Transport Research Knowledge Centre

PASSENGER THEMATIC RESEARCH SUMMARY

Directorate-General for Energy and Transport

EUROPEAN COMMISSION

www.transport-research.info

European Commission
DG Energy and Transport

Transport Research Knowledge Centre

Thematic Research Summary:

Passenger transport

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Date 21.12.2009

Foreword

This paper has been produced as a part of the activities of the TRKC (Transport Research Knowledge Centre) project of the Sixth Framework Programme.

The role of TRKC, as its predecessor project EXTR@Web, is to collect, structure, analyse and disseminate transport research results. It covers EU-supported research, as well as research financed nationally in the European Research Area (ERA) and selected global RTD programmes. The main dissemination tool, used by TRKC, is the public web portal at www.transport-research.info.

The approach to dissemination of results of the research projects, adopted by the TRKC team, includes the following three levels of analysis:

- Project Analysis, which provides, project by project, information on research background, objectives, results, technical and policy implications;
- Thematic Analysis, which pools findings of research projects according to a classification scheme based on into thirty themes, fixed for the life time of the TRKC project; the product of this analysis activity is the set of Thematic Research Summaries (TRS); the present document belongs to this set;
- Policy Analysis, which pools findings of research projects according to combinations of themes based on ad-hoc policy priorities, which are agreed with DGTREN of the European Commission and the representative group of research users.

The present Thematic Research Summary deals with Passenger Transport theme. The aim is to provide the reader with a structured guide to the results of research projects carried out mainly in the European Research Area (ERA). The paper is intended for policy makers at the European, national and local levels, as well as interested readers from other stakeholders and from the academic and research communities.

Disclaimer

The analysis in this paper is under responsibility of the TRKC project team; it does not represent the official viewpoint of the European Commission; it has not been approved by the coordinators of the research projects reviewed.

Executive summary

This paper has been produced as part of the activities of the TRKC (Transport Research Knowledge Centre) project of the Sixth Framework Programme. The role of TRKC, as its predecessor project EXTR@Web, is to collect, structure, analyse and disseminate transport research results. TRKC provides comprehensive coverage of transport research in EU programmes as well as key research activities at national level within the European Research Area and selected global programmes.

The paper is one of the thematic research summaries (TRS). The TRSs aim at providing a synthesis of research results and policy implications from completed projects. Each TRS deals with a theme according to the classification, which the TRKC project has adopted. The theme of this TRS is Passenger transport.

The first part of the paper includes a brief analysis of the scope of the theme, and a policy review where the main policy developments at EU level are summarised.

The Passenger transport theme refers to all forms of the public and private transport of people, by air, land or water, whether scheduled or unscheduled, urban, rural, coastal, local, long distance or cross-border and involving one or more modes.

Given the scope of the Passenger transport theme, it only deals with the research relevant to the planning, organisation or operation of passenger transport modes to the exclusion of freight.

Policy developments at EU level have traditionally been related to pursuing a form of mobility that is sustainable, energy-efficient and respectful of the environment; promoting co-modality, technical innovations and a shift towards the least polluting and most energy efficient modes of transport; establishing a policy framework which promotes sustainable mobility; providing practical assistance to numerous institutions throughout Europe which contribute to the development of local and regional transport for the citizens' benefit: the public authorities, transport companies and user groups

The second part of this paper includes a synthesis of the main findings and policy implications from research projects and is concluded with an overview of the implications for further research. The research projects synthesised are EU-funded projects from the

Fifth and the Sixth Framework Programmes that have results publicly available. Projects that had been reviewed in the related paper produced within the predecessor project EXTR@Web are briefly summarised. This latter paper also includes a selection of nationally funded projects.

Five sub-themes are considered in the synthesis. The following are the main achievements.

In the sub-theme of **Sustainable intermodal passenger transport:**

- To reduce air pollution, several cities have focused on 100% clean municipal vehicle fleets including CNG and EURO IV buses, CNG delivery vans and car-sharing vehicles with hybrid engines as well as the increased use of biocombustibles.
- The demand from private car owners for clean vehicles (especially gasbased) has been stimulated through several measures.
- Important results have been achieved in implementing a variety of travel solutions and the positive impact of modal shift towards more sustainable transport modes has been shown.

The **Accessibility and comfort of public transport** sub-theme reports that:

- Best practice guides have been developed.
- Principles of network design have been demonstrated, introducing concepts that simplify and clarify the planning public transport services.
- A roadmap identifying future R&D needs through a scenario-based analysis has been designed.
- The tests of an innovative automatic security and safety video surveillance system have shown that the system is able to recognise and codify a wide range of events.
- Carsharing complements PT rather than competing with it.
- The costs for developing a CNG ferry are too high to be accepted by the local political and municipal authorities.

In the sub-theme **Traffic management** it is mentioned that:

- A Real Time Passenger Information (RTPI) system has been well accepted and a bus priority scheme has proved its effectivity.
- Commuters change their behaviour and tramline patronage increases after the introduction of Park and Ride facilities.
- Implementation of a modern positioning system based on GPS technology to be used for public transport vehicle prioritisation, fleet management and real time passenger information can produce positive impacts only if appropriate complementary measures are implemented.
- Measure implemented to promote mobility management among commuters, as well as to raise awareness of the need to rationalise home-to-work journeys among

employees, decision makers, private transport companies and administrators have strong potential to significantly reduce CO2 and benzene emissions as well as fuel consumption and uneffective travelling in general.

- The innovative TUC (Trafficresponsive Urban Control) strategy performs much better in comparison to the well-established and sophisticated resident systems and user acceptance is generally high.

The **Pedestrians and non-motorised transport** sub-theme informs that:

- The safety of cyclists can be improved greatly by introduction of a contraflow lane for cyclists on a one-way street.
- The Home Zone scheme has the potential to improve quality of the environment in which residents live, which not only keeps cars moving slowly, but also gives equal priority to motor vehicles, cyclists, and pedestrians.
- A guidebook to support designers, planners and decision makers to promote walking in cities by improving the conditions and quality of urban pedestrian environments has been produced.
- A pan-European network of around 100 cities, towns and regions in 21 European countries which actively invest in improving the quality of their cycling policy has been created.
- A significant number of car users (about half) can become the passengers of bus lines serving the P&R facilities, after their introduction.
- The presence of the P&R facilities not only reduces the congestion and demand on inner city parking, but it also encourages the use of more sustainable modes of transport.

In the **Strategic planning and policy facilitation** sub-theme:

- Common best practice principles were defined for the most important processes identified and the handbook for transport modelling was made available.
- A Strategic Research Agenda (SRA) for urban mobility has been developed.

Abbreviations and acronyms used

BQP	Bus Quality Partnership
CCTV	Closed Circuit Television
CEN	European Commitee for Standardisation
CNG	Compressed Natural Gas
CO2	Carbon Dioxide
DAB	Digital Audio Broadcasting
DG TREN	Directorate General Transport and Energy
DRIP	Dynamic Route Information Panels
DRT	Demand Responsive Transport
DVB	Digital Video Broadcasting
EEA	European Economic Area
ERA	European Research Area
ERRAC	Strategic Rail Research Agenda
EU	European Union
EURO 0 – V	EURO emission standards
FP5 and FP6	Fifth and Sixth Framework Programme
FTS	Flexible transport services
GDP	Gross Domestic Product
GIS	Geographic Information System
GPS	Global Positioning System
GSM	Global System for Mobile Communication
HTWPs	Home-To-Work Plans
ICT	Information and Communication Technologies
ITP	Intermodal Trip Planner
ITS	Intelligent Transport Systems

IVT	Intelligent In-Vehicle Terminal
LUTS	Land Use and Transportation Study
NMS	New Member State
P&R	Park & Ride
PDA	Personal Digital Assistant
PPP	Public Private Partnerships
PT	Public Transport
PTI	Public Transport Interchange
QoL	Quality of Life
R&D	Research & Development
RDS-TMC	Radio Data System - Traffic Message Channel
RSD	Remote Sensing Device
RTD	Research and Technological Development
RTPI	Real-time Passenger Information
RTTI	Real-time traffic and travel information
SoA	State-of-the-Art
SRA	Strategic Research Agenda
SWAP	Shared Wireless Access Protocol
TDM	Travel Demand Management
TENs	Trans-European Networks
TEN-T	Trans-European Transport Network
TISA	Traveler Information Services Association
TMC	Traffic Message Channel
TPEG	Transport Protocol Expert Group
TRKC	Transport Research Knowledge Centre
TRS	Thematic Research Summary
TUC	Traffic-responsive Urban Control

UMTS	Universal Mobile Telecommunications System
VMS	Variable Message Sign
WG	Working Group

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1. Introduction

This paper provides a structured review of the research relating to Passenger Transport, carried out in transport research projects throughout the European Research Area (ERA). The theme "Passenger Transport" is one of the thirty themes in the classification scheme adopted by the TRKC project. The scheme, and the Passenger transport position in it, is shown in the table below.

Table 1. The classification scheme adopted in TRKC

Sectors
✓ **passenger transport**
✓ freight transport
Geographic
✓ urban transport
✓ rural transport
✓ regional transport
✓ long-distance transport
✓ EU accession issues
Modes
✓ air transport
✓ rail transport
✓ road transport including walking and cycling
✓ waterborne transport
✓ innovative modes
✓ intermodal freight transport
Sustainability policy objectives
✓ economic aspects
✓ efficiency
✓ equity and accessibility
✓ environmental aspects
✓ user aspects
✓ safety and security
Tools
✓ decision support tools
✓ financing tools
✓ information and awareness
✓ infrastructure provision including TENs
✓ integration and policy development
✓ Intelligent Transport Systems (ITS)
✓ regulation/deregulation
✓ land-use planning
✓ transport management
✓ pricing and taxation
✓ vehicle technology

The scheme has been adopted to enable search facilities in the TRKC portal, and to ensure comprehensive coverage of research results and appropriate policy analysis in the Thematic Research Summaries (TRS). Definitions for each theme are found on the TRKC portal at www.transport-research.info.

In the predecessor EXTR@Web project, TRSs were produced for 28 out of the thirty themes (resulting from merging of some themes into a single TRS). The TRKC project is producing first versions of TRS for a sub-set of themes for which a critical mass of project results is available by November 2009 (including this one on Passenger transport). Final versions of TRSs for the full set of themes are planned for production in early 2010.

A large number of research projects have dealt with the theme addressed by this paper and the nature of the TRKC's classification scheme is that all overlap with at least one other theme, and in many cases several themes. The thematic research summary "Passenger transport" produced in the predecessor project EXTR@Web (EXTR@Web, 2006), had reviewed research from European projects belonging to the Fifth Framework Programme (FP5) and national projects. The paper here adds new projects to the analysis reported on in that paper. The new projects are mainly European projects from FP5 and FP6.

The research reviewed in this paper does not represent the entire range of research dealing with Passenger transport carried out in Europe. The paper focuses on research from those projects, which have prepared documentation on their results available to the TRKC team after the issue of the EXTR@Web paper (EXTR@Web, 2006). A summary of the research, reported on in the EXTR@Web paper, is also included to make the reader aware of a more complete range of research, which has dealt with the theme.

The paper is organised as follows. Sections 2 and 3 set the scene. **Section 2** includes a brief analysis of the scope of the theme. **Section 3** provides an overview of the policy priorities at EU level, which underpin the research objectives. The sources for this section are principally European Commission documents, which have set the policy agenda such as white papers, green papers, and communications.

Section 4 reports on the results from specific research projects. The section is structured according to sub-themes to make the broad area of research, which has dealt with Passenger transport, more manageable. For each sub-theme, the research objectives and findings are reported on. A special focus is given to the policy implications of research

results. **Section 4** is concluded with an overview of the gaps and topics for future research, which could be identified by the projects. Sources for Section 4 are documents available from the projects and reporting on achievements, essentially the project final reports and selected deliverables.

The sub-themes covered in Section 4 are:

- sub-theme 1: Sustainable intermodal passenger transport;
- sub-theme 2: Accessibility and comfort of public transport;
- sub-theme 3: Traffic management;
- sub-theme 4: Pedestrians and non-motorised transport;
- sub-theme 5: Strategic planning and policy facilitation.

The **Annex** 1 includes the list of the research projects that have been reviewed in the paper. Links to the projects' websites are included. In several cases these websites make the project documentation available to the public. This may include final reports and project deliverables.

2. General

2.1 Scope the theme Passenger transport

Passenger transport consists of all transport of people rather than of freight. It includes all forms of public and private transport of people by air, land or water, whether scheduled or unscheduled. It includes non-motorised and pedestrian transport. It also includes the transport of baggage which is travelling with a passenger. Passenger transport may be urban, rural, coastal, local, long distance or cross-border and involves one or more modes. Given the scope of this theme, it is only used where the research is of relevance to the planning, organisation or operation of passenger transport modes to the exclusion of freight.

In 2007, total passenger transport activities in the EU27 by any motorised means of transport are estimated to have amounted to 6 473 billion pkm or on average 13 092 km per person. Passenger cars accounted for 72.4 % of this total, powered two-wheelers for 2.4 %, buses & coaches for 8.3 %, railways for 6.1 % and tram & metro for 1.3 %. Intra-EU air and intra-EU maritime transport contributed 8.8 % and 0.6 % respectively. (CEC: DG TREN)

The above figures are for passenger transport movements by the respective modes on national territory, regardless of the nationality of the vehicle. A key finding in the vast majority of Member States, GDP grew faster between 1996 and 2006 than the volume of inland passenger transport. The most notable exception was Lithuania which, relative to GDP, recorded considerable growth in inland passenger transport volumes in 2004 and 2005, and to a lesser extent in 2006. Slovakia and Hungary both recorded GDP growing considerably faster than the volume of inland passenger transport between 1996 and 2006. (Eurostat yearbook 2009)

Road fatalities in the EU-27 fell sharply between 1996 and 2006, from 59 357 deaths to 42 955 deaths, a fall of over 25 %. In 2006 the road fatality rate, expressed as the number of deaths per milion inhabitants averaged 87 in the EU-27. There were nevertheless stark differences between countries, with the highest rates in the Baltic Member States, all exceeding 150 deaths per million inhabitants, and Greece marginally below this level. (Eurostat yearbook 2006)

Almost 800 million passengers were carried by air in 2007 in the EU-27. The largest number of passengers carried was reported by the United Kingdom, over 217 million, equivalent to 3.6 passengers carried per inhabitant. Relative to the size of the population the largest numbers of air passengers carried were reported by the islands of Cyprus and Malta, closely followed by Ireland.

In 2020, 80% of Europeans will live in urban areas where cars account for 75% of km travelled.

- Congestion costs represent 1% of GDP.
- 65% of road accidents occur in urban areas.
- 40% of all transport CO2 emissions are produced in cities and are expected to further grow.

Poor air quality, mainly due to exhaust gases from traffic, causes the premature death of almost 300,000 citizens a year in the EU.

An efficient European passenger transport system is one of the key factors for correct functioning of the European Union's internal market. Indeed, the transport sector accounts for approximately 7% of the EU's gross domestic product and 5% of all jobs in EU Member States. It also makes a significant contribution to the achievement of one of the EU's primary objectives – the free movement of persons and goods between Member States.

