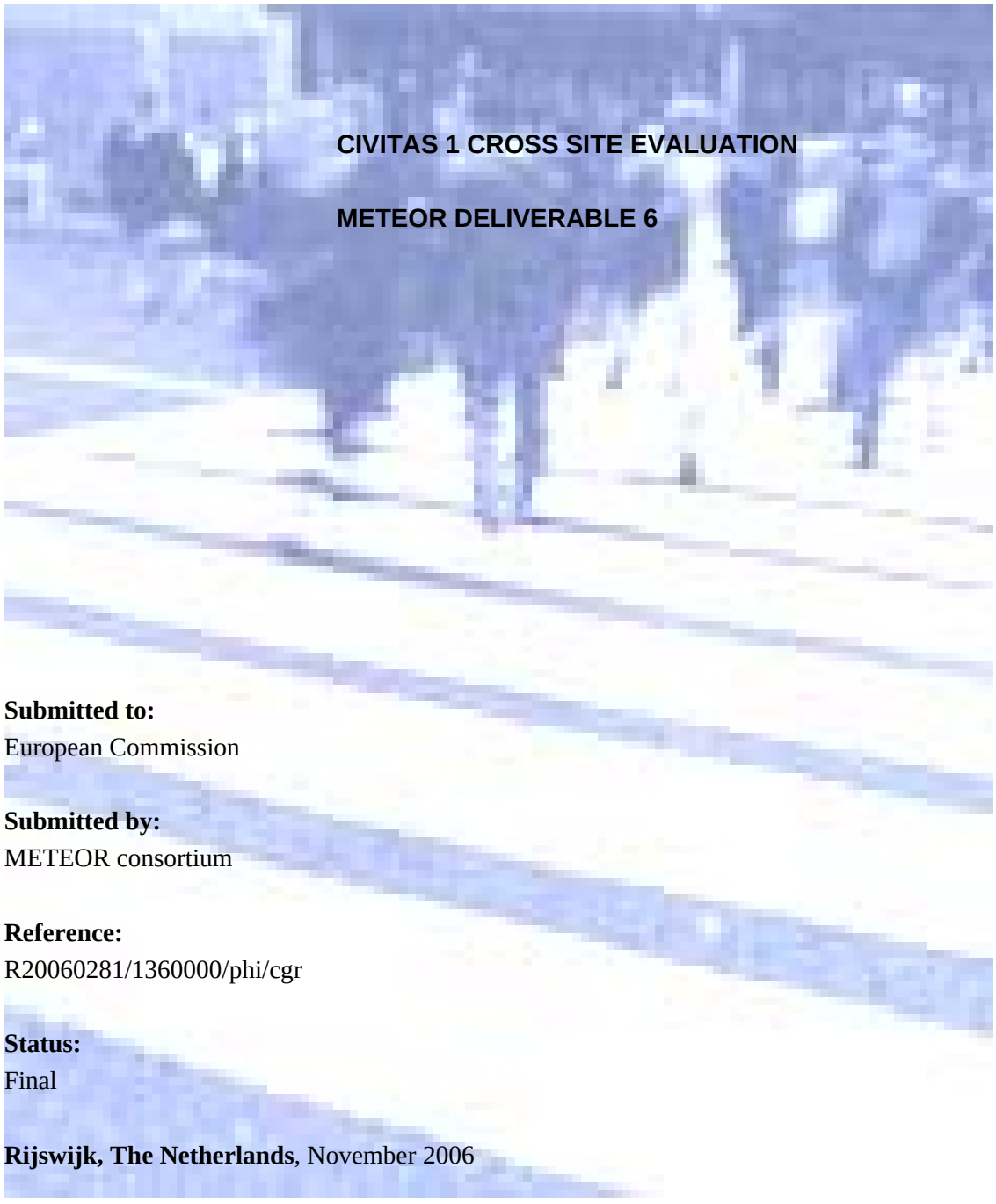

CIVITAS 1 CROSS SITE EVALUATION

METEOR DELIVERABLE 6

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PART A
CROSS-SITE EVALUATION ON HEADLINES

PART A - EXECUTIVE SUMMARY

The CIVITAS Initiative

The CIVITAS Initiative - cleaner and better transport in cities - stands for CIty-VITAlity-Sustainability. In the CIVITAS I Initiative, launched by DG-TREN from 2002 to 2005 19 cities participated in testing and implementing measures to achieve the objective of cleaner and better transport. With 50 million euros of financial support from the European Commission the following cities; Aalborg, Barcelona, Berlin, Bremen, Bristol, Bucharest, Cork, Gdynia, Gothenburg, Graz, Kaunas, Lille, Nantes, Pecs, Prague, Rome, Rotterdam, Stockholm, Winchester), implemented a total of 212 measures on sustainable transport. The measures contributed to an enormous boost for sustainable transport solutions in the cities and in many cases a definite breakthrough was achieved. METEOR was the project responsible for monitoring, evaluating and disseminating the results of the 19 cities who worked together in four separate demonstration projects (MIRACLES, TELLUS, TRENDSETTER and VIVALDI).

D6: The report on Evaluation

The D6 report provides a cross site evaluation of all the CIVITAS I measures that have been implemented. During the project the cities have evaluated the impacts of the measures where possible.

The evaluation can be divided into process evaluation (the process of realising the output of the Measures) and impact evaluation (the outcome of the measures). An analysis has also been performed to investigate to what extent the measures are suitable for adoption by other cities: this aspect is referred to as ‘the transferability of measures’.

The report is based on evaluation data, provided by the demonstration projects and the cities. Part A describes the methodology and the overall results, Part B provides more detail and describes the results for each cluster of measures.

Evaluation clusters

METEOR has grouped the 212 different innovative measures into 11 clusters which was necessary in order to draw constructive conclusions of the several themes. The clusters are listed in the following table:

Clusters for cross site evaluation analysis

The clusters for cross site evaluation analysis
• Transport information and Management
• Multimodal interchange
• Mobility management
• Cycling
• Car sharing and car pooling
• Zones with controlled access
• Clean vehicles and fuels

- Public Transport
- Goods distribution and logistic services
- Parking management
- Road Pricing

Process evaluation

Process evaluation aims to identify typical patterns of *barriers* and *drivers* that affect the implementation of measures in CIVITAS I, and to provide substance for the formulation of policy recommendations regarding future implementation processes. The information for the process evaluation has been provided by the 19 CIVITAS I cities and their local partners through self-assessment. A total of 212 measure level result templates have been analysed in terms of statements concerning barriers and drivers, including any additional information with regard to the implementation process. Based on the issues identified by the local representatives, 12 barrier/driver categories have been defined, four of which have further been divided into subcategories. The assessment of the level of influence of each barrier/driver has been used to obtain a weighted ranking of barrier/driver categories. A general assessment of the numbers of barriers and drivers identified within each cluster provides an indication for the expected success and failure rate:

High success rate (drivers surpass barriers):

Clean Vehicles and Fuels / Mobility Management / Cycling / Parking Management / Transport Information and Management

Proximity of success and failure (balanced influence of barriers and drivers):

Public Transport / Car Sharing and Car Pooling

High failure rate (barriers excel drivers):

Goods Distribution and Logistic Services / Multimodal Interchange / Zones with Controlled Access / Road Pricing

Impact evaluation

The cross site impact evaluation is based on the MAESTRO approach which was developed on behalf of the European Commission within the 4th Framework Program. Essential elements from MAESTRO that have been applied are the application of an ex-ante and an ex-post analysis, the distinction between the before and after comparison and the projects' impact by comparing the project results with the results of a do-nothing scenario. Evaluation at measure and city level was performed by the cities according to the evaluation plans. The cross site evaluation focused on the analysis at cluster level; while results from cities regarding up-scaling possibilities were also investigated.

At measure level many positive impacts on environment and energy use were reported; clusters where the measures reported excellent results, are cycling, carpooling and car sharing, clean vehicles and fuels, public transport, goods distribution and logistic services, parking management and road pricing. Indicators of the transport system also showed positive results.

The impact at economic level was mixed, as several measures caused higher costs when compared to traditional solutions. This was the case in several measures within the cluster public transport. Awareness and acceptance was good in almost all clusters: many citizens recognised the CIVITAS measures and supported them.

Due to the relatively small scale of the measures in general no major impacts on economy, environment, energy use and on transport indicators were reported as a direct result of the measures implemented within the CIVITAS program. Nevertheless the following positive conclusions can be made:

- In many cities a positive impact on awareness of the objectives of the CIVITAS program could be measured. Citizens recognise and support the objectives related to the way in which mobility and transport in cities needs to change.
- Many of the demonstration projects will continue after CIVITAS.
- Many of the measures are appropriate for up-scaling and will have a notable impact at city level once implemented on a wider scale.
- The impact will be more strongly felt if accompanied by other measures (packaging).

Transferability

The approach towards transferability is based on identifying relevant information from the data accumulated during CIVITAS I, in order to replicate such measures in any new target cities. Transferability does not simply refer to individual technical or operational features, but how a measure corresponds to the receptor city. In some cases not only the measure will be transferred as a policy instrument but also certain relations between measures themselves, whilst ensuring suitable institutional support.

The measures' full potential may not be achieved unless enhancing combinations of measures are considered (packaging). Mobility management and zones of controlled access are types of measures that can enforce many of the measures in the other clusters.

Findings suggest that clusters of measures can indeed be characterised regarding their ability to be successfully transferred to different cities. The most important driver in a successful transferability process is predominantly the ability to adequately replicate the context, namely physical, cultural and institutional conditions. The success of a number of individual measures within a certain policy cluster is sensitive to several different, specific conditions meaning any aggregated analysis on transferability is likely to be insufficient for a city to assess its own situation, in which case individual consideration per measure will be required, however, it is worth taking into account that there are general notions to explore regarding the guidelines for transferability.

1 INTRODUCTION

1.1 About CIVITAS

CIVITAS - cleaner and better transport in cities - stands for CIty-VITAlity-Sustainability. Within this DG-TREN initiative cities participated in programmes to test and implement measures to achieve the objective of cleaner and better transport. In the so called CIVITAS I programme from 2002 to 2005 19 cities (Aalborg, Barcelona, Berlin, Bremen, Bristol, Bucharest, Cork, Gdynia, Göteborg, Graz, Kaunas, Lille, Nantes, Pecs, Prague, Rome, Rotterdam, Stockholm, Winchester) participated; in total 212 measures on sustainable transport have been implemented in the abovementioned cities within the initiative.

With financial support of 50 million euros from the European Commission, the 19 cities have implemented many integrated measures and in many cases achieved a definite breakthrough. By implementing these measures an enormous boost has been given to sustainable transport solutions in the cities. For example:

- in Pecs the whole inner city has been redesigned in a way that sustainable (slow) modes have priority and are in some areas even the only permitted mode for the inner city;
- in Lille a huge biogas production plant has been developed due to the stimulation from CIVITAS;
- the topic clean vehicles is now on the agenda in many counties and in some cities up to 5% of the total vehicle stock has been changed to clean fuels vehicles.

Figure 1.1 CIVITAS I initiated a real breakthrough in Europe on the topic 'Clean Vehicles'

There are many success stories directly resulting from CIVITAS I, most of which can be found in Deliverable 8, which includes the most striking findings of CIVITAS I.

METEOR was the project responsible for monitoring, evaluating and disseminating the results of the 19 cities who worked together in four separate demonstration projects (MIRACLES, TELLUS, TRENDSETTER and VIVALDI). As well as the 19 cities in CIVITAS I the European Commission now supports another 17 cities in CIVITAS II. The European Commission will announce a programme within the 7th Framework Programme to start in 2007.

1.2 Role of this report in CIVITAS

The report D6 provides a cross site evaluation of all the CIVITAS I measures that have been implemented and was produced based on information provided by the projects and the cities. During the period 2002-2006 of the project, the cities have not only implemented the measures, but have also tried to evaluate what the impact of the measures was.
What was the effect on the environment and general transport conditions in the cities once a measure had been implemented?

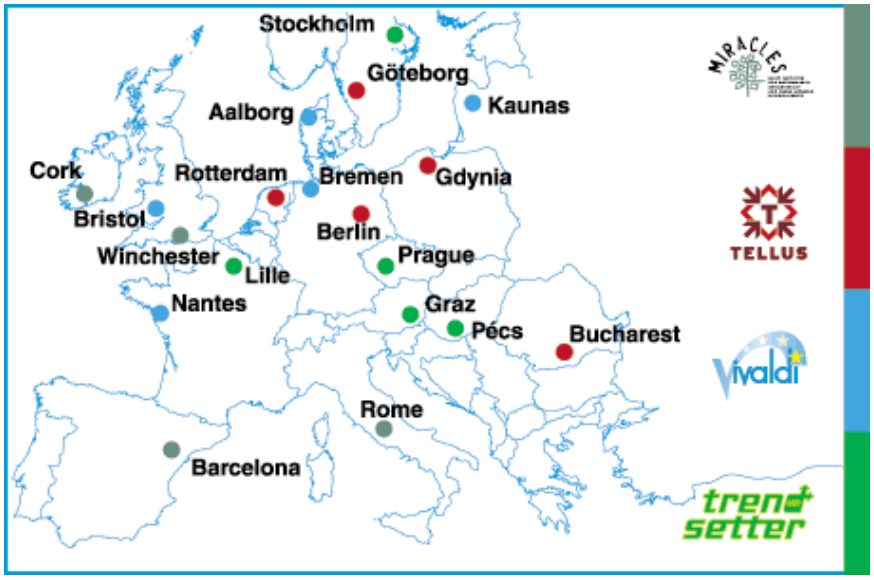
The report consists of two parts: A and B. Part A is a general introduction and provides the outlines of the project, while part B presents the results of the various evaluation steps for the clustered measures in more detail.

The introduction forms chapter 1 of part A and is followed by the description of the cities (chapter 2), process evaluation (chapter 3), impact evaluation (chapter 4), transferability and packaging (chapter 5) and the final conclusions (chapter 6). This METEOR Deliverable 6 report will be accompanied by two other METEOR final reports: Deliverable 8 (Good practices in CIVITAS 1) and Deliverable 9 (Policy Recommendations). In Deliverable 8 a summary of the results and conclusions of CIVITAS I is provided. In Deliverable 9 the final conclusions are elaborated and more general visions on future actions and policies are included, based on the results of CIVITAS I.

1.3 The 19 CIVITAS I cities

The 19 cities involved in the CIVITAS I initiative are shown in the map below as well as the grouping of the cities into the four demonstration projects MIRACLES, TELLUS, TRENDSETTER and VIVALDI. In chapter 2 the participation and main results of each city are briefly described.

Figure 1.2 The 19 CIVITAS I cities



1.4 Overview of the 8 policy fields and the 11 clusters

CIVITAS I has in total eight so called 'policy fields' within which it was proposed all measures should be implemented:

Table 1.1 *The 8 policy fields within CIVITAS I*

The policy fields
• Access restriction
• Integrated pricing strategies
• Collective passenger transport
• New forms of vehicle use
• New concepts of the distribution of goods
• Innovative soft measures
• Integration of transport management systems
• Clean public and private fleets

METEOR subsequently regrouped the measures into 11 clusters which was necessary in order to draw constructive conclusions, as using only the 8 policy fields would have been too complex to undertake. Cross site evaluations have been performed based on the regrouped and more homogeneous clusters, enforcing in turn the value of the cross site evaluation. Part B presents the whole cross site evaluation process per cluster, introduced in the following table:

Table 1.2 *Defined clusters for cross site evaluation*

The clusters for cross site evaluation analysis
• Transport information and Management
• Multimodal interchange
• Mobility management
• Cycling
• Car sharing and car pooling
• Zones with controlled access
• Clean vehicles and fuels
• Public Transport
• Goods distribution and logistic services
• Parking management
• Road Pricing

1.5 Process evaluation

In CIVITAS I METEOR has tried to understand the process behind the implementation and operation of the measures, so that we can learn from the test sites for future implementations and operations. CIVITAS I is therefore an example to other cities on how to implement and operate measures, and how to avoid obstacles when doing so. Through the process evaluation a better insight is given into three steps: implementation, output and results. The impact evaluation and the process evaluation have been carried out on the same level of clusters to enable a better understanding. The overall process evaluation is described in chapter 3 of part A, the results for each cluster level in part B.

1.6 Impact evaluation

The main results from the measures of CIVITAS I have been identified and compared with one another. Since the individual measures are relatively small, the impact at the measure level itself is much clearer than the consequent impact at city level, explaining why the cities have reported mainly at measure level in detail and at city level only where possible and meaningful.

As mentioned before, METEOR has regrouped the measures into 11 clusters in such a way that the output and results of the measures are easily compared. The approach of the impact analysis and the main results are given in chapter 4 of part A. The main total results and most striking elements of each cluster are highlighted in part B of this report. If detailed information on measure level is required, the individual city reports are appropriate.

Upscaling

Most CIVITAS I measures had a duration of less than two years from implementation until reporting on the evaluation. To draw general conclusions based on such a limited time span is

very difficult, however we can still learn a lot from the implementation, organisation and operation process during CIVITAS I in order to be fully prepared for full scale implementation. There are still a number of questions to be answered: What would the effects be of a full scale implementation? And what exactly do we mean by full scale implementation? What are the obstacles faced for full scale implementation measures? In order to answer these questions more research is necessary. METEOR has already tried to provide the initial insight into the long term possibilities and consequences.

1.7 Transferability and Packaging Analysis

1.7.1 Transferability

The results produced by the CIVITAS I cities have provided a large amount of information from the practical experience acquired during the application of measures throughout a set of different contexts. A considerable part of these measures are relatively innovative while not much experience was achieved before its application with availability of rather standardized information on its course of action and results. In line with the Theoretical Framework developed on Transferability, this report has mapped the contexts associated to each cluster of measures, highlighting the role of the standardised **Barriers and Drivers** identified in the scope of the process evaluation to the **High Level Objectives** (HLOs) served by each cluster, thereby closing the full cycle described below:

Needs (HLOs) – Type of Cluster – Measures – Crucial Concerns & Actions for Success – Barriers/Drivers

The importance of understanding the context surrounding such dependencies is therefore at the heart of the issue of "transferability", considering that the replication of measures and clusters of measures can only succeed if the context is correctly understood in order to be assessed and possibly replicated in the target city.

1.7.2 Packaging

Although it is common-sense to say that measures taken individually may miss the ability to promote the changes they envisage, to know which are the most relevant combinations in a systematised manner has not really been achieved before. Even during the early stages of CIVITAS,t cities realised the need to adopt combined measures, assuming that not only measures considered alone but their coherent bundling with other measures (packaging), will ultimately determine the overall degree of success of a set of measures within and across policy fields and clusters. This is the key idea of the "packaging" in this report, based on a systematisation of the interdependent structures. This has allowed identifying packaging of

measures within cluster and, most importantly (because it often escapes common analysis), packaging of measures across clusters.

2 DEMONSTRATING CITIES

2.1 Aalborg

Aalborg is centrally situated in mainland Denmark and also functions as the centre for the region. With a population of 161.000 inhabitants Aalborg is the fourth largest city of Denmark. In recent years Aalborg, and in particular the city centre, has become more pedestrian friendly. Aalborg is a rapidly growing city, but environment and sustainability remain the key factors in this progress.

During CIVITAS I Aalborg focused on car sharing and telematics.

The impacts of the car sharing scheme may be as high as 1% of the current annual energy consumption for transport in Aalborg. The primary reason for this is that the purchase of a car has been postponed or abandoned by the users, relieving the transport system of a high annual mileage.

2.2 Barcelona

Barcelona, located on the east coast of Spain has a population of 1.5 million, with 4.2 million inhabitants in the metropolitan area. Similar to most Mediterranean cities, its central area is very densely populated. Its underground metro system comprises of 7 lines, 129 km of track and 138 stations. Some 726 million passengers used the public transport system in 1999.

Barcelona aimed for a set of innovative demonstrations securing a cleaner and more efficient urban mobility. The overall aim was to determine how the municipality can influence citizen's awareness of, and support for, clean urban transport policies and innovation. The applied measures focused on integrating the public transport system, restricting car access, introducing new concepts of goods distribution and expanding the number of clean vehicles in the public transport fleet.

The results of the re-introduction of the tramway to Barcelona's streets demonstrated that this mode of transport achieved a high level of usage in combination with walking, with a high appreciation of features such as its high speed and easy access. Passenger levels exceeded first-year forecasts, and had reached 41.000 pax/day by November 2004.

2.3 Berlin

The city of Berlin is the German capital and the biggest city in the country. The geographic position of Berlin in Europe places it as a junction in the Trans European Transport Network. Despite this fact, most traffic is local and regional and growing suburban development after reunification has led to continuously growing car traffic. The road traffic in Berlin faces a potential bottleneck which may slow down future city development and the achievement of sustainability. Thanks to an excellent public transport network, Berlin has the lowest car density in Germany, with less than 350 cars per 1000 inhabitants. Berlin's transport strategy has always focused on multi modal and sustainable mobility. As a consequence, public transport, car and slow mode shares are nearly balanced.

The Berlin CIVITAS I measures aimed at reducing a number of traffic externalities: traffic related emissions, pollution and noise. As a consequence most demonstration measures dealt with the implementation of technical innovations.

Transport in Berlin is now more environmentally friendly and lower energy consumption has also decreased NOx, CO_2 and NO_2 emissions. The level of CO decreased from 6 ug/m3 in 2001 to 5 ug/m3 in 2004 and the level of benzene decreased from 5.4 to 3.4 ug/m3 in the same period.

2.4 Bremen

Free Hansestadt Bremen is a well-known port and trade centre on the banks of the river Weser close to the North Sea. Bremen is an independent "Land" of the Federal Republic of Germany. Bremen consists of the City of Bremen and the City of Bremerhaven. There are 681.000 inhabitants living on 400 square kilometres.

Bremen focused on all CIVITAS I aspects. In the realm of car sharing and public transport the CIVITAS I measures have improved the existing transport systems.

CIVITAS I contributed a lot to the growth of car sharing. The number of cars increased and the number of clients went up by 39%.

2.5 Bristol

Bristol is the largest urban area in the South West region of Great Britain and provides a centre of industry, commerce, education and culture. Bristol covers an urban area with a population of 400,000. The city has a much higher level of in-commuting and the region is predominately car-based, with car ownership and car use amongst the highest in the country. Buses provide the bulk of public transport in Bristol and a network of bus Park & Ride sites with routes serving the city centre have been established around the edge of the built up area.

Bristol focused on all CIVITAS I aspects. One of the best results was that the modal split for cars has been reduced by 5% in the Home Zone, using the residential traffic management measure in which the number of available parking spaces were significantly reduced.

2.6 Bucharest

Bucharest is the capital of Romania. Similar to most European cities, Bucharest faces the problems linked with population growth and dispersion from the central area to the suburban areas. In this context, car ownership has increased leading to traffic congestion and pollution. Public transport within the urban area of Bucharest is provided by four major public transport modes: metro, tram, trolley bus and bus; the number of public transport passengers has not declined during recent years.

Within the framework of CIVITAS I, the Bucharest Municipality intended to maintain the high level of public transport usage by service quality improvements, clean and safe public transport, reducing congestion, public transport prioritisation, inter-modal coordination, and operational safety.

Energy use was reduced by 10% mainly thanks to the modernisation of 70% of the trolley buses with new energy saving vehicles and also to the introduction of the 8 energy saving trams and infrastructure upgrading. Another result was the increasing public transport usage: use of the trolley bus increased by 6% and bus use by 5%.

2.7 Cork

Cork, situated on the south coast of Ireland, is a commercial, cultural, educational and industrial centre and the second largest city in Ireland, with a city population of about 124,000 and an extended area population of 345,000. Traffic congestion is endemic in the city centre and along the main radial and circumferential roads, particularly during peak periods. The many narrow streets in the central area are completely inappropriate for the volumes of traffic carried.

The above mentioned problems have led to proposals for reviving the city centre, putting the major emphasis on public transport. In line with the Cork Strategic Transport Plan 2001-2020, CIVITAS I focused on measures for car traffic reduction, Park & Ride, mobility management, network management and clean vehicle promotion.

The Cork CIVITAS I measures acted as a catalyst for advancing the implementation of planned major city improvements such as the very successful redesign of St Patrick's Street and the construction of the new Park & Ride facility. The redesign of St Patrick's Street created space for recreational activities and has attracted many visitors to the city centre.

2.8 Gdynia

Gdynia has a population of 255.000 inhabitants over an area of 136 km^2. It is located in the northern part of Poland, next to Gdansk Bay and between the towns of Sopot, Gdansk and Rumia. Spatial development is determined by natural limitations: the Gdańsk Bay and the natural forestry reserves. Gdynia transport strategy is therefore closely linked to the maritime economy. Gdynia is aiming for sustainable development of the city both through modern methods of organising public transport as well as the thorough modernisation of the city's road network.

The aim is to transform the city centre into a clean urban transport area focussing on the city centre and on physical measures.

The result of the CIVITAS I measures in Gdynia have shown an impact on the attractiveness of the area, the situation in the downtown area has improved significantly. The measures encountered wide acceptance from citizens thanks to strong political support and broad communication. 91% of the citizen respondents approved the new image of the Gdynia's main street. Newly installed bollards, making parking impossible on the pavement, were also supported by 76% of the respondents.

2.9 Göteborg

Göteborg is Sweden's second largest city with 470,000 inhabitants and with 800,000 inhabitants in the greater Göteborg region. As the largest port in the Nordic region, Göteborg is a centre for trade, transport and industry. Göteborg has a tradition of being an *environmentally proactive city*. Transport policies have always targeted sustainable development solutions. Göteborg supports the idea that it is important to use as many partners as possible: private companies, public organisations, citizens' consortia. The main task for the authority is to provide the means for efficient, safe and sustainable mobility in Göteborg.

Seven demonstration measures have been challenged in Göteborg: aiming at creating a competitive city, which is pleasant to live in. To achieve this goal, Göteborg decided that commercial transport was the relevant urban transport sector to be addressed. Clean vehicles promotion, access restrictions and freight management measures have been carried out to reduce demand for transportation or to make it more environmentally friendly.
Göteborg has worked with goods distribution/freight in three of the measures and the promotion of clean vehicles. One interesting issue is the lessons learnt from the environmental zone and improving the load factor and the Lundby project and Göteborg is continuing these pilots within the new project START. The water hydraulic that the Renova waste vehicles used is a very inventive technique. Particularly important results are those from the clean vehicles projects.

2.10 Graz

With nearly 240.000 inhabitants, Graz is the second largest city in Austria and the cultural, economic and university centre of the region. Graz has a historic centre with many pedestrian precincts and a large proportion of bicycle traffic. It was the first city in Europe to implement a speed limit of 30 km for the entire city area (with the exception of major roads) and the first Austrian city to open a Mobility centre.

In CIVITAS I Graz focused on the environment, (reduction of fuel consumption or CO2, HC, NOx emissions), safety (reduction of accidents), mobility (combined modes Bike&Ride and Park&Ride) and awareness (satisfaction with the quality of public transport). The overall effects at city level of CIVITAS I measures on energy use and the environment have been positive.

One of the positive outcomes was the implementation of an integrated pricing strategy for parking zones, including a differentiation between polluting and non-polluting vehicles.

2.11 Kaunas

Kaunas is the second biggest city in Lithuania with a rich history, beautiful landscapes and a strong industry. The city is established on the confluence of the two largest rivers in Lithuania. At present 381.000 people reside in Kaunas.

Kaunas focused in CIVITAS I on the development of its urban public transport network, in particular on pricing strategies and the stimulation of public transport use.

As a result Kaunas is the first city in Lithuania to present timetables of minibuses together with timetables of buses and trolleybuses on the public transport website. This form of public transport integration was based on negotiation and changing administration processes including the gradual integration of minibuses into the general public transport system and the installation of information at bus-stops.

2.12 Lille

Lille, with a population of 1,2 million people, has become a base for distribution in the centre of Northern Europe and a major route for north-south and east-west traffic across Europe. From the first “mongy” tram to the VAL automated underground railway, over the years Lille has built up a strong public transport network. The objective of the transport policy is to double passenger levels from 100 to 200 million between now and the year 2015.

CIVITAS I supported the introduction of the smart card system, enlarging the Park & Ride facilities, the introduction of a company mobility plan and boosting the overall urban mobility plan. Lille focussed on having 85% clean public transport journeys in the year 2005, a rise of 21% in public transport passenger journeys from 1998 to 2005 and to reduce pollution with a clean vehicle fleet.

This is illustrated by the fact that 50% of the current bus fleet (167 busses) runs on gas/biogas. Lille has built a new bus depot including a new dual CNG and biogas compression station for the buses with the aim of having a 100% clean public transport system.

2.13 Nantes

With its 24 municipalities and 550,000 inhabitants, Nantes is the largest urban centre in western France. Over the past 10 years, it has seen the second highest rate of growth in France. For the past ten years, despite its demographic expansion and the two million individual journeys recorded every day, the Urban Council of Nantes has operated a voluntary policy for urban development and the environment. Thanks in particular to the development of its public transport system (83 million journeys every year, 36 kilometres of tramway), it has witnessed a significant reduction in the use of the private car for journeys.

Nantes focused in CIVITAS I on the following aspects, namely: 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 public transport network and to encourage the use of the soft modes walking and cycling.

Public transport patronage is on the increase again since 2002. The tram in particular is gaining importance in the public transport network; about 55% of the daily trips are made by tram for only 18% of the publicly run transport kilometres.

2.14 Pecs

The City of Pécs, with 170 000 inhabitants, is a middle-sized cultural, educational, commercial and health centre in Hungary. The transition period resulted in a huge demand for both private car parking spaces and public transport as the number of cars and the number of tourists and students increased rapidly. The City of Pécs has a number of overall transport objectives, namely: improving air quality, improving environmental living circumstances and reducing the use of fossil energy and noise.

The main focus for Pecs in CIVITAS I was to introduce a car-free zone in combination with a zone-model parking-system with limited time parking and an increase in parking fees. Secondly Pecs focused on the reduction of air and noise pollution by limiting the number of cars accessing the centre. The CIVITAS I measures show a reduction in traffic in the city and an increase in the use of public transport.

The main result is the establishment of a car-free zone in the inner city of Pécs and the establishment of a zone-model parking system in the central city area.

2.15 Prague

The City of Prague is the capital of the Czech Republic and the country's largest city with 1,300,000 inhabitants. On an average weekday, 44 % of commuters use public transport, 34% go by car and 22% accounts for pedestrians and cyclists. Prague has a high concentration of both political and economic administration, industry, trade, education, research and tourism which requires good traffic management. One of the biggest problems is the very fast increasing number of private cars, which have more than doubled since 1990. A new traffic policy promotes public transport, the development of traffic infrastructure and regulation of car traffic, particularly in the city centre.

The main focus was put on restricting access for heavy vehicles and introducing and improving bus lines. Emphasis was also placed on improving the modal split from private car transport towards public transport, more specifically on improving bus services (using new and alternative approaches) to the same high level service as other means of transport (underground, tramways) in the City.

The most important result has been the raising of the standards and competitiveness of public transport in comparison with cars by integrating the different public transport modes. Especially the system of the preordination of public transport on signal controlled intersections received good results and have
led to the implementation of the system in many other places.

2.16 Rome

Rome is the capital of Italy. The city counts some 2.6 million inhabitants, while the metropolitan area has about 4 million residents over an area of 5,300 km2. Private cars are the most prevalent mode of transport despite the fact that the roads are narrow, with uneven surfaces and intermittent pavements. In recent times, general improvements have been made to the transport supply, especially in relation to the needs of pedestrians and bus/metro users.

Over the course of the 4 years project lifetime of CIVITAS I, Rome implemented 19 measures with a broad range of application, such as the further development of access restrictions, promotion of public transport and non-motorised modes, adoption of clean vehicles and fuels, development of mobility management and improvement of the transport network through the use of ITS. In doing so, Rome sought to reduce energy consumption due to city centre traffic, improve the air quality, reduce the noise levels, increase accessibility to public transport, reduce private traffic flows and provide space for private cars, and induce a modal shift towards sustainable forms of transport. Utilizing a "push and pull" approach, Rome scored good results

especially in terms of the increase in the use of public transport and walking in the current modal split.
One of the best results was the creation of a pedestrian network in the city centre with car-free areas and retractable bollards. This contributed to reduced pollution level. The ex-post measured values of benzene concentrations at the Tridente area (the largest pedestrian zone), for instance, were the lowest surveyed in the whole Laboratory area (4.1 microg/m^3 at the Tridente vs. 5.2 microg/m^3 in the whole Laboratory area), exceeding the ex ante predictions.

2.17 Rotterdam

The Dutch city of Rotterdam is a harbour city; Rotterdam's transport problems have always been dominated by the river crossings. Due to the dense population, traffic flows in both peak and off peak hours are intense. Furthermore, freight transport is considerable due to the large percentage of goods entering the port and distributed further inland by freight trucks. The air quality in Rotterdam is poor, due to heavy traffic and the heavy industry. To improve the air quality the development of a good spatial and mobility development framework is necessary. Rotterdam focuses on a "no-nonsense" policy; concrete measures which will have a direct impact. Examples are concrete bollards on the pavement to create clear and safe pedestrian areas or speed ramps to make it immediately clear to the car driver that they are entering a speed reduction zone.

In CIVITAS I Rotterdam focussed on a modal shift in favour of biking and public transport and on cleaner transport alternatives.

The impact of CIVITAS I measures at the city level is perhaps best illustrated with the recently formulated policy document called "Action Plan Air Quality". In this plan eight CIVITAS I measures have been identified to support policy-making for better air quality in the future.

2.18 Stockholm

Stockholm is the capital of Sweden. It is located on a number of small islands, which makes transportation difficult for both transit traffic and traffic inside the city. Stockholm has about 1,000,000 inhabitants and about 1,5 million in the surrounding area of Greater Stockholm. Stockholm has political support for making its transport system more environmentally compatible by substituting conventional vehicles with clean vehicles and improving the efficiency of logistic services.

The CIVITAS I measures aimed to reduce the number of vehicles, congestion on principal roads, heavy-duty traffic and at improving the capacity of the rail network. Cycling has a

relatively low share of the transportation in Stockholm. The activities fulfilled within the CIVITAS I project in the city of Stockholm have contributed to a number of improvements in the city.

Recently, the interest for and sales of clean vehicles have increased considerably, which was one of the CIVITAS I targets. In general, the clean vehicle drivers are satisfied with the vehicles and the use of fossil resources has decreased. Another measure in CIVITAS I concerns the trial of road pricing in Stockholm. The congestion charges have reduced traffic by 25%, reduced emissions and enhanced the urban environment.

2.19 Winchester

Hampshire County Council

Winchester in Southern England has a population of around 30,000 people. A further 80,000 reside in the surrounding villages. Winchester itself is on the main London – south coast rail line and is well connected by the primary road network (namely M3 and A34), to London and the Midlands. The central area of Winchester experiences the classic problems associated with an historic city: high volumes of traffic using narrow ancient streets, pedestrians and traffic in close proximity, and lorry movements being perceived as intrusive and problematic.

The focus of CIVITAS I was to support the underpinning transportation strategy for the locality and help to achieve the wider social, environmental and economic policies for the area. The project was integrated by contributing to the overall aims of the local transport policy.

A good example is the associated parking policy which helped to encourage the use of more sustainable transport (P&R) and deter city parking. The extension of the “St Catherine’s” Park &Ride car park enabled ticket sales to increase by 43% during the CIVITAS I period.

3 PROCESS EVALUATION

3.1 Objectives

Process evaluation provides insight into the main factors that have influenced the implementation of measures, illuminating in particular the reasons for deviation or under-achievement regarding the planned objectives. Critical issues, risks and success factors that appear to be common for particular types of measures need to be identified. The process evaluation exercise has therefore aimed to identify typical patterns of *barriers* and *drivers* that affect the implementation of measures in CIVITAS I, and to provide substance for the formulation of policy recommendations regarding future implementation processes.

3.2 Approach and methodology

Based on the results of the CIVITAS I mid-term assessment, a pragmatic process evaluation approach has been adopted, focusing in particular on the ex-post identification of *barriers* (negative influence on implementation) and *drivers* (positive influence on implementation). For analysis purposes, the implementation process has been divided into two consecutive phases[1] as these typically relate to different kinds of problems, and may partly involve different actors:

- **Planning phase**: embraces the concept and detailed elaboration of a measure before it is put into practice;
- **Operation phase**: includes the realisation of all tasks and subtasks until completion, including possible modifications or replacements of tasks.

The information for the process evaluation has been provided by the 19 CIVITAS I cities and their local partners through self-assessment. All information has been collected in "measure-level result templates" after the implementation of the measures had (almost) been completed. The templates contained the following information:

- Project, city, measure number and title
- Measure objectives
- Measure description
- Method of measurement
- Achievement of quantifiable targets
- Achievement of evaluation-related milestones
- Report on the measure results

[1] The further distinction of a "set-up phase" situated in-between the *planning* and *operation* phases (i.e. the acquisition and installment of all system components required until the first day of full system operation) has not been pursued since it is mostly not possible to derive from the available information (see also section 3.3 below)

- Barriers and drivers of the measure implementation
- Lessons to consider for replication and introduction to other cities

While the focus of the process evaluation has been on the qualitative description of implementation barriers/drivers, other information included in the templates (in particular "lessons to consider") as well as the project's evaluation reports have equally been taken into consideration, in particular for calibration and to place the individual measure implementation in its local context.
It should be emphasised that the information available for process evaluation presented a number of important limitations that affect the manner in which certain conclusions can be derived, as well as the overall validity of the analysis results:

- **Ex-post information collection**: All evaluation statements have been formulated exclusively in retrospect i.e. 3-4 years after the implementation process started. Barriers and drivers that were relevant during the process may have therefore been neglected or reinterpreted in the reports. A tendency to overemphasise highly visible and evident factors (technical failure, lack of funding, political support) in comparison to more subtle and complex ones (e.g. role of institutions, actor constellation, synergies between measures) is possible. An analysis of changes in the assessment that may have occurred at different stages of the implementation process could not be carried out.
- **Open list of categories**: Cities were not obliged to refer to a limited set of barrier/driver categories. Following an open approach that was meant to generate and prioritise categories from scratch without offering a predefined structure, possible types of barriers and drivers were only indicatively mentioned in the template. Yet, the definition of the categories obviously influences the quantitative analysis results (counting references R20060281/136000/PHI/CGRto particular categories). The barrier/driver definitions were therefore narrowed down as far as possible, including the use of various subcategories. Nevertheless, conclusions could not be drawn regarding categories that have not been addressed in the templates, since the reasons for their omission remains unknown (no relevance? overlooked? concealed?).
- **Unclear attribution to implementation phases**: In many cases, the barriers/drivers identified could not be clearly attributed to a particular implementation phase. Barriers such as "understanding user needs" and "lack of funding", or drivers such as "political commitment" and "cooperation/partnership" may affect planning and/or operation, while they may have only been critical in one element of the various phases. Where the use of complementary information could not clarify the case, an assessment in this respect has not been possible.
- **Deficit of other stakeholder views**: The information does not systematically reflect the viewpoints of the different local stakeholders involved in the implementation. A parallel assessment by several actors may however lead to the identification of different sets of barriers/drivers and/or put the relevance attributed to them by one actor into perspective. In those cases where corresponding methods (consultation, interviews) have been employed, the results have of course been considered for the evaluation.

- **"Bias" of reported information**: The information provided by the cities may have been filtered or manipulated with or without intent for various reasons. Frequently it represents a self-assessment carried out by persons equally responsible for the implementation of the measures. This may either imply strategic considerations regarding the information made available (e.g. effect on funding? effect on image?), or reflect the specific perceptions of the person reporting and their own position within the local system (e.g. role of cooperation? role of the other actors?). In addition, such filtering may have occurred at individual organisational and/or city level.
- **Conceptual preparation of the reporting person**: Even when the person reporting is deemed to be an independent and in a more objective position, the actual ability to identify and prioritise drivers and barriers, and to interpret the influences in the processes may differ. It obviously depends on the conceptual framework(s) and analytic tools the individual evaluators were familiar with whether, for instance, the crucial role of *policy windows* or *discourse coalitions* could be identified and reported as barriers/drivers.
- **Varying quality of project information**: While most project information is consistent regarding analysis depth, issues addressed and categories used, there are considerable variations between projects in this respect, which affects the overall comparability of the reported statements.

These reservations should not be forgotten since they put the results presented below into perspective. The patterns of barriers/drivers identified through the templates and reports may offer a rough idea of *certain* issues that seem to have influenced the implementation, however, these issues are likely to be incomplete and not fully representative of the specific conditions that have actually governed measure implementation in CIVITAS I.

The process evaluation approach involved three consecutive steps:

- Pertinent categories of barriers/drivers have been established iteratively, based on a qualitative interpretation of similarities found in the measure-level result templates;
- For each measure and the corresponding barrier/driver categories, values have been attributed to the following variables of analysis based on a qualitative and comparative assessment (Table 3.1):
  - **for measures**: cluster, success level (achievement of implementation targets);
  - **for barriers/drivers**: influence on the implementation process, ability to vary depending on location;
- All data has been analysed using a Microsoft ACCESS database regarding the absolute influence of barrier/driver categories, and the correlations between barrier/driver categories and other variables (cluster, success level, phase, and ability to change locally).

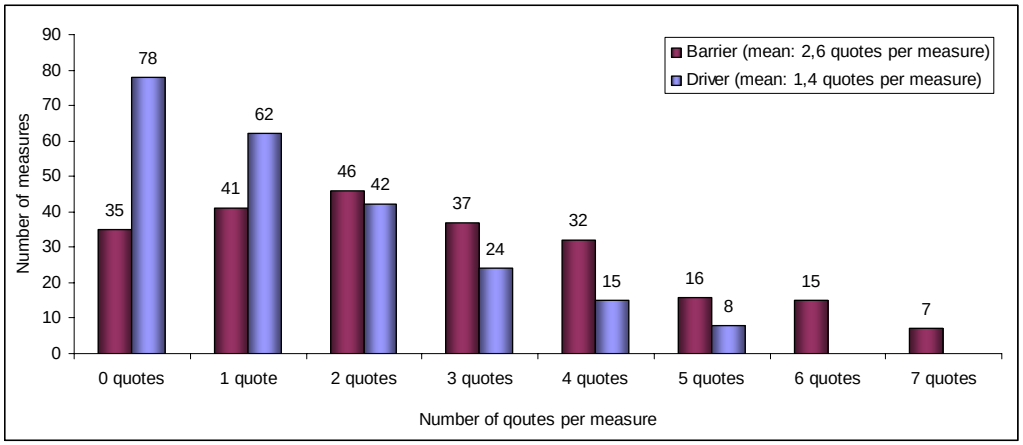
Table 3.1 *Analysis variables used for process evaluation*

Attributed to *measures*	**Values**		**Attributed to barriers / drivers**	**Values**
Barrier category	11 categories (see 3.3.2 below)		Influence on implementation process	- high - low
Driver category	12 categories (see 3.3.2 below)		Phase of implementation process	- planning - operation - both
Cluster	11 categories		Ability to influence locally	- yes - no
Success level	Heavily delayed: a) fully implemented only after CIVITAS I; b) implemented too late to perform a meaningful evaluation - Abandoned: officially cancelled by the projects - Weak: a) not reported; b) unclear results; c) obvious deviations from original targets d) lost track of original targets; e) achieved less than 1/3 of the planned volume f) remained far below the expectations in qualitative terms - Acceptable: a) achieved at least 1/3 of the planned volume b) showed good results in qualitative terms - Notable: a) achieved at least 4/5 of the planned volume b) showed remarkable results in qualitative terms			

3.3 Analysis results and interpretation

A total of 212 measure level result templates have been analysed in terms of statements concerning barriers and drivers, including any additional information with regard to the implementation process. On average 2,6 barriers and 1,4 drivers were identified per measure (Table 3.1). Only 36 measures provided no indications regarding barriers while twice as many (78) specified no drivers at all illustrating that drivers are usually more difficult to recognise as such and are therefore underrepresented in the assessment.

Figure 3.1 Number of statements concerning barriers and drivers per measure



3.4 Main barriers/drivers: What curbs or enhances implementation?

Based on the issues identified by the local representatives, 12 barrier/driver categories have been defined, four of which have further been divided into subcategories (Table 3.2). While it has not been an objective to define fully independent categories, particular attention has been paid to defining categories that are well suited to derive policy recommendations (e.g. the availability of *public funds* strongly depends on *political commitment*, while both issues would need to be addressed in their own right to achieve improvements). Furthermore, all categories but one can equally be interpreted positively (driver) or negatively (barrier). The figures below provide an overview of the percentage of references made to the 12 barrier/driver categories (Figure 3.2), and in each category of the percentage of barriers/drivers attributed a low/high level of influence (Figure 3.3).

Figure 3.2 Percentage of references made to barrier/driver categories

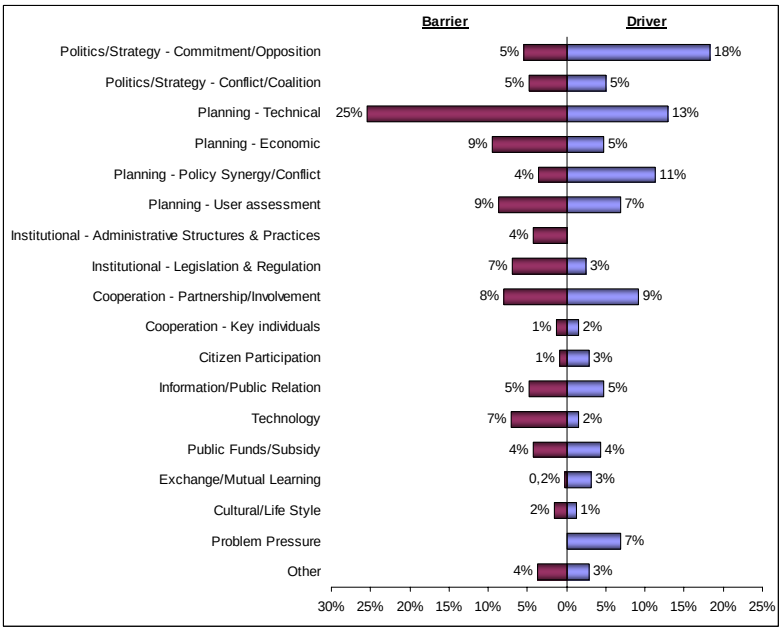
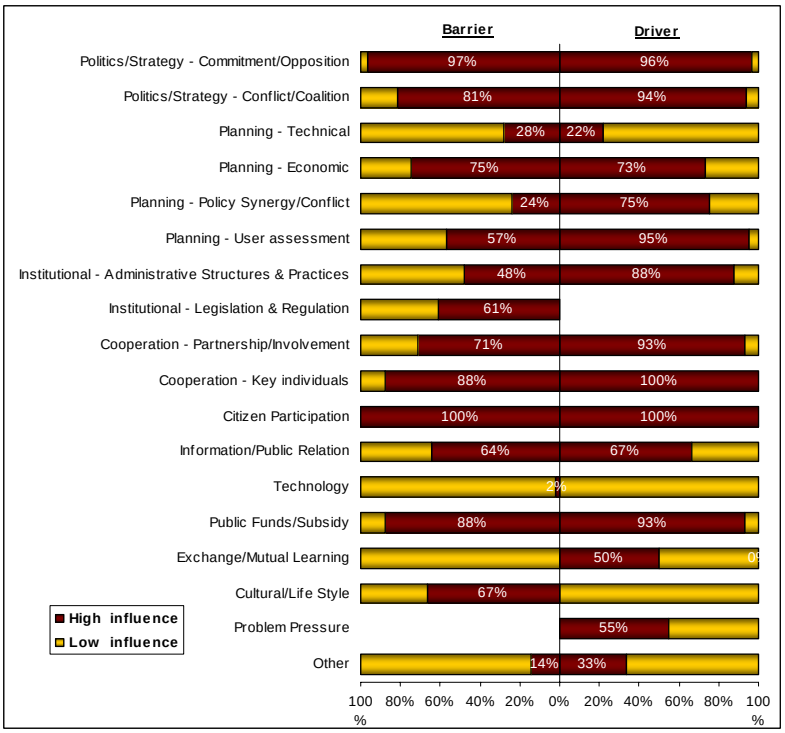


Figure 3.3 Percentage of barriers/drivers attributed a low/high influence



The assessment of the level of influence of each barrier/driver identified has been used to obtain a weighted ranking of barrier/driver categories (Figure 3.5) by multiplying all barriers/drivers assessed

as having a notable influence with a factor two. The results are expressed in percentages and form the basis for all further interpretations below.

Apart from "Technical Planning" as a barrier and "Politics and Strategy: Commitment" as a driver, a fairly narrow distribution of weighted rankings among all barrier/driver categories is visible. Three major groups have been defined for a more pointed interpretation in terms of overall influence on measure implementation (Table 3.2):

- high influence (weighted ≥ 6%)
- medium influence (weighted < 6% but ≥ 3%)
- low influence (weighted < 3%)

Figure 3.4 Weights attributed to barriers/drivers by category regarding overall influence on measure implementation (x factor 2 for high influence)

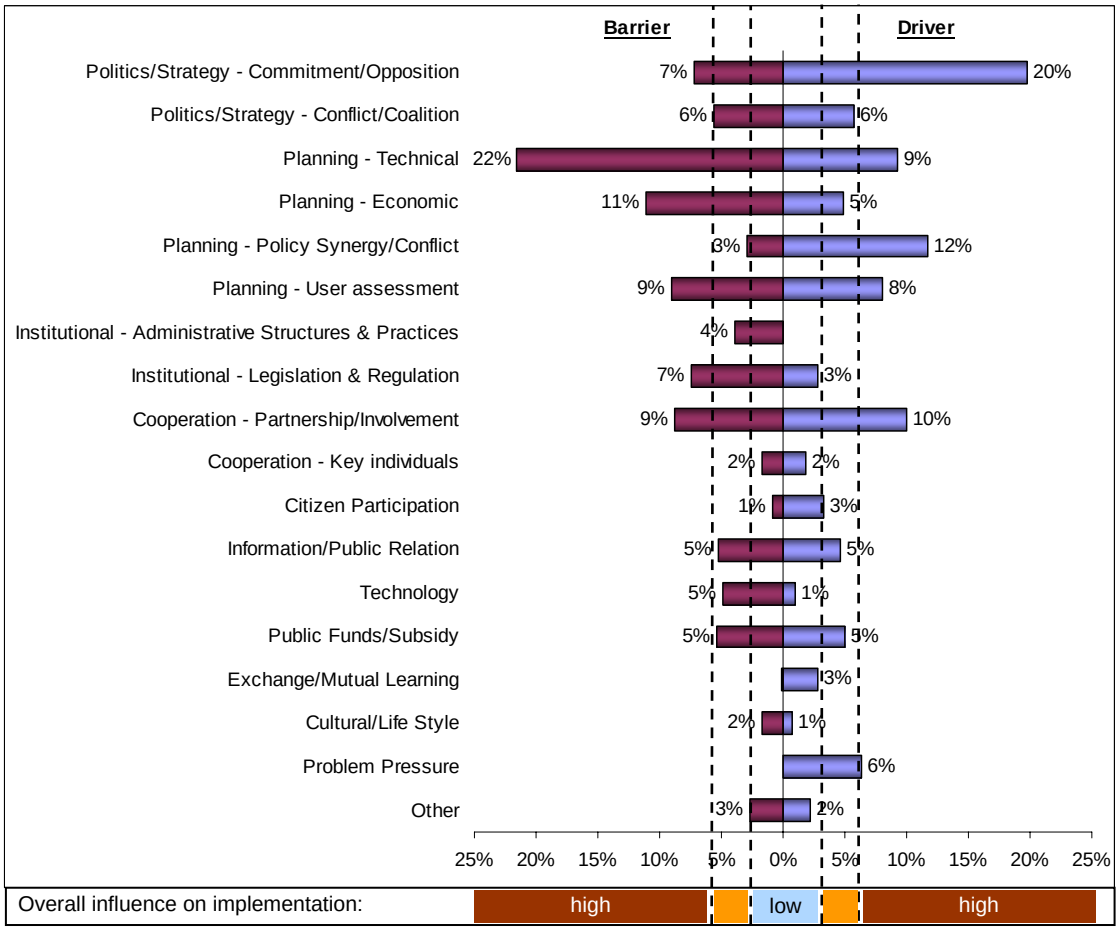


Table 3.2 *Overview: Categories of barriers and drivers – overall influence*

Category	Subcategory	Interpretation as Barrier	B	Interpretation as Driver	D
Politics and Strategy	**Opposition/ Commitment**	Opposition of key actors based on political and/or strategic motives; Lack of sustainable development agenda or vision	**B**	Commitment of key actors based on political and/or strategic motives; sustainable development agenda /vision	**D**
	Conflict/ Coalition	Conflict between key actors due to diverging material interests and expectation of redistributive losses	**B**	Coalition between key actors due to shared/complementary material interests and expectation of redistributive benefits	**D**
Planning	**Technical**	Insufficient technical planning and analysis to determine requirements of measure implementation	**B**	Accurate or visionary technical planning and analysis to determine requirements of measure implementation	**D**
	Economic	Insufficient economic planning and market analysis to determine requirements for measure implementation	**B**	Accurate economic planning and market analysis to determine requirements for measure implementation	**D**
	Policy Conflict/ Synergy	Conflicting policies or policy frameworks hampering measure implementation	**B**	Synergetic policies or policy frameworks fostering measure implementation	**D**
	User assessment	Lack of user needs analysis; Limited understanding of user requirements	**B**	Thorough user needs analysis; Good understanding of user requirements	**D**
Institutions	**Administrative Structures and Practices**	Hampering administrative structures, procedures and routines	**B**	Facilitating administrative structures, procedures and routines	D
	Legislation and Regulation	Hampering laws, rules, regulations and their application	**B**	Facilitating laws, rules, regulations and their application	**D**
Cooperation	**Partnership and Involvement**	Failed or insufficient partnership arrangements and limited involvement of key actors	**B**	Constructive partnership arrangements and open involvement of key actors and/or other stakeholders	**D**
	Key Individuals	Lack of leadership, individual motivation or know-how of key persons	**B**	"Local champions" motivating actors and catalysing the process	**D**
Citizen Participation		Insufficient or poorly performed consultations with and involvement of citizens	**B**	Broad consultations with and involvement of citizens	**D**
Information and Public Relations		Insufficient information of key stakeholders; lack of awareness raising activities	**B**	Information of key stakeholders; Awareness raising activities	**D**
Technology		Technology failure; additional technological requirements	**B**	New potentials offered by technology	**D**
Public Funds and Subsidy		Dependency on public funds (including CIVITAS funding) and subsidies	**B**	Availability of public funds (including CIVITAS funding) and subsidies	**D**
Exchange and Mutual Learning		Relative isolation of the measure and lack of exchange with other cities	B	Exchange with other cities on experiences and lessons learned	**D**
Cultural and Life Style		Hampering cultural circumstances and life style patterns	**B**	Facilitating cultural circumstances and life style patterns	**D**
Problem Pressure		*not applicable*	B	Severity of problems to be solved (e.g. air pollution)	**D**
Other		special issue - cannot be categorised	**B**	special issue -cannot be categorised	**D**

Overall influence no references **high** **medium** **low**

The following barrier/driver categories are presented below and discussed in terms of their overall influence on implementation, as well as their coincidence with particular implementation phases (planning, operation).

Politics and strategy

This category refers to the influence of key actor positions. Since any particular actor constellation is shaped by a complex interplay of cognitive, motivational and identity orientations, both at corporate and individual level, the information available allows only limited insight into the "games" played. However, two levels can be distinguished, depending on whether *political motives* or *material interests* appear to be at the heart of the barrier/driver identified by the cities. This distinction is important with a view to formulating policy recommendations, as it either points to consensus building and information activities (e.g. to influence policy discourses), or to the development of new measure designs and packages (to achieve synergies or compensation) that can be supported by all actors, and is reflected in the two categories of opposition/commitment and conflict/coalition. It should be underlined though that the role of individuals could not be discerned here (see also category "cooperation: key individuals" below).

Politics and strategy: Opposition **B** ***/Commitment*** **D**

Key actor positions that appear to be essentially based on *political and/or strategic motives* can represent an important barrier or driver. While there may also be material interests involved in the respective positioning (see below), it is at the political level that these have been articulated. "Opposition" is typically experienced prior to elections leading to a withdrawal of support "for political reasons" as measures are seen to be incompatible with the agenda of the incoming administration (programme, political clientele). It equally arises if politicians or administrations are afraid of unpopular measures and possible failure, or if key stakeholders (neighbouring municipalities, Public Transport operators, car parking operator) show "disinterest".

In turn, "commitment" that drives implementation is reflected in the "enthusiasm", "engagement", "political will" or "high motivation" of key actors, local politicians in particular. It often implies that long-term backing for the envisaged change of direction is expressed, especially regarding the turn to clean vehicles and alternative fuels and to cost internalisation (pricing). From a strategic point of view, the positive perception and image effects of the "EU project status" also plays a role.

Apparently, "opposition" is usually encountered in the planning phase where it appears to be significantly influential, and is the fourth most important barrier of all. "Commitment" is seen to be of influence throughout the entire implementation process, thus including continued support during measure operation, and is assessed as the number one driver, considerably exceeding all other categories.

***Politics and strategy: Conflict* B */Coalition* D**

Barriers and drivers in this category are key actor constellations characterised by the articulation of *material interests* (losses or benefits), anticipating the redistributive effects of a particular measure design. While actor positions at this level are certainly conditioned by values or political affiliation, it is predominantly the material properties of a measure that causes *conflict* or underpins *coalition*. We consequently find car park operators and retailers resisting access restrictions, pressure groups (car drivers, shop keepers) fighting a new tram line or a "car free day", as well as Public Transport operators refusing financial contributions or the exchange of commercially sensitive information for the set-up of traveller information systems. Conversely, where the actors perceive a measure's implementation as mutually beneficial, "win-win situations" and the orientation at "common objectives" of several authorities, operators and businesses can be identified.

Similar to "opposition/commitment", "conflicts" arise especially during planning, whereas "coalitions" are attributed continued relevance during planning and operation. Both as a barrier and as a driver, this category is assessed to be of medium overall influence.

Planning

Barriers and drivers that derive from the quality of activities that determine the detailed design and set up of a measure are subsumed under this category. If taken together, they would represent the most important category by far, accounting for 45% (barriers) and 34% (drivers) of the weighted references. Four different types of planning activities can be defined regarding their specific focus and the different actors involved: *Technical design*, *economic planning*, *policy coordination* and *user assessment*.

***Planning: Technical* B / D**

Technical planning issues are the most commonly reported barriers and rank second as drivers. In terms of barriers they refer to a wide range of shortcomings regarding land-use and urban planning (selection of sites, land acquisition, assignation), product analysis (availability and suitability of vehicles, equipment, infrastructures), interoperability and integration of systems and/or data, tendering procedures and activity schedules, among others. While many quotes reflect the problem of uncertainty and risks related to technology choices, it appears to be a general lack of sound feasibility studies that seems to be crucial here. In turn, the correct technical functioning of a measure that builds on correct assumptions as well as previous experiences and knowledge has proven its ability to drive the implementation process. Focusing on feasibility and not on the "best solution" helps the achievement of the targets set and causes tangible improvements, which results in an important motivation for the participating actors. It is therefore mainly in the planning phase that technical planning barriers are identified, whereas the driving potential of technical issues is usually experienced during operation when the first results are available.

Nevertheless, it should be considered that the outstanding recurrence of technical planning issues may well reflect the background and focus of the reporting actors and their related inclination to identify technical problems. The actual importance of technical planning issues for the implementation process

is usually considered to be comparatively low, which explains that their overall influence is assessed to be lower than the frequent references may suggest.

Planning: Economic **B / D**

Where planning activities essentially refer to market and transport demand analyses, as well as to investment planning or business plans for new services, these have been subsumed under this category. Frequently barriers in this category are expressed as "unexpected" or "underestimated" equipment costs, a lack of demand (e.g. for logistics services, car sharing, clean vehicles) and slow market take-up. Failures in economic planning are the second most important barrier of all, since they tend to affect the feasibility of a measure as a whole. Conversely, planning and analysis of the economic measure aspects is also experienced as a driver of medium overall influence, in particular where economic benefits represent a key incentive for implementation (e.g. price of alternative fuels lower than petrol, tax reductions for clean vehicle use).

With regard to particular implementation phases, economic planning shows a similar pattern to technical planning. As a barrier it usually affects the planning phase predominantly related to investment planning, while its influence as a driver is even more accentuated during operation, highlighting the effect of demand and business development on measure success.

Planning: Policy Conflict **B** ***/ Synergy*** **D**

Interactions with other policies and measures requires particular attention in terms of measure planning. It may imply effects in terms of political and strategic opposition/commitment or cooperation (partnership and involvement), but these rely on coordination and integration between policies (subjects, instruments). While *policy conflicts* are occasionally mentioned as a minor barrier, especially where larger infrastructure projects existed, *policy synergies* are typically attributed a high influence and are assessed as the second most important driver of all. This implies for example the support of a measure through the existence of an air quality management plan or a strategic framework plan for the entire city, other sector policies (e.g. cultural heritage protection), specific measure combinations resulting in "push & pull" effects, or simply the incorporation of a measure into the local transport plan. Conflicting policies as well as policy synergies are issues that equally emerge in the planning and operation phases of a measure.

Planning: User Assessment **B / D**

Another important aspect of planning is the assessment of the "users" i.e. organisations or social groups that are targeted by a particular measure. This ranges from the initial identification and delimitation of the target groups to a detailed assessment of their perceptions, needs, and preferences. Barriers encountered under this category include a lack of "acceptance" (e.g. of access restrictions by citizens, of city logistics by retailers and hauliers), problems with the use of new technologies, deviations of the measures introduced by users (e.g. motorcyclists using illegal paths), as well as problems with vandalism. As a driver, adequate user assessment results foster user acceptance or loyalty, and enhance the appeal of the measures.

User assessment is considered to be of high overall influence both as a barrier and as a driver. It is obviously of critical importance during the operation phase since this is when the positive or negative effects emerge, but would need to be tackled early on during the planning phase.

Institutions

While the influence of institutions (formal and informal social structures) on the implementation process can hardly be overestimated, the information does not provide a differentiated insight in this respect. It is therefore not surprising that the role of institutions figures less prominently than one may expect. It is reduced to only two specific aspects that could be clearly identified among the references: The *structures and practices of public administrations* and the influence of *legislation and regulation*.

Institutions: Administrative structures and practices **B** / D

This category includes all references made that put the emphasis on the existing relationships between public administrations across authority levels, policy sectors and spatial boundaries. It does not, however, include issues of cooperation with the private sector (see category "cooperation: partnership and involvement" below). Hence what is invoked here are the "different working cultures" of the partnering administrations, questions of competency (unclear, "monopoly"), or delays due to "bureaucracy" or approval procedures. Administrative structures and practices appear only to be of low overall influence as a barrier that predominantly affects the planning phase. References to positive effects have not been made, which again underlines the general difficulty of driver identification through the actors involved.

Institutions: Legislation and regulation **B** / **D**

Where explicit mention has been made regarding the influence of legal or regulatory conditions, this has been subsumed under a separate category with a view to assessing how such conditions could be influenced. For instance, this includes cases where "unclear" legal situations have been encountered (e.g. concerning congestion charging, recent deregulation of transport markets) and where existing regulations perceived as "inadequate" enter into conflict with the innovations introduced (e.g. bio-fuel taxation, parking regulation, property rights). It equally comprises difficulties due to regulatory coordination between levels (national, local) and bordering municipalities. As a driver, legislation and regulation issues are rarely identified - only 2 quotes refer to the EC air quality directive. However, all quotes addressing local air quality plans have been categorized under "policy synergies" (see above), while these plans in turn may have been driven by the EC directive.

