

8- CONCLUSIONS AND THE WAY FORWARD

In **Environmental** terms we can identify three great categories of measures which produce environmental benefits.

The first category belongs especially to WP5, it aims to introduce new cleaner vehicles for public transport, and is composed by the following measures:

WP5	Clean & energy-efficient vehicles		
5.1	Transition towards clean vehicle fleets in Genoa	Genoa	AMT
5.2	Support for clean fuels and introduction of clean public and private fleets in Burgos	Burgos	AYTOBU
5.3	Transition towards clean vehicle fleets in Krakow	Krakow	MPK

The second category aims to reduce traffic in some areas, for example sensitive areas, city centers, with different strategies; it belongs especially to WP6 and WP7.

WP6	Access management		
	Creating & controlling access to clean zones		
6.1	Integrated access control strategy in Krakow	Krakow	UMK
6.2	Integrated access restrictions strategy in Burgos	Burgos	AYTOBU
6.3	Policy options for access restrictions in Stuttgart	Stuttgart	LHS
	Enforcing traffic restrictions in sensitive areas		
6.4	Enforcement of access restrictions in Krakow	Krakow	UMK
6.5	Parking strategy and management in Burgos	Burgos	AYTOBU
WP7	Integrated pricing strategies		
7.1	Integrated access control strategy and road charging scheme in Genoa	Genoa	CDG

The third category aims to improve PT quality and to encourage the use of public transports instead of private vehicles, through different measures like for example realizing high mobility corridors or providing innovative mobility services.

These measures belong especially to WP8.

WP8	Stimulation of collective transport modes		
	Improving quality & intermodality		
8.1	Clean high mobility corridor in Genoa	Genoa	AMT
8.2	Clean high mobility services in Burgos	Burgos	AYTOBU
8.3	Clean high mobility corridor in Krakow	Krakow	UMK
	Providing innovative mobility services		
8.4A	Agency for flexible services and new mobility services in Genoa	Genoa	AMI
8.5	Collective mobility services for target users in Burgos	Burgos	AYTOBU
8.6	Demand-responsive transport services in Krakow	Krakow	MPK
8.7	New mobility services for visitors in Burgos	Burgos	AYTOBU

8.8	New leisure related mobility services in Krakow	Krakow	MPK
	Integrated ticketing & tariffs		
8.10	Integrated ticketing and tariffs in Krakow	Krakow	UMK
	Passenger security		
8.11	Security action plan for public transport in Krakow	Krakow	UMK
8.12	Security action plan for suburban railway in Greater Stuttgart	Stuttgart	VRS

These three categories produce different environmental effects.

The introduction of new cleaner vehicles for public transport, that is the substitution of old and polluting pre-EURO or EURO 0-1 buses with EURO4-5 buses or CNG buses, produces a strong reduction of CO, NOX and particulate emissions for Public Transport. These effects are evident especially for measures 5.1 and 5.2. In measure 5.1 we can see that the renewal of AMT fleet generates an important reduction of both average fleet emission factors and total pollutants emissions; in measure 5.2 we can see that the purchase of CNG buses in Burgos during the project caused a decrease in average emission factor related to the whole fleet.

This type of measures are important under the environmental point of view because buses, in particular old diesel ones, give surely a contribution to total transport emissions, especially in urban areas; for this reason it would be desirable to encourage the purchase of new buses to substitute old pre-EURO or EURO 0/1. However we can say that this kind of measures don't generate great effects on pollution because the incidence of PT emissions on the total traffic emissions is low, while it could be important in some old city centres because it favours the protection of historical monuments.

Moreover the use of new low-emission buses could lead to an improvement in the whole image of PT.

The **second category** of measures is characterized by the limitation of vehicle access in some areas; the main environmental effect of these measures is the decrease of vehicle emissions in these specific areas, through the restriction of vehicle access or the ban for some categories. These effects are described especially for measure 6.2 and 6.3: for measure 6.2 we can see a small reduction of NOX levels and a great reduction of small particulate levels, measured by monitoring stations in Burgos, and, for measure 6.3, we can see a decrease of particulate and NOX emission due to the reduction of heavy duty vehicles – HDV transit, that produce, according to simulation results, an improvement of air quality.