Road passenger markets have been opened up to a large extent: any company anywhere in the EU that meets EU professional requirements may set up business in any Member State. On the other hand, the right to run scheduled passenger services (commercially or with subsidy) depends on the regulatory regime in each country. The road transport sector itself already contributes hugely to the European economy: it provides about 4.5 million jobs and generates a turnover worth about 1.6 % of EU gross domestic product. And without an efficient, vibrant road transport system, other modes cannot function properly as most freight and passenger journeys begin and end with a trip on the road.

Road transport therefore also plays a vital role in the development of Europe's integrated transport network and intermodal transport solutions.

One of the key principles is intermodality, as it allows different means of transport to be used as part of seamless transport chains.

The simplest and most obvious way to categorise passenger transport topics is by passenger transport mode.

The significance of passenger transport as a theme, as against freight transport, is self-evidently large. Excluding walking, the average European citizen travels 35 km per day, of which about three quarters is in private cars.

Intelligent Transport Systems (ITS) can have a beneficial impact on the transport system by making its operation and management more efficient through the provision of real-time information.

Mobility management oriented to passenger transport is an innovative demand-oriented approach to enhance and promote sustainable mobility, and is a very cost-effective way of guiding or changing citizens' transport behaviour. ITS tools are often a key component of mobility management schemes.

3. Policy context

With growing freight and passenger transport, pollution and congestion risk aggravating, the European Commission is working towards a form of mobility that is sustainable, energy-efficient and respectful of the environment.

The EU's aim is to disconnect mobility from its adverse effects. This means promoting co-modality, i.e. optimally combining various modes of transport within the same transport chain, which is the solution for the future in the case of freight.

Technical innovation and a shift towards the least polluting and most energy efficient modes of transport — especially in the case of long distance and urban travel — will also contribute to a more sustainable mobility.

EU transport policies have been designed both for households and the business community, regardless of location, whether urban or rural. The recent midterm review of the 2001 White paper (CEC, 2006) shed a spotlight on urban travel, reflecting the fact that 'eighty per cent of Europeans live in an urban environment'. The review points to picking up on the best-practice initiatives used by a number of cities regarding 'transport infrastructure, norm-setting, congestion and traffic management, public transport services, infrastructure charging, urban planning, safety, security and cooperation with the surrounding region'. The Commission published a Green paper (CEC, 2007) on a new culture for urban mobility in September 2007 that looks to stimulate the adoption of these best practices. (Eurostat yearbook 2009)

Sustainable and functional local and regional passenger transport would be achieved by providing the public authorities, operators and user groups with appropriate tools and establishing a policy framework which promotes sustainable mobility.

The European Commission manages the funds and programmes so as to optimise the potential contribution from a sustainable local and regional passenger transport system. In its review of the guidelines for the trans-European Transport Network (TEN-T), for example, the Commission is paying particular attention to the question of local and regional connections to the TEN-T (whether to include intermodal passenger terminals in the guidelines). All in all, the Commission's work programme is intended to provide practical assistance to numerous institutions throughout Europe which contribute to the

development of local and regional transport for the citizens' benefit: the public authorities, transport companies and user groups.

In the European Union, over 60% of the population lives in urban areas. Just under 85% of the EU's gross domestic product is created in urban areas. Towns and cities are the drivers of the European economy. They attract investment and jobs. They are essential to the smooth functioning of the economy. (Green Paper)

Intra-urban transport is only one element of passenger transport policy. Enlargement of the EU has opened up further opportunities for inter-urban passenger travel by rail, road or airplane, which has been and continues to be strengthened by improvements to the infrastructure (such as extensions of the high-speed rail links or raising of airport capacity), by more competition and greater co-ordination (such as the 'single sky' policy). The strengthening of passenger rights has also made passengers more secure to enjoy the freedom to travel and work throughout the EU. (Eurostat yearbook 2009)

The recent mid-term review underlined the point that rail and sea passengers should benefit from similar rights, and this was achieved for rail passengers with the adoption of the third railway package in October 2007. (Eurostat yearbook 2009)

European towns and cities are confronted with a constant increase in freight and passenger flows. However, there are substantial limits to the development of the infrastructure needed to cope with this increase, as a result of a lack of space and environmental constraints. Against this background, stakeholders have highlighted that Intelligent Transport Systems (ITS) applications are currently underexploited for the efficient management of urban mobility, or are developed without due attention to interoperability. (CEC, 2007 Green Paper)

3.1 EU policy strategies related to environmental impacts of passenger transport

Passenger transport is one of the main sources of greenhouse gases and also gives rise to significant air pollution, which can seriously damage human health and ecosystems. The indicator helps to understand developments in the passenger transport sector (transport's 'magnitude'), which in turn explains observed trends in transport's impact on the environment.

The relevance of the modal split policy for environmental impact of passenger transport arises from differences in environmental performance (resource consumption, greenhouse

gas emissions, pollutant and noise emissions, land consumption, accidents etc.) of transport modes. These differences are becoming smaller on a passenger-km basis, which makes it increasingly difficult to determine the direct and future overall environmental effects of modal shifting. The total environmental effect of modal shifting can in fact only be determined on a case-by-case basis, where local circumstances and specific local environmental effects can be taken into account (e.g. transport in urban areas or over long distances).

CO2 emissions from new passenger cars sold in the EU have decreased by 12.4% between 1995 and 2004, following a voluntary agreement between the European Commission and industry. To enable the EU to reach its 120 g objective by 2012, the Commission, in a Communication of February 2009, outlined a comprehensive new strategy. A legislative framework should ensure 130 g CO2/ km by improvements in vehicle motor technology, and a further reduction of 10 g CO2/ km by other technological improvements and by an increased use of biofuels. Pollutant emissions from vehicles have also been successfully reduced through a gradual tightening of the EURO emission standards. As a result of the EU regulation setting, on a continuous basis, lower limits for new vehicles, an overall reduction of 30-40% nitrogen oxide and particulate emissions from road transport has been achieved over the past 15 years since the adoption of the first EURO standard, despite rising traffic volumes.

3.2 The main policy documents related to passenger tranport

In 1998, a European Commission Communication on developing the citizen's network [COM (1998) 431 final] outlined a system of local and regional passenger transport which would be achieved by providing the public authorities, operators and user groups with appropriate tools and establishing a policy framework which promotes sustainable mobility.

A well-functioning European transport system needs a good, sustainable local and regional passenger transport structure.

This is primarily a matter for local, regional and national authorities, working with transport operators and users, amongst whom there is a high degree of consensus on the fundamental need to shift away from dependence on private cars and make transport systems more sustainable.

Methods of making passenger transport systems more sustainable and shifting away from excessive dependence on private cars include:

- raising the quality and accessibility of public transport services and increasing their capacity to respond flexibly to changes in transport needs;
- making walking and cycling more attractive by offering more favourable conditions;
- reducing the demand for travel, for example by reversing the trend for housing, jobs, schools, etc. to dispersed places which are hard to reach except by car;
- removing psychological barriers to the use of alternatives to cars;
- active transport management in congested areas;
- making transport an essential component of strategies for spatial planning, economic development and social cohesion;
- flexible working time arrangements;
- door-to-door transport system.

The Public Procurement Directive 2004/17/EC and Directive 2004/18/EC of 31 March 2004 apply in full to public service contracts such as transport by bus and tram. Furthermore, the new regulation on public passenger transport services by rail and by road - Regulation on public passenger transport services by rail and by road and repealing Council Regulations (EEC) No 1191/69 and (EEC) No 1107/70 (interinstitutional file 2000/0212 (COD)) is offering increased transparency and help authorities and operators improve the quality and efficiency. (http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:315:0001:0013:EN:PDF)

White Paper

Since the 2001 White Paper, which was revised in 2006, this policy area has been oriented towards harmoniously and simultaneously developing the different modes of transport, in particular with co-modality, which is a way of making use of each means of transport (ground, waterborne or aerial) to its best effect. (CEC, 2001; CEC, 2006)

The mid-term review of the Transport White Paper emphasised the need for basic passenger rights in all modes of transport, with a particular focus on passengers with reduced mobility. Stakeholders have recommended that the Commission should promote the idea of a European Charter on rights and obligations for passengers using public transport.

EU policy in the White Paper was oriented on the link between transport growth and economic growth without any need to restrict the mobility of people and goods.

It introduced slower growth in road haulage thanks to better use of the other means of transport (increase of 38 % rather than 50 % between 1998 and 2010).

This trend was more marked in passenger transport by car (increase in traffic of 21 % against a rise in GDP of 43 %). The increasing distances between centres at opposite

ends of the Union as it enlarges mean that an effective high-speed passenger network is required. Such a network comprises the high-speed lines, including upgraded lines, connections and systems which allow the integration of air and rail transport services and airports. In passenger transport, there is considerable scope for improvements to improve travelling conditions and facilitate modal transfers which are still highly problematic. Far too often passengers avoid using different modes of transport for a single journey. They have problems obtaining information and ordering tickets when the journey involves several transport companies or different means of transport, and transferring from one mode to another can be complicated by inadequate infrastructure (lack of parking space for cars or bicycles, for example).

Green paper

Rethinking urban mobility involves optimising the use of all the various modes of transport and organising "co-modality" between the different modes of public transport (train, tram, metro, bus, taxi) and the different modes of individual transport (car, motorcycle, cycle, walking). It also involves achieving common objectives in terms of economic prosperity managing transport demand to guarantee mobility, quality of life and environmental protection. Lastly, it involves reconciling freight transport and passenger transport interests whatever the mode of transport used.

In view of stakeholders, any urban mobility policy must cover both passenger and freight transport. Distribution in urban areas requires efficient interfaces between long-haul transport and short distance distribution to the final destination. Smaller, efficient and clean vehicles could be used for local distribution.

Consolidated distribution in urban areas and zones with access regulations is possible but requires efficient planning of the routes to avoid empty runs or unnecessary driving and parking. The development of these solutions requires the involvement of all stakeholders.

Public passenger transport is usually supervised by the competent administrative body while freight transport distribution is normally a task for the private sector. Local authorities need to consider all urban logistics related to passenger and freight transport together as a single logistics system.

Mobility plans integrating the wider metropolitan conurbations, covering both passengers and freight transport in the city or town and in its surrounding region, also form a sound basis for efficient urban mobility planning.

The sometimes perceived low personal security of passengers inhibits certain social groups from travelling, or from using public transport services. This concerns not only

vehicles, terminals and bus/ tram stops but also the walk to and from the stops. The result may be unnecessary car use and may prevent people from living an active life.

Safer vehicles are of a particular importance in urban areas where they share the street with pedestrians, bikes and collective transport. Technologies such as night vision, break assistant, collision avoidance and sleep warning can make a difference to the safety of all street users.

The European Commission communications on e-Safety and on the i2010 intelligent car initiative "ICT for safe and intelligent vehicles" present valuable solutions that could be applied to urban context. Passenger transport could also be handled by “city vehicles”, while stakeholders have suggested that over-dimensioned trucks and cars, could have restricted access.

Substantial financing of various kinds is needed in order to invest in infrastructure and passenger interchanges, the maintenance and operation of networks, fleet renewal and maintenance, and public awareness and communication campaigns. For the most part, the responsibility for this investment lies with the local authorities concerned.

3.3 EU stimulation for information exchange

To promote increased use of local and regional passenger transport systems and to help to achieve the objectives of the European Union's common transport policy with regard to efficiency, quality and sustainable mobility, political and legal framework is being established. The Commission plays an important part in the development of this policy framework. In land use planning, for example, it encourages good practice with regard to transport through instruments such as the trans-European transport network, regional policy, and cohesion policy.

Among the main initiatives that have been launched at EU level are:

- ELTIS, the European Local Transport Information Service, which is a guide to current transport measures, policies and practices implemented in cities and regions across Europe.
- The Citizens Network Benchmarking Initiative which developed indicators to compare one local passenger transport system to another.
- EPOMM, the European platform on mobility management, aimed at promoting and developing the concept of mobility management in Europe and at fine-tuning its implementation.

- POLIS, network of European cities and regions from across Europe, which promotes, supports and advocates innovation in local transport. POLIS strives to improve transport at local level, especially in relation to the environment & health, mobility & traffic efficiency, the economic & social aspects of transport and safety & security,
- The CIVITAS programme which was started in 2002 to help realise innovative projects on Clean Urban Transport across Europe; the projects, which are funded under the umbrella of the Commission's Framework Programmes, involve integrated demonstrations of technology and policy measures in both fields of energy and transport.
- The International Association of Public Transport (UITP) is the international network for public transport authorities and operators, policy decision-makers, scientific institutes and the public transport supply and service industry covering all modes of public transport: metro, bus, light rail, regional and suburban rail, and waterborne transport. It acts as a platform for worldwide co-operation, business development and the sharing of know-how among 3,100 members from 90 countries. It is the global advocate for public transport and sustainable mobility, and the promoter of innovations in the sector.
- ERRAC was established in 2001 with the ambitious goal of creating a single European body with both the competence and capability to help revitalise the European rail sector and make it more competitive, by fostering increased innovation and guiding research efforts at European level.
- ERTRAC, the European Road Transport Research Avisory Council was established in 2003, with similar aims to ERRAC but for the road sector.
- EURFORUM is a European Initiative, aiming at setting up research priorities for the urban mobility sector in Europe. The objective of EURFORUM is to create a forum at the European level, effectively representing stakeholders of European research on urban mobility, including representatives of local authorities, public transport associations, research bodies, etc. The forum will provide recommendations for the coordination of European research on urban mobility issues.

Some of these platforms have been implemented by the European Commission in order to build up a vision for the development of the sector and an associated strategic research agenda (SRA), and to help prepare the calls of the current European Research Framework Programme (FP7, 2006-2013) as well as the future 8th R&D Framework Programme (FP8). EuroTeam is actively participating in the working groups of these technology platforms.

EU policies are focused on stimulating the benchmarking of service performance to enable public authorities and transport operators to benefit from comparison of the performance of their local and regional passenger transport systems with systems in other countries. In this respect, the Commission presented a Communication on benchmarking of transport.

The European Commitee for Standardisation (CEN) has adopted standards and definitions which could be used in setting quality criteria for passenger transport. From 1999 onwards, the Commission is seeking to encourage widespread use of benchmarking by public authorities and operators.

The EU has reached agreements with a number of non-Member States on road transport issues that take priority over those bilateral arrangements. For example, the agreement on the European Economic Area (EEA) provides that Iceland, Norway and Liechtenstein apply the Union's road transport rules in the same fashion as the Member States. Similarly, on the basis of the agreement between the EU and Switzerland on transport of goods and passengers by road and rail, Switzerland applies equivalent rules as the EU and the EEA countries in the field of land transport. The Interbus agreement between the EU and a number of its eastern and south-eastern European neighbours has helped to liberalise access to the market for certain services supplied by bus and coach operators.

It originally came into force in 2001, so many of the original signatories are now EU Member States. The EU's current co-signatories are Albania, Bosnia and Herzegovina, Croatia, the Former Yugoslav Republic of Macedonia, Moldova and Turkey. Interbus encompasses a number of social, financial and technical measures that have helped to harmonise and simplify rules under which coach and bus operators work.