Consequently, legislation and regulation issues are experienced mainly as barriers and are attributed a high overall relevance (7%), obviously, almost exclusively in relation to the planning phase.

Cooperation

The issue of cooperation has been defined as a separate category to reflect the role of management and collaboration arrangements that have been made specifically for the purpose of implementing the CIVITAS measures. References in this category may of course be strongly influenced by aspects such

as political commitment/opposition, administrative practices or regulations as discussed above. Yet, they suggest a different scope for influence since they point to two types of choices made during the set-up of the CIVITAS projects that are sufficiently independent from the previous categories to be addressed in their own right: *Partnership and involvement* of actors, and the role of *key individuals*.

Cooperation: Partnership and Involvement **B / D**

This category includes all references to deficits regarding the common basis of the partnership created for measure implementation and the functioning of the cooperation between the parties involved. This comprises issues such as an unclear definition of objectives or division of responsibilities among partners, a lack of involvement from key stakeholders, "distrust" and "communication problems" between partners, and in particular problems concerning the cooperation between the public and private sector. It also embraces the identification of "complexity" of the usually novel co-operations experimented as a problem in itself. Cooperation has also been experienced to drive measure implementation where working together on common problems and shared goals has contributed to improve the solutions or opened new ways for financing (public-private partnership). Strong project management structures and partnership frameworks that already existed also played a role.

Partnership and involvement issues have a high overall influence both as a barrier (9%) and as a driver (10%) as they have impact on the entire implementation process, in particular in the planning phase (including the preparation of the application for funding), when decisions on collaborative structures are taken and cooperative practice is first put to the test.

Cooperation: Key Individuals **B / D**

A particular issue of cooperation is the varying influence of key individuals partly highlighted by the cities, though the references found do not identify their particular motivations: These may be ideological or materialist and echo a mix of personal or organisational orientations. Key individuals (decision makers, responsible managers) can play a negative role if they do not fully support the measure, or if staff changes interrupt the continuity of a key project task. Furthermore, lack of communication and cooperation between responsible key individuals, or a lack of personal skills and cooperation culture can also constitute important barriers. In the positive case, the "personal commitment" of a politician, key stakeholder or project manager appears to drive the process. The limited identification of this issue (only 12 statements in total) leads to a low overall weight of this category, both as a barrier and as a driver. It should be clear, however, that where it is identified, the role of key individuals can be assumed to have been fairly important.

Citizen Participation **B / D**

Explicit references to the influence of citizen participation in the implementation process have been attributed to a separate category as the topic represents a key policy concern (e.g. Aalborg convention). Citizen participation issues are distinguished from "planning: user assessment" (see above) in that citizens are not addressed as a particular "user group", but rather as general stakeholders in local decision making. Consequently the barriers identified relate to the lack of "public support" or

even “public opposition” especially in the context of (obligatory) consultation processes. These problems point to a deficit in citizen involvement early on in the policy process that would allow improving acceptance and ownership of a measure, provided that real modifications of the initially proposed design are admitted. Where citizens in general have been supportive of a measure, this is underlined as a driver for implementation.

On the whole, citizen participation is hardly mentioned (only 14 quotes in total), which explains that it is only attributed a very low overall relevance as a barrier (1%) and driver (3%). If identified it does appear to have played a significant role. The scarce reference to citizen participation as an issue of relevance for implementation seems to reflect a general lack of consideration given to participatory planning of the measures, which may also have improved the understanding of specific user needs.

Information and Public Relations **B / D**

Information on the measure’s objectives and functioning, and a targeted dissemination approach addressing different user groups is an important issue for implementation. Failures in this area have resulted for instance in a flawed image or mistrust due to negative local press reports or unauthorized publications of confidential meeting results, or the use of an inadequate marketing terminology (“negative connotations”). Inadequate awareness raising, information and promotion or an inadequate timing of such activities is equally seen to cause problems with acceptance, understanding and usage of a measure, and is especially harmful where the measure results aimed at are not tangible or visible enough i.e. are “difficult to sell”. In turn, having taken a “professional approach” to marketing and PR, high or intensive “communication efforts” with target groups, as well as the involvement of strategic multipliers (e.g. taxi drivers) and image campaigns have been experienced as drivers.

Both as a barrier and as driver, information and public relation issues are attributed an overall medium influence, although when quoted they are considered to be highly relevant (64%/67%). Their pertinence for the operation phase is particularly evident (86%/73%), although this is not exclusively the case as for instance press relations and stakeholder information also affect the planning process.

Technology **B / D**

While the role of technology in policy implementation would certainly require a broader assessment reflecting the interplay between society and technology and the mediation achieved through politics, economy and science, this category takes a rather pragmatic stance on references made to *technological failure* and practical *benefits through technology application*. Hence what is identified here are the “system complexities” encountered in practice, frequently resulting in problems with integration (between systems or data, of equipment in public space) and interoperability. Moreover, the insufficient maturity of new technological equipment (clean vehicles, software) has constituted an important barrier, which also questions the relationships between cities and industry with a view to RTD. However, technology has also been seen to drive implementation where visible benefits could actually be achieved through its application. This has been the case especially for clean vehicles that proved better environmental performance.

In general, limited to these aspects technology mainly emerges as a barrier of medium overall relevance, while it hardly counts as a driver. It is principally an issue related to operation i.e. when systems are actually tested, while the driving potential has already played a significant role during implementation, thus facilitating actor cooperation with a view to *expected* benefits.

Public Funds and Subsidy **B / D**

The availability, extent and continuity of public financial support plays a central role for implementation. It should be considered a highly dependent variable though as it is essentially influenced by the political willingness and actor coalitions in place (see category "politics and strategy" above). However, the explicit reference to "funding" as a factor may provide useful orientation regarding the formulation of policy recommendations for particular policy fields. As a barrier, the general "lack of funding" is the issue referred to most, underlining the difficulty of defending expenses for demonstration measures that imply (political) risks. In some cases, changes in the availability of public funds have also curbed the process, usually based on a high-level political decision, or the organisation of financial support ("too centralised"). As a driver, most quotes in this category invoke the role of "external funds" i.e. the CIVITAS programme funding, which has helped to obtain the necessary support.

Despite their crucial impact on implementation, public funds and subsidies are assessed to have an overall medium relevance both as a barrier and driver due to the low number of references made to this category. It is a key factor during the planning phase when the required funds to ensure the feasibility of a particular measure design need to be secured.

Exchange and Mutual Learning **B / D**

Where working with other cities and the exchange of practitioners' information and experiences has been explicitly considered as an important factor, this is captured by the present category. The driving influence of learning from other cities that are implementing or have already implemented similar measures is evident as well as the inspiration and motivation that well-known good practice examples can provide ("London congestion charging"). An interpretation of this category as a barrier would in principle be possible (relative isolation and lack of exchange), but no references have been made in this respect. Exchange and mutual learning are therefore attributed a low overall influence and are seen to mainly affect the planning phase when external information can still be taken on board and make a difference for implementation (80%).

Cultural and Life Style **B / D**

In some cases, the cultural context appears to have played an important role regarding the general acceptance of measures and the underlying policy orientations and value judgements. This implies the identification of a general "desire for independence" or a reluctance to "change habits" or "use quirky cars" (e.g. regarding car sharing and clean vehicle use), which reflect dominant basic perceptions and attitudes of the targeted users. At the same time, the need for a long-term approach to actually address these issues is also acknowledged. Where a "positive attitude" of the general public towards clean

vehicles or the reduction of road travelling speeds has prevailed, this has been experienced as a driver for implementation. The overall relevance of cultural and life style issues is however assessed to be rather low (2%/1%), while most barriers tend to affect the operation phase (78%).

Problem Pressure *B* / *D*

As a particular kind of driver, the role of problem pressures has also been acknowledged. This category includes references to the influence of "severe local air quality and/or noise problems" and the "increasing oil price", pushing towards the use of clean vehicles and alternative fuels. It equally covers the identification of a "poor public transport offer" in a city area or "road congestion", as well as fragmented information provision or cycling infrastructures, demanding a more integrated and networked offer. Problem pressures are therefore attributed a medium overall relevance (6%), and affect equally planning and operation.

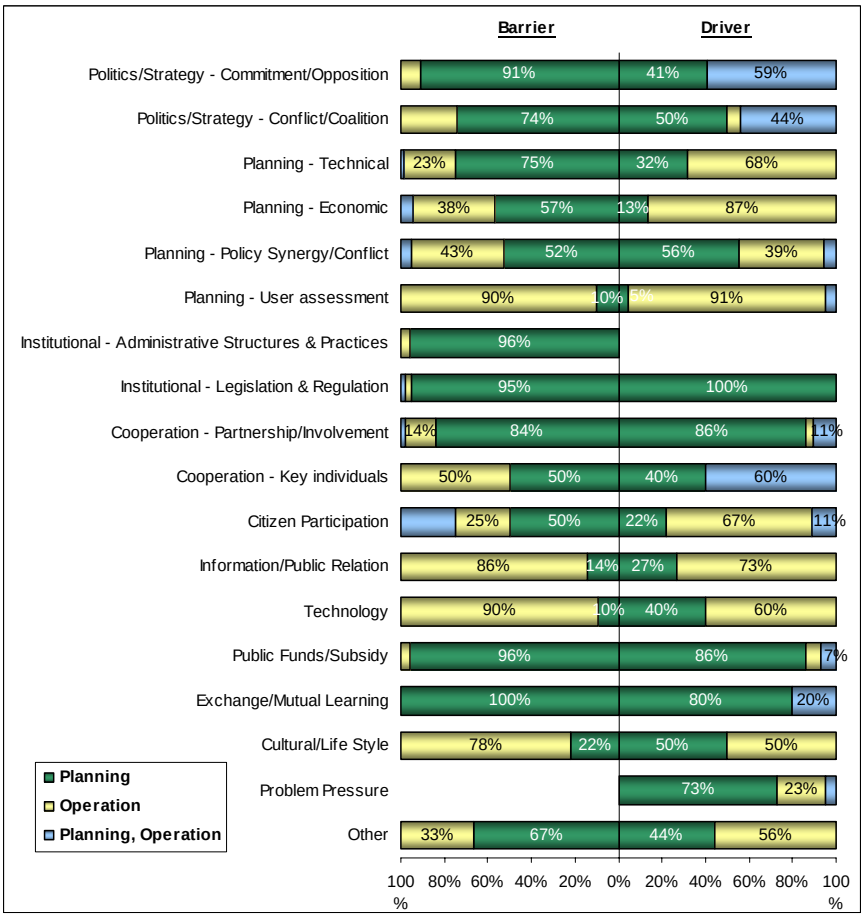
Other B / D

Any issues that appear to be highly specific for a measure and the context within which it has been implemented have not been categorised. This includes for instance the hampering effects of damage caused during public works, broken equipment due to "vandalism", "dependency on weather conditions" or the influence of major political incidents (terrorist attack in Madrid). In terms of drivers, examples are the "existence of a successful pilot project" or the "quality service of a manufacturer" experienced.

3.5 Which barriers/drivers affect the planning phase - and which operation?

With a view to the pertinence of barriers/drivers for particular implementation phases, some general conclusions can be drawn on the basis of the analysis. Categories that mainly affect the planning phase are "Administrative Structures and Practices", "Legislation and regulation", "Partnership and Involvement", "Public Funds/Subsidy" and "Exchange/ Mutual Learning". In turn, "User assessment", "Information/ Public Relations", "Technology" and "Cultural/ Life Style" issues mainly emerge during operation. "Politics and strategy" aspects are essentially barriers during planning, but as a driver are seen to be relevant throughout the entire implementation process. A similar pattern emerges for issues related to "Key Individuals", so that continued attention is required to address the risks and potentials of these categories. "Technical Planning" and "Economic Planning" issues are noticeably divided, resulting either in barriers affecting the planning phase or in drivers during operation. Figure 3.5 shows the percentage of barriers/drivers attributed to each implementation phase.

Figure 3.5 Percentage of barriers/drivers pertinent for a particular implementation phase (planning, operation, planning & operation)



3.6 What influence has the local context?

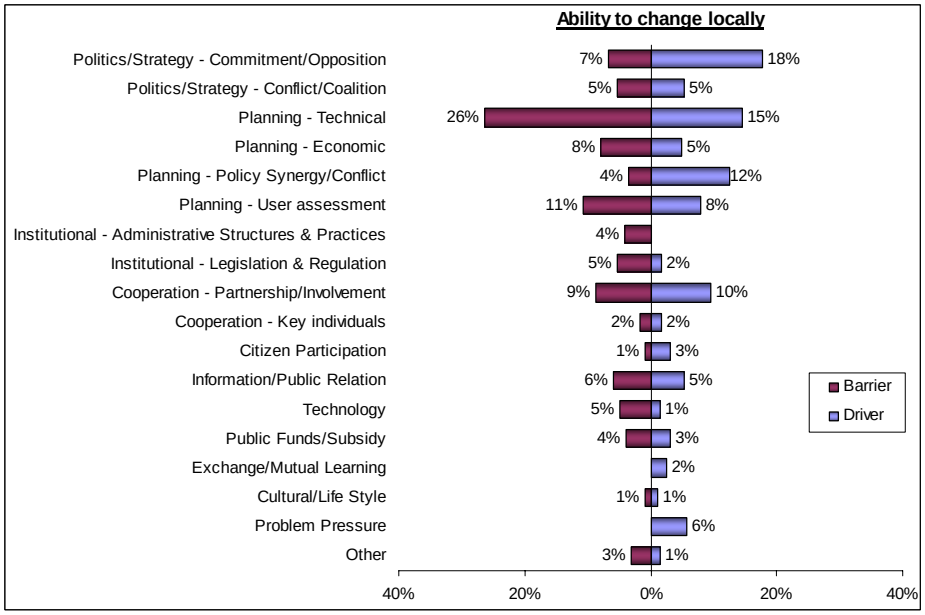
The direct influence of the local level on the implementation process has been assessed by defining for each barrier and driver identified whether it could be changed locally or not. Local changeability has been assumed where dependence on higher authority levels and general framework conditions that surpass the local level (culture, markets, etc.) has been marginal.

The overall picture that emerges underlines that local authorities do not simply have the full control over the implementation processes: For 63% of the measures, *all* barriers could be changed locally, for 28% however this is only the case for *some* of the barriers, while for 9% of the measures *none* of the barriers could be modified at local level, this includes general framework conditions such as culture and life-styles, equipment costs or technology failure.

Nevertheless, in terms of barrier categories, the highest local influence for the most relevant barrier categories are “Technical Planning”, “User Assessment”, “Partnership/Involvement”, “Economic Planning”, “Opposition” and “Information and Public Relations”. Equally the most important driver

categories are those that can best be influenced locally: “Commitment”, “Technical Planning”, “Policy Synergy”, “Partnership/Involvement” and “User Assessment” (Figure 3.6). Obviously, “Legislation/Regulation” issues cannot always be modified only at local level. Especially in the cases of clean vehicle and fuel measures, as well as for road pricing measures, national regulation and policies have had a critical influence (tax on bio-fuels, toll systems for highways).

Figure 3.6 Local influence on Barriers/Drivers by category



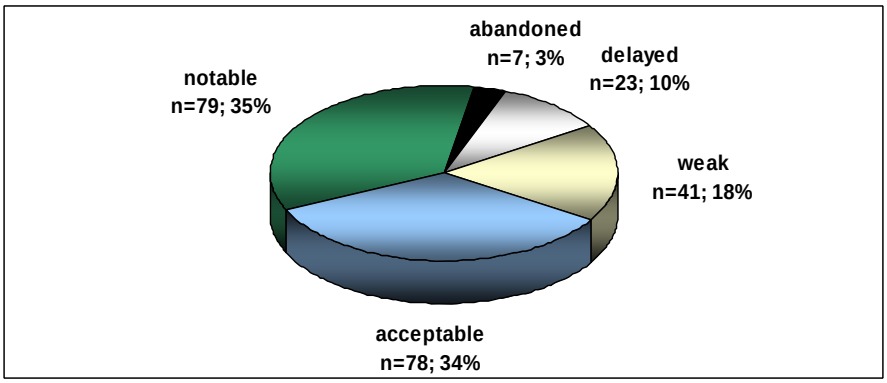
3.7 What barriers/drivers are critical for successful implementation?

In order to analyse the influence of barriers and drivers on the actual success of measure implementation, all measures have been categorised according to the degree of achievement of the implementation targets set by the cities themselves (see the above table):

- **Heavily delayed**: a) fully implemented only after CIVITAS I; b) implemented too late to perform a meaningful evaluation
- **Abandoned**: officially cancelled by the projects
- **Weak**: a) not reported; b) unclear results; c) obvious deviations from original targets d) lost track of original targets; e) achieved less than 1/3 of the planned volume f) remained far below the expectations in qualitative terms
- **Acceptable**: a) achieved at least 1/3 of the planned volume b) showed good results in qualitative terms
- **Notable**: a) achieved at least 4/5 of the planned volume b) showed remarkable results in qualitative terms

As a result, over two thirds of the measures appear to have performed in a notable or acceptable way regarding their implementation targets, while different kinds and degrees of difficulties characterise those assessed as weak or heavily delayed. Only 3% of all measures were completely abandoned (Figure 3.7).

Figure 3.7 Number of measures by success level (n=229)[2]



The analysis of barrier/driver patterns by success level does not show major deviations from the average. Measures assessed as "weak", only issues of "Partnership/Involvement" and "Legislation and Regulation" seem to be attributed slightly greater importance. "Key Individuals" also appear to have played a negative role more frequently than in other cases. In turn, for measures assessed as "acceptable", "Commitment" and "Policy Synergies" are seen as particularly relevant drivers.

Most importantly, the results seem to indicate a particular effect of the evaluation methodology and reporting arrangements. Some differences emerging appear to *contradict* the impact of barriers and drivers on implementation i.e. measures with a "weak" performance attribute a higher relevance to certain drivers (e.g. "Commitment") and lower relevance to barriers (e.g. "Opposition"), whereas measures with "notable" success emphasise the importance of barriers (e.g. "Technical Panning") and play down the impact of drivers (e.g. "Policy Synergy"). This may well reflect the attitude and intentions of the reporting actors being more critical where performance has actually been good, and rather "generous" if the measures have not really achieved the targets set (Figure 3.8 to 3.11).

[2] Some of the 212 measures have been split up for analysis purpose due to a more detailed reporting at sub-measure level, thus leading to a total of 229 measures analysed.

Figure 3.8 Barriers/Drivers profile for measures with "weak" success

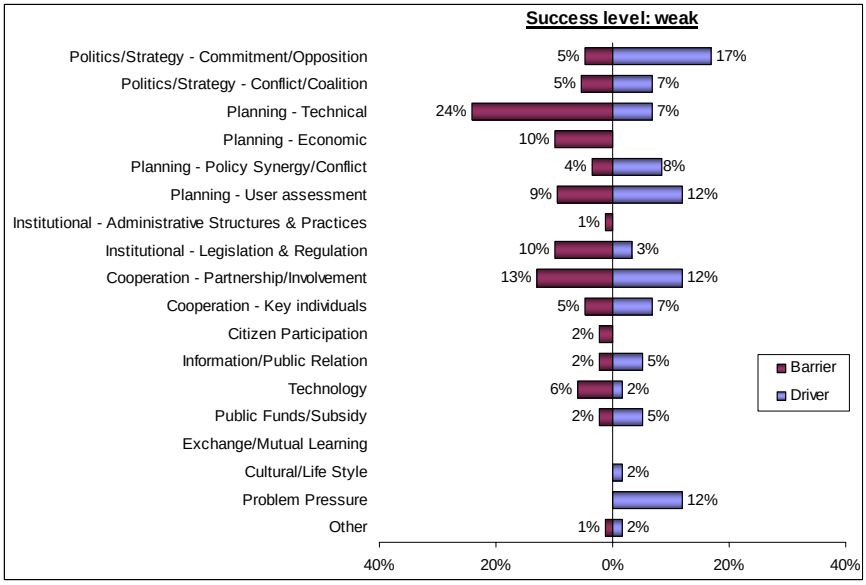


Figure 3.9 Barriers/Drivers profile for measures with "acceptable" success

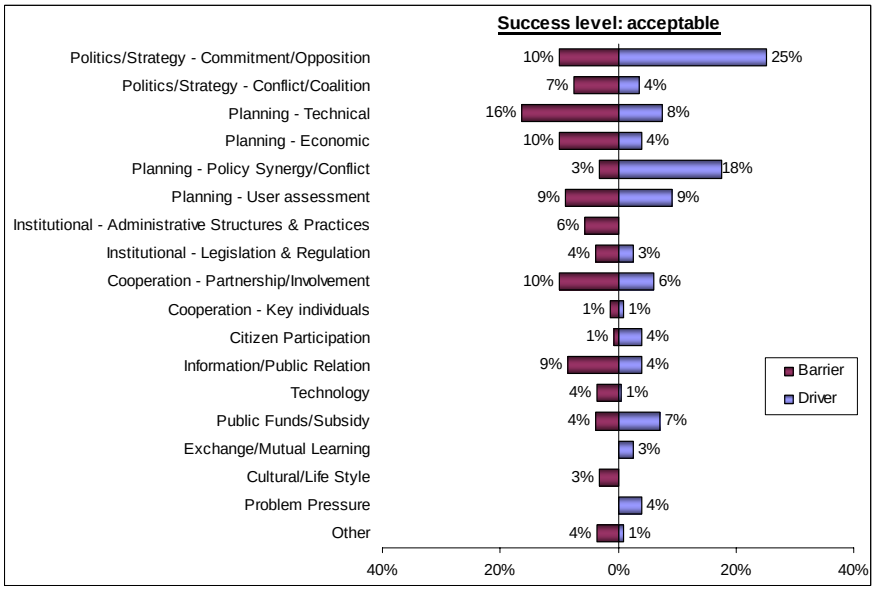


Figure 3.10 Barriers/Drivers profile for measures with "notable" success

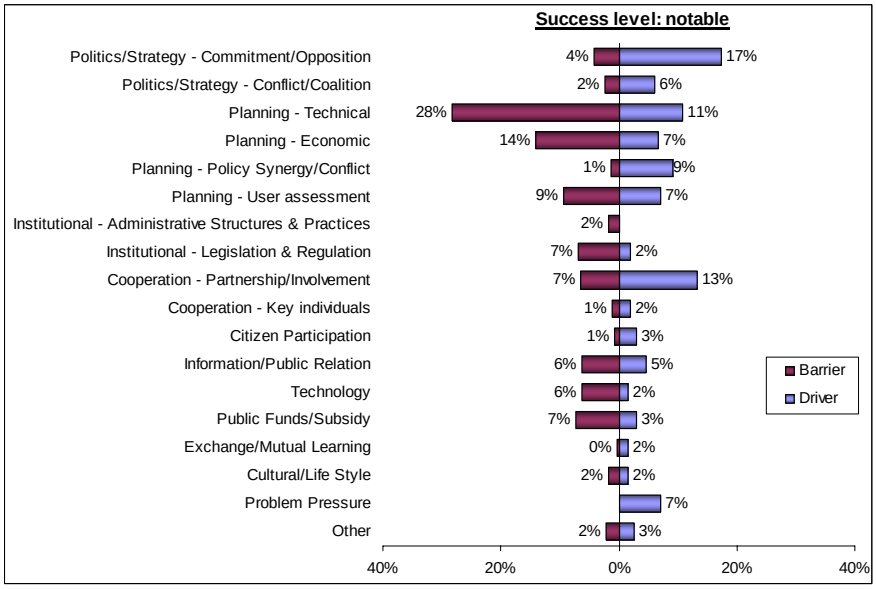
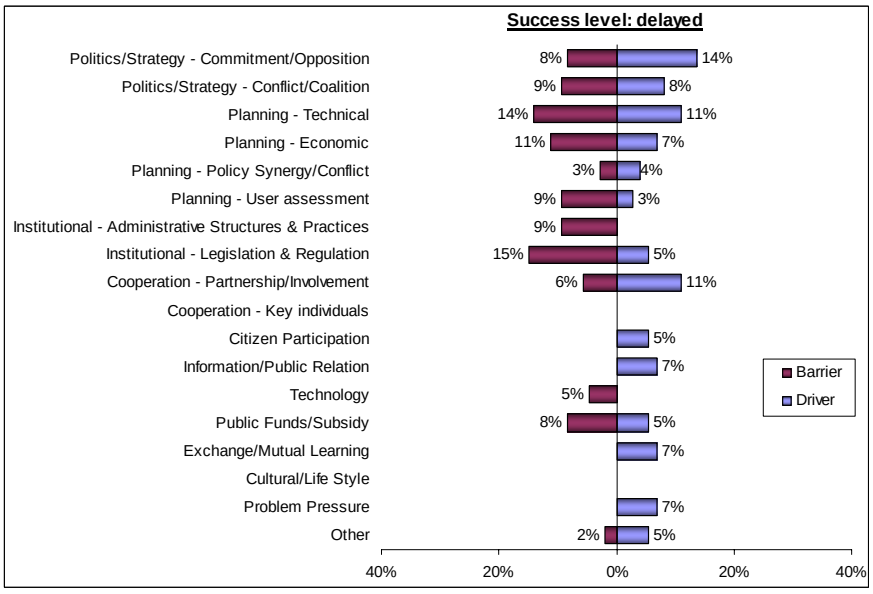


Figure 3.11 Barriers/Drivers profile for heavily delayed measures



Regarding a breakdown of the clusters by success level, a number of significant differences result (Figure 3.12) which suggest focusing future efforts on the particular risks and potentials of each policy type discussed in Part B.

Clean Vehicles and Fuels measures appear to be the most successful with over half of the measures performing "notably". Yet an important share is still assessed as "weak", which underlines the major

barriers encountered in terms of vehicle availability, fuel infrastructures and retrofitting ("Technical Planning", "Economic Planning, "Technology").

The highest overall level of success has been achieved by **Mobility Management** measures almost entirely assessed as "acceptable" or "notable". This result should however be regarded with prudence since the implementation targets actually set have often not been very ambitious or say little about the quality of the measure, so that success was easier to achieve (e.g. a certain number of "persons contacted").

Public Transport measures have generally performed well ("acceptable" or "notable") although almost one third has also struggled with major issues of cooperation, technical planning and funding. This has led to substantial delays or weaknesses and in two cases to the cancellation of the measures.

Also measures in the clusters of **Cycling**, **Parking Management** and **Transport Information and Management** appear to have been implemented with considerable success. This is remarkable especially for the latter two clusters, since achievement has been linked to more difficult barriers than in the case of Cycling (partnerships, acceptance and technology). Information and Management measures have equally encountered significant problems, particularly related to data availability, access, exchange and interoperability (partnership issues and technical problems).

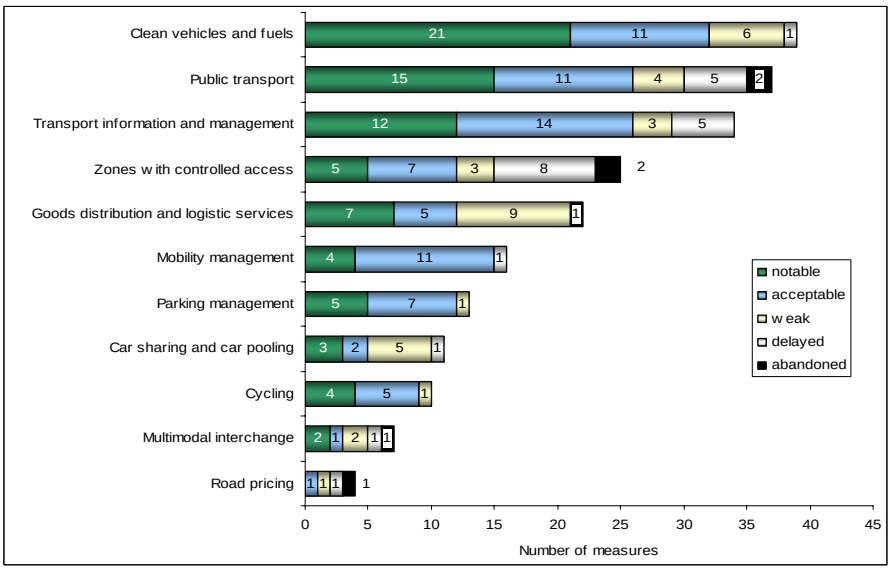
Regarding the clusters **Goods Distribution** and **Multimodal Interchange**, about half of the measures have shown "weak" performances or delays, or have even been completely abandoned. For both clusters, especially complex partnership and cooperation issues have played a major role, either along the public-private boundary (Goods Distribution), or among the actors responsible for different transport modes (Multimodal Interchanges).

More than half of the **Car Sharing and Car Pooling** measures have been assessed as "weak" or "delayed", which is mainly due to an insufficient orientation towards specific target groups and a corresponding communication ("Culture/Life Style", "Public Relations"). In combination with deficits in technical planning this has meant that most Car Sharing and Pooling measures have not fulfilled the expectations.

Results for **Zones with Controlled Access** are only slightly inferior compared to Car Sharing and Pooling, which can be considered an achievement regarding the controversial character of this approach. Technical planning issues, conflicts of interest between partners and a limited understanding of user needs and attitudes have weakened or delayed the implementation. The fact that two measures have also been abandoned underlines the potential weight of these difficulties.

Finally, the four **Road Pricing** measures show a very diverse spectrum of performance as each measure has been assessed with a different success level. This illustrates the level of risk linked to measures in this still relatively new policy field, related to barriers in terms of legal and regulation issues, coordination requirements with national policies and user assessment deficits.

Figure 3.12 Number of measures by success level (abandoned, delayed, weak, acceptable, notable) per cluster (n=218)



The above overview of success levels per cluster suggests a global grouping that reflects the specific weights of barriers and drivers in each cluster:

High success rate (drivers surpass barriers):

- Clean Vehicles and Fuels
- Mobility Management
- Cycling
- Parking Management
- Transport Information and Management

Proximity of success and failure (balanced influence of barriers and drivers):

- Public Transport
- Car Sharing and Car Pooling

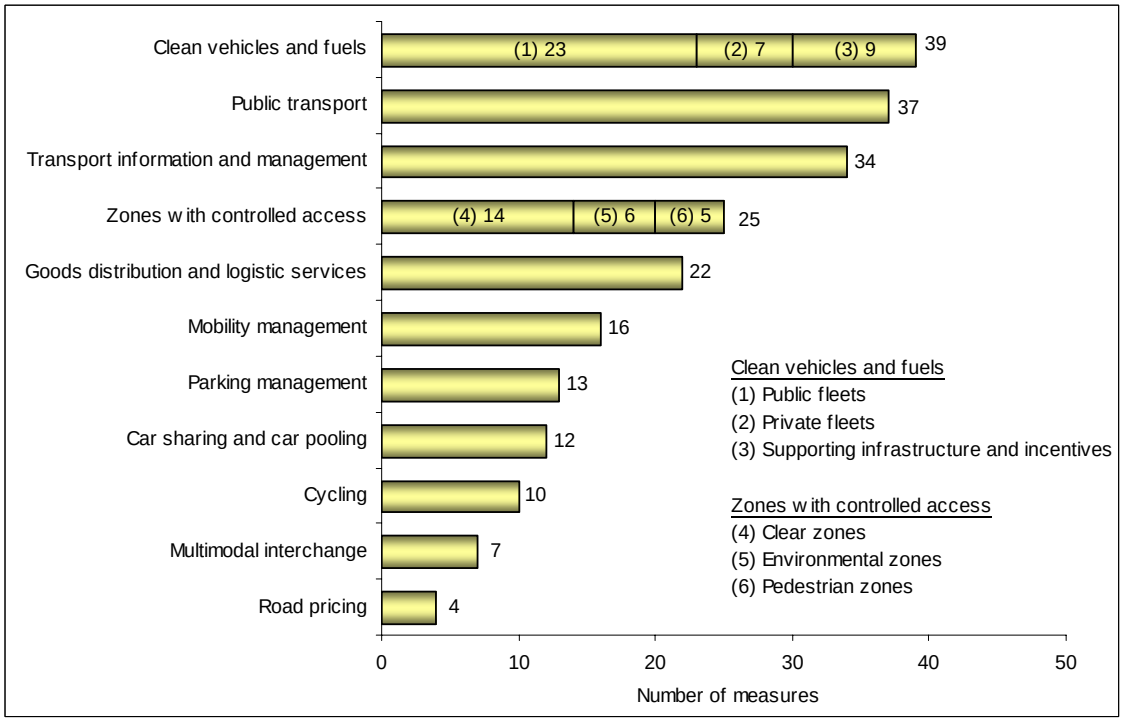
High failure rate (barriers excel drivers):

- Goods Distribution and Logistic Services
- Multimodal Interchange
- Zones with Controlled Access
- Road Pricing

3.8 What are policy-specific barriers/drivers?

Regarding the pertinence of barriers/drivers for particular measure clusters, only five out of 11 clusters defined comprises of sufficient measures for a meaningful statistical analysis (n>20). (Figure 3.13). For the other six clusters, particularities in terms of barriers and drivers have been assessed in qualitative terms drawing on examples that appear to be characteristic. A detailed discussion of the analysis results by cluster is provided in Part B.

Figure 3.13 Number of measures by cluster



3.9 Conclusions

Based on the results presented above and with a view to the future of CIVITAS, a number of conclusions can be drawn regarding three principal issues: Improving the process evaluation methodology used, addressing the key barriers and drivers identified, and further developing the framework provided by the CIVITAS initiative. The implications in terms of policy orientation in particular will be further explored.

Improving the process evaluation methodology

To enable a more meaningful evaluation of local implementation processes and to improve the relevance of the results for policy learning and practice, the main constraints that have affected the

exercise in CIVITAS I should be carefully considered (see 3.2 above). The following four methodological characteristics may help future programmes to perform better in this respect:

1) Information on the implementation process is usually available as part of the management and progress reports (in CIVITAS II as periodic activity reports). A mechanism needs to be introduced that allows an easy extraction of drivers/barriers, ideally at four stages within the project cycle: At the end of I) inception/conception, II) planning/design, III) set-up/creation and IV) operation. Procedures of this kind would usually include major deviations from project objectives and implementation targets. In this way it would be possible to actually assess the *process*, instead of providing a static picture provided with hindsight. It would equally allow barriers and drivers to be addressed specifically in relation to the key phases that characterise any implementation process, without performing guesswork.
2) Reporting should occur on the basis of *common categories* of barriers and drivers and of levels of influence. This would improve the consistency of the analysis, facilitate a better identification of drivers and thus provide a solid foundation for a quantitative substantiation of priority policy responses. The categories developed in CIVITAS I may perhaps only be the starting point to establish a more comprehensive grid, accompanied by detailed guidelines to facilitate the application by local actors, which ideally need to be completed and disseminated prior to the inception phase.
3) The CIVITAS I projects undertook risk management following a common process and guidelines provided by METEOR. The risk management helped the project managers to classify critical measures and apply contingency actions due to diversions. When designing risk management guidance, common categories of risks and the aspects of drivers and barriers should be included and reported on. The perception of risks can be interpreted as an anticipation of barriers before they actually manifest. It reflects the capacity and preparation of local actors to deal with the different barrier types and enables an assessment of the strengths and weaknesses of the contingency strategies employed.
4) The interpretation of barriers and drivers is best done *by all local stakeholders collectively*, and not only by one (especially not the individual responsible for implementation). This should help to differentiate perceptions and avoid biased information provision. It requires organising regular assessment meetings among stakeholders with the help of an independent moderator, who should also take charge of the reporting. It equally presupposes a common training of all moderators to harmonise the approach and type of results aimed at during the inception phase.

Addressing key barriers and drivers

Among the wide range of barriers and drivers identified, some merit specific mention as they point towards a more general need for modifying the approaches taken in CIVITAS I cities, while also for local influence. This concerns in particular the role of local politics, participation and partnerships, institutional issues, measure planning activities, information and communication, as well as technology.

Local politics: With a view to the heavy influence of local politics and cooperation issues, implementation results may have been improved considerably by ensuring broader commitment from stakeholders in general, and of politicians in particular, before or during the inception phases. European financial and political support has been confirmed as a crucial lever in this respect and should therefore become further conditioned to the existence of *local sustainable mobility strategies*, agreed by stakeholders and citizens which could help to secure commitment and continuity over the long-term perspective, as well as to improve the overall legitimacy of the measures.

Participation and partnerships: The *adequacy of partnership and management arrangements* for measure implementation should in the future be demonstrated by the projects more explicitly to ensure the necessary level of involvement and contributions of public and private partners. The Commission should thus promote the elaboration of such strategic policy frameworks and provide the necessary guidance, defining quality criteria for the preparation process (in particular regarding citizen participation) and strategy coverage. Furthermore, management structures and partnership issues should become a particular focus of systematic case studies and good practice dissemination, also independent of the actual measure subject.

Institutional issues: The role of institutional issues could not be properly assessed using the information available, however, a critical review of the results obtained should be undertaken to extract those barriers that point to the need for changes in administrative structures (particularly *approval procedures* and *inter-municipal cooperation*) and legislation/regulation at the national and local levels of some Member States (particularly *alternative fuel taxation* and *parking*), as they may imply actions necessary at European level i.e. promote and harmonise enabling frameworks for sustainable urban mobility.

Measure planning activities: The major influence of planning activities (technical, economic, policy coordination, user assessment) reflects the need for more detailed measure analyses and preparation which should be handled within the frame of the project as otherwise the threshold for participation in CIVITAS would become too high. A considerable potential seems to lie in the exploitation of the *driving effects of planning*, regarding policy synergies and user acceptance, while barriers related to public funds availability, business plans and technical conditions require better management. CIVITAS will have to strike a balance regarding the *degree of innovation* of measures in contrast to their *practical feasibility*. The political choice concerning the essential character of CIVITAS should lead the way: Deploying and integrating available good practice, or enhancing the development of new (and therefore more risky) measures? Both however do not seem to be achievable in a satisfactory way. The frequent identification of “complexity” as a problem in its own right and at individual measure level underlines that in fact, *improved integration at city level* already represents a major challenge for innovation.

Information and communication: Although the cities and projects invested strongly in information and dissemination, information and public relations activities have been attributed only an average influence regarding all CIVITAS I measures. The low number of references made to this category, especially as a barrier, may well reflect the limitations of the evaluation method (see 3.2). Looking at those measures for which communication activities have been identified as a barrier or driver rather suggests that their importance tends to be *underestimated*, that their requirements *lack sufficient understanding*, and that they do represent *powerful drivers*. A highly professional approach to targeted marketing and public relations activities seems to be a strong asset that should reinforce any measure implementation, taking into account their integration at city level.

Technology: Finally, the role of technology in the implementation processes assessed appears to require a specific reply regarding the future planning of measures and initiation of partnerships. Where the achievement of implementation targets relies to a large extent on new technological equipment, the *availability* and *maturity* of these at the time of implementation should be reviewed more critically – particularly if high investment costs are involved. Software and information technologies, equipment for public areas and in particular clean vehicles are examples illustrating that the extent to which technology conditions successful realisation should remain limited. This calls either for the use of proven and broadly availably technologies or, where these do not comply sufficiently with the strategic aims of CIVITAS, broader partnerships at programme level for key technologies – for instance in the case of clean vehicles and alternative fuels.

Developing the CIVITAS framework

CIVITAS I has demonstrated the importance of European funding as a crucial driver for local innovations in the field of sustainable urban mobility. In times of tight and even declining city budgets and high pressures for demonstrating the (economic) efficiency of any public investments, progressive forces in cities critically depend on the availability of high-level political support (which usually results in necessary financial allocations) to achieve urgently needed innovations. As such innovations are intrinsically related to political risks it has often been the “external” funds that have actually enabled the necessary support and partnerships, further enhanced by the opportunity for exchange and learning with peers from across Europe. Hence, from an implementation process point of view, there is indeed a strong case for the continuation of CIVITAS. Nevertheless, there is also room for improvement regarding the framework provided by CIVITAS, which essentially concerns three aspects: The selection criteria used for assessing applications, the role of industry, and the flexibility of the implementation arrangements.

As mentioned, there is a need to review and complement the criteria against which project proposals are assessed. In order to improve the overall quality and long-term effectiveness of the measures implemented, more emphasis should be put on demonstrating *commitment*, *policy integration* and *feasibility*. In addition, measures should also incorporate a strong *marketing and information* component. The barriers and drivers identified for measure implementation in CIVITAS I clearly

underpin such a move towards a strategic planning basis as a core condition for funding and, ultimately, target achievement.

Regarding implementation arrangements, there seem to be conflicting objectives that need to be brought into line. As procedural quality standards e.g. in terms of policy integration, stakeholder involvement or citizen participation are high already, it appears to be difficult for local actors to keep their measure implementation schedules and budgets within the agreed project framework. Changing measure designs may result precisely from open coordination and consultation processes and require additional time. Consequently, 10% of the measures have suffered substantial delays, and another 18% has been assessed as "weak" partly for related reasons. A step forward could be to allow for a *more flexible implementation and evaluation schedule* of individual measures also beyond the general project lifetime in order to obtain a correct picture of what has actually been achieved.

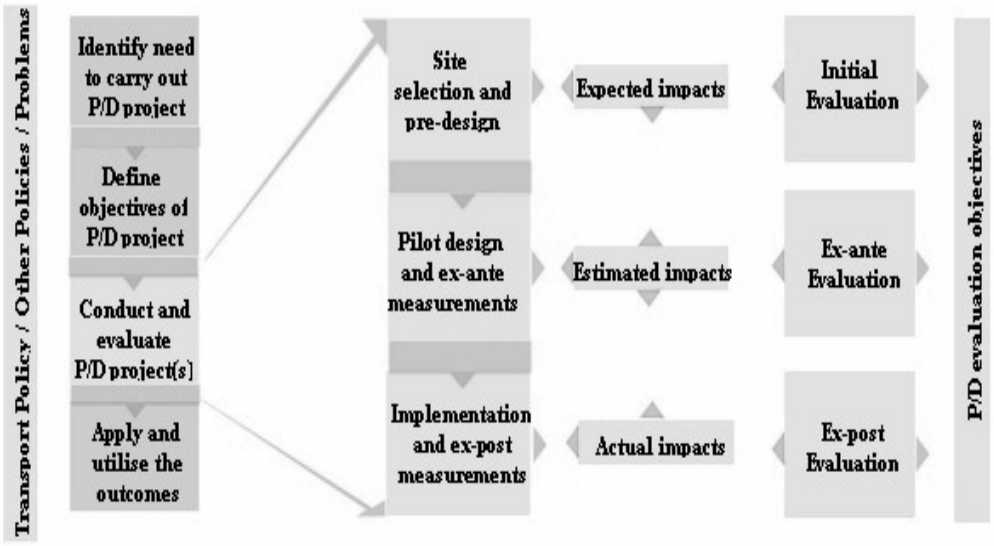
Last but not least, technology plays a central role as a cross-cutting issue in sustainable urban mobility. Major difficulties in terms of availability and maturity of technology as those encountered in CIVITAS I should be prevented by working towards a broader private sector involvement on a European and international scale e.g. by opening up the CIVITAS Forum to pertinent industry representatives or linking with existing industry platforms. A more focused *dialogue between cities and industry* may help to better match future demand and supply in line with European policy objectives, and bridge the gap between demonstration and market development. Apparently, clean vehicles and alternative fuels as well as information technologies are sectors that would justify the sketched approach.

4 IMPACT EVALUATION

4.1 Methodology

The cross site impact evaluation is based on the MAESTRO approach which was developed on behalf of the European Commission within the 4th Framework Program. MAESTRO was adopted for use in CIVITAS I as some of the steps in MAESTRO are specifically directed towards supporting the decision on whether or not to perform the project. As this decision was already taken with the inclusion in the Projects of CIVITAS I the steps were no longer necessary.

Figure 4.1 The MAESTRO evaluation steps



Essential elements from MAESTRO that have been applied to the CIVITAS I are the application of an ex-ante and an ex-post analysis, the distinction between the before and after comparison and the projects' impact by comparing the project results with the results of a do-nothing scenario[3].

The ex-ante evaluation aimed at estimating the likely impacts of the CIVITAS Initiative prior to its implementation. This in turn requires an assessment (snapshot) of the situation prior to the implementation of CIVITAS and the estimating the corresponding "Do-nothing Scenario" (e.g. a scenario projecting the estimated progress of the situation *without* the CIVITAS Initiative) and a CIVITAS Scenario (projecting the estimated situation *with* the CIVITAS Initiative).

[3] Note that an initial evaluation, aimed at the definition of the expected impacts, was not required since the CIVITAS cities had already completed such exercise at the time of METEOR inception.

The ex-post evaluation aimed at analysing the actual impacts of the CIVITAS projects comparing the estimated results with the actual results, and using the chosen evaluation method to determine whether or not the project has achieved its objectives.

The cross site evaluation is based on the evaluation reports provided by the cities and information gathered during the lifetime of the projects. In order to facilitate cross-site evaluation two important harmonisation aspects were developed.

1. Common templates for data collection in order to perform an evaluation at measure level, so that every demonstrating measure would be presented in a similar manner.
2. A common choice of 28 core indicators grouped in the following 5 impact areas[4]:
    a. Transport: with a focus on the quality of service, safety and the transport system.
    b. Energy: with a focus on the energy consumption
    c. Environment: with a focus on pollution and nuisance
    d. Economy: with a focus on the benefits and costs
    e. Society: with a focus on the acceptance, accessibility, employment and security.

A list of the 28 indicators is provided in table 4.1.

Evaluation at measure and city level was performed by the cities according to the evaluation plans. Each project developed an evaluation report containing an analysis of all evaluation levels (including project level). As an annex to the evaluation reports the projects were responsible for producing a document with the templates at measure level.
Data and information collected by the projects and the cities was used for the cross site evaluation with the measures grouped into the aforementioned clusters. The cross site evaluation focused on the analysis at cluster level; while results from cities regarding up-scaling possibilities were also investigated.

In addition to the comparative analysis of the results, quantitative analyses have also been made using the ITEMS model which focuses on the effects of a perceived modal split, energy use and environmental impacts. The analyses using ITEMS were based on several fictive cities and the results of which are presented in Deliverable 9. All results shown in the present report are based on actual

[4] These indicators are described in the report Assessment Framework and Evaluation Guidelines for Data Collection (METEOR D2); the report has been produced in close cooperation between the cities within the so-called Evaluation Liaison Group (ELG)

data provided by the cities themselves. In several cases ITEMS and other models have been used to calculate impacts; in other cases measure form the basis of the cross site comparison.

Table 4.1 *List of common impact indicators captured in the 5 evaluation categories*

NO.	EVALUATION CATEGORY	EVALUATION SUB-CATEGORY	IMPACT	INDICATOR	DESCRIPTION	DATA /UNITS
	Economy					
1		Benefits	Operating Revenues	Operating revenues	Revenues per public transport passenger-km	Euros/pkm, quantitative, derived or measurement
2		Costs	Operating Costs	Operating costs	Costs per public transport passenger km	Euros/pkm, quantitative, derived or measurement
	Energy					
3		Energy Consumption	Fuel Consumption	Vehicle fuel efficiency	Fuel used per vehicle km, per vehicle type	MJ/vkm, quantitative, derived or measurement
4				Fuel mix	Energy used per type of fuel, per vehicle type	MJ, quantitative, derived or measurement
	Environment					
5		Pollution/Nuisance	Air Quality	CO levels	CO concentration	Ppm or g/m3, quantitative, measurement
6				NOx levels	NOx concentration	Ppm or g/m3, quantitative, measurement
7				Particulate levels	Particulate (pm10) concentration	Ppm or g/m3, quantitative, measurement
8			Emissions	CO2 emissions	CO2 per vehicle km	G/vkm, quantitative, derived
9				CO emissions	CO per vehicle km	G/vkm, quantitative, derived
10				NOx emissions	NOx per vehicle km	G/vkm, quantitative, derived
11				Small particulate emissions	Pm10 per vehicle km	G/vkm, quantitative, derived
12			Noise	Noise perception	Perception of noise	Index, qualitative, collected, survey
	Society					

NO.	EVALUATION CATEGORY	EVALUATION SUB-CATEGORY	IMPACT	INDICATOR	DESCRIPTION	DATA /UNITS
13		Acceptance	Awareness	Awareness level	Degree to which the awareness of the policies/measures has changed	Index, qualitative, collected, survey
14			Acceptance	Acceptance level	Attitude survey of current acceptance with the measure	Index, qualitative, collected, survey
15		Accessibility	Spatial Accessibility	Perception of Public Transport accessibility	Attitude survey of perception of physical accessibility of the public transport network (distance to nearest public transport stops)	Index, qualitative, collected, survey
16			Economic Accessibility	Public transport services relative cost	Cost of public transport related to average personal income (i.e. cost of a weekly, monthly or annual pass in proportion to the average weekly, monthly or annual income, respectively)	Index, quantitative, measurement
17		Security	Security	Perception of security in public transport	Perception of security when using public transport options	Index, qualitative, collected, survey
	Transport					
18		Quality of Service	Service reliability	Accuracy of timekeeping in public transport	Percentage of services arriving/departing on time compared to timetables (each city should fix the interval of time considered as a delay compared with timetable)	%, quantitative, collected, measurement
19			Quality of service	Quality of public transport service	Perception of quality of public transport services	Index, qualitative, collected, survey
20		Safety	Transport Safety	No. of injuries and deaths caused by accidents	General transport accident no. within the city causing injured and deaths	Quantitative, measurement

NO.	EVALUATION CATEGORY	EVALUATION SUB-CATEGORY	IMPACT	INDICATOR	DESCRIPTION	DATA /UNITS
21		Transport System	Traffic Levels	Vehicle km by vehicle type - peak	Total trips length per vehicle per day	Vkm per day, quantitative, derived
22				Vehicle km by vehicle type -off peak	Total trips length per vehicle per day	Vkm per day, quantitative, derived
23			Congestion Levels	Average vehicle speed – peak	Average vehicle speed over total network	Km/hr, quantitative, derived
24				Average vehicle speed - off peak	Average vehicle speed over total network	Km/hr, quantitative, derived
25			Freight Movements	Total no. of goods vehicles moving in demo areas	Assessment of whether the daily no. of goods vehicles accessing city centre changes as a result of the demonstrations	Quantitative, derived or measurement
26			Modal split	Average modal split-Passenger kms	Percentage of passenger kms for each mode	%, quantitative, derived
27				Average modal split-vehiclekms	Percentage of vehicle kms for each mode	%, quantitative, derived
28			Vehicle Occupancy	Average occupancy	Mean no. persons per vehicle/day	Persons/vehicle, quantitative, derived, measurement

4.2 Results

In total the 19 cities within the CIVITAS I projects proposed the implementation of 248 measures. 212 measures in total have been reported and upon which the analysis has been based in the following table.

Table 4.2 *An overview of the proposed and the reported measures for each city*

City	Proposed number of measures	*Number of reported measures*
Aalborg	6	2
Barcelona	5	5
Berlin	10	10
Bremen	32	9
Bristol	45	29
Bucharest	4	4
Cork	6	6
Gdynia	1	1
Göteborg	5	7
Graz	17	18
Kaunas	7	4
Lille	10	10
Nantes	21	22
Pecs	2	3
Prague	4	3
Rome	16	23
Rotterdam	26	26
Stockholm	18	19
Winchester	13	11
Total	248	212

Table 4.3 provides a qualitative overview of the results for each cluster on the 5 impact levels. As can be seen from this table the CIVITAS I measures in the 19 demonstration cities have on general a positive impact on transport, energy, environment and society level. The impact on economical level is stated as neutral, in where there are great differences between the thematic clusters. On general a lot of measures that have been implemented need initial investments or subsidies to exist.

In part B of this report a detailed analysis on cluster level is presented. The main findings are summarized here:

Table 4.3 *Results of all clusters and CIVITAS overall on the 5 impact levels*

Clusters	Transport	Energy	Environment	Economy	Society
Transport information and management	☺	*	☺	😐	☺
Multimodal interchange	*	*	*	*	☺
Mobility management	*	*	*	*	☺
Cycling	☺	☺	☺	☹	😐
Car pooling and car sharing	☺	☺	☺	😐	☺
Zones with controlled access	☺	*	☺	*	☺
Clean vehicles and fuels	*	☺	☺	☺	☺
Public transport	☺	☺	☺	☹	☺
Goods distribution and logistic services	☺	☺	☺	☺	☺😐
Parking management	☺	☺	☺	😐	☺
Road pricing	☺	☺	☺	*	😐
CIVITAS I	☺	☺	☺	😐	☺

Definition of conclusion table	
Improved	☺
No change or negative impact	😐
Situation has worsened	☹
Situation is currently unknown	*

Transport information and management

The positive interpretation of the results is that the availability of Real Time Passenger Information (RTPI), the higher the frequency of buses travelling in key corridors and the improvement of planning tools have opened public transport towards other users. The fact that transport timetables no longer have to be studied in advance due to the high frequencies in the rush hour and the real time information on when to expect the next arrival/departure has made

public transport less “complicated” demonstrating to a new group of less frequent users that public transport is a suitable alternative for them.

Transport Information and Management measures have successfully demonstrated that they definitely contribute to the ultimate CIVITAS Initiative objectives mainly by increasing the access to the public transport system, providing real-time information on public transport and traffic congestions, raising public transport customer satisfaction and reducing CO_2 emissions in the demonstration areas.

Multimodal interchange

Multimodal interchange measures have been well accepted by the citizens of the different CIVITAS I cities. The awareness of the improved conditions is also quite high and although not firmly stated, one can expect that these kinds of measures do have a positive impact on the use of public transportl. When public transport is made more attractive people may be more inclined to change from car use to public transport, which of course would result in a change in the modal share and ultimately also contribute to a cleaner environment, in line with the ultimate CIVITAS I objective.

Mobility management

Mobility Management measures have a direct and positive influence on awareness and acceptance. With regard to other areas of impact the benefits are mainly indirect such as modal split, vehicle occupancy, fuel consumption, air quality, emissions and noise. Mobility management is at its most effective when used on new employees within a company.

It was determined that the travel behaviour of newcomers can be changed easier than travel behaviour of long time employees. Typical information for newcomers to a company could contain:

- Map of local / regional public transport net
- Brochure on parking in the city
- Special information regarding company surroundings, containing public transport stops, points of interest
- Cycle map
- Timetable of the public transport systems

The implementation of mobility management at schools is also useful for three main reasons:

1) to influence children’s future choice for sustainable mobility
2) to change the current mobility behaviour
3) allow children to influence parents and teachers

Implementing mobility management measures is not a standard procedure, because every situation/ area is different. A uniform measure to fit all situations does not exist.

Mobility management measures contribute in general to the objectives of CIVITAS I by raising the levels of awareness and acceptance. A number of indirect effects such as traffic safety, modal split, emission reduction and vehicle occupancy can also be achieved depending on the environment and habits of the target group in question.

Cycling

The introduction of European cycling measures certainly seems to improve the living conditions in urban areas and to a certain extent the actual physical condition of the citizens involved. The environmental benefits included a reduction in air pollution and noise reductions. Judging from the experience of CIVITAS I measures, more people tend to switch to this form of transportation when infrastructures are improved and new facilities are implemented, resulting in a higher modal share of bicycles. When cycling replaces motorised transport, emissions are reduced as well as energy use helping to achieve the ultimate objectives of the CIVITAS I project.

People tend to appreciate cycling related measures and cycling has become a safer form of transport due to the imposed measures as illustrated by the high level of acceptance within the demonstration projects. One drawback however is the low level of awareness of the measures. In general the measures produced a positive impact analysis although subsidies are required due to rather high initial investment costs.

The cycling measures within CIVITAS I ensured that cyclists were provided with a more integrated infrastructure due to the implementation of green routes and information on new cycle route markings. Cycling is destined to become a more widespread form of transport in the near future due to the ever increasing demand for mobility on overfull inner city roads making cycling an interesting and fast alternative in city centres.

Car pooling and car sharing

Car sharing and car pooling measures have direct benefits at different levels. Firstly the car-poolers and car-sharers whose travel costs have also been reduced no longer have to drive their cars in rush hour traffic every day and in some cases are even able to improve social contacts. Secondly other road users benefit due to fewer vehicles on the road, in turn reducing congestion. Thirdly the governments benefit from these kind of initiatives due to less congestion, lower costs (reduction of new infrastructure), better access to economic centres, a reduction in the average number of car kilometres and fewer emissions providing a better environment to live in.

According to the results on the measures, Car pooling and car sharing seem to provide a substantial contribution to the ultimate CIVITAS I objectives; by creating a modal shift towards more sustainable forms of transport and away from the private car, by encouraging higher vehicle occupancy rates, by reducing the number of car kilometres which in turn reduces noise levels and emissions and provides a better environment. Car sharing and car pooling are also well accepted among the members. Car pooling does however require initial investments.

Zones with restricted access

Despite a natural interrelation, there are at least three zone sub-clusters whose underlying nature deserves an ad-hoc assessment:

- **Clear Zones**, where the emphasis is on restricting access to private cars while encouraging the use of more sustainable modes;
- **Environmental (or Clean) Zones**, where the emphasis is on restricting access to all vehicles beyond certain pollution standards;
- **Pedestrian Zones**, where the emphasis is on creating protected areas for the exclusive pedestrian access of pedestrian and/or non-motorised modes.

Whilst limitation to access is the common denominator, the measures vary considerably in nature, scale and goals. It is however possible to draw a few general conclusions:

Substantial environmental benefits can be expected through the implementation of the different forms of zones;

- Another major positive impact is that on urban liveability, which increases consistently wherever zones are introduced;
- Success is strongly dependent upon the early involvement of noteworthy stakeholders, such as citizens, retailers and transport operators;
- Effective zones are usually part of a wider packages of complementary measures, which however render planning and implementation complicated and expensive.

Clean vehicles and fuels

The measures have been divided into three sub clusters as follows:

- *Public Fleets* includes all measures where vehicles are operated as public services (i.e., public buses, waste collection trucks, municipal fleets, etc.);
- *Private Fleets* includes all measures concerning private activities (e.g., private citizens, freight, private companies' fleets, etc.).
- *Supporting Infrastructure and Incentives* includes less homogeneous measures concerning fuelling infrastructures, supply chain as well as a series of services boosting the development of the clean vehicles & fuels market.

Clean Vehicles & Fuels was a very important pillar of the CIVITAS Initiative in terms of critical mass and of impacts.

Some overall and aggregated conclusions can be highlighted:

- clean vehicles & fuels produced a significant reduction of pollutant emissions and an improvement in air quality;
- a crucial role was played by local authorities (with public fleets, infrastructures and incentives) in paving the way to boost the clean vehicles and fuel market, later followed by private stakeholders (with private fleets);

- Joint procurements and a broad range of incentives to companies and citizens represented a fundamental stimulus to increase the clean vehicles market, allowing the counterbalance of their somewhat higher price in comparison to conventional vehicles;
- A closer cooperation with car dealers, manufacturers and fuel suppliers is required to overcome certain technical inadequacies of the market in terms of vehicle models, performance and affordability, as well as in terms of improved fuelling infrastructures;
- A more coherent fuel taxation policy is necessary at European and national level in order to allow fair and sustainable competition with conventional fuels;
- An important contribution to consolidate the market could be provided, among others, by the implementation of the European Bio-fuel Directive and by the future European Directive on clean vehicles public procurement, presently at proposal stage.

Public transport

Collective transport and in particular public transport is an important alternative to the car in the cities and many measures in CIVITAS I concentrated on this theme. The improvement of the quantity and quality of the system on offer is important; innovative services and integration of services can help to improve the system. However, without supporting measures or developing a package of measures, the impact is limited. Related measures include marketing, information systems, raising awareness, measures on restrictions and pricing regarding car use, integration of modes within a chain-based approach and city (re)development.

In many cities available funds are limited and measures must be implemented in a cost effective manner. Innovative strategies can contribute by improving the image of public transport. Security and access for people with reduced mobility remain areas of concern and always need to be taken into consideration.

In many cases CIVITAS public transport measures support measures related to public transport that already existed prior to CIVITAS in many cities. Public transport lines are very expensive and cannot be implemented solely using CIVITAS funding. The supporting actions that have been implemented via CIVITAS are positive towards the use of public transport in general which explains why the impact categories Transport, Energy, Environment and Society are positively ranked. As public transport is not cost effective and financially self supporting, the impact category “Economy” is negative in all cases.

Goods distribution and logistic services

The main impact objectives were a reduction in kilometres for goods delivery transport and an improvement of the environmental indicators and energy indicators based on the reduction of the goods delivery vehicle kilometres and from the use of environmentally friendly vehicles. The studies showed the potential impacts, in the demonstration projects they were realised. It has however proven to be very difficult to measure the impacts: in several cases the impact of a

demonstration project is based on model exercises or on questionnaires on perceived impacts by stakeholders. Nevertheless measures in this cluster are promising and in general not specific per city.

By reducing the number of kilometres per freight movement, there is a positive effect on transport, environment and energy. The reductions are in many cases also market driven and therefore economically positive. The effects on society are in most cases positive: this can be expected although there is no actual proof available. In CIVITAS cases this has been measured as neutral and in some cases (Stockholm) positive.

Parking management

CIVITAS Initiative implementations of parking management measures have clearly been successful. All measures have been strongly supported by politicians and citizens. Support from local authorities and good communication has ensured implementation success and wide acceptance. The lack of an adequate legal framework remains a barrier and can cause delays.

Parking Management can be used as a global instrument or as a focus measure. Experienced measures show not only the efficiency of parking management policies but also their flexibility.

Parking management generally requires large investments for building new car parks. Active participation of private groups is a great success factor for introducing parking management measures. The impacts and therefore the efficiency have been shown in both cases. Parking management can influence the behaviour of focus groups and can also reduce traffic, congestion, noise and pollution.

Road pricing

Road pricing measures have been strongly delayed and this has affected the delivery of expected evaluations. Some results are however available and confirm that Road Pricing measures clearly lead to more sustainable, clean and efficient urban transportation. Road pricing measures have proven to have a substantial positive influence on liveability, the number of cars in inner cities, and also noise and air quality.

Road Pricing implementations have also emphasised the fact that this type of project can ultimately lead to “mentality changes” in terms of mobility and modality and is crucial for the future. The potential success of such schemes is heavily dependant on the quality of alternative transport available.

4.3 Conclusions

The impact results related to the overall value of the CIVITAS-1 programme

There were positive impacts ascertained at all 5 impact levels in individual measures in the different clusters. At city level however, the impact evaluation did not show major impacts on economy, environment, energy use and on transport indicators as a result of the measures implemented within the CIVITAS program. As mentioned before the measures were on a relatively small scale and the evaluation process could not be realised due to the ambitions at the start of the project. Nevertheless the following positive conclusions can be made:

- In several cities a positive impact on awareness of the objectives of the CIVITAS program could be measured. Citizen's do recognise and support the objectives related to the way in which mobility and transport in cities needs to change. Citizen's were also aware of the measures and the participation of the city within the CIVITAS program.
- Many of the demonstration projects will continue after CIVITAS
- Many of the measures are fit for up-scaling and will have a notable impact on city level once implemented on a wider scale.
- As will be shown in the next chapter the impact can be enlarged by packaging measures. Two examples: hard measures (such as access restriction) do have a better acceptance when combined with soft measures (awareness raising) and Public transport measures also have a better impact when combined with other measures on car use, such as parking restrictions.

Limitations of the evaluation process

Although many measures show major impacts, the impact analysis could not fulfil the ambitions that were stated at the start of the project. Several reasons contributed to this:

- the data collection at measure level was incomplete,
- many measures had a small scale making it difficult to measure effects at measure level or to separate these effects from the impacts of other (non-CIVITAS) measures and from the trend,
- some cities did not have a do nothing scenario,
- the diversity of situations in cities and in measures was not sufficiently covered by the model ITEMS
- as the measure program stopped at the end of the project it was not possible to measure the long-term effects.

