

Sustainable mobility: a few considerations about the Italian experience

- Preliminary draft -

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This paper is mainly intended to provide a survey of the Italian situation concerning the issue of sustainable mobility, in particular at the urban and metropolitan scale. It is at this scale that the most adverse effects on the urban environmental quality are felt, as a consequence of the substantial increase in the mobility demand and in the number of private motor vehicles. Hence, structural policies and operational planning tools have been implemented both at a central and at a peripheral level by the Public Authorities to reduce and control air pollution due to motor vehicles emissions.

Even though the concept of sustainability is multidimensional (at environmental, economic, social and urban levels), this contribution mainly focuses on the environmental aspects, with specific reference to the issue of air pollution. This is one of the adverse effects of mobility that are most visible to the public and also the one for which there isn't technical solution allowing mitigation effects (unlike the case of other adverse effects, such as noise pollution and accidents).

List of Acronyms

ANPA	Agenzia Nazionale per la Protezione dell'Ambiente	<i>National Agency for Environmental Protection</i>
ARPA	Agenzie Regionali per la Protezione dell'Ambiente,	<i>Regional Agencies for the Environmental Protection</i>
ATC	Azienda Trasporti Consorziali di Bologna	<i>The Public Transport Company of Bologna</i>
DL	Decreto legislativo	<i>Legislative Decree</i>
DM	Decreto Ministeriale	<i>Ministerial Decree</i>
DPR	Decreto del Presidente della Repubblica	<i>Italian Republic President's Decree</i>
ENEA	Ente Nazionale per le Energie Alternative	<i>The Italian Board For New Technologies, Energy and the Environment</i>
FFSS	Ferrovie dello Stato	<i>Italian Railways Board</i>
ICS	Iniziativa per il Car-sharing	<i>Car-Sharing Initiative</i>
ICT	Tecnologie dell'informazione e della comunicazione	<i>Information and Communication Technologies</i>
ITS	Sistemi Telematici Integrati,	<i>Integrated Telematic Systems</i>
LR	Legge Regionale	<i>Regional Law</i>
NPNSS	Nuovo Piano Nazionale per lo Sviluppo Sostenibile	<i>New National Plan for Sustainable Development</i>
PA	Pubblica Amministrazione	<i>Public Administration</i>
PETPC	Piano per il Trasporto Pubblico Collettivo Extra-urbano	<i>Extra-Urban Public Collective Transport Plan</i>
PGTL	Piano Generale dei Trasporti e della Logistica	<i>National Plan for Transport and Logistics</i>
PGTU	Piano Generale del Traffico Urbano	<i>General Urban Traffic Plan</i>
PME	Piano per la Mobilità Extra-urbana	<i>The Extra-Urban Mobility Plan</i>
PRIT	Piano Regionale Integrato dei Trasporti	<i>Integrated Regional Transport Plan</i>
PTE	Piano del Trasporto Extra-urbano	<i>The Extra-Urban Transport Plan</i>
PTRQA	Piano Regionale per la Tutela ed il Risanamento della Qualità dell'Aria	<i>Regional Plan for Air Quality Reclamation and Protection</i>
PTVE	Piano per il Traffico Extra-urbano	<i>Extra-Urban Traffic Plan</i>
PUM	Piano Urbano della Mobilità	<i>Urban Mobility Plans</i>
PUP	Programma Urbano dei Parcheggi	<i>Urban Parking Programmes</i>
PUT	Piano Urbano del Traffico	<i>Urban Traffic Plans</i>

Sustainable mobility: a few considerations about the Italian experience

Las ciudades están llenas de gente. Las casas, llenas de inquilinos. Los hoteles, llenos de huéspedes. Los trenes, llenos de viajeros. Los cafés, llenos de consumidores. Los paseos, llenos de transeúntes..... Los espectáculos, como no sean muy extemporáneos, llenos de espectadores. Las playas, llenas de bañistas. Lo que antes no solía ser problema, empieza a serlo casi de continuo: encontrar sitio"
(Ortega y Gasset, 1930)

