responses



Taxi Sharing Scheme

Service quality was assessed through a member survey, although due to the small numbers involved this only represents a sample of 9 current users. The survey revealed that users of the taxi sharing scheme are generally satisfied with most elements of the service, including booking a journey, quality of the vehicles, staff assistance, and fare levels. One of the respondents commented that “As I am a non-driver and use schools that are a 25 minute walk away the introduction of this service has been great”. However some of the comments received reveal that information and knowledge of the service is a problem. One respondent commented that “When the initial information came out I did not feel there was a clear enough explanation and information on how the scheme works”. The comments also highlight that there are problems with the taxi drivers not being aware of the service, one respondent commented “Most of the drivers said that they did not know about the taxi sharing service and how it works. Most of them have to ring someone in the office”. This highlights that there is more work required to improve member knowledge regarding the operating of the scheme and to ensure that all the drivers of the operating taxi company know the details of the scheme.

City Navigators (Information Bus)

The City Navigator information bus is only used at special events in the city to promote the use of public transport and as a result has relatively little exposure to the general public. The clear zone survey showed that only 3% had heard of the bus, all of which had used it at an event.

A user satisfaction was also conducted on board the bus at an event in Bristol to gauge user satisfaction. Overall, respondents were generally satisfied with their experience of using the Info Bus. The following points were highlighted by the survey:

80% found that the information provided was useful in planning a new journey.
 50% agreed that the information provided informed them of a service that they were previously unaware of, commonly with regard to bus, minibus or coach information.
 60% agreed that the information provided had influenced the type of transport they were going to use, again commonly with regard to bus, minibus or coach information.

The survey revealed that over 90% of respondents noted that they were either highly or quite satisfied with the look of the bus and access to it, and with the quality and range of the information provided. Respondents receiving staff assistance were also satisfied with the service provided as were those who had used the paper based information available.

Trip Planner Websites

The Clear Zone survey showed that 8.8% of the sample was aware of the web based trip planner. The survey also showed that there was a high level of satisfaction (86.8%) of the 8% who stated they had also used the service.

Table 3.3.6-6 Impacts and indicators for new mobility services

Area	Category	Sub-category	Indicator	LO	M	Comments
Society	Acceptance	User awareness	Awareness level	-	13	8.3
		User acceptance	Acceptance of measure	-	14	8.3
	Accessibility	Spatial Accessibility	Perception of access to service	-	15	8.3
		Economic Accessibility	Cost to service relative to income	-	16	8.3

The following summarises the awareness and acceptance levels that were achieved for the Car Club and Bristol Dial-a-Ride enhancements that were made under the VIVALDI project.

Bristol City Car Club

- The Clear Zone Public Survey showed that 16.9% were aware of the City Car Club and that 1.2% had used it.
- Analysis of car club membership data showed that 42% of non-members had heard about the Car Club either through a friend or via City Car Club leaflets.
- User satisfaction surveys conducted in 2004 suggested that members felt that rates were not excessive and that the convenience, reliability and accessibility of vehicles was worth the cost of membership. Of 82 members surveyed in June 2005, 93% stated that they would remain members. 75% have been members for 24 months or less.

Bristol Dial-a-Ride Service (BDAR)

Users of BDAR in area K9 are extremely satisfied with the service provided and are keen to stress the importance of having a safe mode of transport that provides them with some freedom and independence. Members find it a valuable lifeline that allows them to travel safely, in comfort and to make door-to-door journeys that would be difficult,

and in some cases not possible, without the service. Some constructive suggestions on how to improve the service included:

- Extension of booking period to 1 hour;
- Moving the booking time forward;
- Advance bookings for standard journeys;
- Producing a BDAR Newsletter; and
- Extending the hours of service to cover evenings and weekends.

BDAR also conducted a passenger survey. The last survey was conducted in October 2004 and received responses from 410 members of the BDAR operation in Bristol. The survey again reveals high levels of user satisfaction with:

- 80% of passengers rated the service as ‘Excellent’ and a further 16% rating the service as ‘Good’;
- 87% of passengers rated staff as ‘Excellent’ in terms of their friendliness, helpfulness, knowledge and efficiency; and
- 100% of passengers reported that they felt safe when using the service.

3.3.7 Transport

Table 3.3.7-1 Clean-Fuelled Vehicle Impacts and Indicators

Area	Category	Sub-category	Indicator	LO	M	Comments
Transport	Quality of service	Service reliability	Ability to operate service	-	18	Collected CZ survey.
		Quality of service	Perception of quality	-	19	
	Transport system	Occupancy (Patronage)	Persons per vehicle	LO3	28	Not Collected

The transport indicators on vehicle flows etc (20-27) were not expected to be affected by the introduction of clean and efficient vehicles. Occupancy data was not collected as any patronage data is not linked to service information.

Service reliability data was collected for the LPG minibus used for the demand responsive service operated by Bristol Dial-a-Ride, see below.

Table 3.3.7-2 Clear Zones Impacts and indicators

Area	Category	Sub-category	Indicator	LO	M	Comments
Transport	Transport system	Traffic levels	VKM per mode	LO4	21	Not Collected
		Mode split by trip	Average mode split PAX	LO4	26	Not Collected
			Average mode split VKM	LO4	27	Not Collected
			VKM	LO4	21	Freight Centre
		Car park space	Number of spaces	LO5	-	Not Collected
	Safety	Transport safety	Accident numbers		20	Not Collected

Traffic levels were not analysed as it was thought the scale of the actual implementations would not have a significant impact on the traffic characteristics of the area. Mode split by trip data was not collected because no access control schemes were implemented and any effects of the other measures would have been swamped by the development of Broadmead. No measures implemented affected car park space or safety and hence this data was not collected.

Changes in freight movements were recorded as part of the evaluation of the freight consolidation scheme. The results have shown that there has been a reduction in delivery vehicle movements to participating retailers every month since the introduction of the scheme. The percentage reduction in vehicle movements has been high and from the third month of operation the percentage reduction in vehicle trips has remained at over 50%. The following graph illustrates the percentage reduction in trips that have been recorded over the evaluation period.

Figure 3.3.7-1 Changes in Trips Through Freight Consolidation

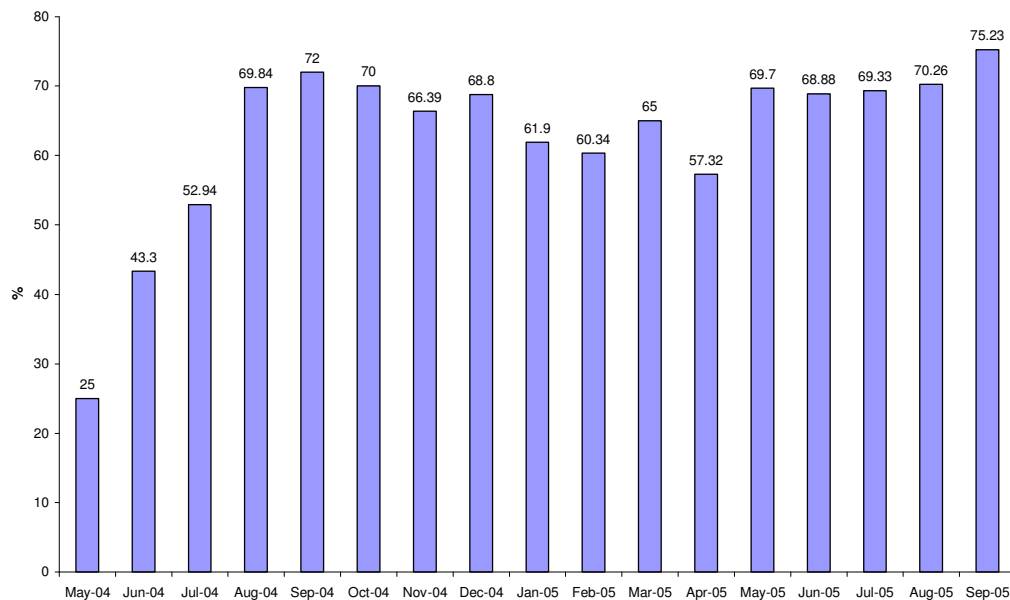


Table 3.3.7-3 Improving safety and access in the inner city: Impacts and Indicators

Area	Category	Sub-category	Indicator	LO	M	Comment
Transport	Safety	Transport safety	No. of injuries and deaths caused by accidents	LO13	20	Collected
	Transport system	Traffic levels	No. of Cars (entering Home Zone)	LO10	-	
		Modal split	Average modal split PAX	LO9	26	
			Average modal split - vehicles	LO9	27	Collected
		Parking spaces	No of parking spaces	LO10	-	
		Car share	No of car share sites/vehicles	LO13	-	

The indicator of the number of cars entering the Home Zone was collected using traffic flow and speed counts. The number of parking spaces indicator was collected as part of the residents surveys and through process interview work with community travel workers and local residents.

The number of vehicles and type (resident owned or commuter) were counted during three time periods across a two-day period prior and post infrastructure change. The time periods were chosen to highlight the commuter parking levels that were being experienced during the day (1100-1300) and compare them to time periods where the

majority of parked cars belonged to residents (0600-0730 and 1800-1930). The counts taken in July 2005 were prior to the residents parking scheme being implemented. There was a 78% reduction in the number of commuters parking in Dings road post implementation, 22% reduction in Birkin Street and 67% reduction in Dings Walk.

Traffic flow and speed data was measured on the three completed streets (Birkin Street, Union Road and Dings Walk). Average flow along Birkin Street in a 24 hour period was 3 vehicles eastbound and 4 vehicles westbound, average speeds were 22 KPH and 24 KPH respectively. Average flow along Union Road during the same period was 5 vehicles northbound and 5 vehicles southbound with speeds of 22 KPH respectively. Dings Walk had the lowest flow during the period with an average flow of 2 vehicles eastbound and 3 vehicles westbound with average speeds of 40 and 38 KPH respectively.

Table 3.3.7-4 Developing Social Inclusion in South Bristol

Area	Category	Sub-category	Indicator	LO	M	Survey ID
Transport	Quality of service	Service reliability	Accuracy of PT time keeping	-	18	8.6
		Quality of service Better information	Quality of PT service	-	19	Not Collected
			% using new information services	LO16	-	12.2
	Transport system	Modal split	Average modal split PAX	LO19	21	10.3
			Average model split - vehicles	LO19 LO19	26 27	CZ Survey estimates
		Vehicle occupancy Car Ownership	Average occupancy Car ownership levels	- LO17	28 -	8.6 Census/ Survey data

The focus of the package of measures was to enhance accessibility and reduce the need for travel, therefore the indicators related to transport were thought to be important. The indicators used for developing social inclusion did not include the transport indicators on safety, congestion and freight movements (20, 23-25) as these were not expected to be affected by the introduction of the package of measures.

Table 3.3.7-5 Providing better public transport impacts and indicators

Area	Category	Sub-category	Indicator	LO	M	Comments
Transport	Quality of service	Service reliability	% of services on time	-	18	8.6
		Quality of service	Perception of quality	-	19	8.6
		Efficient payment	% using electronic payment	LO25	-	Not Collected
		Better information	% using trip planner	LO24	-	12.2
		Traffic levels	No vehicles by type peak	LO21	21	Not Collected
	Transport system	Congestion	No vehicles by type off peak	LO21	22	Not Collected
			Average vehicle speed peak	LO23	23	Not Collected
			Average vehicle speed off peak	LO23	24	Not Collected
			Journey times peak	LO23	-	8.6
		Mode split	Journey times off-peak	LO23	-	8.6
			Mode split PAX	LO21	26	Not Collected
			Mode split vehicles	LO21	27	Not Collected
		Patronage	Patronage	LO22	-	8.6, 8.7

The proposed indicators for better public transport services did not include the noise and safety perception indicators (12 & 17) or the transport indicators on safety, freight movements and vehicle occupancy (20, 25, 28) as these are not expected to be affected by the measures to improve public transport.

Traffic data was not collected as it was identified that no suitable classified count sites and modal split data that could be used for the showcase bus services.

Table 3.3.7-6 Impacts and indicators for new mobility services

Area	Category	Sub-category	Indicator	LO	M	Comments
Transport	Quality of service	Service reliability	% of services on time	-	18	8.3
		Quality of service	Perception of quality	-	19	8.3
	Transport system	Use of DRTS	Patronage per vehicle	LO28	-	8.3
			Total number of users	LO28	-	8.3
			Total number of trips	LO28	-	8.3
			Number of sites	LO27	-	9.1
		Size of car share scheme	Number of vehicles	LO27	-	9.1
			Number of members	LO27	-	9.1

Service reliability data was collected for the Bristol Dial-a-Ride (BDAR) demand responsive service. As the service is demand responsive it is not subject to timetables. BDAR are unable to collect such data but do keep a log of refusals by reason which does allow some quantification of the number of times K9 members were refused a journey. It is possible to identify from the reason types whether these are features of service reliability or bookings that were unable to be met.

The table below shows that there are extremely few occasions where journeys are refused because of service reliability reasons. More frequently passengers are refused journeys because they specifically wish to travel at an exact time and this requirement can not be met because the bus in K9 is already booked for another journey, or because the BDAR member has already made one trip in that week and priority is always given to those who have not already used the service that week, or because the schedule is already full (BDAR operate on a first come first served basis). This pattern is a reflection of growing area membership and patronage levels.

Table 3.3.7-7 BDAR Bookings

		Q1 Jan - Mar 03	Q2 Apr - Jun 03	Q3 Jul - Sep 03	Q4 Oct - Dec 03	Q5 Jan - Mar 04	Q6 Apr - Jun 04	Q7 Jul - Sep 04	Q8 Oct - Dec 04	Q9 Jan - Mar 05
Number of bookings unmet	Exact time required	0	25	27	15	21	81	78	72	18
	No outward available	0	0	0	0	2	0	3	0	0
	No return available	0	0	1	0	0	1	7	3	6
	Second trip	0	2	1	7	13	20	12	10	3
	Vehicle full	0	0	0	0	0	0	4	0	0
	Schedule full	0	19	22	30	13	39	105	92	65
Service Reliability	Vehicle out of service	0	0	0	0	1	0	0	12	0
	Service out of operation	0	0	0	0	0	1	0	0	0
	Reduced service	0	0	4	1	2	17	6	0	22
	No Service	0	0	0	0	0	0	0	0	0

There have been a number of reliability problems with the petrol / LPG minibus operating in area K9. This has included a problem with the fuel system which resulted in a serious petrol vapour leak, the exhaust system twice becoming seriously detached from the vehicle and breakdown assistance had to be summoned on both occasions, and the fuel powered saloon heater continues to give problems.

The Bristol City Car Club has successfully increased membership to 200 members. The total number of vehicles and car sites stands at eighteen.

Table 3.3.7-8 Car Club Cars

District	Street/Location	Vehicle Details	On/Off Street
Redland	Kensington Road	Vauxhall Corsa	On
Cotham	Cotham Road	Vauxhall Corsa	On
Kingsdown	Clevedon Terrace	Vauxhall Corsa	On
Knowle	Norton Road	LPG/Petrol Astra Estate	On
Totterdown	Hill Avenue	Vauxhall Corsa	On
Southville	Milford Street	Vauxhall Corsa	Off
Southville	Southville Centre	LPG/Petrol Astra	Off
Easton	Bloy Street	Kia Kelisa	On
Whitehall	Prospect Place	Vauxhall Corsa	On
Clifton	Clifton Park	Ford Focus	On
Hotwells	Albermarle Road	Vauxhall Corsa	On
St Andrews	Effingham Road	Vauxhall Corsa	On
St Werburgh's	Mina Road	Vauxhall Corsa	On
Ashley Down	Ashley Down Road	Toyota Corolla	On
Ashley Down	Seymour Avenue	Vauxhall Corsa	On
Southmead	Southmead Hospital	Vauxhall Corsa	Off
Frenchay	Frenchay Hospital	Vauxhall Corsa	Off
St Pauls	Brunswick Court	Vauxhall Corsa	On

3.3.8 Synthesis

The above results show that the VIVALDI project has collected a large number of METEOR indicators that have been used to evaluate each measure implemented. It can also be seen that there has been considerable variation between the data collected to that

planned in the evaluation plan. There are the following three main reasons behind these changes:

1. The evaluation plan was written on the assumption that all data would be able to be collected. The study has shown that in some circumstances it has not been possible to collect data due to non-availability and issues such as commercial sensitivity;
2. The implementation objectives of many measures have changed from the original plan (as to be expected with new and innovative demonstrations). This has resulted in the data collection programme being altered to suit the revised implementation; and
3. Major re-developments in the centre of Bristol have affected the traffic behaviour, commercial retail turnover and many other indicators. The impacts of this re-development have out-weighed any local impacts as a result of the relatively small VIVALDI demonstrations.

3.4 Kaunas – City-Level Evaluation

Within the context of the CIVITAS programme and the VIVALDI project, Kaunas City was to implement a series of measures designed to develop and rationalise its urban public transport network. As the CIVITAS programme is a demonstration project, it was vital that the city learnt as much as it could from the implementation procedure as well as gaining valuable knowledge and skills exchange from the VIVALDI partners.

All four measures implemented in Kaunas were part of a city wide demonstration and were closely connected to each other in their planning, delivery and implementation.

VIVALDI in Kaunas was agreed upon by the City Council as a means of engaging fellow EU member states (Kaunas began VIVALDI as an EU accession country) and as a means of instigating some system improvements to the city's public transport structure. We aimed to use some of the demonstration tasks as a means of building them into bigger projects over the course of the VIVALDI timescale.

Kaunas demonstrations were within the following areas, linked to the CIVITAS policy themes:

- Stimulation of collective passenger transport and service quality by means of introducing innovative organisational, financing and management schemes;
- Innovative 'soft' measures for managing mobility demand by means of introducing new approaches to integrated planning, mobility marketing and awareness;
- Integration of transport management systems, including related information systems, and passenger services, such as those for inter-modal travel information, transport pricing and payment, vehicle location and guidance as well as traffic management.

The objective for Kaunas was to win new public transport customers and so ensure a more sustainable public transport system through the provision of new public transport services, by:

- Modelling and better planning of city public transport traffic flows
- Modification of the existing ticketing system by introduction of fixed-date tickets for buses and trolley-buses and
- The application of a more flexible tariff structure

Kaunas has managed to carry out its planned activities successfully as well as add in several continuation projects that will allow the city to extend and build upon current activities (such as involvement in other EU projects).

3.4.1 Do-nothing Scenario Results

The do-nothing scenario is not something that Kaunas had a technical model for. The considered do nothing scenario would have been a maintained a public transport system that had not improved or changed since the Soviet era and this was not considered as an option for the city.

3.4.2 Economic

The economic evaluation of public transport system modification will take into account capital costs, subsidy amount, operational costs and direct effect both to the public transport operator and to the customer. Socio-economic evaluation will include decrease of ticket vending and distribution costs, indirect impact of emission reduction and saved vehicle travels (km) due to stop manoeuvring. Interviews with business experts from the AB “Autrolis”, UAB “Kauno autobusai” and micro-bus companies will be carried out and profitability data will be included while evaluating the measures undertaken in the VIVALDI project. Customer perception on changes to the ticketing system and implementation of completely new services will be provided in the project evaluation on the economic background.

3.4.3 Energy and Environment

The measures implemented within the VIVALDI project should affect and improve the environment of the city. Modification of Kaunas City PT network, access restrictions to the centre of Kaunas and congestion control system should ensure sustainable mobility in the city and result in environmental improvements. Environmental surveys to be provided by “Kauno miesto aplinkos kokybės tyrimai”. Energy savings may be caused indirectly during the implementation of modified bus and trolley-bus routes, calculations and estimations made with help of software “PIKAS”, bus priority allocation, stop manoeuvring and elimination of unprofitable travel (km).

3.4.4 Society

Promotion and image change of public transport and improvement of services are the main elements that will have an influence on society. A survey of VIVALDI measures will be distributed among users of public transport and operating units. Implemented measures should change public attitude towards public transport, and the modified network of PT routes based on analysis of passenger flows should go some way towards meeting the needs of citizens and city visitors.

Access to public transport is often subjectively blocked by limited travel information or by anxiety and difficulties related to buying of tickets. All implemented measures were assessed on the ground for the awareness and the general acceptance of the improvements. Data has been collected and evaluated through the interviews and similar surveys.

3.4.5 Transport

An alternative for ensuring mobility in the city is the creation of an effective public transport system (PTS). Effective mobility would assist in solving the problems of congestion, parking, sustainability of transportation flows, as well as ecological problems in cities, especially in central areas where the concentration of commercial, administrative and entertainment centres is high.

Mathematical models of the PTS modelling include systemic analysis of the transport network, establishing of the public transport needs (questionnaires, statistical methods) and the level of their fulfilment. Overall evaluation of PT system modification in the city is based on the scientific survey, prepared by the Institute of Transportation Problems at Kaunas University of Technology.

3.4.6 City Level Results

Ticketing and Pricing Systems

For the years 2001 to 2004, ticket sales were increasing on a small scale year on year apart from a minor dip in sales for Trolleybuses in 2003. The single monthly tickets allowing travel on both autobuses and trolleybuses did not become reality until July 2005.

However, since then sales have risen dramatically from around 8,000 per month in July to 13,000 in August, 20,000 in September and now expected to reach over 25,000 for October and this has been achieved without the aid of an advertising campaign to promote the benefits of such.

Because the numbers of individual monthly tickets (allowing travel on trolleybuses or autobuses) also appear to be slightly increasing, it is believed that people buying the new single ticket are previous single journey ticket users.

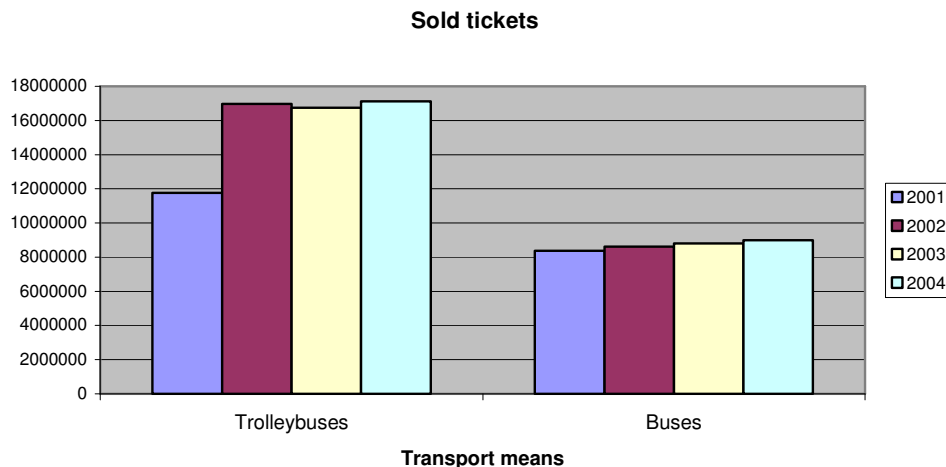


Figure 3.4.6-1 Number of public transport tickets sold in Kaunas in 2001-2004

The following chart shows a split of ticket usage based on a public survey carried out in Kaunas in September 2005. The majority of users are still predominantly single journey ticket passengers.

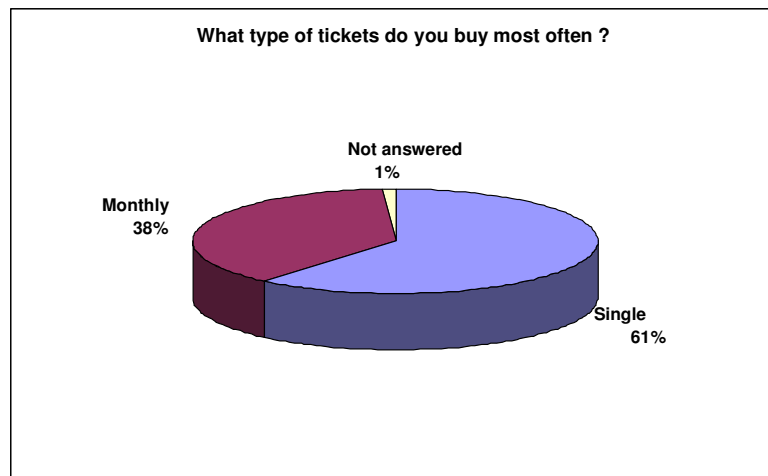


Figure 3.4.6-2 Ticket usage

As part of efforts to change the ticketing system to one aimed towards an e-ticketing system, a survey was carried out to discover the perception of changing the style of ticketing. The results showed that the most favourable responses to the convenience of electronic cards came from respondents in the 19 to 29 years age group.