It must be concluded that the planned evaluation programme was overambitious. On the other hand improvements could be achieved in the CIVITAS-II and follow up to the CIVITAS

Initiative evaluations based on the experience in CIVITAS-I. The lessons learned in this respect are:

- make financial and contractual arrangements on the provision of data,
- be realistic regarding the scale of the measures in relation to the impact at city level,
- do not underestimate the problems in applying model approaches in other cities,
- make provisions for evaluations and data collection beyond the project life.

5 TRANSFERABILITY AND PACKAGING

5.1 Introduction

This chapter analyses the cluster contexts for transferability and the measure and cluster packaging recommendations. The approach presented is based on identifying relevant information from the data accumulated during CIVITAS I, in order to replicate such measures in any new target cities. The intension is to be able to provide grounded support when implementing CIVITAS type measures in plans adopted by any new city, taking into account transferability requirements and adequate packaging. Transferability does not simply refer to individual technical or operational features, but how a measure corresponds to the receptor city. In some cases not only the measure will be transferred as a policy instrument but also certain relations between measures themselves, whilst ensuring suitable institutional support. Examples taken from prior initiatives indicate that a number of phases/ stages must be followed in any transferability process:

- a “demonstration phase” where a best practice is identified in the originator city;
- a “transferability phase” where the compatibility of the best practice in the receptor city is appraised;
- an “assessment phase” where specific barriers amenable to change and factors of success are identified in the receptor city;
- finally, an “implementation phase” where the good practice is implemented in the receptor city

5.2 Objectives

Introducing the measure Transferability and Packaging successfully into a target city requires a number of logical steps; from the diagnosis of the situation in the target city, to the pre-selection of the measures considered suitable for addressing the problems and a thorough understanding of the pre-conditions for success (*enabling contexts)*. The 10 steps are identified as follows

- STEP 1 - Diagnostic of the Problems
- STEP 2 - Characterisation of the City
- STEP 3 - Analysis of the city context and implications of problems identified
- STEP 4 – Search for Similar Contexts
- STEP 5 - Selecting Examples of Source Urban Contexts
- STEP 6 - Identify measures with potential for transferring
- STEP 7 – Packaging and Dimensioning the Measures for Transferring

- STEP 8 – Ex-ante Assessment of Measures to Transfer
- STEP 9 - Identify Need for Adjustment
- STEP 10 - Implement Measures and Steer Results

The information produced by the CIVITAS I cities is systematized in order to allow receptor cities support from the reference cases provided by CIVITAS. The central objective addressed in this section is to highlight the knowledge gained from the information reported by the CIVITAS cities regarding the surrounding context for the measures and the crucial relationships between them in order to produce general conclusions about Transferability and Packaging from CIVITAS.

5.3 General Findings of Transferability in CIVITAS

Policy fields and corresponding measures adopted in CIVITAS represented meaningful complex urban systems. To portray the feedback at work and the "cause and effect" relationships involves assessing the dynamics related to successful implementation in order to draw conclusions on the preconditions for transferability and produce recommendations for packaging. Identifying the causal structure represents a crucial step in providing grounded support for the adoption of policy measures experienced in CIVITAS. Causal Loop Diagrams in Part B of this report link elements taken from the CIVITAS assessments evaluation with the characterisation of the context within a cluster and the respective High Level Objectives. In doing so, the most likely re-enforcing relationships between CIVITAS measures as well as counteracting influences not only between measures themselves but also between context variables (drivers / barriers) have been illustrated. The following section summarises some of the key findings from Part B.

5.3.1 Addressing local city problems adopting CIVITAS policy measures

A number of city requirements or targeted objectives in local context have been identified in the CIVITAS reports. The so called High Level Objectives (High Level Objectives) can be seen as the fundamental objectives driving the adoption of measures in CIVITAS.
The fact that target cities are often not fully aware of the exact context of their local problems implies that several steps are required before the concept starts taking shape. Firstly, it is necessary to develop a structured analysis of the local situation and subsequently assess the need to take actions. The following stage consists of a Source/Target City analysis in view of transferring and adapting practices adopted in CIVITAS. To do this requires a number of preconditions framing the approach, such as having a clearly defined number of guiding objectives, without which the ability to undertake an effective improvement process will be lost. A city should have a clear definition of its strategic orientations making it possible to frame and identify specific key areas contributing to or against attaining the ascertained objectives.

Having identified the major High Level Objectives in CIVITAS, the measures intended to contribute towards the achievement, as well as the problems and the obstacles acting against such strategic orientations can then be considered. The diagnosis of the problems can be seen as a starting point for the transferability process and in order to produce the correct structuring, the transferability process should always depart from a clear definition of High Level Objectives. The definition of the most relevant problems in the local city context will be crucial in understanding which measures should be analysed. In this respect, it is important to ensure a certain amount of independence between High Level Objectives in order to avoid duplication in impact accounting, i.e. High Level Objectives such as e.g. "promote cycling" and "promote alternative transportation modes" would have to be refined to ensure little on no overlapping in definition.

In CIVITAS this was achieved by assessing all the information contained in city reports and combining the identified High Level Objectives with the clusters of measures considered[5]. A shortlist of suitable measures for specific problems has been realised taking into account the existence of key relationships between policy measures and the requirements of the city in question. The following tables reflects the feedback structure associated to each of the clusters of measures[6], showing which clustered policy measures contribute most decisively towards the achievement of the High Level Objectives found to be common in CIVITAS cities, providing an entry level for those who may wish to learn from CIVITAS about which measures should be considered in any new particular case.

Table 5.1 *Key Relationships between Policy Measures and High Level Objectives in CIVITAS*

IF A CITY NEEDS TO:	THEN IT SHOULD CONSIDER ADOPTING:
HLO1 Improve the longer-term planning process and information provision"	• Transport Information and Management Systems
HLO2 Reduce congestion	• Transport Information and Management • Mobility Management • Zones with Controlled Access • Public Transport • Goods Distribution and Logistic Services • Parking Management • Road Pricing
HLO3 Reduce traffic Emissions and Energy Consumption	• Mobility Management • Cycling • Car Sharing and Car Pooling • Clean Vehicles • Public Transport • Road Pricing

[5] Mobility Management, Zones with Controlled Access, Road Pricing, Parking Management, Public Transport, Goods Distribution and Logistic Services, Transport Information and Management

[6] Please refer to Part B of this report on the issue of transferability

HLO4 Protect City Centre	• Zones with Controlled Access
HLO5 Increase the Efficiency of the Transport System	• Multimodal Interchanges • Mobility Management • Cycling • Car Sharing and Car Pooling • Public Transport • Goods Distribution and Logistic Services
HLO6 Promote better integrated planning between Transport and Land Use	• Transport Information and Management • Mobility Management
HLO7 Increase the Attractiveness of Public Transport, induce modal shift and its share	• Transport Information and Management • Multimodal Interchanges • Mobility Management • Car Sharing and Car Pooling • Zones with Controlled Access • Public Transport • Road Pricing
HLO8 Increase Clean Vehicles Market Share in Private and Public Fleets	• Car Sharing and Car Pooling • Zones with Controlled Access • Clean Vehicles • Parking Management
HLO9 Establish Business Cases and accelerate take up of clean vehicles solutions	• Cycling • Car Sharing and Car Pooling • Clean Vehicles
HLO10 Decrease Parking Pressure	• Cycling • Car Sharing and Car Pooling • Parking Management
HLO11 – Increase competitiveness and reliability of local production of alternative fuels	• Clean Vehicles
HLO12 – Foster Competitive Procurement of Clean Vehicles	• Clean Vehicles
HLO13 Reduce Journey Times	• Multimodal Interchanges
HLO14 Decrease Local Emission and Improve Quality of Life in City Centres	• Zones with Controlled Access • Goods Distribution and Logistic Services • Parking Management
HLO15 Improve Safety and Security of Public Transport	• Public Transport

5.3.2 Checking the Expected Impacts of Policy measures

The following table reflects the expected impacts of the adoption of policy measures, providing a different perspective to the decision maker when assessing the ability of those measures to meet specific city targets. The adoption of such measures will be further confronted with drivers/barriers as depicted in the diagrams shown in part B and described in this chapter.

Table 5.2 *Conclusion on Key Impacts of Policy Measures in CIVITAS*

IF A CITY PLANS TO ADOPT:	THE EXPECTED IMPACTS ARE:
Transport Information and Management	HLO1 Improve the longer-term planning process and information provision"
	HLO2 Reduce congestion
	HLO6 Promote better integrated planning between Transport and Land Use
	HLO7 Increase the Attractiveness of Public Transport, induce modal shift and its share
Multimodal Interchange	HLO5 Increase the Efficiency of the Transport System
	HLO7 Increase the Attractiveness of Public Transport, induce modal shift and its share
	HLO13 Reduce Journey Times
Mobility Management	HLO2 Reduce congestion
	HLO3 Reduce traffic Emissions and Energy Consumption
	HLO5 Increase the Efficiency of the Transport System
	HLO6 Promote better integrated planning between Transport and Land Use
	HLO7 Increase the Attractiveness of Public Transport, induce modal shift and its share
Cycling	HLO3 Reduce traffic Emissions and Energy Consumption
	HLO5 Increase the Efficiency of the Transport System
	HLO9 Establish Business Cases and accelerate take up of clean vehicles solutions
	HLO10 Decrease Parking Pressure
Car Sharing and Car Pooling	HLO3 Reduce traffic Emissions and Energy Consumption
	HLO5 Increase the Efficiency of the Transport System
	HLO7 Increase the Attractiveness of Public Transport, induce modal shift and its share
	HLO8 Increase Clean Vehicles Market Share in Private and Public Fleets
	HLO9 Establish Business Cases and accelerate take up of clean vehicles solutions
	HLO10 Decrease Parking Pressure
Zones with Controlled Access	HLO2 Reduce congestion
	HLO4 Protect City Centre
	HLO7 Increase the Attractiveness of Public Transport, induce modal shift and its share
	HLO8 Increase Clean Vehicles Market Share in Private and Public Fleets
	HLO14 Decrease Local Emission and Improve Quality of Life in City Centres
Clean Vehicles	HLO3 Reduce traffic Emissions and Energy Consumption
	HLO8 Increase Clean Vehicles Market Share in Private and Public Fleets
	HLO9 Establish Business Cases and accelerate take up of clean vehicles solutions
	HLO11 – Increase competitiveness and reliability of local production of alternative fuels
	HLO12 – Foster Competitive Procurement of Clean Vehicles

IF A CITY PLANS TO ADOPT:	THE EXPECTED IMPACTS ARE:
Public Transport	HLO2 Reduce congestion
	HLO3 Reduce traffic Emissions and Energy Consumption
	HLO5 Increase the Efficiency of the Transport System
	HLO7 Increase the Attractiveness of Public Transport, induce modal shift and its share
	HLO15 Improve Safety and Security of Public Transport
Goods Distribution and Logistic Services	HLO2 Reduce congestion
	HLO5 Increase the Efficiency of the Transport System
	HLO14 Decrease Local Emission and Improve Quality of Life in City Centres
Parking Management	HLO2 Reduce congestion
	HLO8 Increase Clean Vehicles Market Share in Private and Public Fleets
	HLO10 Decrease Parking Pressure
	HLO14 Reduce Local Emissions and Improve Quality of Life in City Centres
Road Pricing	HLO2 Reduce congestion
	HLO3 Reduce traffic Emissions and Energy Consumption
	HLO7 Increase the Attractiveness of Public Transport, induce modal shift and its share

5.4 Recommendations on Packaging for Successful Transferability

Several measures in CIVITAS are generally obvious scenarios relating to the promotion of sustainable mobility and can gather large consensus by themselves, having the power to create their own momentum. Even in such cases the measures' full potential may not be achieved, prejudicing the effectiveness, unless enhancing combinations of measures are considered. Although packaging can be considered as an intuitive need, little information was available prior to the large scale research undertaken in CIVITAS, which is all the more important considering its relevance for attaining the necessary insight into the context for Measure/Cluster transferability. CIVITAS investigated the basic notion for packaging and found significant evidence to promote a systematised approach, depicting key relationships both within and across clusters.

5.4.1 Packaging Across Policy Clusters

Clusters of measures complement and enhance the effectiveness of others often beyond what any typical analysis can ascertain. They form what can be called as a "package" of clusters acting together to achieve a certain objective. The key associations between objectives and the relevance of the clusters of policy measures adopted in CIVITAS are further explained below. The need for packaging across policy clusters stems from the notion that there are interactions and feedback relationships between measures, both across and within policy fields / clusters. The most relevant for the transferability analysis is to take the interrelationships across the clusters into consideration.

The following sections illustrate the associations of clusters found to be decisive for the key aims of CIVITAS, with an indication regarding the relevance of each cluster in combinations,

assessed using a shaded scale, from strong (dark blue) to weak (light blue).

A – PROMOTION OF CLEAN URBAN TRANSPORT

The following objectives are directly related to the general purpose of promoting clean urban transport:

- HLO3 Reduce traffic Emissions and Energy Consumption
- HLO5 Increase the Efficiency of the Transport System
- HLO8 Increase Clean Vehicles Market Share in Private and Public Fleets
- HLO9 Establish Business Cases and accelerate take up of clean vehicles solutions
- HLO11 Increase competitiveness and reliability of local production of alternative fuels
- HLO12 Foster Competitive Procurement of Clean Vehicles
- HLO14 Reduce Local Emissions and Improve Quality of Life in City Centres

The following table identifies the requirements in terms of combining policy fields. The importance of combining them is complemented by an indication relating to the relevance of each cluster in this association, based on the references provided in the city reports:

Table 5.3 *Packaging of Policy Fields to promote Clean Urban Transport*

POLICY FIELD	RELATIVE RELEVANCE IN THE PACKAGE
• Clean Vehicles and Fuels • Car Sharing and Car Pooling • Cycling	
• Zones with Controlled Access • Public Transport • Parking Management • Mobility Management • Goods Distribution and Logistic Services • Road Pricing	

In order to successfully transfer measures priority should be given to the strongest measure, in this case, “Clean Vehicles”. The natural prevalence of measures regarding “Clean Vehicles”, seems fair if we consider that the overall purpose of the package is simply unachievable without actual promotion of new technology. In contrast, “Car Sharing and Car Pooling” appears, somewhat surprisingly, to be a strong policy measure in this context, which may be explained if we consider the current experimental phase of the adoption of clean vehicles and the role of this type of measures in promoting an increase in the market share for e.g. hybrids. Although the importance of each policy field in the package should be carefully analysed on a case-by-case basis, it seems acceptable to assume that all the “strong” be strongly considered.

B - PROMOTING BETTER CONDITIONS FOR PUBLIC TRANSPORTATION

The following objectives are directly related with the general purpose of promoting better conditions for Public Transport, including an increase in the modal share.

- HLO2 Reduce congestion
- HLO7 Increase the Attractiveness of Public Transport, induce modal shift and increase its share
- HLO13 Reduce Journey Times

The following table identifies the requirements in terms of combining policy fields. The importance of combining them is complemented by an indication relating to the relevance of each cluster in this association, based on the references provided in the city reports:

Table 5.4 *Packaging of Policy Fields to promote better conditions for public transportation*

POLICY FIELD	RELATIVE RELEVANCE IN THE PACKAGE
• Zones with Controlled Access • Transport Information and Management • Road Pricing • Public Transport	
• Multimodal Interchange • Mobility Management • Parking Management • Goods Distribution and Logistic Services	
• Car Sharing and Car Pooling	

The table depicts a reasonable balance among policy fields regarding their relative importance in the package, allowing the conclusion to be drawn that measure combinations should be carefully analysed on a case-by-case basis in order to promote the successful transfer of best practices.

C – LONG TERM PLANNING OF THE TRANSPORT AND LAND USE SYSTEM

The following objectives are directly related to the general purpose of promoting long term planning for the transport and land use system.

- HLO1 Improve the longer-term planning process and information provision"
- HLO4 Protect City Centre

- HLO6 Promote better integrated planning between Transport and Land Use
- HLO10 Decrease Parking Pressure

The following table identifies the requirements in terms of combining policy fields. The importance of combining them is complemented by an indication relating to the relevance of each cluster in this association, based on the references provided in the city reports:

Table 5.5 *Packaging of Policy Fields to promote long term planning of the transport and land use system*

POLICY FIELD	RELATIVE RELEVANCE IN THE PACKAGE
· Transport Information and Management · Mobility Management · Zones with Controlled Access	
· Parking Management · Cycling · Car Sharing and Car Pooling	

Again, the table depicts a reasonable balance among policy fields regarding their relative importance in the package, allowing the conclusion to be drawn that measure combinations should be carefully analysed on a case-by-case basis in order to promote the successful transfer of best practices. Yet, successful long term planning seems to be strongly associated with initiatives aiming at developing new "Transport Information and Management Systems" as well as "Mobility Management Measures", which can be considered crucial requirements when planning to transfer related best practices such as "Zones with Controlled Access", "Parking Management", or "Cycling".

5.4.2 Packaging of Specific Measures within Policy Clusters

Only a handful measures have been implemented in cities which are not in any way grouped or packaged. Hence, we have seen that most of the measures have been developed coherently within each cluster, and most of the times the need for simultaneous implementations of the measures that are inside the cluster is rather straightforward and can be identified from the exercise of mapping the relationships within each cluster. For each of the clusters considered we present below sensible packaging indications, judging from the evidences taken from the city reports. Within each cluster we could find the **Main Measures** primarily targeted at the High Level Objectives of the Cluster, helped by the **Complementary Measures.** The following table summarizes the findings in this respect:

Table 5.6 *Packaging of Specific Measures per Policy Cluster*

Policy Cluster	**PACKAGING**	
	Main Measures	Complementary Measures
Transport information and management	Transport planning integrated with land-use	
	Automatic Vehicle Detection /Real-Time Passenger Information	
	On-street information	Information on the Internet
	High Level Service Bus and Tram Routes	Network management
	Accessible road network (street) data	Centres for E – working, Commerce and Learning
Multimodal interchanges	Public transport integration through service extensions	Awareness Raising
	Quality Improvement and Integration of Public transport	Multimodal Information for Passengers
	Park and Ride	
	Improve Interchange Facilities	
Mobility management	Mobility Management actions on the field	Mobility Centre
Cycling	New Cycling and Walking Facilities and Services	Information material / awareness campaigns
Car sharing / car pooling	Implementation of car pooling and car sharing services.	Information material / awareness campaigns
	Establishment of park & pool areas.	Management of car pooling and car sharing services.
	Physical integration between car sharing schemes and public transport.	Establishment of HOV-lanes and/or use of bus lanes for HOVs.
		Smart card systems between car sharing schemes and public transport.
Zones with controlled access	Set Up of City Centre Clean Zone	Information material / awareness campaigns
	Set Up of Clean Corridors	
	Residential Traffic Management	
Clean vehicles and fuels	Introduction of Clean Road Vehicles	Information on the Use of Clean Vehicles
	Introduction of Zero Emission Trams	Renewable Energy Supply
		New service stations
		Analysis of Previous Biogas experience
Public transport	Introduce new public transport services	Groups Integrated Pricing Systems
	Services for Special Customer	
	Improve public transport Security and Safety	
Goods distribution and logistic services	Innovative City Logistics Schemes	Info. & Support Services to Kerbside-doorstep Delivery
		Creation of a Material Logistic Centre
		Community Delivery Points
Parking management	Parking Pricing	Innovative Parking Paying Schemes
Road pricing	Implement Road Pricing	

The findings suggest that certain measures worked fundamentally towards the support and success of others. The packaging within each cluster is the adoption of core measures along with the complementary or supportive ones which cannot in itself ensure that the full potential of effectiveness is seized, since the role of packaging across clusters will, in most cases, represent one of a number of important requirements.

5.5 Transferability of Measures

In part B of this report relationship models have been mapped per cluster of policy measures to answer the question of which barriers/drivers are the most critical for successful transfer and implementation. The findings suggest that clusters of measures can indeed be characterised regarding their ability to be successfully transferred to different cities. The most important driver in a successful transferability process is predominantly the ability to adequately replicate the context, namely physical, cultural and institutional conditions. By mapping the context associated to the measures, hence the clusters, it has been possible to provide a detailed insight into:

(i) each policy cluster
(ii) across policy clusters

Which was based on:

(i) The identification of Barriers and Drivers undertaken elsewhere in this report (including the assessment of their influence as Low, Medium or High),
(ii) The CIVITAS measures themselves
(iii) The key concerns and crucial actions for success referred to in the city reports for all measures adopted
(iv) A list of High Level Objectives resulting from the objectives declared by the cities for each cluster detailed above.

Transferability Guidelines

The systematised approach to key interdependencies between context variables and successful measures presented in Part B of this report, suggest that the success of some individual measures within a certain policy cluster are sensitive to several different, specific conditions. This makes any aggregated analysis on transferability likely to be insufficient for a city to assess its own situation. In that case, individual considerations per measure will be required, however, it is worth taking into account that there are general notions to explore regarding the guidelines for transferability. The general guidelines are presented below, resulting from the links found per each policy cluster.

This represents a synthesis of the conclusions that can be taken from the Causal Loop Diagrams in Part B. The reader should however still perform his own analysis of the diagrams, given the multitude of interactions that can be explored. Indeed, all key remarks regarding Transferability are mostly "Policy Cluster Specific", and consequently depend on a variety of elements. The information summarised is extensively detailed in Part B of the report.

A - Guidelines for the Packaging of Policy Clusters

Table 5.7 *Transferability Requirements (Packaging Across Clusters)*

TRANSFERABILITY OF THE CLUSTER	IS ENHANCED BY MEASURES IN CLUSTER:										
	Transport information and Management	Multimodal interchange	Mobility management	Cycling	Car sharing and car pooling	Zones with controlled access	Clean vehicles and fuels	Public Transport	Goods distribution and logistic services	Parking management	Road Pricing
Transport information and Management			●								
Multimodal interchange	●		●	●				●			
Mobility management				●	●	●		●			
Cycling			●			●				●	
Car sharing and car pooling	●		●					●		●	
Zones with controlled access	●	●	●	●							●
Clean vehicles and fuels					●	●				●	●
Public Transport	●										
Goods distribution and logistic services						●					●
Parking management			●		●	●					
Road Pricing							●	●			

B - Guidelines on Policy Cluster's Transferability Sensitiveness

Table 5.8 *Assessment of Policy Cluster's Transferability Sensitiveness to City Context Constraints*

POLICY CLUSTER	DRIVERS/BARRIERS					
	1	2	3	4	5	6
	Politics and Strategy Opposition /Commitment	Politics and Strategy Conflict /Coalition	Planning Technical	Planning Economic	Planning Policy Conflict /Synergy	Planning User assessment
Transport information and Management	Medium	High	High	Low	High	High
Multimodal interchange	-	Moderate	High	-	High	High
Mobility management	-	High	Moderate	-	Moderate	High
Cycling	High	High	High	Low	High	High
Car sharing and car pooling	High	-	High	-	High	High
Zones with controlled access	High	-	High	-	High	High
Clean vehicles and fuels	High	-	High	High	High	High
Public Transport	High	Moderate	High	High	High	High
Goods distribution and logistic services	High		High	High	High	High
Parking management	High	High	High		High	High
Road Pricing	High	-	High	-	-	Moderate
	DRIVERS/BARRIERS					
	7	8	9	10	11	12
	Institutions Administrative Structures and Practices	Institutions Legislation and Regulation	Cooperation Partnership and Involvement	Cooperation Key Individuals	Citizen Participation	Information and Public Relations
Transport information and Management	Moderate	-	High	Low	Moderate	Moderate
Multimodal interchange	Moderate	-	High	-	-	High
Mobility management	-	High	-	-	-	Moderate
Cycling	-	-	High	-	High	High
Car sharing and car pooling	-	High	-	-	-	Moderate
Zones with controlled access	-	High	High	-	-	High
Clean vehicles and fuels	-	High	-	-	-	Moderate
Public Transport	-	High	High	-	Low	Moderate
Goods distribution and logistic services	-	High	High	-	-	-
Parking management	-	High	High	-	-	Moderate
Road Pricing	-	High	-	-	-	High
	DRIVERS/BARRIERS					
	13	14	15	16	17	
	Technology	Public Funds and Subsidy	Exchange and Mutual Learning	Cultural and Life Style	Problem Pressure	
Transport information and Management	Moderate	High	-	-	-	
Multimodal interchange	-	-	-	-	-	
Mobility management	-	-	-	Moderate	-	
Cycling	-	-	-	High	-	
Car sharing and car pooling	-	Moderate	Low	Low	-	
Zones with controlled access	Moderate	-	-	-	Moderate	
Clean vehicles and fuels	High	High	-	-	-	
Public Transport	Moderate	High	-	-	-	
Goods distribution and logistic services	-	-	-	-	Moderate	
Parking management	Moderate	-	Low	-	High	
Road Pricing	High	-	-	-	-	

C - Guidelines on Policy Cluster's Transferability sensitiveness to local context

Table 5.9 *Assessment of policy cluster Transferability sensitiveness to other local conditions*

POLICY CLUSTER	OTHER LOCAL CONDITIONS								
	City Size	Urban Sprawl	City Hilliness	Public Support / Acceptability	Previous Sucessfull Experiences	Public Transport Network		Mobility Master Plan/Trip Plan in Place	Ability for Effective Enforcement
						Quality	Density		
Transport information and Management	Positive	N/A	N/A	N/A	Positive	Positive	N/A	Positive	N/A
Multimodal interchange	Positive	Positive	N/A	Positive	N/A	Positive	Positive	Positive	N/A
Mobility management	N/A	N/A	N/A	N/A	N/A	Positive	Positive	Positive	N/A
Cycling	Negative	Negative	Negative	Positive	Positive	N/A	N/A	Positive	Positive
Car sharing and car pooling	Positive	Negative	N/A	N/A	Positive	Positive	Positive	Positive	N/A
Zones with controlled access	Positive	Negative	N/A	Positive	Positive	Positive	Positive	Positive	Positive
Clean vehicles and fuels	N/A	N/A	N/A	Positive	Positive	Negative	N/A	Positive	N/A
Public Transport	N/A	Negative	N/A	Positive	Positive	N/A	Negative	N/A	Positive
Goods distribution and logistic services	N/A	Negative	N/A	N/A	Positive	N/A	N/A	N/A	Positive
Parking management	N/A	N/A	N/A	Positive	Positive	Positive	Positive	Positive	Positive
Road Pricing	Positive	Positive	N/A	Positive	Positive	Positive	Positive	N/A	N/A

N/A - Not Available/Applicable

5.6 Conclusions

Considering the clusters of measures presented, three groups can be defined as follows, regarding the risk associated to their transferability across territories or cities:

- **High Risk**: those that absolutely require some form of support or where a perceived risk is above and beyond what can be considered 'normal'. This group includes: *Zones with controlled access, Multimodal interchange, Car sharing and car pooling, Road Pricing*

- **Moderate Risk**: those measures that can typically be implemented under regular circumstances in most European cities. These measures include: *Mobility management, Clean vehicles and fuels, Cycling, Goods distribution and logistic services*

- **Low Risk**: those measures that can be implemented using existing powers and which are relatively easily enforceable if needed. These measures include: *Parking management, Transport information and Management, Public Transport*

6 CONCLUSIONS

6.1 Introduction

This chapter presents the conclusions of CIVITAS I.
In CIVITAS I a total of 19 cities participated by implementing 212 measures in different clusters. All cities were very eager not only to implement their own measures, but also to share their experiences in the several workshops which were almost always held within a demonstration project.

The main reasons given by cities to participate in CIVITAS I was not only the availability of extra budget enabling the cities to implement more complex and innovative measures, but also the opportunity to share their experience with other cities. CIVITAS I encouraged cities to make and maintain contact with their counterpart cities which in many cases has resulted in long term cooperation being generated, going far beyond the project lifetime. A number of cities have opted to join new EU projects purely because they now have the right contact persons, giving CIVITAS I the role of generating more innovative projects at European level.

One of the main areas of feedback from the cities was the fact that the measure life time goes beyond CIVITAS I. The cities had therefore enquired if it would be possible to evaluate the long term effects of the projects. The European Commission reacted positively to the request, and a new CIVITAS project on Dissemination and Evaluation of CIVITAS results is about to begin. A lot of CIVITAS I cities will also be involved in the follow up project.

The following paragraphs explains the conclusions relating to the different aspects; process evaluation, impact evaluation and transferability.

6.2 Process evaluation

The evaluation of the measure implementation processes has provided a range of useful insights into the formulation for policy recommendations. In particular it has helped to identify and assess (assign a weight) typical patterns of barriers and drivers that characterise clean urban transport policies in general. Moreover, indications have been obtained regarding the correlations between barrier/driver patterns and key parameters such as the policy fields or clusters, as well as the local and institutional context (planning system, agglomeration size, local influence). It has also shown the high level of success achieved by the CIVITAS I initiative in as far as more than two thirds of the measures have been assessed to have had an “acceptable” or “notable” performance.
With regard to the various reservations concerning the data (see paragraph 3.2), the most

important findings should be seen on a global scale concerning the relevance of particular barriers and drivers for measure implementation processes. In this respect, the following barrier/driver categories have been identified as particularly important:

Main barriers:

- Technical Planning
- Economic Planning
- Partnership and Involvement and User Assessment
- Political Opposition" and "Legislation and Regulation

Main drivers:

- Political Commitment
- Policy Synergy
- Partnership and Involvement
- Technical Planning and User Assessment

In addition to this perspective, the categories of "Opposition/Commitment", "Key Individuals", "Conflict/Coalition", "Public Funds and Subsidy" and "Partnership and Involvement" have predominantly been attributed a high relevance both as a barrier *and* as a driver. This combination of *planning issues* (technical, economic, policy conflict/synergy, user assessment), *political-strategic implications* (commitment/opposition, public funds) and *cooperation aspects* (partnership and involvement, key individuals) reflects the main challenge of designing "innovative" measures in a context such as CIVITAS: Apart from the difficulty of ensuring local political support by key actors, the trouble lies in sufficiently considering the wider implications and conditions for implementation (e.g. in a full-fledged feasibility study) while attempting to increase the chances for funding (by proposing measures that transcend the borders of common practice but therefore also accumulate risks). Actively addressing the highlighted categories appears to be of crucial importance for any implementation of innovative transport policies.

The specific patterns obtained for the policy fields and measure clusters require attention with a view to addressing barriers and drivers in a more targeted way. Differences appear to exist regarding the degree of sensitivity to various issues. *Access restriction*s are more affected by the main barriers and drivers, while the low relevance of user assessment" and public relation issues puts the expected acceptance problems into perspective. *Pricing strategies* depend critically on political support and legislation issues, while exchange and mutual learning seem to provide important assistance. *Collective transport* measures appear to have a high acceptance among politicians and citizens while difficulties emerge in the area of technical planning and partnership. *New forms of vehicle use* are highly sensitive to user assessment and public relation activities as well as technical planning issues and political commitment, which also applies to *soft measures*; cooperation and policy synergy aspects should also be highlighted. *Intelligent*

transport systems measures show a significant cooperation and user assessment issues, as well as technology failures, while there are fewer problems with political support and funding. To conclude, the *clean vehicle* measures are mainly affected by political, technology and cooperation issues.

The discussion of the role of the different planning systems illustrates that significant correlations exist. The positive performance of measures implemented in the British and Scandinavian systems, as well as the particular difficulties encountered in Central European systems are indicators that need to be linked to the specific types of barriers and drivers identified. The results should be followed up by further exploring the specific conditions that shape the respective system influences - a task beyond the scope of METEOR.
The relation between agglomeration sizes and barrier/driver patterns showed variations that would require a more dedicated response in the future. The degree of organisational capacity and institutional complexity found within different urban agglomerations can have both enabling and constraining effects on implementation which should also be taken into account. While issues of political support, coalition forming and administrative structures are of increasing relevance for larger agglomerations, smaller agglomerations appear to lack expertise and capacities especially in terms of public relations. For medium-sized cities the dominance of a few key players (city authority, operator) may have hampered the full recognition of the crucial relevance of cooperation and partnership issues for innovative transport policy implementation.

6.3 Findings on the impact of the measures

6.3.1 General findings

Measures implemented in CIVITAS I have contributed to the development of attractive cities and improved the quality of life for citizens. Congestion has been reduced as well as emissions, greenhouse gases, energy consumption and noise levels.

CIVITAS I has allowed cities the opportunity to promote themselves by implementing innovative and sustainable measures. The implementation of such measures does not only influence the quality of life for citizens, but also provides an example for other European cities to follow.

It is difficult to pinpoint the most effective combination of measures, however it seems that all categories of measures seem to be very useful and in some cases vital to achieve sustainable growth in cities. The stimulation and initiation from the European Commission aides cities in improving the quality of life in cities and the surrounding areas. The exchange of information on a European scale is crucial for the (Financial) support from the European Commission and is

welcomed by all cities.

The overall conclusions regarding the five major impact levels from CIVITAS I are shown in the following figure.

Figure 6.1 Overall impact conclusions for CIVITAS I

	Transport	Energy	Environment	Economy	Society
CIVITAS I	☺	☺	☺	😐	☺

6.3.2 Specific findings

Transport information and management

Transport Information and Management measures have successfully demonstrated that they definitely contribute to the ultimate CIVITAS Initiative objectives mainly by improving and increasing the access to the public transport system, providing real-time information for public transport and traffic congestions, raising public transport customer satisfaction and reducing CO_2 emissions in the demonstration areas.

Multimodal interchange

Multimodal interchange measures have been accepted by the citizens in the various CIVITAS I cities. The acceptance and awareness of the improved conditions is also quite high and although not firmly stated, one can expect that these kinds of measures have a positive impact on the transport impact level. When public transport is made more attractive people may be more inclined to change from car use to public transport, which of course would result in a change in the modal share and ultimately also contribute to a cleaner environment, in line with the ultimate CIVITAS I objective.

Mobility Management

Mobility Management measures have a direct and positive influence on awareness and acceptance. With regard to other areas of impact the benefits are mainly indirect such as modal split, vehicle occupancy, fuel consumption, air quality, emissions and noise. Mobility management is at its most effective when used on new employees within a company.

Cycling

The cycling measures within CIVITAS I ensured that cyclists were provided with a more integrated infrastructure due to the implementation of green routes and information on new cycle route markings. Cycling is destined to become a more widespread form of transport in the near future due to the ever increasing demand for mobility in overfull inner city roads making cycling an interesting and fast alternative in city centres.

Car pooling and car sharing

According to the results on the measures car pooling and car sharing seem to provide a substantial contribution to the ultimate CIVITAS I objectives; by creating a modal shift towards more sustainable forms of transport and away from the private car, by encouraging higher vehicle occupancy rates, by reducing the number of car kilometres which in turn reduce noise levels and emissions and provides a better environment. Car sharing and car pooling are also well accepted among the members. Car pooling does however require initial investments.

Zones with controlled access

Substantial environmental benefits can be expected through the implementation of the different forms of zones; another major positive impact is that on urban liveability, which increases consistently wherever zones are introduced; success is strongly dependent upon the early involvement of noteworthy stakeholders, such as citizens, retailers and transport operators; Effective zones are usually part of a wider packages of complementary measures, which however render planning and implementation complicated and expensive.

Clean vehicles and fuels

Clean vehicles and fuels produced a significant reduction in pollutant emissions and an improved air quality. A crucial role was played by local authorities (with public fleets, infrastructures and incentives) in paving the way to boost the clean vehicles and fuel market later followed by private stakeholders (with private fleets). Joint procurements and a broad range of incentives to companies and citizens represented a fundamental stimulus to increase the clean vehicles market, allowing the counterbalance of their somewhat higher price in comparison to conventional vehicles. A closer cooperation with car dealers, manufacturers and fuel suppliers is required to overcome certain technical inadequacies of the market in terms of vehicle models, performance and affordability, as well as in terms of improved fuelling infrastructures. A more coherent fuel taxation policy is necessary at European and national level in order to allow fair and sustainable competition with conventional fuels. An important contribution to consolidate the market could be provided, among others, by the implementation of the European Biofuel Directive and by the future European Directive on clean vehicles public procurement, presently at proposal stage.

Public Transport

Collective transport and in particular public transport is an important alternative to the car in the cities and many measures in CIVITAS I concentrated on this theme. The improvement of the quantity and quality of the system on offer is important; innovative services and integration of services can help to improve the system, however, without supporting measures or developing a package of measures, the impact is limited. Related measures include marketing, information systems, raising awareness, measures on restrictions and pricing regarding car use, integration of modes within a chain-based approach and city (re)development.

Goods distribution and logistic services

By reducing the number of kilometres per freight movement, there is a positive effect on transport, environment and energy. The reductions are in many cases also market driven and therefore economically positive. The effects on society are in most cases positive: this can be expected although there is no actual proof available. In CIVITAS cases this has been measured as neutral and in some cases (Stockholm) positive.

Parking management

The CIVITAS Initiative implementation of parking management measures has achieved a clear success. All measures were strongly supported by politicians and citizens. Experience with the measure Parking space management showed the efficiency and flexibility of such a tool. Parking Management can be used as a global instrument or as a focus measure. The impacts and therefore the efficiency have been shown in both cases. Parking management can influence focus groups behaviours but can also reduce traffic, congestion, noise and pollution. Providing a soft manner to charge users works well and faces less reluctance from decision-makers.

Road pricing

We can conclude that Road Pricing measures clearly contribute to CIVITAS Objectives. Road Pricing leads to more sustainable, clean and efficient Urban Transportation. Effective Road Pricing schemes in Rome and Stockholm showed that charging car users encourages reductions in traffic and more environmentally friendly transport systems.

6.4 Transferability of measures

Instead of trying to find a universal solution for transferability analyses based on a quantitative analysis, it seems more relevant to apply effort to the collection process of the knowledge produced by initiatives such as CIVITAS in order to strengthen the consistency of the information available today in order to undertake ex-ante assessments on the issue of transferability. Although we acknowledge that transferability conclusions cannot be generalised as it is mostly a “measure specific” matter requiring a stepwise methodology based on coherent guidelines, there were still some interesting general conclusions regarding e.g. the apparent transferability risk, assessed taking into consideration findings on the measure’s implementation requirements. Considering the clusters of measures presented, three groups can be defined as follows, regarding the risk associated to their transferability across territories or cities:

- **High Risk**: those that absolutely require some form of support or where a perceived risk is above and beyond what can be considered ‘normal’. Consequently these measures are assessed which requires carefully checking the preconditions for implementation as well as recommending an adequate supportive packaging. This group includes: *Zones with controlled access, Multimodal interchange, Car sharing and car pooling, Road Pricing*

- **Moderate Risk**: those measures that can typically be implemented under regular circumstances in most European cities, but still require careful attention regarding adequate local conditions for implementation as well as particular attention to supportive packaging. These measures include: *Mobility management, Clean vehicles and fuels, Cycling, Goods distribution and logistic services*

- **Low Risk**: those measures that can be implemented using existing powers and which are relatively easily enforceable if needed, while perceived to provide clear benefits for the City or to the public. These measures include: *Parking management, Transport information and Management, Public Transport*

The results further suggest that the identification and development of a set of objective transferability guidelines to assist in screening measures (i.e. choosing which ones to implement) and the subsequent implementation of the chosen measures in a new city is feasible, yet still requires careful analysis for each particular case, meaning that key transport practitioners at city level are still perceived as being in a better position to screen measures based on knowledge of the local situation. It does however seem fair to admit that CIVITAS has brought about a significant insight into key relationships regarding **Transferability Sensitiveness to Local contexts** and **Transferability Packaging Requirements**, together representing some of the key elements required to adopt the transferability algorithm proposed.

The structure of a systematic methodology, based on guidelines such as those proposed and the careful analysis of the choices made at every stage in the decision process involved for transferability seems to be the most effective process for undertaking transferability processes.

The importance of upgrading the way in which the growing flow of information is managed in initiatives like CIVITAS, including the impact evaluation methods must not be underestimated. Indeed, this aspects has largely failed to bring additional and valuable information to the transferability exercise in CIVITAS, which would have otherwise contributed to take measure's impact and effectiveness levels into account regarding the expectable results of measure's transferability.

6.5 Conclusions on the level of the CIVITAS I programme

The CIVITAS-1 program has as its main impact a growing awareness, among citizens in the participating cities, of the needs and possibilities to achieve a sustainable urban transport system. The measures taken within CIVITAS were visible and the message to the citizens was that this program leads the way to future urban mobility.

The impact on energy use, environment, economy and on the transport systems of the CIVITAS program is less obvious. Many of the measures were on a small scale and the impact could only

be measured on a small level, nevertheless the evaluation shows that many measures are fit for up-scaling and they are transferable to other cities. Local initiatives should assess the results and identify sets of measures to fit their own situation whereby the CIVITAS initiative has impact far beyond the cities that were part of this program.

PART B
CROSS-SITE EVALUATION ON CLUSTER LEVEL

PART B – INTRODUCTION

Part B provides a more detailed cross site evaluation at cluster level, while part A presented a summary of the results. The next 11 chapters have the following structure.

Each cluster starts with a short **introduction** in where the cluster topic is explained and the corresponding measures are presented in a schematic overview.

The second paragraph presents the **implementation** of the different measures. The set-up of the different measures in the cities is explained.

The third paragraph provides information about the **process evaluation** of the measures within the cluster. Similar categories of barriers and drivers are identified as in chapter 3 of part A.

The fourth paragraph provides an overview of the planned and achieved **outputs** for the different measures. Planned outputs (from the initial reports) and the achieved outputs (based upon the templates and progress reports) are presented in a schematic overview. The last column of the table is that of the completion rates. The method for the score is similar to that in chapter 3 of part A regarding the success levels of the measures as follows:

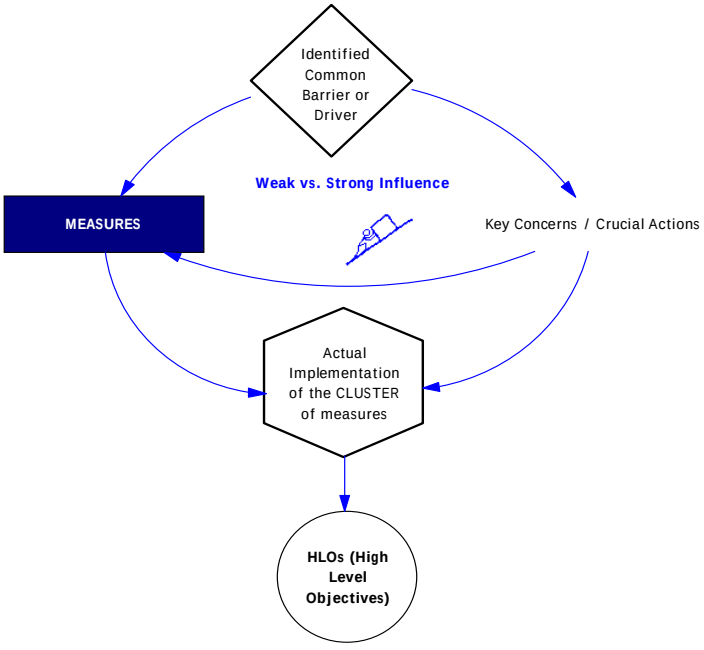
- Abandoned: officially cancelled
- Delayed: a) full implementation after CIVITAS I officially ended; b) implemented too late to perform a meaningful evaluation
- Weak: a) not reported; b) unclear results; c) obvious deviations from original targets d) lost track of original targets; e) achieved less than 1/3 of the planned volume f) remained far below the expectations in qualitative terms
- Acceptable: a) achieved at least 1/3 of the planned volume b) showed good results in qualitative terms
- Notable: a) achieved at least 4/5 of the planned volume b) showed remarkable results in qualitative terms

The fifth paragraph goes into more detail regarding the cross site **impact evaluation** of the cluster using the data and information collected by the projects and the cities. The focus was on 5 impact levels:

- Transport: with a focus on the quality of service, safety and the transport system.
- Energy: with a focus on the energy consumption
- Environment: with a focus on pollution and nuisance
- Economy: with a focus on the benefits and costs
- Society: with a focus on the acceptance, accessibility, employment and security

The sixth paragraph is that of **transferability and packaging**. The characterisation of the context is provided in which each cluster operates, supporting "cluster implementation mapping". The diagrams supported the section of general conclusions and findings contained in Part A of this report. The diagrams are based on information provided by the cities concerning the fundamental analysis of the enabling context for the transferability of measures/clusters, assessing key dependencies, drafting causal trees associated to the diagrams to highlight the most important aspects to be taken into consideration in the process. The following figure illustrates this approach:

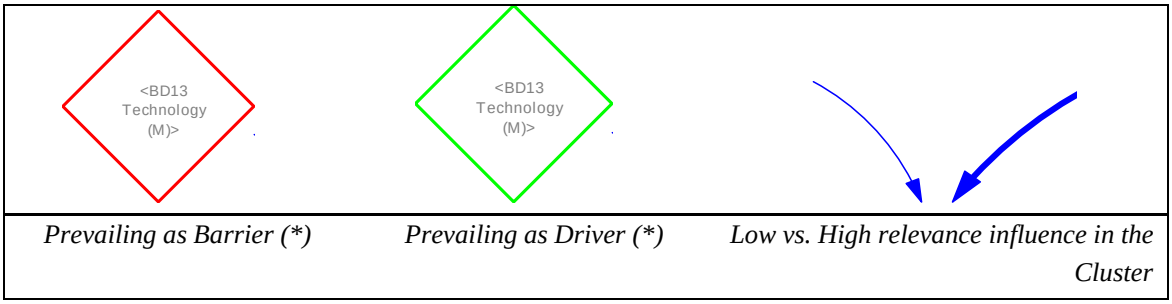
Principles for Mapping Transferability Contexts



The notation used for the barriers/drivers (BD) adopted different colours according to the prevailing trend in each particular cluster as identified in the process evaluation. Whenever a certain Barrier/Driver prevailed as a barrier, the outline will be in red, otherwise it will be in green. The importance of the barrier/driver referred to within the cluster as "HIGH" has been given thicker blue arrows, as illustrated below.

Finally each Barrier/Driver (BD) has been noted with a suffix (L/M/H) according to its overall importance in the whole context of the CIVITAS process evaluations as Low, Medium or High importance, therefore immediately suggesting to the reader the sort of relevance associated.

Legend for Cluster Mapping



Prevailing as Barrier (*)	*Prevailing as Driver (*)*	*Low vs. High relevance influence in the Cluster*

(*) In the cluster

The last paragraph of the cluster is that of the **conclusions** and contains the main cross site findings, which are presented accompanied by a qualitative score on the before mentioned 5 major impact levels.

Definition of the conclusion tables in Part B

Definition of conclusion table	
Improved	☺
No change or negative impact	😐
Situation has worsened	☹
Situation is currently unknown	*

Summary Table

In the following table the results of the evaluation per cluster are summarised. With respect to the process evaluation, the percentage of successful ("acceptable" or "notable") measures is mentioned; with respect to the impact evaluation, the clusters providing a positive contribution to the various impact fields are presented. With respect to transferability the possible contribution towards the 15 high level objectives as defined in the CIVITAS programme are shown.

Results of Impact evaluation and process evaluation per cluster

			Cluster										
			Transport information	Multimodal interchange	Mobility management	Cycling	Car pooling and car sharing	Zones with controlled access	Clean vehicles and fuels	Public transport	Goods distribution and logistic services	Parking management	Road pricing
Process Evaluation		% Successful (classified as 'acceptable' or 'notable')	**94**	**58**	**88**	**90**	**50**	**83**	**88**	**94**	**82**	**100**	**50**
		Implementation risk level	More drivers than barriers	More barriers than drivers	More drivers than barriers	More drivers than barriers	Balance between drivers and barriers	More drivers than barriers	More drivers than barriers	Balance between drivers and barriers	More drivers than barriers	More drivers than barriers	More barriers than drivers
Impact evaluation		Transport	☺	*	*	☺	☺	☺	*	☺	☺	☺	☺
		Energy	*	*	*	☺	☺	*	☺	☺	☺	☺	☺
		Environment	☺	*	*	☺	☺	☺	☺	☺	☺	☺	☺
		Economy	😐	*	*	☹	😐	*	☺	☹	☺	😐	*
		Society	☺	☺	☺	😐	☺	☺	☺	☺	😐☺	☺	😐

Results of Transferability per cluster

			Cluster										
			Transport information	Multimodal interchange	Mobility management	Cycling	Car pooling and car sharing	Zones with controlled access	Clean vehicles and fuels	Public transport	Goods distribution and logistic services	Parking management	Road pricing
		Transferability Risk level	**Low**	**High**	**Med-ium**	**Med-ium**	**High**	**High**	**Med-ium**	**Low**	**Med-ium**	**Low**	**High**
Transferability – contribution to High Level Objectives	1	Improve the longer term planning process	X										
	2	Reduce congestion	X		X			X		X	X	X	X
	3	Reduce traffic emissions and energy consumption			X	X	X		X	X			X
	4	Protect city centre						X					
	5	Increase the efficiency of the transport system		X	X	X	X			X	X		
	6	Promote better integrated planning between transport and land use	X		X								
	7	Increase the attractiveness of Public Transport, induce modal shift	X	X	X		X	X		X			X
	8	Increase Clean Vehicles market share in private and public fleets					X	X	X			X	
	9	Establish business cases and accelerate take up of clean vehicles solutions				X	X		X				
	10	Decrease parking pressure				X	X					X	
	11	Increase competitiveness and reliability of local production of alternative fuels							X				
	12	Foster competitive procurement of clean vehicles							X				
	13	Reduce journey times		X									
	14	Decrease local emissions and improve quality of life in city centres						X			X	X	
	15	Improve safety and security of Public Transport								X			

1 TRANSPORT INFORMATION AND MANAGEMENT

1.1 Introduction

Traffic and mobility management is primarily a demand-oriented approach to promote and enhance sustainable mobility. Its aim is to support and encourage a change of attitude and behaviour towards sustainable modes of transport. Within this context information on public transport networks plays a critical role. Intelligent Transportation Systems (ITS) vary in applied technologies, from basic monitoring applications to more advanced applications which integrate live data and feedback from a number of other sources, such as real-time weather. Additionally, predictive techniques are being developed to allow advanced modelling and comparisons with historical baseline data.

Traffic congestion in cities makes it difficult for public transport operators to deliver services according to schedules. Disruptions to schedules have a negative impact on the quality of service provided to the customer. This is a universal problem, experienced in every major city. One solution being deployed in many cities is the provision of electronic information displays at bus stops, which give the customer an estimate of the waiting time for the next bus. These systems, commonly referred to as Real Time Passenger Information (RTPI) systems, use a variety of technologies to track the location of buses in real time and use this information to generate predictions of the bus arrival-times at stops along the route. All the measures implemented within the Transport Information and Management cluster are dealing with one or more of the following solutions:

- *Public Interactive Terminals:* located near public transport network facilities as terminals or stations. They are intended to help passengers plan their journeys, to select the bus line and find the arrival and departure times.
- *Dynamic Bus Stop Displays*: are often the most prominent of passenger information systems equipment. They provide passengers with the real-time information on the next bus arrival. This service will certainly improve journey conditions because it will reduce the uncertainty and discomfort of waiting for a bus and minimise the waiting time by enabling, for example, some last minute shopping without the fear of missing the bus.
- *On-board Information*: provides passengers with information on the next bus stop along the route. It may also include information of the destination and possible connections to other bus lines. On-board information will reduce the stress of missing the correct bus stop for passengers who are not regular users of that particular bus line.
- *Information at Home/Office***:** is mainly pre-trip information about routes, connections, fares and time-tables although real-time information such as the next bus arrival time at a chosen bus stop can be found. Enquiry office terminals only provide information for

personnel from transport companies. Their main purpose is to help personnel to answer user requests.

- *Portable information*: equipment such as mobile telephones or hand-held terminals are new instruments for providing information to passengers before or during the journey. This area of technology is rapidly developing for example with Wireless Application Protocol (WAP) based communication. In the future there will be even more methods available to obtain user specific travel information.

The CIVITAS cities have implemented thirty-one ITS measures aiming to optimise the present traffic situation, where a "traffic optimum" is defined as the union of the best of the objectives for efficiency, social impacts as well as environmental concerns. In line with the increasing number of requests for information and for public transport maps, it was decided to broaden the media and tools for accessing information, relying on one single integrated information system within CIVITAS.

The following table provides an overview of the thirty-one transport information and management measures implemented by CIVITAS.

Table 1.1 *Transport information and management measures within the CIVITAS I project*

CITY	CODE	TITLE
Aalborg	12.3	Bus Priority and Real Time Passenger Information
Barcelona	7.2	Multi-operator real-time passenger information for trams
Berlin	11.6	Dynamic real-time passenger information for trams
Bremen	12.2	Travel information centre
Bristol	8.3	Pilot demand responsive transport system and dial-a-ride technology
	12.2	City centre Info Shop
	12.2	City Navigators (info bus)
	12.2	Information kiosk/Advice screens
	8.6/12.3	New public transport contracts/Bus priority & Real-time passenger information
	12.5	Centres for E-working commerce and learning
	12.7	Trip planner development
Bucharest	11.4	Fleet management by GPS
Graz	10.4	Taxi drivers as information multipliers for clean transport
	10.7	Integrated mobility centre
	11.1	Technical basis for an efficient customer focussed operation and information
	11.3	Dynamic traffic management system
Nantes	IP2-IM8	Bus Priority and Real Time Passenger Information
	IP5-IM5	New student service centre with mobility services
Prague	11.6	More adaptive signal control in a bus priority system
Rome	7.2.2	MOBY – On board information
	11.1.1	Bus tickets sold via sms

CITY	CODE	TITLE
	11.2.1.1	Automatic Vehicle Monitoring on the tramway
	11.2.1.2	Automatic vehicle location on the bus network
Rotterdam	5.4	Transport priority and dedicated lines
	11.1	Integration of transport management systems
	11.3	Dynamic public traffic information
Stockholm	10.3	Creation of a visitor web for optimal trip planning
	11.2	Traffic monitoring and supervision
	11.5	More adaptive signal control in a bus priority system (SPOT-project)
Winchester	7 (7.1 & 7.2)	Improving bus service quality & information
	11.2	Improved network management

1.2 Implementation

As shown in table 1.1, the cities have applied different types of actions focusing on differing urban requirements. The city of **Bristol**, for instance, has developed a series of measures aimed at improving public transport information for citizens by implementing an information shop and bus information kiosks, real-time passenger information and an internet trip planner. Moreover, particular attention was paid to the provision of a demand responsive transport service for disabled travellers. The Bristol Dial-a-Ride (BDAR) charitable non-profit organisation, offers a door to door service across the city and aims to provide disabled travellers with equal opportunities to access public transport. Most journeys are booked one day in advance on a 'first come, first served' system, by calling their booking line.

In **Rotterdam** improvements were made to traffic flows within the city and to the Ring Road by designing and linking transport management systems together. A Dynamic Public Transport Information was also developed with state of the art tram and metro stops to increase the appeal and use of public transport.

Figure 1.1 *Passengers Information panel in Graz*

The city of Graz focused on improving the efficiency and organisation of public transport by solving the problem of locating vehicles, allowing buses to trigger right of way when approaching traffic lights, having dedicated bus lanes on existing roads and providing dynamic passenger information so passengers know when the next bus/tram will arrive or depart.

Figure 1.2 *Travel Information on a mobile phone in Rome*

To conclude, the city of **Rome** also implemented a number of measures supporting the large scale implementation of a service for transit including the payment of tickets using sms on mobile phones, access to information on mobility-related issues via new media and mobile devices and the encouragement of a multi-modal shift for citizens and tourists towards public transport.

All of the cities aimed at the following targets:

- Reduce modal share of cars
- Increase patronage on key corridors
- Increase access to public transport system
- Reduce transit time from peri-urban areas to the centre
- Real-time information on all corridors
- Increase the number of people accessing public transport information
- Increase public transport customer satisfaction
- Raise awareness and knowledge of citizens about mobility options
- Increase the percentage of electronic fares
- Reduce energy use and CO_2 emissions in the demonstration areas

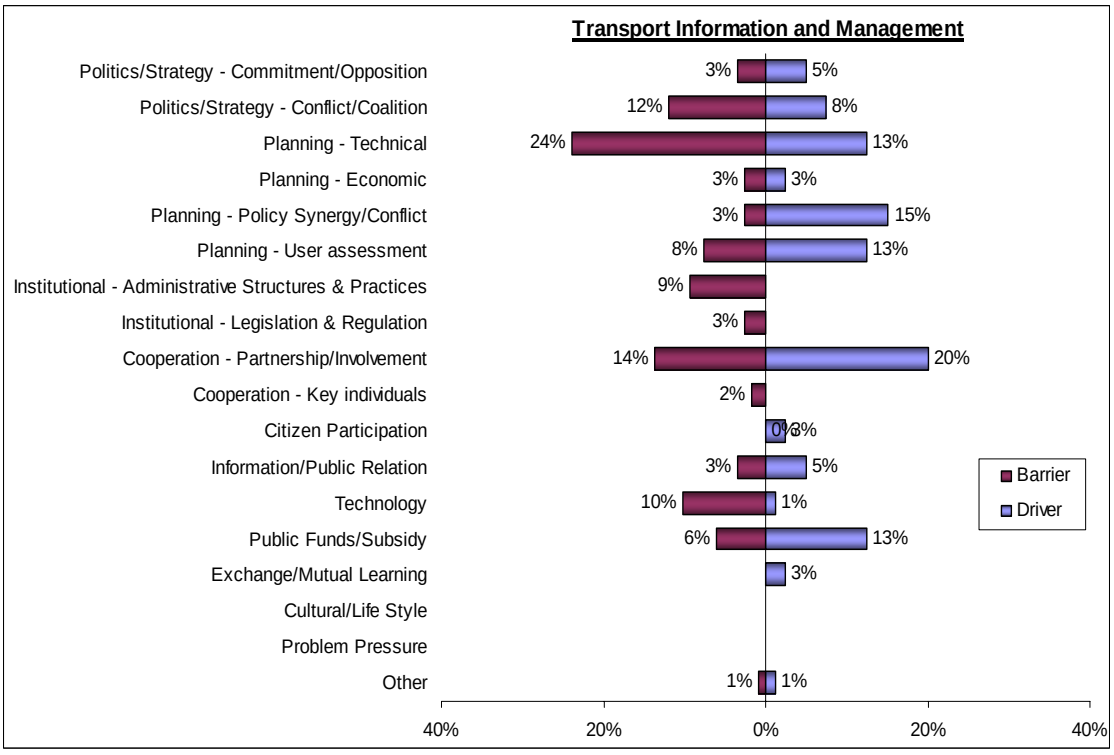
1.3 Process evaluation

Measure implementation in this cluster appears to be less influenced by politics and strategy issues than others, since the category “Commitment/Opposition” is attributed a fairly low status. This seems to reflect the dominant consensus among decision makers in the public and private sector regarding Intelligent Transportation Systems (ITS) investment, a multi-purpose policy-

tool, that helps achieving diverse objectives, even though conflicts emerge at other levels ("Conflict/Coalition" is classed as above average). It is also not surprising that "Public Funds" are available measures in this cluster more so than others as they benefit from a mainstream disposition to invest in ITS.

Nevertheless, "Partnership and Involvement" is attributed a major influence both as a barrier and driver, which reflects the difficulties in this field due to complex organisational requirements (public, private, cross-sector, etc.) as well as the possible benefits. Furthermore, "Technical Planning" and technological drawbacks as well as "User Assessment" appear to have a comparatively high influence on these measures, as many technical and user acceptance problems are still to be overcome. In addition, measures in this cluster are particularly susceptible to "Policy Synergies" (e.g. access restriction, pricing, public transport, goods distribution), and to the potentially motivating effects based upon service improvement through technological innovation (Figure 1.3).

Figure 1.3 *Barrier/Driver profile for "Transport and Information Management"*



1.4 Outputs

By considering all the Transport Information and Management measures' objectives, we can conclude that most of them have achieved their planned output, illustrated by the following table.

Table 1.2 *Overview of the planned and achieved output of the different measures*

CITY	PLANNED OUTPUT	ACTUAL OUTPUT	COMPLETION RATE
Aalborg	▪ Integrate all public transport services in one system by implementing new public transport network structure and integrated info-systems ▪ Increase reliability of public transport services and perceived waiting time by implementing: 20 bus priority units, 188 bus computers and Real time Passenger Information (RTPI) at interchange facilities ▪ Achieve 2-3% more public transport passengers and 2% large modal share	▪ Bus computers on 209 buses ▪ RTPI displays at 32 locations ▪ Bus priority based at 23 intersections ▪ 24'000 pages monthly activated at kiosks (with itineraries and schedules as key searches)	Notable
Barcelona	▪ Improve the quality of public transport information ▪ Demonstrate real-time messaging based on a multi-operator system using 6 standardised information panels ▪ Display messages at bus stops to promote usage of bus services integrated with a new tramway	▪ Implementation and operation of panels at 4 bus stops with further implementation planned during 2006 ▪ All the operators have installed Automatic Vehicle Monitoring (AVM) equipment or have made bus arrivals times available (TMB) in an integrated, automated way ▪ 48 extra-passengers per working day at monitored bus stops	Acceptable
Berlin	▪ Prototyping of an interface between the public transport Operation Control Centre and the dynamic passenger information system (Daisy) ▪ Acceleration of the pilot realisation of Daisy for trams and buses	▪ 182 installed displays (tram 140 and bus 42)	Notable
Bremen	▪ Better information ▪ Increase public transport customers	▪ 250 questionnaires distributed for evaluating the new intermodal travel information centre	Notable
Bristol	▪ Increase car share sites ▪ Increase car share membership ▪ Increase use and patronage of the Demand Responsive Transport System (DRTS) system ▪ Increase access to public transport system ▪ 40% of all fares to be electronic ▪ Introduce new kiosks and associated transport information ▪ Increase use/membership of DRTS/introduce new scheduling system ▪ Introduce a one-stop-shop for travel/transport information	▪ Car trips reduction around 30'000 vehicle km per year ▪ 28 i-kiosks installed	Acceptable
Bucharest	▪ Implement installation of GPS devices on more than 2'000 RATB[7] vehicles	▪ 15 buses endowed with GPS	Delayed

[7] Surface public transport operator in Bucharest.