1. The transport and mobility general framework in Italy

The above mentioned quotation from the Spanish philosopher of the 30's illustrates the situation, which is visible right now. On one hand, space has become narrower: "We have started – and we are just at the beginning of this process – living in a world, which has shrunk, where everything has become much closer than before" (Ortega y Gasset, *ibid.*). On other hand, if in the early 20th century (as the pictures of the large European and North-American cities show), a minority of people (car-drivers) shared the available space with a large majority of pedestrians, now that minority – in those days cars were consumables that only a limited number of people could afford – has turned into the dominant (and overwhelming) mass in the urban scenario. As a consequence of these two events, space has become the object of fierce competition between the different users, to be earmarked either for men's different settlement purposes or for their relationship needs.

A few preliminary considerations should be made concerning the strong interest shown by the Italian public in mobility issues, as also proven by the large number of articles, which are published every day in widely-circulated magazines and in newspapers. Deep concerns are also expressed by civil society for land consumption due to the building of new facilities, for land fragmentation and for landscape deterioration. A few especially critical examples might be made.

First of all, the concern for urban traffic congestion should be highlighted (the 70% of people mobility is concentrated in urban areas throughout the national territory and 40% of transport "consumption" is concentrated in the 12 main Italian metropolitan areas). A lively debate is now going on, especially in the Italian largest cities and metropolitan areas, on the actions to be undertaken to repair this situation. Traffic-free zones concerning increasingly wider areas of city centres are now advocated by the public, in spite of the inconvenience caused by these restrictions. In Milan, for example, the critical level of air pollution and congestion is so high that many authoritative voices have required the enlargement of the traffic-free zone boundaries in the historical centre. These decisions require, of course, the

enforcement of stricter control actions – also made possible by the opportunities offered by modern technologies – and of fines for those car drivers who infringe the no entry signs. A further critical case concerns motorways. They are mainly used by lorries that transport goods during the working days and by private drivers that move for leisure on the weekends. A few experts believe that the system is on the verge of collapse, but in the meantime they are not ready to find a way out from this situation. Proposals to transfer ever larger haulage shares from road to rail can be realistically implemented only in the medium-long term, due to the present railways capacity limits.

On the other hand, it is not easy to find alternative solutions, which undoubtedly would require a revision of the role played by cars in our present society. An example might suffice. Once, a political party – which is indeed characterised by a strong environmentalist faith – addressed a letter to young people inviting them to the polls, labelling both the voting exercise and the car ownership as two events that best symbolise their official entry into the adults' world; in particular, it declared that the car “can be seen as the means providing young people with the first real sense of a long-yearned freedom”. As stated by Morin (1995), “the car has a much more mysterious and deeper function than that merely linked to its material utility: it holds a real affective power”. This allows us to understand how difficult it will be to witness true reversals of the trend in people's attitude towards owning and driving a car.

At the same time, growing investments in ICT-based car applications have been made by car manufacturers, who have designed a whole set of devices allowing access to a wide range of services. As Ascher points out (2001) “the car, regarded as a living place, is bound to become an ever more multifunctional mean”. On the one hand, car manufacturers design cars to make driving and traffic flows easier, but on the other hand, they paradoxically take into account the fact that the average time spent by people in cars is not expected to decrease. Hence, they are thinking of new technology applications allowing car users to perform certain activities, which traditionally take place either at home or at work.

Although it is stated that the public is fully aware of the detrimental effects deriving from the use of private cars, this is not translated into a consistent and responsible behaviour in favour of the use of environment-friendly public means of transport. In principle, the public declares to be in favour of the use of individual cars, but sometimes it changes opinion once provisions are enforced. We can also observe a “certain ambiguity between the desires and the behaviours shown by the inhabitants of any large metropolis”: on the one hand they express the desire to move from one place to another ever more rapidly and, on the other hand, they claim the need for a quiet and protected environment (Ascher, 1997).