On the contrary measures 6.1 and 7.1 still have to be completed and their environmental effects haven't been verified yet.

It can be generally said that policies aiming at restricting the access to a certain area of the city, either for private cars or for some category of vehicles, should in the long run reduce the level of emissions and improve the air quality. However, in order to have good results on air quality, it's necessary to have great traffic reduction, through the implementation of radical and substantial measures. This requires a great political will since these kinds of measures have to deal with the citizens' opposition, so it doesn't often happen because most politicians are not willing to run the risk of becoming unpopular.

The **third category** of measures promotes the improvement of PT quality, for example by increasing PT speed through high mobility corridors or providing innovative mobility services. These measures should encourage people to use public transports instead of private vehicles; in this way it would be possible to reduce the number of vehicles, and consequently reduce traffic emissions and improve air quality in the cities. However to have good results for air quality it's necessary to have strong improvement in terms of PT services and to link these kind of measures with others like parking strategy and management, or access restriction in city centres or sensible areas, otherwise it would be very difficult to produce good environmental effects.

This result has been partially obtained in measure 8.1 in Genoa in which the creation of a high mobility corridor for bus n°17 has produced a decrease in the level of pollutants measured by the monitoring station placed in Corso Europa (i.e. the street where the bus circulates).

The results concerning a reduction in the burden placed on the environment using cleaner and fewer vehicles are positive and in line with expectations: emissions reduction, improvement of air quality mainly due to a reduction of heavy traffic and through traffic, improved traffic management. However, the changes are only slight. One of the reasons for this is that the results in Genoa and Stuttgart cannot be assigned to one individual measure; there are strong interactions with external factors and other measure packages. It may therefore be concluded from the results observed that far-reaching effects can only be achieved through more far-reaching measures, implemented on a larger scale.

Summarizing we can say that Caravel measures have produced some environmental benefit, especially in terms of reduction of the emission, and that the introduced measures have been important because they attempted to reduce traffic in urban areas, to promote innovative services or to improve environmental performance of PT fleet, however to obtain sensitive effects on air pollution it's necessary to promote **more radical measures** regarding PT improvement, access restriction, parking management, purchase of clean vehicles both for private citizens and for PT companies: small measures regarding only specific areas don't produce substantial or more radical changes.

This is true particularly for PM10 or ozone, which are called secondary pollutants, that are strongly influenced by meteorological conditions and by large-scale phenomena; we can say that to obtain good results upon PM10 or ozone concentration it should be necessary to implement measures at national or even at European level.

Moreover it has to be said that four years, that is the project duration, aren't long enough to seriously plan, implement and evaluate the environmental effects of these measures.

According to the evaluation of environmental results we have found some problems; in fact if it's possible to calculate traffic emission reduction due to a measure, often the magnitude of the results in terms of air quality is not clear, because of strong interaction with external factors, like weather conditions or other emission sources; for example Stuttgart has significantly reduced the exceedances of small particulate matters (PM10) during Caravel period but these are the results of conditions favourable to dispersion.

To be able to evaluate air quality effects in this case it could be useful to develop an emission and dispersion modelling, even if the results of this kind of tools should be compared with real data (for example measured by monitoring stations), to verify the reliability of the used model.

Of course models are very useful tools, but a reliable evaluation should be made also using measured data, like is prescribed by the European directive 96/62/CE and 50/2008/CE.

Energy Aspects in Civitas Caravel Project

In Europe 80% of inhabitants live in an urban environment. Public transport, cars, lorries, cyclists and pedestrians all share the same infrastructure. Urban transport accounts for 40% of CO₂ emissions of road transport and up to 70% of other pollutants from transport.

Congestion problems, too, are concentrated in and around cities.