CITY	PLANNED OUTPUT	ACTUAL OUTPUT	COMPLETION RATE
Graz	▪ Increase public transport customers ▪ Efficient management of public transport ▪ Reduction in car use ▪ Education of taxi drivers to be information carriers	▪ 104 real-time information signposts ▪ Reduced car trips 1,500/yr ▪ Fuel savings 1'800 litres ▪ 400 taxi drivers trained	Acceptable
Nantes	▪ Increase modal share in favour of public transport	▪ 24 meetings were organised, 1'700 mails exchanged, user interviews and a round table with 7 people were done to know how the new service has been perceived	Acceptable
Prague	▪ Faster and smoother flow of buses	▪ Additional 5 traffic lights allowing to save 3 dispatched buses	Notable
Rome	▪ Improving public transport ticket payments using mobile ▪ Implementing the first ITS management system ▪ Installation of 250 more electronic bus stop signs ▪ Installation of MOBY (on-board video) system on 200 buses	▪ 3 mobile phones operators supporting the service ▪ 300 tickets/day sold via sms ▪ 50 trams equipped with on-board equipment ▪ Up to 300 electronic bus stop signs installed ▪ 2'455 buses out of 2'784 equipped with on-board units ▪ 285 poles equipped to provide information ▪ 12 depots wired ▪ 200 MOBY systems installed	Notable
Rotterdam	▪ Placing Vehicle Monitoring System (VMS) on the main city roads ▪ Real-time departure information available at 70 stops ▪ Installation of on-board communication systems on 60 trams	▪ 150 signs and panels placed ▪ Dynamic public transport information resulting in 239 panels at the state of the art tram stops ▪ Real-time panels information at 85 stops ▪ Installation of on-board communication systems on 74 trams	Notable
Stockholm	▪ Installation of a dynamic IT-based priority system ▪ Optimized traffic flow	▪ Completely new traffic flow	Acceptable
Winchester	▪ Increase in bus patronage by 8% ▪ Integrate public transport services ▪ New bus fleet ▪ Installation of a journey time Automatic Number Plate Recognition (ANPR) system"	▪ 76 new bus stops with timetable and route information ▪ Increase the time frequency of buses along one route by 5 minutes ▪ 13 new buses and 10 buses re-powered ▪ ANPR system installed ▪ increase in bus patronage by 6% along the improved routes	Acceptable

1.5 Impact evaluation

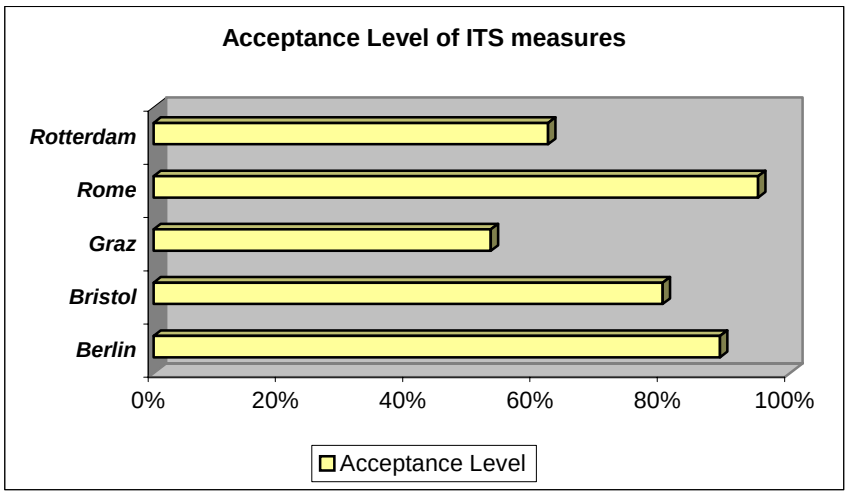
The global results of Transport Information and Management measures are definitely positive:

- In the city of Barcelona the improvement in the quality of public transport information has resulted in an overall growth in multi-stage journeys of 1.6% at stops where bus arrival information was displayed;

- In Berlin 39% of interviewed customers judged the dynamic information system as excellent;
- In the city of Bremen more than 25% of visitors are aware of the services;
- In Bristol there has been an increase in Demand Responsive Transport System (DRTS) passenger journeys of 145%, and 50% of the total number of hits received by the Real Time Information (RTI) website were for locations within the clear zone and 7% for Park and Ride;
- In the city of Graz the number of public transport customers increased by 120% with an increase in travel information (BusBahnBim +Mobil Centre) from below 10.000 hits up to 440.000 per month, between 2002 (November) – 2005 (November);
- In Nantes there has been a yearly reduction of 6% in student car trips, and a monthly increase of employees fidelity to public transport usage by 7.3%;
- In Stockholm, thanks to a dynamic IT-based priority system, the number of stops for urban vehicles was reduced and speed increased by 15%-20%;
- And in the city of Winchester, Park and Ride ticket sales increased by 43%, and the bus patronage along the improved city centre routes by 6%.

All the Transport Information and Management measures implemented focused mainly on increasing patronage of public transport and improving real-time traffic information leaving out the environmental objectives and outputs due to the difficulties in assessing the environmental impact of these types of measures. Despite this, the cities of Graz, Prague and Stockholm have also evaluated the indicators concerning GHG emission reductions. The cities have taken the reduction of CO_2, NO_x and particulate matter emissions achieved by the implementation of Information Transport System (ITS) measures into consideration.
Taking into account the social impact, represented by the level of social acceptance of the ITS measures, strong satisfaction was registered from the concerned public.

Figure 1.4 *Acceptance level of ITS measures*



As shown in the figure above, more than one city has noticed a high level of acceptance of ITS measures implemented within the CIVITAS cities, and in particular the city of Rotterdam evaluated the information provided for waiting time important (and correct).

There were also positive reactions in the city of Rome where the measures implemented have realised savings in time with an increase in the availability of services. A user friendly ticket system was also developed so that regardless of which provider or subscriber is used, the ticket is valid.

In the city of Graz real-time information is available for passengers on the numbers and destination of buses and trams departing and arriving including information on delays and unpredictable incidents. This inevitably increases passenger awareness and consequently waiting/journey time appears shorter. The Bristol Dial-and-Ride service membership has achieved a huge increase during the implementation period and the most common purpose was shopping, social or health related trips.

The city of Berlin experienced high customer satisfaction with the underground dynamic information system with support for expanding it to buses and trams. Customer satisfaction of the tram service was high (passenger information judged as good [2.4], frequency judged as good [2.6] and punctuality judged as good [2.4]). The frequency of Public Transport received a higher rating from passengers where the dynamic information system is in force although the actual frequencies had not changed! The passengers interviewed were however more critical about information regarding disruptions and the reliability of the tram dynamic real-time passenger information system.

A key aspect in the evaluation of ITS measures is of course the extent to which they have in fact changed transport or the perception of public transport meaning he accuracy of public transport timekeeping and the quality of public transport service perceived by the customers can be evaluated. As shown in the following charts, reductions in perceived waiting times in the city of Aalborg were rated low. However, in the city of Prague, after the validation of a more adaptive signal control in a bus priority system, the measurements carried out to identify savings in time made by buses demonstrated an excellent perception of accuracy in public transport timekeeping.
Results on the perceived quality of public transport services were also very positive for the city of Winchester where waiting facilities were improved, buses were re-branded, discount ticketing schemes were introduced, routes improved and the general quality of public transport information was also improved. As shown in the surveys' results, a better integration of the public transport services due to physically improving the interchange area outside the railway station have also helped noticeably in rising patronage for public transport services.

In the city of Prague, the three most positive influences that contributed to encouraging new or more frequent passengers were frequency of services provided, bus travel information and the actual comfort of bus travel.

Figure 1.5 *Public transport timekeeping perception*

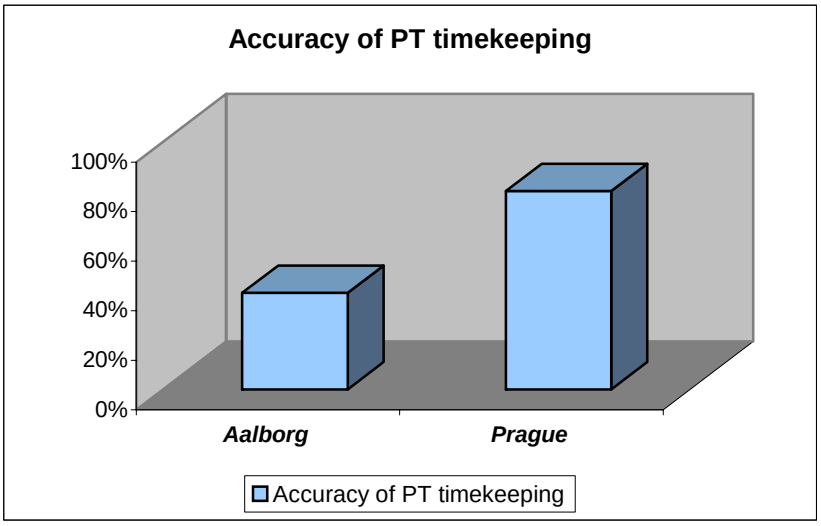
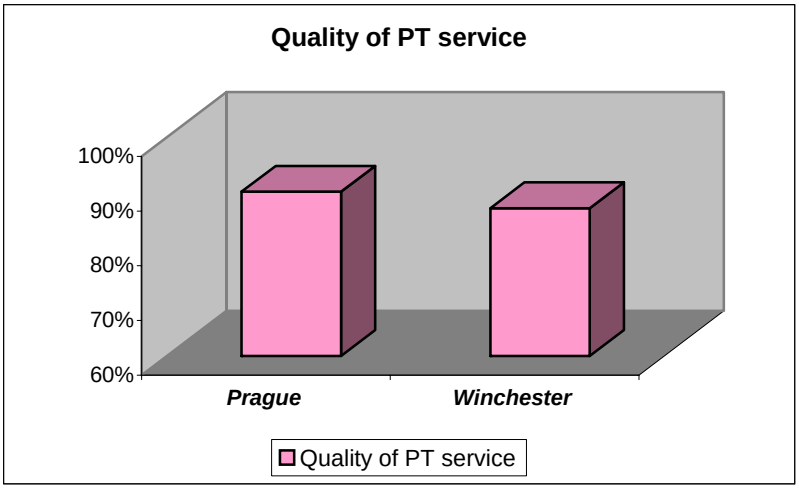


Figure 1.6 *Quality of public transport service (user perception)*



More than one city involved in the CIVITAS Initiative has considered the possibility of up-scaling. The city of Barcelona, for example, is committed to improving the quality of service for collective passenger transport across the metropolitan region, including passenger information. The number of bus stops will continue to grow even after the implementation of the measures' has finished, based upon the devised plan and subject to variations introduced by changes in service concessions, high level requests from Mayors of different municipalities.

The city of Stockholm, is working on cooperation and integration of information services in other regions as well as at national level in order to integrate the national portal with full intermodal information. There is also the opportunity to up-scale the adaptive intersection signal control in the bus priority system about 10 times during the coming years, as the city of Stockholm consists of a number of similar areas near the city centre.

1.6 Transport information and management

With regard to this cluster, the cities had several objectives, including allowing travellers to make the best modal choice, increase the efficiency of the transport system, improve the longer-term planning for process and information provision, induce a modal shift from private to public transport, reduce traffic emissions and energy consumption, reduce congestion, improve mobility and the appeal of public transport, while ensuring that the transport system contributes towards a successful economy. The development and improvement of the integration of modes and integrated planning between transport and land-use was and is of utmost importance to the process.

Regarding the measure "**On-street information"**, and the 17 general Barriers and Drivers previously identified, cities indicated that the requirements for successful implementation within the cluster were the availability of CIVITAS funding and the support to the measure provided by the coincident objectives of the Local Transport Planl. A number of problems were also indicated regarding the difficulty in providing bus personnel during weekends, the coordination of large events, some people's aversion to technology, the type of vehicle and technology used (sometimes acting as its own barrier), the differing motives of partners involved and the city council.

The success of the measure also appears to be very dependent on cooperation with the mobility providers, the exchange of relevant information and common marketing activities, while personal face to face contact was also considered very important in combination with Intelligent Transport Systems. The common use and design of systems with other information measures and all measures that enhance the supply of public transport together with Car Sharing and Car pooling was also extremely important.

In the measures **"Automatic Vehicle Detection and Real-Time Passenger Information"** the drivers identified by cities were political support and the perceived necessity to improve the image of public transport. Difficulties were caused by delays for supplies, inefficient planning, technical problems, resistance to Intelligent Transport Systems within the public transport organisations and public opposition due to public transport price increases. A number of issues crucial to the success of the measures were the thorough testing of systems prior to implementation, actively providing passengers with information of deviations or problems as

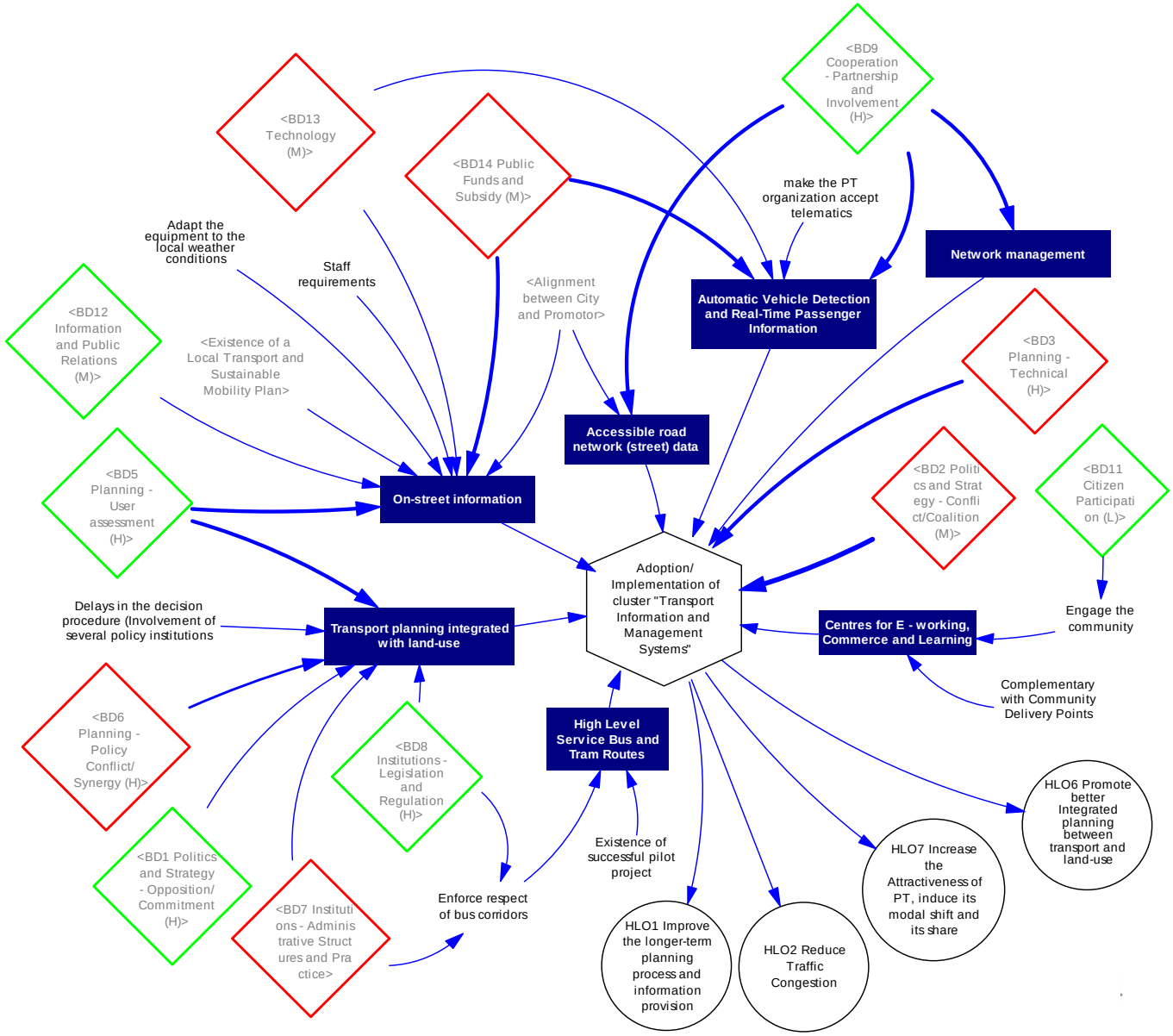
and when they occur, demonstrating the aim and how useful a measure is to policy institutions and the importance of constant project management.

Many drivers, barriers and crucial actions for success were identified in relation to **"Network management"** measures in the CIVITAS cities. Drivers identified in the measure reports were the existence of an Air Quality Action Plan, the inefficiency of a previous parking system, the availability of a system tailor made for local requirements and the availability of external financing (CIVITAS). Aspects such as technical difficulties, lack of data and data accuracy problems, general mistrust from the public regarding the new complex systems and local by-laws. Actions necessary for the successful implementation of the measures were analyses that were performed on previously developed models, the integration of information, explaining the benefits to the authorities, marketing campaigns, good team management, good technical planning, model adaptation for local conditions and the regular updating and correction of data errors.

The measure **"Accessible road network (street) data"** was made more complex by disaggregated city budget management, suspicion from vendors and suppliers to new technology and the different goals between retailers and customers.

The measure of type **"High Level Service Bus and Tram Routes"** initiated new construction developments. The existence of a successful pilot project and the political/stakeholder commitment were also mentioned as facilitators to measure implementation. This type of measure also appears more suitable for medium and large sized cities. The most relevant obstacles were likewise the political commitment, disrespect for public transport priority rules, institutional desegregation, the legal urban planning framework, and the need to negotiate private land. As in many other measures, properly explaining the benefits of the project to policy makers is essential. Other relevant factors are the integration of the project into urban planning, enabling e.g. a strong connection between walking and public transport modes and design integration as part of urban renovation and street amenity improvement. Given the potential dimension and complexity of the projects, successful organisation and financing is required and in relation to new technological innovation, communication is of the essence.
The measure **"Centres for E – working, Commerce and Learning"** which complements the "Community Delivery Points" measure benefited from the involvement of the community in the development of the project.
"Information on the Internet" was only possible when support was gained from different municipalities (given the need to provide information for a whole area). Institutional hindrances, different focuses of stakeholders, incomplete data available for the system development and data accuracy problems and the need for on going funding (for the system update), were noted as the main constraints.

Figure 1.7 *Fundamental Mapping of the Cluster "Transport Information and Management"*



1.7 Conclusions

The positive interpretation of the results is that the availability of Real Time Passenger Information (RTPI), the higher frequency of buses in key corridors, and improved planning tools have opened public transport towards other users. The fact that you no longer have to study the transport timetables in advance due to the high frequencies in the rush hour and the

real time information on when to expect the next arrival has made public transport less "complicated" showing a new group of less frequent users that public transport is a suitable alternative for them.

In the city of Aalborg the flexible platforms with RTPI have freed the inner city of the bus service to the coach terminal, minimising walking distances and as a result, making the area needed for the terminal available for other urban activities – including offices and shops – expected to increase the demand for public transport.

In Barcelona the installation of information panels and the communication of bus arrival times at interchange stops has had a positive impact, leading to a relative growth in multi-stage trips. In the city of Berlin the development of a dynamic information system for implementing real time passenger information for tram and buses (Daisy system) has also considerably contributed to the quality and acceptance of public transport. The Berlin Transport Corporation will continue to install extra interfaces at busy tram and bus stops and interchange points.

In the city of Bremen the Intermodal Travel Information Centre is a good example of the centralisation of all relevant local and regional customer public transport information. The combination of personal face to face contact together with new technology improves the customer relationship significantly.

In Bucharest the implementation of the vehicle location system using GPS technology represents a platform for its integration with other IT systems for the RATB (the Surface public transport operator in Bucharest), such as the large scale expansion of real time passenger information systems at stops with other public transport operators' information systems. Bucharest has a very high density of inhabitants (1222.7 inh/km^2) with intense traffic and the implementation of the ITS measures is very important for solving traffic problems.

New technology for efficient customer focused operations and information has shown good results in the city of Graz. Passengers can access real-time information on the routes and destinations of arriving and departing buses or trams, information regarding delays and relevant incidents, such as construction works, accidents, or buses substituting trams. passengers perceive a shorter journey time using real-time information where the connections between lines can be guaranteed if a feeder bus or tram is delayed.
In the city of Nantes the provision of real-time information to customers on mobile phones has strengthened the opinion of the usefulness and relevance of the information available and is has been assessed as agreeable and user friendly.

A more adaptive signal control in the bus priority system was implemented in the city of Prague which has facilitated the real-time location of buses in comparison with the timetable, and, based on the time difference identified, the vehicle in question is then allocated an appropriate

level of priority. This has contributed to increasing the prestige of public transport even if the benefits perceived from the user's perspective will only be apparent after the introduction of a greater number of signal timing control at intersections within integral segments resulting in higher time savings.

The on-board information system (MOBY videos) implemented in the city of Rome has upgraded customers' travel experiences by providing punctual information, adopting easy and friendly media, and informing citizens as soon as possible of unexpected events relevant for public transport services.

In the city of Rotterdam the high quality tramline concept (TramPlus) with dedicated lanes has improved the use of public transport and demonstrated a more efficient use of the network.

The multi-modal transport model implemented within the city of Stockholm has served as a platform for a traffic management system, which aims at optimising and balancing traffic flows on main roads, reducing the effects of traffic incidents and accidents on queues and delays, inducing a modal shift from private cars to public transport facilities and contributing to a smoother traffic, reduction of energy consumption and thereby the emissions from the traffic.

In the city of Winchester passengers have stated that improved comfort and frequency were the most important positive influences for using the service.

Transport Information and Management measures have successfully demonstrated that they definitely contribute to the ultimate CIVITAS Initiative objectives mainly by increasing the access to the public transport system, providing real-time information on public transport and traffic congestions, raising public transport customer satisfaction and reducing CO_2 emissions in the demonstration areas.

Figure 1.8 *Summary of the overall effects of the cluster transport information and management*

	Transport	Energy	Environment	Economy	Society
Cycling	☺	*	☺	😐	☺

2 MULTIMODAL INTERCHANGE

2.1 Introduction

The cluster 'multimodal interchange' focuses on the measures that cities have introduced on multi modal interchange, aiming to encourage citizens to make use of public transport for as much of their journey as possible. The following table illustrates the CIVITAS I measures on multimodal interchange.

Table 2.1 *Multimodal related measures within the CIVITAS I project*

CITY	CODE	TITLE
Bristol	12.4	Multi-modal scheduling
Graz	7.4	Smooth connections for transport modes by multimodal interchange
Lille	7.3	Intermodal local/regional transport interchanges
Rome	7.2.1	Multi-modal pre-trip information on existing cycle tracks and accessible bus stops for the mobility impaired
	11.1.2	Improved multimodal traveller services – integration of public transport & tourist information on a common platform
	11.1.3	Improved 'multimodal traveller' services - Info point for wireless devices
Rotterdam	10.2	Improve accessibility in the Rotterdam region by integration of public and private transport initiatives
	11.2	Intermodal travel information
Nantes	IP2-IM7.1	Multimodal information and reservations – Multimodal information centre
	IP2-IM7.2	Multimodal information and reservations – The Mobility Workshops
	IP6-IM2	Multi-modal station at the junction of the extended tramline 3 and Vannes Road
Winchester	11.1	Improved multi-modal real time traveller information

2.2 Implementation

The multimodal interchange measures within the CIVITAS I initiative can be split up into a number of groups of measures that all stimulate multimodal interchange.

Firstly, measures that aim to create better connections between public transport lines and/or different modes of transport such as in the city of Graz, where for example at the terminus of Andritz a connection between regional and local buses and trams was created. Also, more importantly, guaranteed connections were created at important stops, ensuring passengers of easy changeovers between lines or modes.

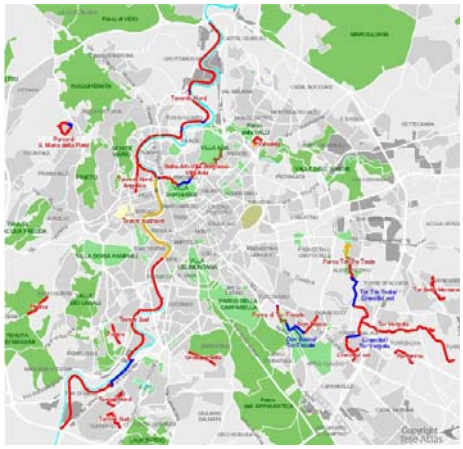
Secondly, measures that aim to create intermodal exchange points, where people can easily

switch between the various transport modes and which were accomplished in the cities of Graz, Lille and Nantes. Such an exchange point was created in the city of Graz, that is free of charge and is linked by tramline directly to Graz city centre. The frequency of the tram service is roughly 7-10 minutes, and it takes about 12 minutes to reach the city centre. The tramline then provides a connection to all other lines and the federal railway. The intermodal exchange point in Lille links all public transport services (metro, bus, tramway, regional, national train, high speed train), and also links cars, pedestrians, bicycles and other two-wheelers with public transport services.

Figure 2.1 *Intermodal exchange point (Graz)*

The third kind of measures introduced within this cluster aim to improve the quality and accessibility of transport information. Rome for example introduced a database where information on accessibility for the disabled is displayed, which also has a mobile info point and also a website for cycle routes. In the city of Winchester, there are numerous locations within the city centre where traffic information can be accessed by the public using sources such as electronic information kiosks, bus departure information displays and real-time information display units.

Figure 2.2 *The information website and the accessibility database measures (Rome)*



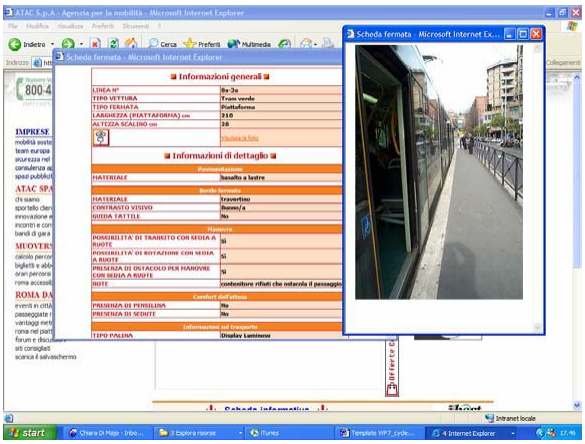


Figure 2.3 *The mobile infopoint measure in Rome*

Figure 2.4 *Bus display information system and a information kiosk (Winchester)*

2.3 Process evaluation

Any modifications at interchange locations usually result in complex processes involving a multitude of actors, and for these measures *complexity* represents a key barrier to the actual implementation. This is illustrated by the large number of fully abandoned measures as well as the various references made by the cities to the difficulties encountered in terms of “Partnership and Involvement” as well as “Administrative Structures and Practices”.

Implementation of measures mainly dealing with the provision of multi-modal traveler information, has been confronted with problems relating in particular to data availability (conflicting interests of operators and authorities) and data integration (interoperability). Against this backdrop, measures showing notable performance suggest opting for *feasible* "second-best" solutions for multimodal interchange measures instead of striving for the optimum, which tends to get lost in an overwhelming complexity.

2.4 Outputs

Cities setting up multimodal interchange measures were generally successful in completing the activities planned at the outset of the project, although many cities only managed to implement several of the proposed aspects towards the end of evaluation period (Bristol, Winchester) and in some cases the proposed measures were delayed or even cancelled (Bristol, Nantes). The following table illustrates that the original plans were often completed within the CIVITAS I timescale.

Table 2.2 *Overview of the planned and achieved output of the different measures*

CITY	PLANNED OUTPUT	ACHIEVED OUTPUT	COMPLETION RATE
Bristol	▪ Develop an automatic link with bus service database ▪ Integrate database with DRTS booking system	▪ Pilot application introduced to book and schedule journeys in parallel with existing system but cancelled halfway	Weak
Graz	▪ Create better connections between lines or modes at important stops ▪ Introduce 1 Park & Ride lot at the end stop of tram 1 in Mariahost for more than 500 cars	▪ Better connections between lines and modes have been created ▪ Park & Ride lot at Mariahost has been introduced for 60 cars	Weak
Lille	▪ Implement 2 new intermodal exchange points in Armelières & Don-Sainghin which linked public transport service	▪ Intermodal exchange point in Armentières in the last phase of definition of work	delayed
Nantes IP2-IM7.1	▪ Constitute a working group for conditions necessary to develop multimodal information ▪ Implement a mobility information centre	▪ Delayed	Weak
Nantes IP2-IM7.2	▪ Organise three two day workshops on mobility	▪ Three two day workshops on mobility have been introduced	Acceptable
Nantes IP6-IM2	▪ Extend tramline 3 ▪ Introduce park & ride lot for car traffic (300 places) and shopping (100 places)	▪ Extension of tramline 3 ▪ Introduction of the park & ride lot for car traffic (300 places) and shopping (100 places)	Notable
Rome 7.2.1	▪ Create a GIS database for	▪ All cycling tracks are	Acceptable

	citizens of all existing cycling tracks ▪ Collect information on public transport accessibility for the disabled for input in GIS database	visible on the internet ▪ Info point interface for disabled services is available	
Rome 11.1.2	▪ Construction of a mobile info point interface	▪ Construction of a mobile info point interface	Acceptable
Rome 11.1.3	▪ Extend info on multi modal information system through multilingual website + kiosk ▪ Extend delivery mobility information through portable devices	▪ Extension of info on multi modal information system through multilingual website + kiosk ▪ Extension of delivery mobility information through portable devices	Acceptable
Rotterdam 10.2	▪ 2 interactive workshops with users & road authorities which would result in better traffic congestion plan	▪ 2 network meetings have been held ▪ Traffic congestion plan has been improved	Acceptable
Rotterdam 11.2	▪ Improve the existing region TIC by adding real time information on PT to it	▪ Not implemented Plans changed to information on accessibility	Weak
Winchester	▪ Implement a bus departure information system display ▪ Implement 4 electronic information kiosks ▪ Implement 4 variable messages signs ▪ Implement 3 real time information display units ▪ Access traffic information from website by mobile devices	▪ Implementation of a bus departure information system display ▪ Implementation of 3 electronic information kiosks ▪ Implementation of 3 variable messages signs ▪ Implementation of 3 real time information display units	Acceptable

2.5 Impact analysis

As mentioned before, the multimodal interchange measures consisted of three different types. With regard to the impact of connecting the various modes, the example in Graz is highlighted. At the public transport terminus Andritz in Graz a better connection between (local and regional) buses and trams was created by reconstructing the entire tram (end)station with platforms created close to each other. The bus timetables were also reconsidered in an attempt to limit waiting time to a minimum and allowing more buses to serve passengers within a given time interval.

Pedestrian access to and within Andritz station has been facilitated, and waiting areas are clearly separated from the tracks and stops. New tangential lines were implemented, which allow travelling between outer city districts without having to actually travel through the city centre. Guaranteed connections were created at important stops where passengers either change lines or transport modes. Additional (over decked) bike and ride facilities have been created.

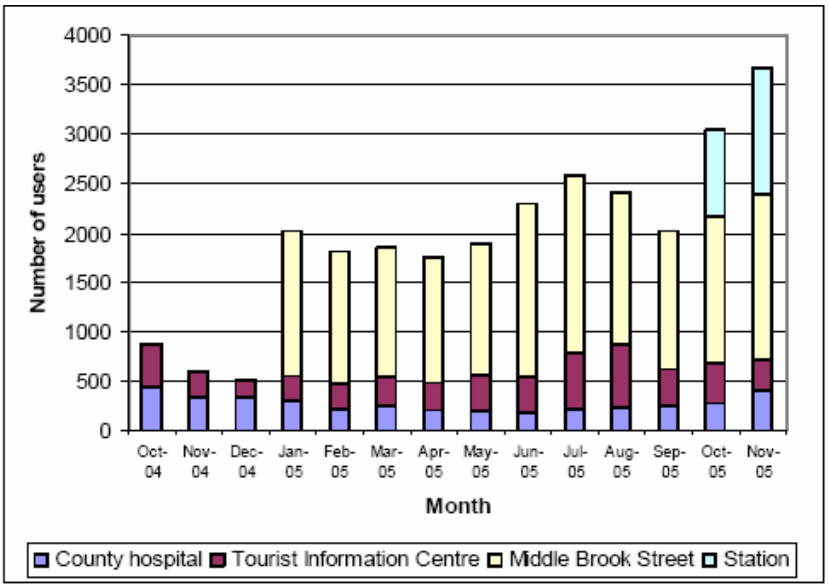
59% of public transport passengers who use the new user-friendly stop in Andritz are of the opinion that public transport has become more attractive due to the reconstruction of the terminus. Most of the positive feedback refers to an improved overview of the station and the division of space, 57% however complain about the lack of green areas.

With regard to the intermodal exchange points there have been numerous delays. In the city of Lille, due to the number of stakeholders, the intermodal exchange station was in the last phase of completion and no results on impact were available. The intermodal exchange station in Mariatrost, Graz has been implemented, although not as proposed, or as was described at the outset. The station was established at the terminus of tram 1 in Mariatrost. A survey among public transport users who entered the tram at the terminus in Mariatrost found that 87% of the interviewees knew that the station was an intermodal exchange station. 60% indicated that public transport had become more attractive with the new station, 45% had already used the station before. 60% of those who had previously used the station stated that it was one of the reasons why they would use public transport more often than before. Satisfaction among the users ranked well with 1.7 (on a scale from 1 very satisfied to 5 dissatisfied) – 81% of the users said they were very satisfied. The station was also considered important for the image of the public transport operator (2.1 on a scale of 1 very relevant to 5 irrelevant). Bike and Ride was considered less important for the general image (only 3 on average) but this resulted from an independent sample.

With regard to the information measures, such as those implemented in the cities of Rome and Winchester, there was a positive impact shown on the social level in general. In the city of Rome the information measures resulted in a 30% increase in the availability of information. The travel information website has led to an increase of visitors to the site from 48.000 to 190.000 in one month. The number of disabled people on the buses has almost doubled as a direct result of the accessibility database. The mobile info point has not yet been evaluated.
The information services in the city of Winchester also had a positive impact on a social level. Results from the awareness questionnaire showed that 49% were aware of the bus display information systems, 23% of the kiosks and 19% of the ROMANSE website. The questionnaire results for the bus display information system were relatively high due to their viability and the prominent and strategic locations. The awareness of the kiosks was much lower possibly accounting for the fact that they had only just been installed. Given the location of one of the kiosks in the precinct area of the city centre (Middle Brook Street), it is hoped that awareness will be increased subsequent to the duration of the project.

The following figure shows the number of people using the kiosks from October 2004 to November 2005. The average number of users per month from October 2004 to November 2005 was 1955 but from January 2005 (when the third kiosk was installed) to August 2005, it increased to 2074 users per month. During October and November 2005, four kiosks were in place, and monthly usage then rose to 3358.

Figure 2.5 *The number of users using the kiosks in Winchester*



The figure shows that the installation of the third kiosk at the precinct (Middle Brook Street) led to a tremendous increase, almost quadrupling the total number of users from January 2005. In addition, the installation of the fourth kiosk led to a further 40% increase in the number of kiosk users. This was probably due to the fact that the third and fourth kiosks are located outdoors in easily accessible areas with large numbers of pedestrian traffic, and therefore a greater number of potential users. They are also both located next to bus stops, thereby targeting queuing bus passengers with time to spare (as well as rail passengers in the case of the fourth kiosk). Due to the outdoor locations of the kiosks, people may have felt less inhibited using them than, for example, the one situated in the tourist information centre.

The following table shows the results of the two bus departure information system interview surveys.

Table 2.3 *Results of the bus departure information system interview surveys (%)*

	First survey	First Survey (other towns in Hampshire)	Second survey
Noticed BDIS	100	97	68
Intended to check screen	66	89	60
Regular bus user	97	56	62
Clear to read	100	66	98
Easy to understand	100	86	98
Information useful	15	64	98
Information accurate	14	44	12
Used printed timetables	80	50	74
Should display cancellations/delays	100	59	20
Encourage more bus use	0	55	34

The results showed that the bus display information system screens in Winchester were noticeable and easy to read. In an awareness survey in Measure 10, 49% of the general public

were aware of the screens, which was high in relation to many of the other measures implemented in Winchester. Differences between the two Winchester surveys may be due to the small number of interviews taken for the first survey. The results also show that about 60% of respondents planned to check the screens, but only a small minority thought the information was always accurate (12% in the first survey and 14% in the second survey). The information displayed was not real-time and therefore would be inaccurate when there were delays or cancellations. In addition, the screens were initially only updated every 5 minutes, which resulted in many buses being displayed that had already departed. Updating the screens every 1-minute rectified this. The majority of respondents stated that they were regular bus users who would already know the departing time and location of the bus they were waiting for. Of the 7 Hampshire towns surveyed, Winchester was the last to have bus information system screens installed, therefore, bus passengers in Winchester had less time to become familiar with them and were still mainly reliant on printed timetables as their main source of information. It is expected that in time the results for Winchester will be similar to the other towns in Hampshire, where nearly 90% of passengers stated that they check the bus display information system before boarding their bus.

2.6 Transferability and packaging

The main High Level Objectives related to the "multimodal Interchanges" cluster were to improve the appeal of public transport, to enhance flexible transport services, to reduce journey times, to enhance intermodality, increase traveller information and to reduce the impact of transport on the environment.

In the measure **"Multimodal Information for Passengers"**, the technical and organisational needs and the excessive use of the system by other services were regarded as the most relevant difficulties encountered during implementation of the measure. Its effectiveness could perhaps be more easily reached through the use of open stands to build communication interfaces, the location and appeal of the information points, the provision of a transition period for passengers to use new information sources and the availability of updated, real-time information. A balance between information and other services may encourage more users.

The measure **"Public Transport integration through service extensions"** is best suited to a local situation with a poor public transport system, unsatisfied transport demand and low levels of car ownership. The main barriers encountered for the projects implementation were, the time needed for overcoming legal bureaucracy or the call for tender procedures, the need for funding or problems due to property rights or ownership. With a highly innovative scheme the public may be uncertain regarding the use and operators may be deterred. Crucial actions for the measures' success were the realisation of an in-depth customer satisfaction survey run at an early stage and marketing initiatives. Where ppp's (Public Private Partnerships) are involved, close negotiation with operator(s) and a deep understanding of their operational processes is

important. The measure has potential synergies with the clusters of Zones With Controlled Access and Car Sharing And Car Pooling.

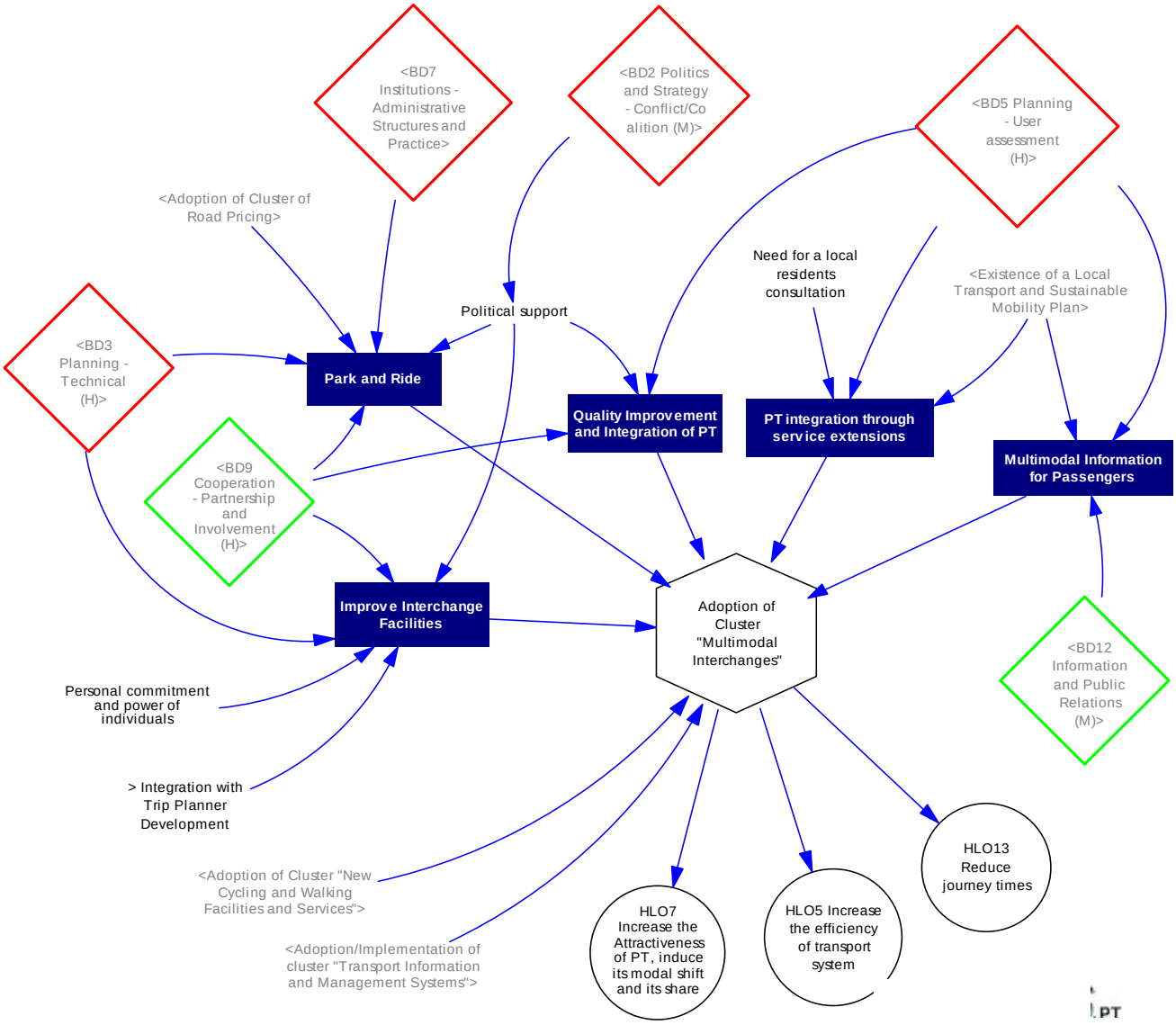
In the measure **"Quality Improvement and Integration of Public Transport"**, the potential for passenger growth and the knowledge of previous successful experiences were referred to as drivers. The main barriers were the legal framework, commercial and technical hindrances, the limited capacity of Park and Ride car parks, privately owned public transport and the need for commercially sensitive information. On the social/political side there were hindrances related to several changes in leadership and there was some opposition from an interest group. In one case the integration of clean vehicles encountered problems relating to delays in supplies and technical aspects. Actions necessary for providing a user friendly system are bringing together key stakeholders (achieved through a Quality Partnership), marketing campaigns, consistent parking policy and enforcement and bus priority measures. The most important action to achieve success was the preliminary survey for passenger demand that was carried out prior to implementation, showing the most important factors for passengers. This type of measure potentially interacts with efficiency gains for the measures from the Zones with Controlled Access cluster and the Car Sharing and Car Pooling cluster.

The measure **"Park and Ride"** gained experience through the other CIVITAS cities. Only a few drivers and barriers were referred to in the country reports although there were many crucial actions for success noted. The most relevant drivers mentioned were the enforcement of the measure by an existing city strategic plan and the actual demand for Park & Ride services. The need for licensing, strong opposition from shops and residents and the necessary land acquisition were highlighted as barriers. The large set of factors for success included offering a price advantage in comparison to inner-city parking, marketing campaigns. awareness measures, stopping "wild" parking and offering a high quality service. Thorough planning (with technical and economic analysis) and a strong project management are essential along with attracting investors. Synergies with other measures from the clusters Zones with Controlled Access, Public Transport, Mobility Management and Transport Information and Management can enhance the efficiency.

The measure **"Improve Interchange Facilities"** brought drivers and barriers of a predominantly political and social nature. Barriers to the measures' success were political support (in different cases), complex administrative procedures, too many stakeholders coming from different environments, centralised public funding, problems with bike security, lobby groups against the measure, long negotiations delaying the decision, lack of budget and the need for consultations with the local residents.
Apart from social and political barriers, other problems were property and land transfer, unexpected construction problems or a reduction in the potential demand for the scheme. A number of relevant advisable actions for permitting the success of the measure included considering long term planning including managing and prioritising the transfer of property,

finding a compromise between the intended solutions, packaging the project contract, studying the price structure to implement fare integration and the promotion of walking by improving pedestrian access. Marketing, eventually combined with other measures, is an important element. Measures which could be considered suitable for packaging are particularly the ones in the clusters Transport Information and Management, Public Transport, Cycling and Transport Information and Management.

Figure 2.6 *Fundamental Mapping of the Cluster "Multimodal Interchanges"*



2.7 Conclusion

Overall, one can conclude that multimodal interchange measures have been accepted by the

citizens of the different CIVITAS I cities. The acceptance and awareness of the improved conditions is also quite high and although not firmly stated, one can expect that these kinds of measures do have a positive impact on the transport impact level. When public transport is made more attractive people may be more inclined to change from car use to public transport, which of course would result in a change in the modal share and ultimately also contribute to a cleaner environment, in line with the ultimate CIVITAS I objective. The following table shows that that only definite results relating to the social impact have been observed.

Table 2.4 *Summary of overall effects of the cluster multimodal interchange*

	Transport	**Energy**	**Environment**	**Economy**	**Society**
Multimodal interchange	*	*	*	*	☺

3 MOBILITY MANAGEMENT

3.1 Introduction

Mobility management is one of the newer and more innovative European measures to have evolved in the past decade. One of the main objectives of mobility management is to make citizens more aware of how public transport is used and to promote alternatives to the use of a car. One of the CIVITAS I objectives is to reduce the publics' dependency on (private) cars. In order to achieve this, public transport and alternative forms of transport such as cycling, walking, car sharing and carpooling have to be user friendly, easy, affordable and attractive. Mobility management is a measure that is capable of contributing to the general objective, although it often proves difficult to actually measure the impact.

Mobility management measures were implemented in ten demonstrating cities, see table 3.1. Most of these implementations were a success, particularly in Bremen, Bristol, Graz, Pecs and Winchester.

Table 3.1 *Implementation of mobility management measures*

CITY	CODE	TITLE
Berlin	10.4	Customer and user participation
Bremen	8.5	Public transport & car sharing
Bristol	11.3	Marketing and travel awareness campaigns
Graz	8.1	New services & services for special customer groups
Graz	8.4	Mobility management for large firms, schools and events
Graz	10.5	Marketing/information and quality management
Lille	8.2	Company mobility plan for employees
Lille	8.5	Set-up description of the Urban Mobility Plan and implement a micro version
Nantes	IP2-IM4	Implementation of Nantes Metropole mobility plan
Nantes	IP2-IM5	Promotion of company mobility plan
Pecs	5.5	Preparation of a new traffic and transport strategy
Rome	5.2b	Urban traffic plans to increase the safety for pedestrians
Rome	10.2	Increase number of Mobility Managers and raise awareness of commuter alternatives
Rotterdam	10.1	Green commuter plans and mobility management
Rotterdam	10.3	New approaches to integrated planning
Winchester	10	Awareness measures & mobility management measures

3.2 Implementation

Three TravelSmart projects were successfully introduced to different areas of Bristol. TravelSmart is an example of mobility management which promotes the use of public transport, cycling and walking. The TravelSmart method has already been successfully applied in other

parts of Europe, but its successful application in the United Kingdom proves its versatility across different regions. Other examples of mobility management are Quality management in Graz, Urban Mobility Plan (PDU) in Lille, Local Urban Traffic Plan (LUTP) and Mobility Manager of the Area (ATAC) in Rome, the mobility advice centre for the greater Rotterdam region (VCC-R) in Rotterdam and the School Travel Plan (STP) in Winchester.
The city of Graz (and Winchester) introduced mobility management at schools. By focusing on pupils, the awareness raising activities[8] not only aim to reach the youth but to encourage them to influence their parents, teachers, and in some cases even the police. The benefit of trying to influence children who is turn influence their parents is the long term effect of children becoming acquainted with alternative forms of transport from an early age and not automatically "preferring" to travel by car due to lack of knowledge regarding the alternatives. The most notable problem encountered when realising school mobility management is in most cases the attitude of teachers, many of whom have numerous excuses as to why they still need to travel by car when a whole class of 30 pupils manages to walk or cycle to school!

TravelSmart1[9] was implemented in a suburb of Bristol, where walking and cycling statistics were low. The project was designed to measure the impact of TravelSmart as well as improvements made to the local bus service. In TravelSmart1 an Individualised Marketing Campaign (IMC) was launched to substantially increase the number of walkers, cyclists and public transport users and reduce the number of journeys made by car. TravelSmart2 was carried out in an area with a large proportion of car owners but also with high statistics for walking and cycling; the objective of the project being to increase the use of public transport as a result of service improvements and an Individualised Marketing Campaign (IMC). A third project, TravelSmart3, was completed in an area just outside the city centre with regular public transport services, and particularly good facilities for walking and cycling such as direct routes to the city centre provided by footbridges and pedestrian/ cyclist ferry services. In TravelSmart3 an Individualised Marketing Campaign (IMC) was also used. All three projects had a target population of 5000 people.

One of the most important tasks for the Mobility Manager of the area of Rome (ATAC) is to raise awareness regarding problems related to traffic congestion and sustainable mobility policies among citizens and stakeholders. This is being achieved through the use of publicity campaigns (public events, delivery of brochures, media information, web information, advertising), with particular reference to citizens who live in areas affected by the CIVITAS implementations. The best way to implement this measure it is to support it using incentives and though limiting the use of private cars (e.g. pay for parking).

[8] The awareness raising activities are: carpooling within the school classes, analyses of the school neighbourhood with respect to traffic safety aspects together with the police, collecting "green miles: while walking or biking to school and a benchmarking tool as available on www.schoolwaynet.at served to define specific measures per school.
[9] TravelSmart is a technique for promoting public transport use. Later, it was extended and refined to include cycling ad walking.

3.3 Process evaluation

Mobility management measures are strongly dependent on the quality and adequacy of the information provided and the communication channels chosen. Insufficiencies in terms of "User Assessment" would represent a main barrier for implementation. Mobility management is immediately confronted with established life styles, habits and consumption patterns, which require careful analysis in order to achieve change. Moreover, the high visibility of these measures makes them particularly susceptible to critical reactions from the general public and the media, underlining the need for a thorough preparation: Quick and simple solutions are easily identified as such and even risk having counterproductive effects (negative opinions of the mobility alternatives promoted). This type of measure also has to deal with the difficulty in justifying both internal expenditure (public administration, operators) and external expenditure with a view to impacts that may be perceived as uncertain ("waste of tax-payers' money").
Mobility management is affected by a *double problem of perception*, making strong backing from partners and politicians as well as a measure design that closely matches the specific requirements of the target group(s) particularly important for driving the implementation. As a "stand-alone" measure, it can perhaps be considered unsuitable and appears to be more successful where it accompanies actual changes in the mobility service on offer (e.g. Public transport and car sharing).

3.4 Outputs

In general the measures delivered the output as described in the following table. Measures that did not deliver the planned output had problems specifically describing the planned output, such as Berlin and Nantes, or due to the fact that they did not achieve their high level objectives e.g. number of participating companies, such as in Graz. Certain demonstration cities have elected to continue the such as in Nantes, Pecs, Rome and Winchester.

Table 3.2 *Overview of the planned and achieved output of the different measures*

CITY	PLANNED OUTPUT	ACHIEVED OUTPUT	COMPLETION RATE
Berlin	• Establish interactions with all the other Berlin demonstration measures	• With some of the Berlin demonstrations the participation concept was realised. • Dissemination campaign 'Clean Transport in Berlin' and 'Tell us about TELLUS'[10] was carried out.	Acceptable
Bremen	• Keep most of the existing 200 customers of the CSO • Sell more "Autocard" at the new location	• Most of the former CSO customers were kept • 30 new contracts were sold[11]	Notable
Bristol	• Launch of three TravelSmart projects	• TravelSmart is completely implemented	Notable
Graz	• Two new bus lines to suburbs • Night buses to suburbs • Integrate and improve on demand services • PR-work, information and improved services • Evaluation of services	• Two new bus lines towards suburbs • Night buses towards suburbs • Integration of the surrounding municipalities in the on demand service system • PR-work, information and improved services • Evaluation of services	Acceptable
	• Implement mobility management in 25-40 small and medium sized companies, four schools and a event in the new city hall	Mobility management implemented: • in two large companies • in four schools • for large-scale events	Acceptable
	• Implement Quality management for public transport • Launch information and awareness campaigns • Set-up public transport planner with address-specific information and route finding	• Implemented Quality management for public transport • Two marketing measures take place • Launch door-to-door information system towards customers	Acceptable
Lille	Long term (2015): • Introduce the Urban Mobility plan • The gradual replacement of the entire bus fleet by clean buses	• Use of 4 electric scooters, 23 bicycles • Some are carpooling • 123 people get a refund of the season ticket for collective transport	Acceptable
		• Working groups and a steering committee established for mobility planning in Lille • One micro urban mobility plan is ready for a specific site	Notable
Nantes	• Launch mobility plan, with evaluation process	• Mobility plan launched • Evaluation process is still continuing	Acceptable
	• Organize a debate with employees during the preparation of the company mobility plan	• 16 plans are under way and 19 plans being studied	Acceptable
Pecs	• Analyse private and public transportation in the city centre	• Traffic city centre analysed • Professional background for future	Notable

[10] TELLUS is one of the four projects in which the city of Berlin took part
[11] A small growth, because of a (absolutely and relatively) small group of public transport users in the periphery and in the region.

CITY	PLANNED OUTPUT	ACHIEVED OUTPUT	COMPLETION RATE
	• Predict facilities required in the future • Give suggestions on how to re-plan the city traffic	city transportation actions • Suggestions for re-planning city traffic	
Rome	• Re-design and re-shape the pedestrian crossings and road intersections	• Output only in model simulation	Delayed
	• Encourage the companies to appoint Mobility Managers, in order to increase their number • Provide support to the Mobility Managers in implementing commuter plans and integrated mobility management tools • Provide the Mobility Manager with support to catch opportunities for funding • Raise awareness about commuter plans alternatives	• Number of Mobility Managers raised with about 180 • All the evaluation related milestones are achieved	Acceptable
Rotterdam	• Virtual information points • Create an information centre for employees • Start an extensive publicity campaign to ensure information provision to the target group	• An internet site has been built incorporating information on several aspects of mobility management	Acceptable
	• Masterplan Alexander • Design of target lane to Kralingse Zoom and presentation Succes-Fail factors of large scale Park and Ride implementation • Design study for Ahoy and Zuidplein	• Masterplan Alexander realized • Design Kralingse Zoom and presentation Success-Fail factors realized	Delayed
Winchester	• Implement a series of innovative soft measures to raise awareness • Encourage the development of green travel plans • Develop and implement an air quality plan for Winchester	• Implementation of soft measures still going on • Green travel plans are ongoing • Air quality plan is implemented	Notable

3.5 Impact analysis

The main desired impact of the mobility management measures is to make citizens and commuters more aware of other forms of transport by providing improved information and by organising alternative forms of transport. Another objective of CIVITAS I mobility management is to achieve synergy when combined with other cluster measures, unfortunately awareness and synergy are not easily measured. A number of demonstration cities reported an increase in the number of people walking, cycling and using public transport to travel to work and reductions in emissions and the number of car users. It is difficult to tell whether or not this can be attributed to mobility management or from separate measures. The following table shows the impact of the measure and corresponding remarks.

Table 3.3 *Impacts and remarks*

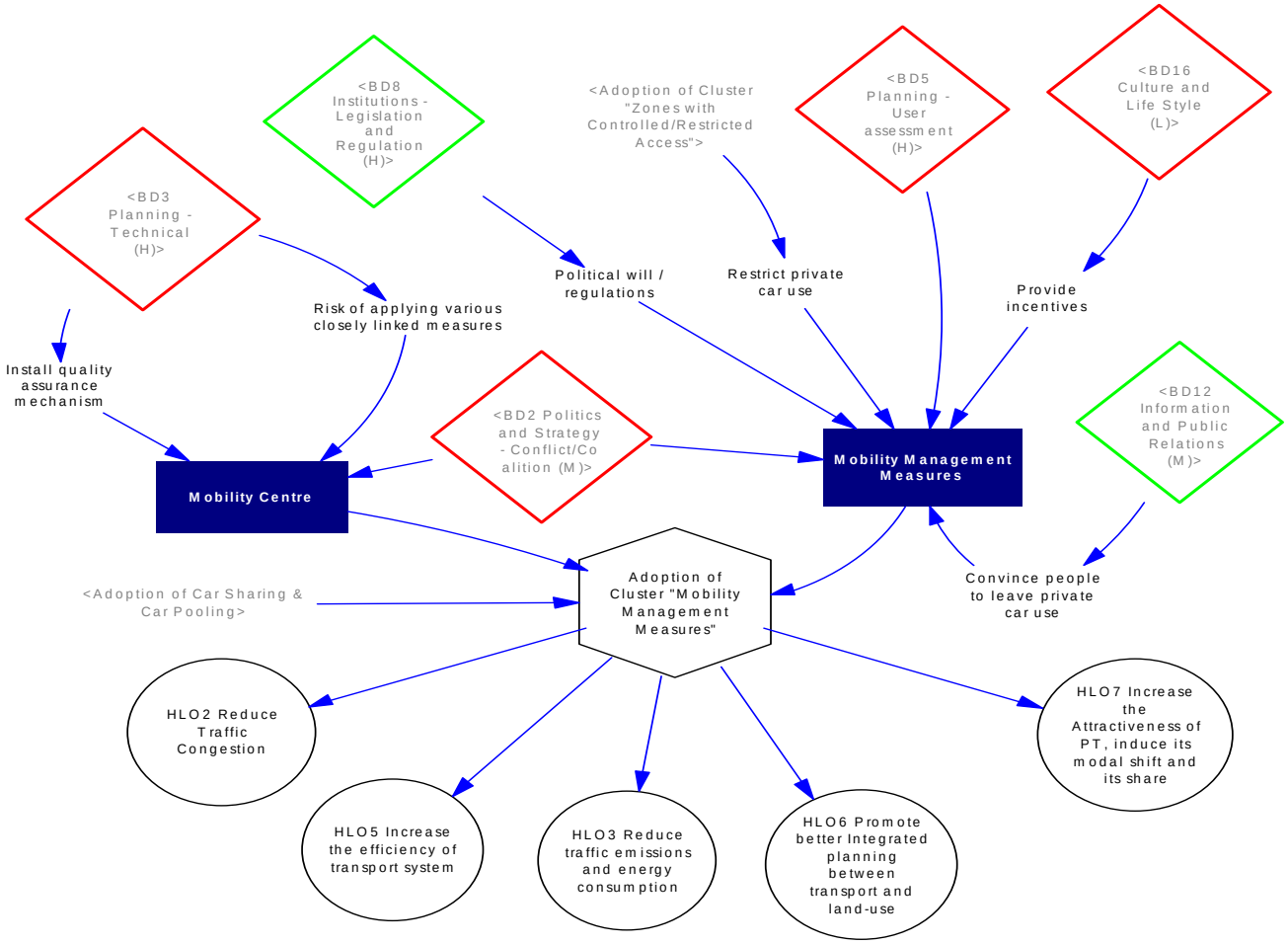
CITY	IMPACT	REMARKS
Berlin	• Improvements of mobility management were recognised	• All objectives were partly achieved
Bremen	• Bremen population becomes more aware of the measure • Combined offer attracts public transport users, but could also gain new public transport customers • Car kilometres reduced	• This measure is strongly related to other measures • Most clients have a relatively high level of education and slightly more income than the average adult Bremen population
Bristol	• The use of public transport has increased • The number of cycle trips has increased • Walking increased • The number of car driving trips was reduced • Project has positively contributed to the awareness level of public transport information, perception of public transport accessibility and security	• Lack of available mainstream funding are a barrier for large projects like this one • The TravelSmart projects have enabled greater partnership working • The TravelSmart method successful application in the UK proves its versatility across different regions
Graz	• Improved services by introduction of night buses • Increased on-demand services by harmonisation and improvement of all on demand taxi systems • Improved quality of public transport • Special services increased number of passengers amongst disabled and elderly	• Night buses implementation could be realised within two weeks after official agreement • Use new buses for night line (to decrease noise)
	• The implementation of mobility management has helped to generate less single car use in favour of more sustainable modes of transport	• The best measures do not succeed without promotion – early in advance
	• The level of satisfaction with the quality of public transport increased by 15%	• It is not really predictable, which measure receive most publicity
Lille	• Emission reduction • Modal shift of staff from car to public transport • 2.200 people aware of transport “bad habits”	• Barrier: resistance to change from habits
	• Emission reduction	• The micro Urban mobility plan approach is fully replicable in other environments
Nantes	• 14% of Nates Métropole employees are PassPartout fare holders	• Employees become aware of the necessity to develop a positive attitude
	-	• Barrier: Resistance to change habits
Pecs	• Car free zone established	• Each city should modify, update its traffic strategy after the completion of the Civitas projects
Rome	• 50% accident reduction, according to simulation model	-
	• TIM project: percentage of public transport users of the employees raised from 11% to 24% • La Sapienza project: percentage of public transport users of the employees raised from 61% to 72% • Emission reduction	• Best way to implement this measure is to support it by incentives and through limitation in the use of private cars
Rotterdam	• 50% of the respondents are familiar with the website, the success of advertising is overall positive	• Most visitors only use the website for information about biking
	• Positive attitude amongst many parties	• In general it is not easy to estimate the impact of ‘soft measures’
Winchester	• Awareness level at 20% • 11,835 employees now covered by a workplace travel plan	• Awareness raising events, combined with visual aspect and personal contact, are the most effective

3.6 Transferability and packaging

The highest overall level of success has been achieved by Mobility Management measures which were almost entirely assessed as "acceptable" or "notable". This result should however be regarded with prudence since the implementation targets actually set have often not been very ambitious or say little about the quality of the measure. In any case the main High Level Objectives mentioned in this cluster were to reduce the share of single car use in favour of other modes, to raise awareness about alternatives, to increase public support of sustainable transport, to reduce energy consumption and environmental impact, to increase the efficiency of transport of goods and people, to offer higher quality information and to form synergies between city services.

The measures contained in this cluster were aggregated into two types of measure: **"Mobility Management Measures"** and **"Mobility Centre".** Aspects that hindered the measures' success were political unwillingness, local regulations, and established habits towards car use. Identified actions that contribute for success are to restrict private car use and to perform public awareness-raising campaigns.

Figure 3.1 *Fundamental Mapping of the Cluster "Mobility Management "*



3.7 Conclusion

Mobility Management measures have a direct and positive influence on awareness and acceptance. With regard to other areas of impact the benefits are mainly indirect such as modal split, vehicle occupancy, fuel consumption, air quality, emissions and noise. Mobility management is at its most effective when used on new employees within a company.

It was determined that the travel behaviour of newcomers can be changed easier than travel behaviour of long time employees. Typical information for newcomers could contain:

- Map of local / regional public transport net
- Brochure on parking in the city
- Special information regarding company surroundings, containing public transport stops, points of interest
- Cycle map
- Timetable of public transport system

The implementation of mobility management at schools is also useful for three main reasons:

1) influence their future choice of sustainable mobility
2) change current mobility behaviour
3) influence parents and teachers via children

Implementing mobility management measures is not a standard procedure, because every situation/ area is different. A uniform measure to fit all situations does not exist. As shown in the three TravelSmart implementations in the Bristol area, target groups can be just as diverse as the material and equipment of the infrastructure. In Graz the implemented mobility management measures were specifically aimed at improving the accessibility for the elderly and disabled living in the suburbs.

In Bremen media reporting was very important for the success of rising awareness of the services available. Even the best measures do not succeed without promotion as far in advance as necessary. It is amazing how little is known about the integration of public transport and event tickets, and even less about the accessibility map. Advance information should actively be communicated to the visitors, which also requires awareness raising with the event organisers, as they are usually unwilling to take responsibility for transport issues.

Mobility management measures contribute in general to the objectives of CIVITAS 1 by raising the levels of awareness and acceptance. A number of indirect effects such as traffic safety, modal split, emission reduction and vehicle occupancy can also be achieved depending on the environment and habits of the target group in question.

The following table shows the effect of the society level impact. Results for Mobility Management measures could only be proven as being influential on social aspects, giving the positive response for awareness and acceptance. No real evidence can be found to support the actual effect on other impact levels, however it is believed that it has a general positive effect on all categories.

Table 3.4 *Summary of the overall effect on the cluster mobility management*

	Transport	**Energy**	**Environment**	**Economy**	**Society**
Mobility management	*	*	*	*	☺

4 CYCLING

4.1 Introduction

In several countries such as The Netherlands, Belgium and Germany cycling is already a widespread recognised form of transportation while in others, for example Ireland and Spain, cycling is not widespread at all. During the past decade many initiatives have been introduced to improve conditions for cycling in several countries, sometimes initiated at European level. One of the more recent European Union projects is BYPAD[12], which is based on European best practices on cycling. In BYPAD cycling policy is considered a dynamic process whose strengths and weaknesses are analysed. Measures that have proven their benefit are recommended by BYPAD and have been introduced in several other European cities. In this way more than 65 cities in 15 different countries have improved their cycling facilities.