This information was useful because the city aims to initiate a marketing campaign targeting students and young professionals to discover their opinions on more specific aspects of the e-ticketing system planned. The launch of e-ticketing in Kaunas will be a success if people already showing a positive opinion to the changes can be encouraged to promote the benefits to others.

When giving a negative response, respondents presented the following opinions:

- Consumers were used to paper tickets
- Innovations were daunting and it may be difficult till passengers got used to them
- Monthly tickets were the most convenient

The potential for ‘up-scaling’ of this measure is fairly substantial and the city aims to carry this out through the development and implementation of an e-ticketing system. Based on international experience and feedback through VIVALDI (and associated activities with other programmes), it is believed that the development of electronic tickets is imperative in order to allow the Kaunas transport companies to organize their activities more effectively and save money whilst reducing the expenditure related to ticket production. E-ticketing must not add to any inconvenience that passengers currently experience, e-tickets should offer a convenient and comfortable method of payment, which in turn should increase the status of public transport and attract more passengers.

New Public Transport Services

It could be stated that Kaunas residents thought that the layout of public transport routes, schedules and stops were convenient. Only a small part of respondents indicated that the layout of bus routes and bus schedules were inconvenient. This level of satisfaction can be considered as a result of VIVALDI project . The PIKAS system

provides the possibility to timetable miscellaneous schedules of public transport and to coordinate one with another along with necessary intervals.

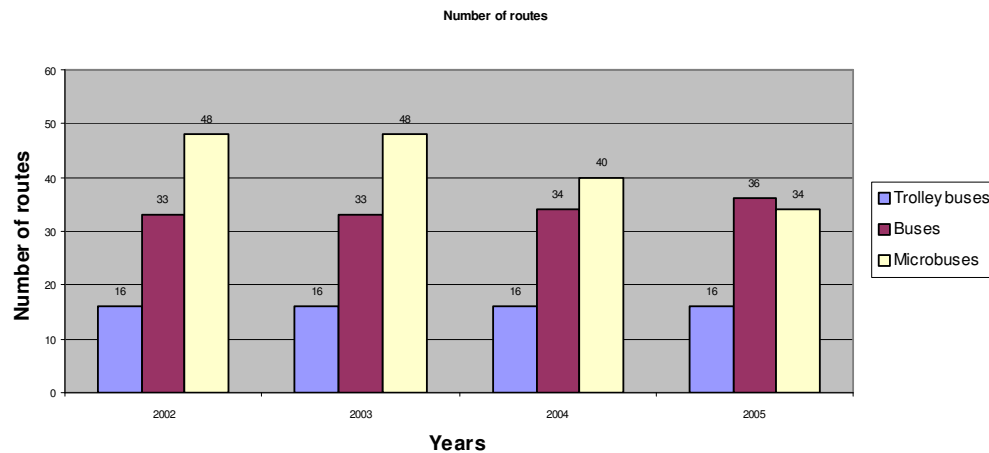


Figure 3.4.6-3 Number of public transport routes in Kaunas in 2002-2005

The change in the number of public transport routes in Kaunas in 2002-2005 is presented in Figure 3.4.6-3. An analysis of number of routes showed that until 2004 minibus routes represented the largest proportion of routes compared to trolleybus routes.

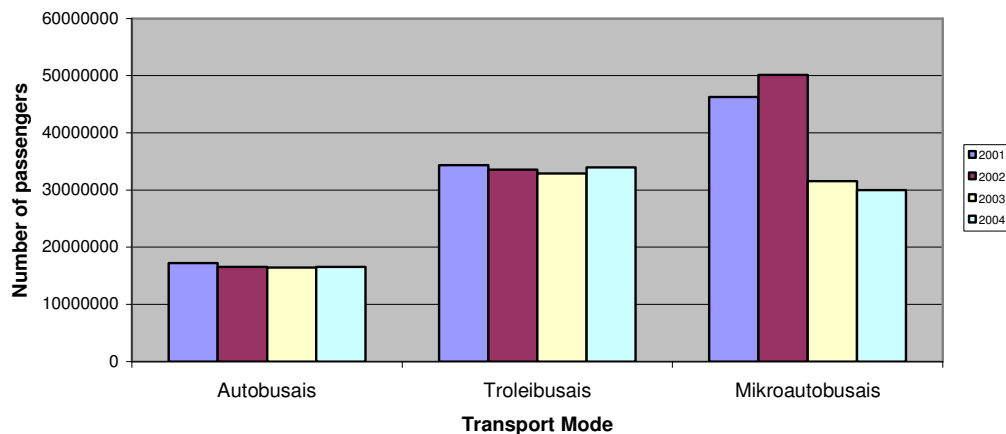


Figure 3.4.6-4 Number of passengers of all PT modes

As better management of the routes came into practice and as more minibus companies were forced to upgrade their fleet or individual vehicles, the actual number of minibus routes decreased by almost 30 percent.

From 2002 to 2005 the number of trolleybus routes had not changed (16 routes), but since 2004, the number of autobus routes increased and the number of minibus routes started to decrease. Therefore, in 2005 the number of bus routes was higher than minibus routes. During the last few years, the number of bus routes increased by 9 percent (4 new routes) and the number of minibus routes reduced by almost 30 percent (14 routes cancelled). Trolleybuses can only increase their numbers if the electric network is extended. This is planned for the Šilainiai district of Kaunas but will not be carried out until 2007 at the earliest.

Analysis of financial indicators of Kaunas public transport carriers showed that in 2002-2004 minibus taxi companies gained the biggest income and trolleybus companies the smallest.

From 2002 to 2004 income of minibus taxi companies was constantly growing and in 3 years increased by almost 19%. In 2003 there was a small decrease of income for bus and trolleybus companies. To summarise; from 2002 to 2004 the income of bus companies increased by 1,6%, and trolleybus companies increased by 5%.

All Kaunas public transport carriers worked at a loss until 2003. However, from 2003 minibus taxi companies started to improve the operating performance and from 2003 to 2004 showed an increase in profits of more than 41%. One of the reasons for this can be attributed to the negotiation of a new contract with the municipality. According to the contract minibuses were obliged to renew their fleet; with all vehicles being no more than ten years old, which meant that a lot of companies needed to buy new vehicles.

In order to do this through accessing bank loans, minibus companies needed to show their true revenues in order to get the necessary amount of loan from the bank for purchasing new vehicles. Beforehand, it was difficult to keep a record of income of such small businesses or to know what their revenues were.

From 2002 to 2004, the losses of trolleybuses increased by almost 60%. But in the opposite direction, the losses incurred by the Autobus Company reduced by 60% between 2003 and 2004. The reason for this may be attributed to the fact that in this period the method of calculating the split between the two companies was amended for the income from selling common single tickets. The losses incurred by the trolley bus company were one of the reasons for the service tariff not being increased for 5 years.

The amount of fuel (buses) and electricity (trolleybuses) used depends on the length of routes and number of units in use. From 2002 to 2004 the amount of electricity used by trolleybuses decreased by about 4%. The amount of fuel used by buses increased by almost 57%. In 2002 annual distance travelled was 5.6 million km and in 2005 it is expected to be 11 million km.

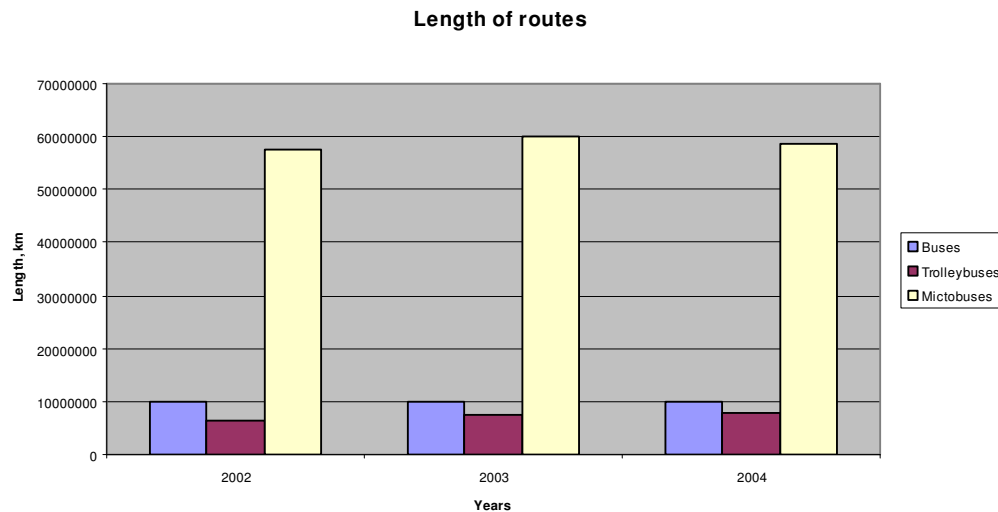


Figure 3.4.6-5. Length of public transport routes in Kaunas in 2002-2004

From 2002 to 2004 the length of Kaunas public transport routes also changed. The Kaunas public transport system is made so that trolleybuses serve the central part of the city, buses reach industrial and residential districts, and minibuses taxis reach Kaunas suburbs. Thus, minibuses routes are the longest.

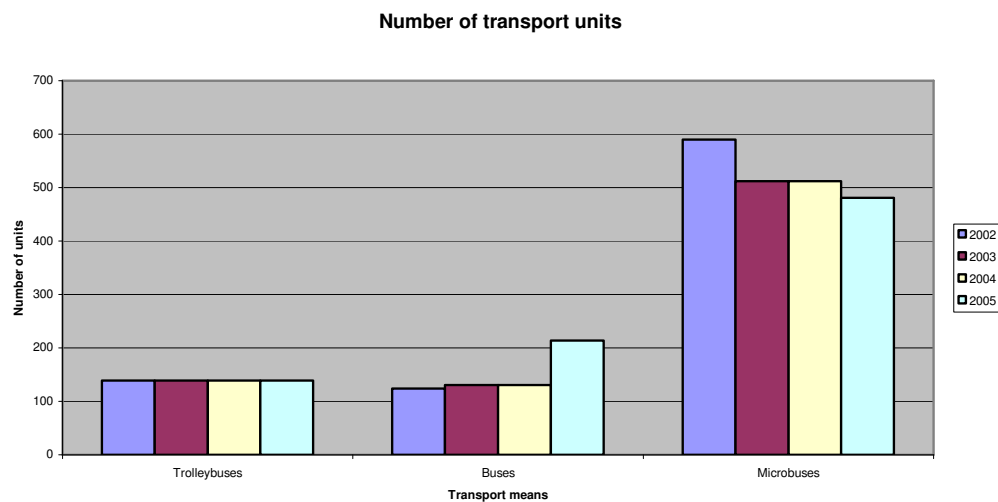


Figure 3.4.6-6. Number of transport units used in routes in 2002-2005

Analysis of the transport units used in routes showed that minibuses made the biggest number. From 2002 to 2005 number of trolleybuses changed, the number of buses increased by more than 72%, and number of minibuses reduced by more than 18%.

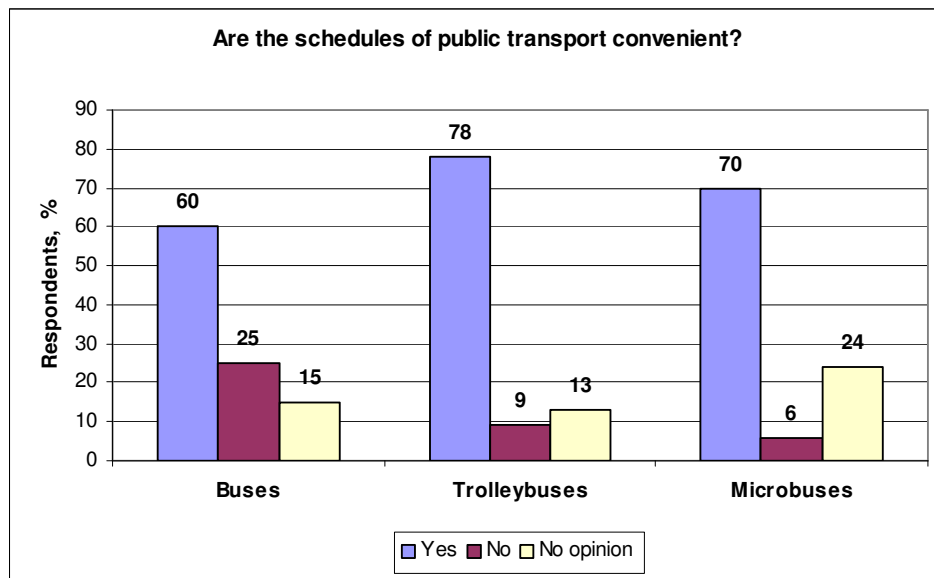


Figure 3.4.6-7. Evaluation of the convenience of public transport schedules

When asked about the convenience of PT services, respondents could write comments indicating reasons of inconvenience. The results showed that 78% respondents thought that trolleybus schedules were convenient, 70% respondents thought that minibus schedules were convenient, and 60% respondents thought that bus schedules were convenient. In summary, it is possible to state that a larger part of respondents were satisfied with schedules of public transport. Lowest levels of satisfaction were expressed with bus schedules. The reasons for such opinion could be the less developed bus line systems in some districts where other modes of transport are more accessible, as well as wanting to see more of the new buses on established, older routes.

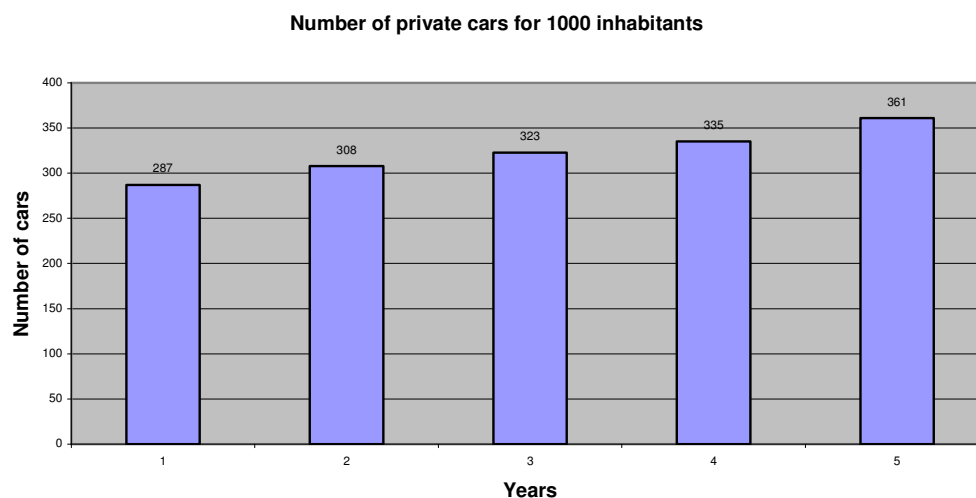


Figure 3.4.6-8. Number of privates cars per 1000 Kaunas inhabitants in 2000-2004

(x axis: 1 – year 2000, 2 – year 2001, 3 – year 2002, 4 – year 2003, 5 – year 2004)

The above figure shows that the increase in the number of private cars per 1000 inhabitants in Kaunas. Lithuania's economic growth has been substantial during the project period and the number of private cars has therefore also increased. The link between economic growth and transport growth has been identified as one of the key obstacles for sustainable urban development in Europe.

Public Transport – Service Information

During implementation of the project 367 new bus shelters were arranged in Kaunas for passengers of public transport and approximately 1300 cylinder timetable holders for public transport. At all newly arranged bus shelters there are now information stands with the Kaunas public transport route maps.

Public information took many forms, such as the innovative 'Transport Routes and Tourism Sites' map, which proved so successful for tourists and visitors that extra copies were printed for inclusion in a glossy Kaunas tourist book that advertised the inclusion of the map on its front cover. We are also pleased with the colour route map guides installed on all buses and trolley buses with public comments posted on the website particularly welcoming this innovation. Other formats included stickers on all buses and trolley buses advertising the public transport website, and the production of a CD promoting the improvements to our public services throughout the VIVALDI project (this was also used at an international business expo in Kaunas in the summer of 2005).

Public transport website pages (www.kaunas.lt/transportas) were created and are updated using data from the PIKAS system, and from public feedback on its usefulness and relevance. The new website was launched in May 2005 and since then there have been around 130,000 hits – this equates to approximately 700 hits per day and over 5,000 per week, and some 21,000 per month. It became possible to get information on public transport by SMS message from spring 2005, however for the meantime there is no statistical data on the number of people using this service.

Evaluation results showed that 83% of respondents thought transport stops were comfortable and the older the respondent, the more satisfied he/she is with the convenience of public transport stops. This tendency can be best explained through historical and cultural factors and differences in generations. Older generations have witnessed the change of the quality of the transport stops. The younger generations are more critical as have not experienced what the stops were like before. It is also thought that as the younger generations are more internationally mobile and they use their experiences as ground for a more critical evaluation.

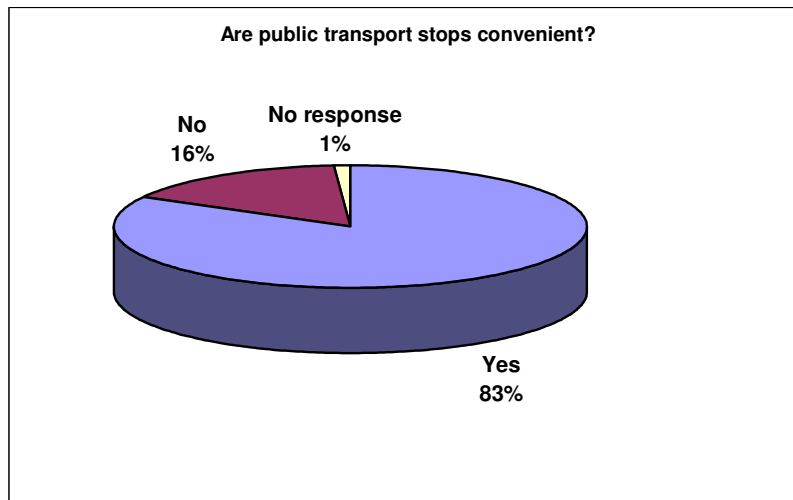


Figure 3.4.6-9. Convenience of public transport stops / shelters

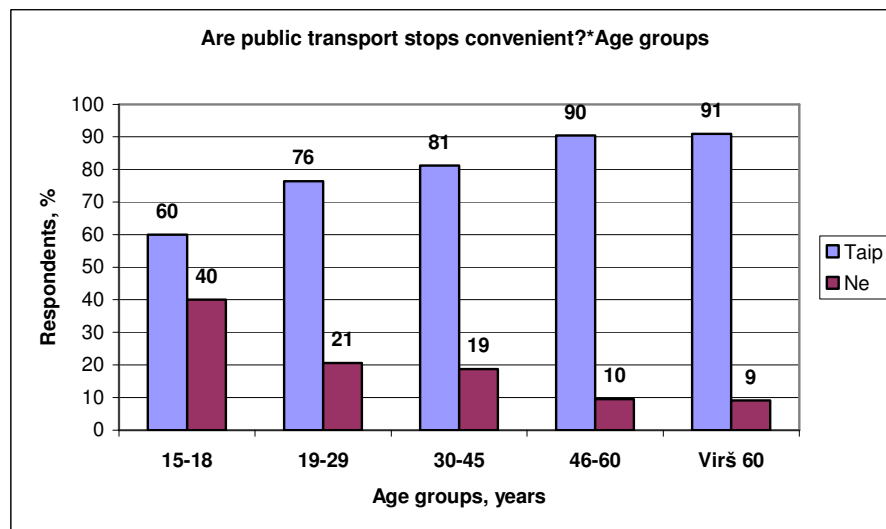


Figure 3.4.6-10. Convenience of public transport stops / shelters according to age groups

The following results were obtained regarding the quality and availability of public transport. Information sources are presented according to the number of respondents aware of and using them.

Information stands at stops: 94% of respondents were aware of information stands at the stops, and 85% of respondents used them. This is obviously the most available source of information for all public transport users, however there are still 9% who are aware but do not use them. This indicates that the information could be made more attractive, or some people just do not like to look at the information.

Internet: 60% of respondents knew that information about public transport routes and schedules were available on the Internet, however, among them only 25% used this

information source. The higher percentage of those who know, but don't use information on internet than those who know and use the information could be explained either by limited access to Internet of certain groups of people (e.g. pensioners), or lack of knowledge as to which Internet pages people could find this information.

Leaflets: the difference between those who use (11%) and those who know but don't use (20%) leaflets as a source of information indicates the low availability of this form of information to the public. Leaflets are a source of information which could be specifically targeted to social groups that do not have access to internet or do not have mobile phones (e.g. pensioners, old aged, low income), therefore the recommendation is to decide, which way it is the best to disseminate leaflets (e.g. a schedule of public transport issued at selling places together with monthly tickets).

SMS: the majority of people (77%) do not know about the possibility to receive schedules by SMS. This indicates that among all means of information, this is the most unusual one, and it is not 'implemented' in the daily routine of public transport passengers. The dissemination of this information could be organized in cooperation with mobile providers, for example through their Internet pages or newsletters.

There are noticeable differences in the pattern of use for various means of information by various age groups. Information stands are most commonly used by student aged people (19-29), this group is also most active users of internet information (47%). This age group could be the most active group in need of information about public transportation, because students are dependent of lectures time schedules, which could be different on different days. Plus, this age group usually have access to computers and therefore information on the Internet.

Kaunas City Administration is continuously improving the access to information, and as has previously been mentioned, are planning a major promotional campaign to target specific target groups of users based on much of the research produced, which will lead towards increased campaigning and identification of most relevant means of information to different target groups. However, at present, Kaunas inhabitants thought that the layout of public transport routes, schedules and stops are convenient to use.

3.5 Nantes – City Evaluation

In 2003, in its final Evaluation Guide to carry out the evaluation of CIVITAS measures, METEOR proposed the production of estimations through the ITEMS model for:

- A *Do-nothing Scenario* (e.g. a scenario projecting the estimated situation *without* the CIVITAS Initiative)
- A *CIVITAS Scenario*, projecting the estimated situation *with* the CIVITAS Initiative

This evaluation process in Nantes has not used ITEMS. ENERDATA, who produced the model, was provided with data in 2004 but has not given any results. So a global “do nothing scenario” for all VIVALDI project measures has not been implemented, only for some specific actions: new CNG bus implementation and Public Transport evolution. In the same document, METEOR summarized Nantes VIVALDI actions regarding CIVITAS objectives as following:

Access Restriction:

- Increase soft modes market share
- Increase PT modal share
- Reduce traffic

Integrated Pricing Strategies:

- *None*

Collective Passenger Transport:

- Increase PT modal share
- Improve PT service quality and user satisfaction
- Increase rail modal share
- Reduce car passengers
- Increase cycling modal share
- Increase P&R use

New Forms of Vehicle Ownership and Use:

- Increase soft modes modal share

New Concepts for the Distribution of Goods:

- Reduce road traffic

Innovative Soft Measures:

- Reduce car market share
- Raise awareness of mobility behaviour

Integration of Transport Management Systems:

- Increase user information
- Improve PT reliability, customer satisfaction

Clean Private and Public Transport Fleets:

- Reduce emissions
- Lower clean fuel costs

Goods distribution measures have not been implemented completely at this stage.

So the global local objectives have been summarized, at the city level, into three main items:

- To increase Public Transport use as an alternative mode in relation to car use.
- To reduce air pollution with the use of clean vehicles on the PT network.

- To encourage the use of the soft modes walking and cycling.