4. Research findings

4.1 Introduction

The research synthesised in this paper deals with six sub-themes, as shown in the figure below. Each sub-theme is a domain for policy action. Actions in these domains have the potential to improve intelligent transport systems.

The first sub-theme focuses on the possibilities of enabling **Sustainable intermodal passenger transport** and considers convenient connections between different modes while generating impact on the modal split in the cities and encouraging the use of alternative modes to a car. Besides that it takes into account also wide range of conditions such as environmental aspects, road safety, security in the city or congestion in urban areas. It features elements like demand responsive transport, clean and access controlled zones, changes in the bus networks and integrated ticketing, travel planning, shared vehicles - bikes and car sharing / car pooling, stimulation of collective passenger transport and its quality of service or new forms of vehicle use and/or ownership and less car-intensive lifestyle.

The second sub-theme attempts to promote **Accessibility and comfort of public transport** of the European public transport systems. It handles topics such as designing universal accessibility systems for public transport, investigating the integration of light and heavy rail networks, improving PT station security, increasing the patronage of PT by offering better or integrated services etc.

In the third sub-theme concerning **Traffic management** e.g. the implementation of measures contributing to the reduction of environmental pollution and congestion and increasing social cohesion, economic efficiency and safety or encouraging modal shift towards more sustainable modes of transport are discussed. It addresses the improvement of the international state-of-the-art of real-time network-wide urban traffic control through the application of the Traffic-responsive Urban Control (TUC) strategy or intelligent trip planning. Real-time traffic and travel information (RTTI) and application of mobile technologies are used in order to develop an innovative multimodal and intermodal transport software platform offering a number of integrated services and information for trip planning.

The fourth sub-theme related to **Pedestrians and non-motorised transport** concerns with the promotion of non-motorised passenger transport and changing modal split in favour of alternatives to the solo-driven car as well as promoting walking in cities by improving the conditions and quality of urban public spaces. It highlights more and better cycling audits in EU cities and regions and therefore making cycling safer and more attractive and includes internet route planning to help cyclists plan fast and safe routes. It also featured an extension of the cycling network and equipping tram and bus stops and metro stations with Bike&Ride facilities.

The fifth sub-theme deals with **Strategic planning and policy facilitation,** centered on European study, and has also provided an assessment of the regulatory framework of local public transport operations in Europe. It aims to support transport policy in Europe by defining common good practice principles for national and regional transport modelling and to identify and develop innovative concepts and tools for organising a proper coordination at EU level between all relevant stakeholders.

The overview of the specific sub-themes is given in the following table:

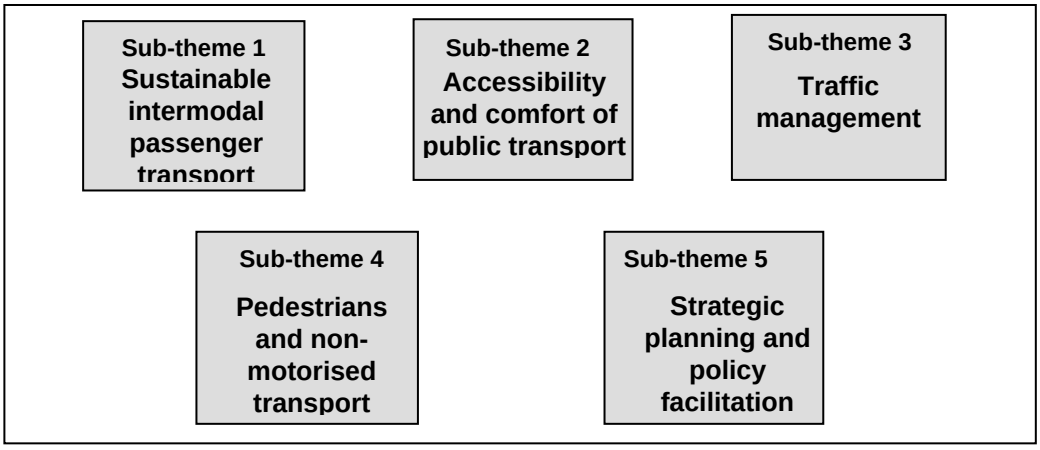

Table 2 below shows the EU-funded projects, which have dealt with each of the sub-theme. Further details of projects listed in this table are given in the Annex. The Table includes:

- projects which had been synthesised in the EXTR@web TRS and which are briefly summarised in the background of the following sub-sections;
- completed projects which are synthesised in this TRS and for which the following sub-sections report on research objectives, research results, policy implications and implications for further research;
- projects which are still on-going or which, although completed, have not yet made results publicly available.

Table 2. Projects relevant to the theme

Sub-theme	Contributing projects
1. Sustainable intermodal passenger transport	Projects covered in this paper CONPASS, CARAVEL, CIVITAS SMILE, SUCCESS, CONNECT, TARGET 2, EMMA, MIRACLES Projects covered in EXTR@Web paper: TRENDSETTER; Network Study of Urban Passenger Transport; A3; NETMOBIL; Non-conventional transport systems: application fields and feasibility analyses Other FP6 projects with results not yet available: CAESAR
2. Accessibility and comfort of public transport	Projects covered in this paper: HITRANS, UNIACCES, CrossRail, INVETE, MIRACLES, VIVALDI, TELLUS, METEOR Projects covered in EXTR@Web paper: F4 Other FP6 projects with results not yet available: SAFETEL; COUNTERACT; EASIS
3. Traffic management	Projects covered in this paper: TARGET 2, SMART NETS, TRASCOM, CONNECT, VIVALDI, TELLUS, MIRACLES, EMMA, AGORA Projects covered in EXTR@Web paper: VOYAGER; An Assessment of the Effects and cost-effectiveness of a public transport journey planner Other FP6 projects with results not yet available: ERASMUS; AD4
4. Pedestrians and non-motorised transport	Projects covered in this paper: ARTISTS, ASI, BYPAD, MIRACLES, VIVALDI, PROMPT, TELLUS Projects covered in EXTR@Web paper: A9, Effects of Cycle Parking Arrangements on Bicycle Use; Promotion of Walking and Cycling on Village Roads
5. Strategic planning and policy facilitation	Projects covered in this paper: MOTOS, TRANSFORUM, EURFORUM Projects covered in EXTR@Web paper: INTERCEPT; PRISCILLA; TRENDSETTER (CIVITAS I); UG293 (UK); B6; D5; MARETOPE; A2 Other FP6 projects with results not yet available: PROCEED

4.2 Sub-theme 1: Sustainable intermodal passenger transport

4.2.1 Background

Research reviewed in the related EXTR@Web paper (EXTR@Web, 2006) has focused on intermodal transport and considered convenient connections between different modes. It has also investigated the share and importance of different modes in the passenger traffic market.

4.2.2 Research objectives

The first group of objectives was focused on developing strategies and concepts for improvements as well as compiling tools for experience based enhancement of cross-border public transport supply.

A special emphasis was given on local and regional cross-border public transport in urbanised border regions.

The main emphasis was put on:

- providing a state-of-the-art overview,
- elaborating an analysis methodology for cross-border transport connections,
- performing dissemination activities in EU member states and in accession countries.

The targeted user groups of the research activities and implementing of results are local, regional and national authorities, transport operators and cross-border institutions which all have a key interest in European integration by improving cross-border cooperation in PT. (CONPASS)

Other intention of the research activities was to promote and exchange best practice on the major urban policy challenges concerning passenger and goods mobility.

The use of alternative and innovative vehicles, the increasing transport efficiency, lower demand for motorised transport, access control and improved collective transport modes,

together implemented by a specific mix of measures, resulted in a reduction of transport-related noise and air pollution.

As a consequence, research contributed significantly to a healthier and more enjoyable life in urban areas. The absence of cars or a strong reduction in their number in certain areas also led to a re-definition of public spaces as meeting points for people. (CARAVEL)

The CIVITAS SMILE cities have, for a long time, been actively engaged in promoting the European sustainability agenda by participating in European processes and carrying out ambitious programmes and projects to improve the environmental situation in the cities. In this proposal the cities are developing new forms of co-operation to find solutions to a wide range of economic, environmental and societal challenges facing medium-sized cities within EU and in the accession countries. The main emphasis was placed on taking their collaboration further, by addressing:

- The knowledge transference of scientific, technical, commercial and financial steps necessary for the successful development and marketing of new or improved clean vehicles and sustainable travels from door-to-door;
- The involvement of the public in the research evaluation in innovative ways to raise the public's understanding of sustainability and travel behaviour.

The measures in these research activities are expected to have significant impact on solving the problems of:

- dependency on fossil fuels
- competitiveness of clean vehicles and alternative fuels
- congestion in urban areas
- deteriorating environmental quality in the cities, i.e. air and noise
- security in the city
- social inclusion and equal opportunities
- road safety
- economic efficiency and competitiveness of the cities
- fall in the modal share of the public transport services.

Anonther objective of research was concerned to demonstrate that, with an ambitious package of mobility and traffic management measures, significant results can be provided regarding sustainable transport and energy policy in small and medium sized cities. SUCCESS addressed technical, social, environmental and economic aspects of an integrated mobility strategy. Research has involved extensive investment in the participating cities, along with a large range of stakeholders and integrated packages of demonstration measures. Several actions have been executed in each city ranging from controlled access zones to biofuels, from real time information systems to alternative modes for transport, from cycle and walking paths to integrated ticketing.

In total, more than 50 different projects have been set up involving a large number of stakeholders leading to a very wide scope on sustanable mobility managemnt implementation.

Research was also focused on flexible transport services (FTS) covering a broad range of mobility products usually - but not necessarily - operated by moderate and/or small capacity vehicles. The distinguishing feature of FTS was that one or more of the dimensions of the service can be adjusted to meet the actual user needs. This means that the route can be designed for the specific requests of the users for that specific trip, the time of departure or arrival could be brought forward or delayed to suit the customers, a bigger or smaller vehicle could be used depending on the number of passengers, and a specifically equipped vehicle or trained driver could be assigned if a customer has special needs.

Throughout Europe, a wide range of FTS has now been established, including:

- demand responsive transport (DRT) services for general use in rural areas,
- DRT services for general use in peri-urban and suburban areas,
- dedicated services for users who face difficulties using regular public transport (e.g. the elderly and disabled),
- flexible services to replace fixed-line services at evenings and weekends,
- flexible services serving destinations of special demand, e.g. airports, shopping precincts.

However, such transport services to date do not yet exploit the true potential of flexible collective mobility and further work is required on the knowledge acquisition, analysis and dispatching functions of the intermediate transport solutions that are required in the pursuit of sustainable mobility. (CONNECT)

Another group of objectives was related to the development, implementation and evaluation of a package of mobility management measures in order to promote, facilitate and encourage the use of alternative modes to a car (TARGET 2). Research was motivated by the fact that the development of sustainable urban transport requires changes of behaviour, attitude and culture in order to encourage modal shift towards more sustainable modes of transport.

Another research objective has been the investigation into behavioural response to Travel Demand Management (TDM) policy measures (EMMA).

4.2.3 Research results

CARAVEL: To reduce air pollution, the cities of Burgos, Genoa and Krakow focus on 100% clean municipal vehicle fleets. This includes the purchase of CNG and EURO IV buses, CNG delivery vans and car-sharing vehicles with hybrid engines as well as the increased use of biocombustibles.

Furthermore the three cities intend to stimulate the demand from private car owners for clean vehicles (especially gasbased) through several measures.

Large-scale demonstrators with a substantial impact have been implemented (e.g. extension of access restricted zones coupled with enforcement, road and parking pricing, freight distribution schemes), e.g.:

- Access restrictions has been further extended and enforced in inner-city areas of Genoa and Krakow (ca. 400.000 m2). In Burgos (ca. 400.000 m2) and Stuttgart access restrictions have been realised
- Genoa has developed an integrated pricing and access restriction strategy (2,5 km² in the city centre from former pilot application and extension to non-enforced area)

The use of clean vehicles for freight, high volume PT and flexible services were demonstrated, e.g.:

- Genoa: 20 large clean EURO IV buses on High Mobility Corridors, 30 medium-sized methane buses for flexible and inner-city services, 30 hybrid cars to be used for car sharing and electrical vehicles as buses and freight vans
- Krakow: 100 large buses and 5 small CNG buses for demand responsive services
- Burgos: 8 CNG buses and a 5% use of bio-combustibles for diesel fleet, 3 clean delivery vehicles
- The Genoa pilot of goods distribution centre served by electric/methane vans have been extended and the concept transferred to Krakow and eventually to Burgos which has limited access to clean delivery vehicles only.
- Demonstrations have been highly integrated in few demonstration areas and some city-wide activities.

Emphasis was put on measures with strong impact on the modal split in the cities, and restriction of private car use, e.g.:

- ‘Clean high mobility corridors’ in Genoa (with bus priority system at 12 traffic lights) and Krakow (with 2 high quality model stops); ‘Clean zone’ in Burgos
- Improved information provision in Genoa (intermodal traffic and travel information services, TTI), Krakow (info-mobility platform), Burgos (10 touch screens for car

pooling, 5 for transport information and 20 electronic information panels at bus stops) and Stuttgart
- Promotion of “bicycle culture” in Burgos (the existing 15 km of bicycle path has been extended to 38 km) and Krakow (existing 35 km bicycle path system and purchase of 100 city owned bicycles for rent)

High visibility and profile was ensured through publicity and awareness raising schemes, e.g.:
- Mobility Fora in Genoa, Burgos and Krakow
- Mobility Marketing in Genoa, Krakow (including €CO Points)

The improvements that have been made for four of the five cities are listed below:

Malmö:
- 8% of people surveyed said that they made more bus journeys, due to the availability of timetables and real-time updates through mobile internet services;
- CCTV Cameras have been installed on 170 buses. In a follow up survey 17% of people stated that they now travelled more often as a result of the cameras;
- The new simplified bus routes in the city have been promoted under the theme of ‘greener, easier and more often’;
- 91% of respondents to a survey were aware of planned changes to the bus routes in the month that the changes were implemented.

Norwich:
- 16 on-street ticket machines have been installed to reduce bus dwell times. Average boarding times per passenger have fallen from 8 to 6.4 seconds;
- A new bus-rail interchange has been built outside Norwich Railway Station;
- The frequency of buses has doubled from 6 to 12 buses per hour (Monday to Saturday daytime) between the railway station and the city centre; and
- 98% of respondents to a survey were satisfied with the quality of the new facilities.

Suceava:
- 30 new buses using renewable fuels have been purchased, to replace the older fleet of minibuses;
- Bus passenger numbers increased by over 250,000 between June 2006 and January 2007, while minibus passenger numbers fell by almost 100,000 over the same period; and
- 67% of citizens responding to a survey strongly agreed with the introduction of a dedicated bus lane.

Tallinn:

- The installation of a public transport priority system has meant that trolley-bus speeds have returned to 2005 levels, whilst car speeds have fallen by 11km/h since 2005; and
- Information signs and announcements of the next stop inside vehicles have been well received according to passenger surveys.