Within the CIVITAS I initiative 10 cycling related measures have been introduced in 8 different countries. The following table displays these measures, all of which have the same general aim; to make cycling a more attractive form of transportation.

Table 4.1 *Cycling related measures within the CIVITAS I project*

CITY	CODE	TITLE
Bremen	11.4	Improved cycling conditions
Bristol	11.4	Improved cycling conditions
Cork	10.1	Bike about scheme
Graz	10.1	Improved cycling conditions
Nantes	IP2-IM3	Bike & Ride and rent a bike service
	IP5-IM4	Vélocampus bike renting service
Rotterdam	5.2	Dedicated bicycle routes
	8.1	Electric two-wheelers
Stockholm	10.2	Bike & Ride information on the internet
Winchester	8.2	New cycling opportunities

4.2 Implementation

Most of the cycling measures, not only in the CIVITAS I project but also in the BYPAD project, are relatively easy to implement, with the exception of the city of Rotterdam that had the challenge of introducing electrically powered bicycles. In several different areas in a number of cities (Cork, Bristol, Graz and Rotterdam) the existing cycling paths were improved in terms

[12] BYPAD stands for Bicycle Policy Audit

of safety and accessibility. One particular example is the Netham park Route area in Bristol which can be seen in the figure below.

Figure 4.1 *Example of the redesign of a park route for walking/cycling (Netham Park Route)*

Before

After

In several sites in the city of Bremen for example contra flow lanes have been created to provide better access to the city for cyclists. These lanes are clearly marked, as shown in the figure below, with clearly visible red coloured stone and the symbol of cycle, which has been standard in The Netherlands for a number of decades.

Figure 4.2 *Example of a contra flow lane in a one-way street in the city of Bremen*

Another improvement that has been implemented in the cities of Cork and Winchester is the cycle stands where cyclists can safely park their bicycles.

There are also a number of softer cycling measures such as the “Bike About” schemes to enhance awareness of cyclists and cycling (in the cities of Winchester and Nantes), the creation of a compact pocket map containing all the cycling routes in that particular city (Cork and Graz), and a website to the same effect (Stockholm), the creation of a bicycle rent service (Nantes) and cycle training (Graz) for school pupils (approx. 10 years old), see figure below.

Figure 4.3 *Cycle training for school pupils in the city of Graz*

4.3 Process evaluation

The implementation processes for cycling measures seem to indicate the need for a true *cultural change* regarding the role of cycling both in planning and urban mobility. Despite the rather "light" character of the actual interventions (cycling paths, signs, bicycle racks, provision of information, new services) several measures ran into problems with the amount of time required for planning procedures (land-use, infrastructure, facilities) often causing conflicts with the more compact project timeframe.

The most important confrontations with the conventional planning procedures for cycling, mainly conceived in terms of infrastructure, seem to represent an important barrier ("Administrative Structures and Practices", "Partnership and Involvement") and the more integrated approaches including services and promotion require more flexibility and cooperation across organisational boundaries. In spite of the comparatively low expenses, the difficulty encountered in various cases to secure the necessary funding further underlines the need for a more explicit political pledge for cycling as a key mode in the local transport network.

Specific difficulties were apparent in the rent-a-bike scheme in Nantes and the electric bikes in Rotterdam, where deficits in terms of "Information and Public Relations" seem to have failed in encouraging more demand, where "Life Style" implications were perceived to foster implementation ("fun factor"). Other relevant driving influences have been a clear "Political Commitment" (Bremen, Cork, Graz), synergies in terms of intermodal offers or air quality management (Stockholm, Winchester), as well as a favourable attitude from citizens towards cycling promotion.

4.4 Outputs

The CIVITAS I cities that opted to set up cycling related measures were generally successful in completing the activities planned at the outset of the project, although some of the cities did not implement several of the proposed aspects, e.g. when a city planned to improve 7 areas in a city

only 6 were realised (Bristol demonstration) or the proposed quantified number was not achieved, e.g. only half of the proposed 100 electric bicycles were introduced in Rotterdam. As illustrated in the following table, the original plans were often completed within the CIVITAS I timescale.

Table 4.2 *Overview of the planned and achieved output of the different measures*

CITY	PLANNED OUTPUT	ACHIEVED OUTPUT	COMPLETION RATE
Bremen	▪ Set up a contraflow lane (marking and signposting) for cyclists in the '*Lahnstraße*' to improve the physical safety of cyclists ▪ Reallocation of road space in the `*Hohentorsheerstraße*' a through road in the northern part of the Neustadt area ▪ Reallocation of road space in *Langemarckstraße*, one of Neustadts' main shopping and main traffic streets	▪ A contraflow lane (marking and signposting) for cyclists in the '*Lahnstraße*' to improve the physical safety of cyclists has been set up ▪ Road space in the `*Hohentorsheerstraße*', a through road in the northern part of the Neustadt area, has been reallocated ▪ Road space in *Langemarckstraße*, one of Neustadts' main shopping and main traffic streets has been reallocated	Acceptable
Bristol	▪ Improve provision of cycle infrastructure in 7 area's	▪ Improvement of provision of cycle infrastructure in 6 area's	Notable
Cork	▪ Provide safer routes for cyclists accessing the city ▪ Provide secure places for cycles to be locked ▪ Raise awareness ▪ Implement cycle parking facilities	▪ Safer routes for cyclists have been provided ▪ Secure places for cycles to be locked have been provided ▪ Awareness around European Car Free Day ▪ Cycle parking facilities have been implemented ▪ A cycle safety training program for primary schools has been created	Acceptable
Graz	▪ Generate a bike map which contains bike routes, repair facilities and bike shops ▪ Create an information brochure on cycling ▪ Equip public transport stops with Bike & Ride facilities ▪ Introduce new bike paths and crossings over the river ▪ Set up bike training for pupils (approx.age 10) in all schools in Graz ▪ Link the University Joanneum to the city bike network	▪ Generation of a map which is also available online ▪ All public transport termini now have a roofs/Bike & Ride facilities ▪ An information brochure on cycling ▪ Introduction of new cycling paths ▪ Bike training has been set up ▪ University is almost linked to city bike network	Acceptable
Nantes IP2-IM3	▪ Implement a Bike and Ride service ▪ Implement a bike renting service	▪ 3 enclosed bike park spaces in Nantes-Vertou railway link stations have been implemented ▪ Map of cycling routes has been created ▪ Implementation of a bike renting	Notable

		service	
Nantes IP5-IM2	▪ Implement a vélocampus bike rent service	▪ Implementation of a vélocampus bike rent service	Notable
Rotterdam 5.2	▪ Introduce 4 cycle routes to Central Station and other places of public interest	▪ Introduction of 1 cycle route	Delayed
Rotterdam 8.1	▪ Introduce 100 electric bicycles and 5 electric scooters ▪ Set up of a marketing and introduction plan	▪ Introduction of 50 electric bicycles and 5 scooters ▪ A marketing and introduction plan has been set up	Acceptable
Stockholm	▪ Introduce a web system for Bike & Ride information	▪ Introduction of a web system for Bike & Ride information	Acceptable
Winchester	▪ Introduce a Bikeabout scheme ▪ Install 75 cycle stands ▪ Introduce a pocket cycle map	▪ Bikeabout scheme was introduced ▪ Installation of 11 cycle stands ▪ Introduction of a pocket cycle map	Acceptable

4.5 Impact analysis

The redesign of the park routes have been implemented in most places as previously described and subsequently had direct impacts on the transport level. In all the area's the improvement consisted of widening a dedicated path for walking and cycling and where possible constructed through a park. One example of which was shown earlier (Bristol redesigned path). The results of the survey on walking and cycling indicate that the improved paths are being utilised by both pedestrians and cyclists. The new routes are mainly used for commuting (54%) and leisure (50%). More than half of the respondents (in total 124) indicated that they used the path on a regular basis (once a week or more). As a result of the introduction of new and improved facilities, cycling has become safer in those area's. Before the introduction of the dedicated cycling path (in the Bristol example) there was an average of 123 casualties (child pedestrians) whereas after the introduction the number was on average 93 casualties. The perceived safety has also increased, on average from 20,6% to 74,8%, in the three streets in Bremen where improvements were made. The contraflow lane in Lahnstrasse is the example from the former paragraph.

Table 4.3 *Assessment of physical safety (in percentages) in three locations (Bremen)*

Street	**Langemarckstraße**	**Lahnstraße**	**Lahnstraße**	**Hohentorsheerstraße**
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	before 2,2 | after 28,7	before 1,2 | after 10,8	before 0,0 | after 8,6	before 5,0 | after 12,5
Rather safe	before 14,7 | after 50,7	before 15,7 | after 59,0	before 33,8 | after 70,0	before 33,8 | after 58,8
Rather unsafe	before 40,4 | after 8,1	before 37,3 | after 16,9	before 43,8 | after 12,9	before 43,8 | after 21,3
Very unsafe	before 34,6 | after 0,7	before 32,5 | after 8,4	before 13,8 | after 5,7	before 13,8 | after 7,5

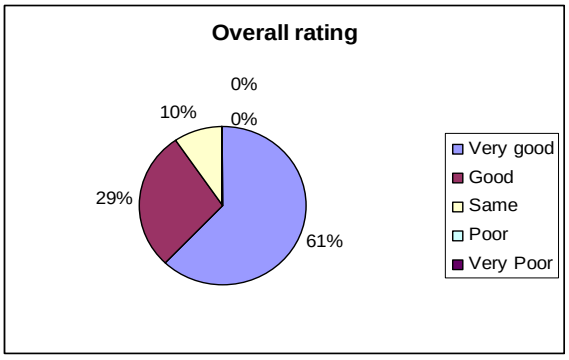
Furthermore there has also been a huge increase in cycles stands with a substantial increase (2000%) in the city of Cork, where the number of cyclists also increased. There is only limited evidence to suggest that the soft measures such as the Bikeabout scheme in Winchester have replaced trips by motorised forms of transport.

Cycling related measures have an important impact on the energy and environmental levels, since cycling is a clean form of transportation and replaces trips that would otherwise have been made by motorized forms of transport therefore creating conditions for a better environment to live in.

cycling measures do not have such a positive economic impact due to the fact that these kind of measures are usually authoritative decisions where initial investments are needed to serve the public domain. Examples of which are the cycle stands and the redesigned cycle tracks which everybody can use.

Predictably, the impact analysis show that these kinds of measures are well received by the inhabitants of the city in question. The level of acceptance is very high in most demonstration cities, although in general only a low level of awareness has been achieved, e.g. in Winchester the Bike About scheme only has an awareness of 37,5% and the creation of the pocket map only 5,9%. The level of acceptance of the Cycle stands in the city of Cork is shown in the following figure.

Figure 4.4 *Overall rating of the cycle stands from user surveys (Cork)*

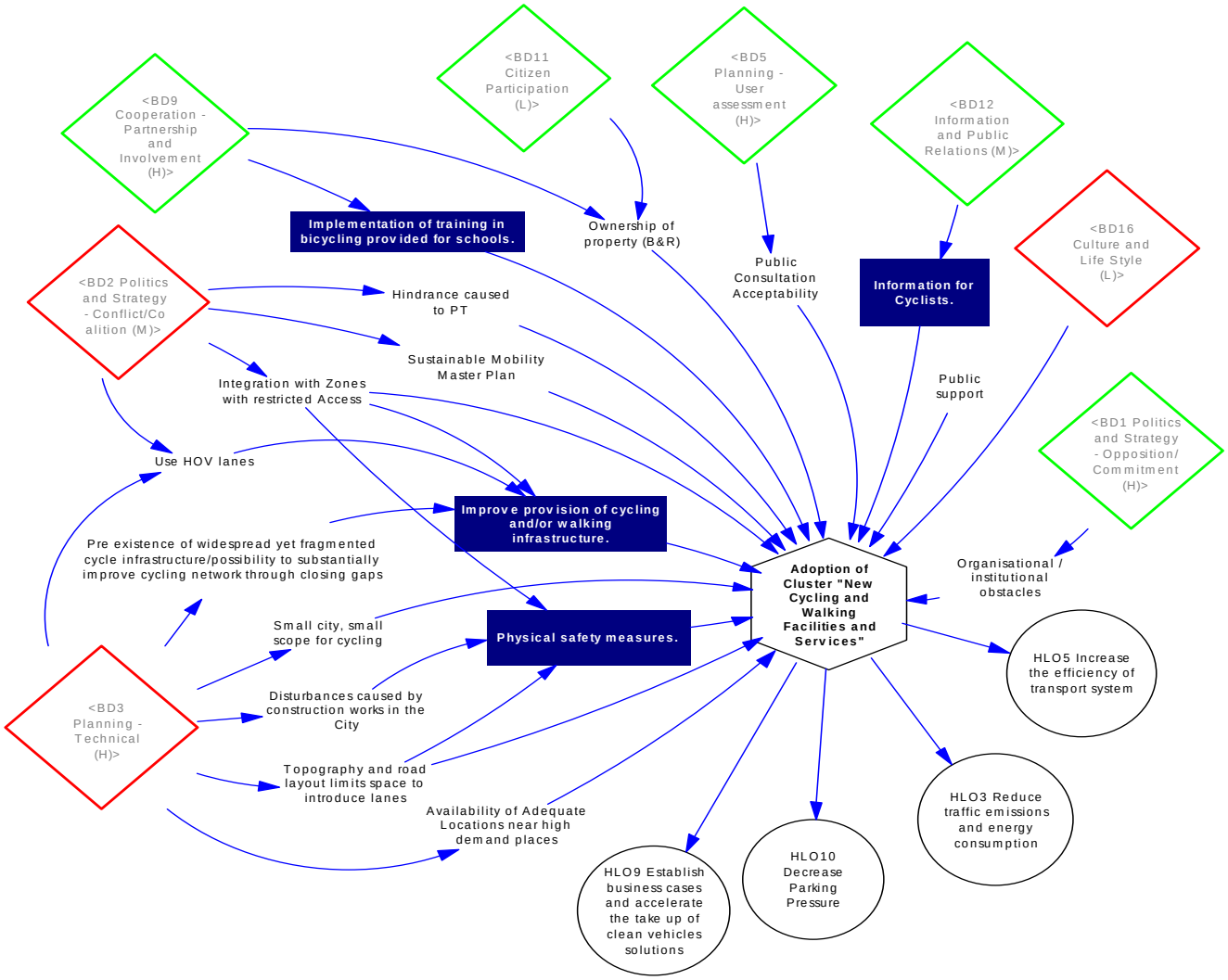


4.6 Transferability and packaging

Cycling measures aimed at expanding the modal share of bicycles which enables other objectives such as a better environment or reduced congestion. Only one type of measure was considered for the cycling cluster, which also promotes walking. **"New Cycling and Walking Facilities and Services"** was a type of measure applied in numerous CIVITAS cities. The experience gathered from it reveals that political willingness and high public acceptance was

crucial to its success. Its barriers included the capital needed, finding suitable space for cycle tracks and stands, institutional constraints, very long land procurement processes or the conflict of construction design with other interests (e.g. with public transport). The measure was complemented with various actions across clusters in order to improve its effectiveness, namely with pricing strategies for the use of bicycle stands, installation of cycle stands near high demand places, access restrictions for cars, integration with park and ride facilities.

Figure 4.5 *Fundamental Mapping of the Cluster "Cycling"*



4.7 Conclusion

The introduction of European cycling measures certainly seems to improve the living conditions in urban areas and to a certain extent the actual physical condition of the citizens involved. The environmental benefits included a reduction in air pollution and noise reductions. Judging from the experience of CIVITAS 1 measures, more people tend to switch to this form of

transportation when infrastructures are improved and new facilities are implemented, resulting in a higher modal share of bicycles. When cycling replaces motorised transport, emissions are reduced as well as energy use helping to achieve the ultimate objectives of the CIVITAS 1 project.

People tend to appreciate cycling related measures and cycling has become a safer form of transport due to the imposed measures as illustrated by the high level of acceptance within the demonstration projects. One drawback however is the low level of awareness of the measures.

In general the measures produced a positive impact analysis although subsidies are required due to rather high initial investment costs.

The cycling measures within CIVITAS I ensured that cyclists were provided with a more integrated infrastructure due to the implementation of green routes and information on new cycle route markings. Cycling is destined to become a more widespread form of transport in the near future due to the ever increasing demand for mobility in overfull inner city roads making cycling an interesting and fast alternative in city centres. The concluding table for this cluster illustrates the impact of the measures on the 5 important impact levels.

Table 4.4 *Summary of the overall effects on the cluster cycling*

	Transport	Energy	Environment	Economy	Society
Cycling	☺	☺	☺	☹	😐

5 CAR POOLING AND CAR SHARING

5.1 Introduction

Good examples of car sharing and car pooling initiatives can be found in many countries. In Germany, the UK and the Netherlands in particular many initiatives of this kind have led to the successful establishment of new types of companies, public campaigns and renewed infrastructure for new forms of vehicle use. European projects such as MOSES[13] and ICARO[14] generated several successful examples of car sharing and car pooling initiatives.

Within CIVITAS I there are twelve measures that initiated car sharing or car pooling demonstrations. These are displayed in Table 5.1.

Table 5.1 *Car sharing and carpooling measures within the CIVITAS I project*

CITY	CODE	TITLE
Aalborg	9.1	Car Sharing / City car club development
Berlin	8.4	Metropolitan fleet-car business/private shared use of fleet cars
Berlin	8.5	Car modal – new service for organised passenger transport in private cars
Bremen	9.1	Car Sharing / City car club development
Bristol	9.1	Car Sharing / City car club development
Cork	10.2	Car pooling register for employees of City Council
Graz	8.3	Increasing car occupancy using special HOV lane
Nantes	IP5-IM3	Incentives for car-pooling; launch of www.illicovoiturage.com
Rome	8.1.1	Car pooling
Rome	8.1.2	Car sharing
Rotterdam	8.2	Expansion of Van pooling for commuters
Rotterdam	8.3	Expansion of car sharing

5.2 Car sharing

Car sharing has been implemented in a number of European countries including among others, Italy, Germany and Sweden[15].

While car sharing sites and initiatives continue to expand in many countries, in others the new measures are only just being introduced. The fundamental principle of car sharing is that the actual use of a car does not have to be directly linked to the ownership of a car. According to this principle a car has multiple users instead of one or two and is therefore used much more efficiently (ie more than once a day) in contrast to the current use of most cars which is

[13] MOSES stands for MObility SErvices for urban Sustainability
[14] ICARO stands for Increase of Car Occupancy through Innovative Measures and Technical Instruments
[15] The countries stated here are the ones involved in the EU project MOSES

approximately 1 hour per day.

Within this cluster the following 6 cities of Aalborg, Berlin, Bremen, Bristol, Rome and Rotterdam have introduced car sharing measures. All 6 cities had a similar objective for the introduction of a car sharing measure: to reduce private car use and ownership (in Berlin it was also to integrate large car fleets for companies), thereby reducing the total number of car kilometres driven which in turn would have a positive effect on emissions and energy use. In Berlin and Rotterdam the measures were not untirely new: a large car sharing network is already in use in Germany and The Netherlands by StattAuto CarSharing in Germany (600 car sharing stations in 80 cities) and GreenWheels in The Netherlands (908 car sharing stations in 65 cities). The city of Bremen has extended its car sharing sites (car sharing has existed there for more than 15 years) and aimed to focus on a new target group: business people. Car sharing is however perceived as relatively innovative for the cities of Aalborg, Bristol and Rome.

5.3 Implementation of car sharing measures

Most of the car sharing measures have a fairly similar and easy concept. Everything has to be simple, immediately understandable and usable, as the main goal is to convince as many people as possible to adjust the common view that the private car is a privileged, almost sacred, means of mobility. The main marketing principle used to convince people of the measure, was the idea of transforming the fixed costs that go hand in hand with owning a car into variable costs linked solely to actual vehicle use. The system architecture is based on the extremely simple concept of vehicle pick-up and return. Reservations are obligatory and can be made to a 24 hour-a-day call centre (Aalborg, Bremen and Rome) and/or internet websites (such as used in the cities of Bristol and Rotterdam). The car can be opened with a magnetic smart card (see figure 5.1) or by using a PIN (personal identification number), the ignition key is left inside, together with the credit cards that are used to purchase fuel so that clients do not have to pay any money in advance.

Figure 5.1 *Opening the car by the use of a magnetic smart card (Berlin demonstration)*

The applied technology ensures that the car cannot be accessed by a member if they have not

made a reservation and that particular car has is reserved by other members. If the car has no reservations at that particular time, a member may access the car and directly make a reservation using the on-board unit (the cities of Bristol, Rome and Rotterdam use this method, see figure 5.1). If a member would like to extend his current reservation period this can also be done using the on-board unit as long there is no overlap with previously made reservations.

Figure 5.2 *A customer using the on-board unit (Rome demonstration)*

The fee structure is quite simple: a single fee for the period of use and for each kilometre driven and in some cases, such as in Rotterdam, a fee on a yearly basis (subscription) has been introduced. The cars can be used even for only a very period, for example to go shopping which could take less than an hour. The on board system records the distance and the applicable rental charges which are then sent electronically and will appear on the member's invoice. Members are able to access their personal data and their journey records at all times.

In most of the cities, after use, the car may be returned to a different location to where it was accessed. Once a member has vacated the vehicle, it is immediately available to other members. In many of the cities the car sharing vehicles have also been granted certain privileges, such as free parking in the city and permission to use preferential lanes (Rome), further reinforcing the concept of an integrated mobility system for urban public transport. The car sharing service is generally promoted by "word of mouth" among friends and colleagues. In the city of Rome the car sharing service is advertised on their public transport operator and municipality website. The typical car sharing customer is someone who travels less than 10.000 kilometres a year in his or her private vehicle.

5.4 Car pooling

Car-pooling is very closely related to car sharing, the main difference is that when one is carpooling, the driver is the owner of the car (in contradiction to car sharing where a car does not belong to one person), and has several passengers on a regular basis. The concept of car pooling is therefore quite simple and cost-effective. Six demonstrating cities have implemented

carpooling related measures, see the previous table. All of these measures had the same general aim: to reduce private car use and increase occupancy rates of vehicles by offering incentives to share (private) vehicles, resulting in fewer vehicles on the road simultaneously, reducing congestion and environmental pollution due to emissions.

5.5 Implementation of carpooling measures

The ICARO project indicated that the average car occupancy rate throughout Europe is about 1.3 persons per car, with an even lower rate, 1.14, for commuters. The concept of car pooling is that the average occupancy for commuters has to be higher in order to reduce the number of cars on the road in peak hours. The concept of car pooling is quite easy: a car driver (owner) has one or more passenger(s) on a regular basis. All six demonstrations in this cluster follow the same principle but in contrast to the idea of car sharing, each city has implemented the measures in an individual manner. In the city of Berlin a collective taxi service was set up, under the name of CharterCab. This service was not bound to timetables and specific routes (like a bus service) and was introduced based on innovative IT solutions such as detection technology and scheduling software. The intention of this service was to improve the accessibility of the area during the evening and early night hours. The vans (see figure below) were implemented as a commuter service to and from the public transport stations of selected peripheral areas in the South-West of Berlin. The customers could order a cab via mobile phone or internet and were picked up at home.

Figure 5.3 *One of the vans in the CharterCab demonstration in Berlin*

In the city of Cork a car-pool register was set up, in which employees of Cork City Council provided details of their regular journey (origin and destination patterns), along with minimal contact details. They would then be introduced to other willing car-poolers with similar journey patterns.

In the city of Graz a specially designed HOV lane was created alongside one of the busiest access roads which has bottlenecks at several intersections and faces traffic congestion during the rush hours. It connects suburban areas with the regional capital and is used by many commuters who otherwise do not have acceptable public transport alternatives. The lane has been assigned the status of a bus lane with the exception of usage by taxis and vehicles with 3 or

more passengers, aiming to increase car occupancy.
In the city of Nantes a student association has developed an internet carpooling service for students (www.illicovoiturage.com) see figure below. Nantes Métropole has supported the association. The target group was students who came to the campus by car.

Figure 5.4 *The Nantes internet car pooling service for students*

In the city of Rome the car pooling measures consisted of encouraging the employees of certain companies to travel to the workplace with three or more sharing the same car. The measure involved all the employees of the Municipality offices, the Polyclinic and the university. In total 1000 employees were addressed regarding this measure.
In the city of Rotterdam the concept of Van pooling has also been introduced; a maximum of 9 employees share a luxury van with an employee as designated driver.

5.6 Process evaluation

The implementation of car sharing and pooling measures has frequently been linked to problems of "Technical Planning" (practicality of facilities and services). Apparently, also "Culture and Life Style" aspects as well as "Public Relation "activities have had a negative impact on implementation so that more attention needs to be paid to the actual target groups in order to create and secure the necessary demand (mainly educated, central-urban middle class attracted, acceptance of station locations). Legal and funding issues in the "grey area" between public transport and taxi services have also played a role in some cases. Car sharing and pooling has been driven especially by high level "Political Commitment", "Policy Synergies" (e.g. integration with PT) and the possibility of learning from the experience of other cities.

5.7 Outputs

The CIVITAS I cities that have established car sharing and car pooling measures were generally successful in completing the activities planned at the outset of the project, although some of the cities were unable to implement a number of the proposed aspects, although as illustrated in table 5.2, the original plans were often completed within the planning of CIVITAS I .

Table 5.2 *Overview of the planned and achieved output of the different measures*

CITY	PLANNED OUTPUT	ACHIEVED OUTPUT	COMPLETION RATE
Aalborg	▪ Implement 1 site for CarSharing ▪ Implement an internet booking service	▪ Implementation of 5 sites for Car Sharing ▪ Implementation of an internet booking service	Notable
Berlin 8.4	▪ Setting up a test with 120 metropolitan fleet cars as car sharing vehicles	▪ delayed	Delayed
Berlin 8.5	Implement 3 mobility alternatives: ▪ A collective taxi service (CharterCab) ▪ Virtual disposition centre for car pooling based on private cars for collective use (Fellow Passengership) ▪ Car rental with option on one way trips without fixed stations in city centre (Telematic Carshare)	▪ Implementation of a collective tax service (CharterCab)	Weak
Bremen	▪ Implement 9 Car Sharing locations with 33 vehicles ▪ Open up the scheme for new target groups for business people, commuters and cyclists	▪ Implementation of 9 Car Sharing locations with 33 vehicles ▪ Opened up the scheme for new target groups for business people, commuters	Notable
Bristol	▪ Extend the existing car club scheme by 2 new neighbourhoods ▪ introduce 4 clean vehicles	▪ Extension of the existing car club scheme by 2 new neighbourhoods ▪ Implementation of 19 street parking bays. ▪ Introduction of 2 LPG vehicles	Notable
Cork	• Implement a car-pool register between employees of Cork City Council	▪ Implementation of a car-pool register between employees of Cork City Council	Acceptable
Graz	▪ Implement a 350 m HOV lane, next to the intersection of highways of Vienna – Klagenfurt East-West and Salzburg-Maribor North-South to get around one traffic light. ▪ Implement a Car pool matching service	▪ Implementation of a 350 m HOV lane, next to the intersection of highways of Vienna – Klagenfurt East-West and Salzburg-Maribor North-South to get around one traffic light	Weak
Nantes	• Launch of an internet website www.illicovoiturage.com	▪ Launched the internet website www.illicovoiturage.com	Notable
Rome 8.1.1	▪ Set-up of a carpooling service for employees of Policlinico and Municipality office ▪ Implement dedicated parking areas	▪ carpooling service for employees of Policlinico and Municipality office ▪ Implementation of dedicated parking areas	Weak
Rome	▪ Implement 11 Car sharing vehicles	▪ Implementation of 11 Car Sharing	Acceptable

CITY	PLANNED OUTPUT	ACHIEVED OUTPUT	COMPLETION RATE
8.1.2	▪ Realise reserved garages and parks on 7 points in the city	vehicles ▪ Realisation of reserved garages and parks on 7 points in the city	
Rotterdam 8.2	▪ Introduce 24 Vans as carpooling vehicles for commuters	▪ Introduction of 10 vans and 2 demo-vans as carpooling vehicles for commuters	Delayed
Rotterdam 8.3	▪ Implement 50 new car sharing sites in different areas ▪ Develop methodology to find locations suited for cost effective exploitation in commercially difficult areas	▪ Realisation of 18 parking spaces ▪ Tool to find locations suited for cost effective exploitation in commercially difficult areas	Weak

5.8 Impact analysis

The idea behind car sharing is that people currently considering the purchase of a (second) car, may now opt to become a member of a car sharing organisation instead of actually buying a car, and sometimes even dispose of the car they own. As a result, a car sharing measure reduces the number of private cars and trips and will increase the availability of parking spaces in city centres. In the city of Aalborg for example results showed that a shared car replaces 4.6 to 6.2 private cars.

The following table illustrates that car sharing is popular in all six demonstration sites since there is a considerable number of new members.

Table 5.3 *Number of new members in the car sharing measures*

City	Number of new members[16]	Introduced vehicles
Aalborg	200	11
Berlin	n/a	130
Bremen	700	33
Bristol	120	24
Rome	200	11 (started with 10, extended by 1)
Rotterdam	130	18

This is clearly a very positive result as the modal shift is towards sustainable modes and not the private car. In general fewer private car kilometres have been made; in the city of Bremen there was an average saving of about 500.000 car kilometres a year. In the city of Berlin 75.000 car km per month were saved by replacing 250 company cars by 130 MFC cars.

Car sharing has also had some very positive effects on congestion in general; since its introduction in Aalborg only 12% of the members used the car for commuter transportation and the average occupation is 1.93 person per car compared to 1.21 (commuters) – 1.87 (weekends) persons per private car.

[16] It is still difficult to compare these numbers, but they give an indication for success.

Due to the modal shift there are fewer private cars on the roads in the demonstration cities, which logically resulted in a dramatic saving in energy and reduced harmful emissions. In Bremen a reduction of 85.000 kg of CO_2 emissions was measured resulting from reduced car mileage. As part of the car sharing measure, three of the car sharing cities have also introduced, clean(er) vehicles; Bristol has LPG vehicles, Rome has Euro-III compliant vehicles and Bremen Euro-IV compliant vehicles. Clearly this has also contributed to the energy savings and emission reductions in the impact areas.

The city of Berlin stated in their analysis of the measures that their Metropolitan fleet cars (MFC) vehicles are cleaner than private cars; this statement was based on the assumption that private cars travel less kilometres per year and the MFC's travel more kilometres which means these cars will be replaced earlier. The engines are also on average cleaner than that of private cars which can save up to 33% NO_x and 7.500 tons of CO_2 when the fleet is optimized. In Aalborg there is an estimated potential saving of about 1% on the transport energy consumption from the current car sharing measures.

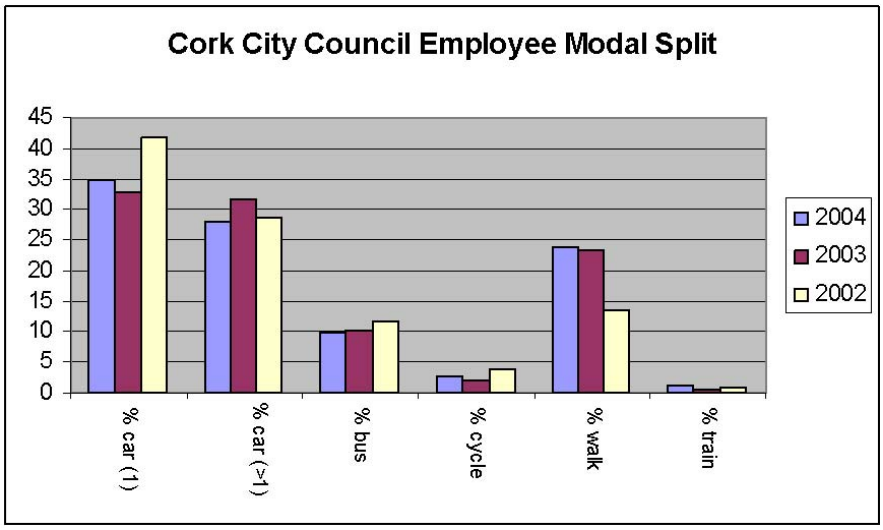
The car sharing measures are often market initiatives meaning that they will also be profitable for the car sharing operator, in this case applicable to all the demonstration cities in this particular cluster. In Berlin, companies and car sharing provider fleets have complementary routes and integrating them increases cost efficiency. On average, once someone has become a member they tend to remain members of the car sharing schemes and seem very satisfied with the services provided (in Bristol 93% of the members are very satisfied with the service). The determining factor for most of the members is that by sharing a car they will have more money at the end of the month than had they actually owned a car.
As the car sharing measures are market initiatives it is important for the operators to have satisfied customers who will remain members and ensure the profitability of the schemes. As previously stated, a lot of new car sharing members remain members of the service even to the point of disposing of their car; showing that satisfaction levels are high and that this type of measure is well accepted. In Aalborg interviews showed that 37% of the members would consider not buying a car due to the car sharing measure. In Bristol about 60% of the members that previously owned a private car resulted in that 32% no longer did so after they became member of the service.
In Bremen a rather high proportion recognizes the term 'car sharing' with about 20% that have an in-depth knowledge of how the system works.

5.9 Car pooling

Similar effects can also be seen for the carpooling measures. As a result of the measures the vehicle occupancy of the cars has risen in the various participating cities, the CharterCab taxis is Berlin had an average occupancy of 2.4 and the average occupancy rate in the Vans in the city of Rotterdam was about 8 persons where prior to this the participants drove their own private

cars. The car-pool register illustrates the change in the modal split in favour of more sustainable modes of transport as shown in the following figure.

Figure 5.5 *Cork City Council Employee – Travel to work modal split*



While car pooling measures have generated new members they do not compare to the numbers generated by car sharing measures. In Berlin for example the CharterCab service attracted 15 customers and the internet carpooling service for the students in Nantes generated about 1000 regular users.

The cities demonstrating car pooling measures made the assumption that the reduction of energy consumption and emissions would be linear with the reduction of the vehicle kilometres.
The Chartercab car pooling service (Berlin), Vanpooling (Rotterdam) and the special carpooling lane (Graz) are all government initiatives that required start up subsidies.

The authority initiated car pooling measures show a positive impact on the society level. 60% of the CharterCab service customers in Berlin were very satisfied with the service. 91% stated the reliability as ‘good – very good’ and 80% stated the flexibility as ‘good – very good’, however, the actual waiting time between the order and the arrival of the taxi was 14 minutes, which was perceived as acceptable. The users of the Vanpooling system in Rotterdam were very satisfied. People who travelled by car prior to Vanpooling had a longer average journey time but this was not seen as a problem, mainly because Vanpooling is considerably cheaper than travelling by car, and the opportunity to read the paper, drink a coffee and socialize with their colleagues was perceived as a positive aspect.

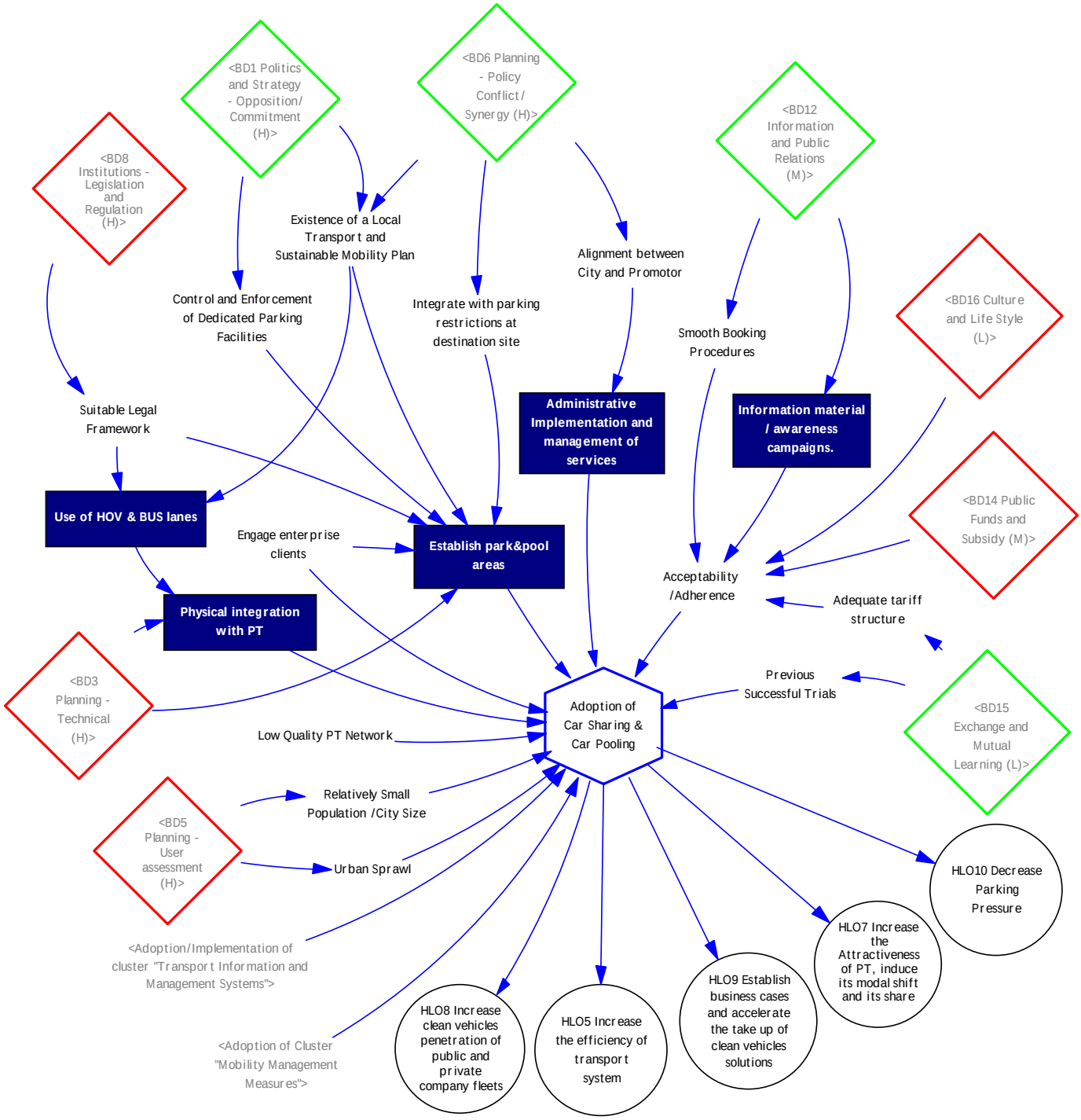
5.10 Packaging and Transferability

The objectives of Car Sharing and Car Pooling were to provide new forms of vehicle use, to increase car occupancy and to achieve a modal shift to reduce the number of car-journeys and emissions.
As referred to earlier in this report, more than half of the Car Sharing and Car Pooling measures were assessed as "weak" or "delayed", due to insufficient orientation towards specific target groups and the corresponding communication ("Culture/Life Style", "Public Relations"). In combination with deficits in technical planning this has meant that most Car Sharing and Pooling measures have not fulfilled the expectations. The reality emphasises the importance that should be given to certain aspects of the planning process for measures within this cluster.

The lessons learned for this cluster in CIVITAS have been combined with other relevant information, in order to map the key relationships and interactions that should be considered in order to achieve the successful implementation of car sharing and car pooling. The main drivers reported for **"Car Sharing"** were the acceptability, other successful experiences and a good partnership with the operators. Barriers posed against the measure were that in some cases the car is seen as a place of intimacy and solitude (people's desire for independence), people have variable working hours, social and home commitments, the limited availability of off-street parking facilities and the time needed to expand the business. In addition, the major actions for enabling the success of the measure were guaranteeing easy parking, marketing campaigns promoting the measure before and during implementation, face to face surveys for an increased return rate, encouraging new customers by addressing enterprises, studying fleet size and the effective use by customers, integrating parking restrictions at destination sites, full-fare integration of car sharing and public transport, keeping the scheme simple, minimum dimension of the project scale and tight project management.

The measure can be integrated with measures from other clusters, increasing the effectiveness, namely the clusters of Public Transport, Parking Management and Transport Information and Management. The measure type **"Car Pooling"** also faced a number of barriers, such as the political unwillingness of responsible authorities, dispersed origins of the commuters, time was needed to illustrate the effectiveness of incentives and the publics' resistance to change habits. Crucial actions recommended for success were to promote car-pooling measures from within a number of companies, to provide financial incentives for drivers and the integration with mobility management activities at companies

Figure 5.6 *Fundamental Mapping of the Cluster "Car Sharing and Car Pooling"*



5.11 Conclusion

Car sharing and car pooling measures have direct benefits at different levels. Firstly the car-poolers and car-sharers whose travel costs have also been reduced no longer have to drive their cars in rush hour traffic every day and in some cases are even able to improve social contacts. Secondly other road users benefit due to fewer vehicles on the road, in turn reducing congestion. Thirdly the governments benefit from these kind of initiatives due to less congestion, lower costs (reduction of new infrastructure), better access to economic centres, a reduction in the average number of car kilometres and fewer emissions providing a better environment to live in.

According to the results on the measures Car pooling and car sharing seem to provide a substantial contribution to the ultimate CIVITAS I objectives; by creating a modal shift towards more sustainable forms of transport and away from the private car, by encouraging higher vehicle occupancy rates, by reducing the number of car kilometres which in turn reduce noise levels and emissions and provides a better environment. Car sharing and car pooling are also well accepted among the members. Car pooling does however require initial investments. The following concluding table for this cluster illustrates the impact of the measures on 5 levels.

Table 5.4 *Summary of the overall effects of the cluster car sharing and carpooling*

	Transport	Energy	Environment	Economy	Society
Car Sharing and car pooling	☺	☺	☺	😐	☺

6 ZONES WITH CONTROLLED ACCESS

6.1 Introduction

An increasing number of European cities is engaged in the operation of demand management strategies based upon the concept of "**controlled access**", which entails the more or less gradual interdiction of selected urban areas to traffic. Access restriction policies vary a great deal, depending on the chosen exclusion criteria. Popular examples include closure of inner city areas and other sensitive zones to less clean and energy efficient vehicles or to freight vehicles above a certain weight, to private vehicles owned by non-residents in the restricted area, or to all motorised vehicles altogether.

We can accordingly speak of environmental or clean zones, limited access zones, pedestrian and car-free zones.

The defining objectives of this type of strategies relate to:

- the improvement of air quality;
- the decrease of congestion, preserving the flow of traffic in the road system in terms of safety, capacity, and speed;
- the preservation and improvement of the urban landscape;
- the improvement of public health.

In this respect, the CIVITAS I cities have planned and implemented sixteen measures characterised by the common denominator of gradients of controlled access. Altogether, the more or less flexible closure of urban space, combined with its re-organisation and remodelling, effectively succeeded in creating new and sustainable zones.

Despite a natural interrelation, there are at least three zone sub-clusters whose underlying nature deserves an ad-hoc assessment:

- **Clear Zones**, where the emphasis is on restricting access to private cars while encouraging the use of more sustainable modes;
- **Environmental (or Clean) Zones**, where the emphasis is on restricting access to all vehicles beyond certain pollution standards;
- **Pedestrian Zones**, where the emphasis is on creating protected areas for the exclusive pedestrian access of pedestrian and/or non-motorised modes.

This report is accordingly articulated in three sub-sections grouping together the CIVITAS I measures shown in the following table.

Table 6.1 *Zones with controlled access measures within the CIVITAS I project*

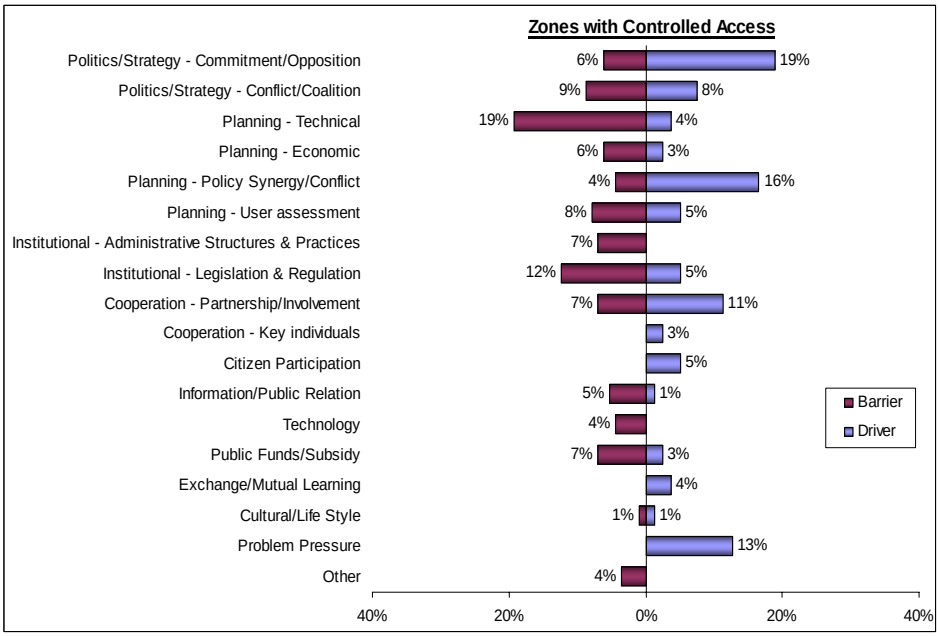
CITY	CODE	TITLE
Barcelona	5.1	Set-up of City Centre Clean Zone
Bristol	6.1	Development of a Clear Zone
Bristol	6.2	Access Management
Bristol	6.3	Home Zones
Bristol	11.1	Community Travel Workers
Cork	5.1	Set-up of City Centre Clean Zone
Gdynia	5.6	Transforming the City Centre into a Clean Urban Transport Area
Göteborg	5.7	Environmental Zone for Heavy Duty Vehicles
Graz	5.3	Implementation of Strolling Zones
Nantes	IP5 – IM5	Remodelling of the University Campus Site
Nantes	IP6 – IM1	Integration and Rehabilitation of Vannes Road
Pécs	5.4	Establishment of Car-free Zone in the Inner City
Prague	5.2	Widening the Environmental Zone for Vehicles > 6tons
Rome	5.1a & b	Set-up of City Centre Clean Zone
Rome	5.2a	Set-up of Green Corridors/ Zone
Rotterdam	5.1	Access Time Window to Promote Clean Commercial Vehicles
Stockholm	5.1	Widening the Environmental Zone
Winchester	5.1	Set-up of City Centre Clean Zone

In terms of planning and implementation, the 18 projects which form part of the cluster "Zones with Controlled Access" were carried out without major obstacles, and as a whole can be deemed to have been a successful experience for CIVITAS I. While the next sections provide specific insights as to the outputs, barriers and drivers and results witnessed in each sub-cluster, the following paragraphs sum up the gist of the hurdles faced and the solutions found by the cities engaged in the adoption of clear, environmental and pedestrian zones.

Measures in this cluster have been hampered especially by insufficiencies in terms of "Technical Planning", impeding regulation issues (esp. concerning parking), partnership problems (involvement of parking operators, retailer associations) and deficits regarding "User assessment". In turn, they appear to be driven by strong political commitment, suitable cooperation arrangements, citizen participation (acceptance by residents and shopkeepers) and the exploitation of "Policy Synergies" (e.g. improving collective transport). The unsustainable parking situation in many city centres has a particularly strong influence as a "Problem Pressure" driving implementation, whilst the influence of "Economic Planning" remained below average.

It is remarkable that "Information and Public Relations" as well as "User assessment" have been assessed to have a rather limited overall influence. This could indicate that acceptance problems may be less severe than usually expected for this type of measure (see figure).

Figure 6.1 *Barrier/Driver profile for "Zones with Controlled Access"*



6.2 Clear Zones

6.2.1 Introduction

Clear zones generally seek to improve traffic and environmental conditions in the study areas employing tools such as:

- enforcement of vehicle access control;
- spatial design to reduce the physical extent of roads;
- removal of parking spaces;
- use of retractable bollards.

The main objectives of clear zone schemes can generally be found in the following list:

- reduce traffic levels in city centres;
- reduce parking and road space in order to create amenable 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.

In CIVITAS, clear zones are instituted and enforced by means of access control regulations and access control devices, principally retractable bollards and Automatic Number Plate Recognition (ANPR) systems. The predominant concepts are those of enclosed central zones protected by a cordon and corridor-like access control systems. Examples of access restriction limited to bus lanes only can also be found.

Figure 6.2 *Rome, Trastevere Access Control*

Figure 6.3 *Barcelona, Ramblas Access Control*

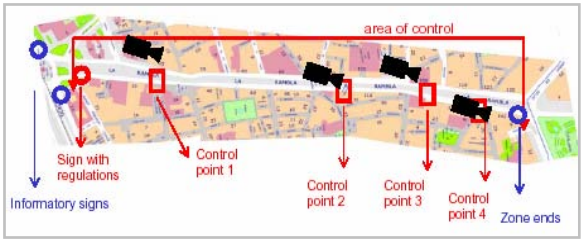


Figure 6.2 shows the Trastevere controlled area in Rome (the area contained inside the blue line), a typical example of camera-enforced cordon-based access restriction system, while Figure 6.3 shows the Ramblas corridor-based access restriction scheme in Barcelona, also operated via a camera system.

Thanks to CIVITAS, the cities of Barcelona, Bristol, Cork, Gdynia, Nantes and Rome were able to implement their clear zone plans. The main objective of Barcelona was to close the Ramblas boulevard to non-motorised traffic, thereby improving the pedestrian amenity and demonstrating the viability of restricting traffic on this type of primary road. The Ramblas access control evaluation plan incorporated trials of ANPR equipment to enforce both control access and limit speeds to 30 km/h along the controlled road section.

6.2.2 Implementation of Clear Zones

Bristol concentrated its efforts on the implementation of both access management and bus priority systems seeking 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 was achieved using a range of city centre access management tools such as bus priority systems including bus lanes and pre-signals, and a bus lane camera based enforcement trial using ANPR technology.

In **Cork** the general objective was to provide a safer, healthier, more comfortable environment for pedestrians and cyclists in the city centre. This was achieved by redesigning the main arterial route (St. Patrick's Street) to reduce the existing four lanes to two. The pavements were considerably widened providing new bicycle parking facilities and textured paving for the visually-impaired to guide them along the street towards the new audible pedestrian crossings. All on-street parking was removed from St. Patrick's Street and access to nearby multi-storey car parks was redirected via alternative routes. Retractable bollards were placed on side streets off the "Clear Zone" at their entry/exit points. The following figure shows the area affected by the street interventions.

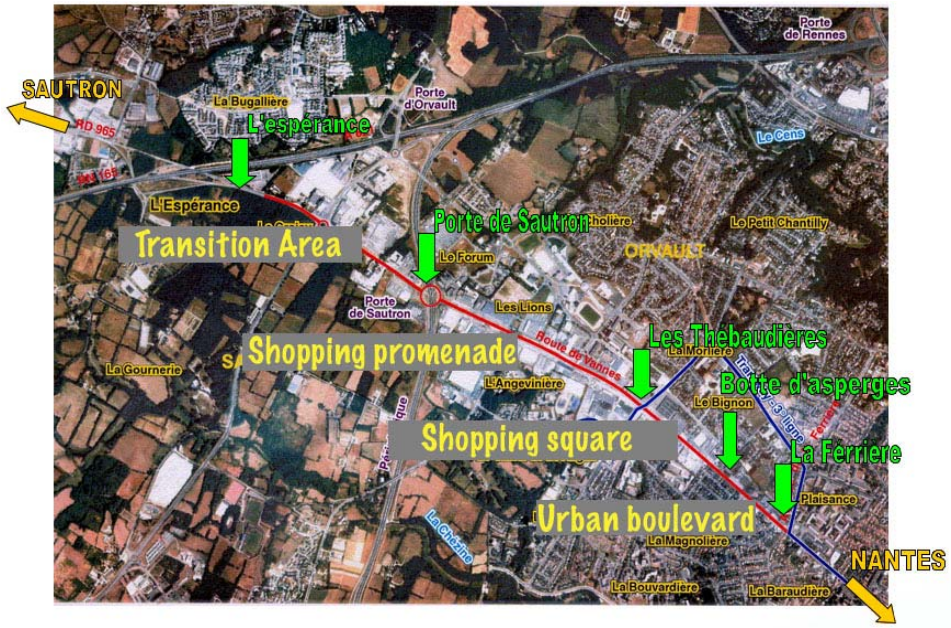
Figure 6.4 *The Clear Zone in Cork*

Gdynia aimed for the modernisation of the main city street (Świętojańska Street) and to turn it into a more citizen and tourist friendly environment. The main actions involved the reorganisation of the traffic, softly discouraging private vehicle users from going by car to the city centre, better quality of public transport and improved conditions for leisure activities. The following figure shows part of Świętojańska Street before and after the remodelling works.

Figure 6.5 *Gdynia, Świętojańska in the 40s and today*

Nantes concentrated on two projects. The first concerned the Tertre University campus, a protected green area that prior to CIVITAS still encountered high car usage with very little space to ensure a true protected green zone. The problem was approached by re-developing the area, creating a new public square and new lay outs for access to the university, and remodelling the landscape in relation to the surrounding natural environment. The second project (see following figure) sought to remodel Vannes road, an historical city centre thoroughfare, which required improvement in terms of quality of the surrounding urban space, improved Public Transport services and soft modes facilities.

Figure 6.6 *Nantes, Remodelled Vannes Road*



Pecs established a car-free-area in the city centre around the UNESCO protected site. This zone was completely closed to private cars (except local residents and other exempt categories) using

police control, posted signals and retractable bollards. Complementary actions consist of a 30 km/h speed limit in the whole city centre and an access limitation to freight vehicles over 6 tons.

Rome sought to boost its wider city centre clear zone strategy by furthering a set of access control interventions such as the optimisation of the Access Control Systems (ACS) and the extension of the ANPR controlled Limited Access Zone (LTZ) to the S. Lorenzo and Trastevere districts. The main objectives were the improvement of traffic mobility, to improve road safety, the reduction of traffic-related pollution, the re-generation of urban spaces and the preservation of cultural heritage, and the safeguarding of citizens' health.

6.2.3 Process Evaluation of Clear Zones

The design and implementation of clear zones appears to have been relatively trouble-free in CIVITAS. Table 6.2 shows the main barriers and drivers indicated by the managers engaged in the CIVITAS implementation.

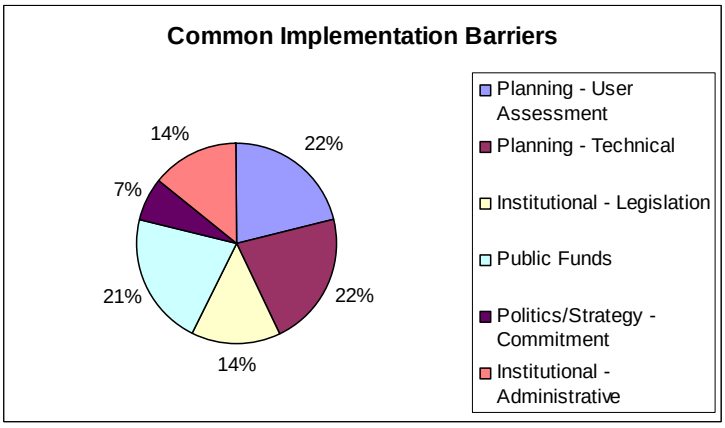
Table 6.2 *Overview of barriers and drivers of clear zones measures*

CITY	BARRIER	DRIVER
Barcelona	▪ Planning - User Assessment ▪ Planning - Technical ▪ Institutional – Administrative	▪ Cooperation - Involvement ▪ Policy/Strategy - Commitment
Bristol	▪ Institutional – Legislation	▪ Policy/Strategy - Commitment
Cork	▪ Planning - Technical ▪ Institutional – Legislation	▪ Policy/Strategy - Commitment
Gdynia	▪ Public Funds ▪ Planning - User Assessment	▪ Information - Public Relation ▪ Policy/Strategy - Commitment
Nantes	▪ Planning - User Assessment ▪ Institutional – Administrative	▪ Nothing reported
Pecs	▪ Policy/Strategy - Commitment ▪ Public Funds	▪ Institutional - Administrative
Rome	▪ Planning - Technical ▪ Public Funds	▪ Cooperation - Involvement ▪ Policy/Strategy - Commitment

The chart below shows the main barriers to implementation, which essentially relate to:

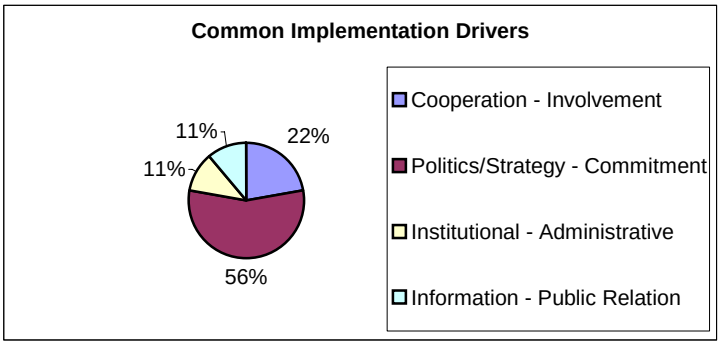
1. the difficulty of identifying the most efficient technologies and the obstacles posed by their deployment in practice;
2. the delays caused by the recurrent lack of available funds;
3. the legal hurdles facing access restriction institution and enforcement (e.g. compliance with local codes, authority legitimised to enforce the rule, privacy issues);
4. the initial resistance posed by the most affected local stakeholders, generally retailers and couriers fearing a loss of business competitiveness.

Figure 6.7 Clear Zones - Common implementation barriers



Conversely, the following image highlights the main drivers to an effective implementation of clear zones.

Figure 6.8 Common Implementation Drivers



Clearly, the establishment of clear zones appears to be most effective when supported by broader transport/spatial plans, which provide the necessary policy legitimacy and creates favourable conditions (e.g. integration with parking and public transport). The previously mentioned stakeholders resistance leads to the search for procedures which allow effective and continuous consultation throughout the planning and implementation process. Surprisingly, a strong political commitment is rarely mentioned, possibly owing to the importance of designing clear zones as part of the strategic view of the local plans.

6.2.4 Outputs of Clear Zones

The CIVITAS I cities working with clear zones were generally successful in completing the activities planned at the project outset. As illustrated by the following table, the original plans were often completed within the timescale of CIVITAS I, with occasional delays essentially due to irregular funding flows and technical challenges. There are no cases of aborted of severely

altered projects, though several implementations, which were preceded by lengthy designing and testing phases, were only sealed toward the end of CIVITAS, while others are being completed at this time.

Table 6.3 *Overview of the planned and achieved output of the different measures*

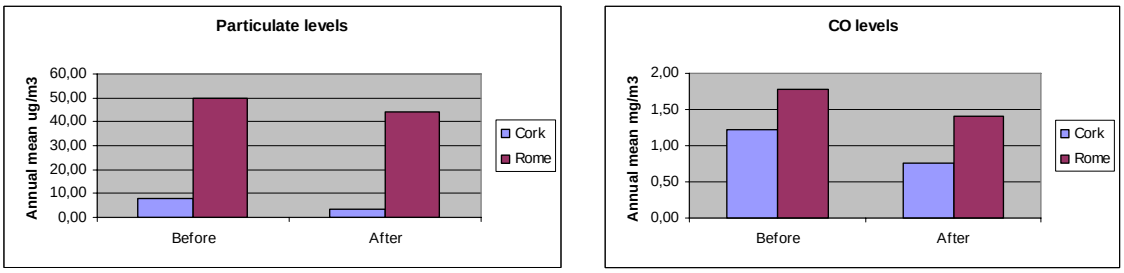
CITY	PLANNED OUTPUT	ACHIEVED OUTPUT	COMPLETION RATE
Barcelona	Design, installation and trial of access restriction equipment (retractable bollards or ANPR) in the main city street	▪ Implementation of ANPR system based on 4 access control points	Acceptable
Bristol	Design, installation and trial of ANPR-based bus lane access restriction in two locations	▪ Implementation of ANPR-based bus lane access restriction in two locations	Acceptable
Cork	50% lane reduction in city centre	▪ 50% lane reduction in city centre ▪ New retractable bollards ▪ Widened footpath pavements	Notable
	40% parking facilities increase	▪ 226 cycling spaces	
Gdynia	1.636m of modernised main city street	▪ 1.193m of modernised main street ▪ widened footpath pavements ▪ 961 new stationary bollards ▪ 12 new bicycle racks	Acceptable
	Modernised trolley-bus traction	▪ 3.335m of new trolley bus line ▪ 136 new traction pillars	
Nantes	Planning design, public consultation and remodelling works	▪ Design of and approval of remodelling project ▪ Public consultation ▪ Initiation of road/public space remodelling and P&R installation	Acceptable
	Public space remodelling, new parking standards	▪ Creation of new square, with 300 parking spaces removed, 200 bike racks installed ▪ Landscape remodelling ▪ Establishment of new parking standards	Notable
Pecs	Introduction of 30km speed limit, access restriction to HDVs above 6 tons, establishment of cycle lanes	▪ Design and approval of car free zone ▪ Introduction of speed limit ▪ Access restriction to selected streets	Acceptable
Rome	Completion of existing ANPR system with design and installation of 1 access control point (zone 1)	▪ Selection of final solution for the access control point	Acceptable
	Design, installation and trial of ANPR system based on 9 access control points (zone 2)	▪ Implementation of ANPR system based on 9 access control points (zone 2)	
	Design, installation and trial of ANPR system based on 7 access control points (zone 3)	▪ Design of ANPR system	
	Provision of access restriction regulation	▪ Adoption of access restriction regulation	

6.2.5 Impacts of Clear Zones

The late completion of some of the clear zones does not allow a comprehensive cross site assessment of the results, several categories of data were not available by the time CIVITAS was concluded.

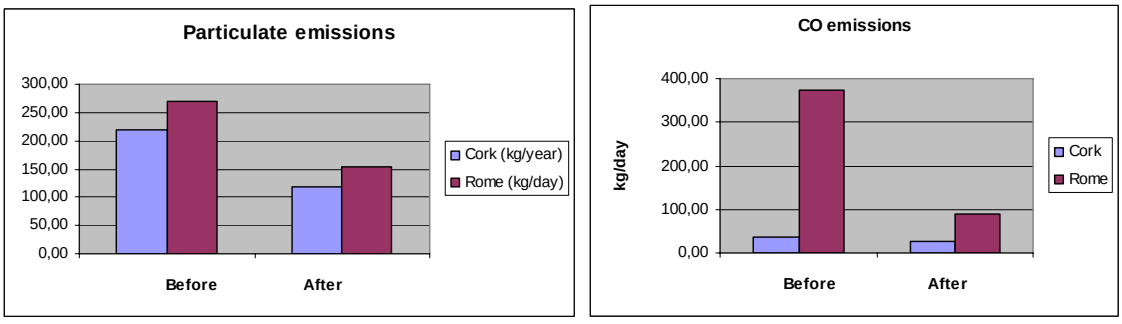
The most significant findings must inevitably relate to the principal objectives declared by the experimenting cities, that is the improvement of air quality and the reduction of congestion. The graphs below provide evidence of the noticeable improvement in terms of CO and particulate matter concentrations, which score positive results in both Cork and Rome (though measurements in Cork are city-wide and not measure specific).

Figure 6.9 Air Quality in Cork and Rome



Reductions in CO levels range from -39% to -21%, while reductions in particulate levels range from an exorbitant -55% to a more conservative -11%. Such considerable differences are due to the size of the cities in question and to the nature of the clear zones.
Despite the fluctuation, it is worth noticing that the declining trend is consolidated across the 4 years of CIVITAS. Expectedly, results regarding emissions are even more encouraging.