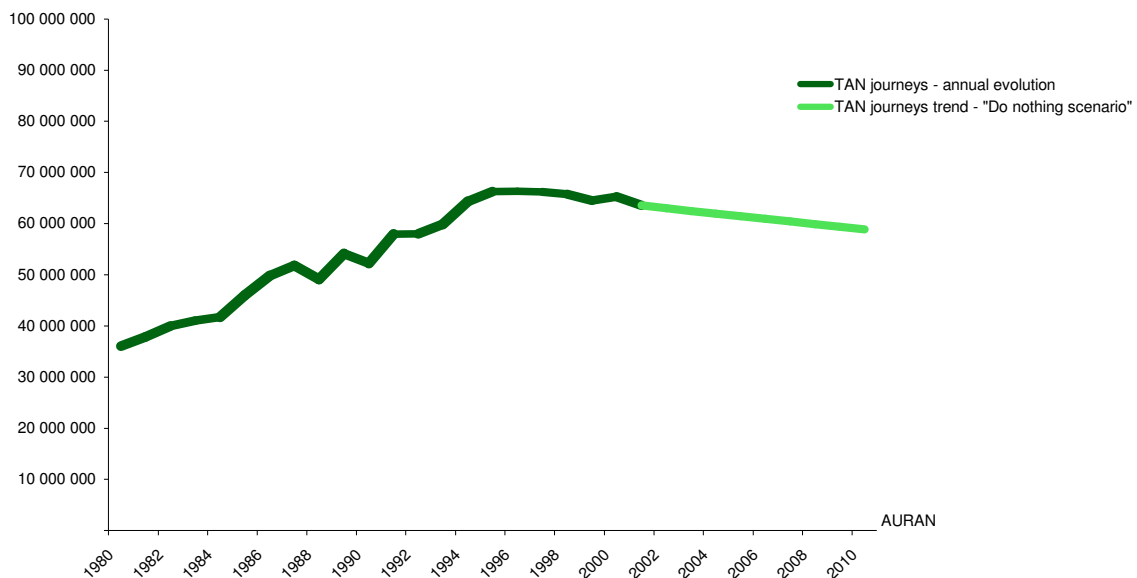
3.5.1 Do-nothing Scenario Results

Two “Do nothing scenarios” have been carried out. One concerning PT use and the modal share induced, another one concerning the new CNG fleet.

PT use “Do nothing scenario”

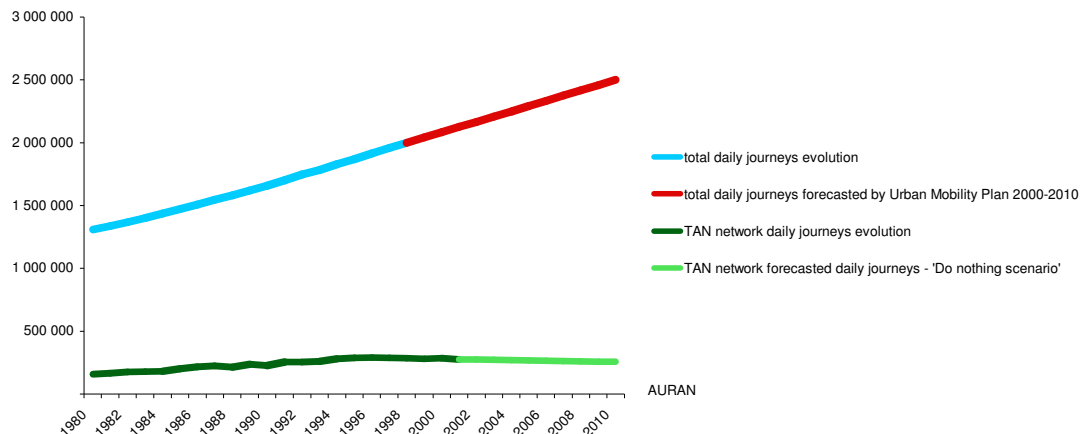
PT usage increased on the TAN urban network with the opening of two new tram lines, as shown on the following figure. But since 1995, even while tram patronage was increasing, total PT use was decreasing by about -0.85% by year. This trend constitute the base of the “Do nothing scenario”.

Figure 3.5.1-1 TAN annual journeys evolution and "Do nothing scenario"



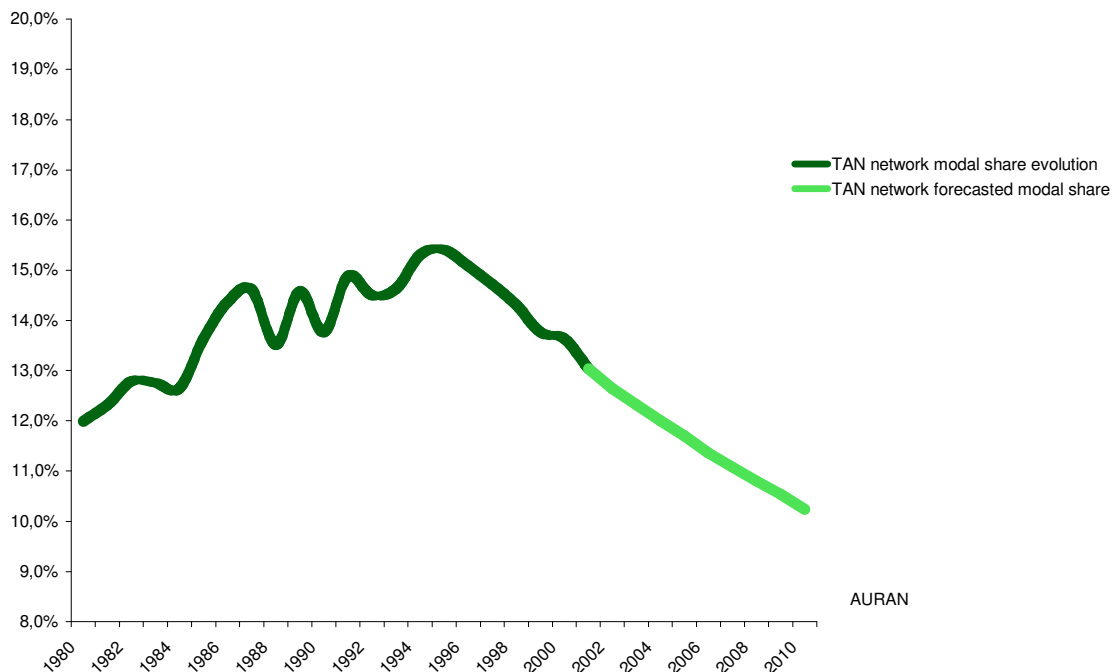
The Urban Mobility Plan 2000-2010 scheduled about 2,500,000 journeys generated in Nantes Métropole in 2010. The following figure shows total journeys and TAN journeys, with Urban Mobility Plan and “Do nothing scenario” assumptions.

Figure 3.5.1-2 Daily journeys evolution, Urban Mobility Plan forecast and "Do nothing scenario"



These two evolutions induce a PT modal share of about 10% in 2010, as shown on the following figure.

Figure 3.5.1-3 Tan network modal share and "Do nothing scenario"



PT new clean bus fleet "Do nothing scenario"

In this case, a "Do nothing scenario" for the TAN bus fleet consists of keeping diesel buses and replacing the older ones with new diesel buses, and calculating bus fleet emissions in 2004. The results for the all fleet (buses and trams) are:

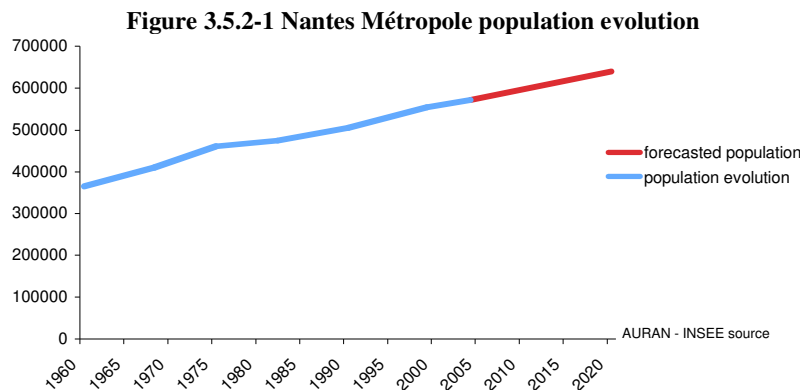
- Energy consumed: 103,896 MWh
- Energy cost: 6,649,000 €
- Green House Gas: 21,242 metric tons
- Carbon monoxide: 52.07 metric tons

• Non-Methane Hydrocarbons:	15.95 metric tons
• Nitrogen oxides:	400.88 metric tons
• Particulates:	5.58 metric tons
• Global pollutants social cost	5,004,000 €

3.5.2 City-level Results

3.5.2.1 Society

Since VIVALDI started, Nantes Métropole has gained population, about 18,000 inhabitants between 1999 and 2004. The population forecast in 2020 will be about 640,000 inhabitants.



3.5.2.2 Economy

A new mobility survey was carried out in 2002 at the beginning of the VIVALDI project on the Nantes Métropole territory, but also on the larger Urban Area of Nantes. The main results, for Nantes Métropole inhabitants, about the daily journeys and the modal split are summarized in the following figure.

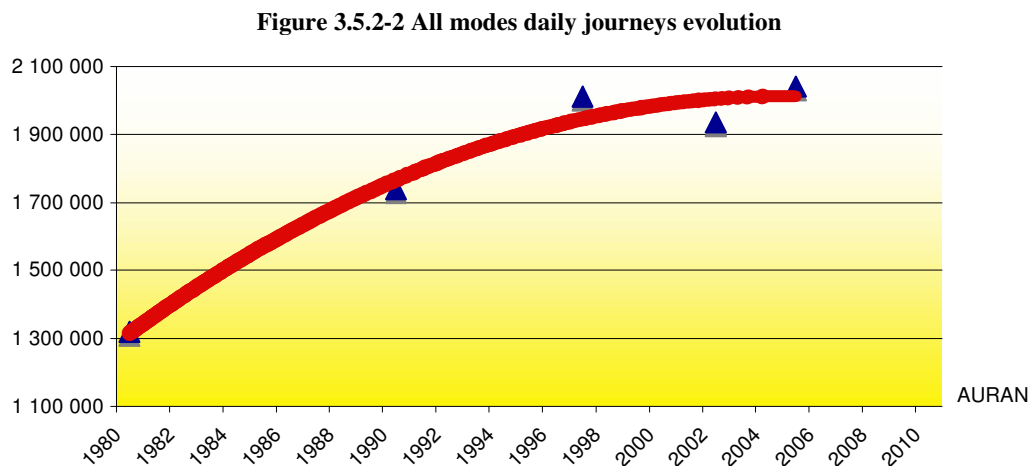
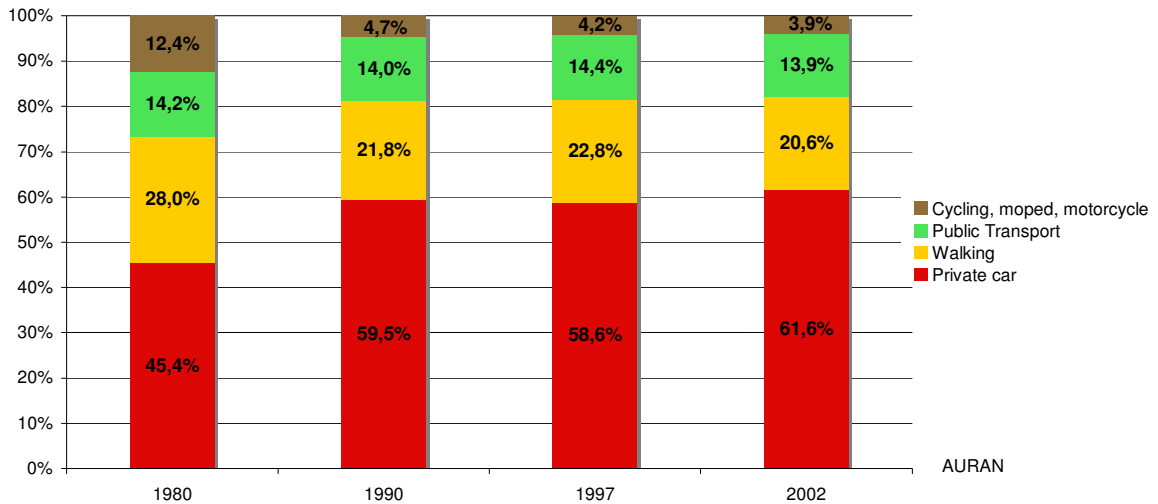


Figure 3.5.2-3 Daily journeys modal split evolution

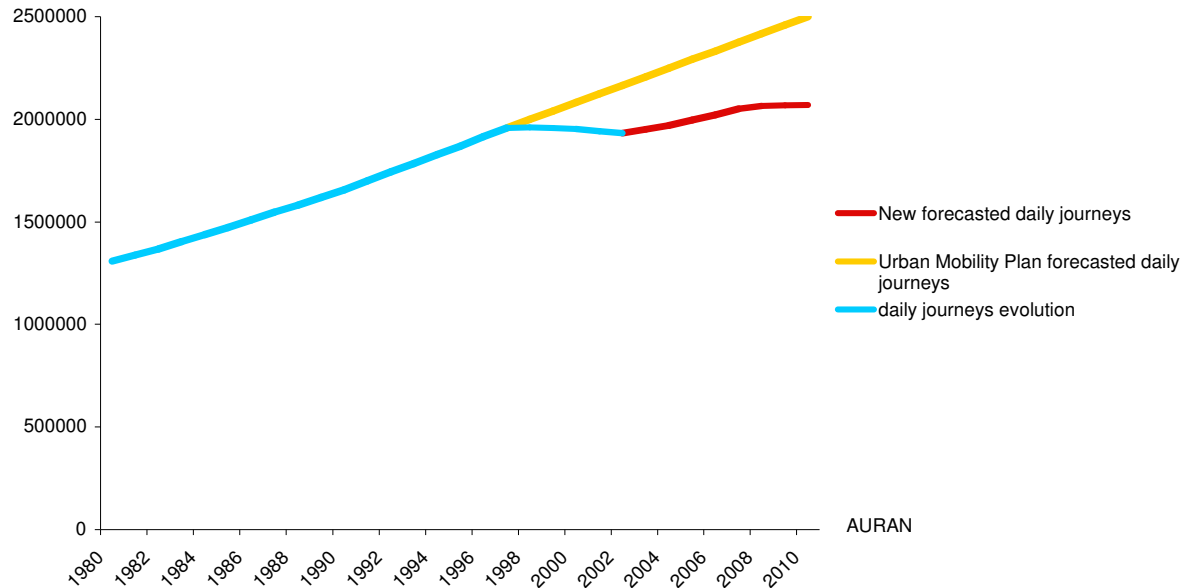


The new elements given by this survey are:

- Individual mobility seems to reach a stable period of about 3.5 daily journeys per inhabitant. The trend scheduled in the Urban Mobility Plan 2000-2010, according to national values at the time, was to reach about 4 daily journeys per inhabitant in 2010. Sociological elements explain these results: population aging, longer journeys, economic situation, new shopping behaviour, new working times (in particular the reduction of the legal working time or part-time working).
- The modal share of Public Transport is slightly decreasing: 0.5% loss.
- The modal share of private cars increases, but the trend of the increase of journeys made with private cars is strongly decreasing: 0.2% yearly rate during the 1997-2002 period, against 1.9% during 1990-1997 and 5.6% during 1980-1990.
- The modal share of cycling is relatively stable, like moped and motorcycle, both at a low level.
- The modal share of walking is decreasing.

Analysis of the results of this mobility survey, and prospective works has permitted to have a new modelling view of the future. The figure below shows mobility evolution in Nantes Métropole until 2010.

Figure 3.5.2-4 New daily journeys forecast



3.5.2.3 Transport

3.5.2.3.1 Urban Traffic data analysis

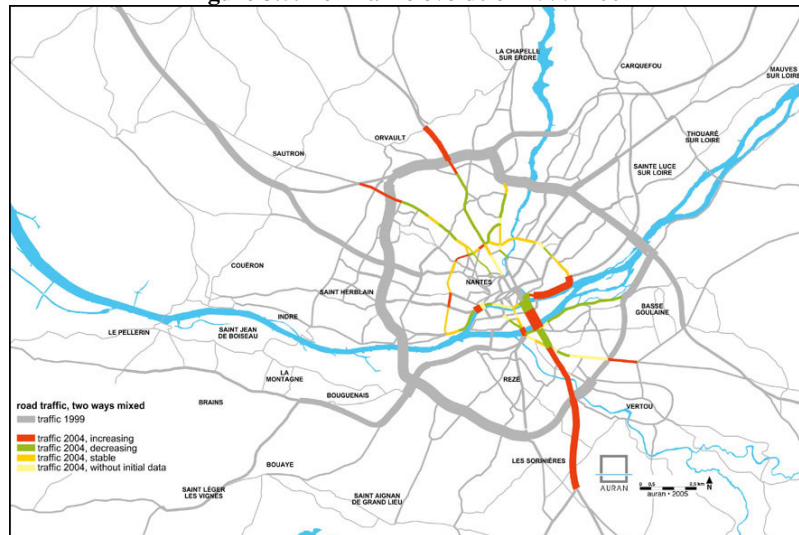
The figure below shows the role played by the ring road in urban traffic levels of Nantes Métropole.

Figure 3.5.2-5 2001 road network traffic



Between 1999 and 2004, urban traffic evolution has been studied on 6 urban motorways linked to the VIVALDI demonstration areas and a small ring road around the city centre. The following pages give detailed data about these roads. The figure below shows the synthesis. The main point of this analysis is that traffic is growing on urban motorways near the main ring road. It is decreasing towards the city centre, except in some localized points like bridges.

Figure 3.5.2-6 Traffic evolution 1999-2004



Traffic evolution on the Vannes road

Table 3.5.2-1 Route de Vannes area, traffic evolution

Section number	Street	Daily traffic two ways mixed 1999	Daily traffic two ways mixed 2004
10052	Rte de Vannes	24 400	27 450
474	Rte de Vannes	24 400	33 578
473	Rte de Vannes	29 400	24 529
472	Rte de Vannes	29 400	21 433
471	Rte de Vannes	24 400	18 189
470	Rte de Vannes	24 400	23 297
469	Rte de Vannes	24 000	19 334
71	Rte de Vannes	21 810	17 493
73	Bd Boulay Paty	10 950	10 035
72	Bd Jean 23	11 960	10 668
396	Rue des Hauts Pavés	8 190	7 734
398	Rue du Poitou	13 000	8 327

Nantes Métropole/Department of Loire Atlantique/ French roads Ministry source

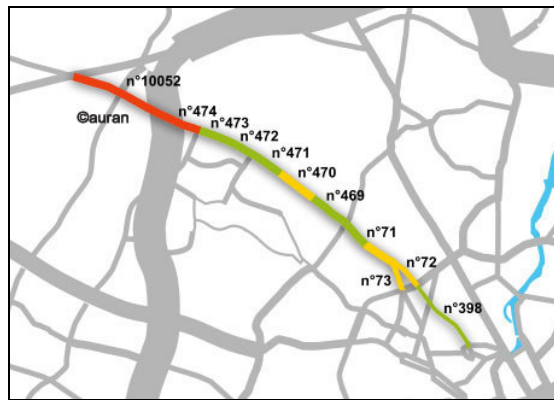
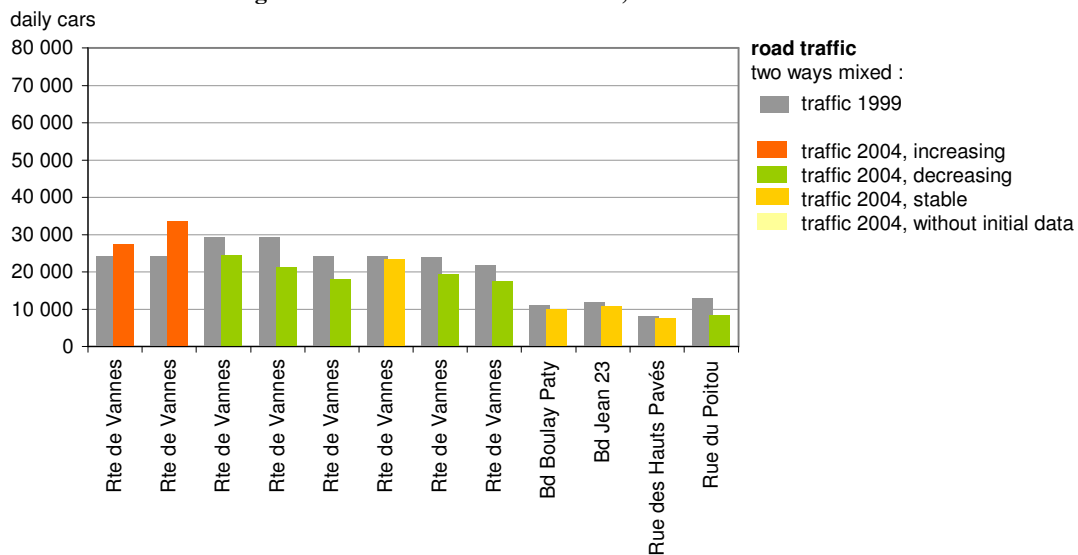


Figure 3.5.2-7 Route de Vannes area, traffic evolution



Traffic evolution on the Rennes road

Table 3.5.2-2 Route de Rennes area, traffic evolution

Section number	Street	Daily traffic two ways mixed 1999	Daily traffic two ways mixed 2004
10058	Rte de Rennes	37 750	43 870
12	Rte de Rennes	29 100	30 511
13	Rte de Rennes	23 330	21 736
14	Rte de Rennes	28 310	25 640
80	Bd Schuman	24 390	19 346
81	Bd Schuman	23 520	20 096
393	Rue Paul Bellamy	21 700	20 896
82	Rue Paul Bellamy		23 449
83	Rue Paul Bellamy	21 180	

Nantes Métropole/Department of Loire Atlantique/ French roads Ministry source

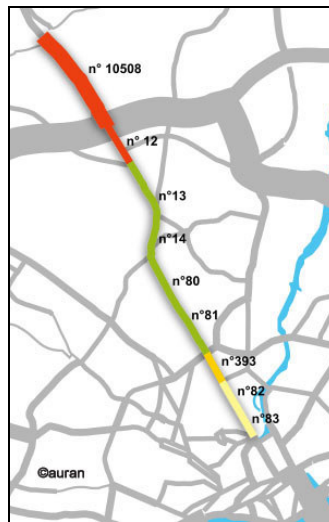
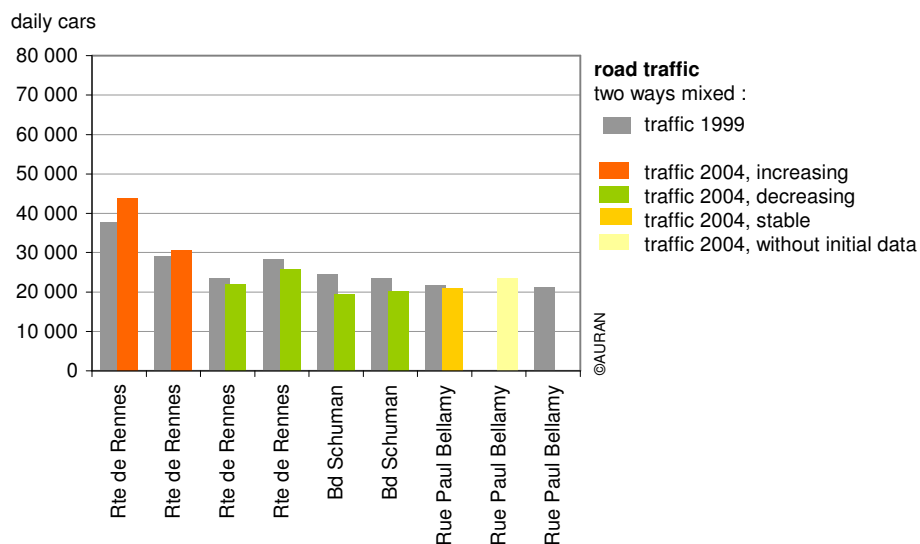


Figure 3.5.2-8 Route de Rennes area, traffic evolution



Traffic evolution on the Tertre University road

Table 3.5.2-3 University area, traffic evolution

Section number	Street	Daily traffic two ways mixed 1999	Daily traffic two ways mixed 2004
91	Bd King + Picherit	28 415	27 738
92	Bd Mollet Guy	21 150	19 761
230	Bd du Petit Port		
163	Bd Michelet	6 941	7 216
94	Bd Michelet		11 884
390	Bd Amiral Courbet	15 730	14 155
496	Bd Lauriol Gabriel	20 000	15 357