Some preliminary results are now available for the innovative soft measures that have been introduced in the city of Norwich in order to reduce single occupancy car trips and encourage new forms of vehicle ownership and travel by other modes.

Travel plans:

- This measure aimed to develop travel plans in schools and businesses. 88 school travel plans and 20 workplace travel plans have been submitted and approved;
- Single-occupancy car journeys to school were reduced by over 10%;and
- Single-occupancy car journeys to work were reduced by 22%, with one organisation achieving a 45% modal shift.
- Car Pooling:
- This measure aimed to sign up 3 businesses per year over 4 years to the car sharing scheme and to re-launch / re-brand the existing car sharing web tool;
- Economy: The amount of money saved on fuel and car running costs by the members of the car share schemes is £99,369;
- Energy: The fuel savings delivered by this measure is 993,690 miles;
- Environment: This measure has saved 304 tonnes of CO2; and
- Transport: With 76% of the commuting car sharers previously travelling by single occupancy cars it can be claimed that this measure has removed approximately 1,646, single occupancy cars from the network at peak time.

Car Club:

- 26% of Norwich City Car Club members gave up a private car;
- 48% of Norwich City Car Club members decided not to buy a car;
- Total number of cars displaced to date is equal to 40 cars;
- 79% of cars given up were five years old or more and these were replaced with new low-emission diesel cars;
- There is a 17% reduction in short journeys by car;
- There is a 12% increase in cycling and 9% increase in walking; and
- From a zero threshold in 2005/6, awareness of the club amongst the wider population
- grew to 23% amongst the population within the Survey Area (The Norwich urban area, and its rural hinterland) by May 2007. (SMILE)

On the technical side, we have seen the start of large scale implementation and as a consequence the increase of changes in urban mobility in each city. The main technical improvements cover the following points:

- Implementation of clean and access controlled zones in the 3 cities, along with associated improvements to the surroundings to create more attractive public spaces. In the same way, infrastructure improvements have been made to stimulate the use of public transport.
- Developments of pathways and cycle routes have been realised, adding several kilometres of alternative routes in each city.
- Involvement of stakeholders to detail the contents or the way of implementing the measures; although taking longer than expected it has proved to lead to a better acceptance and an increased understanding of shared mobility.
- The start up of several new services for the citizens of the 3 cities: changes in the bus networks and integrated ticketing, also travel planning (students and business), shared vehicles such as bikes and car sharing, car pooling and freight deliveries.
- Implementation of several information systems, dedicated real time information for passengers (in buses and at stops...), and the integration of operators' databases for the management of mobility.

Integration is a common way of conducting the project in the 3 cities regarding the involvement of the local partners and stakeholders. This integration operates at several levels:

- Physical level, where modal integration has been improved by the implementation of information terminals at bus stations in La Rochelle
- Information level, by the design of better information, signage and branding of bus services in Preston; in Ploiesti with GPS equipment and the introduction of integrated pricing strategies (smartcards, one stop ticketing, kiosks) on bus services
- Organisational level, with cooperation between operators and decision makers which have adapted their organisations to these new ways of mobility

Also in the city of Cork, a measure was implemented to raise awareness of the need and potential of more sustainable transport among commuters, through the implementation of a car-pooling scheme for Cork City Council employees in order to reduce the number of vehicle trips. In the baseline surveys, 70% of employees commuted by private cars (42% travelling alone), while the remaining 30% used sustainable modes (i.e. public transport, cycling, walking, and train). In the 2004 surveys, 61% used private cars (34% travelling alone) and 36% used sustainable modes. However, the change in modal split has been largely affected by the increased access restrictions in the city and from the reduction in parking spaces available to City Council employees (approximately a 20% reduction in

parking spaces over 3 years). Unfortunately, the user acceptance of the car pooling scheme has been 'very negative'. People were mainly concerned about issues such as insurance and restrictions on the use of vehicles for work (MIRACLES, 2006).

Research has achieved important results in implementing a variety of travel solutions and has shown the positive impact of modal shift towards more sustainable transport modes (TARGET 2). However, research activities have also shown a single solution applicable to all situations does not exist. For the implementation of the solutions, linked transnational Work Areas have been established, each designed to target a specific population group with the most appropriate interventions to achieve the modal shift. These work areas are:

- Work Places. This area developed a model for working with key business sectors and developing travel options, such as car-pooling, bicycle usage and the promotion of greener fuels.
- Mobility Education. This area developed positive attitudes to sustainable transport modes by targeting households and school initiatives with information.

4.2.4 Policy implications

The clean transport policy implemented in the four cities proposed a broad variety of measures able to fully exploit the synergies between individual innovations within an integrated PT.

A policy of integrated transport planning requires collaboration and consensus among all involved public institutions, private companies and the users of the transport system. Mobility Forum was established to stimulate this by introducing an urban discussion platform on transport, contributing towards vital and sustainable Europe. (CARAVEL)

The four cities will also benefit by sharing experience and by transferring know-how and technology. Making this knowledge available to other cities in Europe, a total of 55 projects is going to be implemented, all related to the eight policy fields defined by the initiative:

- Energy-efficient, cost-effective and clean public and/or private vehicle fleets
- Demand management strategies based upon access restrictions
- Demand management and revenue raising strategies based upon integrated pricing strategies
- Stimulation of collective passenger transport and its quality of service
- New forms of vehicle use and/or ownership and less car-intensive lifestyle
- New concepts for the distribution of goods
- Innovative 'soft' measures for managing mobility demand
- Transport management systems and traveller services

The results of the executed projects focused on Sustainable Mobility are going to help local authorities by presenting good practices and introducing innovative approaches.

- They support local authorities by presenting 170 successful and replicable practices for sustainable urban mobility in its local experience database
- They analyse local policies and jointly with experienced European cities and towns, drafts recommendations for local authorities to facilitate the replication of these practices
- They identify innovative activities in reducing noise from urban traffic and elaborates practical guidelines aiming to point out existing potential for noise-abatement measures in a field for which local authorities are responsible and can therefore take action more easily
- Guides and recommendations: "Towards Sustainable Urban Transport Policies: Recommendations for Local Authorities"; "Public Transport: A Pillar for Sustainable Mobility"; "Sustainable Mobility for All!"; "Guidelines on Noise Abatement Planning Principles for Road Traffic at the Local Authority Level". (CIVITAS)

Policy activities of research has provided European local authorities and decision makers with a consistent and ambitious panel of best practices for managing urban transport in medium sized cities with respect to environment, citizen satisfaction, traffic congestion, safety and flexibility. The results include both policy recommendations and environmental progress.

Contributions to European and national policies, by:

- providing guidance on the procurement and operation of clean vehicle technologies in the urban setting;
- taking into account the accessibility issues of sustainable transport implementations;
- developing new technologies for implementing innovative transport processes
- contributing to new processes in administering transport policies at the city level, which could be transferred to other cities
- producing generalised conclusions about sustainable urban policies for other European cities
- helping accession countries to implement environmentally friendly technologies

Finally, the demonstration of the mobility management measure in the city of Rome has achieved to involve just 2.7% (41 805) of all the potential users. Therefore, for future initiatives it is recommendable to develop campaigns to increase employees' awareness of better solutions other than driving alone to work, such as car pooling or collective taxis. These campaigns should be mainly targeted to commuters, and should stress on individual benefits from using collective modes as well as the positive outcomes to the environment (MIRACLES, 2006).

Regarding the car pooling demonstration, the scheme alone cannot achieve a significant shift in modal split. It is recommended to implement car pooling schemes in combination with car restrictions (such as a reduction in parking, increase in cost) (MIRACLES, 2006).

4.3 Sub-theme 2: Accessibility and comfort of public transport

4.3.1 Background

Research reviewed in the related EXTR@Web paper (EXTR@Web, 2006) was focused on promoting the intermodality, interoperability and the overall efficiency of the European public transport systems.

4.3.2 Objectives

The first objective was to support the introduction of high quality public transport in medium cities. High quality public transport refers to cost-effective solutions like tram-train, light rail, quality bus etc. A key criterion is the ability to compete with the private car for everyday travel. (HITRANS, 2005)

Reseach objectives were to collect useful state-of-the-art knowledge for designing universal accessibility systems for public transport in a way that allows this knowledge to be used and shared by all stakeholders interested in accessibility of public transport with a view to favouring synergies and better quality, to produce a roadmap of future R&D in universal accessibility to public, to spread knowledge of universal design among educational institutions, end-users, operators, designers and manufacturers with a view of facilitating the adoption of the new concepts.(UNIACCES, 2006))

A strand of research focused on investigating the integration of light and heavy rail networks, and defining a European standard for tram-train vehicles to maximise market size and significantly reduce unit costs. Research was motivated by the fact that this new model of transport, which links and integrates tram/light railway systems with conventional ones, can offer a public transport service which better match the needs and expectations of the modern traveller by reducing mode changes, providing better accessibility, and improving journey times, which become comparable or even better than those achievable using private cars (CrossRail, 2001).

Another strand of research focused on the development or improvement of the technologies used in PT. More specifically, research has developed and demonstrated a modular, multi-application in-vehicle terminal (IVT), which meets the needs of fleet operators and drivers, and the requirements of the transport services and on-board telematic devices (INVETE, 2002).

A further objective was to improve PT station security by using video surveillance technologies (MIRACLES, 2006).

A further strand of research has concerned with solutions to increase the patronage of PT by offering better or integrated services. A number of demonstration measures have been implemented in the city of Bremen, Nantes, Bristol (VIVALDI, 2006), Rome, Barcelona and Winchester (MIRACLES, 2006).

Finally, a strand of research has demonstrated innovative PT services (MIRACLES, 2006),

4.3.3 Results

One of the research results has been the development of best practice guides. These are: Public transport & land use planning, Public transport - planning the networks, Public transport & urban design, Public transport - mode options & technical solutions, Public transport - citizens' requirements. The guides can be used by anyone working in public transport or town planning. It is possible to implement high quality public transport in medium sized cities (pop. 100,000 - 500,000). It is recommended to use the HiTrans best practice guides to find the best solutions for a city. (HITRANS, 2005)

The introduction of high quality public transport can have profound implications for a city's urban design. It may be introduced without any thought about how it will look or its impact on people's ability to move about and enjoy the city's public spaces. On the other hand, it may be carefully designed to reinforce or enhance these aspects — or to play a crucial part in the reinvention of the city's image. (HITRANS, 2005)

The project uses case studies to examine the variety of urban design factors that should be considered when introducing high quality public transport: overhead wiring, rails, signs, stations, stops, guideways, safety barriers, as well as the vehicles themselves. It also provides advice on advertising and preventing vandalism. The constant theme is that all of these factors should be considered within a comprehensive urban design strategy. (HITRANS, 2005)

Small to medium size cities face special challenges when introducing high quality public transport. Also, such cities are often part of a wider regional network of urban settlement that complicates the design of public transport services. These challenges are on top of well-known dilemmas that lie behind questions such as how far apart stops should be and whether resources should be spread between dense network of routes, or concentrated in a few, higher frequency routes. (HITRANS, 2005)

Ilustrations and graphs demonstrate principles of network design, introducing concepts that simplify and clarify the planning public transport services. The project provides many practical examples of the principles being implemented. It contains advice for planners of public transport in settlements ranging from modest towns to large cities. Also the project gives an overview of various appraisal techniques for public transport schemes. (HITRANS, 2005)

Furthermore the project gives an overview of various legislative frameworks and their effects on the provision of public transport. The de-regularisation of public transport in the UK is compared with the off road competition principle that dominates in Sweden, as well as the funding systems of France and Germany. (HITRANS, 2005)

Results presented in the case studies of 10 such cities and 5 corridors, interviewing the officials concerned to find out how they have done it. The case studies pay careful attention to the local circumstances as well as the public transport service itself. The report identifies the qualities that have made a difference — things like the fare structure, speed, reliability and frequency. More importantly, it has advice on how to achieve these for those directly involved in providing the service and for the policy-makers who shape the regulatory environment. (HITRANS, 2005)

Researchers have designed a roadmap identifying future R&D needs through a scenario-based analysis. The roadmap was prepared on the basis of an analysis of the Emerging Concepts and specifically, the solutions needed to deliver a given scenario-based accessibility requirement. The roadmap is organised according to the 5 steps in any journey chain: before the journey (e.g. travel information & booking); to the terminal or bus stop; at the terminal, platform or bus stop; getting into/out of the transport vehicle; during the journey. It also contains a separate section on R&D in relation to legislation, standards, policy and society. (UNIACCES, 2006)

The goal was to provide a methodology that would encourage the collaborative innovation process with relevant stakeholders. This modern design methodology and insight in collaborative group processes have been applied. A description of the state-of-the-art in accessibility schemes was used as input to the development. (UNIACCES, 2006)

In the city of Rome, an implemented measure involved the demonstration of an innovative automatic security and safety video surveillance system able to analyse user behaviour through the "understanding" of video information. The system, which can be used to monitor passengers in indoor areas of metro and railway stations, substitutes the traditional CCTV system manually managed by an operator, and is based on the application of a computerised image processor using complex software, which permits different standard situations to be recognised and the operators to be alerted by an audiovideo alarm, whenever unexpected events occurred. However, it can be used not only for prevention and control, but also for detecting and monitoring travellers' habits in order to improve the quality of PT services. The system has been tested at the Termini subway station, and the results have shown that the system is able to recognise and codify a wide range of events (between 81% and 94%), such as overcrowding, isolated groups of standing people, etc. (MIRACLES, 2006).

In the city of Bremen, measures have been implemented in order to increase PT patronage. A first measure consisted in the integration of PT with a car-sharing service through the creation of a combined offer for people using both services. More in detail, PT and car-sharing users benefit from more convenient fares when using respectively the carsharing service and PT, and they can use a smartcard to access both services. The result has been an increase in the frequency of PT use (except for trains), confirming that carsharing complements PT rather than competing with it (VIVALDI, 2006).

Another measures consisting in the extension of a tramline in the city of Bremen, has shown that tram attracts significantly more residents than the bus, since residents who had never used buses before the extension of the tramline, started using the tram after the extension was implemented, moreover to the detriment of private car (a survey reported that the number of residents who used PT after the extension of the tramline increased by 7.5% and the journey frequency increased by about 12.4%. Furthermore, 27% of residents declared that they had reduced their car usage because of the new tram) (VIVALDI, 2006).

The metropolitan Transport Authority of Barcelona has introduced a modern tramway in the city (The "Trambaix" scheme), combining the latest tram vehicle technologies with a reallocation of street space to offer better accessibility for citizens. The 15 km long tramway line has a total 25 stops and has started its service on 3rd April 2004. The passengers transported per day by the tramway on an average working day have increased from about 20 000 in the first month of operation to over 41 000 in October 2005. The average tram commercial speed has been slightly below the initial target of 20 km/h (17.9 km/h). Regarding integration with other modes, surveys have shown that about 50% of the trips involved a combination of walking (of more than 5 minutes) and tram, 10%

tram and metro, 10% tram and bus, and about 8% are tram and other means of transport (the remaining 22% were tram single-stage trips). The on-tram passenger surveys have shown that more than one-third of passengers were making trips they did not previously made. The reallocation of street space to offer better accessibility has been estimated to have generated more than 11 000 passenger trips per day. As for the other two-thirds of tram users 18% used to travel by car and 3% by motorcycle. Finally, 53% of surveyed passengers declared that their main motivation for using the tramway was its higher speed (MIRACLES, 2006).