Figure 6.10 Emissions in Cork and Rome

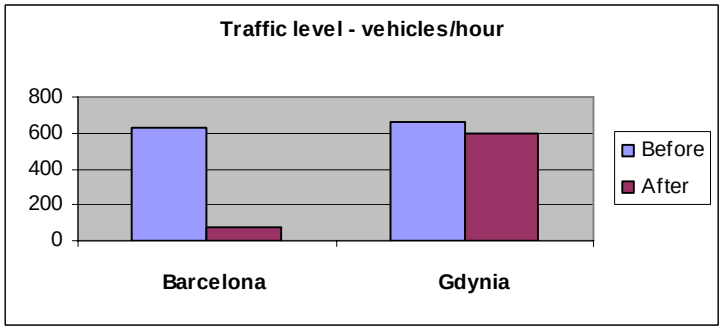


NOx and CO emissions have been reduced considerably, with variations often in excess of 50%. Similar results are shown by particulate emissions, with reductions of approximately 40%.

The situation in terms of noise emissions is less straightforward, with Gdynia and Rome recording considerable cuts (in the range of -6dB(A)/-11dB(A)) and Cork experiencing a slight increase (+2dB(A)). One should however consider the fact that clear zones are often enforced via ANPR, which still fails to detect the entrance of motorised two-wheelers, an increasingly popular transport mode, and arguably one of the noisier.

As previously mentioned, congestion is the other primary source of concern for cities turning to the concept of clear zones. In this respect, CIVITAS shows remarkable results, as outlined in the figure 6.11.

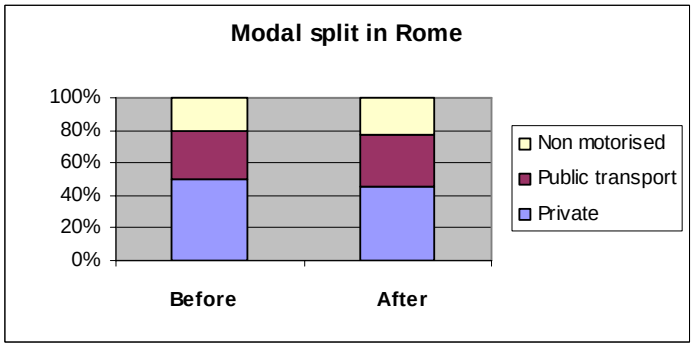
Figure 6.11 Traffic Level in Barcelona and Gdynia



These figures refer to the number of transiting vehicles in the areas subject to the access restriction policy. The trend is clearly on the decline, though with a marked degree of variation due to the different specifications and goals of the adopted schemes (in particular, Gdynia worked primarily towards a modernisation project with a secondary aim at lowering traffic levels).

Modal split is a factor that has yet to be investigated in most cities involved. The small amount of available data shows negligible shifts in Cork, and marked variations in Rome, as demonstrated in the figure below.

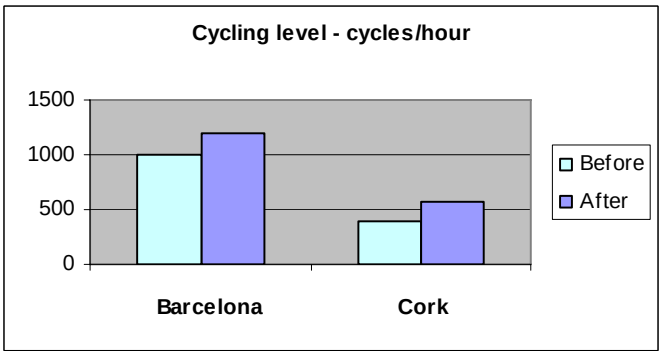
Figure 6.12 Modal Split in Rome



Figures confirm a reduction in the private modes (which include cars, motorised two-wheelers and freight vehicles), a slight increase of public transport, and a more noticeable increase of non-motorised modes.

The improved liveability of the city centres experiencing a clear zone scheme is confirmed by the considerable results for cycling, which in the two cities examined, shows improvements ranging from +20% to +47%. Albeit the small scale of implementation, these are important results obtained in a relatively short time span.

Figure 6.13 Bicycle use in Barcelona and Cork



From an acceptance standpoint, it appears that the establishment of clear zones undergoes an initial complicated phase characterised by the immediate negative reaction of the more affected categories of stakeholders, primarily shop owners and couriers. This effect is however mitigated, or altogether circumvented, by the adoption of consultation procedures. These prove to be especially beneficial whenever applied to the full policy cycle, and namely to the design, implementation and monitoring phases.

The improved environmental conditions and amenity of the city centres featuring clear zones lead to increasingly high appreciation rates for this type of policy. Though mostly qualitative, the available data shows that generally “negative” or “very negative” early acceptance is followed by a complete reversal with acceptance ratings 60% higher at project conclusion.

6.2.6 Conclusions from Clear Zones

The cross-site assessment of impacts allows to draw some general conclusions by impact area:

- Clear zones have proved effective in improving the transport conditions of the study areas. All 5 demonstration sites experienced positive effects in terms of modal shift, traffic and congestion levels. This in turn resulted in the improved quality of public transport. When used, technology proved successful, though further testing is necessary;

- Energy savings were rarely a driver for this type of measure, thus little information was elicited. The noticeable shift from private to public and non-motorised modes leads to infer that whenever measured, energy consumption would be on the decline;
- The CIVITAS clear zones were able to significantly improve the environment. The three sites monitoring emissions and concentrations all recorded considerable improvements. This, together with declining noise emissions and congestion levels, contributed to improve the amenity of the study areas and preserve the historical heritage thereof;
- Though not always monitored, it appears that the local economic vitality generally benefited from the establishment of clear zones. Apart from any consideration related to the operating costs and revenues of the specific measures, the improved liveability of the study areas created favourable conditions mostly for the food and retail industry;
- Public perception of the measures was generally positive, though the relation between the latter and the ensuing benefits was not always detected. Surveys report a general appreciation for the improved accessibility of the study areas, which are also perceived as cleaner, safer and more appealing. On the other hand, doubts were raised by operators working in the clear zones.

Stating that clear zones are very effective in reducing pollution, protecting the cultural heritage and improve the liveability of the target areas (without causing substantial congestion elsewhere in the network) is consensually accepted. The further consideration that the concept and its application appear to have been generally understood and appreciated by the public, and have generated a fair level of political support, suggest that future expansion of this type of policy can be viable.

However clear zones remain a complicated matter, in that their functioning involves a mixture of limiting and complementary measures, that, with the appropriate technology support, must cope with the everyday problems of each specific context.

No all-around recipe can be recommended. Future expansions or new initiatives must be tailored around the individual target zone. The integration of clear zones, environmental zones, pedestrian zones and road pricing shall be carefully evaluated beforehand and always requires an experimental period to fine-tune the specifications of the measure together with all the involved stakeholders.

New technology developments and the enforcement of the European Directive on automatic charging systems are crucial elements for future applications.

6.3 Environmental Zones

6.3.1 Introduction to Environmental Zones

The establishment and/or the enlargement of *environmental zones* (also referred to as *clean zones* or *low emission zones*) is another widespread concept in CIVITAS. These zones typically seek to limit the access of polluting vehicles to certain areas (generally the historical centres of cities). What varies is the criterion for determining whose vehicle access is restricted and whose is not. Most regulations refer either to the age of the vehicle (e.g. more than 8 years) or the weight of the vehicle (e.g. more than 3.5 tons). Enforcement can also be handled differently, often relying on manual police control, but occasionally on automatic systems (e.g. ANPR).

In terms of objectives, the environmental zones are very much in line with those set out by clear zones:

- improvement of the air quality;
- reduction of noise;
- improvement of cities' liveability.

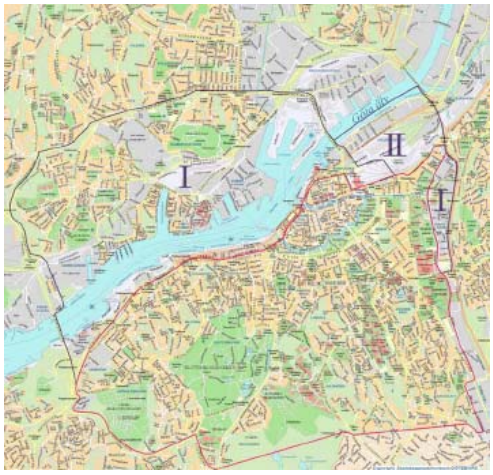
In CIVITAS, environmental zones were set up in Göteborg, Prague, Rome, Rotterdam, Stockholm and Winchester.

6.3.2 Implementation of Environmental Zones

Göteborg first introduced a 15 square kilometres zone in 1996 to reduce the environmental impacts of heavy traffic in the central areas. CIVITAS supplied the opportunity to evaluate the results of the existing environmental zone, to develop new criteria for vehicle access and to develop a proposal for zone expansion (see figure below).

Furthermore the city sought to test an on-board measurement for NOx and to increase the communication between the Traffic and Public Transport Authority, the local transport industry and the Industry Ministry.

Figure 6.14 Göteborg, the Environmental Zone



Due to the recent massive rise in motorisation and volumes of heavy duty vehicle traffic, **Prague** has experienced noticeable negative impacts on the environment, the transport system and safety. This lead the city to adopt a city centre environmental zone restricted to vehicles over 3.5 tons. The continuing negative environmental trends suggested the extension of the regulation to vehicles over 6 tons. On top of the environmental and traffic impacts, the measure intended to put pressure on couriers toward a progressive renewal of their fleets.

In **Rome**, the set-up of a city centre clean zone is part of a multi-task measure, focusing on access control to central areas. The considered access control interventions sought to allow free access to the study Area only to catalysed vehicles, while extending the yearly check-up of vehicle emissions also to motorcycles and mopeds. The main objectives of the measure were to decrease traffic related pollution, safeguard citizens' health and preserve the historical and architectural heritage of the city.

The city of **Rotterdam** aimed at designing a policy plan for the implementation of an Access Time Window system to promote the acquisition of clean commercial vehicles. However, ex-ante studies advised against the implementation of the restrictions and suggested to focus less on time windows and more on improving the accessibility of major economic centres to freight traffic. Consequently, the measure shifted its attention towards an integrated approach for the design of a so-called 'Quality Network', consisting of: a) firstly, a study for urban distribution in the city centre of Rotterdam, b) secondly, the discussion of the results of the study with key stakeholders, which paved the way for the definition of a Quality Network.

The main goal was ultimately to bring together relevant goods transport stakeholders in the region, and to place freight transport and its environmental impacts in the regional agenda.

The **Stockholm** project sought to widen the existing environmental zone to include the Hammarby Sjoestad area. However, probably due to the recession that affected the study area, the expansion was not achieved within the CIVITAS timescale. The focus of the measure thus shifted towards an increase of the obedience level, which had plummeted from 97.5% (1997) down to 89.8% (2000), to rise again to 97% (2005). The measure also aimed to transfer knowledge and information to other cities and authorities via reports and personal contacts.

The objective of **Winchester** was to investigate the impacts of high polluting vehicles and try to improve the air quality in Winchester city centre. A portable Remote Sensing Device (RSD) was intended to measure CO, HC and NOx emissions from vehicles entering the city on main arterial routes. The results could be used to determine if an individual vehicle was deemed a 'high polluting vehicle'. Based on the database of measurements and results from a stated preference questionnaire, four hypothetical strategies on the use of the emissions measurements would be assessed. These strategies ranged from the use of roadside Variable Message Signs (VMS) to report immediate emissions results to providing vehicles identified as 'high polluters' with discounted emissions measurements.

6.3.3 Process Evaluation of Environmental Zones

The design and implementation of environmental zones appear to have been relatively trouble-free in CIVITAS. Table 6.5 shows the main barriers and drivers flagged out by the managers engaged in the implementation of CIVITAS.

Table 6.4 *Overview of barriers and drivers of environmental zones*

CITY	BARRIER	DRIVER
Göteborg	▪ Politics/Strategy - Commitment ▪ Planning - Technical	▪ Institutional - Administrative
Prague	▪ Institutional - Administrative	▪ Cooperation - Involvement
Rome	▪ Nothing reported	▪ Politics/Strategy - Commitment
Rotterdam	▪ Other	▪ Nothing reported
Stockholm	▪ Politics/Strategy - Commitment ▪ Institutional - Legislation	▪ Institutional - Administrative
Winchester	▪ Planning - Technical	▪ Politics/Strategy - Commitment

The chart below shows the main barriers and drivers detected in CIVITAS.

Figure 6.15 Environmental Zones – Common Implementation Barriers

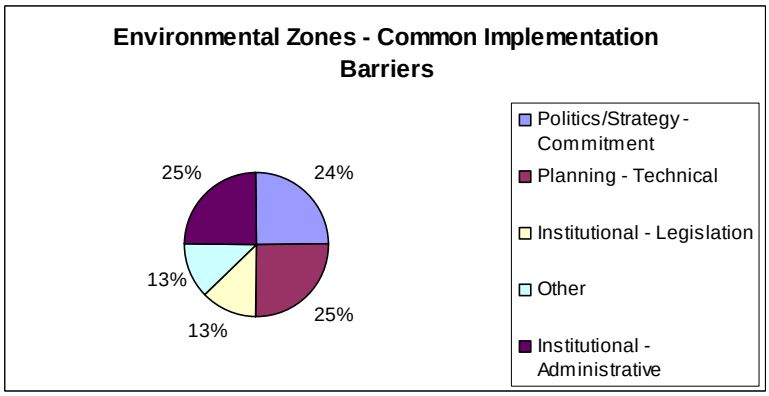
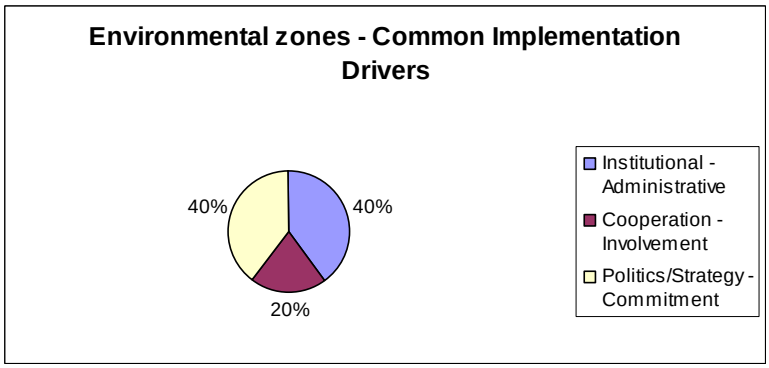


Figure 6.16 Environmental zones – Common Implementation Drivers



Political support ranks high both as a barrier and a driver, proving to be a key element when undertaking the introduction of environmental zones. Similarly, the successful adoption of a restrictive kind of policy that affects the sphere of competence of different authorities requires considerable institutional cooperation. Consultation of and cooperation with the relevant stakeholders, particularly freight associations, is also a necessary step.

6.3.4 Outputs of Environmental Zones

The CIVITAS cities working with environmental zones were generally successful in completing the activities planned at project outset. As illustrated by the following table, the original plans were often completed within the timescale of CIVITAS, with occasional delays due to irregular funding flows and technical challenges. There is only one case of a suspended project, due to the late implementation of a complementary action.

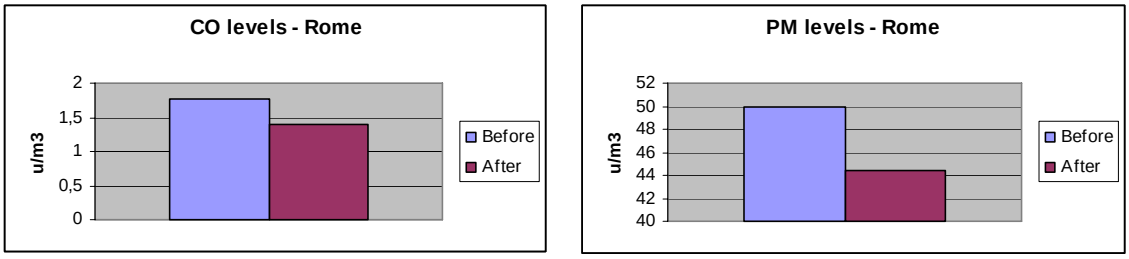
Table 6.5 *Overview of the planned and achieved output of the different measures*

CITY	PLANNED OUTPUT	ACHIEVED OUTPUT	COMPLETION RATE
Göteborg	Expansion of the existing environmental zone, development of new access restriction criteria, NOx field tests	▪ Definition of a larger environmental zone ▪ Development of new access restriction criteria ▪ NOx field tests on 2 vehicles; ▪ 25 measurements for HDVs on a central street ▪ Extensive deployment of information signals across the environmental zone	Notable
Prague	Expansion of the existing environmental zone	▪ Administration of traffic survey ▪ Proposal and approval of 6/tonnes environmental zone extension	Notable
Rome	o To reduce the impact of traffic on the environment o To reduce the number of poorly maintained vehicles in the study area	▪ Validation of RSD emissions monitoring unit ▪ Estimate proportion of gross polluters ▪ Trial feedback mechanisms, such as roadside VMS	Acceptable
Rotterdam	Widening time windows for clean commercial vehicles	▪ Shifted approach to improve the accessibility of the Rotterdam region to freight vehicles	Weak
Stockholm	Expansion of the existing environmental zone, spread information	▪ Policy not implemented due to the delayed development of the target expansion area (Hammarby Sjoestad)	Delayed
	Increase obedience	▪ Improved obedience rates	Notable
Winchester	Completion of existing ANPR system with design and installation of 1 access control point (zone 1)	▪ Selection of final solution for the access control point	Weak
	Design, installation and trial of ANPR system based on 9 access control points (zone 2)	▪ Implementation of ANPR system based on 9 access control points (zone 2)	
	Design, installation and trial of ANPR system based on 7 access control points (zone 3)	▪ Design of ANPR system	
	Provision of access restriction regulation	▪ Adoption of access restriction regulation	

6.3.5 Impacts of Environmental Zones

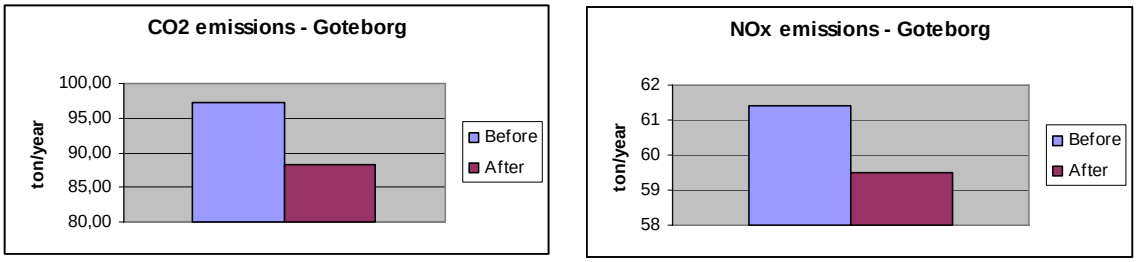
The cross-site assessment of the environmental zones yields a few significant insights, mostly related to the impacts on the environment. Air quality shows decisive improvements, as shown in the next CO levels charts detailing measurements in Rome.

Figure 6.17 Air Quality in Rome



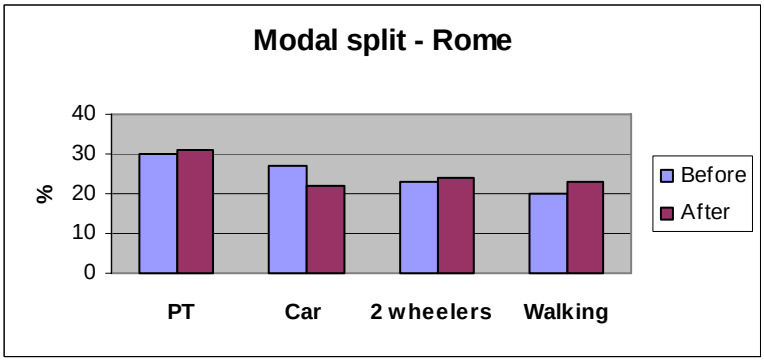
Emission-wise impacts are also extremely positive. The next charts show steady reductions in the city of Göteborg for both CO_2 and NOx emissions.

Figure 6.18 Emissions in Göteborg



Another interesting reading comes from the assessment of the modal split, which unfortunately only relies on the data made available by Rome where modal split measurements were carried out at the "railway ring" level (the local environmental zone encompassing the inner Limited Traffic Zone), where Rome's integrated access restriction strategies were deployed (see also information contained in the clear zones and pedestrian zones clusters). The percentage changes reported by the next figure are intended as the combined result of the overall city strategy. Nevertheless, measurements show encouraging results, with public transport rising by 3%, cars descending by 19%, 2-wheelers increasing by 4% and walking soaring by 15%.

Figure 6.19 Modal Split in Rome



6.3.6 Conclusions from Environmental Zones

The cross-site assessment of impacts allows some general conclusions to be drawn per impact area:

- Environmental zones appear to be an extremely effective tool to improve the air quality of our cities. They are generally applied to fence off the environmental burden imposed by freight vehicles, but the same philosophy can be applied to private cars;
- Environmental zones do not necessarily yield benefits on traffic and congestion levels, since they often cause shifts to other modes of transport (e.g. 2-wheelers) or cleaner modes of transport (from Euro 3 to Euro 4);
- In order to render environmental zones truly effective, high obedience levels must be reached. Clear regulations and good cooperation with the enforcing authorities are necessary;
- When designing environmental zones transportation patterns must be carefully assessed in order to maximise impacts;
- A key success factor is the early consultation with freight associations as well as citizens and shop owners;
- Environmental zones are often regarded as a tool nested within a broader “onion-skin” strategy, contemplating other forms of access restriction (e.g. congestion charging).

Finally, CIVITAS shows that the establishment of environmental zones is a policy suitable of easy incremental expansion toward new city areas. As mentioned previously, a wider geographical scope entails an accurate study of traffic patterns and a thorough involvement of stakeholders in the planning process.

6.4 Pedestrian Zones

6.4.1 Introduction to Pedestrian Zones

3 cities participating in CIVITAS were engaged in the implementation of pedestrian (or strolling) zones. The concept is often seen as an extreme form of access restriction and the last layer of an "onion-skin" model, which also includes increased levels of vehicles interdictions. The goal is to create communities with reduced or no automobile ownership and use, through the employment of multi-faceted tools:

- Development of urban districts (and specifically of housing) where private cars are unnecessary and automobile traffic is restricted. Such restrictions can be part- or full-time, and often include exceptions for delivery vehicles, taxis, and vehicles for people with disabilities;
- Pedestrian-oriented commercial streets where driving is discouraged or prohibited, often through the use of retractable bollards.
- Temporary restrictions on driving, such as during an air pollution emergency or a major event that would otherwise create excessive traffic problems.

The main goals are to improve the environment, to improve the amenity of the study areas, to improve safety and citizens' health.

In conjunction with other related forms of access restriction (e.g. LTZs), the cities of Bristol, Graz and Rome all worked towards the establishment of pedestrian zones, albeit with different intensity.

6.4.2 Implementation of Pedestrian Zones

Bristol pursued the well known (in the UK) Home Zone schemes, with a degree of novelty represented by the integration of residential traffic management with broader Home Zone measures such as community involvement, reallocation of road space and environmental improvements. In practice Bristol targeted seven residential streets in the 'Dings' area of Bristol, remodelling them to ensure equal priority to cyclists, pedestrians and motor vehicles, reducing the impact of commuter parking and coordinating the work with other project measures to provide an integrated package of benefits within the demonstration area.

The Home Zone project was complemented and supported by the involvement of "community travel workers", which allowed a continuing liaison with local residents and stakeholders and an increase share of walking trips.

Graz planned to implement four "strolling zones" along two major city axes (Kunsthaus – Neutorgasse, and Karmeliterplatz – Freiheitsplatz) as part of a wider access restriction strategy also including cycle paths and 30 km speed limit areas. The goal of the city was to promote sustainable alternatives to private cars, primarily walking and biking, and to reduce emissions and noise in the city centre.

Rome aimed to create "environmental islands" inside the central LTZ through further limitation to vehicular traffic. Wishing to boost alternative sustainable transportation modes, such as walking and cycling, and to reduce pollution, the city of Rome heavily resorted to the use of retractable bollards to protect pedestrian pathways in central areas such as the Trastevere District, the Senate and the Capitol, and in the area surrounding Campo dè Fiori and Piazza Farnese. The project also called for the remodelling and pedestrianisation of streets and squares (within the central LTZ - see before and after picture below).

Figure 6.20 Square Pedestrianisation in Rome

6.4.3 Process Evaluation of Pedestrian Zones

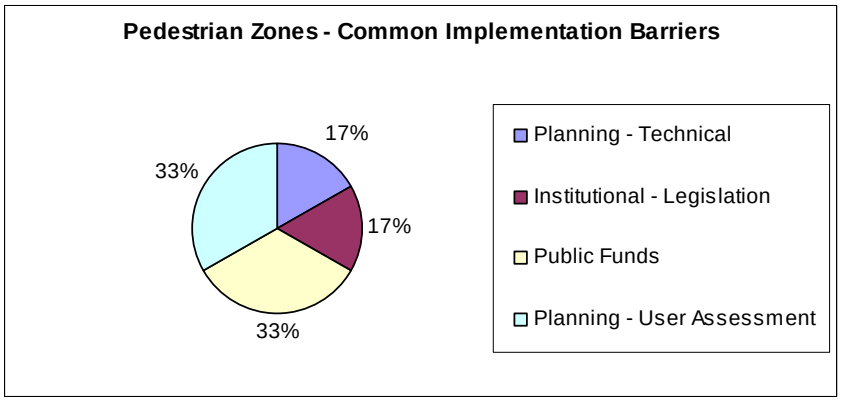
The design and implementation of environmental zones appears to have been relatively trouble-free in CIVITAS. The following table shows the main barriers and drivers from the managers engaged in the implementation of CIVITAS.

Table 6.6 *Overview of barriers and drivers of pedestrian zones*

CITY	BARRIER	DRIVER
Bristol	▪ Institutional - Legislation ▪ Public Funds	▪ Institutional - Administrative ▪ Cooperation - Involvement
Graz	▪ Planning - User Assessment ▪ Public Funds	▪ Planning - User Assessment ▪ Politics/Strategy - Commitment
Rome	▪ Planning - Technical ▪ Planning - User Assessment	▪ Institutional - Administrative ▪ Cooperation - Involvement

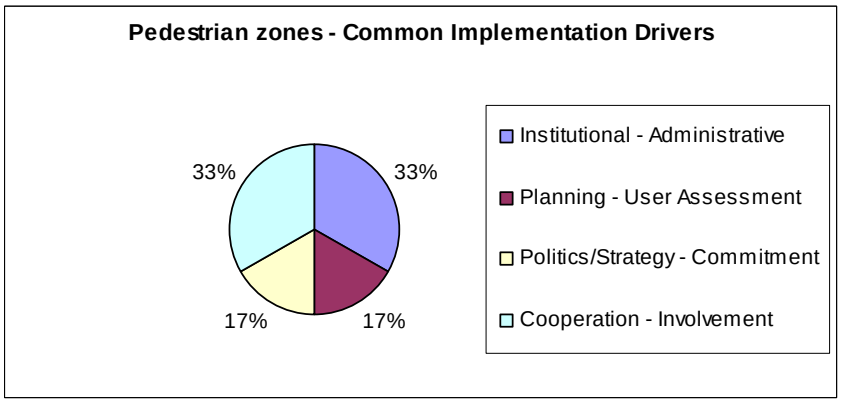
The chart below shows the main barriers to implementation, which essentially relate to the expense of urban space remodelling projects and to the initial resistance posed by citizens (fearing the loss of parking spaces) and shop-owners (fearing the loss of business).

Figure 6.21 Pedestrian Zones – Common Implementation Barriers



Conversely, the main drivers show a strong effort by the cities to win the support of stakeholders through a continuing consultation process. Considering the high visibility that this kind of policy has, strong political support, involvement of stakeholders and institutional cooperation are perceived as crucial factors to achieving success.

Figure 6.25 *Pedestrian zones – Common Implementation Drivers*



6.4.4 Outputs of Pedestrian Zones

The introduction of pedestrian zones appears to have been a relatively smooth operation in the three CIVITAS cities. Plans were almost all achieved according to plan. While reviewing the outputs produced by CIVITAS and the environment they created, one should however bare in mind that Bristol, Graz and Rome established rather heterogeneous zones with respect to the restriction placed on the various means of transport. While the pedestrian zones adopted by Graz are truly car-free areas nested in broader city portions featuring other forms of progressive

access limitations, Bristol introduced zones simply "facilitating" a modal shift toward walking, whereas Rome established both pure pedestrian zones and zones only limiting vehicle access in certain times of the day.

Table 6.7 *Overview of the planned and achieved output of the different measures*

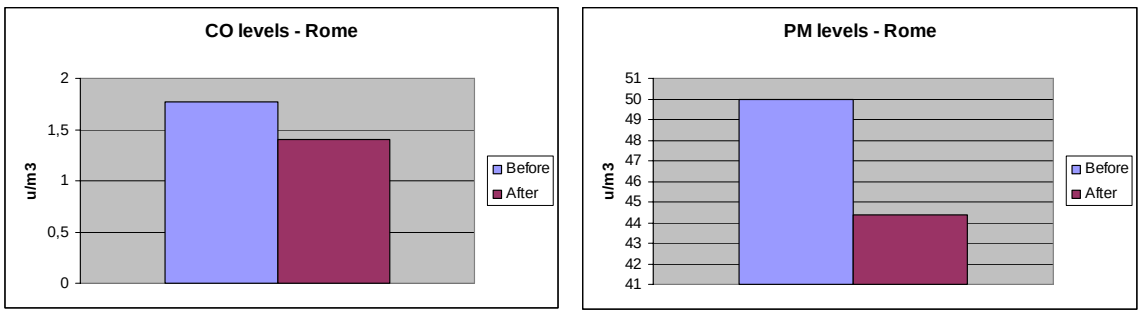
CITY	PLANNED OUTPUT	ACHIEVED OUTPUT	COMPLETION RATE
Bristol	Reconfiguration of 7 streets and surrounding public spaces	▪ Administration of surveys to assess attitudes ▪ Organisation of street events to raise awareness ▪ Redesign of 7 streets	Notable
Graz	Implementation of 4 strolling zones, organisation of marketing and information campaign	▪ Implementation of 4 strolling zones, though in areas sometimes differing from the original ▪ Organisation of marketing and information campaign	Acceptable
Rome	Implementation of pedestrian zones in several central areas	▪ 20% increase of pedestrian areas ▪ Installation of 51 retractable bollards to protect the newly created zones	Acceptable

6.4.5 Impacts of Pedestrian Zones

Though the rather limited evaluation activities performed at site level do not provide ample evidence, it is possible to highlight a few headline results produced by the pedestrian zones realised in CIVITAS.

From an environmental standpoint, Rome has experienced important benefits for the local air quality, though the figures quoted in the following charts refer to monitoring stations scattered around the whole laboratory area and not just inside the pedestrian zones.

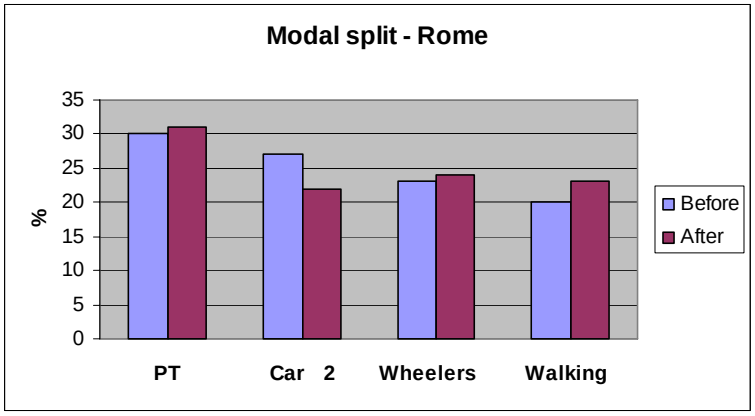
Figure 6.22 Air Quality in Rome



Similar reductions were recorded emission-wise, a trend that is also confirmed by readings in Graz.

There were also interesting findings in the analysis of vehicle movements and modal split within the newly developed pedestrian zones. In Bristol, data shows a noticeable decline in commuter vehicles accessing the Home Zone, which dropped by 26%, with a corresponding car traffic reduction of 10% (matching the objective set at project outset). As reported in the environmental zones cluster, the modal split in Rome confirms this reduction in (private) vehicle movements and the related increase in walking trips. See the next figure for details (caveats for interpretation can be found in the environmental zones cluster).

Figure 6.23 Modal Split in Rome



Whilst little information is reported concerning the level of stakeholders acceptance and awareness, Bristol does confirm the existence of strong public support toward the Home Zone scheme, a fact that is confirmed by the steady backing provided to the policy also by the local businesses (though economic figures are not reported in CIVITAS). Similar findings can be derived from Graz, where 71% of users are satisfied with the 'strolling zones' and 31% of all interviewees declare that they use them more often then before.

6.4.6 Conclusions from Pedestrian Zones

The establishment of pedestrian zones is generally deemed a relatively trouble-free policy endeavour yielding benefits across the full spectrum of impact areas. There are a few crucial points to keep in mind when considering these zones:

- It is important to involve citizens and local businesses in the planning process;
- Their policy acceptance tends to increase after implementation;
- An improved public transport service towards and within the zone boosts the success of the policy;

- Strolling zones are usually easier to implement than pedestrian zones, which totally exclude all other modes;
- Pedestrian (and strolling) zones are also good tool for sustainable urban design.

The future expansion of pedestrian zones is consensual amongst the CIVITAS cities that have already initialised this process. Although the financial requirements label this kind of intervention as an expensive one, the extremely positive return in terms of increase liveability and boosted commercial activity speak in favour of a progressive enlargement of pedestrian zones. A full cost-benefit analysis would be interesting in this sense.

6.5 Transferability

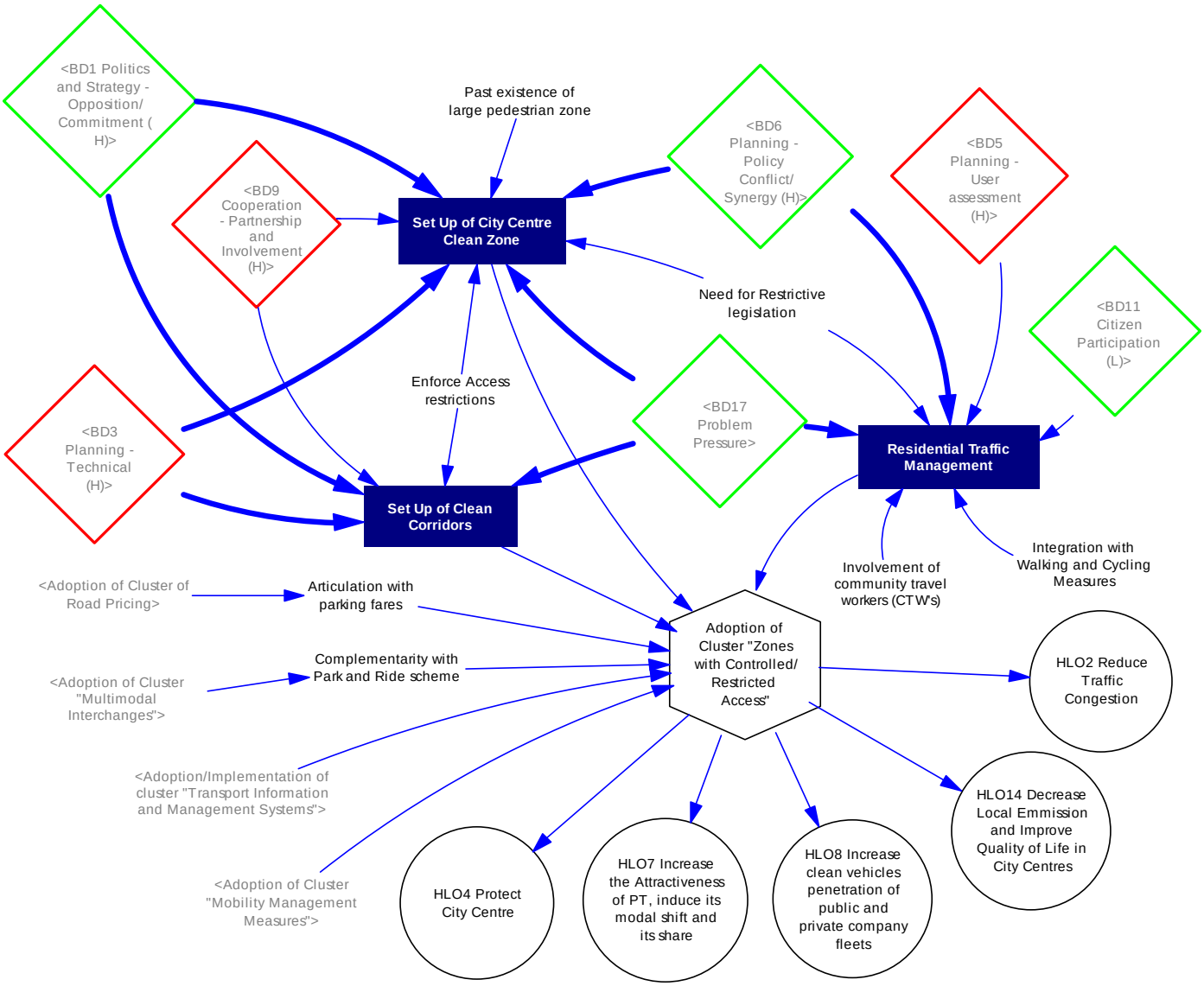
The principal objectives raised within this cluster of measures are to increase environmental protection, increase acceptance of clean vehicles, the promotion of sustainable alternatives to private cars, to provide a better living and working environment, reduce the need to travel by car.

The measure **"Set Up of City Centre Clean Zone"** seems to work better in an environment with high congestion and pollution levels. A restrictive environmental legislation needs to be implemented to support the measure which in turn also supports its acceptability. Given the nature of the measure, which implies a change of habits from the public, a strong political will and good communication are decisive factors for implementation. Support from business representatives or the co-operative attitude of operators were also mentioned as relevant drivers. There were many barriers to implementation apart from the already mentioned acceptability such as conflicting interests, the lack of funding, institutional bureaucracy related to the introduction of a new technology, disrespect for the new regulations, delays in public transport due to traffic reallocation, loss of parking space, technical problems with the installation of a new technology, incompatibility between environmental rules and European standards. The cities found many different ways to overcome the difficulties in implementing the measure in order to enable its success, although is important to learn from other city cases.
An experimental period for improvement of the measure is advisable in order to investigate all possible legal issues. Standardized rules in all cities in a particular country could simplify the integration of systems. The suitability of site locations also needs to be carefully evaluated prior to installation. Socio-political issues require consultations with the stakeholders and the use of media to persuade public support could be decisive for success. Positive synergies between the measures, namely with the clusters of Public Transport, Parking Management, Cycling, Mobility Management and Multimodal Interchanges (Park and Ride) is also preferable.

The **"Residential Traffic Management"** measures requires public support. The most relevant barriers perceived were legal matters relating to traffic regulation, unforeseen technical problems, lack of resources and the inevitable disruption in parking displacement and vehicular

access during works. The main actions contributing to the success of the measures were community involvement, a steering group allowing expertise sharing, the involvement of community travel workers and travel awareness/marketing. The coordination with measures from the cluster of Cycling was also regarded as a success factor. Conflicts of interest between partners and a limited understanding of user needs and attitudes delayed the implementation in some cases. The fact that two measures have also been abandoned emphasises the difficulties faced.

Figure 6.24 Fundamental Mapping of the Cluster "Zones with controlled access"



6.6 Overall Conclusions from Zones with Controlled Access

Because of the three sub-clusters composing this broader group of measures, conclusions are not always transversally consensual. Whilst limitation to access is the common denominator, the aforementioned interventions vary considerably in nature, scale and goals. It is however possible to draw a few general conclusions:

- Substantial environmental benefits can be expected through the implementation of the different forms of zones;
- Another major positive impact is that on urban liveability, which increases consistently wherever zones are introduced;
- Success is strongly dependent upon the early involvement of noteworthy stakeholders, such as citizens, retailers and transport operators;
- Effectives zones are usually part of a wider packages of complementary measures, which however render planning and implementation complicated and expensive.

Table 6.8 *Summary of the overall effects of the cluster zones with controlled access*

Type of Zone	Transport	Energy	Environment	Economy	Society
Clear	☺	*	☺	*	☺
Environmental	☺	*	☺	*	*
Pedestrian	☺	*	☺	☺	☺
Overall	☺	*	☺	*	☺

7 CLEAN VEHICLES AND FUELS

7.1 Introduction

Within CIVITAS I, 36 measures have been implemented concerning Clean Vehicles & Fuels. The measures have been divided into three sub clusters as follows:

- *Public Fleets* includes all measures where vehicles are operated as public services (i.e., public buses, waste collection trucks, municipal fleets, etc.);
- *Private Fleets* includes all measures concerning private activities (e.g., private citizens, freight, private companies' fleets, etc.).
- *Supporting Infrastructure and Incentives* includes less homogeneous measures concerning fuelling infrastructures, supply chain as well as a series of services boosting the development of the clean vehicles & fuels market.

The complete overview of Clean Vehicles & Fuels measures is shown in table 7.1 below, divided into the three clusters mentioned above.

Table 7.1 *Clean Vehicles & Fuels measures in CIVITAS I*

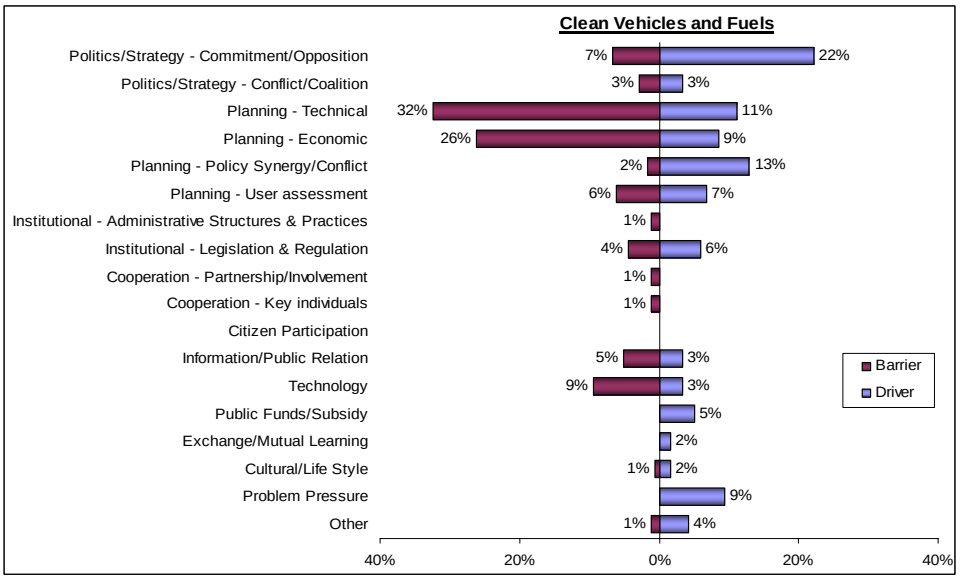
City	Measure code	Measure title
Public Fleets		
Barcelona	12.3	Extension of the CNG bus fleet
Bristol	5.1	Clean and efficient buses
	5.2	Clean fleet vehicles
Bucharest	12.5	Clean & silent public transport fleet
Cork	12.2	Municipal Fleet Vehicles
Göteborg	12.7	Introduction of clean vehicles in public and private fleet
	12.8	Introduction of clean waste collection vehicles
Graz	12.3	Clean and user friendly bio-diesel bus fleet
Lille	12.2	Biogas bus fleet
	12.5	Clean municipal fleet
Nantes	IP 1 – IM 1	Clean and efficient buses
Rotterdam	12.1	Clean & silent public transport fleet
	12.3	Cleaner Vehicles for Waste Collection
	12.4	Electric vehicles in public fleets
Rome	12.1	Clean Vehicles Buses
Stockholm	12.1	Clean and efficient heavy vehicles
	12.4	Clean municipal fleet
	12.6	Waste collection with biogas-vehicles
Winchester	12.1	Clean Vehicles Buses
	12.2	Cleaner Municipal Fleets
Private Fleets		

Berlin	12.6	Introduction of CNG-powered vehicles
Bremen	5.2	Clean and efficient vehicles
Göteborg	6.6	Incentives for purchasing of NG/CBG heavy duty and distribution vehicles
Graz	12.7	Bio-diesel taxi fleet and bio diesel service station
Rotterdam	12.2	Electric vehicles for commercial distribution
Stockholm	12.11/12.12	Making clean vehicles less expensive
	12.13	Increasing clean vehicle use in private company fleets
Winchester	12.3	Clean Fuel Support Services
Supporting Infrastructure and Incentives		
Bristol	5.3	Fuel supply infrastructure and local network
	5.3	Renewable energy supply
Graz	12.8	Optimisation of the bio-diesel collection system
Lille	12.9	Analysis of the biogas experience
Nantes	IP 1 – IM 2	Clean fuels support services, fuel supply infrastructure
Rome	12.3	Clean Fuel Support
Stockholm	12.10	Improved biogas refuelling infrastructure
	12.14	Web-portal for drivers of clean vehicles

Implementation of the Clean vehicles and fuels measure has been dominated by four issues. Firstly, “Political Commitment” appears to be an above average driver for implementation, underlining together with “Problem Pressures” the strategic dimension of this policy field. Secondly, “Technical Planning” constitutes a barrier of utmost importance with a view to the complex procurement, technical supply and infrastructure implications. Thirdly, “Economic Planning” appears to be critical regarding the difficult combination of high investment costs and a market yet to be developed. Fourth, synergies between the introduction of alternative vehicle technologies and other policies (e.g. clean zones, public transport promotion, air quality management) results’ are important drivers for the implementation.

On the other hand, this type of measure is affected more than others by the failures of undeveloped technologies or difficulties regarding tailor-made solutions. In some cases the regulatory framework has also played a major role as a barrier to implementation (e.g. high taxes on bio-fuels in Ireland).

Figure 7.1 *Barrier/Driver profile for "Clean Vehicle and Fuels*



7.2 Public fleets

7.2.1 Introduction to Public Fleets

The cluster on Public Fleets consists of a great number of measures: this is to confirm the major role played by public authorities in promoting and orienting the consolidation of the clean vehicles & fuels market.

Such measures concentrate mainly on municipal fleets and on public services fleets (e.g., public transport), through purchasing, renewing and conversion of fleets. While choosing a wide range of technical and environmental solutions, according to their specific goal (bio fuels, electric, EURO III and IV, Hybrid, CNG, etc.) public authorities nevertheless converge rather unanimously when dealing with objectives behind measures implemented:

- Reduce air pollution and achieve environmental standards;
- Promote and support a clean vehicles market;
- Improve the appeal of public transport;
- Increase end users awareness and acceptance;
- Pave the way for the introduction of new technologies.

7.2.2 Implementation of public fleets

In **Barcelona** TMB, the main bus and metro operator wanted to integrate CNG buses into the public transport fleet as part of its corporate strategy to achieve the highest environmental standards, and to contribute to the improvement of a more sustainable transport for the city. The objectives focused on making a significant demonstration of (at least 70) standard buses running on gas with a view to making a decision for accelerated vehicle acquisition (up to 250 vehicles by 2006).

Figure 7.2 CNG bus demonstration in Barcelona

In **Bristol**, existing diesel vehicles needed to be cleaned up as well as the introduction of new clean fuel buses. Consequently the work followed two implementation paths towards cleaner bus fleets – new hybrid diesel electric buses and retrofitting older vehicles with exhaust treatment equipment. The following was simultaneously planned:

- to introduce 50 additional LPG vehicles and 5 electric or hybrid diesel or petrol-electric - vehicles into the Council's municipal fleet;
- to retrofit 10 older and large diesel vehicles.

Bucharest decided to modernise the fleet by introducing new energy savings and silent vehicles, in order to establish a clean and attractive public transport fleet.

Figure 7.3 New energy saving trolley in Bucharest

In **Cork** the objectives were to promote the use of clean fleet vehicles and to investigate the pros and cons associated with using less polluting vehicles. This was undertaken by converting 17 council vehicles to run on a bio-fuel (rapeseed).

The City of **Göteborg** aimed at increasing the amount of clean vehicles both in the city as a whole and within the municipal fleet. This was achieved by developing new methods and working with more active information strategies such as communication directed towards special target groups, well-directed incentives and demands on procurement. The total amount of clean vehicles increased during the project period by roughly 3,000, which was twice as many as predicted. In another project Göteborg introduced four new waste collection vehicles combining different types of environmentally friendly technologies. The vehicles comprised of a CNG/CBG engine with a body work served by an electric powered engine and the traditional hydraulic oil was replaced by water hydraulics. The clean waste collection vehicles have accomplished waste collection with satisfactory productivity while improving the environmental performance with respect to emissions and fuel consumption during use, eliminating the risk of pollution due to hydraulic oil leakage and reducing noise.

Figure 7.4 The design of a back loader in Göteborg

Graz decided, after a series of tests and trials and an economic and ecological analysis, to replace the use of fossil fuels with bio diesel. This project was introduced step by step, the target being the conversion of the whole bus fleet – which was achieved in 2005.

In **Lille**, after an experimental project and a test period, it was decided to introduce a new fleet of biogas buses into full service. The final objective is to convert the entire fleet (400 buses) into buses running on this type of fuel. Another project was the conversion of the Lille Metropole's heterogeneous vehicle fleet into a clean-vehicle fleet (natural gas and electricity vehicles).

The **Nantes** project aimed at providing public transport service with non-polluting vehicles and to reduce pollutant emissions of the bus fleet by 40% (CO, HC, NOx) by renewing the bus fleet with 155 new CNG buses.

In **Rome**, the project was concerned with the renewal of part of the bus fleet, in order to comply with the latest environmental standards. The renewal involved the purchase of 908 Euro III buses and 30 "new generation" bimodal trolleybuses, plus 10 electric buses.

Figure 7.5 The new Trolleybus in Rome

In **Rotterdam**, one project aimed to convert the whole bus-fleet to EURO IV/V standard using the DNOx filter technique; in the course of 2004 the design was changed into installing active SCR filter systems in 7 new buses. Another project was to introduce 2 new clean waste collection trucks in Rotterdam to test the specially developed filter system in real-life circumstances. It was finally decided to introduce a large number of (hybrid) electric vehicles to the municipal fleet.

In **Stockholm**, using clean heavy vehicles is a step in the right direction to solve the problem of global warming and local emissions. One measure aimed at demonstrating that clean heavy vehicles (buses and lorries) could replace conventional diesel vehicles in an efficient way. Another project was to accelerate the take up of clean vehicles within private companies and in the municipal fleet. This project was successful and more than 3000 clean vehicles were introduced during the project. The successful introduction of clean (biogas) waste collection vehicles in Stockholm city centre has now led to a decision to use only clean waste trucks in the whole municipality.

In **Winchester** the objective of the project was to reduce the environmental impact of the bus fleet owned by the main bus operator in Winchester. This was undertaken by re-powering (i.e. improving the engine technology) in some of the buses to meet a higher Euro emissions standard as well as replacing some older vehicles with new buses. A secondary aim was to introduce the public to different vehicle fuel types and demonstrate that the buses could operate with the same performance as when using conventional fuels. Another project aimed at reducing the environmental impact of Council activity in the Winchester area and beyond by purchasing a fleet of new Euro IV vehicles for their Highway Management car fleet.

Figure 7.6 Electrocity and Designline hybrid electric buses in Winchester

7.2.3 Process Evaluation

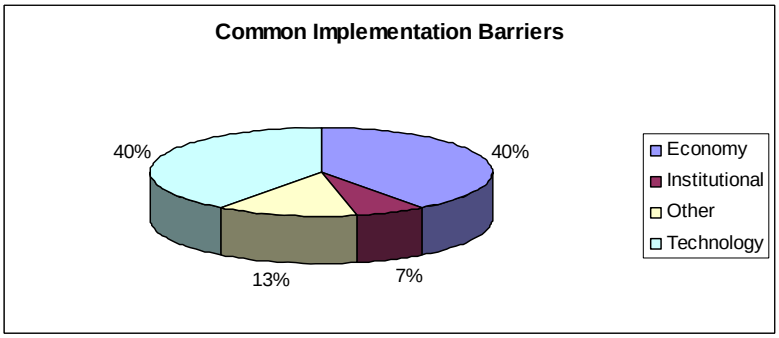
During the measures implementation, the CIVITAS cities faced several barriers, with several drivers employed aiming to overcome them, as showed in the following table:

Table 7.2 *Overview barriers and drivers public fleets*

CITY	BARRIER	DRIVER
Barcelona	• Economy	• Economy • Politics/strategy
Bristol	• Technology • Cultural/life style	• Cooperation • Politics/strategy
Bucharest	• Institutional/administrative	• Politics/strategy
Cork	• Technology	• Technology
Göteborg	• Information • Economy • Technology	• Information • Politics/strategy
Graz	• None	• None
Lille	• Technology • Economic	• Information/public relation • Economy
Nantes	• Technology • Economy	• Politics/strategy • Public funds • Information/public relation
Rome	• Legislation & Regulation	• Legislation & Regulation
Rotterdam	• Technology • Institutional	• Cooperation • Politics/strategy • Technology
Stockholm	• Technology • Economy	• Politics/strategy • Economy
Winchester	• Technology • Economy	• Institutional • Politics/strategy

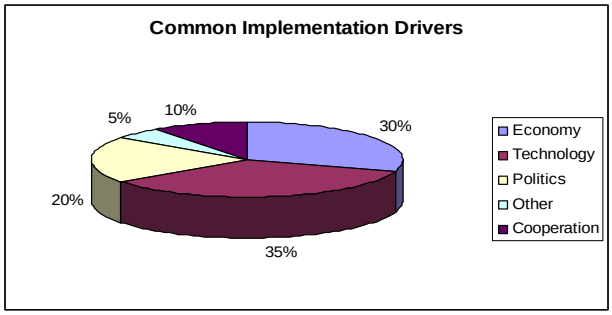
Most of the barriers hindering the implementation of measures, as shown in the graph below, concern economy and technology, in particular high investment costs for purchasing and running vehicles, several technical problems and the insufficient size of the market.

Figure 7.7 Public Fleets - Common Implementation Barriers



On the other hand, higher environmental benefits, strong political commitments, cooperation from stakeholders', economic incentives and effective communication campaigns can facilitate overcoming such barriers.

Figure 7.8 Public Fleets - Common Implementation Drivers



7.2.4 Outputs

In general, most of the outputs were achieved by the CIVITAS cities, although there were delays and modifications to the activities. Some measures have radically changed since the beginning, thus achieving a rather low completion rate or not being able to produce an evaluation score. Others still need to be finalised after the end of the CIVITAS projects.

Table 7.3 *Overview of the planned and achieved output of the different measures*

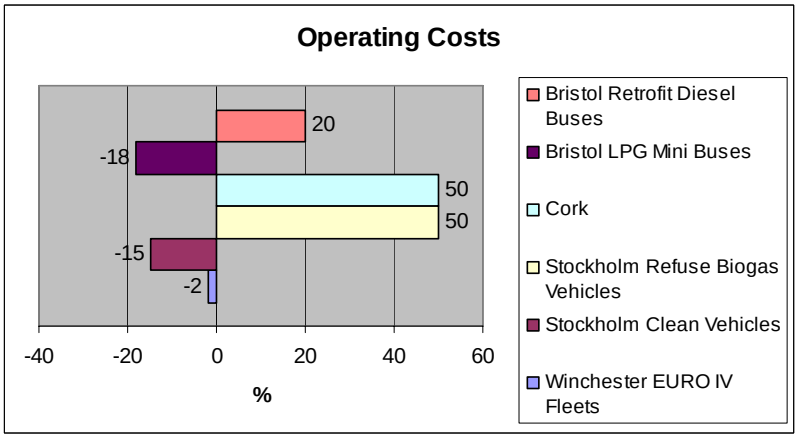
City	Planned Output	Achieved Output	Completion Rate
Barcelona	Purchase of 70 CNG buses.	70 CNG buses have been purchased	Notable
Bremen	No clean buses planned; 4 EEV truck CNG planned which have not been delivered	9 articulated buses ordered with EEV emission standard (based on diesel)	Acceptable
Bristol	1) Introduction of 4 clean buses to replace existing diesel vehicles; 2) The retrofit of up to 40 diesel buses; 3) Introduction of 2 new clean fuel buses to demand responsive fleet.	1) No more feasible 2) Achieved (58 diesel buses retrofitted). 3) 5 LPG vehicles introduced.	Acceptable
	1) Introduce 50 additional LPG vehicles and add 5 electric or hybrid diesel or petrol-electric vehicles into the Council's municipal fleet of cars, vans and coaches. 2) Retrofit 10 older and larger diesel vehicles, less suited to LPG operation, with particulate traps or oxidisation catalysts.	1) 73 LPG vehicles, 5 battery powered Reva G-Wiz cars and a hybrid technology Toyota Prius have been introduced; 2) Output modified: introduction of hybrid diesel/electric minibus.	Notable
Bucharest	Introducing 30 new silent and energy saving trams and 60 LPG buses.	Output modified: 60 trolley buses instead of LPG buses; introduction of 8 trams.	Acceptable
Cork	Conversion of 17 diesel city council vehicles towards biofuel.	16 vehicles converted.	Acceptable
Göteborg	1) 250 new clean vehicles in municipal fleet; 2) Increased awareness for retailers and end users.	1) About 200 new clean vehicles; 2) Increased number of visitors to the national website of clean vehicles, as well as acceptance and satisfaction.	Notable
	1) 1500 new private clean vehicles; 2) Increased awareness for retailers and end users.	1) About 3000 new private clean vehicles. 2) Increased number of visitors to the national website of clean vehicles, as well as acceptance and satisfaction.	Notable
	Purchase of 4 clean heavy waste collection vehicles.	4 clean heavy waste collection vehicles purchased	Notable
Graz	Modifying of existing buses in the fleet to biodiesel (a total of 56 buses) and purchase of 41 new biodiesel buses.	Existing buses modified and 41 new bio diesel buses purchased	Notable
Lille	To introduce 128 new biogas buses in public transport fleet.	128 Biogas buses have been introduced	Notable
	Purchase of 120 municipal fleet clean vehicles.	84 CNG vehicles and two electric vehicles were purchased.	Acceptable
Nantes	1) 125 Standard CNG buses within 3 years; 2) 30 articulated CNG buses within 3	1) 125 Standard CNG buses 2) 20 articulated CNG buses	Notable

	years.		
Rome	Purchase of 908 EURO III buses, 200 EURO III CRT buses, 30 "new generation" bi-modal trolleybuses, 10 traditional electric buses (5 mt) and 36 bigger e-buses (9 mt)	Achieved, except delay of 36 bigger e-buses (expected by summer 2006).	Acceptable
Rotterdam	1) Retrofit 7 buses with DNOX filter; 2) 1 Hybrid bus for testing ; 3) All 212 buses converted to EURO IV/V .	1) Modified with introduction of SCR filters ; 2) Postponed for technical problems; 3) Total of 80 equipped in summer 2005. The rest between 2006 and 2009.	Acceptable
	1 waste collection vehicle with special filter (Euro IV) and 3 waste collection vehicles (Euro IV) for the underground containerisation system	Outputs modified: - 1 waste collection truck with SCR filter (achieved) - A second truck (Achieved) - 20 sweeping vehicles with CPO filters (achieved).	Acceptable
	50 (hybrid) electric vehicles	Outputs modified: - 50 Ford FFV (achieved) - 2 Toyota Prius II (achieved) - 6 electric vehicles in Spijkenisse (achieved) - 1 electric shuttle bus (achieved) - Installing 2 E-CRT systems on waste collection trucks (achieved) - Testing electric scooters at the Roteb lease department (achieved) - Installing another 30 E-CRT systems on waste collection trucks (achieved)	Notable
Stockholm	Purchase of 26 heavy biogas vehicles (distribution trucks and/or buses).	26 heavy biogas vehicles purchased	Notable
	Purchase of 200 clean municipal fleets vehicles.	200 clean municipality fleet vehicles purchased	Notable
	Purchase of 7 biogas refuse collection vehicles to replace diesel vehicles.	7 Biogas refuse collection vehicles purchased	Notable
Winchester	1) 13 new EURO III buses; 2) 10 buses from EURO I to EURO III; 3) 4 EURO II buses fitted with CRTs; 4) Introduce different vehicles fuel types.	1) 13 new EURO III buses; 2) 10 buses converted from EURO I to EURO III; 3) 4 EURO II buses fitted with CRTs; 4) SCR introduced and diesel electric hybrid buses trialled.	Acceptable
	1) 27 EURO IV fleet vehicles; 2) Extension of Motorvate scheme to other companies.	1) 27 EURO IV fleet vehicles; 2) Not achieved 3) additional 7 LPG vehicles purchased; 4) additional purchasing of 4 new library buses (EURO IV with CRT).	Acceptable

7.2.5 Impact evaluation

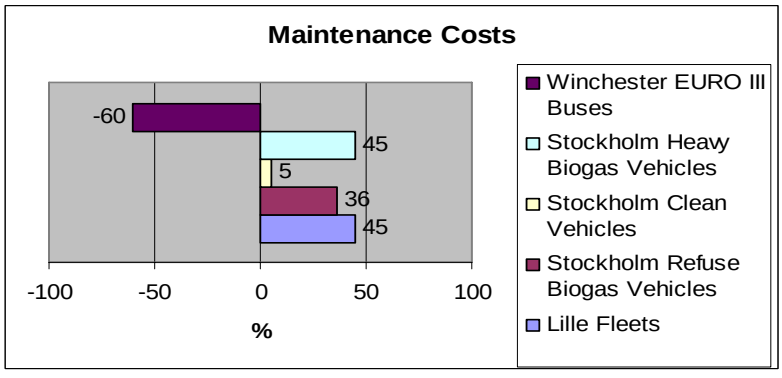
In general, the rather scarce availability of data, has limited a comprehensive comparison exercise among cities. This was only partially possible for some of the indicators within economy, energy, environment and society impact areas. The following graph shows comparisons among different cities in terms of operating costs relating to the economic impact.

Figure 7.9 Operating Costs of clean public fleet vehicles



Several cities recorded a reduction, ranging from 2% in Winchester (using LPG/Petrol vehicles) to 18% in Bristol (LPG mini buses), including 15% in Stockholm clean vehicles (average value among electric hybrid, biogas and ethanol vehicles); on the other hand, in Cork the use of rapeseed oil was more expensive (compared to diesel) due to the fact that tax reductions and exemptions are still not applied to such fuels. In Stockholm, the use of biogas (for waste collection vehicles) was twice as expensive as diesel. Results on maintenance costs are included in the following chart:

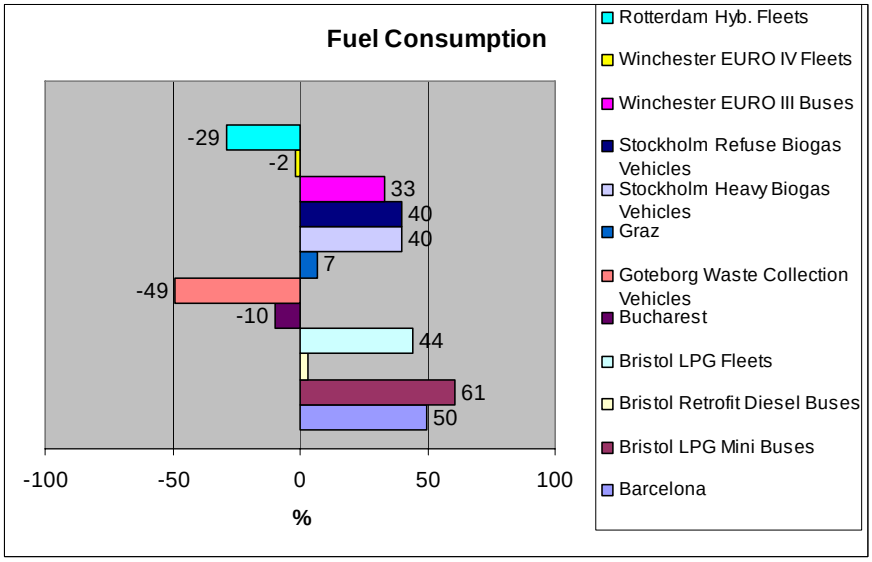
Figure 7.10 Maintenance costs of clean public fleet vehicles



An increase is shown ranging from 5% in Stockholm (clean vehicles) to 45% in Lille (electric vehicles) and Stockholm (heavy biogas vehicles and refuse biogas vehicles), due to the hire of batteries (Lille) and extra costs for maintenance services (Stockholm). The reduction of 60% in Winchester is due to the introduction of new buses for the renewal of fleets. Reliability problems have been detected in LPG mini buses in Bristol and in Barcelona the higher CNG bus investment cost was balanced by saving in maintenance costs ; 1,027 Euro per month (under the strategic partnership with the utility provider, although the energy consumption of a gas bus is higher than the diesel bus, fuel cost savings exceeded the higher maintenance of the gas buses).