Nantes Métropole/Department of Loire Atlantique/ French roads Ministry source

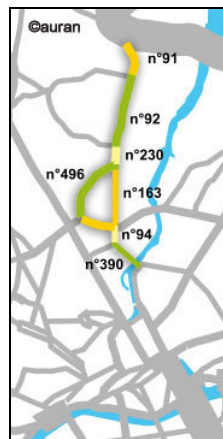
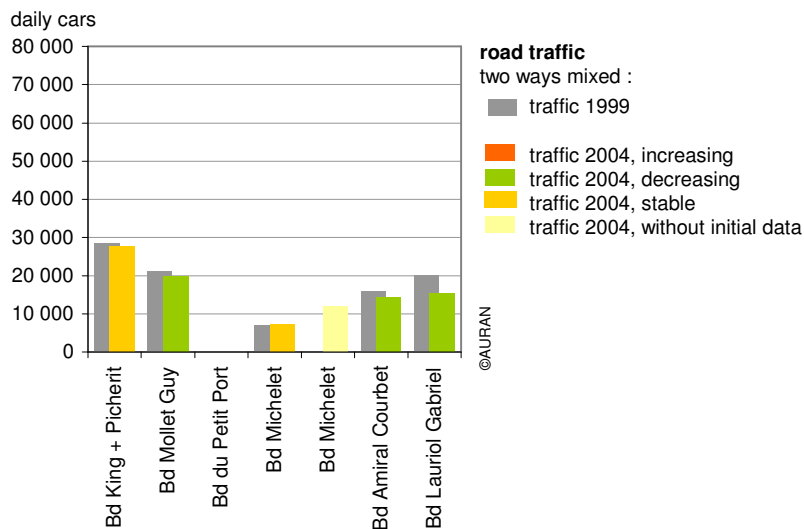


Figure 3.5.2-9 University area, traffic evolution



Traffic evolution on the RN 801 road

Table 3.5.2-4 RN 801 area, traffic evolution

Section number	Street	Daily traffic two ways mixed 1999	Daily traffic two ways mixed 2004
	A83	45 250	55 800
	Bd de Vendée	29 100	33 600
	Bd Emile Gabory	38 000	33 600
129	Pont Clemenceau	58 600	62 238
130	Pont Briand	51 640	47 047

Nantes Métropole/Department of Loire Atlantique/ French roads Ministry source

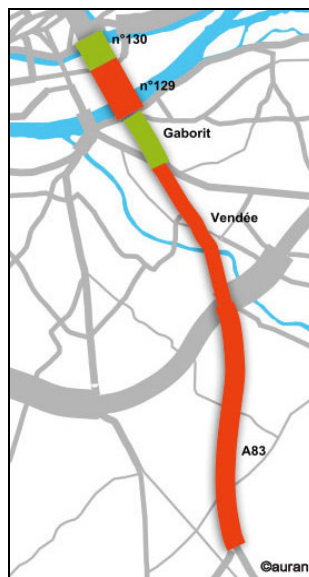
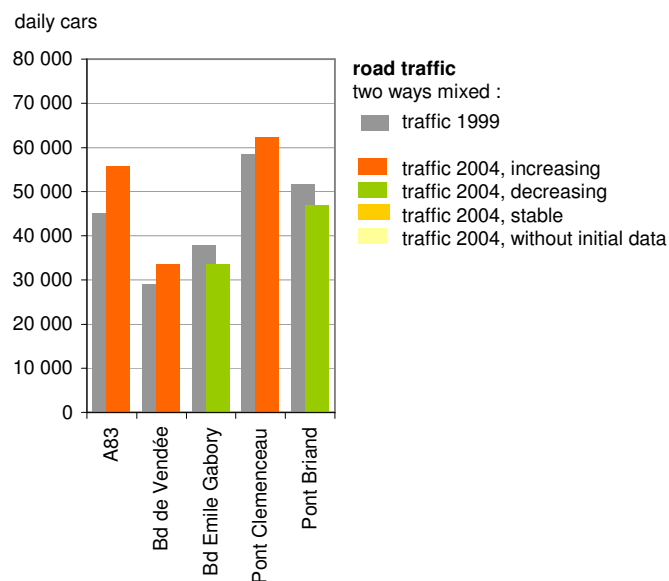


Figure 3.5.2-10 RN801 area, traffic evolution



Traffic evolution on the Clisson road

Table 3.5.2-5 Route de Clisson area, traffic evolution

Section number	Street	Daily traffic two ways mixed 1999	Daily traffic two ways mixed 2004
1143	Rte de Clisson	13 000	16 816
1126	Rte de Clisson		14 465
1124	Rte de Clisson	20 511	14 574
1123	Rte de Clisson		23 770
1078	Bd Joliot Curie	16 121	16 242
1140	Rue St Jacques		14 903
136	Pont Audibert	20 100	20 821
135	Bd Martyrs Nantais	17 510	17 058
331	Bd des Martyrs Nantais		21 104
134	Pont Pirmil	38 470	40 136
148	Bd Victor Hugo		27 895
328	Bd Victor Hugo	23 201	16 564
329	Bd Victor Hugo	28 500	22939

Nantes Métropole/Department of Loire Atlantique/ French roads Ministry source

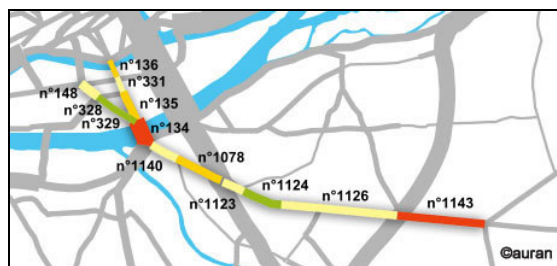
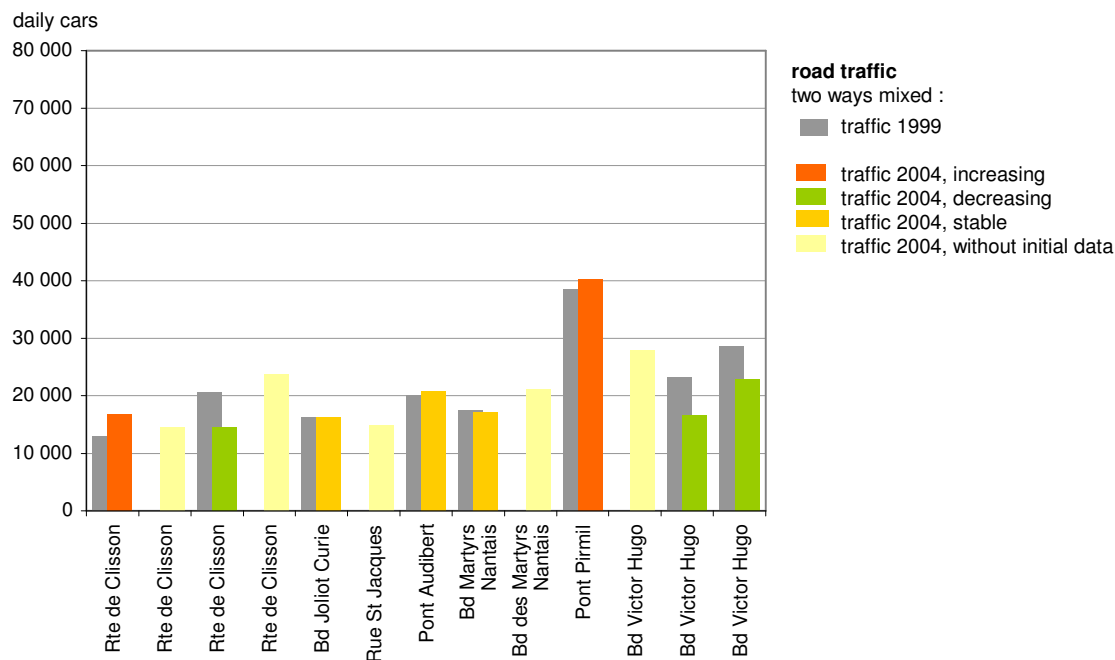


Figure 3.5.2-11 Route de Clisson area, traffic evolution



Traffic evolution on the Boulevard des Pas Enchantés

Table 3.5.2-6 Boulevard des Pas Enchantés area, traffic evolution

Section number	Street	Daily traffic two ways mixed 1999	Daily traffic two ways mixed 2004
1130	Bd Pas Enchantés	15 662	12 457
1131	Bd Pas Enchantés	15 800	12 572
1133	Bd Pas Enchantés	16 580	13 107
1034	Bd Pas Enchantés	18 423	13 663
1136	Bd Pas Enchantés		18 137
1135	Bd Pas Enchantés		17 130
58	Côte St Sébastien	21 040	18 770

Nantes Métropole/Department of Loire Atlantique/ French roads Ministry source

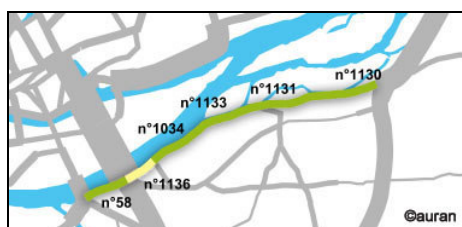
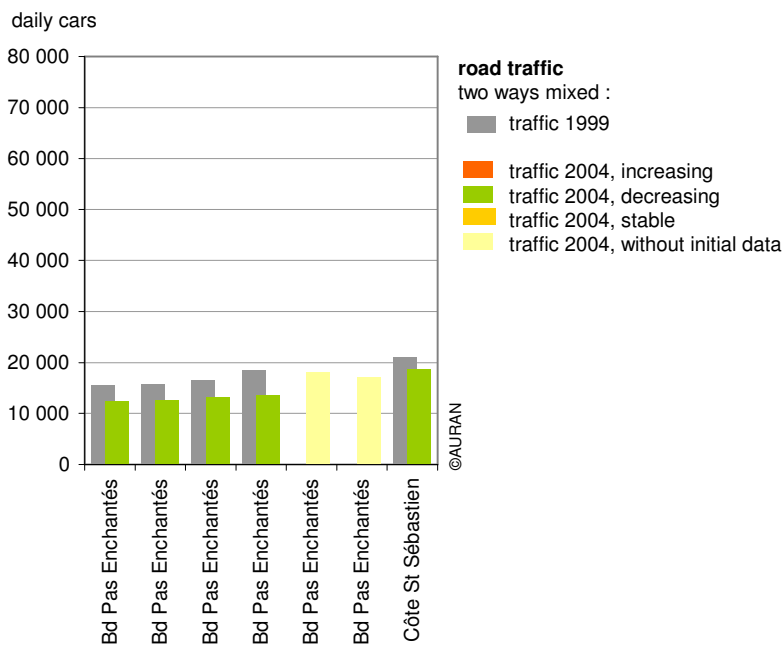


Figure 3.5.2-12 Boulevard des Pas Enchantés area, traffic evolution



Traffic evolution on the Inner ring boulevards

Table 3.5.2-7 Inner ring boulevards, traffic evolution

Section number	Street	Daily traffic two ways mixed 1999	Daily traffic two ways mixed 2004
25	Bd Cardiff	19 298	19 102
26	Quai Renaud	20 960	17 273
28	Quai de la Fosse	48 000	56 059
432	Quai de la Fosse		75 716
29	Quai de la Fosse	42 673	41 319
30	Quai André Morice		17 861
321	Quai Magellan		9 414
322	Quai Magellan		11 468
323	Quai Magellan		13 173
320	Quai Magellan	18 790	17 691
31	Pont Tbilissi	30 100	24 979
32	Quai Malakoff	23 753	25 872
332	Quai Malakoff		39 756
33	Bd de Sarrebruck	41 170	44 385
34	Bd de Doulon	16 430	16 736
35	Bd de Doulon	13 720	13 359

Section number	Street	Daily traffic two ways mixed 1999	Daily traffic two ways mixed 2004
36	Bd des Poilus	14 810	12 487
372	Bd Poilus		17 674
37	Bd des Belges	19 340	19 278
38	Bd des Belges	17 370	17 701
39	Bd Orioux	26 440	27 287
41	Bd Frères de Goncourt	28 430	25 821
40	Bd Orrion	24 660	24 915
42	Bd Lelasseur	20 000	22 734
158	Bd Lelasseur	15 320	15 000
160	Bd des Anglais	18 437	16 356
43	Bd des Anglais	14 290	17 256
44	Bd des Anglais	16 840	17 222
45	Bd de la Fraternité	13 610	13 912
46	Bd de la Fraternité	16 680	16 696
47	Bd de l'Egalité	11 300	12 670
453	Bd de la Liberté	8 500	7 903

Nantes Métropole/Department of Loire Atlantique/ French roads Ministry source

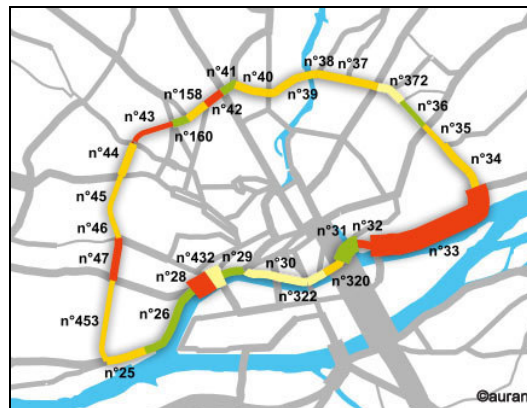
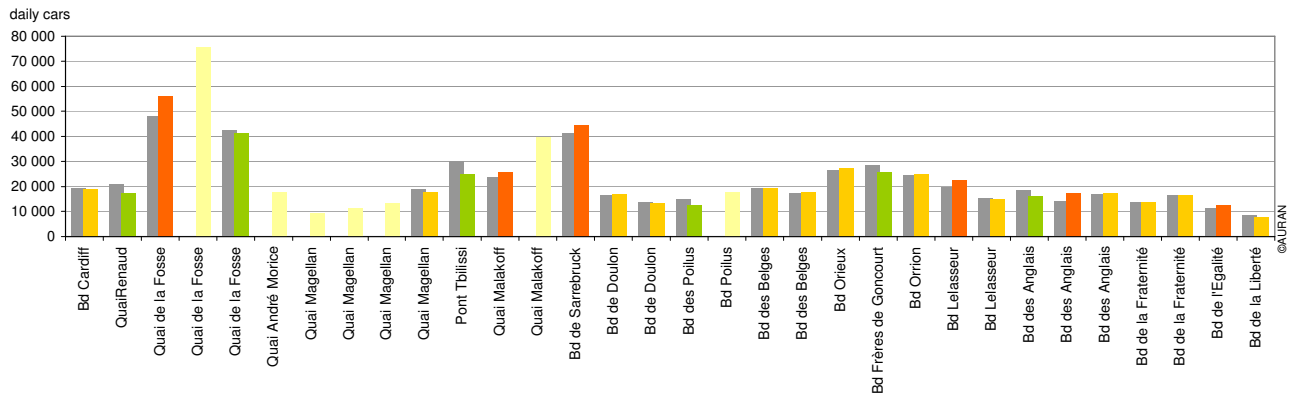


Figure 3.5.2-13 Inner ring boulevards, traffic evolution



3.5.2.3.2 Urban traffic evolution – Synthesis

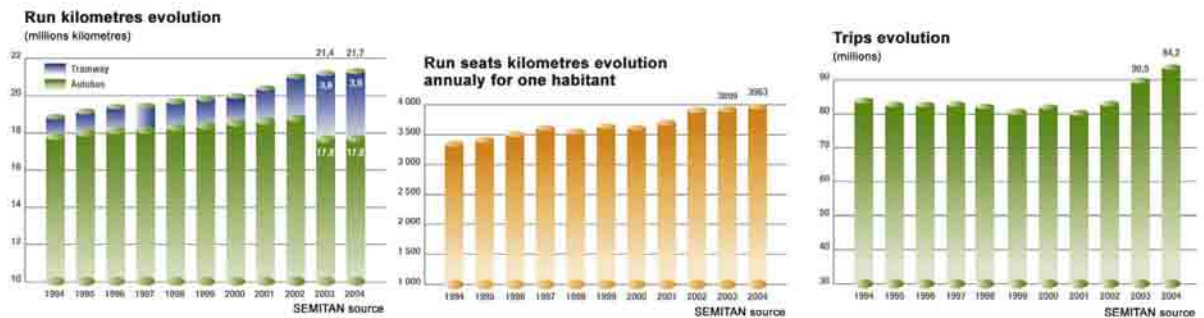
The results from traffic and car mobility analysis, results obtained on Park and Ride or from other soft measures, or from car flow restrictions, show that mobility policy in Nantes is changing the tendency of increasing journeys only made by car. But it is too early to have a correct modelling view of the car share evolution. It could be carried out in few months, when very structuring works (BusWay route, RN801 remodelling, Vannes Road remodelling) currently progressing will end.

Public transport

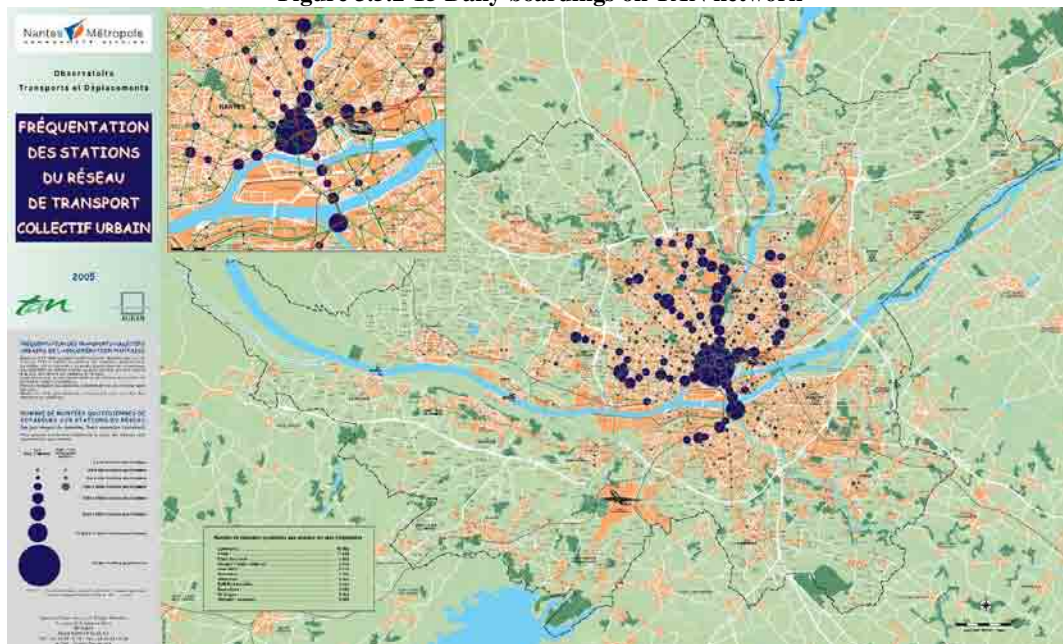
Tan network patronage

Public Transport is mainly TAN urban Public Transport. The evolution of the journeys made on TAN network has been shown in the “Do nothing scenario” part (see 4.1.1). The main positive point is that patronage is increasing again, since 2002, while the tram is gaining importance in the PT network: about 55% of daily trips are made by tram for only 18% of run kilometres.

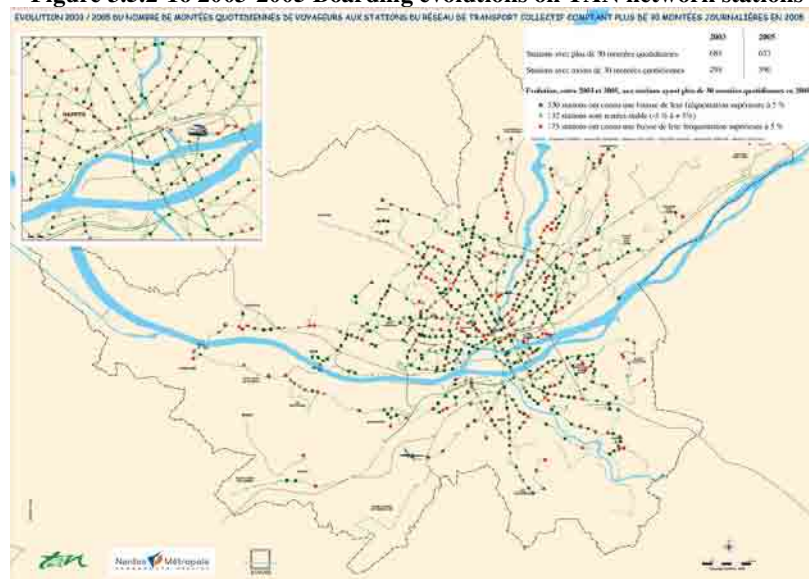
Figure 3.5.2-14 Annual run kilometres and annual trips on TAN network



The following map, showing daily boarding on TAN network stations, illustrates the tram’s predominance.

Figure 3.5.2-15 Daily boardings on TAN network


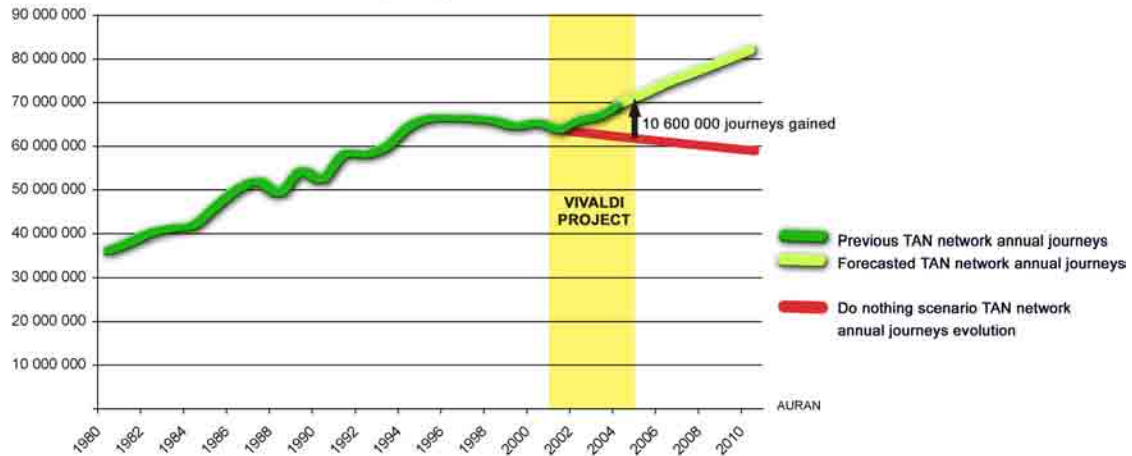
The boarding changes between 2003 and 2005 show that some bus routes are losing patronage, often outside the ring road or on busy roads without reserved bus lanes. Stations on “Chronobus routes” have gained patronage.

Figure 3.5.2-16 2003-2005 Boarding evolutions on TAN network stations


Between 2001 and 2004, the three tramlines gained 13.5 millions trips and all bus routes lost 575,000 trips. But the two first “Chronobus” routes gained about 550,000 trips. The results obtained on the TAN network during VIVALDI, and the analysis of TAN patronage response in function of new investments in the past, combined with other results of VIVALDI measures, can give a modelling view of the future that is shown on the following figure, compared to the “Do nothing scenario”. It can be said that there

are more than 10 million annual journeys that have been gained by the end of VIVALDI compared to the “Do nothing scenario”.

Figure 3.5.2-17 TAN annual journeys – previous and forecasted



This TAN annual journeys forecasting view can be integrated to the total daily journey evolution. The result shown on the following figures is an increasing of TAN network modal share in future years, showing that the Urban Mobility Plan 2000-2010 objective to have a PT modal share of 18% in 2010 is achievable.