The Public Administration tends to take action on multiple fronts, both resorting to traditional (command-and-control) policies, but also implementing policies aimed at the improvement of the quality of the collective transport services and at the promotion of incentives, according to Stavins' indications (1988; see also: Kolstadt,

1986; Sartzetakis, 1999; Fullerton and West, 2000) to harness market forces to protect environment in view of a cost-effective sustainable mobility choice.

1.1 A quantitative framework

The following table (Source: PGTL, p. 24) illustrates the transport demand size and structure.

Table 1.

Overall (national and international) Demand for Passengers' Transportation (millions of passengers/year) and Freight Transportation (millions of tonnes per year).

(The national demand and the related percentage is reported in italics and in brackets)

			1998	
			millions of passengers	% by mode
Passengers' Demand	Total	Overall	1,796 (<i>1,689</i>)	100,0
Road			1,584 (<i>1,421 + 79 in regular bus service</i>)	88,2 (88,8)
Railways			184 (<i>179</i>)	10,3 (<i>10,6</i>)
Air			28 (<i>10</i>)	1,5 (<i>0,6</i>)
			millions of tonnes	% by mode
Freight Demand	Total	Overall	1,297 (<i>835</i>)	100.0
Road			855 (<i>747</i>)	65.9 (<i>89.5</i>)
Railways			76 (<i>28</i>)	5.9 (<i>3.4</i>)
Coastal navigation			366 (<i>60</i>)	28.2 (<i>7.2</i>)

According to the estimates made by the NPNSS (2000) by the Ministry of Environment and ENEA, in 1996 the transport sector was responsible for:

- 26% of carbon dioxide emissions (106 Mt),
- 77% of carbon monoxide emissions (73 % if the road traffic alone is taken into account; approx. 6Mt),
- 56% of nitrogen oxide emissions (52% if the road traffic alone is taken into account) (approx. 1Mt),
- 52% of non-methane volatile hydrocarbons emissions (47% if the road traffic alone is taken into account) (approx. 1, 2 Mt),
- 3% of sulphur oxide emissions, almost all released by motor vehicles (approx. 0,1 Mt).

As is well-known, urban traffic is highly responsible for benzene emissions and for particulate by more than 90% and this percentage is now increasing in spite of the fact that Italy is one of the OECD countries with the lowest energy consumption

intensity rate. The detrimental impact deriving from this mobility demand on environmental resources (ranging from acid rains to the thinning of the ozone layer in the atmosphere), on health and on the quality of life are all well known. It is estimated that in Italy the number of deaths due to people's prolonged exposure to traffic pollution amounts to 80,000 every year.

Furthermore, OECD data (1996) show that Italy is the country with the heaviest road passengers traffic per unit of gross domestic product, with $441 \cdot 10^9$ vehicles-km/1000\$ (France 422, Germany and the Netherlands 389, Japan 270) and per inhabitant with $7.9 \cdot 10^6$ vehicles-km/inhabitant (the Netherlands 7,0, Germany 6,9); Italy is also the country with the highest road congestion, with $1430 \cdot 10^6$ vehicles-km/km (Germany 890, the Netherlands 780, France 575).

There is a wide range of traffic and transportation factors causing air pollution. In particular, the specific Italian context is characterised by the widely scattered settlement layout and production units delocalisation, passengers transportation and good haulage mainly concentrated on roads, high "vulnerability" of the transport system exposed to especially critical events and constraints, due to "employment conflicts, lack of infrastructures and of alternative routes to the main trunks" (source: PGTL). In addition to these reasons, other factors come into play with reference to this special socio-economic change phase, including the globalisation of economy, the opening up of new markets, the changes in production/consumption relationships, etc. All these factors determine a continuous increase in mobility demand.

2. The research role

With regard to the research contents and trends (inside and outside university circles) in the transportation and mobility area, it is possible to think of an hypothesis of classification (although somewhat conventional).