On Fuel Consumption, the chart below reports comparisons among several cities.

Figure 7.11 Fuel Consumption of clean public fleet vehicles

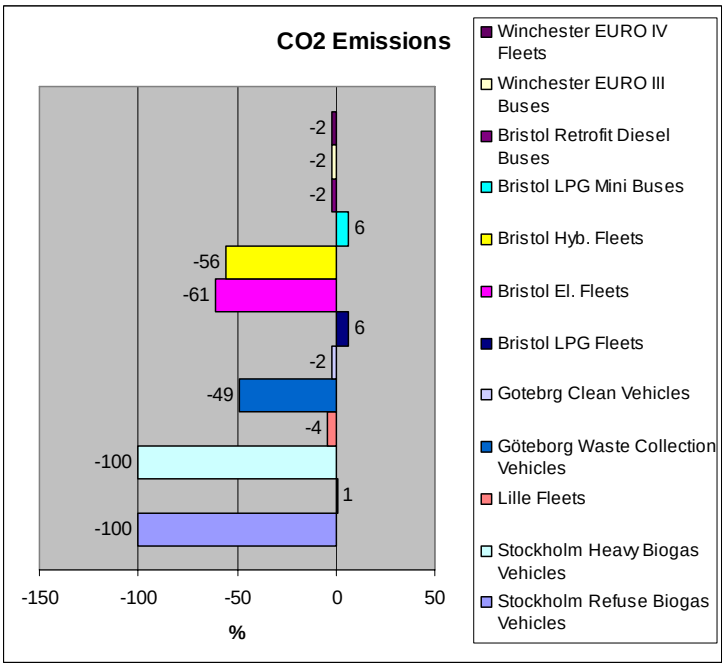


Most of the cities registered an increase ranging from 7% in Graz (use of biodiesel) to 61% in Bristol (using LPG buses). Compared with diesel vehicles, Bristol (LPG buses and fleets), Barcelona (CNG buses) and Stockholm (biogas heavy and collection vehicles) experienced a higher level of fuel consumption due to lower engine energy efficiency (fuel consumption is correlated according to energy content). In Barcelona the configuration of the city also played a role (fuel consumption increased by about 50% on hilly routes and 42% on flat routes compared to a standard diesel bus), while in Bristol (Retrofit Diesel Buses, LPG Mini Buses and LPG Fleets) several factors had to be considered, such as an ambient temperature and the variety of routes. A different case is represented by Winchester (EURO III buses), due to the specific characteristics of vehicles (heavier than others).

There was a reduction in fuel consumption ranging from 2% of Winchester (EURO IV fleets) to 49% of Göteborg (waste collection vehicles). While Winchesters increase can be explained by the conversion from EURO III to EURO IV, others opted for electric and hybrid vehicles (Göteborg having, for waste collection vehicles, a CNG engine combined with electric powered

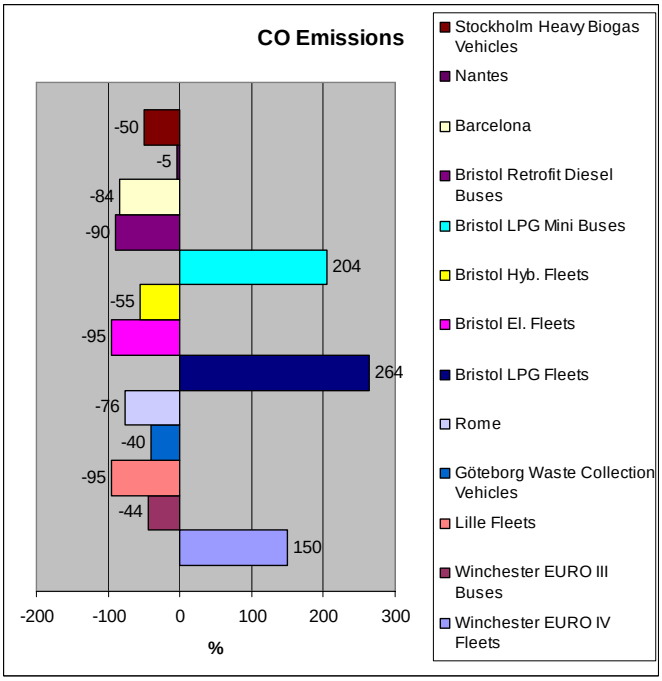
bodywork, Bucharest introducing trolleys and trams and Rotterdam using hybrid instead of petrol vehicles), resulting in a better fuel consumption performance. Important reductions of CO2 emissions have been achieved as indicated in the following chart:

Figure 7.12 CO_2 Emissions of clean public fleet vehicles



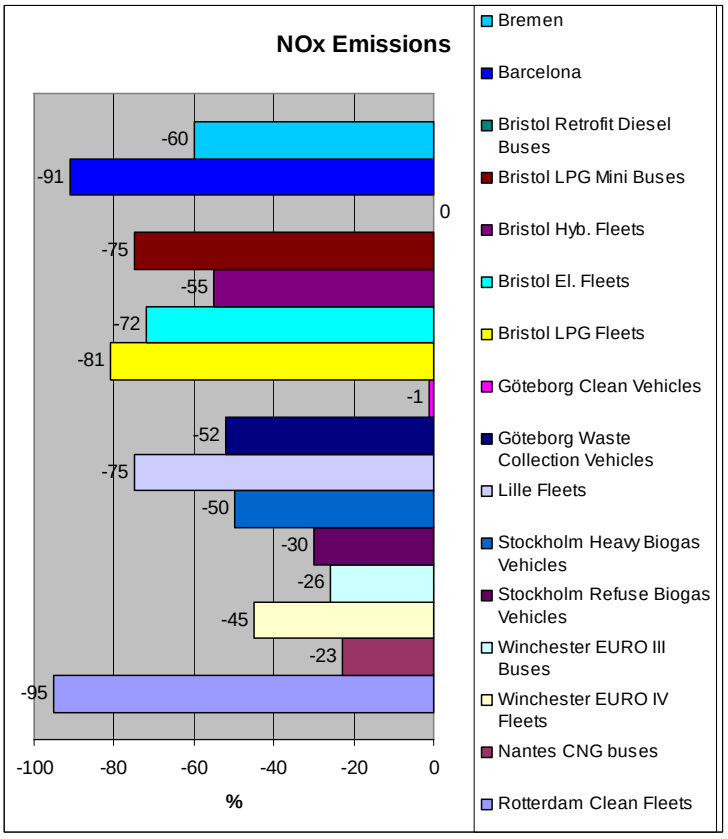
Improvements range from 2% in Winchester (EURO III buses and EURO IV fleets) and Bristol (retrofit diesel buses) to 100% in Stockholm (refuse biogas vehicles). The only increase, in Bristol (LPG minibuses and fleets) is probably due to higher fuel consumption and to the use of petrol in greater proportion than expected. The electric fleets in Bristol took into account the full life cycle analysis. In Cork, emissions were reduced by about 55 t/y. In Rotterdam (clean fleets) the use of urea lead to higher emissions of CO_2 (132 t). Important results have also been achieved in terms reductions of CO emissions, as indicated in the following chart:

Figure 7.13 CO Emissions of clean public fleet vehicles



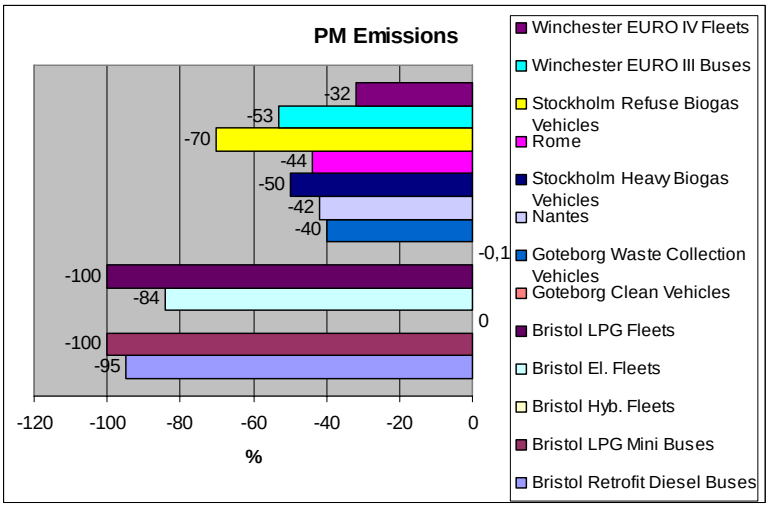
Improvements range from 5% in Nantes (CNG/Diesel compared with a full diesel bus fleet) to 95% in Lille (electric fleets) and Bristol (electric fleets). Reductions in NOx emissions are very significant, as indicated in the following chart:

Figure 7.14 NOx Emissions of clean public fleet vehicles



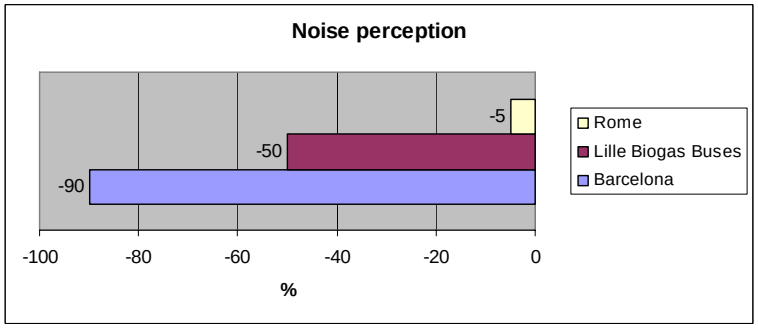
Improvements ranged from 1% in Göteborg (clean vehicles) to 95 % in Rotterdam (clean fleets). Important results have also been achieved in terms of reduction in PM emissions, as indicated in the following chart:

Figure 7.15 PM Emissions of clean public fleet vehicles



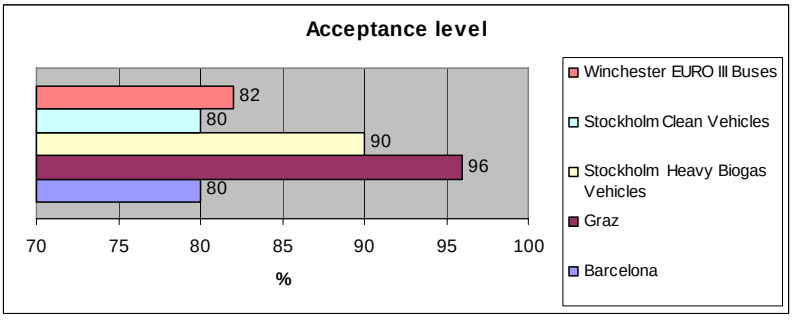
Improvements ranged from 0,1% in Göteborg to 100 % in Bristol (LPG mini buses). In Rotterdam (clean fleets) a reduction of PM was also recorded (0,39 g/km). Noise perception was also improved in some cities, as indicated in the following chart:

Figure 7.16 Noise Perception of clean public fleet vehicles



Values decreased from 5% in Rome to 90% in Barcelona. In Bucharest the new trams reduced noise levels by 6dB. In Göteborg the use of electronic hybrid techniques (waste collection vehicles) also determined noise reductions. Positive results were also shown for acceptance levels in cities where data is available, as indicated in the following chart:

Figure 7.17 Acceptance level of clean public fleet vehicles



Scores range between 80% in Barcelona and Stockholm to 96% in Graz. In Cork a positive attitude towards the use of bio fuels in vehicles from operators was recorded. In Göteborg, drivers were satisfied with use of waste collection vehicles.

7.2.6 Conclusion

The cross site impact analysis in the CIVITAS cities showed the strong effectiveness of measures concerning public fleet clean vehicles:

- Environmental benefits are generally positive with an overall reduction of main pollutant emissions; representing one of the principal drivers in favor of the introduction of clean vehicles and choice;

- Energy impacts are less homogeneous, depending on technologies employed and consequent performance of vehicles;
- Society impacts are generally positive in terms of acceptance by users and operators, , despite some technical problems hindering development of the market;
- Economy impacts are sometimes less straightforward, with higher costs for clean vehicles, explained as characteristics of the market (often a "niche" market, thus higher investments costs) and regarding the fiscal policies of individual countries (not enough in favor of clean fuels and vehicles).

In this context, consolidation of the market remains a major objective to be achieved and a fundamental contribution in this sense could be provided by the implementation of the European Biofuel Directive and by the future European Directive on clean vehicles public procurement, presently at proposal stage.

7.3 Private Fleets

7.3.1 Introduction to Private Fleets

The cluster on Private Fleets includes several measures in different vehicle and fuel typologies. One of its main features is that effective and positive results in terms of penetration of the market are more difficult to reach (if compared with Public Fleets), because rather often single and scattered interests and aptitudes prevail (of individuals, businesses, fleet operators); multi aspect policies are required(e.g., incentives and information activities coupled together).
Several instruments have been adopted in order to boost private fleets, such as:

- Awareness and communication campaigns, using different media and materials, e.g. postcards, information panels, websites, mailings, events, participation at fairs, in order to establish a cooperation framework with key stakeholders.
- Financial assistance for purchasing CNG-vehicles.
- Offering technical assistance and support for CV use.
- Addressing target groups such as companies, taxi drivers, car traders and all consequent potential user groups.

7.3.2 Implementation Private Fleets

In **Berlin**, the project aimed to promote CNG-lorries by the provision of information and creation of financial incentives. The aim of the measure was to bring at least 100 additional CNG-powered distribution lorries in different weight classes (3.5 – 24 t) onto Berlin's roads.

In **Bremen**, the main objective of the project was 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 were set against these objectives: 200 to 250 CNG vehicles should be brought to the streets (through private households, companies and fleet-operators).

In **Göteborg** the objective of the project was to reduce NOx and particle emissions from heavy and distribution traffic in the city centre of Göteborg by influencing private companies to choose "green" HD and distribution vehicles (CNG/CBG vehicles) instead of conventional ones.

In **Graz**, the aim of the project was to accelerate the gradual change from fossil fuel to bio-diesel in the largest taxi fleet in Graz and to provide a bio diesel service station adjacent to the headquarters of the main taxi company.

In **Rotterdam**, the project aimed at using clean vehicles technologies, with the introduction of seven electric vehicles for urban distribution. The vehicles had to prove themselves in the existing logistic systems of three participating companies.

In **Stockholm**, the aim of the project was to increase the number of clean vehicles to reach a breakthrough on the market, through:

- Encouraging the introduction of the clean vehicles among the private companies with subsidies for part of the additional costs;
- Facilitating the procurement of clean vehicles;
- Encouraging vehicle manufacturers to produce clean vehicles ;
- Establishing the network Clean Drivers of Stockholm.

Another project aimed at influencing private companies to choose clean vehicles instead of conventional vehicles, in order to reduce pollutant emissions. By raising the awareness of clean vehicles among important purchasing organisations, the city increased the penetration of clean vehicles in private company fleets.

In **Winchester**, the objectives of the project were to:

- Establish a business case for the introduction of clean engine technology
- Overcome barriers to the introduction of new engine technologies.

A fleet of six clean vehicles was purchased and one vehicle was loaned to each of the participating businesses for up to one month, to aid business community exposure to alternatively fuelled vehicles.

7.3.3 Process Evaluation

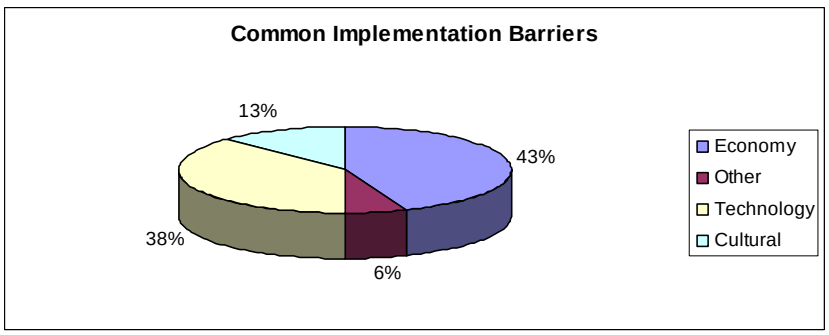
During the measures implementation, the CIVITAS cities faced a number barriers, for which several drivers were employed with the aim of overcoming them, as shown in the following table:

Table 7.4 *Overview of barriers and drivers for private fleets*

CITY	BARRIER	DRIVER
Berlin	• Cultural • Technology	• Information • Legislation & Regulation • Economy
Bremen	• Technology • Economy	• Politics/strategy • Economy • Information • Cooperation
Göteborg	• Technology • Economic • Politics/strategy • Information	• Technology • Economy • Information • Politics/strategy
Rotterdam	• Technology • Economy	• User assessment • Technology
Stockholm	• Cultural/life style	• Economy • Cooperation
Winchester	• Technology • Cultural	• Politics/strategy • Information

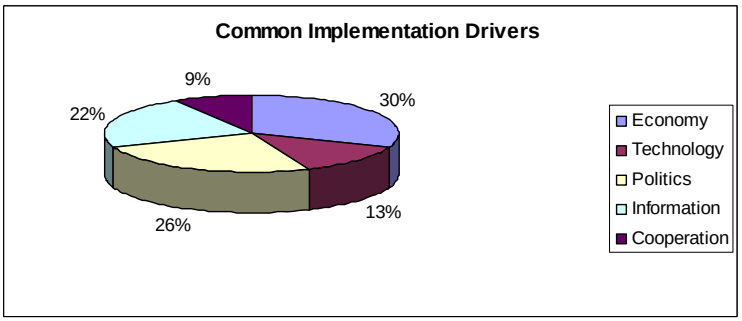
Most of the barriers hindering the implementation of the measures were economy and technology, in particular the high costs for purchasing vehicles, several technical problems due to breakdowns and lack of acceptance among potential buyers and users, as shown in the following figure.

Figure 7.17 *Private Fleets - Common Implementation Barriers*



Economic incentives, strong political commitments, often coupled with well distributed environmental benefits and effective communication campaigns represent the main drivers to overcome the barriers mentioned above.

Figure 7.18 Private Fleets - Common Implementation Drivers



7.3.4 Outputs

Table 7.5 *Overview of the planned and achieved output of the different measures*

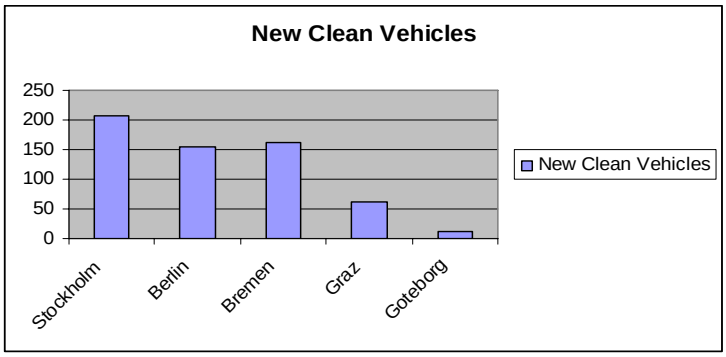
CITY	PLANNED OUTPUT	ACHIEVED OUTPUT	COMPLETION RATE
Berlin	1) Introduction of at least 100 CNG distribution lorries; 2) To improve acceptance and reduce investment costs through incentives, technical and financial assistance.	1) 161 CNG lorries introduced ; 2) Achieved.	Notable
Bremen	Information Campaign and subsidies for introduction of 200-250 CNG vehicles.	160 vehicles purchased.	Notable
Göteborg	Provide subsidies and assistance to companies in order to introduce 2-3 large and 10-15 lighter distribution vehicles.	Output partially modified; 2 large and 10 lighter distribution vehicles were introduced.	Notable
	Implement fast fuel systems of alternative fuels.	Adaptation to increased traffic; a CNG fuel station has been built.	Notable
Graz	120 taxi vehicles converted to bio-diesel.	6 bio diesel vehicles.	Weak
Rotterdam	Tests for 7 electric vehicles.	2 electric vehicles introduced (for a limited period) due to technical problems.	Weak
Stockholm	1) Lowering prices of clean vehicles through common procurement and subsidies. 2) 100 clean vehicles in private companies.	1) Decrease of 4-18%; 2) 206 clean vehicles in private companies.	Notable
	300 substituted clean vehicles in private companies.	More than 3000 vehicles introduced.	Notable
Winchester	Surveys of business and undertaking of trials (on emissions, costs, etc.) with loaning of 6 clean vehicles purchased by HCC. The 6 clean vehicles were loaned to approximately 100 businesses; each trial was typically of a 1 month duration.	3% of participating businesses that were interviewed, 3% had purchased a clean vehicle has a result of the trial.	Notable

7.3.5 Impact evaluation

The rather scarce availability of data does not allow a comprehensive comparison among cities. This is only partially possible for some of the indicators within environment and society impact areas.

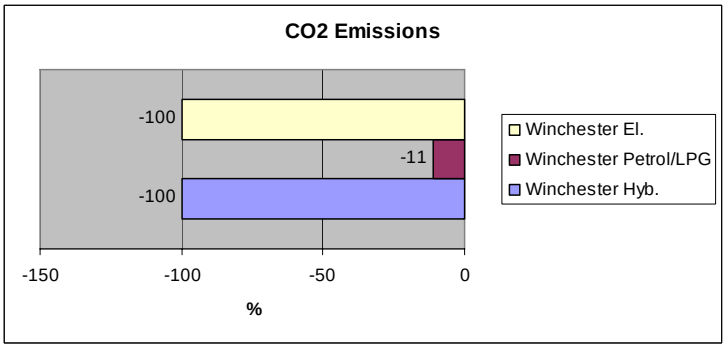
As shown in the following figure the CIVITAS measures promoting clean vehicles have increased the use of environmentally friendly private vehicles. The number of new clean vehicles may appear limited but clean vehicles promotion is at an early stage. Only a few drivers were aware of clean vehicle facilities and infrastructures are ill equipped to deal with the new vehicles representing a great barrier for clean vehicle autonomy.
Impacts on private fleet changes should be considered as very promising. In Stockholm, Berlin and Bremen, a number of purchases have been encouraged by CIVITAS and the results come from business targeted promotion as well as from private owner focus.
In Graz, taxis are new clean vehicles which have turned to bio-diesel technologies. In Göteborg, the new clean vehicles are only heavy duty vehicles achieving only small impacts.

Figure 7.19 New Clean private vehicles



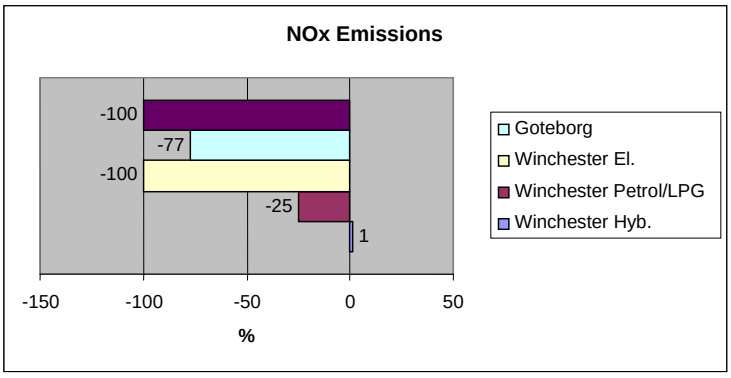
According to purchase surveys, the subsidies available strongly contributed to the purchase of clean vehicles. In Berlin an average subsidy of 4000 Euros was available, in Bremen 2500 Euros while in Stockholm CV prices decreased by 2-3% forming an important impact on CIVITAS measures which should contribute to further expansion of clean vehicles. Important reductions in CO2 emissions have been achieved as indicated in the following chart:

Figure 7.20 **C**O_2 Emissions of clean private fleet vehicles



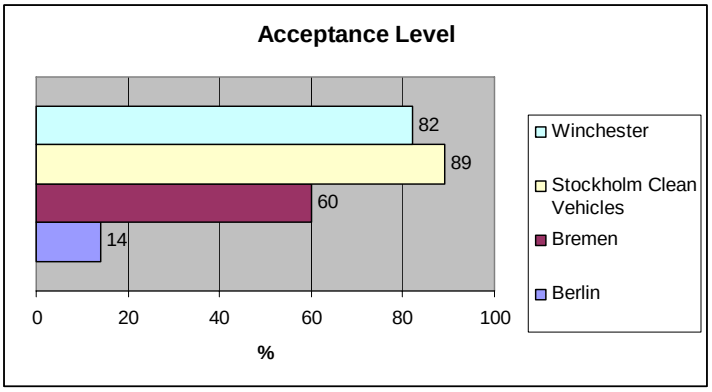
Improvements ranged from 11% in Winchester (using petrol/LPG cars) to 100% also in Winchester (no emissions for electric and for hybrid vehicles). A strong reduction was recorded by Göteborg. Reduction of NOx emissions are very significant, as indicated in the following chart:

Figure 7.21 NOx Emissions of clean private fleet vehicles



Reductions vary between 25% in Winchester (petrol/LPG) and 100% also in Winchester (no emissions for electric and hybrid vehicles). Acceptance levels show positive results in cities where data is available, as indicated in the following chart:

Figure 7.22 Acceptance level of clean private fleet vehicles



Scores range between 14% in Berlin (as ratio between consultation and orders of CNG lorries) and 89% in Stockholm (clean vehicles). In Goteborg, attitude of customers and drivers towards clean vehicles was generally positive.

7.3.6 Conclusions

The cluster on Private Fleets includes a series of differing and non-homogeneous measures however some common lessons can be drawn:

- Energy and environmental impacts are one of the major drivers to develop on the market of clean vehicles and to increase acceptability by users (almost always rather high);
- Economy (in particular higher purchase costs, partly balanced by lower operating costs) represents a major barrier for private users; an appropriate incentive campaign (as Stockholm, Berlin, Bremen, Göteborg) is one of the key issues to ensure success to policies;
- Awareness and information campaigns are fundamental tools to sustain policies of promoting clean vehicles (Stockholm, Berlin, Bremen, Göteborg);
- Technical problems can strongly hamper the effectiveness of clean vehicles promotion and for private users this is an even harder barrier to overcome (Rotterdam, Graz);
- Public-private cooperation and synergies are very important in order to launch and consolidate the clean vehicles market (Göteborg, Stockholm, and Winchester).

7.4 Supporting Infrastructure & Incentives

7.4.1 Introduction of Supporting Infrastructure & Incentives

As perviously mentioned, this cluster includes a rather varied set of measures, among others:

- improvement and construction of infrastructure;

- financial incentives for the purchase of clean vehicles ;
- increasing and optimisation of fuel production;
- reorganisation of fuel supply;
- analysis of clean fuel experiences;
- awareness and communication strategies.

The major focus of the measures was to improve the environment, to comply with air quality standards, to increase the renewable supply of energy sources, to enlarge the distribution infrastructures and to stimulate the penetration of the market by clean vehicles and fuels.

7.4.2 Implementation

In **Bristol**, the objectives of the project were:

- To support the introduction of clean vehicles to assist in meeting local air quality objectives.
- To reduce emissions and human exposure to air pollution.
- To ensure the transport system complements good health and well-being.

This was due to be achieved through new refuelling facilities, the sharing of refuelling facilities and the set up of a clean fuel support network.
Within the same objectives, another project included:

- Introduction of 5 new G-Wiz electric vehicles for use as pool cars by staff;
- Recharging electric vehicle batteries using renewable energy;
- Introduction of school warning signs on roads in the vicinity of schools in the City that use photo voltaic power.
- Investigation of the opportunities to introduce solar powered bus stops in conjunction with upgraded Park & Ride shelter provision, and solar powered mobile traffic signals and VMS.

In **Graz**, the main goal was to transfer a successful, long lasting pilot project into general practice and to achieve a much higher collection rate of used cooking oil, and to increase the awareness on biodiesel and mobility options. The project consisted of optimisation, improvement and extension of the system used to collect waste cooking oil, for use as fuel for the bus and taxi fleets, in combination with mobility consultancy in private households and restaurants (similar to the well-established system of collecting and recycling waste).

In **Lille**, the main issue of the project was to evaluate the feasibility of mass production of biogas, meaning technical reliability, production potential, but also economic competitiveness.

In **Nantes**, a new CNG fuelling station was built in the south of the urban area in order to support the extension of CNG bus public fleet. The choice of Nantes Métropole was to build its own power gas station to reduce the price of the gas delivered to buses.

In **Rome**, the objectives were to increase awareness, satisfaction and usage of electric scooters (e-scooters) and to set up suitable recharging points in the Laboratory Area. Rome Municipality has managed a fleet of 398 e-scooters since 2000. In 2001, a dissemination activity was undertaken with tourist services, non-profit organisations and the general public and the results were encouraging. In addition, the implementation of a network of recharging stations identified 15 priority points partially located in the Laboratory Area.

Figure 7.23 Campaign "Amo Roma GUIDO ELETTRICO"in Rome

In **Stockholm**, the current insufficient infrastructure for bio gas filling stations was considered a main barrier to a market breakthrough for biogas vehicles: at least 10 refueling stations open to the public needed to be realised during the project lifetime.

Another project was to promote and make information on clean vehicles available and easily accessible on a public web site: this was an attempt to break old habits, lack of knowledge and negative attitudes based on lack of information. In this sense, the city reinforced its efforts in the promotion of clean vehicles as a solution for environment and energy matters in order to enlarge the clean vehicles penetration on the market.

7.4.3 Process Evaluation

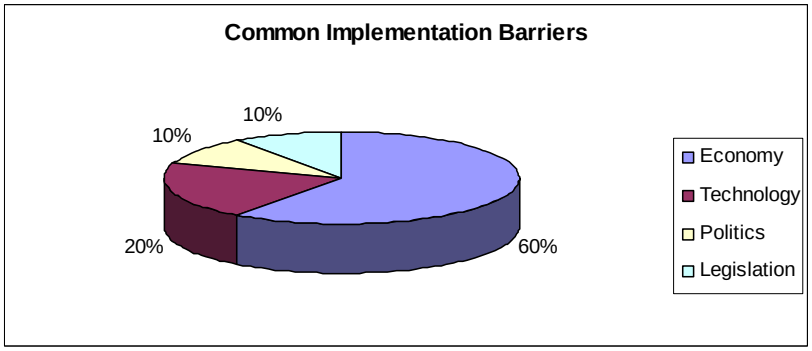
During the implementation of the measures, CIVITAS cities faced several barriers, in some cases overcome by appropriate drivers, as showed in the table below:

Table 7.6 *Overview of barriers and drivers for supporting infrastructure and incentives*

CITY	BARRIER	DRIVER
Bristol	• Economy • Legislation & Regulation	Nothing reported
Graz	• None	• Cooperation • Information
Lille	• Economy	• Politics/strategy • Economy
Nantes	• Nothing reported	• Nothing reported
Rome	• Technology	• Nothing reported
Stockholm	• Economy • Politics/strategy	• Economy • Technology

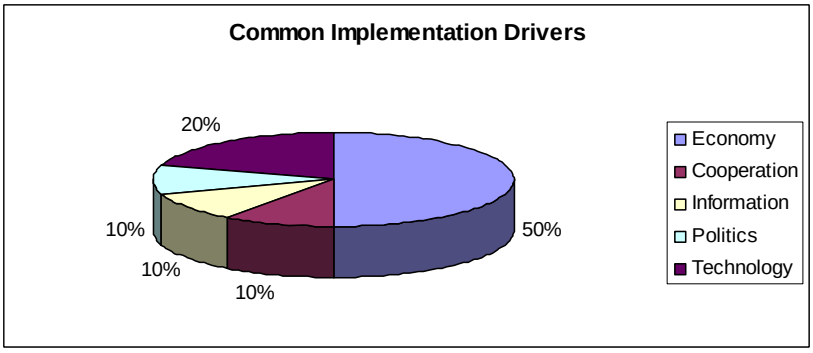
Most of the barriers concern economy and technology: in particular high investment and operating costs for infrastructures as well as technical failures and extremely expensive vehicles. Details of common implementation barriers are shown in the following figure:

Figure 7.24 Supporting Infrastructure & Incentives - Common Implementation Barriers



To help overcome common implementation barriers, institutional and economic partnerships, and comprehensive communication strategies, complemented by financial support to stakeholders is necessary.

Figure 7.25 Supporting Infrastructure & Incentives - Common Implementation Drivers



7.4.4 Outputs

In general, most of the expected outputs were achieved by the CIVITAS cities, even though some activities faced delays or modifications, there was no complete abandonment of measures. Some measures still need to be finalised after the end of the CIVITAS project.

Table 7.7 *Overview planned and achieved output of the different measures*

CITY	PLANNED OUTPUT	ACHIEVED OUTPUT	COMPLETION RATE
Bristol	1) New or upgraded provision of LPG refuelling infrastructure, for municipal fleet and other users. 2) Electric bus battery recharging facilities. 3) Provision of 2 new electric recharging facilities for municipal fleet. 4) Establish agreements and mechanisms to allow a broader cross-section of users to use existing dedicated facilities currently restricted to the operator vehicles. 5) The creation of a widely publicised network (the "Clean Vehicle Support Network") of local vehicle supply and maintenance services to support the uptake of and the conversion towards clean fuel vehicles.	1) Modified: no more required. 2) Modified: no more required. 3) Electric recharging points were introduced at 3 City centre offices in early 2004. 4) Sharing of Refuelling Facilities implemented. 5) Delayed, achieved.	Notable
	1) Installing recharging facilities for 58 electric vehicles5 electric vehicles; 2) Solar School Warning Signs; 3) Other On-Street Applications.	1) recharging facilities installed; 2) 50 solar powered "wig-wag" warning signs; 3) Not implemented.	Weak

Graz	1) Doubling of the total amount of collected oil in households; 2) Reduction of the environmental impact on the sewage system and the costs for water recycling; 3) Reduction of environmental pollution.	1) Partially achieved; 2) reduced; 3) Reduced environmental pollution.	Notable
Lille	1) Increase the production of biogas; 2) A better knowledge about biogas production; 3) Improve experience on biogas production; 4) 1 new biogas refuelling station for buses.	1) To be achieved in 2006; 2) Knowledge about biogas production; 3) experience on biogas production improved; 4) 1 new biogas refuelling station for buses.	Delayed
Nantes	Implementation of a new CNG fuelling station.	Implementation of a new CNG fuelling station	Notable
Rome	1) Allocation plan of 400 e-scooters; 2) Implementation of 8 new recharging stations; 3) Awareness strategy.	1) Allocation plan; 2) Partially delayed, achieved in March 2006. 3) Awareness strategy	Acceptable
Stockholm	1) 4 new biogas filling stations; 2) Assessment of the volume biogas sold and experiences of delivery to fuel stations. 3) Increased use of biogas vehicles.	1) 4 biogas fuelling stations 2) Assessment 3) Achieved	Notable
	Not quantified targets for web-site, measure 12.14	Increasing number of visitors. Highest possible marks from 40% of users, 69% considered it very reliable.	Notable

7.4.5 Impact evaluation

Delayed implementation and missing measurement impacts does not allow for a comprehensive comparison of data between cities, nevertheless available data does allow the detection of certain trends, in particular economic, environmental and social impacts.

- Operating costs decreased in Rome and Nantes, proved to be competitive in Lille, and saved 30.000 € in Graz;
- Estimates for Bristol proved that NOx increased (by some 80%), while CO_2 was reduced by approximately 23%;
- Finally acceptance levels show positive trends in Graz, while Rome and Bristol recorded rather low levels due to technical and financial obstacles.

7.4.6 Conclusions

In general, Supporting Infrastructure & Incentives registers positive records in terms of energy, environmental and economic impacts, while society results are always determined by the effectiveness of communication strategies and by the capillary distribution of clean fuelling facilities as a valid alternative to fossil fuels.

7.5 Transferability

The most relevant objectives in "Clean Vehicles and Fuels" are to reduce emissions of and human exposure to air pollution, to overcome barriers to the introduction of new engine technologies, to accelerate the take up of clean vehicles solutions, to increase the clean vehicles penetration of private company fleets, the promotion of clean vehicles as a solution for environment and energy matters and to optimize production of renewable energy. Clean Vehicles and Fuels measures appear to be the most successful with over half of the measures performing "notably". Yet an important share is still assessed as "weak", which underlines the major barriers encountered in terms of vehicle availability, fuel infrastructures and retrofitting ("Technical Planning", "Economic Planning, "Technology").

The measure type most extensively experienced in CIVITAS was the **"Introduction of Clean Road Vehicles"**. The most referred drivers for the measure were the increased awareness of greenhouse effects and dependency of oil and the rising fossil fuel prices which cause a general support for clean vehicles, (including public and political) the gravity of pollution levels in the city concerned, important knowledge provided by previous experiences, the pre-existence of a support infrastructure, the higher comfort of some clean vehicles and the current conditions of the fleet (which is a stronger driver if they are still old and unclean). Some barriers to the measures' implementation and success were the limited performance of the clean vehicles in relation to traditional ones, technical problems with vehicles, fuels or refuelling stations, the low public appeal of the scheme, including difficulties in user familiarity with new technologies, high cost differentials between cleaner vehicles and conventional vehicles and also high maintenance and fuel prices, the need for new refuelling infrastructures, the public's general perception of the new technologies as unproven and costly, the low interest of car dealers to "launch" clean vehicles and consequent lack of clean fuel car models, delays by suppliers delivering vehicles, long vehicle registration processes and vehicle depreciation (no aftermarket). With regard to crucial actions for the successful of implementation of these measures, recommendations were made for strong communication and awareness campaigns and the realization of strategic partnerships between Public Transport authorities and fuel companies.

Financial support to bus companies may be necessary for them to acquire clean vehicles, provision of tax benefits for clean fuels, and subsidies to new infrastructure. Moreover, there is

the need to subsidize common co-ordinated procurements of clean vehicles, providing parallel incentives such as free parking or exemption from congestion fees, use large-scale strategies for the introduction of clean vehicles, obtain expertise support or to create a second-hand market for clean vehicles. The measure effectiveness can be enhanced if combined with proper measures from other clusters, in particular Zones with Controlled Access, Parking Management or Road Pricing.

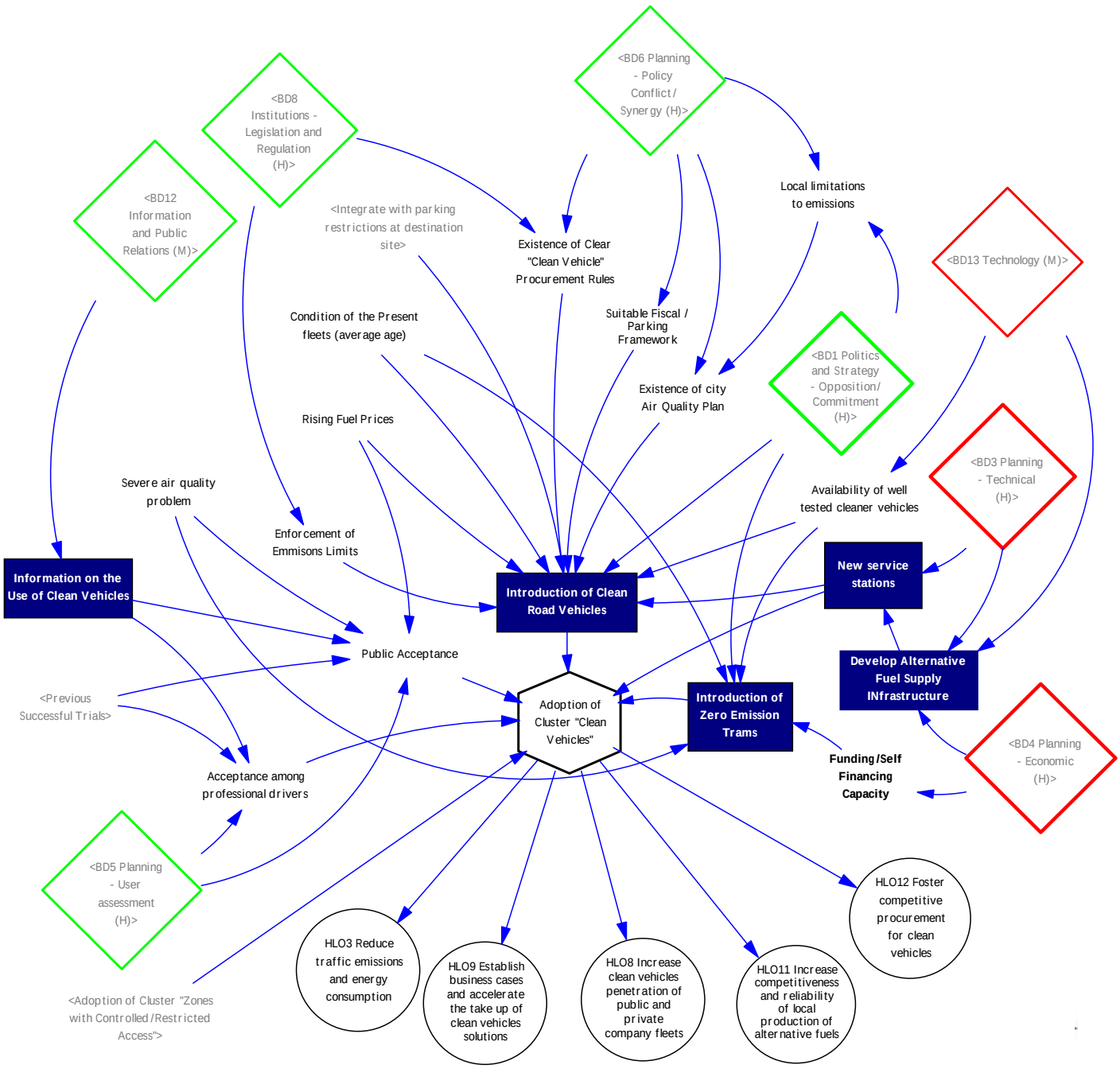
Another measure within the cluster was the "Introduction of Zero Emission Trams". **"New service stations"** were essential in providing the necessary refuelling network. The difficulties experienced for implementation are the necessary investment costs, the difficulty in finding an operator to buy, sell and distribute the fuel and the time needed for market expansion. In addition, setting up a sufficient number of filling stations, subsidizing stations construction, putting the new stations at existing fuel stations, road signs for new directions, providing information and support and focusing on target groups were reported as crucial actions for success.

"Analysis of the biogas experience" identified the requirements for such a measure, which consisted of factors such as complex political consensus (long term investment), motivation of local authorities, economic viability, a high degree of urban waste recycling, full chain control, cooperation with the natural gas provider(s) and an integrated action plan.

The measure **"Information on the Use of Clean Vehicles"** showed the importance of trying to obtain media coverage, of the internet as a primary source and of seminars as an excellent method to inform companies (which can be less expensive through the involvement with seminars from other shareholders). It also shows how important it is to form partnerships with vehicle and fuel suppliers and to put emphasis on lifecycle rather than purchasing costs.

In **"Renewable Energy Supply"**, the main drivers were the geographical position of the city regarding energy supply and past experiences. Drawbacks to the measure were the need to e.g. convince restaurants to adhere to the project, the inability of solar power to provide sufficient energy to solar dependent applications and the inability of suppliers to deliver solar powered bus shelters, along with the need for approval of new type equipment and the still rather underdeveloped conditions of new products.

Figure 7.26 Fundamental Mapping of the Cluster "Clean vehicles and Fuels"



7.6 Overall conclusions of clean vehicles

Clean Vehicles & Fuels was a very important pillar of the CIVITAS Initiative in terms of critical mass and of impacts.

Some overall and aggregated conclusions can be highlighted:

- clean vehicles & fuels produced a significant reduction of pollutant emissions and an improvement in air quality;
- a crucial role was played by local authorities (with public fleets, infrastructures and incentives) in paving the way to boost the clean vehicles and fuel market later followed by private stakeholders (with private fleets);
- Joint procurements and a broad range of incentives to companies and citizens represented a fundamental stimulus to increase the clean vehicles market, allowing the counterbalance of their somewhat higher price in comparison to conventional vehicles;
- A closer cooperation with car dealers, manufacturers and fuel suppliers is required to overcome certain technical inadequacies of the market in terms of vehicle models, performance and affordability, as well as in terms of improved fuelling infrastructures;
- A more coherent fuel taxation policy is necessary at European and national level in order to allow fair and sustainable competition with conventional fuels;
- An important contribution to consolidate the market could be provided, among others, by the implementation of the European Biofuel Directive and by the future European Directive on clean vehicles public procurement, presently at proposal stage.

Table 7.8 *Summary of the overall effects of the cluster clean vehicles*

	Transport	Energy	Environment	Economy	Society
Public fleets	*	☺	☺	☺	☺
Private fleets	*	☺	☺	☺	☺
Supporting infrastructure and incentives	*	☺	☺	☺	😐
Overall	*	☺	☺	☺	☺

8 PUBLIC TRANSPORT

8.1 Introduction

Almost all demonstration cities have included measures on public transport within the CIVITAS I programme. Table 8.1 below presents these measures.

Table 8.1 *Implementation of improving public transport measures*

CITY	CODE	TITLE
Barcelona	7.5	Integration of the tramway in the Collective Passenger Transport network
Berlin	7.5	Future management of urban public transport
Bremen	7.2	Integrated transport pricing system
Bremen	8.4	Hybrid tram
Bristol	5.4	Flywheel powered tram
Bristol	7.2/12.6	Integrated pricing/ Electronic Payment
Bristol	8.7.2	Intermodal integration - walk and ride, bike and ride
Bristol	8.7.3	Park and Ride
Bristol	8.7.4	Interchange facilities
Bristol	8.7.1	Taxi & public transport integration
Bucharest	11.5	Modernizing the ticketing and payment system of the public transport
Cork	7.3	Introduction of new lines - Park and Ride
Goteborg	7.6	Environmental optimised ferry shuttle
Graz	7.5	Customer friendly stops for bus and tram
Kaunas	7.2	Integrated public transport ticketing system
Kaunas	8	Integration of taxi microbuses into public transport services
Kaunas	8.1.2/3	New organisation of planning of public transport services
Kaunas	8.8	Access and security improvements through better information
Lille	11.7	High level service bus routes
Lille	7.2	Public transport security
Lille	6.2	Smart card systems and integrated ticketing
Nantes	IP2-IM1.1	Public transport promotion campaigns - launch of a new student annual fare: the Pass campus
Nantes	IP2-IM1.2	Creation of a new bus route concept: “the chronobus”
Nantes	IP2-IM2	New quality contracts and improvement of public transport perceived quality
Nantes	IP4-IM1	Creation of a new railway link between the towns of Vertou, St Sebastian and Nantes
Nantes	IP4-IM2	Remodelling of RN801 motorway and public transport projects
Nantes	IP5-IM2	Better and new public transport services through a package including a waterbus
Prague	7.7	Introducing low floor midibuses
Rome	7.3	Introduction of new lines by electrical buses and trolleybuses
Rome	7.4	Integration of public transport and collective taxi
Rome	7.1	Improving public transport safety and security
Rotterdam	7.3	Public transport over water
Rotterdam	7.1	Integration of cycling and public transport
Rotterdam	7.4	Automated people movers

CITY	CODE	TITLE
Stockholm	7.1	Increasing public transport passengers
Stockholm	6.1	Smart card systems and integrated ticketing

Public transport ensures that cities are accessible and liveable and contributes to a sustainable transport system. In the old member states there is a revival in the role of public transport in the cities and this is reflected in the CIVITAS I programme.

8.2 Implementation

Within the CIVITAS I measures several themes can be recognised. Several measures contain at least one of the following themes.

Within the theme 'new public transport lines and new service concepts' several innovative projects have been implemented. Innovative aspects include the use of new techniques and the inclusion of the measures in a package. Some projects suffered from technical problems due to new technology, but a number of projects are still in force after CIVITAS and have been implemented within the normal organisation of public transport.

The 'integration' of public transport services and the integration of public transport with other modes is an important issue on agenda's everywhere. Lack of integration is considered the bottleneck for customers' choices regarding public transport based solutions. There is certainly room for improvement on integration within the public transport system between companies and transport modes and between public transport and other modes (taxi, bicycle, car). Integration also contains physical elements such as network and services design and the design of transfers, tariff aspects (integrated ticketing and tariffs) and information aspects (chain-based information). A recent DG-TREN project (2003), "Integration and regulatory structures in Public Transport", reports examples of integration and goes into further detail under various regulatory frameworks, showing that integration and a competitive market can go hand in hand.

Improving 'quality' is a theme in many measures, including certification and the introduction of quality systems. Customer satisfaction systems are used to measure the impact.

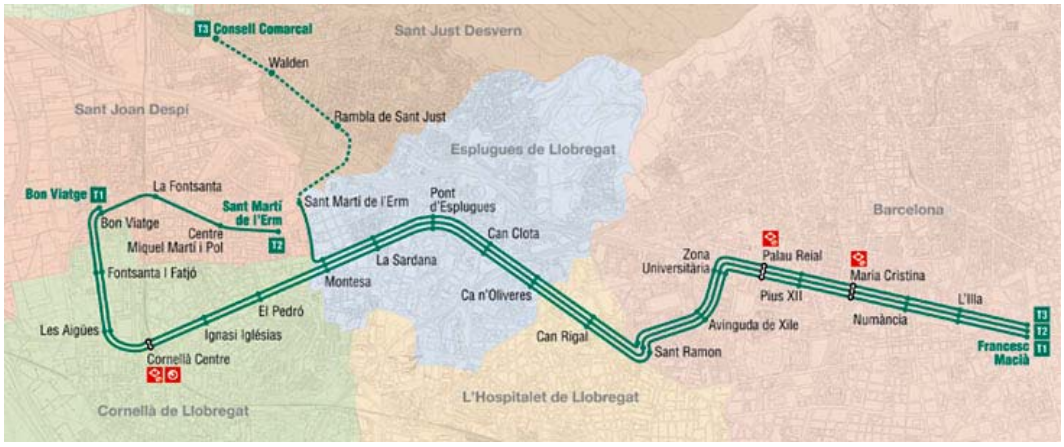
'Security' has become one of the main topics in public transport. Both terrorism and vandalism pose threats to the image of public transport and have an impact on the general feelings of the public safety.[17]

[17] More information on the role of public transport in the city can be obtained through the organisation of public transport operators UITP (www.uitp.com).

In France new, well designed, tramway systems are attracting new customers to Public Transport, among them many former car users. The introduction of the new system was generally accompanied by a set of measures to rebalance the modal split and to revitalise the city. The new tramway system in Barcelona is a good example of a newly introduced system within CIVITAS I (see figure 8.1.). In Bremen the new system, as planned in the CIVITAS program, is still under construction.

New tramway systems are expensive and only cost effective if heavy passenger flows can be accommodated. In Rome, the conversion to a trolleybus and the extension of the electrical bus network was realised within the timeframe of CIVITAS I and proved to be successful. In Nantes a high performance bus line is to be completed by the end of 2006.

Figure 8.1 *Barcelona's Diagonal-Baix Llobregat tramway scheme*



Within CIVITAS new experimental forms of transport were introduced with mixed success. An environmentally friendly ferry was introduced in Göteborg, an automatic people mover in Rotterdam and a flywheel powered tram in Bristol which all suffered teething problems and the pilots were not realised within the CIVITAS I project; the electrical buses and the battery powered trolleybus in the historical centre (both in Rome) are however technically reliable and the hybrid tram in Bremen also looks promising.

Improvements to bus systems can also be successful especially when implemented with a package of accompanying measures. The park and ride systems in Bristol and Cork are good examples of combining measures with parking measures. Quality measures were also introduced to bus systems: quality systems and contracts (Nantes), bus lanes and improved interchanges (Bristol, Lille, Nantes) and improved accessibility at stops (Graz).

Integration between public transport and the bicycle system was implemented in Bristol, Nantes, and Rotterdam; the measures consisted of improved parking facilities for bicycles. A branch Railway was successfully upgraded in Nantes. Waterbuses/taxis were implemented in Nantes and Rotterdam.

In many cities in the new member states car ownership is growing and public transport has to fight for its life; cities will have to recognise the benefits and try to maintain the present high modal share of public transport. Kaunas is an example where within CIVITAS 1, measures were taken to maintain the position of public transport. Other examples include Prague and Rome, and in Bristol a taxi sharing scheme enabled journeys to be integrated effectively with public transport services. Although new services are well accepted; costs per passenger are in general relatively high, so resolving the funding problem is essential.

In Stockholm a package of quality and marketing activities was implemented; the impact on public transport use was considerable.

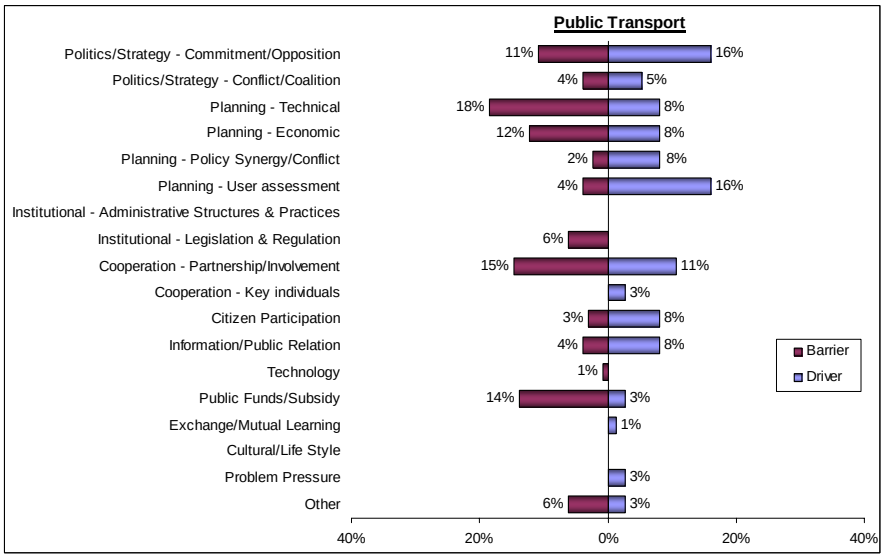
Several cities (Bremen, Bucharest, Lille, Kaunas, Stockholm) planned the introduction of smart card systems during the CIVITAS I projects. The introduction however proved to be a very complex process, leading to delays. The process of introducing smart cards will be continued after CIVITAS I has been completed. Within the CIVITAS I programme new pricing strategies were introduced, such as the student pass in Nantes, the introduction of several innovative tariffs in Bremen and the fare integration in Lille.
Security measures were implemented in buses and trams in Lille and a video based innovative security program was tested in the metro of Rome.

8.3 Process evaluation

The implementation of measures in this cluster appears to struggle in particular with technical and economic planning issues (negative cost/benefit ratio for public transport). They are equally hampered by “Partnership/Involvement” problems (especially where public transport is private, issues regarding deregulation and revenue distribution), while depending more than others on “Public Funds” regarding the need for expensive long-term investments. In turn, “Political Commitment” and “User Assessment” are identified as the most important drivers, while “Citizen Participation” and “Information and Public Relations” are seen to provide above average support to implementation.

Public transport measures benefit from a comparatively high acceptance among politicians and citizens, but run into problems surrounding technical planning and cooperation. The low impact of “Policy Synergies” could be an indication that integration aspects should be considered more duly in the future (Figure 3.18).

Figure 8.2 *Barrier/Driver profile for "public transport" measures*



8.4 Outputs

In general the measures delivered the output as described in the original planning such as new lines and concepts, better integration, services with improved quality and accessibility, innovative tariffs, security systems and better planning systems. The measures that did not deliver output within the CIVITAS I project had implementation problems; a number of smart card systems were delayed due to their complexity, certain measures in the theme "new modes and technology" had technical implementation problems and a number extensions of high quality networks were problematic due to the construction time required.

Table 8.2 *Planned and achieved output of the public transport measures*

CITY	LANNED OUTPUT	ACHIEVED OUTPUT	COMPLETION RATE
Barcelona	• Integration of the new tramway network within the total public transport network • Achieving an operational speed of 20km/h • Quantifying of benefits of the tramway • Reporting of best practice in implementation of the tramway	• Tramway running as part of the integrated network with passenger volumes above expectations; also strong integration with walking • Operational speed of 18.5km/h	Notable
Berlin	• Decision on future management structure of public transport based on the output of a management game • To achieve standards for future tendering public transport • Benchmark for future public transport plans	• Better insight in best future structure of organisation of public transport	Acceptable

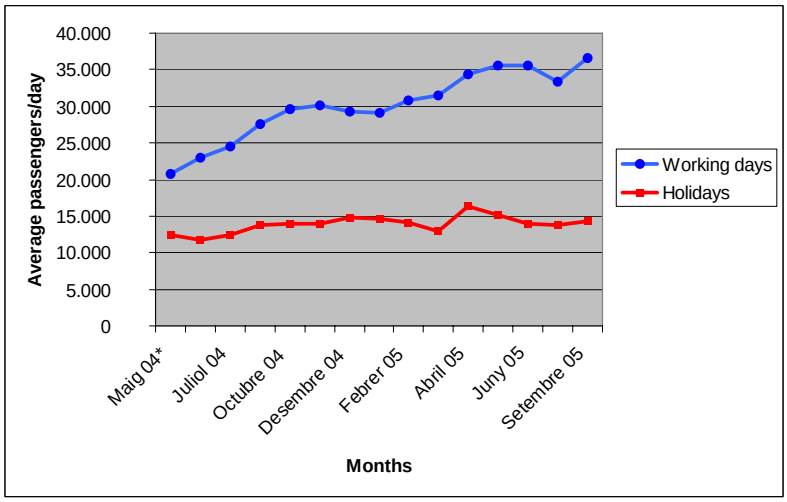
Bremen	• To increase use of season tickets • To increase the use of electronic tickets • Relief of congestion • Increase public transport modal split	• Public transport increased, however measurement took place in another corridor than the corridor with the proposed tramway extension due to the date of implementation • Electronical ticketing not yet introduced (was not part of CIVITAS measure)	Notable
Bristol	• To provide and promote quality alternatives to the car • Ensure that the transport system contributes towards a successful economy • To achieve an integral pricing and electronic payment system	• Successful park and ride system • Successful public transport and taxi integration • Pilot with integration public transport with cycling • Smart card not realised during CIVITAS I • UK first purpose built cycle resource centre	Acceptable
Bucharest	• To implement fare integration and contact less smartcard technology	• Due to delays no output received in the CIVITAS project	Delayed
Cork	• Provide at least 450 park and ride spaces at a new site • To achieve park and ride patronage at full capacity	• Over 900 park and ride spaces provided • Full capacity of park and ride patronage	Notable
Göteborg	• To introduce an environmentally optimised ferry shuttle	• Not implemented	Abandoned
Graz	• Better accessibility and better information at bus stops	• More stops than envisaged were rebuilt; information profile at stops slightly altered	Notable
Kaunas	• New electronic integrated ticket system • Better integration public transport -taxi's • Better information in public transport • Better planning system in public transport	• New ticket system not yet introduced • Better integration public transport -taxi's • Better information in public transport • Better planning system in public transport	Acceptable
Lille	• New bus lanes • Implementation of a safety plan • Integrated ticketing and smart card system	• New bus lanes • Implementation of a safety plan • Integrated ticketing ; smart card in preparation	Acceptable
Nantes	• New student pass • New bus concept "Chronobus" • New quality contract with public transport operator • New rail link with park and ride and provisions for bicycles • Remodelling a motorway with better access for public transport • Introduction waterbus	• New student pass • New bus concept "Chronobus" on 2 routes (increased speed and increased reliability) • New quality contract with public transport operator • New rail link with park and ride and provisions for bicycles • Remodelling a motorway with better access for public transport partly completed • Introduction waterbus	Acceptable
Prague	• Introduce low floor midi buses	• Introduced low floor midi buses	Notable

Rome	• Introduce more electrical buses and reintroducing the trolleybus • Introduce integration collective taxi's and public transport • Experiment with a new safety and security system	• Introduced more electrical buses and reintroducing the trolleybus • Introduced integration collective taxi's and public transport • Experimented with a new safety and security system executed	Notable
Rotterdam	• Waterbus system • Guarded parking places and improved non guarded facilities for bicycles • Automatic people mover	• Waterbus system introduced but suspended at the end of the project • Guarded parking places and improved non guarded facilities for bicycles • Automatic people mover delayed due to technical problems	Notable
Stockholm	• Packages of measures to increase public transport use • Smart card system	• Packages of measures to increase public transport use introduced • Introduction part of smart card system	Acceptable

8.5 Impact analysis

The main impact of the measures to promote public transport was the growth of public transport patronage. Several increases in public transport volumes to the order of more than 10.000 passengers a day were realized as a result of the CIVITAS measures, such as the new tram in Barcelona, see figure 8.2, the tramway extensions in Bremen, the trolleybus in Rome and the use of the system in Stockholm. Projects on a smaller scale were also successful, with about 1.000 additional passengers a day, such as the park and ride services in Cork and Bristol, the measures on quality, the upgraded rail link and the student pass in Nantes and the electric buses and collective taxi's in Rome.

Figure 8.3 *Trambaix tramway passenger volumes (to September 2005), source ATM*



Subsequent impacts were environmental improvements and a reduction in the use of energy. An increased awareness on environmental issues was also reported in many cities. The impact on the economy however is mixed: in financial terms the costs are generally higher than the benefits, even in cases where the net benefits for society are positive. Funding remains a critical issue; by combining several measures within a package there is scope for innovative funding.