Figure 3.5.2-18 TAN network daily journeys compared to all modes daily journeys

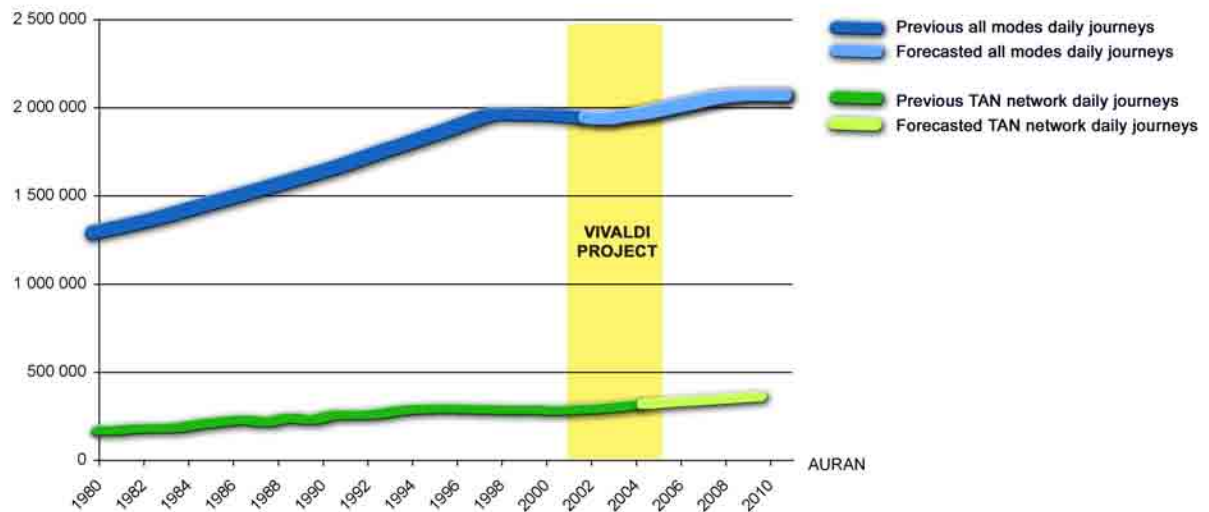
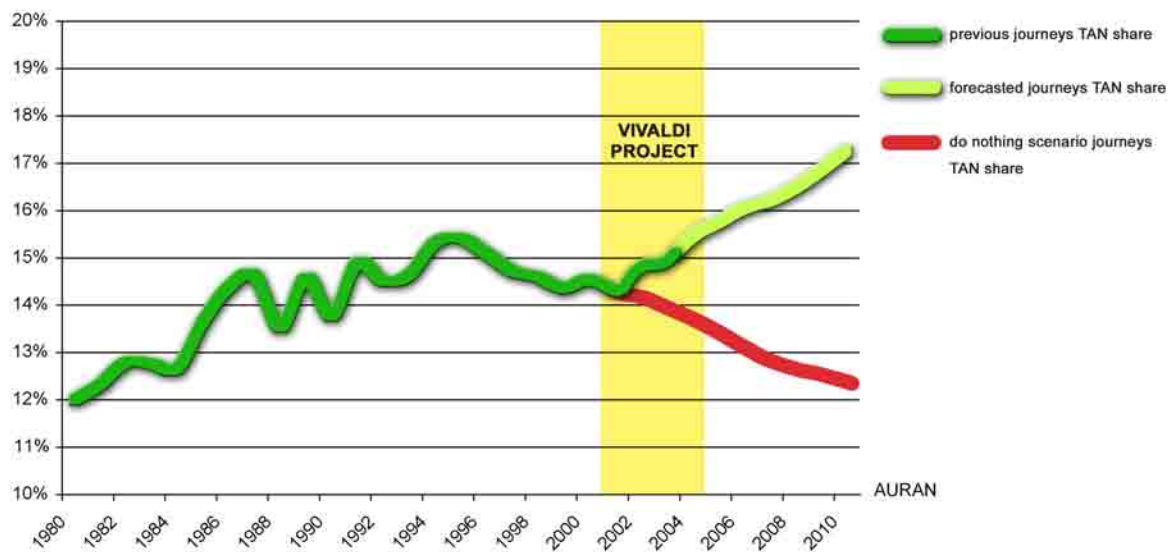


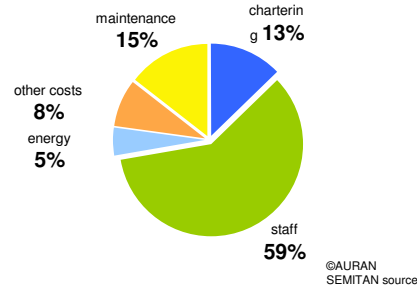
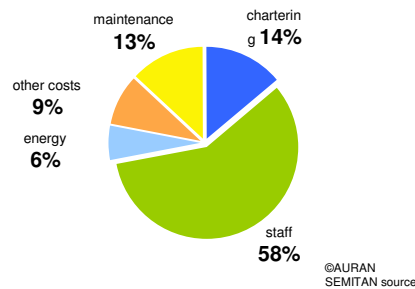
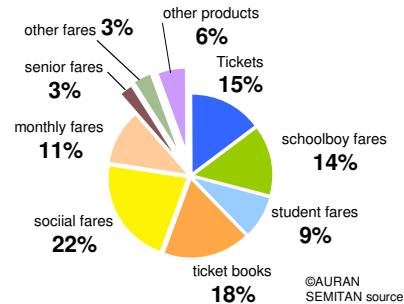
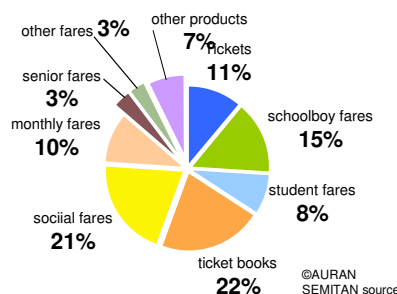
Figure 3.5.2-19 TAN network modal share evolution


Tan network operating costs and revenues

Between 2001 and 2004, operating costs increased by 23.6% and operating revenue by 18.7%. The ratio revenues/costs lost two percentage points in the four years. The following table shows this evolution for one inhabitant, one trip or one run kilometre.

Table 3.5.2-8 2001-2004 TAN network financial data

Financial data			
SEMITAN source			
	2001	2004	Evolution
Operating costs			
Total (M€)	70,3	86,9	23,6%
per inhabitant (€)	125	152	21,3%
per trip (€)	0,81	0,92	13,3%
per run kilometre (€)	3,41	4,01	17,6%
Operating revenue			
Total (M€)	35,3	41,9	18,7%
per inhabitant (€)	63	73	16,5%
per trip (€)	0,41	0,44	8,8%
per run kilometre (€)	1,71	1,93	12,9%
revenues/costs ratio	50,2%	48,2%	

Figure 3.5.2-20 Structure of TAN network operating costs and revenues
2001 - Operating costs : 70.3 M€ HT
2004 - Operating costs : 86.9 M€ HT

2001 - Operating revenues : 35.3 M€ HT
2004 - Operating revenues : 41.9 M€ HT


Between 2001 and 2004, the increasing costs are maintenance (+43%), staff (+26%) and leasing (+15%). Energy costs only increased by 3%, less than the inflation rate of the period (+6.5%). Run kilometres increased during this period (+5%), so the CNG strategy seems to be efficient to reduce energy operating costs, as shown by the simulation done in the same conditions as in the “Do nothing scenario” for the all TAN fleet (buses and trams):

“Do nothing scenario”

- Energy consumed: 103,896 MWh
- Energy cost: 6,649 K€

CNG bus fleet improved

- Energy consumed: 119,442 MWh
- Energy cost: 6,173 K€

Balance

- Energy consumed: +15%
- Energy cost: -7.2%

It is not possible at this date to link maintenance cost increases and new CNG bus fleet, because of the debugging period for the new buses but also for the new tram. So it requires a longer time to observe and to analyse these tasks.

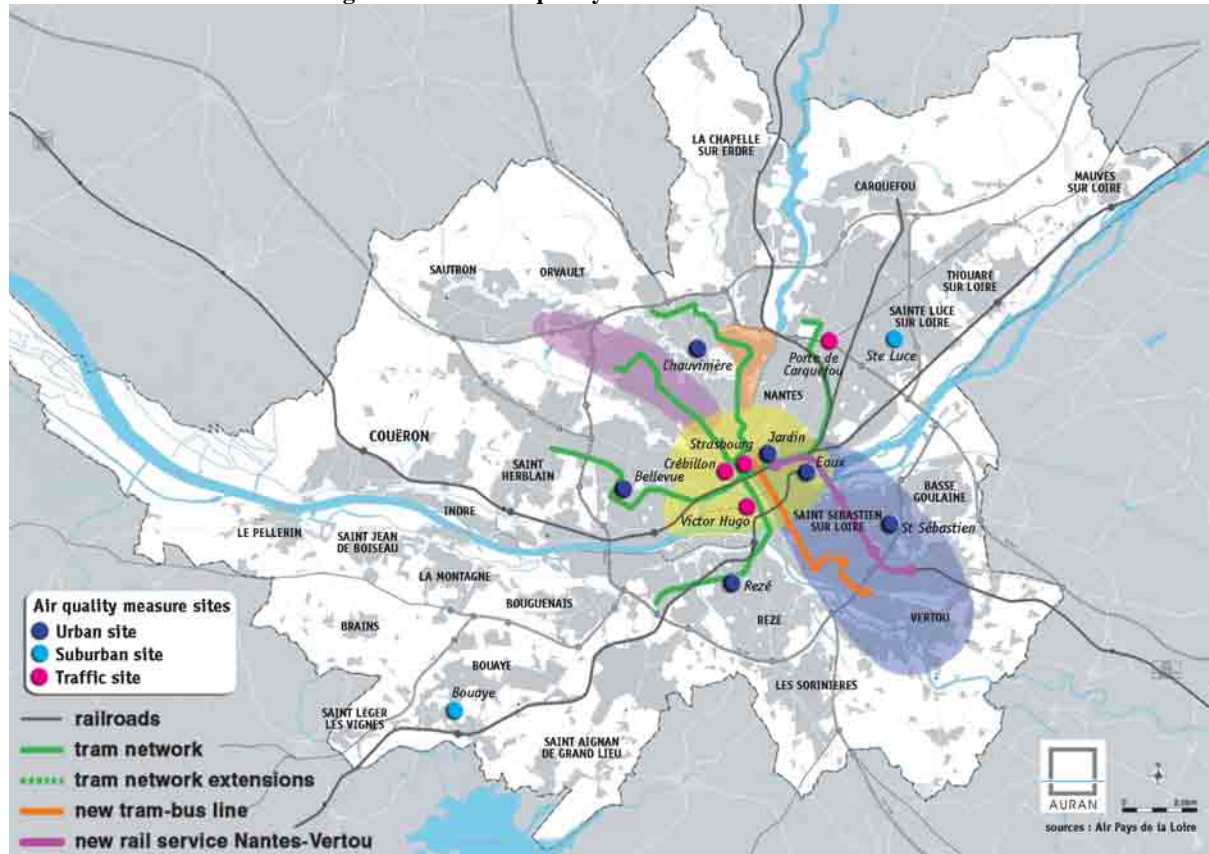
3.5.2.4 Environment

The Nantes Métropole area has 12 air quality monitoring stations that do not all have the same equipment and do not measure the same indicators. The following table and figure shows the specifications and the locations of these stations.

Table 3.5.2-9 Air quality monitoring stations

Monitoring station	Nantes Jardin	Nantes Eaux	St Sébastien	Rezé	Bellevue	Chauvinière	Victor Hugo	Crébillon	Strasbourg	Porte de Carquefou	Ste Luce	Bouaye
Type	urban	urban	urban	urban	urban	urban	traffic	traffic	traffic	traffic	suburban	suburban
Pollutant												
Nitrogen dioxide	NO ₂	NO ₂	NO ₂	NO ₂	NO ₂	NO ₂	NO ₂	NO ₂	NO ₂		NO ₂	
Ozone	O ₃		O ₃	O ₃	O ₃	O ₃					O ₃	
Particles			PM ₁₀	PM ₁₀	PM ₁₀	PM ₁₀	PM ₁₀	PM ₁₀				
Carbon monoxide							CO	CO	CO	CO		

Figure 3.5.2-21 Air quality measures sites



The following pages summarize available data from “Air Pays de la Loire” for each site, by type of pollutant. A synthesis is made at the end for each pollutant.

3.5.2.4.1 Air quality data analysis

Nitrogen dioxide – Data



Figure 3.5.2-22 Nitrogen dioxide evolution, Nantes Jardin

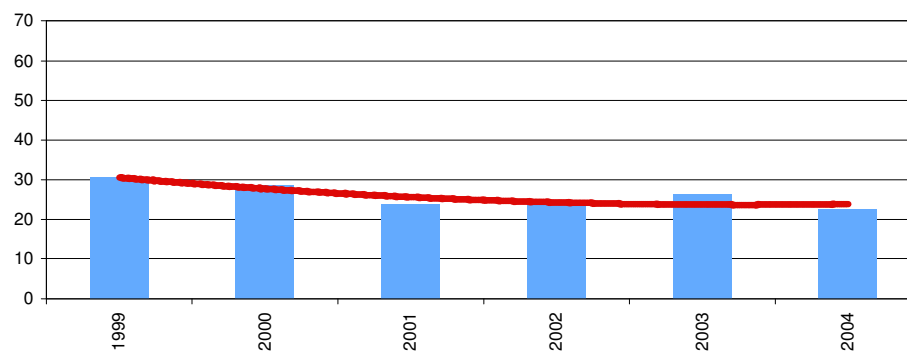
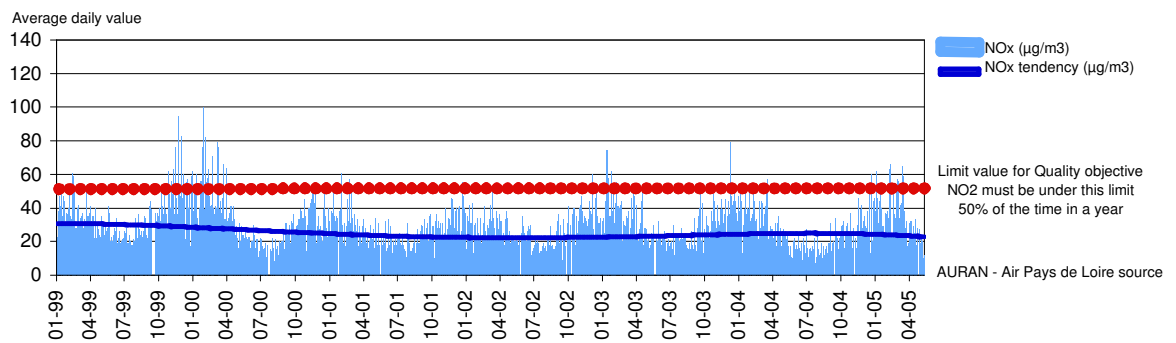




Figure 3.5.2-23 Nitrogen dioxide evolution, Saint Sébastien

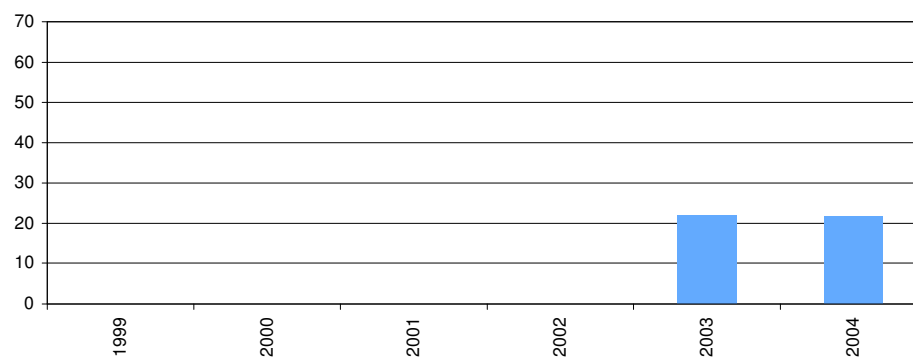
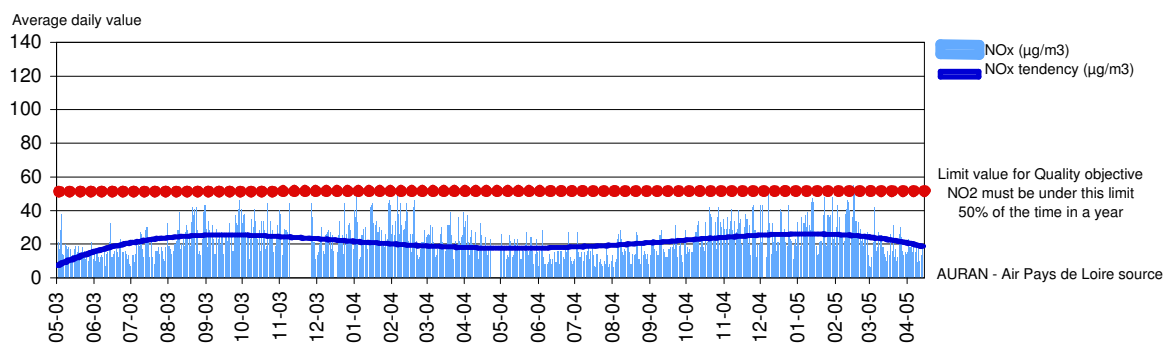




Figure 3.5.2-24 Nitrogen dioxide evolution, Nantes Bellevue

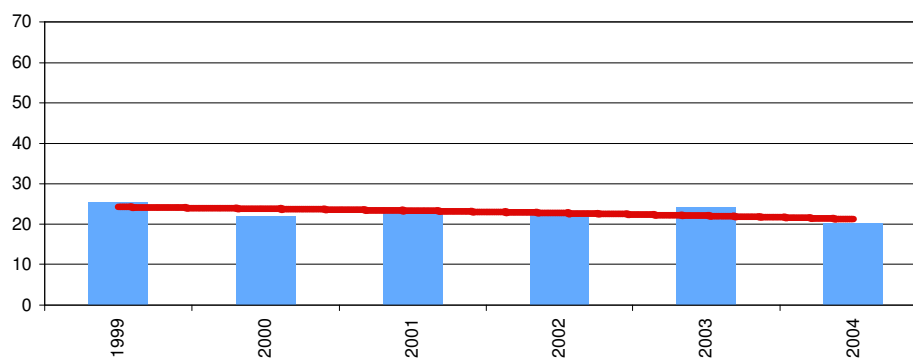
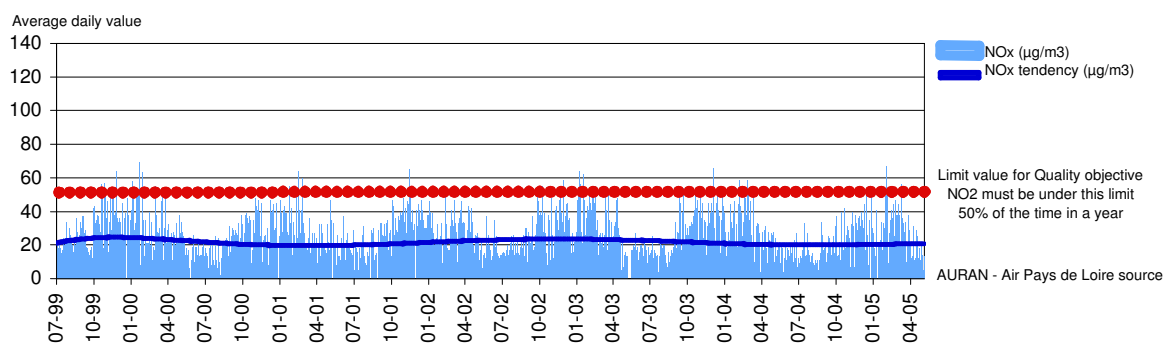




Figure 3.5.2-25 Nitrogen dioxide evolution, Nantes Chauvinière

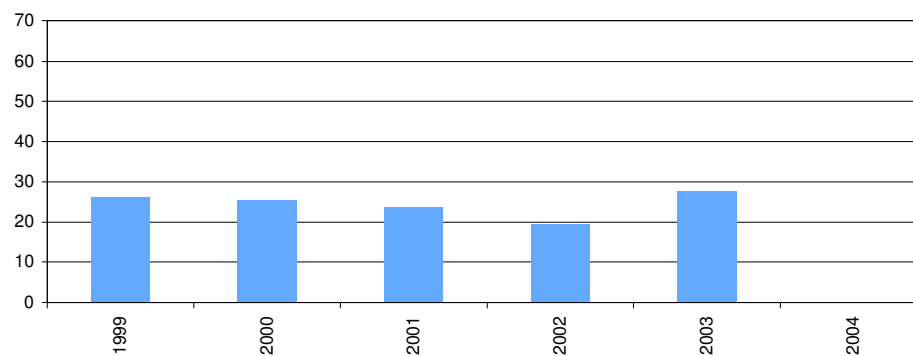
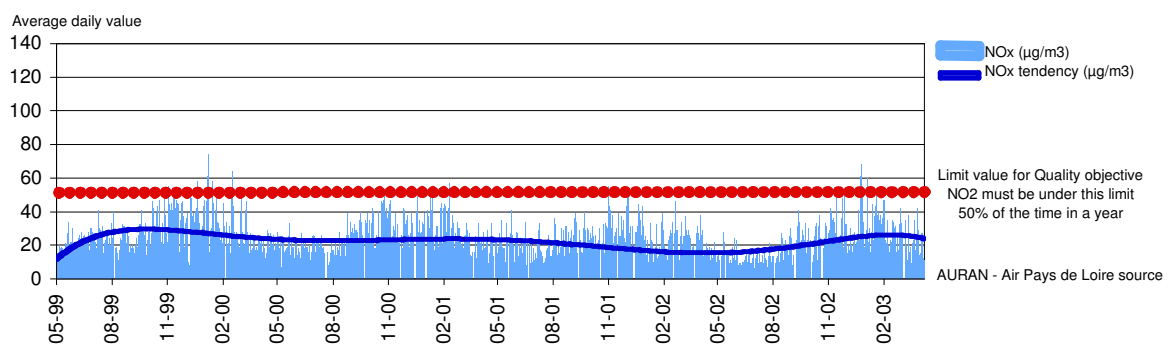




Figure 3.5.2-26 Nitrogen dioxide evolution, Nantes EauX

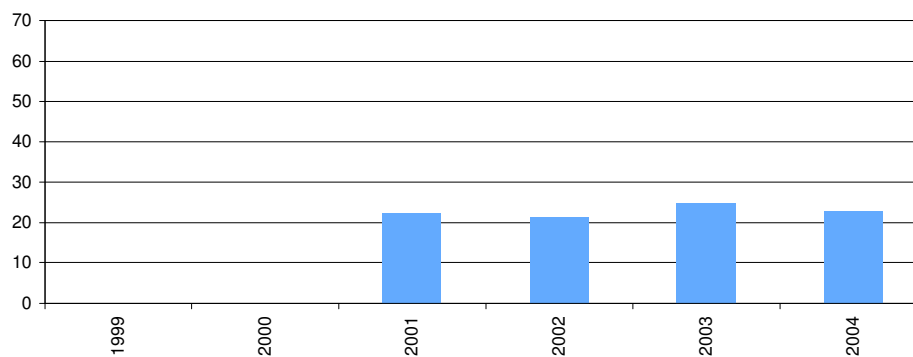
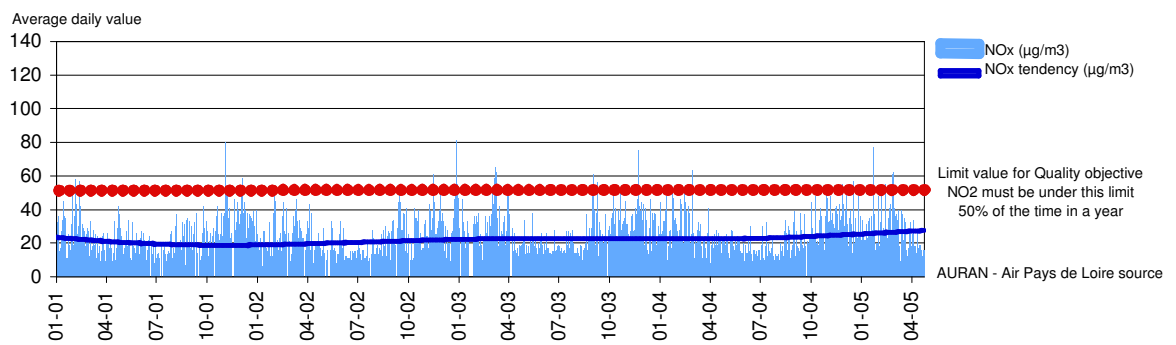