Also in Bristol and Nantes measures were implemented to increase the patronage of PT with the introduction of a Showcase bus and the Chronobus route respectively. A Showcase bus route was introduced to improve bus service quality and attractiveness by providing improved information, better priority for buses, and improved waiting facilities. The results have been an increase in the number of passengers (passenger growth reached the peak of 10.8% in January 2005), and improved journey times. A survey has shown that thanks to the better quality services, 24% of people used the bus more than they had previously (a third of them previously used car, so, through a rough estimation, it was calculated a reduction of car trip equal to about 30 000 vehicle kilometres per year) (VIVALDI, 2006).

The concept of “Chronobus” introduced in two main bus routes in the city of Nantes ensures passengers a high level of service quality (frequency, regularity, comfort, and short journey time). To this aim a number of interventions were made on the two lines, like the introduction of CNG buses with low floor, kneeling system, and on-board information systems, as well as some changes in the layout of streets (bus lanes, bus priority, staff training for new operating conditions, quality certification, and promotion campaigns) (VIVALDI, 2006).

Furthermore, the construction of two new railway stations, which use existing rail tracks on the national Nantes to Bordeaux line, with parking facilities designed for car drivers and cyclists and connections with existing bus stops, resulted, in just one year, in a threefold increase in the number of passengers, and 29% of interviewed passengers who did the same journey the year before, declared that they used a private car (VIVALDI, 2006).

In the city of Winchester, integrated measures were implemented to improve bus service quality and information with a view to increasing PT patronage and user satisfaction. This scheme has consisted of the purchase of 13 new buses serving city centre routes, improved infrastructure and bus information, and car park extension of a P&R. As a result, PT patronage has increased by an average of 6% on the three demonstration routes, while other two ‘control’ routes has shown an average decrease in patronage by 6% (which was in line with the reported national 2% reduction in bus passengers per annum during the 2002-2005 period). 87% of the passengers rated the service as ‘good’ or ‘very good’.

Furthermore, for demonstration city centre routes, revenue has increased by an average of 27%, while the revenue generated on the two 'control' routes has only increased by 16% (mainly ascribable to the fare increase by 20% between 2001 to 2005). Ticket sales at the extended P&R site have also increased substantially (by 43%). It has also estimated that the investment in the 13 new buses should be recovered within 12 years thanks to the additional revenue generated by the increased patronage (the expected life of the vehicles is 15 years), while there have not been enough additional revenues from ticket sales to recover the investment made in extending the P&R car park (MIRACLES, 2006).

In the city of Rotterdam a water taxi service has been implemented in order to enhance the PT over water. The service is similar to that offered by regular taxis (passengers choose the landing stage to embark and disembark). The measure has involved the construction and operation of a network of 30 water taxi landing stages (including the 8 already existing and serving the Waternet service for tourist transport over water) served by 10 boats. The operation of the Water taxi service has been a successful demonstration of PT over water (in 2003, 280 000 passenger kilometres were travelled by the water taxis), and a valid alternative to cars or conventional taxis (40% of passengers would have chosen a car or a conventional taxi if the service would have not been available, and 13% of the passengers would have not travelled at all). Furthermore, the occupancy rate of the average water taxi was higher than that of the average car. Finally, the harbour and the broad river passing the city centre of Rotterdam create perfect scenery for high-speed boats, which people enjoyed watching; this was an important driver for the municipality to support the project. The main barriers to the implementation were the costs and the complex process to implement a new landing stage; the main drawback was the low environmental friendliness of the boat engines (TELLUS, 2006).

The city of Gothenburg has carried out a feasibility study for implementing an environmentally friendly ferry shuttle connecting the northern river bank with the central areas of the city to meet the increased demand of PT and reduce the environmental impacts. The idea was to test the CNG or Biogas propulsion for use on marine vessels, because so far this has been done only for buses. An in-depth analysis of present and future mobility demands across the river led to conclusion that the costs for developing a CNG ferry are too high to be accepted by the local political and municipal authorities.

However, the measure has contributed to increase knowledge of this kind of environmentally friendly ferries, as well as knowledge of optimised diesel engines for boats, which constitutes a useful basis for starting other initiatives aimed at introducing environmentally optimised ferries in other cities (TELLUS, 2005c).

Research concerning the integration of tram/light railway networks with conventional railway networks (tram-train schemes) has led to the following findings (CrossRail, 2001): The analysis of existing schemes (18 case studies across Europe) has shown many similarities between successful schemes, although the number of vehicles is low (an average of 10 per scheme) and they are custom built to fit specific local infrastructure requirements.

The user benefit study has concluded that tram-train schemes can offer considerable benefits (they provide faster end-to-end journey times, they reduce the need of changing mode, they improve the accessibility by increasing frequency and stops, finally their capital cost can be reduced by maximising the use of existing conventional railway infrastructure) which make them attractive to travellers and can increase the patronage of PT to private car use detriment. Furthermore, barriers to the implementation of tram-train schemes have identified, like the lack of political and organisational support, the lack of an appropriate regulatory framework, technical problems (which are possible to overcome, although they increase realisation costs), lack of standards in the tram-train design. In a cross-border context these barriers become more serious. Also the market potential of this scheme has been assessed in different scenarios, and the conclusion was that even in the best conditions the number of sales is expected to be low, so the economies of scale would be limited, and as a consequence, the cost of tram-trains quite high.

Finally, the functional design specifications have been identified, and they mainly relate to the light and heavy rail infrastructure interface. Besides vehicle specifications, a set of recommendations concerning the criteria to follow when designing new urban infrastructure have been produced. Their adoption when designing any tram-train scheme would ensure a certain level of standardisation and harmonisation of tram-train rolling stock across Europe, which would optimise the overall costs of the projects.

Research has also developed and demonstrated (in two different DRT services in the Italian city of Florence, and in a DRT service and in regular line buses in Finland) an IVT terminal consisting in (INVETE, 2002).

4.3.4 Policy

There have been some spectacular cases of cities increasing public transport patronage and achieving a shift from car use to public transport. The gains have been made using both bus and rail-based services, in a variety of regulatory circumstances, and have sometimes been achieved without heavy expenditure. And sometimes the gains have been won in the most unlikely circumstances. (HITRANS, 2005)

The most successful cities have used high quality public transport as part of an overall strategy that has included not only land use measures, but also complementary policies to restructure and market public transport — and to limit our use of cars. A series of case studies provides some inspirational illustrations of what can be done — as well as some salutary lessons of what to avoid. There are examples of cities regenerating rundown areas, curtailing urban sprawl, building successful public transport oriented communities, ridding themselves of traffic-chocked city streets, as well as examples of cities reinventing themselves as attractive places in which to invest and to live. (HITRANS, 2005)

The implementation of PT measures can be a real challenge in terms of technical and economic planning. The complexity of large-scale PT measures requires huge financial resources and long implementation timescales, which always imply political fluctuations. Consequently, when designing a PT system, a general recommendation is to ensure a good coordination and co-operation between the main stakeholders (e.g. involved actors, transport authorities, public transport companies and operators), and to involve politicians supporting long-term mobility strategies. Naturally, it is also critical to meet passengers' needs (METEOR, 2007).

The main recommendations when constructing an environmentally optimised ferry are (TELLUS, 2005c):

- It is recommended to review the costs at an early stage and to check if there are sufficient funds for the project;
- It is better to investigate other means of public transport and make sure there are no better options than ferries before starting the project;
- It is advisable to investigate if the existing infrastructure is appropriate.

The development and demonstration of the modular, multi-application IVT for collective transport fleets has led to recommend authorities and public transport operators to take the entire life cycle of the system into account when implementing or updating monitoring systems for regular and/or flexible public transport, mainly considering features such as modularity, compliance to standards, possibility to make updating, and flexibility (INVETE, 2002).

4.4 Sub-theme 3: Traffic management

4.4.1 Background

Research reviewed in the related EXTR@Web paper (EXTR@Web, 2006) has largely concerned with the implementation of measures which contribute to the reduction of environmental pollution and congestion and increase social cohesion, economic efficiency and safety.

4.4.2 Research objectives

The first group of objectives has related to the development, implementation and evaluation of a package of mobility management measures in order to promote, facilitate and encourage the use of alternative modes to the car (TARGET 2). Research was motivated by the fact that the development of sustainable urban transport requires changes of behaviour, attitude and culture in order to encourage modal shift towards more sustainable modes of transport.

Other group of objectives have focused on the improvement of the international state-of-the-art of real-time network-wide urban traffic control through the application of the Traffic-responsive Urban Control (TUC) strategy (SMART NETS). Research was motivated by the fact that current congestion problems in urban areas require the best possible use of existing infrastructure by using systems which permit to avoid oversaturation, increase throughput, and reduce travel times. Unfortunately, the existing real-time (trafficresponsive) urban traffic control strategies have the following drawbacks:

- they do not address saturated traffic conditions directly; they are functionally decentralised, i.e. signal-setting decisions in each junction are based on the current traffic conditions in adjacent streets only;
- several of the currently available strategies require specific real-time measurements, or complex implementation software, which render their transferability difficult and increase their implementation costs.

By using the currently available ICT technologies, it is possible to manage information and provide information services in order to help citizens to make the most rational and sensible choice when they plan their trips, and, as a consequence, reduce the traffic congestion in urban areas. Therefore, another group of objectives has concerned with the application of mobile technologies in order to develop an innovative multimodal and intermodal transport software platform offering a number of integrated services and information for trip planning (TRASCOM).

Researchers in this field focused mostly on Real-time traffic and travel information (RTTI) that can contribute greatly to safety as well as on facilitating access to public sector data and enabling the private and public sectors to cooperate in the service provision.

RTTI is the first area of a new generation of telematics services for drivers and other travelers to achieve appreciable success. Currently, this is due to the fast-growing implementation of services and products based primarily on existing RDS-TMC broadcast technology. By delivering traffic data messages promptly to a suitable in-vehicle terminal, TMC and TPEG upgrade static navigation to real-time, i.e. dynamic route guidance, or “electronic traffic avoidance” while giving safety benefits by alerting drivers to accidents, congestion and hazardous driving conditions.

Floating Vehicle Data, ‘Floating Phone Data’ (GSM network-based telephone location) and other advanced data collection techniques are now being used to support high quality TMC services. Public/private partnerships help increase the use of these techniques. (CONNECT 2005).

4.4.3 Research results

In the city of Ålborg in Denmark, a Real Time Passenger Information (RTPI) system has been demonstrated along with a bus priority scheme. This integrated scheme consisted of more than 200 buses equipped with computers able to communicate with a mobility centre, 32 signs and information kiosks with RTPI located at the most important bus stops and at the four local railway stations, and 51 intersections with bus priority. The result has been that PT users well accepted the system and were well aware of the opportunities offered by the information kiosks (on a monthly basis, 24 000 pages were activated at the terminal, mainly for searching itineraries and schedules). Regarding the bus priority system, it has been calculated that each day each bus passing the 51 intersections with priority saved about 4 minutes (VIVALDI, 2006).

In the city of Bristol, a demonstration involved the implementation of a wireless hotspot providing equipment and Internet access to local residents to widen participation and encouraging e-learning and use of other online services. A survey among residents involved in the initiative has shown that (VIVALDI, 2006):

- 13% of participants have started to work from home, reducing the need to travel;
- 57% used the Internet for shopping and 35% used Internet banking facilities, which may lead to a reduced number of trips;
- 30% used the Internet to obtain travel information (this suggests that Internet access may make it easier for people to travel by public transport).

Furthermore, in order to give access to travel information for the bus, rail, and ferry services, as well as by bicycle or walking, the Intermodal Trip Planner (ITP) has been implemented. This planner is an Internet-based application which allows the user to plan door-to-door trips using addresses or places of interest. The outputs are full itineraries provided in textual or graphic form, and the system is able to provide information tailored to the individual traveller. It has been estimated that in a month an average of 600 journey requests have been hit (VIVALDI, 2006).

In the city of Nantes, a new system for real-time passenger information available on mobile phones called MOBITRANS has been implemented to provide better public transport information. The system provides information on the two next departures of any bus or tram route from any stop on the urban network, warning messages about potential route disruptions, and the location of the nearest bus or tram stops from a given address. Interviews carried out to find out how the MOBITRANS service had been perceived by users showed that the information provided was considered reliable and accurate, and delivered in a user-friendly manner, thus enabling a better planning of journeys. However, users were worried about the potential costs of using the mobile phone to access the data. On average between 250 and 300 connections per day were made (VIVALDI, 2006).

A hard measure implemented in the city of Nantes involved the remodelling the historical axis from the city centre towards Brittany (the Vannes road) by assigning freight traffic and buses to a central road with local traffic on side lanes, enhancing pedestrian and cycling facilities, providing efficient connections between buses and tramline 3, and, finally, improving the urban landscape. The site measure included a Park and Ride facility (302 parking spaces, 10 bicycle parking spaces, and private parking with 98 spaces reserved for the shopping centre). Surveys showed a constant increase of the tramline patronage since it opened, and evidence that commuters have changed their behaviour: 13% of passengers surveyed were car users before switching to the tramway (VIVALDI, 2006).

The city of Bucharest has implemented a modern positioning system based on GPS technology to be used for public transport vehicle prioritisation, fleet management and real time passenger information at stops. During the demonstration only the indicator “accuracy of time keeping” was assessed. The results of the measurements performed before and after the implementation of the system did not show significant improvement of the schedule adherence. This should prove that it is not possible to solve this problem by only introducing a vehicle positioning system, which only contributes to quantify this problem. Therefore the implementation of the system on the entire PT fleet can produce positive impacts only if appropriate complementary measures are implemented (e.g. preparation of schedules adapted to the real traffic situations, public transport vehicles’ prioritisation) (TELLUS, 2005b).

In the city of Rotterdam, a measure has been implemented involving the installation and operation of 5 Dynamic Route Information Panels (DRIP – also called variable message sign VMS) at main city roads leading towards the highway ring road. Since in the Rotterdam Region, there are two organisations which gather and manage real time traffic information (the National Road authority for the National Highway Network and the City Administration for the City Roads), but do not cooperate, the measure also aimed at establishing information exchange between these two organisations in order to give complete and integrated information about the flow of traffic on the ring road. This information will support users to make decisions on which direction of the ring road to choose, and this will result in better traffic flows on the ring road in both directions and therefore less congestion on the adjacent urban roads. Although no significant effects on traffic could be assessed, the DRIPs, in case of accidents or road works on the ring road, can help to adequately redirect traffic with positive effects on transport, energy and environment. Furthermore, traffic situation in and around the city will certainly benefit from the cooperation between the abovementioned organisations, since high road traffic and urban traffic strongly interact with one another (TELLUS, 2006).