Table 8.3 *Impact of the public transport measures*

CITY	IMPACT ON PT USE	IMPACT ON AWARENESS	REMARKS
Barcelona	• New tram line carries more passengers than forecasted (November 2005: 41.000/day) • Former car users 18%; modal shift from former car users was 7% • 40% of the trips new generated (predicted 20%)	• Positive achievement of the high speed of the system • Better social inclusion (wheelchairs, baby chairs) due to good accessibility	Combination of new line with redevelopment of an area; more new lines will follow
Bremen	• Increase of patronage of tram extensions number of regular public transport users raised	• Raise of awareness in: • Punctuality • Speed • Availability of seats • Quality of the stop	Measure was a tramway extension; the survey was held on the previous tram extension due to late implementation of the CIVITAS measure; results were expected to be similar
Bristol	• Rising use of public transport from park and ride site on two bus routes • Impact of bicycle and ride and integration taxi services limited	• Measured positive awareness of information provided service/infrastructure improvements and of environmental aspects	More priority to public transport could enforce the impact further
Cork	• Rise from patronage on public transport due to an average of 500 parking places/day occupied	• High user acceptance (83% very positive) • High safety acceptance (85% very positive • High acceptance of information (70% very positive)	Effects on environment were measured Park and ride measures going to be extended
Graz	• No direct impact reported	• Survey of users showed that users are satisfied with the improved facilities and information	Measure was related to improved facilities at stops
Kaunas	• Package of measures to improve quality of public transport should reverse declining trend in public transport due to rising motorisation; no figures reported	• Several elements of the improvements were recognised	Measures were cost-effective; which is very important in the Kaunas context
Lille	• Increased speed on various bus routes reported; evaluation of patronage not yet complete	• Safety measures were recognised by the public	Impact will be enforced by creating more bus lanes

Nantes	• Increased number of student cards by 35% • Increased patronage on the two "Chronobus" lines (25% resp. 7%) • Traffic tripled on improved rail link • Satisfactory use of the waterbuses	• Better perceived quality on routes affected by the measures (from the Chronobus users 28% perceived better quality)	All measures are going to be continued or extended
Prague	• Acceptable patronage on the new minibus services; however mostly transfers	• Positive contribution to the image of public transport	Costs are a barrier for continuation/ extension
Rome	• Number of new users on electrical buses 20000/month • Trolleybusline carries 32000passengers/day • Use of Taxibus services raised from 16000/month to 90000/month	• The measures on electrical buses and trolleybus raised awareness on clean transport from 53% to 76% and satisfaction from 3.6 to 3.96 on a 1-5 scale	Electrical buses and trolleybus have a large impact on emissions
Rotterdam	• Impact of the bicycle measures was a positive development of public transport use	• Positive acceptance of bicycles measures	Watertaxi is mostly creating "fun" users
Stockholm	• Growth of public transport patronage about 10% (60000 passengers /day) in 6 years	• No increase in customer satisfaction	More measures will follow to achieve the objective of 15% more passengers and 15% more satisfied habitants

Both the present level of integration within the public transport and integration between public transport and other modes are in most cases below the optimal level from a customer's point of view. Many integration measures are not expensive; they do however require good organisation. The integration between the train system and the local bus and rail system is often underdeveloped; even small improvements can sometimes make the whole public transport system more appealing. Park and ride facilities need a minimum number of users to be economically viable; an alternative without such a minimum requirement is the provision of parking facilities using existing services. The integration of public transport with cycling often suffers from the current lack of a "cycling culture" which could in many cases be pinpointed as the problem and not the attempt to achieve integration. Integration of public transport with taxi services is usually introduced on a smaller scale: large scale application could disturb the "normal" taxi market.

New lines of public transport have to be assessed case-by-case; there is no general rule to follow. New concepts generally have a pilot-character showing the approach to a new system. Examples of this in CIVITAS I are: taxis, water taxi's, people movers, (hybrid) trams, shuttle buses, and minibuses. Once a pilot is successful the most favourable level of application will probably be above that of the pilot.

Security measures and accessibility measures generally need to be continuously upgraded and public awareness will rise in the course of an integral application. If choices have to be made due to cost constraints the optimum level can be calculated using cost/ benefit analysis.

8.6 Transferability

The most important objectives of the cluster of measures "**Public Transport**" were to improve the safety and security of public transport, to improve the appeal of public transport, cost efficiency, energy efficiency, reduce air pollution, address the needs mobility of niche markets and achieve a modal shift from private to public transport.

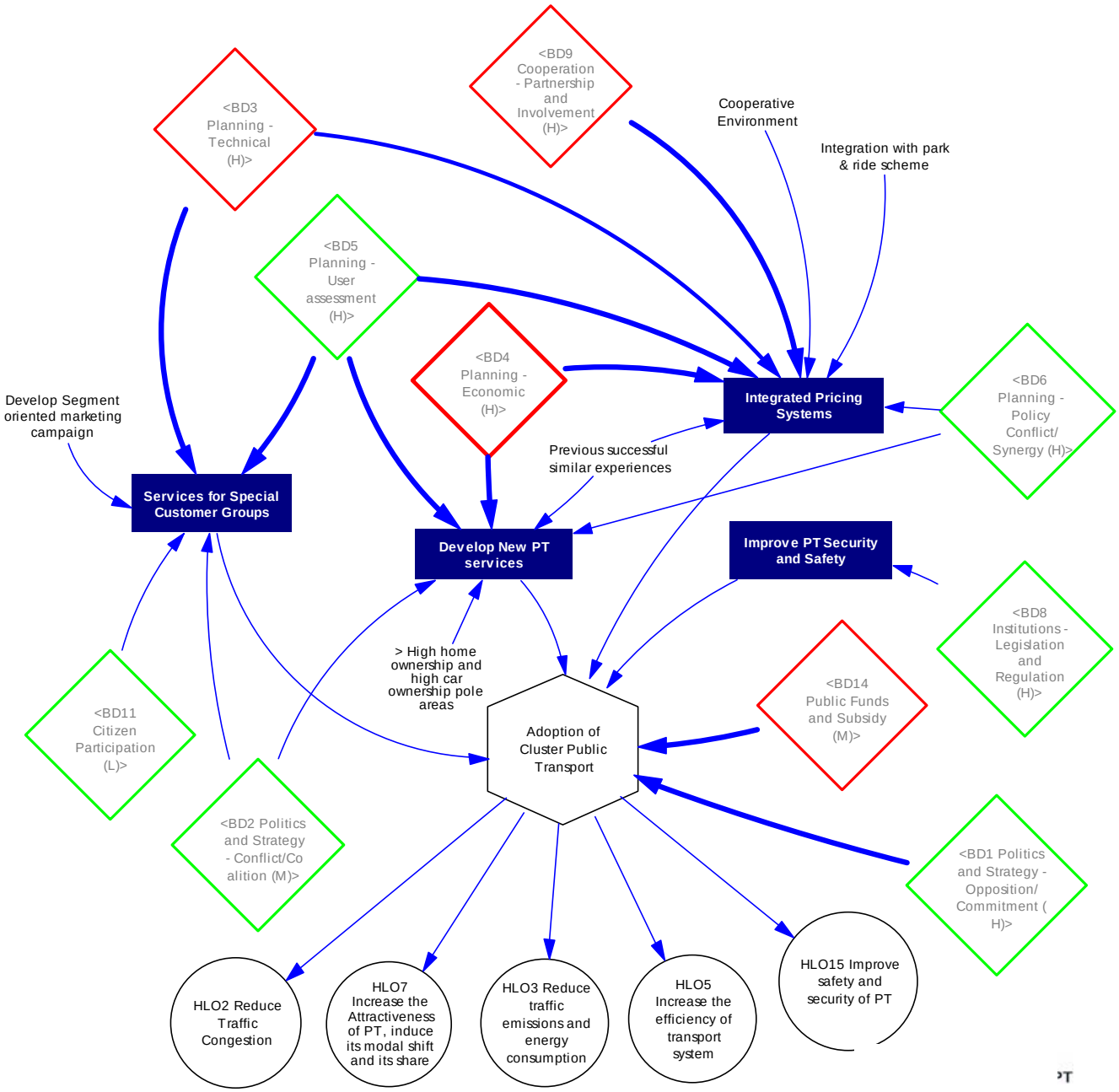
To **"ImprovePublic TransportSecurity and Safety"** was one of the cluster measures. The initial investment along with the difficulty in implementing joint actions between various entities can be considered a barrier. A large scale implementation and the set up of a legal framework for cooperation between the entities involved were identified as crucial actions for success.

The measure **"New Public Transport services"** primarily requires demand. Public support and previous successful experiences were also indicated as drivers. On the barriers side, the high investment costs, the eventual controversy around the project (requiring political legitimacy), the need for agreement from different municipalities, pressure groups against the project (car drivers and shopkeepers), high home and car ownership areas, uncertainty regarding the success of the measures and disturbances to traffic caused were identified by the cities. With regard to the most relevant actions for success, formal and informal participation activities, the consideration of alternative proposals and communication with pressure groups and the general public were mentioned.

"Services for Special Customer Groups" was another measure within the Public Transport cluster. The measure was reported to have benefited from the available national and regional funds, the availability of infrastructure and a proper political context. No specific barriers were identified. The actions for success were good planning, personal engagement and cooperation between all parties, implementing lessons learned from other European examples or segment oriented marketing campaigns.

The **"Integrated Pricing Systems"** was partly possible due to the cooperation of operators. Barriers were identified as lack of preparation by operating contractors, miscalculated schedules for preparation prior to and during the procurement, difficulties relating to supplies, legal complexity of processes, investment due to technical difficulties and the existence of privately owned public transport. A number of recommendations for future reference were to realise a study of similar experiences, to properly inform and provide assistance to passengers, to anticipate unexpected problems and to integrate all sections of the scheme in a single procurement. This type of measure can be successfully integrated with park and ride.

Figure 8.4 Fundamental Mapping of the Cluster "Public Transport"



8.7 Conclusion of the cluster

Collective transport and in particular public transport is an important alternative to the car in the cities and many measures in CIVITAS I concentrated on this theme. The improvement of the

quantity and quality of the system on offer is important; innovative services and integration of services can help to improve the system. However, without supporting measures or developing a package of measures, the impact is limited. Related measures include marketing, information systems, raising awareness, measures on restrictions and pricing regarding car use, integration of modes within a chain-based approach and city (re)development.

In many cities available funds are limited and measures must be implemented in a cost effective manner. Innovative strategies can contribute by improving the image of public transport. Security and access for people with reduced mobility remain areas of concern and always need to be taken into consideration.

In many cases CIVITAS public transport measures support measures on public transport that already existed in many cities prior to CIVITAS. Public transport lines are very expensive and cannot be implemented solely using CIVITAS funding. The supporting actions that have been implemented via CIVITAS are positive towards the use of public transport in general which explains why the impact categories Transport, Energy, Environment and Society are positively ranked. As public transport is not cost effective and financially self supporting, the impact category "Economy" is negative in all cases.

Table 8.4 *Summary of the overall effects of the cluster public transport*

Theme	Transport	Energy	Environment	Economy	Society
Public transport	☺	☺	☺	☹	☺

9 GOODS DISTRIBUTION AND LOGISTIC SERVICES

9.1 Introduction

Goods distribution and logistic services is the only topic in CIVITAS directly relating to freight transport. In the field of sustainable city transport systems this is logical since this is the only real freight transport occurring in city centres. The impact of freight movements can be quite high (noise and pollution related impacts) and it is therefore advisable to include the integration of this topic in city transport system improvements.

There were 17 measures taken in 11 CIVITAS I cities relating to this cluster. The main topics of this theme are:

- Bundling of goods delivery
- Guided routes for goods delivery
- Use of clean vehicles

Within the topic bundling of goods delivery a number of measures were taken:

- the use of an inner city logistics centre
- use of permits for certain types of delivery vehicles and restrictions for other types
- promotion of contact between companies to stimulate bundling

The aim of the majority of the measures is to reduce congestion and to improve the environment. [18]

[18] Within the DG-TREN BESTUFS projects more details on demonstration projects relating to goods distribution can be found. BESTUFS II CA is a follow-up initiative of the thematic network BESTUFS and aims to maintain and expand an open European network between urban freight transport experts, user groups/associations, ongoing projects, the relevant European Commission Directorates and representatives of national, regional and local transport administrations and transport operators in order to identify and furthermore to describe and disseminate best practices, success criteria and bottlenecks with respect to City Logistics.

The overriding objective of BESTUFS II is the collection, synthesis and dissemination of information on good practices related to urban freight transport operations, strategies and policies that will in turn promote sustainable urban freight operations.

Table 9.1 *Implementation of goods distribution measures within CIVITAS-I*

CITY	CODE	TITLE
Barcelona	9	New concepts of distribution of goods
Berlin	9.3	Inner city Logistics Centre
Berlin	9.4	Financing contracts for CNG vehicles
Bremen	10.1	City logistic scheme/freight village
Bristol	10.1	City logistic centre Scheme/Clean goods
Bristol	10.2	Freight Loading/Signing Strategies
Bristol	10.3	Community Delivery Points
Göteborg	9.5	Incentives for improving the load factor in inner-city freight transport
Göteborg	10.5	Consumer driven goods management from a Mobility Centre base
Graz	9.2	Distribution of goods- green city logistics
Nantes	IP3-IM0	Distribution of goods
Rome	9.1	Kerbside-doorstep delivery
Rotterdam	9.1	E-commerce logistics
Rotterdam	9.2	Multi core tube logistics
Stockholm	9.1	Material logistic centre- to optimise freight deliveries at construction sites
Stockholm	9.3	Logistic centre for the old town of Stockholm
Winchester	9.2	Sustainable Urban Distribution

9.2 Implementation

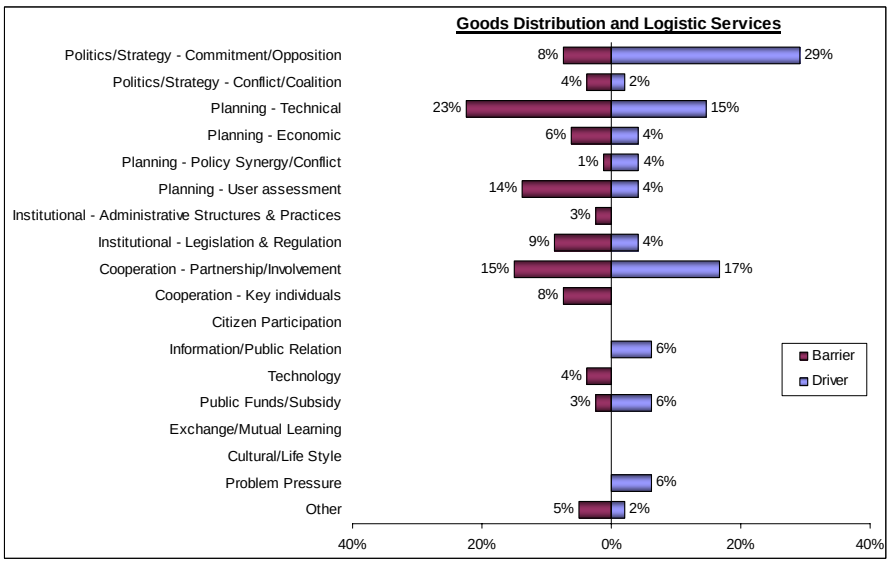
Many measures were successfully implemented although certain measures suffered delays or were only partly implemented during the project period due to the fact that the realisation of the logistics centre where the measures were to take place was delayed. Measures using ‘clean’ trucks in Bristol and Bremen could not be implemented as the trucks were not available and the measures had to be realised using regular trucks. Nevertheless a lot of implementation knowledge was gained and all cities involved learnt a lot about the implementation process behind the complex measures within the CIVITAS projects.

9.3 Process evaluation

The strong influence of “Political Commitment” on implementation is remarkable for measures in this cluster. It reflects the significant implications of measures in this field for the local private sector (commerce and freight), making adequate political backing a key success criterion. “Partnership/Involvement” also appears to be a particularly sensitive issue here. Together with the above average importance attributed to ”User Assessment” problems (existing diversity of commercial logistic networks, low priority of environmental issues) this underlines the need for broad co-operation among all stakeholders concerned (authorities, retailers, hauliers, local main-ports etc.) in order to establish common objectives and to avoid a possible imbalance of competitive advantages. Moreover, “Technical Planning” has also had a

negative influence on implementation, in particular regarding the limited availability of clean delivery vehicles (Figure 3.19).

Figure 9.1 Barrier/Driver profile for ”Goods Distribution and Logistic Services”



9.4 Outputs

The output delivered consists, in most cases, of demonstration projects and studies. In several cases the measure is continued after the project, as is the case in Barcelona, Bristol and Stockholm. In Göteborg (the inner city freight transport project) and Rotterdam (the multi core tube) up-scaling possibilities are investigated.

Table 9.2 *Planned and achieved output of the goods distribution measures*

CITY	PLANNED OUTPUT	ACHIEVED OUTPUT	COMPLETION RATE
Barcelona	▪ Multi-use lane for better vehicle circulation ▪ Adapted 40ton lorry for night delivery ▪ Loading/Unloading active guide ▪ Kerbside loading/unloading	▪ Multi use lane with ▪ Demonstration with night delivery by an adapted truck ▪ Loading/unloading active guide ▪ Experiment with kerbside loading/unloading	Notable
Berlin	▪ Optimised leasing concept	▪ Innovative leasing concept ▪ Website on leasing of CNG-vehicles www.erdgasfahrzeuge-leasing.de	Notable
Bremen	▪ Introducing of a city logistic scheme using CNG trucks	▪ Introducing of a city logistic scheme using regular trucks	Weak
Bristol	▪ Introducing a city logistic scheme ▪ Atlas showing preferred routes ▪ Variable message signs for trucks ▪ Trials of a community delivery points ▪ Home shopping using clean trucks	▪ Introducing a city logistic plan ▪ Atlas showing preferred routes ▪ Variable massage signs for trucks ▪ Trials of a community delivery points ▪ Home shopping using regular trucks	Notable
Göteborg	▪ Development of a scheme for improvement of the load factor in inner city freight transport and demonstration/ pilot of this scheme	▪ Development of a scheme for improvement of the load factor in inner city freight transport and demonstration/ pilot of this scheme	Notable
Graz	▪ Bundling of good distribution	▪ Agreements on bundling at two sites	Acceptable
Nantes	▪ Concept of goods distribution in the city	▪ Concept completed, implementation not during the CIVITAS programme	Weak
Rome	▪ Feasibility study on kerbside-doorstep delivery	▪ Feasibility study on kerbside-doorstep delivery	Weak
Rotterdam	▪ E-commerce logistic system ▪ Logistics system using a multi-core tube in the harbour	▪ Logistic system using a multi-core tube realised	Acceptable
Stockholm	▪ Inner city delivery using clean vehicles	▪ Inner city delivery using clean vehicles	Notable
Winchester	▪ Several improvements of goods distribution	▪ A collect point scheme ▪ A freight map ▪ A waste recycling scheme	Acceptable

9.5 Impact analysis

The main impact objectives were a reduction in kilometres in goods delivery transport and an improvement in environmental indicators and energy indicators based on the reduction of the vehicle kilometres in goods delivery and from the use of environmentally friendly vehicles.

Two cities that have quantified transport impacts and saved emissions due to the measures in CIVITAS I are Göteborg and Stockholm

The aim of the Lundby Mobility Centre, one of the two measures in Göteborg was to establish contacts between wholesalers of office material and companies on the northern bank of the river, and through a voluntary agreement between both parties to reduce the number of transports of office material by 30%. The objectives were to reduce air pollution and noise levels and to improve public-private co-operation. In total 17 companies participated. The majority showed a reduction in the transport frequency of office material by 30 to 80 percent with a average of 41%. The overall effect is that out of 101.5 transports per month to the target companies, 42 no longer take place as a direct result of the measure.

The Old Town logistic centre in Stockholm was aiming to establish a smart logistical solution to deliver goods to clients in the old town with small, clean vehicles. The objectives were to reduce the number of small direct deliveries, reduce congestion, energy use and emissions and to improve the environment. The project has been successful in reducing queue time, reducing the number of trips, emissions and achieving energy savings.

The other measure in the Stockholm project consisted of the implementation of a logistics centre for construction materials to a building site. The aim was to reduce the number of small direct deliveries, congestion, energy use, emissions and noise and to improve living conditions and the working environment.

The project has succeeded in reducing exhaust emissions, noise, congestion, energy use and the total number of trips whilst obtaining a more-or-less break even financial operation.

Table 9.3 *Impact of the measures in the cluster goods distribution*

City	Transport	Environment
Göteborg	Transport frequency down by 41%	Saved emissions: 260 kg CO_2, 1,8 kg NOx, 0,03 kg PM, 0,45 kg HC, 0,07 kg SO_2
Stockholm	Decreased number of trips: from 120.000 to 117.268 (>2%)	Less exhaust emissions: 110 ton/year CO_2, 1 ton/year NOx, 0,8 ton/year PM. Noise level the same

In Rotterdam a multi core tube system was created as an alternative to road surface transport within a city environment.

A multi-core tube system was built in the harbour of Rotterdam. The aim was for reductions in road transport and a more efficient use of underground space with a reliable, cost effective and time saving alternative to lorries and inland shipping and it should have achieved a positive effect on the environment and harbour accessibility (less congestion and air pollution) and road

safety should have improved. Cost comparisons with other modes were not made due to lack of data and the confidentiality of certain financial data. A break-even point was expected several months after the project evaluation. A modal shift has actually taken place, but only from inland waterway transport to tube. The goods now transported by the tubes should be considered new goods flows, instead of substituting transport by other modes. There were only slight reductions of emissions and noise because waterway transport was substituted instead of road transport. Most indicators had a neutral or positive effect.

9.6 Transferability

The objectives of the cluster "Goods distribution and logistic services" were to enable goods operators to improve the exploitation of freight capacities, increase the efficiency of transport networks, reduce congestion, reduce energy use and emissions and improve enforcement efficiency.

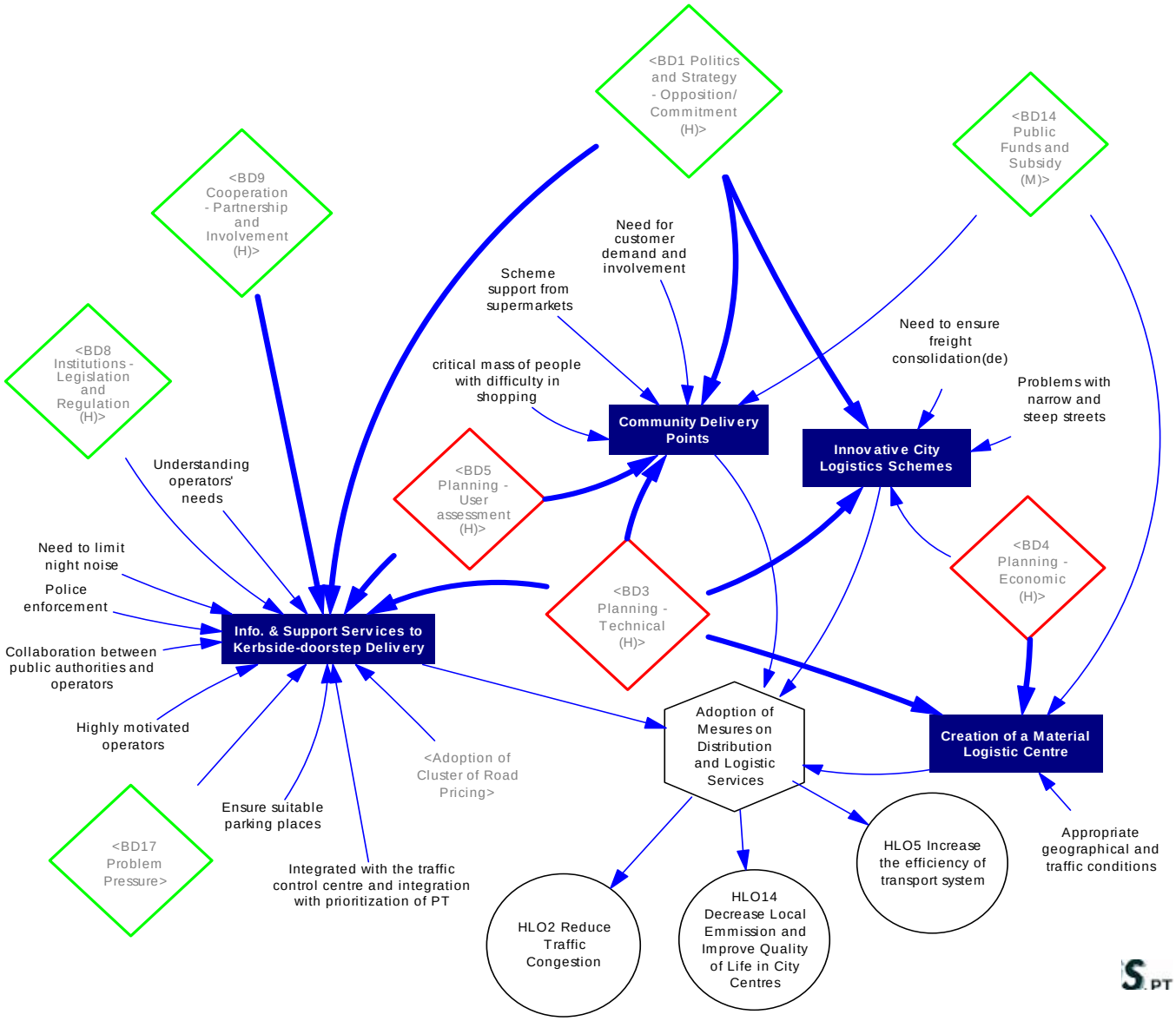
The measure **"Info. & Support Services to Kerbside-doorstep Delivery"** required political will, highly motivated operators, initiative from the operators and collaboration with public authorities. The main barriers to implementation were the conflict of interests between operators and residents, mistrust felt by the local operators, lack of parking places and loading slots, public acceptance of the reduction in parking places, noise during the night or supply needs during specific time frames. Police enforcement is in some contexts essential for the measure's effectiveness. The use of silent vehicles and processes is a requirement for night operations. Understanding operators' needs, introducing experimental traffic regulations, need for economies of scale, integration with a traffic control centre and integration with prioritization of public transport were also regarded as important actions for measure success.

The measure **"City Logistics Schemes"** involved numerous cities with corresponding experiences, permitting a large set of information aggregation. The similar drivers related to the large number of organisations being supplied with little cooperation between them, narrow and steep streets, the presence of cars causing a disturbance to pedestrians, initiatives from NGOs, support from key local and national stakeholders, political support, a positive reception of the scheme by the media and availability of external funding. Some of the most relevant barriers reported were difficulties of familiarity with a new scheme, the dependence on private companies for the project implementation, the time required for planning, lack of political support, the individual interests of local businesses not being coincident with the general interest, distrust among project partner companies, ignorance of shop owners concerning logistics, atomisation of the sending-sizes or absence of previous national experiences (generating scepticism). A number of actions for success were to incorporate the scheme into the system of internet retailers, award partners at the beginning by offering special services, law enforcement to force or award the forwarders to drive fully loaded, learning from previous experiences, engagement of stakeholders in the development at an early stage, ensure a reliable and if possible improved level of service, approach large businesses or to serve clients with

special needs instead of focusing on the city centre. If done in conjunction with other goods delivery measures, it is easier to involve stakeholders in discussions and information sharing.

The **"Creation of a Material Logistic Centre"** measure was driven by the large numbers of deliveries and partners, appropriate geographical and traffic conditions and political support. Barriers against the effectiveness of the measure were an initial negative feeling about measure among stakeholders and a conservative industry. Some factors to enable success were the existence of a strong coordinator, economical support (to overcome the conservative attitude/culture within the industry) and involving the organisations to disucss threats and opportunities. Recognition of the measures from stakeholders comes with implementation, and prices may be raised as the clients become familiar with the measure. The last measure within Goods Distribution and Logistic Services is **"Community Delivery Points"**, which requires a substantial number of people where shopping poses a problem, due to e.g. the inexistence of shops near people's homes. A support scheme from supermarkets is required for measure implementation. The barriers encountered regarding the measures were the difficulties of using the designed reservation system (internet), in particular the elderly, a suitable supermarket for home deliveries, the cost of the "companions" and consequent need of funding, delays caused by the low priority given to the scheme by supermarkets.

Figure 9.2 Fundamental Mapping of the Cluster "Goods distribution and logistic services"



9.7 Conclusions of the cluster

The main impact objectives were a reduction in kilometres for goods delivery transport and an improvement of the environmental indicators and energy indicators based on the reduction of the goods delivery vehicle kilometres and from the use of environmentally friendly vehicles. The studies showed the potential impacts; in the demonstration projects they were realised in practice. It has however proven to be very difficult to measure the impacts: in several cases the impacts from a demonstration project are based on model exercises or on questionnaires on

perceived impacts by stakeholders. Nevertheless measures in this cluster are promising and in general not specific per city.

By reducing the number of kilometres per freight movement, there is a positive effect on transport, environment and energy. The reductions are in many cases also market driven and therefore economically positive. The effects on society are in most cases positive: this can be expected although there is no actual proof available. In CIVITAS cases this has been measured as neutral and in some cases (Stockholm) positive.

Table 9.4 *Summary of the overall effects on the cluster goods distribution*

	Transport	**Energy**	**Environment**	**Economy**	**Society**
Goods distribution	☺	☺	☺	☺	😐/☺

10 PARKING MANAGEMENT

10.1 Introduction

Park and Ride parking management is being considered by all cities as the central issue for traffic and transport urban policies. Parking management is a flexible tool, suitable for targeting various groups and to fulfil a large panel of objectives.

Eleven parking management measures have been supported in ten cities throughout Europe. Three different approaches have been proposed for the parking measures and issues within CIVITAS:

- Berlin's measure focused mainly on ***innovative technical solutions*** for improving payment facilities, and overcoming legislative barriers at national and state level.
- Graz, Stockholm and Winchester focussed on 'group-pricing' and parking management in order to ***increase the attractiveness of clean vehicles***.
- Bucharest, Cork, Nantes, Pecs, Rome and Rotterdam aimed at developing a more efficient parking management strategy with a wider range of challenges and goals, e.g. reducing traffic and increasing the liveability of a city. Parking management is implemented as a ***general traffic demand management tool***.

The eleven CIVITAS parking measures are enumerated in table 10.1.

Figure 10.1 The parking management measures within CIVITAS I

CITY	CODE	TITLE
Berlin	6.4	Tele-parking System/ Mobile parking
Bucharest	5.5	Parking restrictions in central areas.
Bucharest	6.3	Demand depending strategies for paid parking.
Cork	11.2	Improved Network management: park by mobile phone
Graz	6.4	Integrated pricing strategy for parking zones – differentiation between polluting and non-polluting vehicles.
Nantes	IP2-IM6	New parking policy and strategy.
Pecs	6.5	Establishment of a zone-model parking in the central city area.
Rome	6.2	Environmental Parking Charge.
Rotterdam	6.1	PARK & RIDE pricing strategies for target groups.
Stockholm	6.3	Reduced parking fees to promote clean vehicles.
Winchester	6.2	Adoption of flexible parking policies and environmentally linked parking charges.

10.2 Implementation

The principal aims of parking management measures are to rationalise urban spaces, to change mobility practices and to initiate a modal split by reducing car use facilities. A more efficient park and ride management policy leads primarily to the regeneration of urban spaces which increases public appeal. Adapted parking management plays an important role in improving the city centre and prevents situations, as shown in the figure below, where cars parked on pavements prevent pedestrians' right of way of.
The long term aim is to reduce traffic permits and in doing so also reduce the use of energy in line with urban ecologic issues. Parking management is also a useful tool for more modest goals such as revenue growth and the promotion of clean vehicles.

Figure 10.2 Parking on the pavement in Nantes city centre prior to implementation

Figure 10.3 Special parking price for low emission cars "Umweltjeton" (Graz)

Parking management measures implement tools such as:

- Price changes: Focus-group prices, Zone tariffs, etc.;
- Change of parking availability: Increase or reduction in the number of parking spaces,
- Enforcement of the measures;
- Use of new technological systems.

Figure 10.4 New Parking House in Bucharest

In CIVITAS, all the above-mentioned tools have been used. The multi-storey car park "Parking House" in Bucharest was constructed and realised thanks to the CIVITAS Initiative.

Figure 10.5 Parking garage under Karmelitzerplatz (Graz)

10.3 Process evaluation

Parking management measures that redistribute the available parking spaces in the inner city areas typically enter into conflict with individuals defending their right to park in the city against the best interests of the general public. Resistance from residents fearing the loss of their right to park close to their homes or retailers who worry that lack of accessibility for vehicles may affect sales, as well as opposition from parking operators have characterised the implementation of such measures. In addition, several measures also struggled with existing parking regulations that clashed with the envisaged restrictions (possible exemptions for clean vehicles or the establishment of pricing according to zone and time). Peripheral Park and Ride facilities also suffered from the difficulty of bringing together very diverse actors and interests in order to achieve suitable integration of all transport modes (public transport, private car, cycling, walking) which formed the principal barrier. The essential driver for the implementation of parking management appears to be strong "Political Commitment", to ensure the required co-operation and applying pressure where necessary. The existence of a policy framework (e.g. air quality management plan) that underpins parking management measures has also been necessary to facilitate implementation.

10.4 Outputs

As shown in the following table, very efficient plans were put into practice for CIVITAS parking management measures. The anticipated output was generally achieved except in Winchester where the ANPR scheme has not been implemented. A few delays occurred, usually as a direct result of difficulties in coordination between participants although this didn't obstruct the actual implementation of the plans.

Table 10.1 *Planned and achieved output of parking management measures*

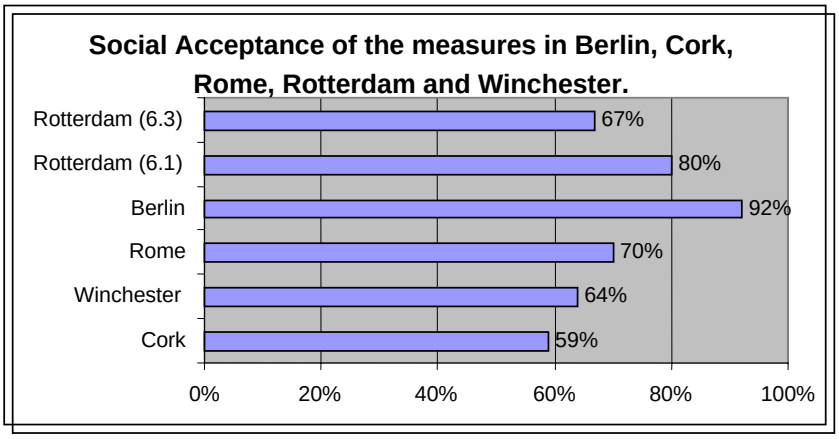
CITY	PLANNED OUTPUT	ACTUAL OUTPUT	COMPLETION RATE
Berlin	▪ Hiring new employees. ▪ Establishment of an innovative parking management	▪ A sample of 300 persons. ▪ 6800 users (2/2006) ▪ New legislative rules in favour of more flexible parking regulations	Notable
Bucharest	▪ Reorganisation of Parking offer.	▪ A new parking house of 1000 places. ▪ Suppression of parking in central area. ▪ Police enforcement	Acceptable
Cork	▪ New Park and Ride spaces at Blackash. ▪ Achieve and maintain Park and Ride patronage at near full capacity. ▪ Modernisation of park infrastructure.	▪ subscriber database. ▪ New printers. ▪ over 900 Park and Ride spaces at Blackash.	Notable
Graz	▪ Implementation of Focus-group Pricing scheme.	▪ Office for registration at the council. ▪ Clean Vehicle official sticker. ▪ Extension of the "blue zone" (10.000 -> 15.000 parking spaces)	Notable
Nantes	▪ New police parking control team. ▪ Construction of new pay parking. ▪ Reorganisation of existing parking spaces.	▪ New squad of 33 policemen and 3 officers for control enforcement. ▪ 5 new outdoor park. ▪ Parking guide for citizens. ▪ Strong modification of existing pay parking spaces.	Notable
Pecs	▪ Design and reorganisation of parking spaces and attached equipment.	▪ establishment of free parking spaces out of the city centre. ▪ Limited parking time process in the city centre.	Acceptable
Rome	▪ To reach 65.000 on street park spaces. ▪ Operation of technical support (payment systems and informatics' management).	▪ ICT control and payment technology. ▪ Installation of new terminals. ▪ Reach 78.000 on street park places	Acceptable
Rotterdam (M.6.3)	▪ Parking meters and signs.	▪ Parking meters and signs.	Acceptable

CITY	PLANNED OUTPUT	ACTUAL OUTPUT	COMPLETION RATE
Rotterdam (M.6.1)	▪ Control team. ▪ Electronic control.	▪ New Controllers. ▪ Electronic control system.	Notable
Stockholm	▪ Implementation of system for reduced parking fees for clean vehicles	▪ Municipal Regulation .	Notable
Winchester	▪ Implement a parking policy to deter long-stay car parking in the city centre and encourage use of park and ride ▪ Provide car parking incentives to encourage use of cleaner vehicles ▪ Conversion of some city centres car parks from 'Pay and Display' to 'Pay on Foot' and implementation of Automatic Number Plate Recognition (ANPR) system.	▪ Implementation of a parking policy to deter long-stay car parking in the city centre and encourage use of park and ride ▪ Provided car parking incentives to encourage use of clean cleaner vehicles ▪ Conversion of four city centre car parks from 'Pay and Display' to 'Pay on Foot' ▪ ANPR system implemented	Acceptable

10.5 Impact evaluation

The results from parking management measures have been extremely positive. The main social impact is represented by the level of social acceptance. As seen in the following Figure, the level of satisfaction from the public is high. The impressive level of satisfaction in Berlin can be attributed to the fact that the parking management implementation was free of charge.

Figure 10.6 Social Acceptance of the measures in Berlin, Cork, Rome, Rotterdam and Winchester.



The direct impact of the measures is also confirmed by the results and feedback from local managers engaged in this CIVITAS measure. The following pictures show the impact of

parking management improvements in Bucharest. On the left the city-centre before the reorientation of the parking management strategy, on the left after.

Figure 10.7 Impact of parking in pedestrian areas in Bucharest

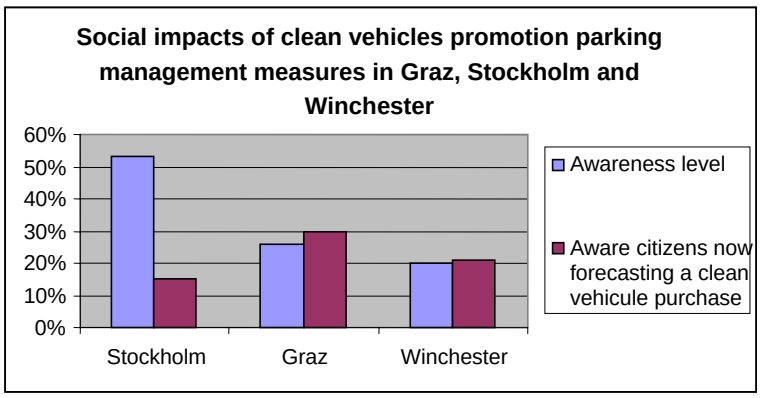
Quantifiable impacts of parking management measures are difficult to assess due to strong correlations with limited access restriction measures implemented in CIVITAS Initiatives. Five of the ten cities (Bucharest, Cork, Pecs, Rome and Stockholm) merged these measures, a number of conclusions can however be drawn:

- Observed mobility survey in the cities which developed a parking strategy showed that parking policy is an effective instrument for increasing the accessibility of an area, to reduce the use of cars and to increase the liveability of a neighbourhood.
- In Winchester, the management of parking spaces contributed to a 16% decline in ticket sales in the city-centre car park and a 43% increase in the Park and Ride ticket sales.
- Limited access measures and parking management rely on each other and CIVITAS experiences attest their high efficiency in joint implementation.
- In Pecs, the application of both measures reduced traffic by 80% in the inner-city.
- An efficient parking management can produce revenue growth. The rate of return can range from immediate revenue to long term impacts. In Rome, a 15% increase in Revenue has already been established and 8% in Winchester. In Nantes and Bucharest, the primary expenditure will be recuperated within a few years.
- From a Welfare point of view, positive socio-economic impacts are certain**.**

Impacts of Parking measures for *clean vehicles promotion* seem marginal because of low level of concerned citizens. However, these measures have to be considered as a success.

As show in figure 10.8, these initiatives considerably impacted awareness of journalists, politicians and citizens about clean vehicles existence. A significant number of citizens are now considering the eventual purchase of clean vehicles in the concerned cities. That can have considerable influences in the future.

Figure 10.8 Example of social impacts of clean vehicles promotion parking management measures in Graz, Stockholm and Winchester



The results from the CIVITAS Parking Management measures are extremely positive. All cities are continuing with the implemented parking management measures. Only Rotterdam's "Demand depending strategy for paid parking" measure has been aborted as there were not enough users in Rotterdam.

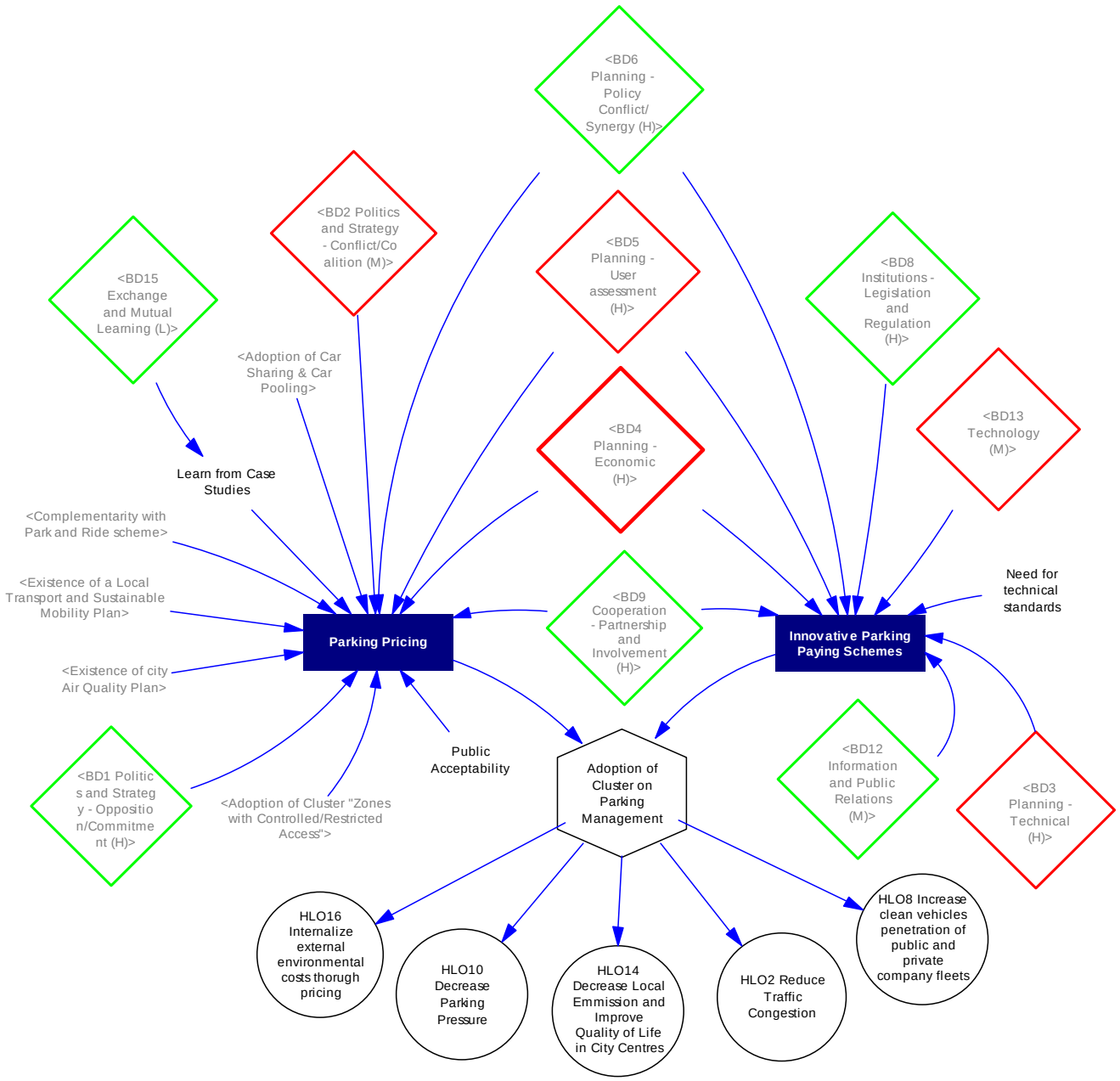
10.6 Transferability

The main stated objectives of the cluster Parking Management were to promote the energy efficiency of the vehicle fleet, to internalise external environmental costs and to enable more flexible and cost-efficient parking management. Two types of measures were included in this cluster. The first is **"Parking Pricing"** in which the integration with an existing Air Quality Action Plan, its integration within a project (TRENDSETTER) and political support were considered drivers. The barriers reported were technical problems applicable to new technology, problems with cross-organisational co-operation with the introduction of more radical schemes, political and institutional barriers to new parking policies/charges, public reluctance to accept new, "unproven" car technologies, delays due to the political process, the legal framework and the lack of standards for criteria fulfilment. The most relevant crucial actions for success were, taking the political risk involved into consideration, communicating the benefits to citizens, using simple technology, not underestimating the time needed for changing local law, setting up a steering group with involving key stakeholders, analysing similar cases and best practices prior to implementation, not taking revenue from the system (to improve acceptance), providing information and the opportunity to discuss the measure (for better support). One of the parking pricing systems only seemed to achieve success if it was integrated with a package of sustainable mobility policies, e.g. Park and Ride.

"Innovative Parking Paying Schemes" benefited from its status as an EU-Project from an acceptability perspective, there were however several obstacles, namely the extra price/effort by

users, legal hindrances, the potential resistance due to loss of jobs or expectancy of lower income or lack of user orientation. The free mobile calls scheme, the adaptation of legislation, the cooperation with several public administrations and personal commitment were reported as crucial issues for success.

Figure 10.9 Fundamental Mapping of the Cluster "Parking management"



10.7 Conclusion

- CIVITAS Initiative implementations of parking management have clearly been successful.
- All measures have been strongly supported by politicians and citizens. Support from local authorities and good communication has ensured implementation success and wide acceptance. The lack of an adequate legal framework remains a barrier and can cause delays.
- Parking Management can be used as a global instrument or as a focus measure. Experienced measures show the efficiency of parking management policies but also their flexibility.
- Parking management generally require large investments for building new car parks. Active participation of private groups is a great success factor for introducing parking management measures.
- The impacts and therefore the efficiency have been shown in both cases. Parking management can influence the behaviour of focus groups and can also reduce traffic, congestion, noise and pollution.

Table 10.2 *Summary of the overall effects of the cluster parking management*

	Transport	Energy	Environment	Economy	Society
Parking management	☺	☺	☺	😐	☺

11 ROAD PRICING

11.1 Introduction

Current CIVITAS Initiative experiences have confirmed that Road Pricing in urban areas is a fully fledged transport policy instrument and is being considered more and more by local authorities .

Figure 11.1 The Road Pricing recognition system in Rome

The implementation of road pricing schemes is a long term project and this is mainly due to a certain political and public reluctance. In this context, the CIVITAS initiative time span was not long enough to reach final implementation and also the reason why road pricing measures consisted of supporting implementation.

The four Road Pricing measures of CIVITAS are enumerated in the table below.

Table 11.1 *Overview of road pricing measures within CIVITAS 1*

CITY	CODE	TITLE
Berlin	6.5	Concept for heavy-duty vehicles road pricing
Rome	6.1	Time Based Road Pricing
Rotterdam	6.2	Kilometre Pricing
Stockholm	5.6	Congestion Charging

In Berlin, the road pricing measure was a conceptual “emission based” road pricing scheme for heavy duty vehicles. This was a demonstration measure acting as a preparatory step for the introduction of road pricing in Berlin, the aim being to study potential impacts of road pricing on external environmental and traffic costs.

In Rotterdam, the road pricing measure also had a demonstration character. The Dutch ministry of traffic and transport aimed at implementing kilometre pricing projects for national highways and this type of program will of course impact local mobility. The city of Rotterdam was therefore responsible for evaluating and monitoring the effects in order to contribute to the development of the kilometre road pricing scheme design for the region.

Stockholm's congestion charging measure's main aim was to evaluate the impacts of the Stockholm road pricing trial.

Rome's time based road pricing measure also consists of an evaluation plan to primarily assess the performance of the operating scheme (access restriction and road pricing) in terms of design and chosen technology. Secondly to analyse the feasibility of a road pricing policy for tourist coaches.

11.2 Implementation

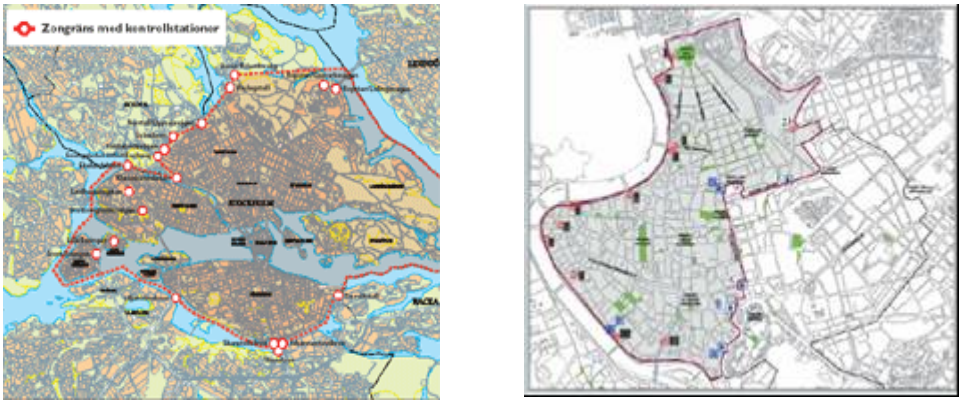
The main objectives of road pricing are:

- To increase the economic efficiency of transport systems internalising external costs generated by drivers but covered by welfares and their citizens.
- To improve the liveability and sustainability of cities.
- To protect the environment whilst reducing pollutant emissions.
- To increase safety in urban areas.
- To reduce the impact of transport systems' on human health.
- To create growth in revenue.

The concept of Road Pricing is to transform a free access zone into a fee-operated area. City centres are generally the most congested parts of cities and so the principally targeted. In order to focus on specific zones of the city, peak traffic times or specific transport groups; road pricing programs are generally subjected to price modulations. Drivers are charged manually or whenever they pass a gate with a system of Automatic Number Plate Recognition (ANPR).

The two pictures below, exemplify two areas subjected to road pricing. The charging zone in Stockholm on the left, and on the right Rome. However, Rome, with a scheme mixing road pricing and access restriction may be differentiated from Stockholm. Technical features of the scheme (number of gates, recognition system…) differ in accordance to local needs.

Figure 11.2 Charged zones in Stockholm on the left and Rome on the right



Several European Projects (like IMPRINT, PROGRESS, CUPID[19] and cities like Bergen, Oslo, London and Trondheim) dealt with urban road pricing measures and detailed barriers and drivers to its implementation. Some cities already implemented Road Pricing systems.

11.3 Process evaluation

The implementation of the four measures in this cluster highlight a number of barriers for road pricing measures that point towards the need for harmonised regulation and coordination on higher levels. On the one hand, an unclear legal situation regarding the status of congestion charges and their use in public budgets has slowed down the decision making process (Stockholm, Rome) while on the other hand, a strong interdependence with the set-up of national highway toll systems has impeded key decisions and choices regarding technology and regulation (Berlin, Rotterdam), which in the case of Rotterdam actually led to the cancellation of the entire measure. Furthermore, the lack of acceptance by citizens played a significant role and as a barrier to implementation in Rome.

The diversity of success levels among only four measures (abandoned, delayed, weak, acceptable) illustrates the considerable uncertainties and risks linked to measures in this still relatively new policy field. “Political Commitment” appears to be crucial in providing the required security for actions, as well as the existence of good practice examples that strengthen the central argument (feasibility of cost internalisation).

[19] For more detailed information on the mentioned project see the websites for these projects http://transport-pricing.net/ .

11.4 Outputs

Table 11.2 *Planned and achieved output of road pricing measures*

CITY	PLANNED OUTPUT	ACTUAL OUTPUT	COMPLETION RATE
Berlin	▪ Design for a multifunctional road pricing scheme for Berlin.	▪ Theoretical modelling survey.	Notable
Rome	▪ Framework for night access restriction and bus access. ▪ Technical support for two wheels recognition.	▪ Additional OCR camera with better resolution to recognise mopeds. ▪ New legal framework extending access restriction to weekends night. ▪ Definition of the new legal "coach plan".	Delayed
Rotterdam	▪ Trial of kilometre pricing scheme. ▪ Evaluation of impacts.	▪ Abandoned	Abandoned
Stockholm	▪ Feasibility studies and a handbook	▪ Feasibility studies and a handbook.	Notable

The city of Berlin was aiming for an original Road Pricing program focusing on heavy Duty Vehicles (HDV). The theoretical analysis of the context has been carried-out and the results identified economic benefits, which arise from the reduction of mileage of HDV, reduced congestion levels and the consequent reduction in air and noise pollution. However, in comparison to the installation and operational costs, the potential gain in welfare benefits seems appears to be very small. The conclusion is that the implementation of the explored environmentally oriented HDV charging system in Berlin cannot be recommended.

In Rome, measures have been delayed. The evaluation processes weren't delivered in time or couldn't be done at all because of delays in the implementation process.

In Stockholm, the evaluation period was shorter due to delays but results are available.

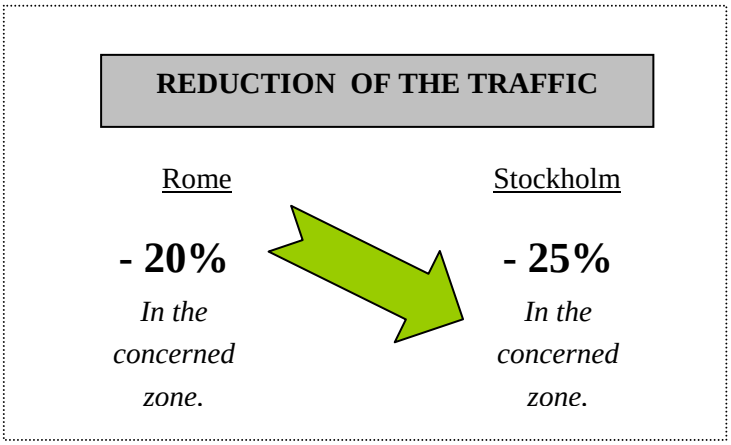
The city of Rotterdam was forced to completely abort the national highway network distance pricing project due political instability and lack of support.

11.5 Impact evaluation

Measure delays in Rome, Rotterdam and Stockholm produced data on the impacts of Road Pricing within CIVITAS lifetime but did not go into depth on the issues of the relevancy and efficiency of such a policy. Some results are now available and confirm positive road user charging impacts in urban areas.

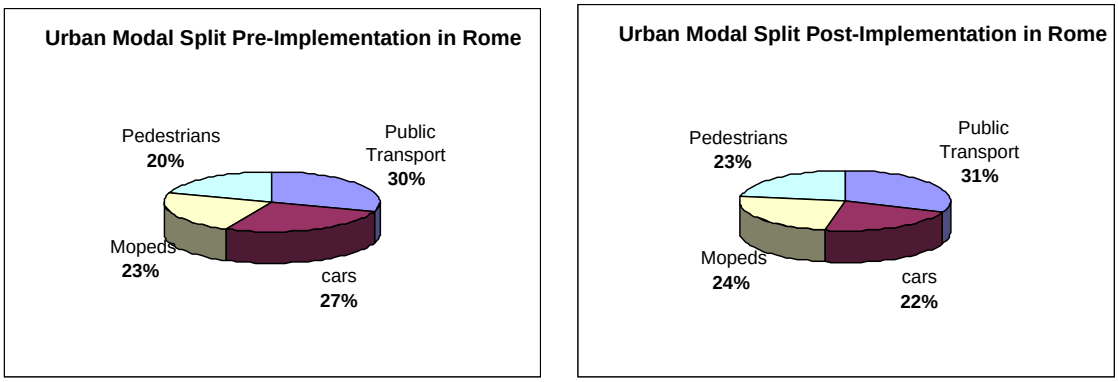
The assessment of impacts of road pricing is often a complex process. While changes in traffic habits are direct impacts as shown below, ecologic impacts, changes regarding safety, and health impacts can only be thoroughly evaluated over a long period of time.

Figure 11.3 Traffic changes in Stockholm and Rome charged zones



The impact of road pricing implementation on transport is significant. An encouraging impact for the future is the change in mobility patterns that it generates. As observed in Rome (e.g. following figures) citizens generally react to road charging by switching from one mode to another.

Figure 11.4 Rome urban modal split before and after road charging

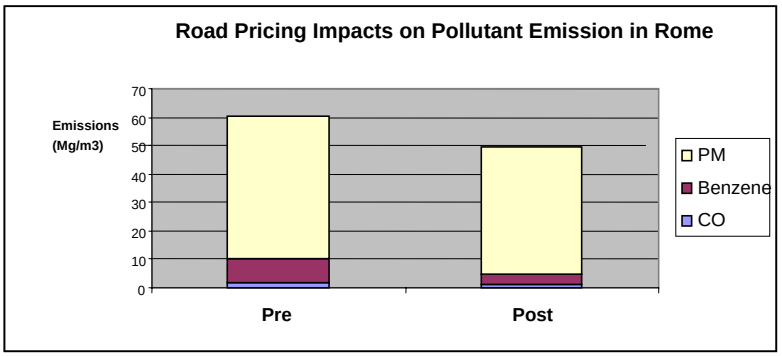


The change in practices is based on a reduction in car use. Citizens choose either to walk shorter trips or to use public transport, cycles or mopeds for longer distances. The choice for public transport relies heavily on the supply service quality level.

From an environmental point of view, road pricing has a positive impact on the liveability in city centres' due to the initiated reductions in traffic.

In Rome there was a reduction in air pollution and CO and PM emissions reached lower levels with repercussions on inner and outer city areas. Impacts have also been noticed during the trial in Stockholm and results now show that CO_2 has been reduced by 14% in the inner city and emissions of particles have been reduced by 1/10.

Figure 11.5 Example of environment impacts from Road Pricing in Rome



Understanding the origins of environment amelioration is complex. Part of the environmental improvements can also to be attributed to other measures (e.g. access restriction, restrictive parking management…), which doesn't mean road pricing has no influence in these areas but highlights the need for *pre* and *post* evaluations.

The main Road Pricing economic effects are linked to the reduction in costs generated by congestion (time loss, fixed costs of car use etc), in the rise of revenue and improved economic activities (shops, tourism, etc).
Road pricing contributes to the regulation of peak traffic periods. The following figure presents the results from one simulation weekend in Rome, subsequent studies confirmed the initial data.

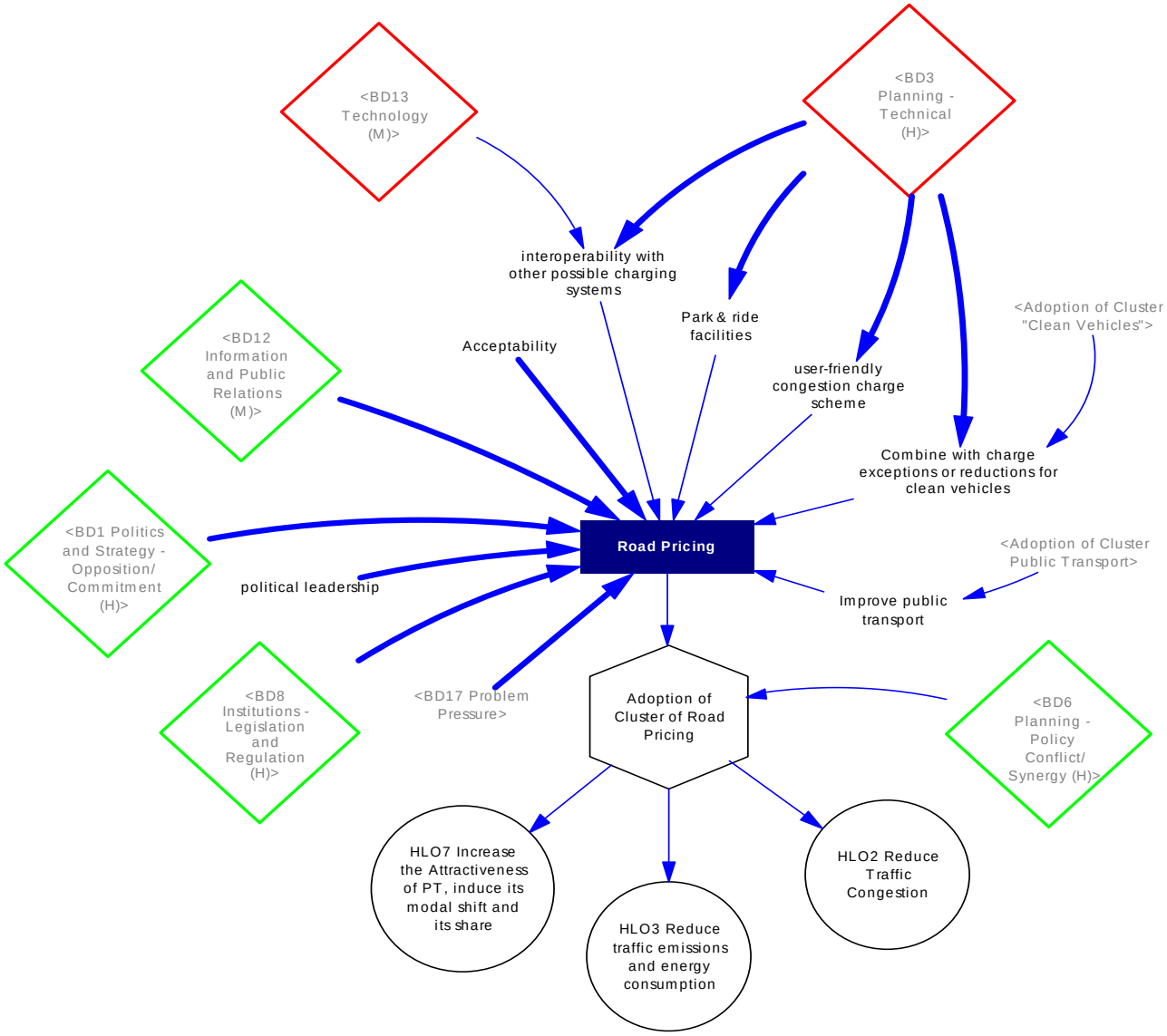
Figure 11.6 Example of road pricing impacts on peak traffic in Rome

Road Pricing implementation often encounters strong resistance. In Stockholm, a large majority was negative prior to the implementation of the congestion charges but the resistance decreased during the trial period. The referendum on Road Pricing is planned for September 2006 and will provide more feedback on this topic. In Rome, satisfaction of access restriction dropped from 3.88 to 3.27 (1.5 scale) during the project period.

11.6 Transferability

The main objectives of Road Pricing were to reduce congestion, to reduce traffic related air-pollution and to influence the modal split towards Public Transport. **"Road pricing"** was the only measure in this cluster and was driven by the existence of severe congestion, poor air quality and resource availability. The procurement laws imposed by EU directives and case law imposed specific challenges for this measure. The recommendations for the measure design were to try to guaranty interoperability with other feasible charging systems, to establish a transparent and user-friendly congestion charging system and to issue an evaluation plan at an early stage. The measure's success can be increased by the simultaneous improvement of Public Transport, the creation of Park & ride facilities or in combination with charge exceptions or reductions for clean vehicles.

Figure 11.7 Fundamental Mapping of the Cluster "Road Pricing"



11.7 Conclusion

Road pricing measures have been strongly delayed and this has affected the delivery of expected evaluations. Some results are however available and confirm that Road Pricing measures clearly lead to more sustainable, clean and efficient urban transportation. Road pricing measures have proven to have a substantial positive influence on liveability, the number of cars in inner cities, and also noise and air quality.

In Stockholm the Effective Road Pricing trial showed that the charging system reduces traffic and encourages more environmentally friendly transport systems.

The delay of the implementation in Rotterdam once more strengthens the observation that social and political acceptance are still difficult to achieve and form the main barriers to the implementation of Road Pricing. Notable efforts with communication campaigns are required to support the positive effects of such projects.

Road Pricing implementations have also emphasised the fact that this type of project can ultimately lead to "mentality changes" in terms of mobility and modality and is crucial for the future. The potential success of such schemes is heavily dependant on the quality of alternative transport available.

Table 11.3 *Summary of the overall effects for the cluster road pricing*

	Transport	**Energy**	**Environment**	**Economy**	**Society**
Road pricing	☺	☺	☺	*	😐