How to increase mobility while at the same time reducing congestion, accidents and pollution is the common challenge to all major cities. More than anyone else, city dwellers directly experience the negative effects of their own mobility and may be open to innovative solutions for creating sustainable mobility.

EU urban transport policy promotes the study and exchange of best practices across the EU in areas such as transport infrastructures, norm-setting, congestion and traffic management, public transport services, infrastructure charging, urban planning, safety, security and cooperation with surrounding regions.

The Commission will build on the experience gained in initiatives like Civitas Caravel, and on its thematic strategy on urban transport, and continue to promote research on urban mobility.

The forthcoming legislation on public transport services will provide a clear and stable legal framework providing for quality investment in clean and efficient public transport.

The main objective of EU transport policy is to help to provide Europeans with efficient, effective transportation systems that:

- offer high level of mobility to people and businesses,
- guarantee affordable and high-quality transport solutions to achieve free flow of people, goods and services,
- protect the environment,
- contribute to ensuring energy security (transport is one of the major energy consuming sector)
- protect European citizens as transport users/providers, both in terms of safety and security.
- innovate by increasing efficiency and sustainability of growing transport sector,
- bring to market tomorrow's innovative solutions that are energy efficient, use alternative energy sources and/or support mature, large intelligent transport projects.

It's clear that energy issues are considered as priorities in EU transport and in particular the objective is the improvement of the energy efficiency and the increase of the use of alternative fuels.

The reason for this is the progressive exhaustion of the oil supplies and the subsequent rising of oil prices. This will have profound implications for those sectors like transport that are utterly dependent upon conventional oil.

On the other hand the increase in greenhouse gas emissions from transport threatens European progress towards Kyoto targets. Therefore it's important to plan a progressive transition towards clean type of fuels, able to guarantee lower pollutant emissions.

Civitas Caravel project acknowledges these objectives and fixes a set of measures for the cities involved. The achievement of the objectives of the single measure is quantified by the two energy indicators chosen: vehicle fuel efficiency and fuel mix.

In general the project reached a good level in the implementation of the measures dealing with energy issues. For example, as far as the alternative fuels is concerned, the city of Burgos (measure no 5.2) purchased 8 natural gas vehicles (total fleet 18 CNG vehicles), introduced 2 diesel buses to test biodiesel fuels and completed the biodiesel cycle with the collection of oil from domestic, commercial and industrial sources with the consumption of biodiesel in the private and public fleets of the city. Furthermore Burgos increased storage capacity and supply of natural gas for clean transport: this kind of action might be practiced in Genoa, where the delay in the usage of natural gas instead of petrol is mainly linked to infrastructural lack, as well as to the change of habits.

Fuel mix indicator highlights the success in the implementation of the measure in PT fleet: the share of natural gas increased from 26% (2004) to 38% (2007) and the share of biodiesel from 0.5% to 62%. It means that in 2007 the whole fleet is served by clean fuels.

Another example to be highlighted is the effort done in Genoa to realize an integrated network of PT services. The strategy included a wide set of actions: the creation of a high mobility corridor (reserved bus lane controlled by a modern monitoring system, bus priority system at traffic lights..), the creation of an agency for flexible services, the enlargement of AMT and car sharing fleet by clean and low consuming vehicles...

Despite of the difficulties in the implementation of some of the actions, good effects may be observed analyzing the energy indicators (measure no 5.01 and no 9.4). In a medium-long term prospective, if Genoa overcome the barriers and is able to carry on this plan, even better results related with might be expected: to relieve traffic congestion in fact implies also a positive effect on fuel consumption of the vehicles (both private and public ones), thanks to more regular runs and a higher average speed of the vehicles.

Under a methodological point of view, it's quite important to underline that energy use can be examined on per vehicle-km or per passenger-km basis.

The former (mainly adopted in Civitas Caravel) is an indication of the inherent energy use of the particular vehicle, the technology it exploits and the environment in which it operates (congestion etc).