In the city of Rotterdam, a measure involved the introduction of real time arrival/departure information at the tram-stops of the high quality tramlines and at the metro stops in order to increase attractiveness of PT. The dynamic information system has been implemented at more than 70 metro and tram stops. The displayed information includes travel and departure times, as well as possible delays or special events. Also on-board communications systems were successfully implemented on 74 trams. A survey showed that the user acceptance was high as the information system led to a perception of shorter waiting times. Whether the number of passengers actually changed due to the information system could not be assessed (TELLUS, 2006).

In the city of Rome, a measure has been implemented to promote mobility management among commuters, as well as to raise awareness of the need to rationalise home-to-work journeys among employees, decision makers, private transport companies and administrators. This measure has involved the development of commuting plans, the organisation of car pooling crews, provision of information on opportunities and initiatives for using collective transport. The results have been the development and operation of ten Home-To-Work Plans (HTWPs) involving private companies, administrative and research bodies. In 2005 the average number of participants involved in the HTWPs was 41 805 who produced 15 772 vkm (about 1 400 users shared HTWP daily). There has also been an increase in the number of managers involved in the creation of new HTWPs. Even though the impacts on traffic and the environment have not been actually assessed, it has been estimated that this measure should led to a reduction of 7.5 million of vkm a year, a decrease in CO2 and benzene emissions of about 67.2 t/year and 239.2 t/year respectively, as well as a reduction in fuel consumption of about 244 t/year (MIRACLES, 2006).

The city of Winchester has set up a measure to investigate the impact of high polluting vehicles with a view to improving air quality in its city centre. Emissions from passing cars have been measured using a roadside Remote Sensing Device (RSD) installed on selected sites on main radial routes leading to the centre. The measurement results have been used for a number of feedback strategies to vehicle drivers, aiming at encouraging voluntary maintenance of high polluting vehicles or to prevent them from accessing the city centre, such as (MIRACLES; 2006):

- use of mobile visual management systems at roadsides to inform drivers on the levels of their emissions;
- use of a website based database to list emission readings from individual vehicles;
- provision of subsidised emission checks and repair services to high polluting vehicles;
- instructions for high polluting vehicles to use P&R instead of travelling into the city centre.

Because of technical problems with the measurement equipment, the strategies could not be implemented on the road. However surveys have been conducted to understand the support and potential take up of the various feedback strategies. The cost of monitoring an individual vehicle's emissions using roadside RSD has been estimated to be £0.21 per measurement not considering the fixed equipment cost, and £3.75 (based on 35 000 measurements) including it. The surveys have shown that 80% of respondents strongly agreed or tended to agree with this scheme to assist and advise drivers to reduce pollution in the city centre. 73% of respondents declared that they would like to be informed of the level of their vehicles emissions, whilst 76% of respondents would be interested in a

subsidy to inspect and repair their vehicle. 72% of respondents agreed that high polluting vehicles should use P&R instead of entering the city centre. About 80% of respondents declared that they would voluntarily let their cars to be checked if the roadside measurements (indicated via a visual management systems) indicated too much emission levels. About 60% of respondents stated that they would check their emission levels on the web service every month or less frequently. Only 6% of the respondents stated that they would not be willing to have their vehicle checked under any circumstance based on the RSD measurement (MIRACLES, 2006).

Research has developed, demonstrated and evaluated the innovative TUC (Traffic-responsive Urban Control) strategy (which also takes into account public transport priority measures) that can be easily and quickly implemented and can provide a significant reduction of travel times within urban traffic networks. The performance of this TUC strategy which makes use of employing advanced automatic control methodologies has been evaluated through simulations and demonstrations in three sites (Chania in Greece, Southampton in UK, Munich in Germany), producing positive results. In particular, it performed much better in comparison to the well-established and sophisticated resident systems in the three test sites, and user acceptance was generally high. Furthermore, the TUC has proved to be easily transferable to any type of network, because the test areas in the three test sites had very different characteristics in terms of network layout and traffic behaviour (SMART NETS).

Research has also successfully developed and validated an information platform which makes use of the most advanced mobile technologies and communication protocols (e.g. PDA, UMTS, Bluetooth, SWAP, Ethernet wireless) and offers services to support travellers and transport operators to efficiently plan their mobility choices by using a combination of all modes of transport. The platform architecture is universal, generic, open and scalable, and contributions to the standardisation of data exchange between the information systems of transport operators have been made (TRASCOM). New applications such as mobile electronic payments and real time assistance to traveller have been also developed.

- Transport and Leisure. This area aimed to reduce car travel to a range of visitor attractions, for example, through logistics improvement.
- City Living. This area developed activities for urban areas such as improvement of information for walkers and cyclists, integrated ticketing and removing causes of social exclusion.

Finally, concerning the investigations on behavioural response to TDM policy measures, research has carried out empirical studies to better understand how car users respond to the following three TDM measures: individualised marketing, road pricing and prohibition.

The main findings are as follows. Coercive measures have low impacts in terms of acceptance and adaptations. Furthermore, adaptations follow a psychological cost-minimisation principle, and the attractiveness of options such as more efficient car use, or use of PT depends on age of the car users, type of trip (work, shopping, leisure), and type of TDM measure (EMMA).

Research focused mainly on traveler information services. RDS-TMC receiver deployment has reached mass-market status thanks to its relationship with navigation systems, particularly the booming Personal Navigation Device market.

The Traveler Information Services Association (TISA) was founded on the basis of TPEG project. This project aimed to develop a new and open international standard for broadcasting language independent and multimodal traffic and travel information. It covers all modes such as road, bus, train, ferry, and air traffic and may be distributed over a wide range of digital media (Digital radio/DAB, Internet, DVB, etc).

The use of higher-bandwidth communication media (such as terrestrial or satellite DAB) and the results of research initiatives such as project AGORA contributed to further development of space syntax methodologies and to integration of live data with GIS to model the changes in use of space by citizens in city districts and urban corridors. The project investigated how space and movement interact with other characteristics of the urban environment (pioneering on-the-fly location referencing) and TPEG (new protocols extending the message set and supported applications) can help broaden the capability for future RTTI services. (AGORA 2005)

4.4.4 Policy implications

Recommendations have been made in relation to the developed approach to integrated planning (TELLUS, 2006):

- It is recommended to ensure that all policy makers (city districts, municipality, regional authority, etc.) and politicians are committed to the policy plan. The energy spent in gaining stakeholders commitment beforehand is only a fraction of that needed to recover acceptance after the establishment of an undesired policy plan.
- It is recommended to exploit pressure from market or market opportunities to enforce the planning process. The pressure of stakeholders from market can be very useful to gain political commitment and therewith accelerate the process.

Concerning the Internet-based information service on mobility management in the region, it is recommendable to broaden the scope of the website which is currently mostly focused

on biking and information about bicycle routes. For example success stories of individual companies working with commuter plans (e.g. examples about van-pooling, use of public transport, etc.) could help to attract other people and obtain more benefit from the mobility management point of view (TELLUS, 2006).

The successful demonstrations of the TUC system in the three test sites have shown that there is scope for the exploitation and further development of TUC. Research has produced the following recommendations for future TUC implementations (SMART NETS):

- to improve the interface of the TUC system in order to improve its user-friendliness;
- considering the positive results of the demonstration, it is necessary to raise awareness of urban control operators on the potential of TUC as a cost-effective answer to urban traffic and congestion problems, and encourage them to introduce TUC into their cities;
- the simulations showed that the most significant contribution of TUC to traffic control is its capability to prevent gridlock, but since no gridlock occurred in any of the test sites during the demonstration, it is necessary to find a test site where gridlock is a frequent problem in order to demonstrate this potential of TUC.

Research into the implementation of travel solutions to encourage modal shift towards more sustainable transport modes has identified three overarching themes of the development of the sustainable transport agenda for the future (TARGET 2):

- Focused activities combined with sustained targeted marketing delivers modal shift.
- Behaviour, attitude and culture change are long term processes. They require continuous efforts and resources which start by raising awareness of sustainable transport options among young people and continue to by involving them throughout all stages of their lives.
- A strategic vision for sustainable transport must include a broader spatial development vision.

Finally, regarding the investigations on behavioural response to TDM policy measures, in order to achieve public acceptance, effectiveness, and political feasibility, it is recommended to combine coercive TDM measures (prohibition and road pricing) with noncoercive ones (information) (EMMA).

The first service trials using TPEG-based technology, started in the end of 2006, formed an important step in bringing this new technology closer to market. The first limited commercial services began to broadcast in the UK in the end of 2008. Several recent European projects support the actions proposed by the RTTI recommendations:

Mobile info (German industry-led but wider applicability) developed TPEG-based RTTI service supporting dynamic navigation. The project delivered its output to TISA to support wider standardisation and deployment work.

TISA (Traveler Information Services Association), a non-profit organisation hosted by ERTICO and formed in order to leverage synergies of TMC and TPEG forums and technologies for a coordinated market development.

- Working on development and standardisation of new features for TMC, following requests from industry and public authorities, on an ongoing basis.
- Working on development and standardisation of TPEG (Transport Protocol Expert Group) framework and travel information applications using digital bearers.

The RTTI Working Group, following 2001's EC Recommendation on the deployment of traffic and travel services in Europe, has provided further analysis and recommendations for accelerating the take-up of the measures for accessing the public sector data, enabling the establishment of public-private partnerships, and the provision of reliable, high-quality RTTI services in Europe. The WG has produced a technical and economical model for implementation of RTTI services. It recognized that the only viable short-term solution is RDS/TMC, while other technologies will offer higher quality services in the future.

The RTTI WG ended its work in 2005. Among the recommendations to Member States:

- An agreement on an implementation strategy for the extension of RTTI services working to European standards is needed;
- Support for the TMC Forum is encouraged;
- There should be a minimum quality of public services;
- Clear guidelines for the private sector should be published on the conditions for establishing private data collection networks for commercial vehicles.
- The frequency spectrum and broadcast capacity should be made available in the near future and support the development of future advanced digital services.

Since then, further development in the field of RTTI has taken place but the issues regarding implementation, recommended measures and further roll-out remain open.

The ITS Action Plan and EasyWay project are current key initiatives which have identified the importance of supporting RTTI development and deployment. Future actions for deployment include:

- Work to take advantage of the RTTI possibilities offered by the availability of new broadcast data bearers such as digital radio.
- Work to improve quality of service in urban and cross-border areas.
- Continual work to optimize and manage the quality of existing services.
- Support in introduction of TMC services to a new markets (e.g. Eastern Europe and China).

TISA is engaged in coordinating and supporting these actions among public and commercial stakeholders. Member State support for digital broadcast deployment is critical for widespread implementation of advanced services using TPEG to deliver a wide range of high quality RTTI and other traveler information services (E-Safety recommendations 2008).

4.5 Sub-theme 4: Pedestrians and non-motorized transport

4.5.1 Background

Research reviewed in the related EXTR@Web paper (EXTR@Web, 2006) largely concerned with the promotion of non-motorised passenger transport and changing modal split in favour of alternatives to the solo-driven car.

The European research intended to make cycling safer and more attractive and included internet route planning to help cyclists plan fast and safe routes. It also featured an extension of the cycling network and equipping tram and bus stops and metro stations with Bike&Ride facilities.

4.5.2 Research objectives

The first group of objectives focused on the development of an approach to the design and management of arterial streets from a people-oriented perspective. In fact, the efficient and effective design and management of arterial streets are challenging aspects of sustainable urban planning, because they must perform often conflicting functions (they provide a major channel for movement between different parts of the city; they provide access for employees, customers and deliveries; they represent a major public space that is visually dominant, culturally charged and of great importance for social interaction; they represent "the garden" for many residents). Unfortunately, conventional principles of design and management of streets have tended to separate the through traffic function of streets from the other urban street functions. In other words, arterial streets have often been re-engineered to optimise vehicle flows in order to increase traffic capacity, efficiency and safety of vehicle users, but often to the detriment of pedestrians, cyclists, and other urban activity performers. In order to reverse this trend, it is necessary to develop a new approach to the design and management of arterial streets which appropriately combine mobility and access functions (ARTISTS, 2005).

The second group of objectives concerned the investigation and development of methods for the assessment of the Quality of Life (QoL) in relation to different types of public measures in the area of transport and mobility. Research was motivated by the fact that transport and mobility significantly affect QoL, because they are key elements of the integration in society. Consequently, it is important to develop suitable tools and methods for assessing how the implementation of transport and mobility measures affects citizens' QoL in order to plan these measures effectively and efficiently (ASI).

Another group of objectives was to provide more and better cycling audits in EU cities and regions, training of certified auditors as well as exchange of knowledge on cycling policy (BYPAD).
Some projects related to strategic objectives like overall improvement of citizens' quality of life and targeted reflecting the specific measures adopted. (MIRACLES)

Research was focused on social inclusion of all groups in society - it is necessary to ensure that all groups of society have equal access to employment, training facilities, retail outlets and leisure facilities:

- Health and well being of the citizens - the transport system should promote the health and personal security of the citizens.
- Sustainability - the transport activities of the city need to contribute to a more sustainable environment through efficient use of resources and minimal environmental impact.(VIVALDI)

A further objective was to improve PT station security by using video surveillance technologies (MIRACLES, 2006).

Another objective of research has been to find new ways of promoting walking in cities by improving the conditions and quality of urban public spaces, through the identification of best practices and the development of new tools and generic solutions to help designers, planners and decision makers to identify and solve problems when developing and implementing measures relating to urban pedestrian environments (PROMPT, 2005).

4.5.3 Research results

Research has focused on demonstration of traffic management measures targeting walking and cycling modes. In the city of Bremen, a contraflow lane for cyclists on a one-way street (Lahnstraße) has been created along with better cycling infrastructure and reallocation of road space to improve safety of cyclists. The overall result according to a survey is that the users of the new cycle lanes feel significantly safer (the share of those who feel "very safe" or "safe" has increased for Langemarckstraße from 17% to 79%, for

Lahnstraße from 10% to 79% and for Hohentorsheerstraße from 39% to 71%) (VIVALDI, 2006).

Also the city of Cork has implemented measures to promote the use of sustainable transport modes by providing facilities for cyclists and pedestrians. Besides providing better footpaths for pedestrian, this measure has extended bicycle parking facilities in the city centre (264 bicycle parking places were available in October 2005), and has introduced in all city primary schools a Cycle Safety Training Programme (which has been positively accepted). 61% of surveyed users rated the new bicycle stands as “very good” (additional 29% rated it as “good”). An increase in cycling across the inner cordon by 47% (according to LUTS – Land Use and Transportation Study- classified traffic counts in October 2005) has been measured (MIRACLES, 2006).

The Home Zone scheme implemented in the city of Bristol has consisted in the remodelling of seven streets in a residential area surrounded by light industrial businesses. The remodelling has involved the use of new surface materials to create more contrast between elements of the street, the reduction of sight lines for drivers to encourage lower vehicle speeds, various street furniture and new street lighting, a link to a cycle/walkway, improved amenities, and a public artwork (to enhance the landscape and the identity and community ownership of the area). The results of this measure have been an improved quality of the environment in which residents live, which not only keeps cars moving slowly, but also gives equal priority to motor vehicles, cyclists, and pedestrians.