1. Disciplinary Research, in the broad sense of the term: it includes the approach towards the following issues:

- *research on the transport system theory and on logistic with their applications to the transport systems analysis and design:* this research field concerns the optimisation of the transport system performance in compliance with the reduction of the noise, vibration and air pollution impact;
- *research on road safety:* from road education to both passive and active safety for motor vehicles drivers and passengers, to "minor" accidents – involving no casualties – (according to the Insurance Companies agreed motor accident statements). The safety issue stems from various economic and structural components to be properly addressed and well co-ordinated. In this case, the traffic engineering contribution, for example, focuses on the requirements and performance of various types of roads, starting from human, infrastructure, vehicle, traffic and environment relationships

This sector covers the whole area ranging from the study of users' behaviour to the comparison methods applied to alternative projects for the transport networks configuration. Furthermore, the role played by quantitative models should not be underestimated (cf. Strategic Environmental Assessment) to assess the long-term substantial impact and structural changes of transport strategies, as a consequence of investments in transport infrastructure and in price and regulation policies.

2. *Interdisciplinary Research:*

It is the most interesting field as it benefits from the cross-fertilisation deriving from the convergence between the various disciplinary contributions. Starting from the historical domains of management sciences and of regional and urban planning, the following disciplinary areas are worth focusing on:

- *Research on institutional and organisational aspects:* it includes the role to be played by the market to meet the public mass transport. In Italy, collective public transport is provided by the State both at a national level (by FFSS) and at a local level (by means of Public Transport Authorities). A whole set of conditions must be put in place to regulate the supply of collective transport by the private sector, at the same time avoiding the distortions that the "privatisation" process has entailed in other countries. A comprehensive research study should be carried out on the development of market dynamics for the production of transport services and on the definition of innovation-oriented policies, also based on the introduction of incentives into the transport sector, as well as on training processes to bring the Public Administration's competence in line with the transport system evolution. Among the various proposals that have been put forward to increase the availability of economic and financial resources for local public transport companies, the suggestion has been made to increase the collection of secondary (non fare) revenue, with the provision of business services, that should be concentrated in the interchange areas, with the setting up of "income producing sites" exploiting commercial opportunities in, around and over transport stations and interchanges. Undoubtedly an important step in this direction consists of the reform of public transport (which is now under way), following the introduction of the market competition mechanism, according to the following pattern: Local Authorities are entrusted with the task to carry out the following activities: service regulation, network planning, infrastructure management, performance monitoring, etc. whereas Local Public Transport Companies task is to take care of the service production.

This step will pave the way for an industrial transformation of the sector that, among other things, will reduce the financial needs for public transport services.

- *Research on ICT:* there are several examples concerning the retrieval in real time of information to guide users towards the destination, the use of innovative technologies for the car flow monitoring and control, traffic information distribution platforms, etc. In general, the aim is to increase the amount of available information to serve as decision-making support on mobility (for

individuals, as well as for the collective, private and public sectors). In general, the research results identify the possible solutions of the mobility problem by suggesting actions to be undertaken on the supply side. It is important to spend a few words on the role played by the ICT in Italy, by means of a few examples.

In Rome, for instance, the so-called ITS for traffic control and monitoring is now being developed. It includes a whole set of new transportation management tools, such as travellers services. The general and functional architecture consists in a modular, expansible, open structure, based on two control levels: a first-tier *subsystem integration*, which operates according to a peripherally distributed intelligence logic, managed by a *central supervisor*. Subsystems and their functions include: traffic lights systems; variable message boards for road and safety indications; automatic access control devices to access traffic-restriction areas; road safety cameras; a central data acquisition and processing device, which is also intended for the organisation and publishing of traffic information.