Energy use per passenger-km is an indication of the mode's efficiency in carrying people, based on the kind of loadings that the mode achieves in different cities. It is related to the energy consumption per transport-service provided, namely per number of passengers multiplied by the distance covered individually, expressed in passenger-km transported. In many cases (Genoa for example) it's not easy to collect the essential data and so the indicator chosen was expressed only in terms of vehicle-km; for the future it would be advisable to describe the real efficiency of the transport policy developed within the project using also the passenger-km indicator and so a wide campaign of data collection and surveys might be planned.

ECONOMY

Not many economic indicators were chosen and as a consequence evaluated during the Caravel project. The main reason expressed by the subjects involved in the evaluation process was that financial information was very difficult to obtain from certain types of institutions. The main reasons availability sensibility of data in all the cities. As a consequence it was impossible to even explore the possibility of a cost- benefit analysis of certain measures.

It can be said however, that during the Validation workshop that was held in Novembre 2008 in Bertinoro- Italy, the informal context of discussion that was created among the subjects involved (EM, LEM and ML) for some measures it has been informally stated that even though the financial data was not included for the reasons explained before, it can be affirmed that the measures were in the end financially sustainable. During the same meeting, it was also said that certain measures like DRT cannot be financially sustainable without the support of the municipality because it turns out to be a huge loss for the PT companies.

SOCIETY

During the four years of Caravel it has been assessed that awareness campaigns are fundamental when we are planning to implement policies in a city. It is highly advisable to start informing the public as soon as possible in order to be able to see their opinions and reactions and as a consequence plan information campaigns. The main goal of any of the measures in Caravel was to improve the quality of life in the involved cities, and whereas the opinion on their dwellers was to be heard and taken into account.

The Caravel logo has managed to be associated with policies aiming at improving the urban mobility, making PT more available and safer to all citizens and promoting sustainable solutions. Diverse methods were employed to promote sustainable transport options including demonstration days, cycle safety training, advertisements, competitions, leaflets, posters, website promotion etc. It was generally found that a mixture of methods was best at reaching a range of different audiences. Burgos and Krakow have identified primary students and a very important target group. Students also proved to be an major driving force in the acceptance of sustainable mobility policies.

Taking into consideration what has been stated before, in terms of evaluation and to avoid being disappointed after seeing the results of the surveys, it is important to note that awareness and (stated preference) acceptance of an initiative does not necessarily influence travel behaviour, as for in example in the case of car pooling in Burgos and Genoa. Change doesn't happen overnight and that's why it is important that what has been achieved in terms of acceptance of new solutions, even if the results are not what expected after four years, should be continued. It is clear that the most difficult task while dealing with the society is getting to change the way they think or behave: for example convincing workers that that sharing the car with others is a good thing for the

environment doesn't necessarily mean an increase in the use of car pooling. They can say they think it's a good idea, but that doesn't mean they will use it.

It can be stated without any doubt that Mobility Forums and mobility offices have turned to be the places to exchange opinions, manifest doubts or concerns and in general to make citizens participate in the decision making process. A participative citizenship is always an asset.

As it has been stated in almost all of the city level conclusions, the involvement and participation of stakeholders has proved to be a as a key for the implementation of successful urban policies. Even when it requires a lot of effort and coordination, the organization of meetings with the stakeholders is of fundamental importance.

TRANSPORT

In terms of transport it can be stated that the main goals during Caravel dealt with the overall improvement of PT, reduction of congestion, implementation of flexible services and transport plans. Within the four cities, even if the problems and solutions proposed were of different magnitude, it has to be said that the effort made to achieve the stated goals was of immense magnitude.