Furthermore, this measure has contributed to demonstrate the positive impact that residents can have on the successful implementation of local transport measures and their positive attitude towards the improvement of their local environment (VIVALDI, 2006).

In the city of Nantes, the large space in front of the university buildings (in the centre of the Tertre campus), which was previously used as car park, has been redesigned to reduce the number of parking spaces (from 2 000 to 1 600) and make space to an esplanade for pedestrians. The measure has also involved the construction of new accommodation and a shopping area linked to the tram station, as well as the installation of new street furniture and 200 bike racks. As a result of the new layout and parking restrictions, the number of students travelling by car to the area has decreased from 22% to 17% (VIVALDI, 2006).

A guidebook to support designers, planners and decision makers to promote walking in cities by improving the conditions and quality of urban pedestrian environments has been produced (PROMPT, 2005).

The basic approach has been to avoid finding partial solutions before becoming acquainted with all the problems inherent to the situation under examination, because the

best results generally can be obtained if all the inherent problems are solved at the same time (some problems are more or less independent so that sometimes also partial solutions can be successful). This approach has led to the identification of the prevailing problems in pedestrian environments, which have been analysed according to aspects such as safety, accessibility, comfort, attractiveness, intermodality, and implementation. The main solutions to these problems are included in the guidebook. So the users can find in this guidebook proper solutions to specific problems; most of them are current best practice examples, but there are also new and innovative solutions. The main clusters of problems for which holistic and coherent solution have been found are (PROMPT, 2005):

- lack of or scarce offer of physical and social space;
- lack of equipment and services in outdoor spaces;
- interference with motor vehicles;
- poor support by PT and connection to other modes of transport;
- poor natural, architectonic and psychological features of the environment;
- poor environmental performance.

Research has also facilitated the coordination of research activities of different stakeholders (e.g. academic institutions, industry, mobility operators and transport authorities) in the area of innovative urban transport concepts. It has also helped to identify and disseminate excellent, transferable examples of innovative transport measures in the most crucial areas of urban transport. More specifically, a “State of the Art in Developing Innovative Transport Concepts in Europe” has been produced. This document provides an overview of the topic, and defines, describes and analyses the 12 selected innovations.

A hard measure implemented in the city of Nantes involved the remodelling the historical axis from the city centre towards Brittany (the Vannes road) by assigning freight traffic and buses to a central road with local traffic on side lanes, enhancing pedestrian and cycling facilities, providing efficient connections between buses and tramline 3, and, finally, the urban landscape. The site measure included a Park and Ride facility (302 parking spaces, 10 bicycle parking spaces, and private parking with 98 spaces reserved for the shopping centre). Surveys showed a constant increase of the tramline patronage since it opened, and evidence that commuters have changed their behaviour: 13% of passengers surveyed were car users before the tramway (VIVALDI, 2006).

One of the research results was facilitating the expansion of the network to the new EU-countries and training of new auditors. The methods have been also adapted for regions (large metropolitan districts, counties, provinces) and for small towns. The exchange of knowledge was improved by developing a good practice database and by organising various international seminars. A pan-European network of around 100 cities, towns and regions in 21 European countries who actively invest in improving the quality of their cycling policy has been created.

In the city of Rotterdam, measures have been implemented to encourage the use of other modes in combination with the PT. A first measure aimed at expanding and enhancing park & ride (P&R) in order to encourage more car drivers to also use PT for their trips.

Another measure aimed at encouraging the use of bicycles in combination with PT by providing good quality bicycle parking to reduce currently considerable risk of bicycle theft (especially in the inner city areas) and the nuisances caused by uncontrolled bicycle parking. Besides developing a strategy for parking locations and exploitation, this measure involved the creation of guarded bicycle parking stands, and the extension of bicycle parking at many PT locations. The majority of interviewed people (96%) use the bicycle parking in combination with the metro. In general people are satisfied with the bicycle parking and are very satisfied about the distance between the parking and the metro. Some respondents said that the renewal of the parking caused them to use it more (and using their car less). Most of the people using the parking are regular users (in summer and winter), and 65% of the interviewees use the parking at least 4 times per week.

Although people are satisfied with the neatness, the covering, the ease of attaching the lock and the ease of getting the bicycle in and out the rack, they are least satisfied with the number of covered spaces. Some people said that the bicycles should be better guarded, for example by cameras, surveillance or closed parking (TELLUS, 2006).

Another measure implemented in Bristol aimed at promoting Park and Ride. Two already existing structures were improved through the enhancement of cycling and walking links, increase in capacity, introduction of an information kiosk, and VMS information. The result was that, according to a survey, about half of the passengers of bus lines serving the P&R facilities declared that they would have used the car before deciding to use P&R (this means a saving of about 220 car journeys per day) (VIVALDI, 2006).

In the city of Cork, a new P&R near the City Centre has been created, which provides about 900 parking spaces with a view to reducing congestion and promoting sustainable modes of transport. In November 2005, the daily patronage was about 500 vehicles per day, saving about 450/475 trips each way to the City Centre. The presence of the P&R facility has not only reduced the demand on inner city parking, but it has also encouraged the use of more sustainable modes of transport. 83% of surveyed users rated the overall quality of the P&R service as “very good” (the remaining 17% rated it as “good” or “satisfactory”). 99% stated that they would use P&R again. The user and operator acceptance of this measure were very positive. The service is mainly used by females (79%) and 71% of respondents were travelling alone. Finally, reliability, cost, perception of security and frequency of the bus service were all significant factors for the success of this service (MIRACLES, 2006).

4.5.4 Policy implications

It is recommended to maintain and improve cycling infrastructure which is essential to keep cycling attractive for residents, and as a consequence to keep modal split for cycling at a high level or increase it (VIVALDI, 2006).

Since 1999 European Commission has supported the creation and improvement of BYPAD (Bicycle Policy Audit), which is an instrument for the evaluation of local and regional cycling policies and their quality improvement, and has now become a European quality standard for cycling policies. Research has continued to finance this platform, which maintains its high quality by updating the audit method, training qualified auditors and offering a quality label (BYPAD, 2008). Its objectives remain:

- to provide more and better cycling audits in EU cities and regions;
- to train new auditors;
- to exchange knowledge on cycling policies;
- to expand the BYPAD-network to the new EU countries.

In order to follow the proposed "people-oriented approach", it is necessary to correctly quantify all users. It is then recommended that road authorities monitor street flows by counting the people inside vehicles (not just the vehicles), but also by counting pedestrians and cyclists. A future task would also be to identify new indicators for people movement and intensity and other types of activities (not transport related).

- Since it was pointed out the scarcity of urban street space, and the need to share it "spatially and temporally", it is also recommended that authorities explore the possibility of explicitly "calculating" the share of space and time given to different users.
- It is recommendable to incorporate this new approach in national guidelines.
- It is recommendable to extend this approach, so far carried out at European level, at national and city level to produce locally adapted guidelines. However, it is essential to always have a network at EU-level which coordinates activities and collects and spreads the gained knowledge and experience. (ARTISTS 2004)

The main policy implications produced by the BYPAD platform for the evaluation of local and regional cycling policy (BYPAD, 2008) are:

- The BYPAD-approach can be the basis for supporting local cycling policy. It helps to give a clear answer to which package of cycle measures is the most appropriate for a specific city, town or region.

- The BYPAD platform does not provide a tool to compare performances of cities and regions from different countries. Nonetheless, some kind of competition has arisen amongst the BYPAD-cities, which want to be the best. However, this competition element could encourage investments in cycling policy. It could also be the starting point for the establishment of a European Award for the best cycling cities and most promising cycling cities in Europe.
- In order to ensure the continuation of the platform on a permanent basis, even if EU funding should end, the creation of a legal body is planned (the BYPAD foundation). The financial basis of this foundation will come from membership fees of BYPAD-auditors and BYPAD cities, towns, regions. The European Cyclists' Federation will be one of the founding members. Furthermore, to avoid that a new city-network organisation will be created, an active co-operation with existing city networks is necessary (POLIS, ICLEI, Energy-Cités, Eurocities, etc.).

BYPAD is a strong instrument with a good name recognition all over Europe. Via BYPAD the aspect of Total Quality Management in cycling policy has been introduced and it is now also recognized as an efficient method to improve local and regional cycling policies. As BYPAD initially is a self-evaluation tool to help improve the cycling policy of a city, region or town, there has been given a lot of attention to the comparing of scores and results by these authorities.

The BYPAD-approach can be the basis for supporting local cycling policy by higher authorities. An indicator that BYPAD is taken seriously is the advice of different national and regional authorities (e.g. Austria, Germany, Czech Republic,…) to use BYPAD as a quality management tool to improve the local cycling policy.

The element of exchanging knowledge on cycling policy between different EU-cities was one of the goals where it was very clear that the participating cities, towns and regions were at the first place interested in the direct advice they got via the audit report and the audit process guided by an external auditor (= trained expert in cycling policy) in their own city, town or region. Secondly, it was interesting for them to see what other cities, towns and regions in Europe are doing.

This way this network of BYPAD-auditors executes the direct knowledge transfer from what is happening on cycling policy elsewhere in Europe by the direct advice to cities, towns and regions. (BYPAD, 2008)

Another important issue is a consensus. A local administrator would not act against the public consensus. Thus, once citizens must trust and support the politicians, policy has to guarantee continuity in pursuing objectives, despite some initial "disappointment".

In general physical barriers were not well accepted, and this is common to all the cities. Nevertheless satisfaction levels have increased after the implementations were completed and people could take advantage of a better environment. The experience of Cork and other Civitas cities was helpful in anticipating and preventing some problems.

Policy must help creating Public Private Partnerships (PPP) that help improving the quality of the services provided (for example in Winchester the BQP - Bus Quality Partnership - brought together the key stakeholders of the local bus company and the local authorities. This has shown that passenger growth is linked to the extent of the BQP).

- The “Push and Pull” strategy has been pursued and actually was an objective of the policy aspects linked to MIRACLES.
- MIRACLES have identified some points that relate to the strategies required to address traffic congestion and to implement Sustainable Mobility solutions.
- The policies adopted must include the physical measures including the implementation of access restrictions to the “Clean zones”, Park & Ride systems, all measures designed to modulate private traffic through infrastructure changes and physical restrictions. (MIRACLES, 2006)

General conclusions from the implemented CIVITAS measures concerning PT are (MIRACLES, 2006; VIVALDI, 2005):

- The improvement of the quality of bus service and information contributes to an increase in patronage;
- P&R sites proved to be well-accepted and popular among public;
- The introduction of a tramway scheme can contribute to significant reduction of the car use.

4.6 Sub-theme 5: Strategies planning and policy facilitation

4.6.1 Background

Research reviewed in the related EXTR@Web paper (EXTR@Web, 2006) was centered on European study and has also provided an assessment of the regulatory framework of local public transport operations in Europe. The following outcomes have been achieved: reference framework and harmonisation of concepts; updates of views on the current legal, organisational and financial frameworks of local public transport systems; analytical framework for the assessment of barriers, impacts and tool changes; synthesis of empirical experience; assessment of barriers and impacts to change; tools to assist key players in

the process of change; and recommendations for the management and assessment of regulatory evolution in local public transport operations in Europe.

4.6.2 Research objectives

The main group of research objectives was to support transport policy in Europe, by defining common good practice principles for national and regional transport modelling that satisfy immediate needs of model developers in the new Member States; to contribute to the establishment of a standardized approach for transport modelling in the European Union. (MOTOS, 2007)

Research found the need to verify the scientific consistency and transparency of policy support and assessment tools, and their ability to match the needs and expectations of policy-makers, users and stakeholders. (TRANSFORUM, 2007)

TRANSFORUM has facilitated this verification process by establishing a scientific forum of individual experts; facilitating the forum in a consensus-based assessment and validation of intermediate and final research results both from national research projects and from European research projects in support of the Common Transport Policy; developing recommendations to ensure compatibility and convergence between the tools used in transport policy support and assessment both at the European and national levels, and identifying best practices; disseminating project results and encouraging their uptake. (TRANSFORUM, 2007)

Another project aimed to identify and develop innovative concepts and tools for organising a proper coordination at EU level between all relevant stakeholders concerning research on urban mobility and passengers, through (EURFORUM, 2007) identification of priority research areas in the field of urban mobility which would benefit from better coordination of stakeholders at EU level, taking into account both technology- and policy-oriented research.

4.6.3 Research results

Research has put considerable effort into determining user needs of model developers and policy makers. This user needs analysis was reinforced by targeted workshops in the new member states. In continuation, the handbook identifies and describes best practices and common pitfalls in setting up, enhancing and linking national and regional transport models. Common best practice principles were defined for the most important processes identified in the user needs analysis. The handbook for transport modelling was also made available in an on-line navigable version. (MOTOS, 2007)

The handbook contains three parts, providing a general description of the modelling process. Topics discussed include data collection, model estimation, uncertainities in models, linkage to other models and transport modelling software. The handbook addresses modelling issues from the point of view of users, i.e. the policy-makers. Its aim is to describe the process followed by policy-makers who have identified a “problem” and need a model to resolve it for each issue. These issues are then linked to modelling processes (passenger demand modelling, freight demand modelling, assignment models, economic models and/or impact models. A list of present models that can be used as a reference case is also presented, as well as a link to best practice examples. An extensive description of the state-of-the-art of transport modelling was made and a number of best practice examples were collected and described. (MOTOS, 2007)

The models used in NMS are ranging from macro-models (state and region level) through mezzo-models (agglomerations, towns, communities) to micro-models (town parts, crossroads). But, in general, there is focus on regional modelling, not on national one. However there are national interests in transport modelling, especially in the Baltic States and modelling of the TEN-T development. (MOTOS, 2007)

Transport modelling as the professional tool for decision-making process is important and the participants of the workshops agreed that it should be promoted in many ways. It was indicated that transport modelling becomes a higher importance where the public is involved which forces the policy makers to make well-founded decisions and arguments. (MOTOS, 2007)

Uni-modal applications are the most common application of the transport modelling, but also multimodal models exist, at regional level (mainly regions and agglomerations). In all NMS the following multimodal models are used: private transport (cars) and public transport models (covering all modes of transport) with modal split; traffic models for forecasting modal flows (rail and road); network traffic models to assign traffic flows (road and rail) to the network elements. (MOTOS, 2007)

The models in passenger transport, both car and public transport, are more often developed and used in practice, than freight models, followed by the user needs, expressed especially at regional and local level. The main focus is on modelling passenger transport demands and forecast of passenger traffic flows. Although all kinds of transport models were assessed as useful, passenger transport models are regarded as more useful than freight transport models.