In Turin, the 5T Project (the Turin Traffic and Transport Telematic Technologies Project) was launched in 1992, with the involvement of public companies (68%) and private companies (32%). The aim was to reduce people's mean travelling time by 25% and also to reduce pollutants emission and fuel consumption by 18%. It is an open-architecture project, made up of integrated and co-operating subsystems co-ordinated by a so-called *Urban Supervisor*, which guarantees the integration of all subsystems in order to provide the best environment-friendly mobility service. It monitors the traffic situation every 5 minutes – thanks to the co-operation between the various subsystems –, it forecasts mobility on an hourly basis, it controls pollution effects and it works out a general strategy for the successive period, which is geared to reach and maintain a “user equilibrium” state compatible with environmental protection constraints. Subsystems co-operate in the general strategy by feeding in the decisions provided by the Supervisor for the adoption of operational methodologies. This kind of experience is now ever more spreading in Italy also thanks to the good results that have been achieved so far: in the case of Turin, the mobility conditions monitoring after the system installation has allowed experts to record a 17% reduction of private transport travelling times and a 13% reduction for the public transport.

- *Research on the fields of electricity, electronics, mechanics and related disciplinary areas:* the special focus is the guarantee of a high safety level in the communication management, in the functional and building characteristics of motor vehicles equipment, assessment and forecast of new transport technologies and of their impact on the environment, “propulsion systems for urban transport” choices, traffic lights time management for mobility control, “the electric cities project”, testing of low environmental impact car fleets, etc.
- *Research in the field of town and regional planning:* in spatial planning university schools, a growing attention is paid to distribution aspects – both

spatial and social – of mobility related policies and projects. This aspect takes up a further and significant relevance in raising awareness and consensus on the mobility and transport related choices, which are strongly linked to both spatial aspects (where the pollution events and/or investments are concentrated) and social ones (what are the population groups that are more strongly involved in costs and benefits deriving from these choices?). A further consideration, which should not be neglected, concerns access limitation to transport supply for those people who do not own any private means of transport either because of age, income or other impairments. This aspect is strictly connected to transport service supply in areas with a low and non systematic mobility demand. In particular, in spatial planning schools, the mobility issue is strongly intertwined with the urban regeneration and quality issues. The objective to put transport systems at the service of the city (as an alternative to what has historically occurred starting from the middle of last century, when the transportation as well as transport mode technologies shaped the city; cf.: Hall, 1992). The study of location strategies that might contribute to the implementation of sustainable mobility is tackled by two mainstream perspectives: one pursuing the objective of a “*car-free city*” through the development and improvement of the collective transportation system performances, which would consequently reduce the use of private cars. On the other hand, there is the “*environment-friendly car*” notion, which is intended to restrict access to urban areas, allowing access only to zero or low-environmental impact cars. Furthermore, these specific points of view must be revised also in relation to the fact that the spreading in the use of the car has led to the collapse of the “proximity concept”. Referred to the previously mentioned “space shrinkage”, it leads to a new type of “proximity culture” (Orfeuil, 1994), which proves to be able to shape the city in a way that interpersonal relations, cohabitation and social life are not paralysed by the mobility adverse effects. From this point of view, actions oriented to traffic calming, for example, are also to be conceived as an “urban ecology technique”, which is extremely important for the achievement of this objective and as a way to protect *weak* users within the urban environment. Yet, it is still far from being fully implemented, due to the lack of a clear regulatory framework. In general, the scientific contribution provided by planning schools tends to be mainly focused on the identification of strategies on the “demand side” (mobility control and guidance and land use planning). More in particular, it can be stated that results are also useful on the “supply side”, with the indication of necessary infrastructural interventions, not only concerning the road and railway networks, but also investments for sustainable mobility (pedestrian paths, cycle paths, etc.). Given the ever growing number of sophisticated representation and research tools and techniques in this field, there is a high risk of obtaining fragmented rather than a well-structured and consistent picture of the reality. Hence, one might end up by representing a *virtual* reality, which is made up of the various development outcomes achieved by theories and models, which lack logical and time consistency. To ward off this danger, it is important to dwell on

the logical and temporal relationships between the various models outcomes, to assess the trickling down effects from one model to the other and to keep track of the evolution of these models in the medium and long run.