Figure 3.5.2-27 Nitrogen dioxide evolution, Rezé

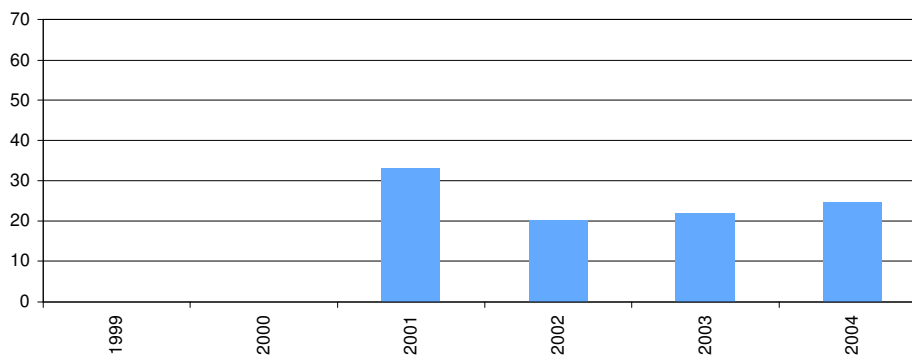
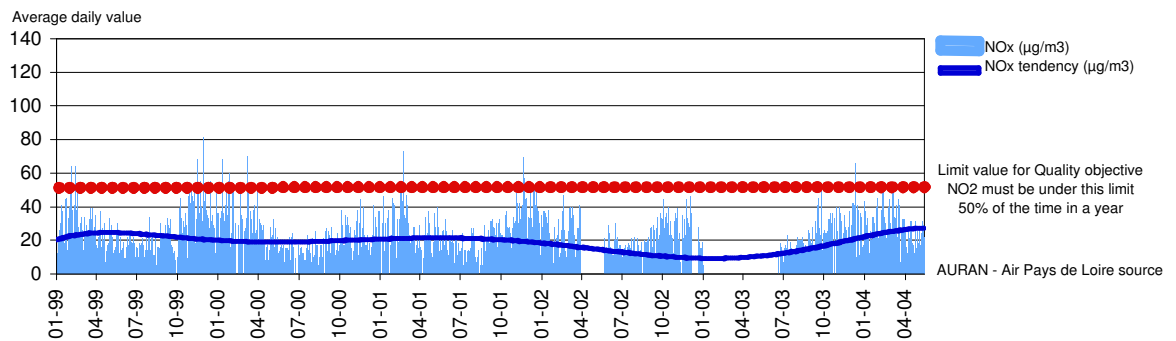




Figure 3.5.2-28 Nitrogen dioxide evolution, Nantes Crébillon

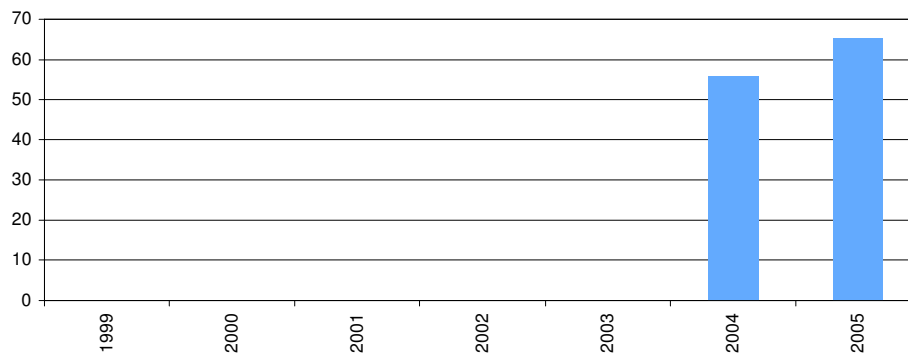
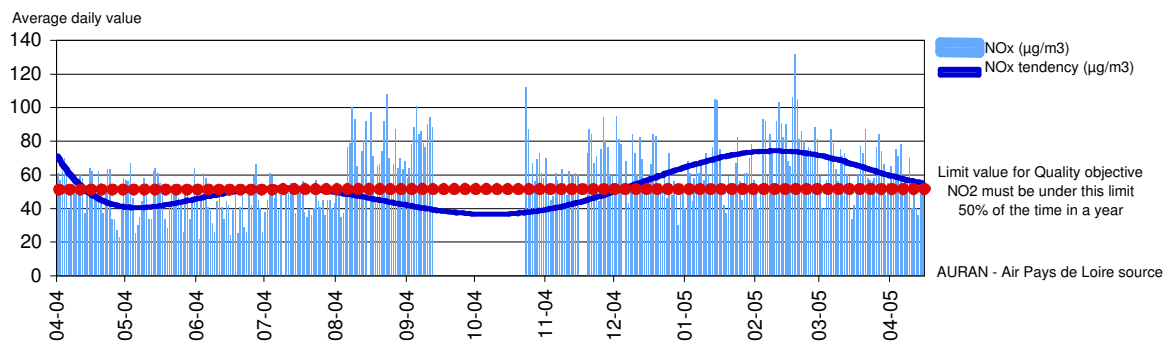




Figure 3.5.2-29 Nitrogen dioxide evolution, Nantes Victor Hugo

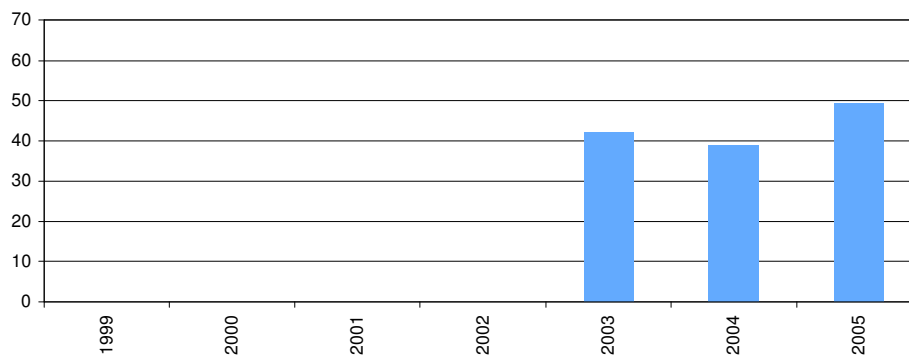
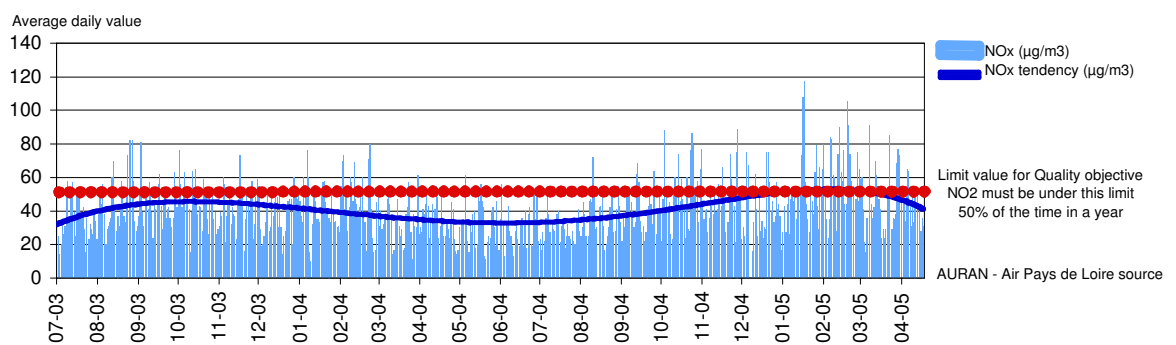




Figure 3.5.2-30 Nitrogen dioxide evolution, Nantes Strasbourg

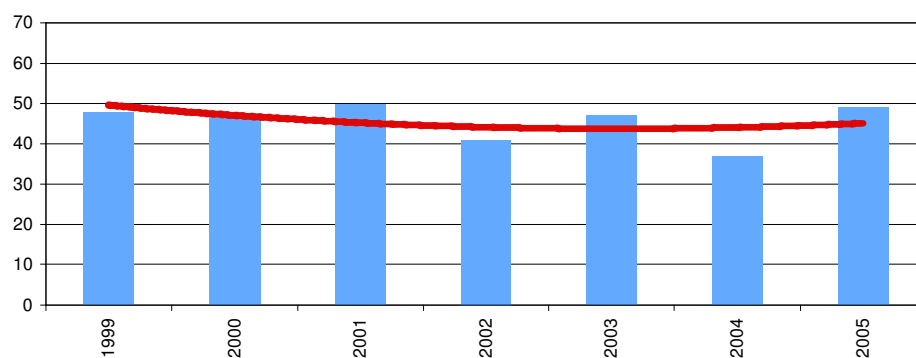
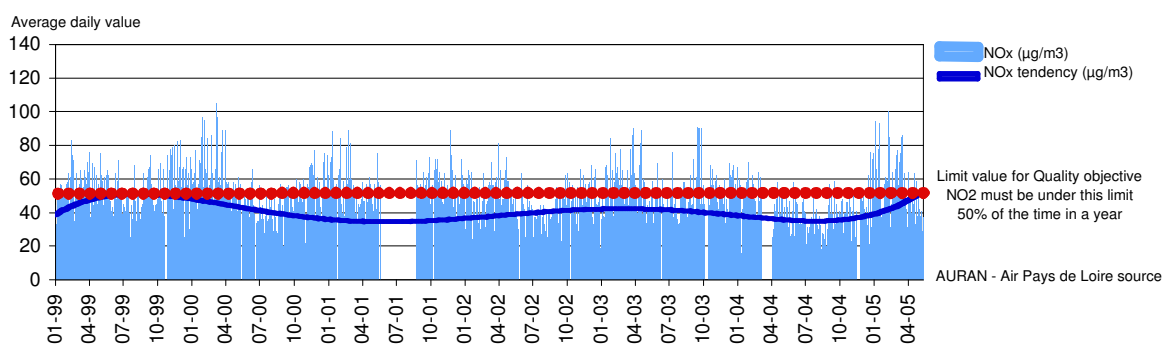
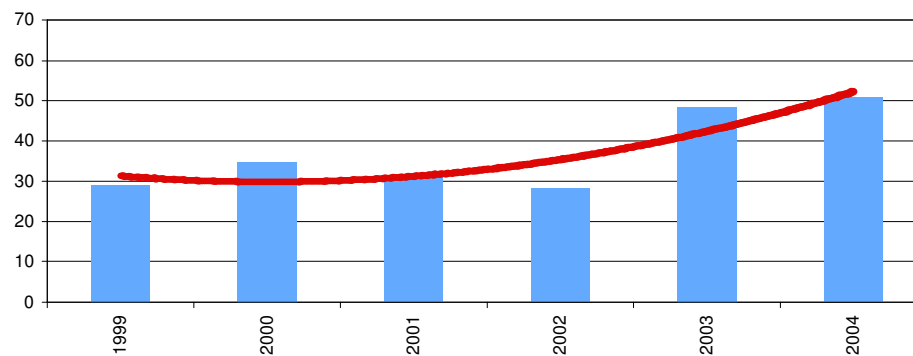
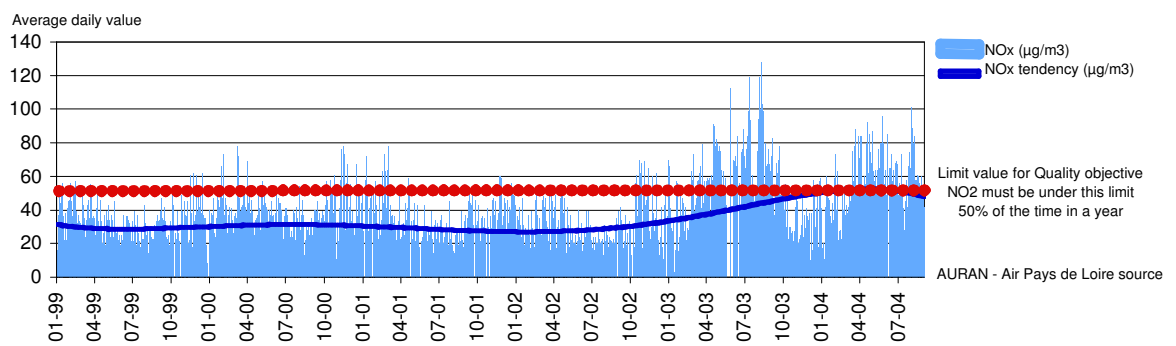




Figure 3.5.2-31 Nitrogen dioxide evolution, Sainte Luce



Nitrogen dioxide – synthesis

At all monitoring stations with NO₂ data, metered values (even peak values) are always clearly under legal limits (hourly average value of 200µg/m³), even for the alert threshold (hourly average value of 400µg/m³).

At “urban” monitoring stations, NO₂ seems to decrease a little on the last five years period. The trend is always under the limit value for the air quality objective, even if NO₂ periodically increases during winter times with some peaks.

At “traffic” monitoring stations in the city centre, the NO₂ trend is always around the limit for the air quality objective.

At the only “suburban” monitoring station, the NO₂ trend was under the limit for air quality objectives, but reached it in the last period. This could be due to the increase of ring road usage and also to the works currently progressing on this road in this area.

Ozone – Data



Figure 3.5.2-32 Ozone evolution, Nantes Jardin

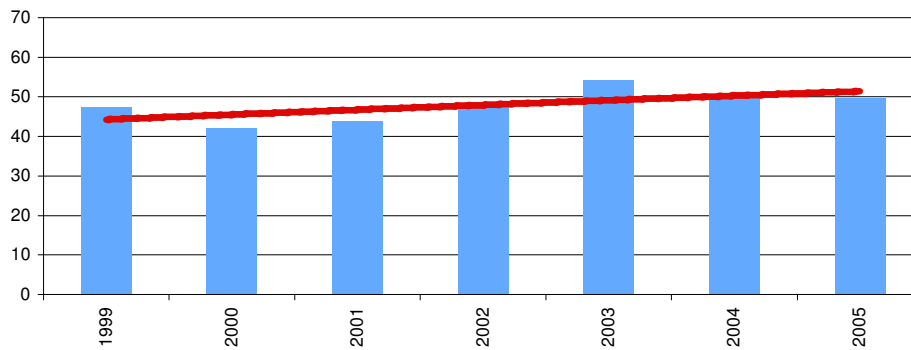
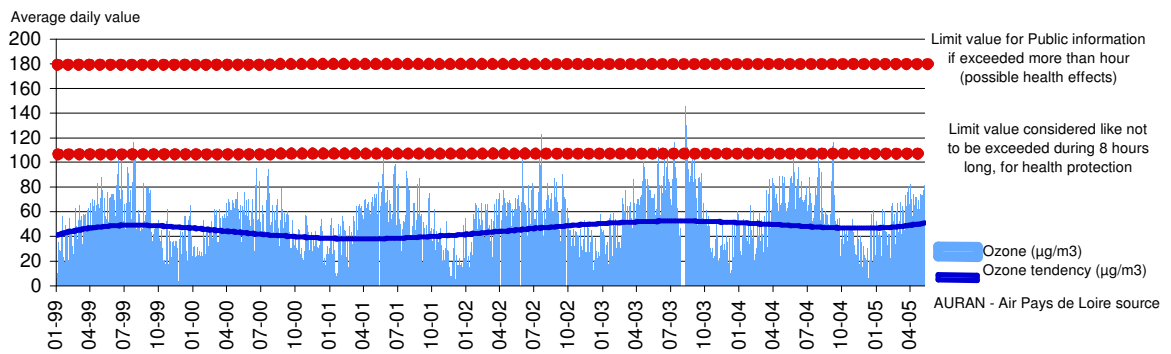




Figure 3.5.2-33 Ozone evolution, Saint Sébastien

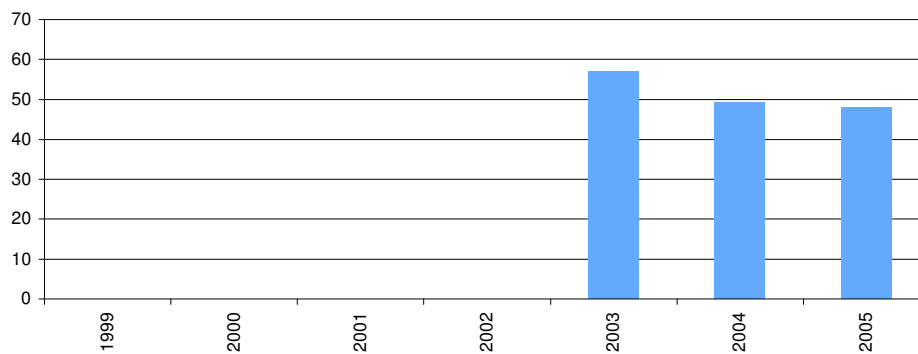
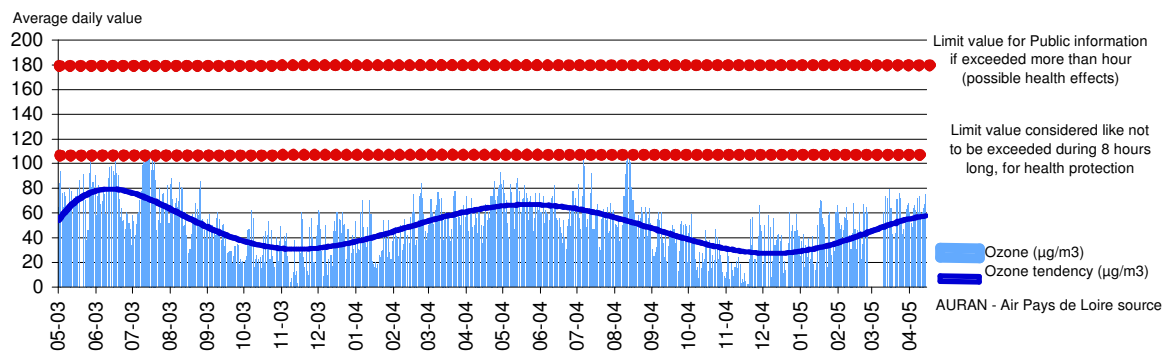




Figure 3.5.2-34 Ozone evolution, Nantes Bellevue

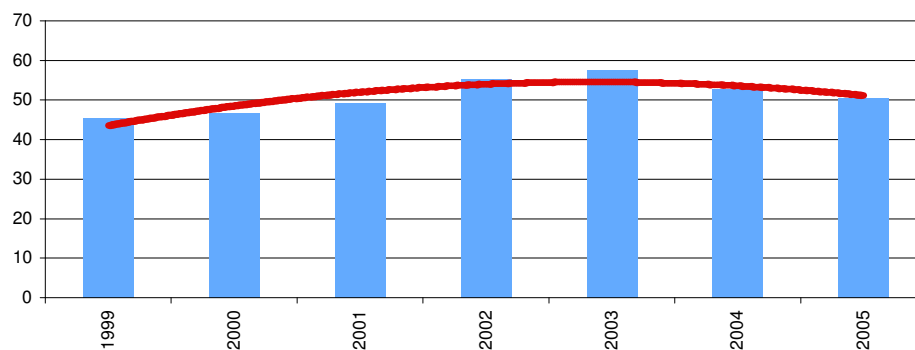
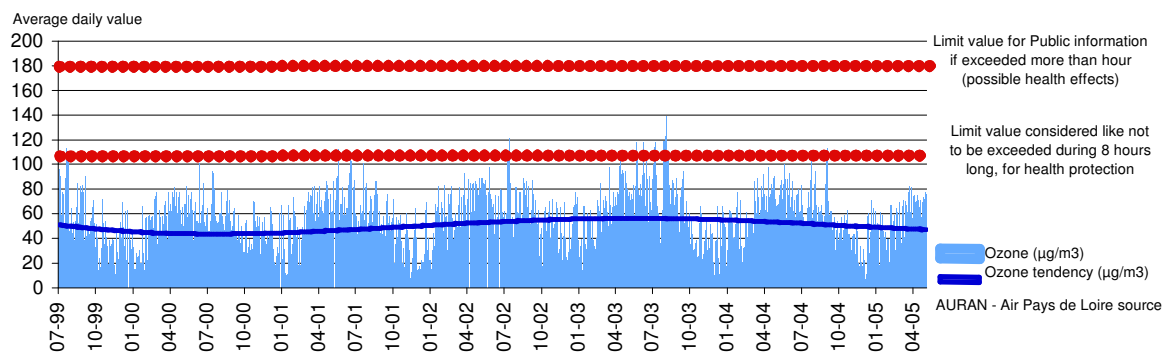




Figure 3.5.2-35 Ozone evolution, Nantes Chauvinière

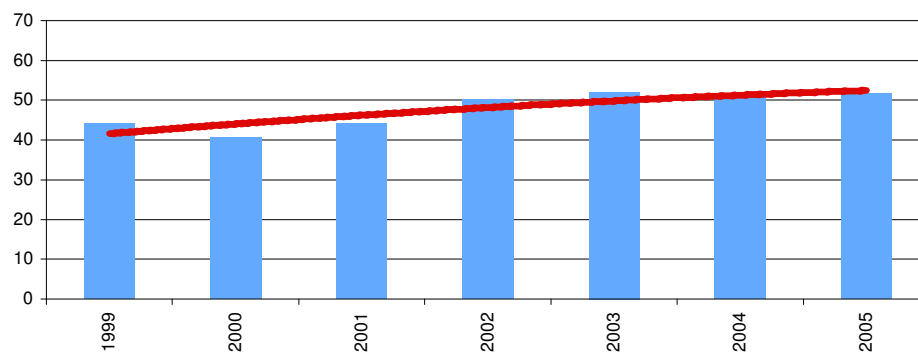
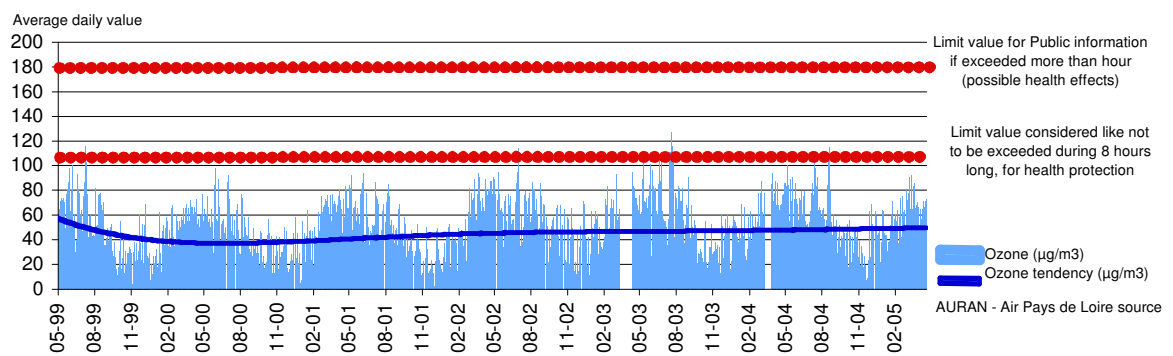




Figure 3.5.2-36 Ozone evolution, Rezé

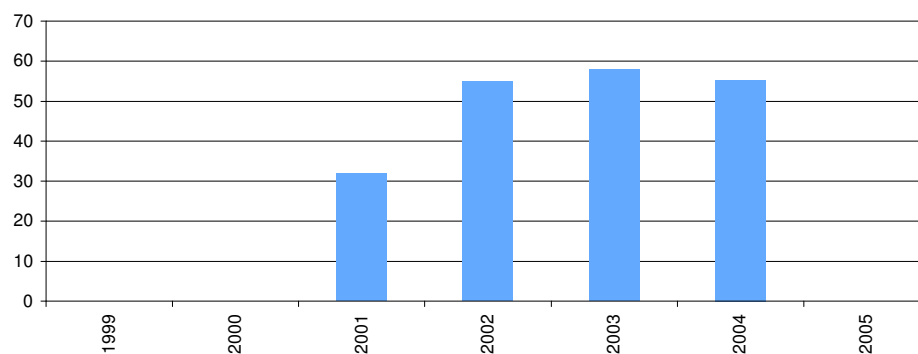
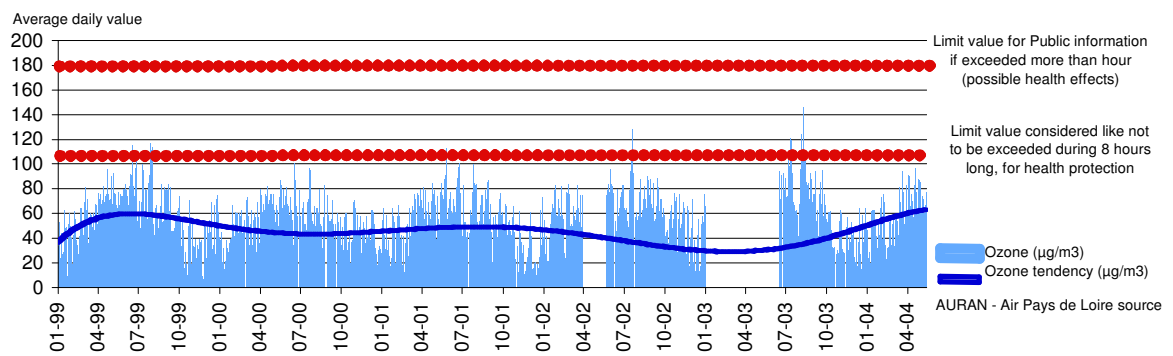
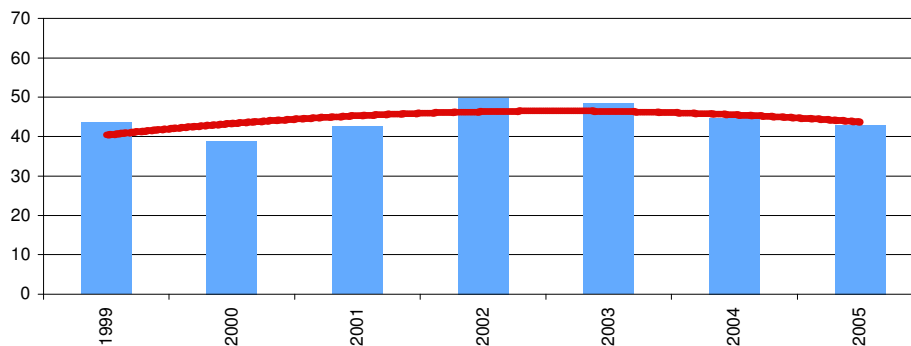
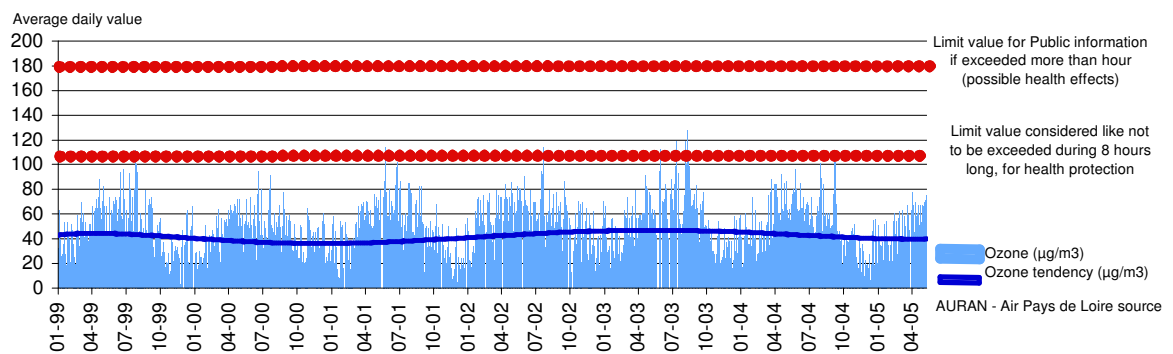




Figure 3.5.2-37 Ozone evolution, Sainte Luce



Ozone – synthesis

At all monitoring stations with ozone data, metered values (even peak values) are always clearly under legal limits (hourly average value of $180\mu\text{g}/\text{m}^3$), even for the alert threshold (hourly average value of $240\mu\text{g}/\text{m}^3$).