The following transport models are mostly used in NMS: forecast transport demand; direct network models to assign traffic flows to the network; impact models on transport infrastructure and policy interventions (using cost-benefit or multi-criterial analysis); socio-

economic impact models; road network models; models on traffic distribution in urban network; financial models. Model developers: typically, professional consultants, from consulting private companies, universities and research institutes develop and operate the transport models in each NMS. (MOTOS, 2007)

Another outcome is the Strategic Research Agenda (SRA) for urban mobility. This SRA has been developed starting from an analysis of the State-of-the-Art (SoA) on the urban transport research issues, and the formulation of a Vision for the Future. In fact, this SRA is based on the comparison between the SoA (where do we stand with respect to our knowledge) and the Vision (where do we want to be with respect to policy outcomes), and takes up the set of issues which are considered crucial for the future development of urban transport: (EURFORUM, 2007)

The concept developed by EURFORUM is to create room for innovative co-ordination and cooperation of stakeholders and decision-makers with regard to urban mobility research developed at European level and supported by the European Commission. (EURFORUM, 2007)

The SRA has identified and described the following future topics for urban mobility research grouped according to the two components of transport demand (Users' needs and behaviour, and the urban structure), and the two components of transport supply (integrated mobility services, and integrated transport systems), as well as according to Urban Transport Demand Analysis and Modelling for Policy Support. (EURFORUM, 2007)

Reducing negative impacts of urban transport (including: safety, security and environmental impacts) by integration of urban transport networks (including: infrastructure sharing, funding, intermodality, intelligent integrated network management); implementation of new urban freight concepts; strengthening of the alternatives to the private car (including: pedestrians and cyclists, better data for improved public transport operation, taxis and alternative modes; organisational and regulatory framework for urban transport, innovations in public transport infrastructure and rolling stock). (EURFORUM, 2007)

4.6.4 Policy implications

One of the assessment tools/methods supporting policy development is to develop transport policy visions from the systems perspective. Basically, the ultimate purpose of the transport system is to serve the needs and expectations of its users, who in turn shape the system by their own behaviour and actions. This requires putting transport research and policies at the service of more general goals. The coherence of the transport system

should be analysed with various goals in mind constantly monitoring the edges of transport related projects within a larger societal context. At these edges lie the richest opportunities for transport innovations and success. (TRANSFORUM, 2007)

Another one is to establish innovation networks, targeted at cooperative policy formulation and mutual learning of researchers and civil servants is recommended as an essential task for the future. The process could be fostered by establishing dynamic discussion and assessment forums or information events between research projects, European and national civil servants/policy-makers on a regular basis. In addition, reserving extra funding for project activities after the completion date (for maintaining websites, organising policy-makers' meetings/ seminars etc.), might help the dissemination activities to reach beyond the research community. Furthermore, local transport authorities often play an important role in policy implementation and therefore best-practice knowledge transfer should be supported. (TRANSFORUM, 2007)

The main recommendations are: (EURFORUM, 2007)

- To prepare a roadmap for the implementation of the SRA and periodically update of the SRA;
- To ensure the coordination with technology platforms and ERA-NET;
- To target public authorities for coordinated R&D and demonstration actions;
- To disseminate and communicate standards, theories and good practices of integrated urban transport planning and managing;
- To build consensus on strategic actions, including, for example, the preparation of a charter on R&D targeting "European urban mobility" for more sustainable cities and for the benefit of all European citizens to be signed by public authorities. (EURFORUM, 2007)

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6. Annex 1: List of EU-funded projects per sub-theme

Sub-theme 1: Sustainable intermodal passenger transport				
Project acronym	Project title	Programme	Project website	Coverage
A3	New, Integrated Mobility Services, NIM	NRP 41 - Transport and Environment (Switzerland)	www.nfp41.ch	Extr@web paper
CAESAR	Coordination Action for the European Strategic Agenda of Research on intermodalism and logistics	FP6-SUSTDEV-2 - Sustainable Surface Transport	www.eirac.net	if reports become available
CARAVEL (CIVITAS II)	Travelling Towards a New Mobility	FP6-SUSTDEV-2 – Sustainable Surface Transport	www.civitas-initiative.org	this paper
SMILE (CIVITAS II)	Sustainable urban transport for the Europe of tomorrow	FP6-SUSTDEV-2 – Sustainable Surface Transport	www.civitas-initiative.org	this paper
CONNECT	Co-ordination and stimulation of innovative ITS activities in Central and Eastern European Countries	European - MIP - Multi-annual Indicative Programme	www.connect-project.org	this paper
CONPASS	Better connections in European cross-border passenger transport	FP5 - GROWTH - KA2 - Sustainable Mobility and Intermodality		Extr@web paper
EMMA	Evaluation of Measures for Controlling Private Car Use in Metropolitan Areas	Project from Sweden		this paper

Sub-theme 1: Sustainable intermodal passenger transport				
Project acronym	Project title	Programme	Project website	Coverage
MIRACLES (CIVITAS I)	Multi Initiatives for Rationalised Accessibility and Clean, Liveable Environments	FP5 - GROWTH - KA2 - Sustainable Mobility and Intermodality	www.civitas-initiative.org	this paper
NETMOBIL	"New transport system concepts for enhanced and sustainable personal urban mobility [cluster project]"	FP5 EESD KA4 - City of Tomorrow and Cultural Heritage		Extr@web paper
-	Network Study of Urban Passenger Transport	RHK - Research and Development activities in Finnish Rail Administration		Extr@web paper
-	Non-conventional transport systems: application fields and feasibility analyses	PRIN calls 1999-2005 - Research projects of national relevance (Italy)	www.ing.uniroma2.it	Extr@web paper
SUCCESS	Smaller Urban Communities in Civitas for Environmentally Sustainable Solutions	FP6-SUSTDEV-2 - Sustainable Surface Transport	www.civitas-success.org	this paper
TARGET 2	Travel Awareness Regional Groups for Environmental Transport 2A	INTERREG III - Community initiative INTERREG		this paper
TRENDSETTER (CIVITAS I)	Setting Trends for Sustainable Urban Mobility	FP5 - EESD KA6 - Economic and Efficient Energy for a Competitive Europe	www.civitas-initiative.org	Extr@web paper

Sub-theme 2: Accessibility and comfort of public transport				
Project acronym	Project title	Programme	Project website	Coverage
COUNTERACT	Cluster of User Networks in Transport and Energy Relating to anti-terrorist Activities	FP6 - Research for Policy Support (Action line: "Global security analysis and validation systems for transport and research relating to accident risk")	pr.euractiv.com/press-release/fighting-terrorism-public-transport-and-energy-counteract-conclusions-have-been-offici	if reports become available
CrossRail	Integrating Local and Regional Rail Including Cross Border Aspects	FP5 - GROWTH - KA2 - Sustainable Mobility and Intermodality		this paper
EASIS	Electronic Architecture and System Engineering for Integrated Safety Systems	FP6-IST - Information Society Technologies - Priority Thematic Area 2 (PTA2)	www.easis-online.org	this paper
F4	Technical perspectives of rail transport	NRP 41 - Transport and Environment (Switzerland)	www.nfp41.ch	Extr@web paper
HITRANS	Development of principles and strategies for introducing high quality public transport in medium size cities and urban regions	INTERREG III - Community initiative INTERREG	www.hitrans.org	this paper
INVETE	Intelligent In-vehicle Terminal for Multimodal Flexible Collective Transport Services	FP5 - IST - KA1 - Systems and services for the citizens		this paper

METEOR	Monitoring and Evaluation of Transport and Energy Oriented Radical strategies for clean urban transport	FP5 - GROWTH - KA2 - Sustainable Mobility and Intermodality		this paper
MIRACLES (CIVITAS I)	Multi Initiatives for Rationalised Accessibility and Clean, Liveable Environments	FP5 - GROWTH - KA2 - Sustainable Mobility and Intermodality	www.civitas-initiative.org	this paper
SAFETEL	Safe Electromagnetic Telecommunications on Vehicle	FP6-IST - Information Society Technologies - Priority Thematic Area 2 (PTA2)	www.esafetysupport.org/en/esafety_activities/related_projects/research_and_development/safetel.htm	if reports become available
TELLUS (CIVITAS I)	Transport & Environment Alliance for Urban Sustainability	FP5 - GROWTH - KA2 - Sustainable Mobility and Intermodality	www.civitas-initiative.org	this paper
UNIACCES	Design of Universal Accessibility Systems for Public Transport	FP6-SUSTDEV-3 - Global Change and Ecosystems	www.uniaccessproject.org	this paper
VIVALDI (CIVITAS I)	Visionary and Vibrant Actions through Local transport Demonstration Initiatives	FP5 - GROWTH - KA2 - Sustainable Mobility and Intermodality	www.civitas-initiative.org	this paper

Sub-theme 3: Traffic management				
Project acronym	Project title	Programme	Project website	Coverage
AD4	4D Virtual Airspace Management System	FP6-AERO-1.4 - Increasing Operational Capacity and Safety of the Air Transport System	www.ad4-project.com	if reports become available
AGORA	Cities for people	FP5 - IST - KA1 - Systems and services for the citizens	www.ertico.com/en/projects/completed_projects/websites/agora_website.htm	this paper
-	An Assessment of the Effects and cost-effectiveness of a public transport journey planner	FITS - FITS R&D Programme on ITS Infrastructure and Services 2001-2004		Extr@web paper
CONNECT	Co-ordination and stimulation of innovative ITS activities in Central and Eastern European Countries	MIP - Multi-annual Indicative Programme	www.connect-project.org	this paper
EMMA	Evaluation of Measures for Controlling Private Car Use in Metropolitan Areas	Project from Sweden		this paper
ERASMUS	En Route Air Traffic Soft Management Ultimate System	FP6-AERO-1.4 - Increasing Operational Capacity and Safety of the Air Transport System	www.atm-erasmus.com	if reports become available
MIRACLES (CIVITAS I)	Multi Initiatives for Rationalised Accessibility and Clean, Liveable Environments	FP5 - GROWTH - KA2 - Sustainable Mobility and Intermodality	www.civitas-initiative.org	this paper

Sub-theme 3: Traffic management				
Project acronym	Project title	Programme	Project website	Coverage
SMART NETS	Signal Management in Real Time for Urban Traffic Networks	FP5 - IST - KA1 - Systems and services for the citizens		this paper
TARGET 2	Travel Awareness Regional Groups for Environmental Transport 2A	INTERREG III - Community initiative INTERREG		this paper
TELLUS (CIVITAS I)	Transport & Environment Alliance for Urban Sustainability	FP5 - GROWTH - KA2 - Sustainable Mobility and Intermodality	www.civitas-initiative.org	this paper
TRASCOM	Traveller Assistance for Combined Mobility in regional areas	FP5 - IST - KA1 - Systems and services for the citizens		this paper
VIVALDI (CIVITAS I)	Visionary and Vibrant Actions through Local transport Demonstration Initiatives	FP5 - GROWTH - KA2 - Sustainable Mobility and Intermodality	www.civitas-initiative.org	this paper
VOYAGER	Vehicle for Mobility - Advancing Public Passenger Transport in Europe	FP5 - GROWTH - KA2 - Sustainable Mobility and Intermodality		Extr@web paper

Sub-theme 4: Pedestrians and non-motorized transport				
Project acronym	Project title	Programme	Project website	Coverage
A9	Pedestrian and cycle traffic	NRP 41 - Transport and Environment (internal research plan)	www.nfp41.ch	Extr@web paper
ARTISTS	Arterial Streets towards Sustainability	FP5 EESD KA4 - City of Tomorrow and Cultural Heritage		this paper
ASI	Assess implementations in the frame of the Cities-of-Tomorrow programme	FP5 EESD KA4 - City of Tomorrow and Cultural Heritage		this paper
BYPAD	Bicycle Policy Audit	FP5 - GROWTH - KA2 - Sustainable Mobility and Intermodality	www.bypad.org	this paper
-	Effects of Cycle Parking Arrangements on Bicycle Use	Project from Finland		Extr@web paper
MIRACLES (CIVITAS I)	Multi Initiatives for Rationalised Accessibility and Clean, Liveable Environments	FP5 - GROWTH - KA2 - Sustainable Mobility and Intermodality	www.civitas-initiative.org	this paper
-	Promotion of Walking and Cycling on Village Roads	JALOIN programme: Cycling promotion (Finland)		Extr@web paper
PROMPT	New Means to Promote Pedestrian Traffic in Cities	FP5 EESD KA4 - City of Tomorrow and Cultural Heritage	http://prompt.vtt.fi	this paper

Sub-theme 4: Pedestrians and non-motorized transport				
Project acronym	Project title	Programme	Project website	Coverage
TELLUS (CIVITAS I)	Transport & Environment Alliance for Urban Sustainability	FP5 - GROWTH - KA2 - Sustainable Mobility and Intermodality	www.civitas-initiative.org	this paper
VIVALDI (CIVITAS I)	Visionary and Vibrant Actions through Local transport Demonstration Initiatives	FP5 - GROWTH - KA2 - Sustainable Mobility and Intermodality	www.civitas-initiative.org	this paper

Sub-theme 5: Strategic planning and policy facilitation				
Project acronym	Project title	Programme	Project website	Coverage
A2	Car-free Households	NRP 41 - Transport and Environment (Switzerland)	www.nfp41.ch/reports/projects/kf-a02.html	Extr@web paper
B6	Integration into the European network: passenger transport	NRP 41 - Transport and Environment (Switzerland)	www.nfp41.ch	Extr@web paper
D5	Strategies in Leisure Traffic	NRP 41 - Transport and Environment (Switzerland)	www.nfp41.ch	Extr@web paper
EURFORUM	European Research Forum for Urban Mobility	FP6-SUSTDEV-2 - Sustainable Surface Transport	www.eurforum.net	this paper
INTERCEPT	Intermodal Concepts in European Passenger Transport	FP4 - TRANSPORT RTD - Transport Research and Technological Development		Extr@web paper

MARETOPE	Managing and Assessing Regulatory Evolution in local public Transport Operations in Europe	FP5 - GROWTH - KA2 - Sustainable Mobility and Intermodality	www.tis.pt/proj/maretope/maretope.html	Extr@web paper
MOTOS	Transport Modelling: Towards Operational Standards in Europe	FP6-INTEGRATING - Specific research and demonstration programme aimed at integrating and strengthening the European Research Area	www.motosproject.eu/?po_id=home	this paper
PRISCILLA	Bus Priority Strategies and Impact Scenarios Developed on a Large Urban Area	FP5 - IST - KA1 - Systems and services for the citizens	www.trg.soton.ac.uk/priscilla	Extr@web paper
PROCEED	PRinciples Of sucCEssful high quality public transport opEration and Development	FP6-SUSTDEV-2 - Sustainable Surface Transport	www.proceedproject.net	if reports become available
TRANSFORUM	Scientific forum on transport forecast validation and policy assessment	FP6-INTEGRATING - Specific research and demonstration programme aimed at integrating and strengthening the European Research Area	www.transforum-eu.net	this paper
TRENDSETTER (CIVITAS I)	Setting Trends for Sustainable Urban Mobility	FP5 - EESD KA6 - Economic and Efficient Energy for a Competitive Europe	www.civitas-initiative.org	Extr@web paper
UG293	Car share and car clubs – Potential and impacts	Project from the United Kingdom		Extr@web paper

Remark: the projects listed in the annex are those that have had the focus on the theme “Passenger transport”. On the TRKC portal www.transport-research.info it is possible to use the “advanced search” functionality, with the option “Passenger”, and find all research projects, EU-funded and national, which have treated, to a variable extent, aspects that can be related to the theme.