Regarding the improvement of PT, and mainly its transformation into an option to the use of private vehicles, several policies were introduced. There was a huge need of making the service more comfortable and accessible to all citizens, and in this sense Burgos for example, has managed not only to modify the buses so people with reduced mobility can use them on a regular basis, but also by doing these they have "convinced" families with small kids using pushchairs that buses were a feasible option while moving around the city. The definition of more efficient routes aiming at eliminating useless stops has proved to be an intelligent tactic to improve the PT timekeeping and by this the improvement of the PT perception has grown. In this sense the PT operators in the four cities have made huge efforts to provide citizens with better and more information through the implementation of info mobility platforms that guarantee real time information inside the buses on on bus stops. In terms of safety, the surveys carried out in the cities show that users have perceived that there has been a change and currently feel safer using PT even at night. These are the things that make PT more attractive and can "convince" citizens that it is possible to use public means instead of the car once the service has been improved.

One of the main reasons people state in favour of the use of cars in the cities is the idea of being flexible. This flexibility is in the four cities confronted with a huge element of discomfort: difficulty of parking. In this sense all the flexible mobility services implemented in Caravel (DRT, car sharing, car pooling, collective taxis) have that element of flexibility can be seen as an option to the use of the private car specially because they eliminate the parking problem and in the end cost less. Car sharing and DRT have shown an amazing degree of growth in the four cities; car pooling grew considerably in Stuttgart where it was established several years ago, while in the other four cities, even if it was an innovative element managed to start attracting possible users and will most likely become bigger in the future. On the other hand, most of the cities have implemented successful parking strategies that aim at eliminating the on street parking, not only by fining those that park without paying, but also through the creation of parking lots in the central and "hotter" areas of the cities.

Another huge success was the introduction of Bike schemes: the use of bikes as an alternative means of transport has proved to be quite successful in Burgos and Krakow. In the past bikes were only used for leisure activities, while after Caravel it has been proved that people started using bicycles as a means of every day transport.

The access restriction related measures have proved to be one of the most complicated to implement specially due to the fact that they absolutely require strong political support for its proper implementation. In Genoa for example, it has been a very long decisional process that ended up with the implementation of the mobility credits that it is a highly innovative scheme at European level that it could't have been achieved without the participation in the Caravel project.

A big problem related to the improvement of the overall PT system deals with the necessity of infrastructural investments, that are extremely expensive and difficult conflicting with the duration of these kind of project. However, it should also be said, that Caravel has managed to achieve improvements even without this fundamental aspect.

The case of the pedestrianisation of an immense area of the city centre in Burgos shows that sometimes it is not a matter of major investments in infrastructure, but specially a matter of strong political will and once it is achieved it has the capacity to improve the livability of a city.

Lessons Learned

- Creation of Awareness and Acceptance level– It is essential to inform citizens on the content of the measures that are planned to be implemented and later on, update them on the results of the project. The awareness and acceptance levels depend on the messages and good results offered by the Administrations. In this sense, good promotional campaigns for the chosen target groups should be planned for every stage/service/phase of the measure, however is important to always have present that the messages should be clear and concise. Communicate, communicate, communicate– in an attractive, convincing and comprehensive way – and start as early as possible.
- Identify the benefits for each stakeholder group and create win-win situations, their involvement in the decision making process and their support are strong tools.
- Make sure that you have strong political leadership and support – ideally from all parties in order to guarantee the continuation of a chosen policy even if there's a change in the government.
- Being realistic with the goals that can be obtained from the beginning.

During the Final Conference in Toulouse and as a final conclusion of these four years of efforts the cities of Burgos, Genoa, Krakow and Stuttgart have stated that their participation in the Civitas Caravel project has contributed in more general terms in the construction of:

- Cities with a better quality of life for citizens achieved through the reduction of the impact of traffic, vehicle emissions, noise and congestion
- Cities with a new culture of mobility which will define the future of their urban design using a more sustainable criteria.
- Cities with a good recognition in Europe thanks to their active policies on the field of sustainable mobility and transport.
- Cities that have learned and now value the views and opinions of stakeholders and actively involved them in decisions regarding mobility.
- Cities that explore new opportunities to introduce and to promote alternative modes of transport and clean fuels.
- Cities that want to learn the lessons and continue to support politically ambitious actions to improve the urban environment with active and sustainable strategies in mobility.