At “urban” monitoring stations, O_3 seems to increase a little in the last five years period. The trend is always under the limit for air quality objectives, even if during summer times O_3 periodically increase with some peaks that exceed it.

There are no “traffic” monitoring station, with O_3 available data.

At the only “suburban” monitoring station, the situation is almost the same as in “urban” stations.

Particulates – Data



Figure 3.5.2-38 Particulates evolution, Saint Sébastien

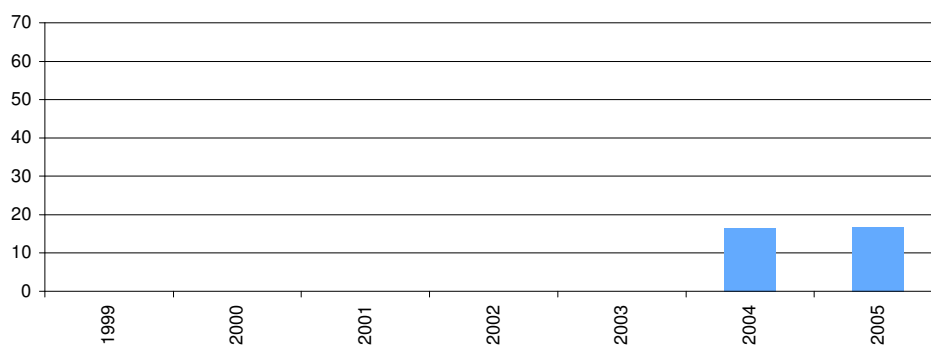
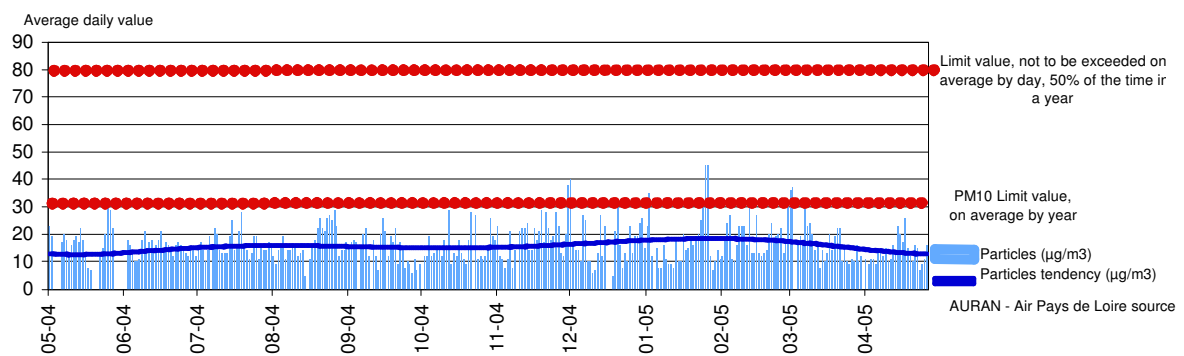




Figure 3.5.2-39 Particulates evolution, Nantes Bellevue

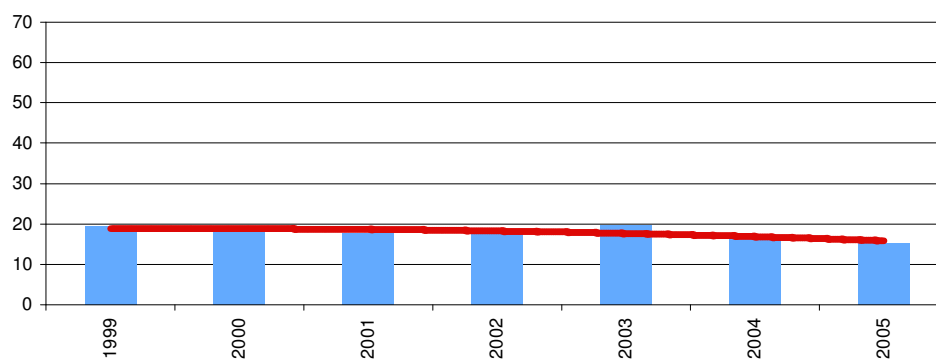
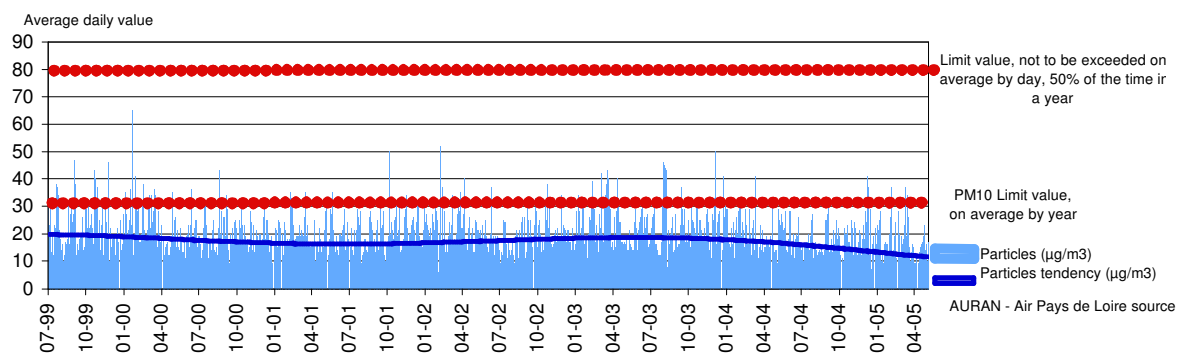




Figure 3.5.2-40 Particulates evolution, Nantes Chauvinière

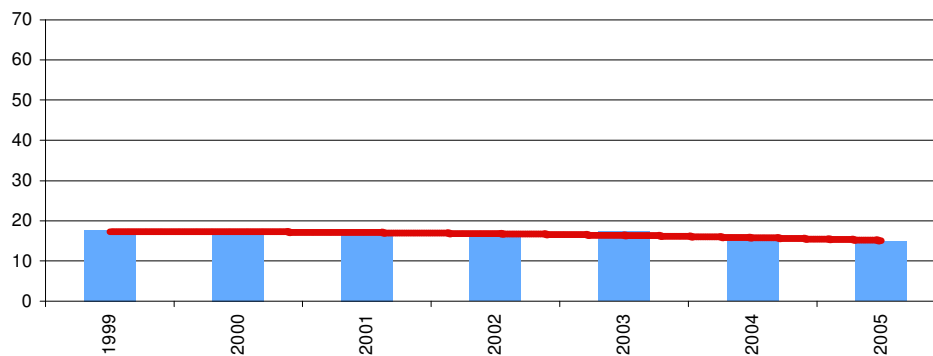
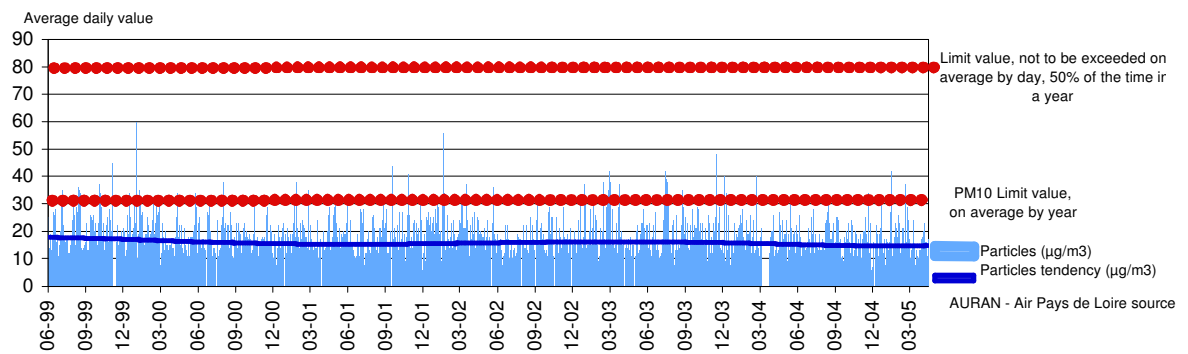




Figure 3.5.2-41 Particulates evolution, Rezé

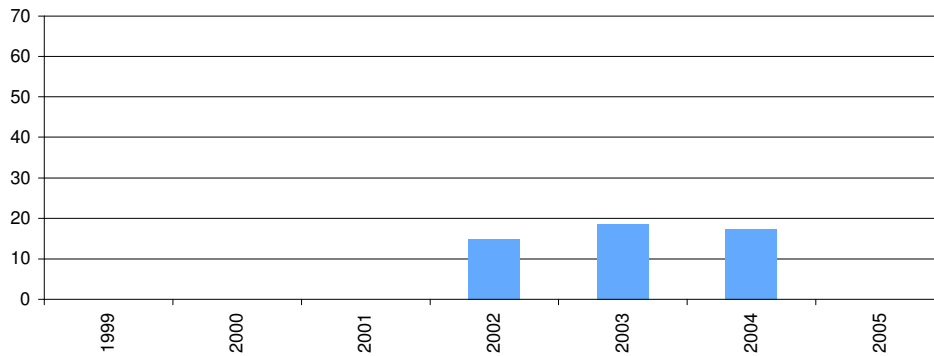
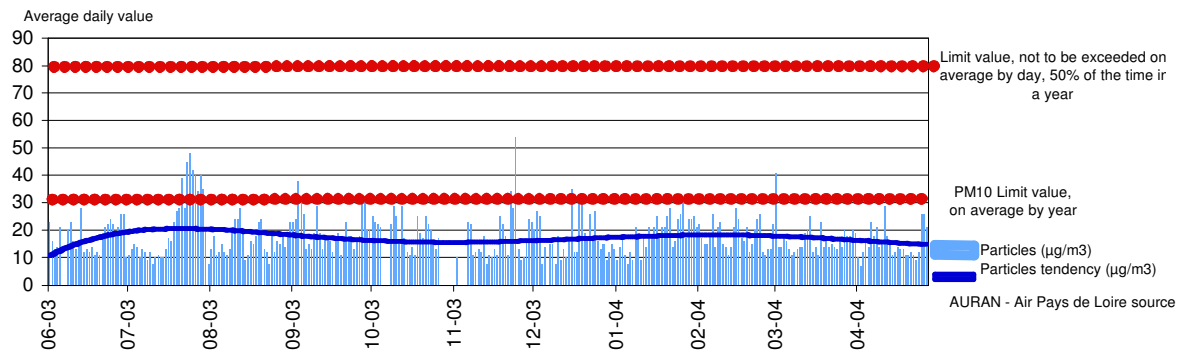




Figure 3.5.2-42 Particulates evolution, Nantes Crébillon

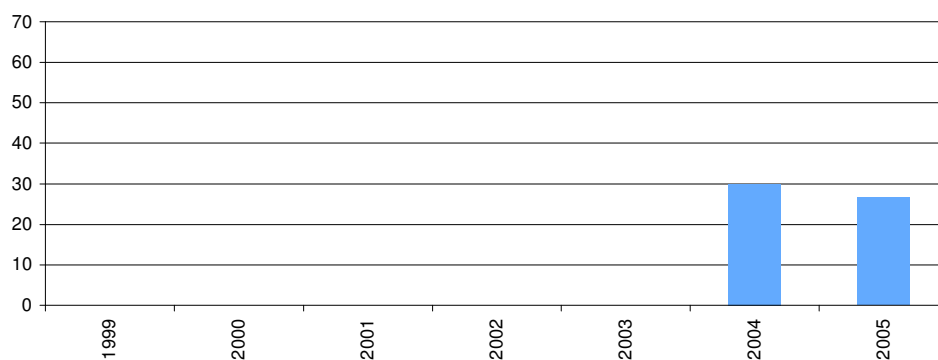
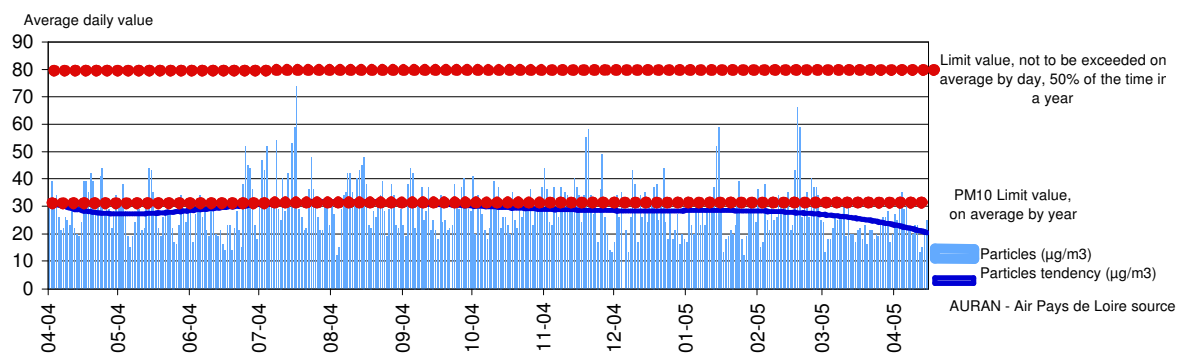
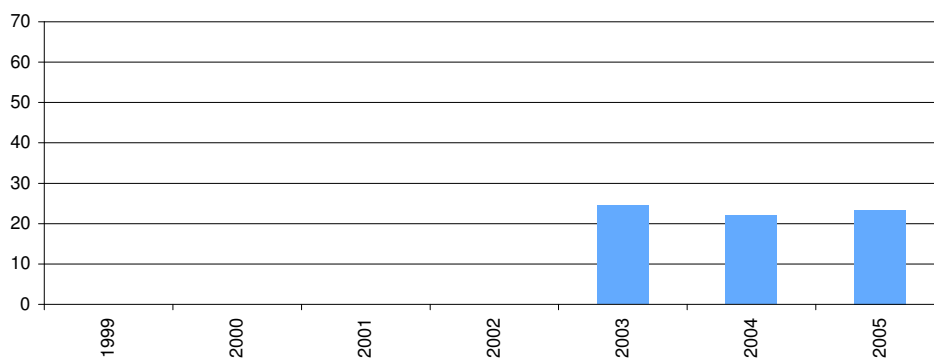
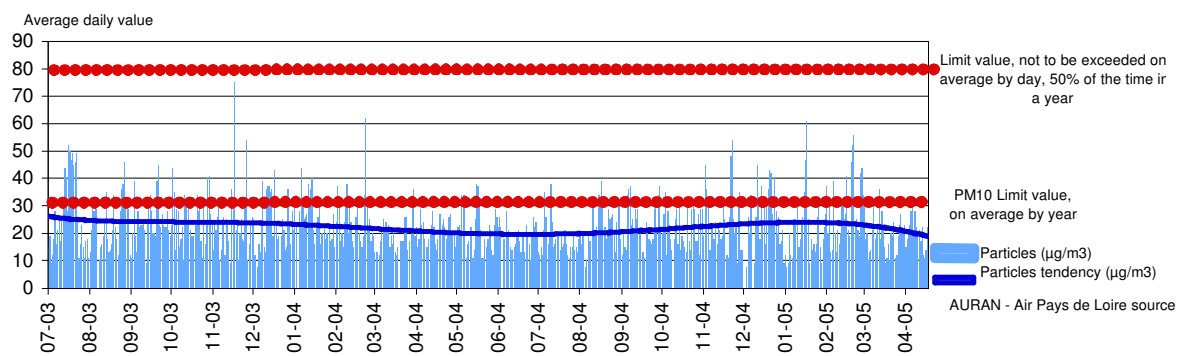




Figure 3.5.2-43 Particulates evolution, Nantes Victor Hugo



Particulates – synthesis

At all monitoring stations with particulates data, metered values (even peak values) are always clearly under legal limits for people's health (half time annual average value of $80\mu\text{g}/\text{m}^3$).

At “urban” monitoring stations, particulates seem to decrease a little in the last five year period. The trend is always under the limit for air quality objectives.

At “traffic” monitoring stations in the city centre, the particulates trend is around the limit for air quality objectives.

No particulates data are available at the only “suburban” monitoring station.

Carbon monoxide – Data



Figure 3.5.2-44 Carbon monoxide evolution, Nantes Porte de Carquefou

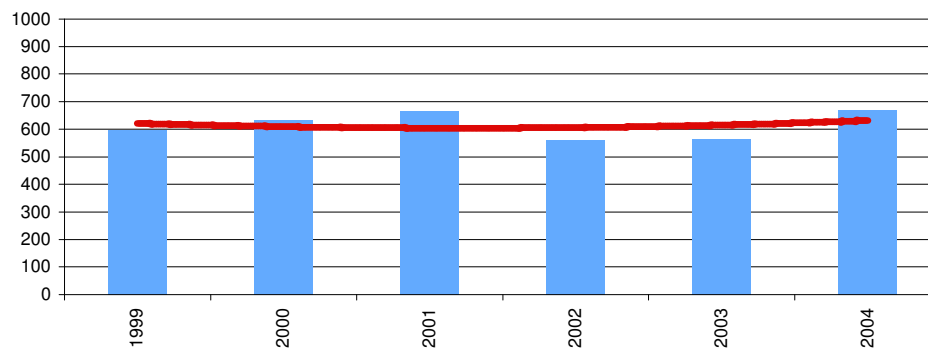
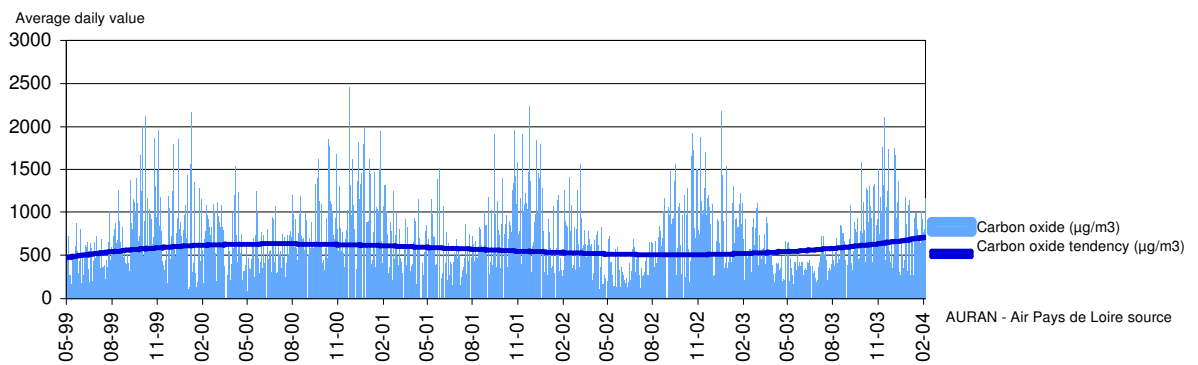




Figure 3.5.2-45 Carbon monoxide evolution, Nantes Crébillion

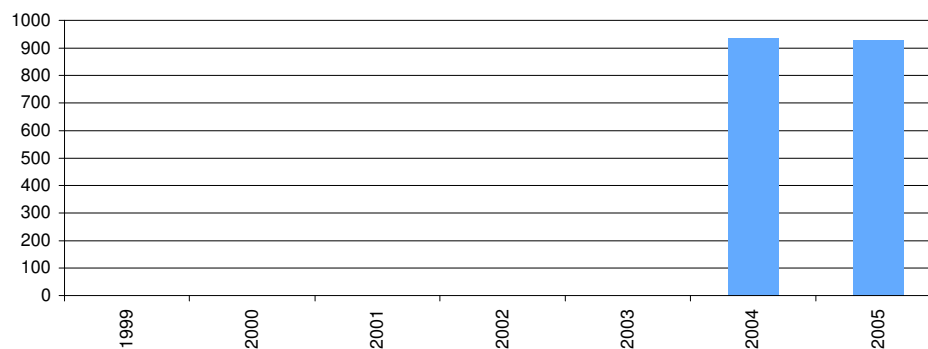
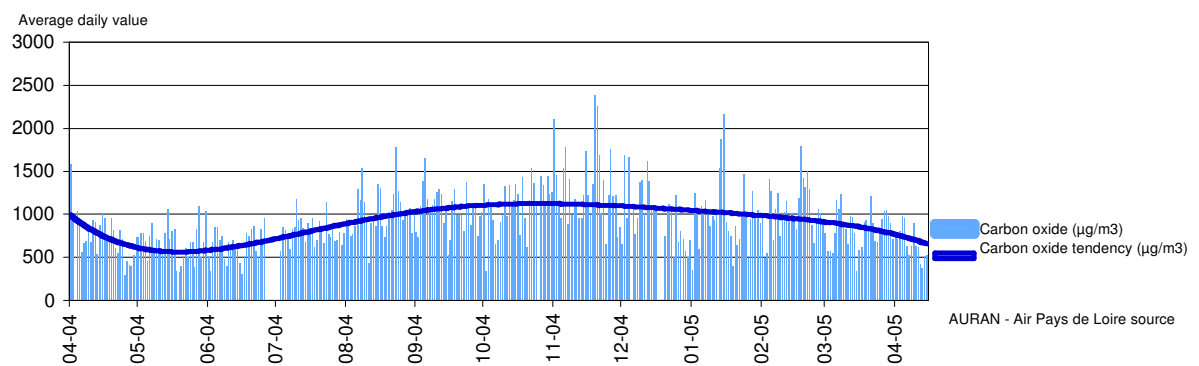




Figure 3.5.2-46 Carbon monoxide evolution, Nantes Strasbourg

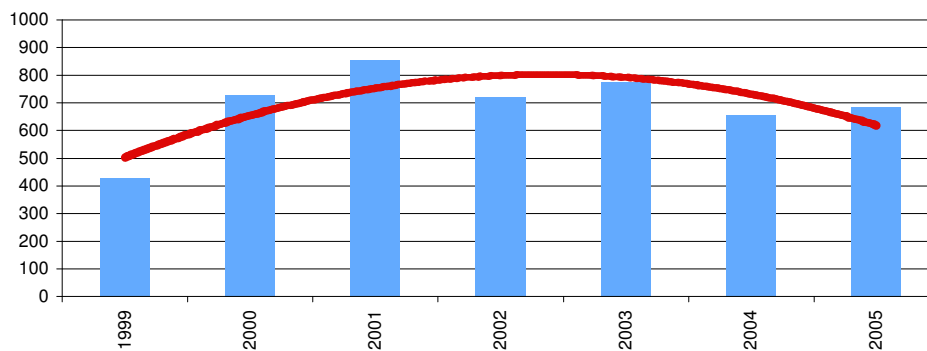
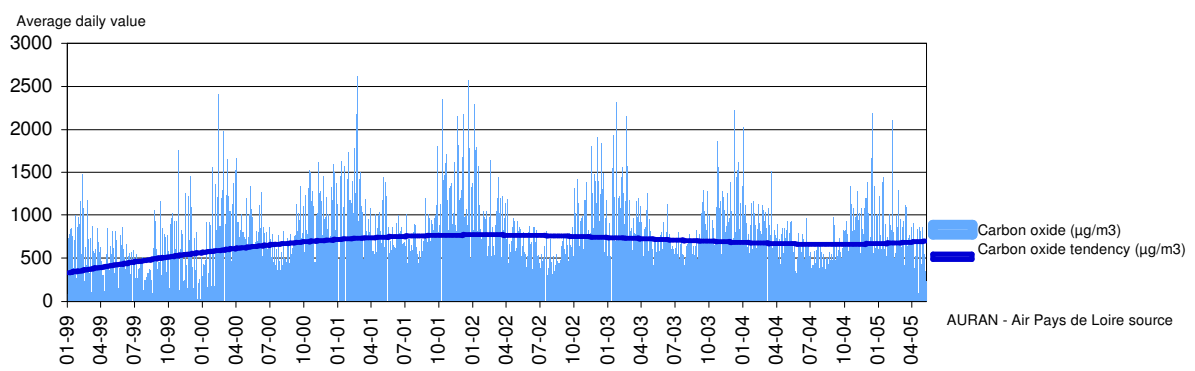
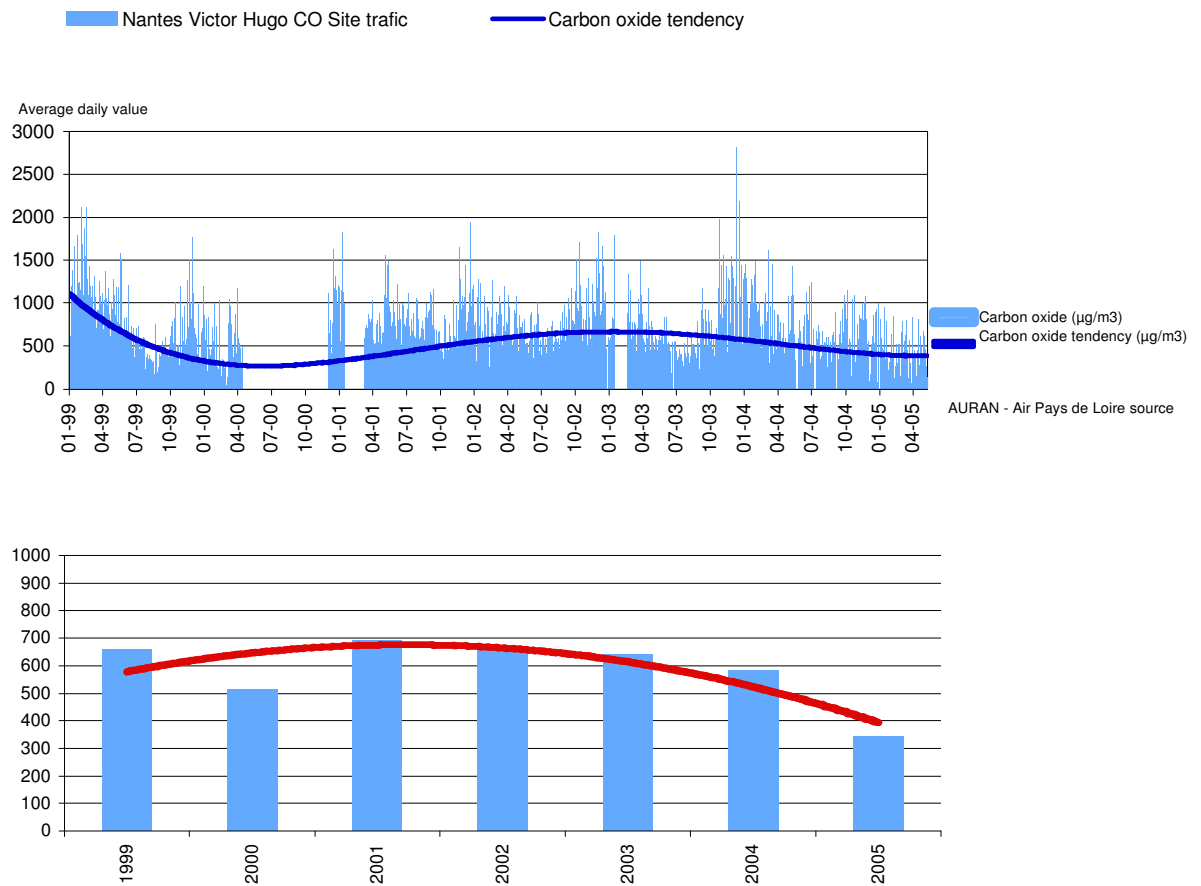




Figure 3.5.2-47 Carbon monoxide evolution, Nantes Victor Hugo



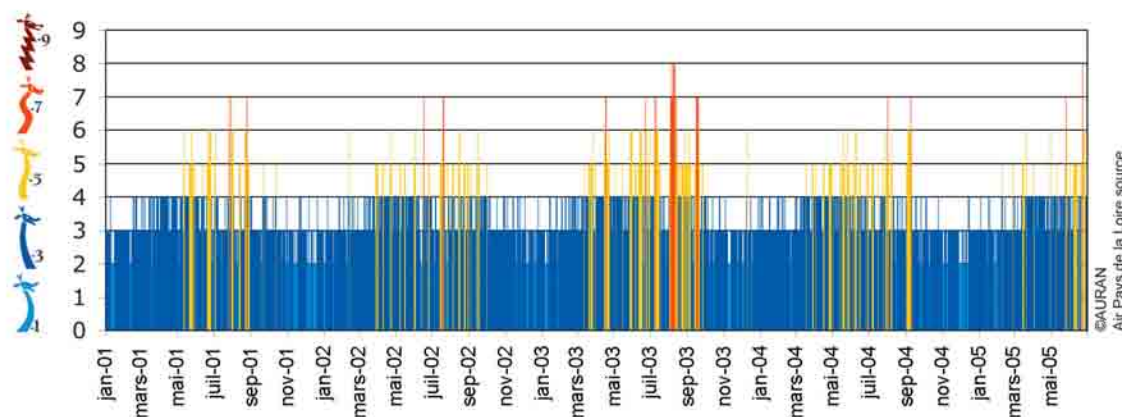
Carbon monoxide – synthesis

At all monitoring stations with CO₂ data, which all are “traffic” stations, metered values (even peak values) are always clearly under legal limits (8 hours average value of 10 000µg/m³).

3.5.2.4.2 Air Quality Synthesis

The analysis of air quality in Nantes is summarized in a global indicator, integrating all the pollutants seen above. It is called “Atmo indicator” and is transmitted each day by “Air Pays de la Loire” on radios, television and newspapers. Air quality is given on 1 to 10 scale: 1 to 2 very good quality, 3 to 4 good quality, 5 to 6 medium quality, 7 poor quality, 8 to 9 bad quality and 10 very bad quality.

Figure 3.5.2-48 : Atmo air quality indicator



During VIVALDI, the Atmo air quality indicator has not really changed, it is very good or good most of the time. Medium or poor air quality appears in summertime because of ozone production with higher temperatures. But air quality in Nantes is never bad or very bad. The worst period for air quality in Nantes was during summer 2003, because it was a very hot summer with very high temperatures and a high ozone production.

The impact of VIVALDI measures on the global air quality could be estimated on a long period when urban traffic modifications will be effective. But the analysis above suggests that there is not a bad trend for air quality in Nantes.

The impacts of VIVALDI measures concerning the bus fleet reinforce this analysis. The pollutants balance for the TAN fleet after VIVALDI measures is:

• Green House Gas:	23,053 metric tons
• Carbon monoxide:	49.44 metric tons
• Non-Methanic Hydrocarbons:	11.63 metric tons
• Nitrogen oxides:	307.42 metric tons
• Particles:	3.24 metric tons
• Global pollutants social cost	3,816 K€

A comparison with the “Do nothing scenario” gives:

- Green House Gas: + 8.5%
- Carbon monoxide: - 5.1%
- Non-Methanic Hydrocarbons: - 27.1%
- Nitrogen oxides: - 23.3%
- Particles: - 41.9%
- Global pollutants social cost - 23.7%

All parameters are decreasing, except greenhouse gases. But this point is counter-balanced by the reduction of greenhouse gases obtained by the modal transfer of car drivers to PT. It could also be noticed that TAN bus fleet greenhouse gases emissions represent only 3% of the total produced by the transport sector in Nantes.

4 PROJECT RESULTS

Table 5-1 below contains the VIVALDI demonstration objectives that were set for the project. These targets were designed to assess the results of the project against the CIVITAS themes. This report has contained a detailed account of the results that have been achieved over the timescale of the VIVALDI project. This task has been a major achievement over a relatively short period of time as some measures have only recently been implemented.

As can be seen in the table below many of the achieved measures reached and often exceeded the headline targets set out at the beginning of the project. Within the framework of the CIVITAS policy fields, results include the following;

- Clean vehicles – The total number of clean vehicles achieved across all VIVALDI cities is 709. The headline target was to implement 250.
- Access management – Aalborg managed to make €1,000 a day savings by implementing bus priority measures.
- Pricing Strategies – Bristol has reduced car trips by 10% in the area through the TravelSmart initiative. The headline target was for a 5% reduction
- Stimulation of collective modes – Through the implementation of the Chronobus measure Nantes has managed to decrease journey times by up to 11 minutes. The headline target was for a 15% decrease
- New forms of vehicle use and ownership – During the VIVALDI project Bremen has managed to install 9 new car sharing locations. The headline target was 5 new locations
- Goods distribution – Bristol has achieved a 50% mileage reduction to participating retailers through the consolidation centre. The headline target was for lorry movements to be reduced by 5%
- Soft measures – In Nantes there are now 16 companies with 16,000 employees who participate in the travel plan measure.
- Telematics – There are now 32% more enquiries in the Bremen ITIC.

The evaluation results in this report show that the majority of the local project targets have been met. The local targets were used to set the overall VIVALDI project targets in Table 5-1. Some targets are easily measured, for example, the project has exceeded its target of introducing 250 Clean Vehicles by 318 vehicles, which equates to a 184% increase. The majority of the other targets set cannot simply be summarised across the demonstration sites to give a total project percentage change, as the detailed results need to be considered in their local context.

Table 5-1 VIVALDI demonstration objectives

CIVITAS Field	Headline Targets	VIVALDI Achievements
Clean Vehicles	VT1. 250 Clean Vehicles across the sites VT2. Reduce energy use and CO ₂ by 8% in demonstration area VT3. Meet national air quality objectives	304 CNG cars in Bremen, 214 various in Bristol, and 191 CNG buses in Nantes 1% reduction in total fuel use Aalborg, 2,000t CO ₂ saving from CNG buses (Nantes) 50% reduction in NO _x in city centre of Kaunas
Access management	VT4. Reduce car traffic in managed area by 10% VT5. Increase economic activity in area by 5% VT6. Increase employment opportunities by 5% VT7. Reduce parking space in area by 10%	10% reduction through TravelSmart (Bristol), 40% reduction on RN801 (Nantes) Up to 1,000 Euros daily savings from bus priority in Aalborg Too difficult to measure as direct result of project 300 places removed on Nantes campus
Pricing strategies	VT8. Reduce mode share for cars by 5%	10% reduction in car trips through TravelSmart (Bristol)
Stimulation of collective modes	VT9. Increase patronage on key corridors by 20% VT10. Increase access to PT system VT11. Reduce transit time from peri-urban areas to centre by 15% VT12. To obtain a modal shift for students in the Nantes demonstration zones doubling the use of public transport and two wheelers.	11% increase on Showcase (Bristol), 7% increase on Chronobus (Nantes) 80% thought accessibility of new 500 service in Bristol improved 4% time savings in Aalborg, 7-11 minute savings on Nantes Chronobus Students using cars to campus from 22% to 17%, and 311 Vélocampus rentals
New forms of vehicle use and ownership	VT13. Increase number of car share sites by 5 VT14. All new car share sites with clean vehicles VT15. Regain urban space by replacing about 1000 private cars	7 more in Aalborg, 9 in Bremen, and 8 in Bristol 2 dual-fuel vehicles introduced in Bristol 313 cars removed in Bremen, 70 in Bristol
Goods distribution	VT16. Reduce lorry movements by 5% VT17. Reduce lorry loading and access times by 10%	50% mileage reduction to participating retailers through consolidation (Bristol) 100% satisfaction ratings with deliveries
Soft measures	VT18. Increase cycle trips by 30% VT19. Increase walking trips by 10% VT20. Travel plans in all organisation in target areas VT21. Decrease road accidents by 20%	30% increase through TravelSmart (Bristol) 15% increase through TravelSmart (Bristol) 16 companies with 16,000 employees active in Nantes 55% improvement of perception of safety in Bristol Home Zone
Telematics	VT22. Real time information on all quality corridors VT23. Increase number accessing PT information by 50% VT24. Electronic payment 40% of all fares VT25. 100% increase in DRTS trips	RTI on Showcase bus stops and Internet (Bristol) 24,000 monthly hits on Aalborg info kiosks, 32% more enquiries in Bremen ITIC BOB card (Bremen) resulted in 6% modal shift, 45% support for e-ticketing (Kaunas) 145% increase in use in new service area in Bristol

5 CONCLUSIONS

The evaluation of the VIVALDI project has provided European cities with information on the likely results that can be achieved when implementing integrated packages of sustainable urban transport measures.

The project has in many cases provided long-term assessments of the introduction of a variety of innovative measures and has also highlighted some of the implementation difficulties and unexpected results that have been achieved for some measures. This process has stressed the importance of a full and continued assessment of the majority of the demonstrations implemented. It is recommended that data collection and analysis is continued over the lifetime of many of the measures to identify the sustained effects of the measure and to identify whether the measure is continuing to meet its objectives and/or identify areas/opportunities for improvement in the future.

Having said this however, a large number of the measures described above have been subjected to long-term evaluation from which meaningful results and conclusions can be drawn. These key conclusions are given below, grouped at a cross-site level but broken down by workpackage.

Clean & Efficient Vehicles

Bremen is very keen on sourcing a number of CNG trucks for use in the City Logistic scheme, as the modelled results on emissions improvements are very impressive. There appears to be a role for the European Commission in encouraging the vehicle industry to develop more of these models and standardise acceptance methodologies across the EU to encourage uptake. Together with other CIVITAS cities, Bremen also plans to take up the issue at a European level, including through the PAC.

The Bremen CNG car fleet has decreased energy use and emissions. Compared to a fleet made up of 60% petrol and 40% diesel cars, the CO₂ reduction amounts to 99,817 kg, which is -17%. The reduction for NO_x is 501 kg (-61%) and for PM₁₀ 34 kg (-98%).

In terms of vehicle emissions in Bristol, the retrofitting of diesel buses with particulate traps led to a reduction in particulate matter (PM), which is important for local air quality. There was a slight penalty in terms of increased fuel consumption and therefore CO₂ emission. The buses fitted solely with oxidation catalysts did not appear to suffer a fuel penalty, but did not remove as many pollutants (in particular PM) from the bus exhaust emissions.

In Bristol the emission reduction benefits of LPG vehicles, were significant for NO_x, which showed a 75% reduction. This is important for local air quality. An increase in fuel consumption meant that there was a very slight penalty by way of increased CO₂ emissions. The lower cost of LPG meant that savings were made on fuel costs.

The G-Wiz electric cars show some admirable cost and emissions savings. Not only are emissions zero at point of use, but total life-cycle emissions are significantly lower on all counts compared to a diesel equivalent vehicle. Fuel costs were extremely low for this vehicle, roughly half that of the hybrid petrol-electric. Due to its increased fuel efficiency over a normal petrol car, Bristol's petrol-electric hybrid is estimated to have proportionately lower emissions of all pollutants. Fuel used and therefore fuel costs

were lower than the comparable petrol car. Problems encountered with new CNG buses in Nantes are under manufacturer's guarantee, and the first thirty GX217 bought between 1998 and 2000 give an appreciation of CNG vehicle maintenance. It seems a little bit more expensive than for diesel, but this is likely to change over time.

New CNG buses have permitted the reduction of pollutant emissions of the fleet, especially for non-methane hydrocarbons, nitrogen oxides, and particulates. Greenhouse gas emission growth has been compensated by the observed modal shift away from car traffic. Surveys show that of the new customers of CNG bus, 5% previously travelled by car. From an environmental point of view, if it is assumed that an average journey for former car users were about 5km, with a CO₂ emission of around 140g/km, there is a saving of 1,918 tons of greenhouse gases between 2001 and 2004.

Access Management

The Bus Lane Enforcement trial in Bristol set out to test the available technology to identify issues and potential problems that could occur in a more extensive trial or full implementation. The trial did not set out to be a fully functioning system where no problems occurred. To this degree the trial can be regarded as a great success. Many issues and problems were identified and discussed; however, it is with this information that further development work can be carried out and potential issues can be predicted.

The remodelling of RN801 in the southeast of Nantes and the implementation of the BusWay, with its Park and Ride site, is still being carried out. However, some effects of the implementation of the project can already be seen: traffic restrictions on RN801, combined with a new PT offer, have led to a decrease in car traffic during rush hours and increased PT use.

Several aspects of the Bristol Home Zone make it a good model for future work in other cities. The community involvement process has helped to demonstrate the positive impact that residents can have on local transport projects and the enthusiasm they have for helping to improve their local environment and strengthen local identity. The project has also shown that streets can be designed with non-conventional features without comprising safety. The new layouts create a unique environment that not only keeps cars moving slowly but also gives equal priority to motor vehicles, cyclists, and pedestrians. The pilot use of Sustainable Urban Drainage (SUDS) in the Home Zone is now going to be actively encouraged for future developments within Bristol.

The new layouts on the Nantes Tertre University campus site have renewed the quality of public spaces. It has permitted an improvement of accessibility to all buildings, and ensures a comfortable link with the two stations of the tramline 2, and with the bus stops on site.

Pricing Strategies

Bremen's BOB ticket has been a highly successful development that will be continued. The number of new subscribers has continued to climb at an impressive rate, encouraging the use of public transport for irregular journeys, mainly by residents close to the city centre.

Stimulation of Collective Modes

The shift from bus to light rail in suburban regions in Bremen is likely to be an efficient means of improving the public transport system, so that it can compete better with private car usage and contribute to the development of the area. Despite the high investment costs, a positive effect can be expected in the long run, as patronage increases and the operation of PT gets cheaper. Despite such major projects producing negative reactions from some residents the experiences especially of the extension of tramline 4 show that the majority of the affected population is in favour of tram projects. However, the public debate about the tram, and the consideration of informal and formal participation activities are essential. The arguments of opponents must be taken very seriously and it is the task of the operator to deliver comprehensive information about the process and targets of the project.

Bristol P&R evaluation results have shown that there has been a high increase in the number of passengers using the P&R services over the VIVALDI project timescale. On-bus surveys have shown that passengers value the information services provided and feel that the use of clean-fuelled vehicles is important

Kaunas public transport routes have been managed in such a way that they more closely reflect passenger usage. There is also now a clear line of feedback from the passenger to the transport division at the city municipality and this aids the monitoring and evaluation of the PIKAS management system. Passengers would like to see more of the newer buses on popular routes – something that is planned with the purchase of further SOLARIS buses in 2006.

Although Kaunas residents generally like the layout of public transport routes, and consider the provision of stops and information to be convenient, Kaunas City Administration is continuously improving the access to information. For 2006, a major promotional campaign to target specific groups of users is planned – based on much of the research produced – which will lead towards increased campaigning and identification of most relevant means of information to different target groups

The implementation of the new Nantes waterbus service, Navibus, has enabled the layout between the campus and the waterbus station to be improved and reinforced the link over the Erdre River towards the east bank neighbourhoods

Increasing PT use from 20% to 30% and decreasing the car share from 65% to 50% for Nantes Métropole employees must be continued with ongoing activities. However, the results obtained by Nantes City show that the aim is obtainable. If the implementation of the Orvault-Molière interchange point in Nantes with its Park and Ride site is successful, this will be because enlargement of the site to include shopping functions has worked: there is a link with the shop CONFORAMA, an example of Private-Public Partnership.

New Forms of Vehicle Use & Ownership

To extend the Bremen car sharing service to the suburban region is one of the potential growth paths for car sharing organisations. A focus group discussion in September 2005 decided that demand for car sharing is too low from a business point of view in the suburban region. The Car sharing operator states it is more worthwhile to compete with

other car sharing organisations in residential areas of other big cities, than to provide a service in the suburban region.

Since the Bristol City Car Club's re-launch in 2002, membership has exceeded the original target and the advent of on-street parking has been advantageous to the club as vehicles are situated more conveniently for members and have greater visibility.

At the end of the VIVALDI project, the car sharing scheme in Aalborg will continue. The scheme has been increasing since its launch two years ago, and the 7 existing car sharing sites around Aalborg may be up-scaled to include a few more. The measure will also be further integrated with future projects with the aim of improving the environment in the urban areas.

Good Distribution

The Freight Consolidation scheme in Bristol has had a very high beneficial affect in reducing goods vehicle distances in Bristol city centre and a consequent reduction in air pollution. All members of the scheme have reported favourably on the service received, and the numbers have continued to grow. The consolidation centre is to be maintained after VIVALDI, in association with an expansion to the Broadmead shopping area. Value added services are being added to the scheme, including the collection of recyclable materials, and the scheme is progressing towards financial self-sufficiency.

The results for the Community Delivery Points and Home Shopping trials in Bristol have shown that there has been a reduction in car trips as a result of the two schemes. In addition, both schemes, in particular the Home Shopping trial, have provided social benefits to the end users.

Soft Measures

Community Travel Workers in Bristol have been an integral and vital component of the Dings Home Zone and the subsequent success of its implementation. The involvement of a trusted independent third party enabled strong lines of communication to form between residents and all partners involved in the project. This measure provides a good model for how difficult decisions relating to local transport issues can be resolved through a meaningful consultation process. The use of CTWs has provided a valuable model that could be employed in future major schemes, particularly those which are likely to be innovative or contentious.

The Bristol TravelSmart programme successfully achieved shifts towards more sustainable modes of transport without significantly altering journey times or distances. The TravelSmart method, previously successfully applied in other parts of Europe, has now been successfully applied in the UK and proves the versatility of the method across different regions. The four local authorities in the Greater Bristol area are preparing a 'Smarter Choices' strategy within which an ongoing programme of Individualised Travel Marketing is likely to be a significant element.

Telematics

When the VIVALDI project finishes, the telematics measures in Aalborg will continue. Moreover, it is decided that RTPI should be implemented in other parts of the city to improve the service level in the remaining part of the PT route network. The measure

will be further integrated with future projects to improve the environment in the urban area.

The Bristol Travel Information Centre is in a high profile location and is attracting a large number of users. Both the First staff and the Tourist Information staff based at the centre are dealing with a large number of travel enquiries, mainly related to public transport information. A survey has shown that this information is important in planning new journeys and has been influential in determining the form of transport that users intended to use.

The growing number of users of the Bristol cycling or walking trip planners suggests that the Inter modal Trip Planner continues to be a useful resource. In particular, the ITP is commonly used for planning short trips into and from the city centre, and other local centres.

BSAG continuously collected data about the transactions in the Bremen ITIC, recording products that have been sold. Compared to the old information centre, the amount of tickets sold clearly decreased in the new ITIC, in line with the results of the user surveys; visitors mainly come to the ITIC because they want advice.