In summary, it might be stated that the transport and mobility research is bound to serve two main types of users: on the one hand, the business system and the Public Administration (it is the research originating from the *transport-oriented schools*), and, on the other hand, *spatial planning schools*, serving the Public Administration as their main end user. It is, yet, important to note that within the Public Administration, the decision-making mechanisms “do not seem to be excessively influenced by ... the logical and formal tools, which are made available by the various disciplines, and in particular by the economics, for transport planning” (Federtrasporti, 1998). This statement is rather pessimistic, but it reflects the Public Administration difficulty in shifting away from a *shopping-list* culture – with the various public authorities advocating the State intervention for the solution of specific transport related problems – towards a *planning-oriented* culture, based on environmental compatibility, effectiveness and efficiency assessments and energy saving, as the basic principles underlying all the proposed actions. Furthermore, there is the feeling that we are now moving towards an ever greater explanation of relationships between research findings and their application in the field of sustainable mobility planning and management. There is an ever stronger need for:

- policies and projects, to be subject to quantitative analyses, able to provide significant alternatives;
- analyses and modelling to be carried out by neutral third-party subjects not involved in the analysis results (cf. the case study of the environmental impact assessment of the High Speed Railways Network project performed by a subcontractor appointed by FFSS, i.e. the institution in charge of building the network itself),
- a budget constraint to be set as the necessary framework for any action proposal.

A last remark should be made concerning planning tools. To the eyes of a foreign expert, it might seem that there is a surplus of planning tools, especially in relation to the large number of actions to achieve a sustainable mobility objective. Considering the initiatives that have been actually undertaken, - some of which might appear to be not properly worked out and thus requiring more evidence - there is a clear lack of measurement and monitoring campaigns to assess the effects engendered by these actions, aiming at reducing any adverse impact on the environment and landscape and to improve mobility.

In my opinion, the importance of planning tools is also linked to the fact that the debate on these tools is also used to raise the public awareness on a different attitude towards mobility and the way to implement it. Faced with a sometimes tense conflictual relationship between the public decision-maker and the subjects involved, this becomes the prerequisite to translate the contents developed by scientific research into practice, as possible solutions to specific problems.

3. The Public Administration competencies

To better understand how the transfer of scientific research results into mobility action strategies by Public Authorities occurs, it is necessary to provide a short description of the Public Administration powers. The Italian Public Administration takes action at four main levels to face the multiple effects deriving from mobility and traffic-related pollution: Central, Regional, Provincial and Municipal level.

Without entering too much into the details of the various levels of competence, it can be summarised that the Central Government is responsible for the issuing of pieces of legislation (i.e.: setting legally binding thresholds for air pollutants emissions, in compliance with the various EU directives) and of guidelines (i.e.: the definition of criteria for the detection of pollution sources and for the identification of pollutants detection technologies and analysis methods). The Central State is assisted by ANPA in this field of action. The Central State exerts its powers on the matter also through *national plans*, which are developed in agreement with Regional Authorities.

Regional Authorities, too, have legislative and guidance powers, through the development of Regional Plans that apply to different areas, such as - as far as the transportation issues are concerned -: the PRIT and the PRTQA, to be implemented in integration with spatial planning tools. Regional Authorities have also the task to co-ordinate the actions, which are carried out by the lower provincial and municipal levels. Regional Authorities are assisted in these activities by the so-called ARPA agencies which, in turn, are responsible for the implementation of environmental control, surveillance, prevention and scientific and technical activities.

Provincial Authorities are entrusted with powers in the areas of measurement, regulation and control of air and noise pollution deriving from motor vehicles and from industrial activities, in addition to specific spatial and environmental planning powers.

The Provincial Authority has the power to draft the PTE and the PME, including the PTVE and the PETPC.

The main difference between these two tools is that the (national, regional) *Transport Plan* is a long-term plan, which envisages the use of – even massive – resources for the implementation of actions, whereas the (municipal) *Mobility Plan* is a short-term, low-budget plan.

Municipal Authorities are in charge of the following tasks:

- control of air pollution deriving from heating systems; control of air and noise pollution deriving from motor vehicles;
- development of operational plans by the mayors of the metropolitan areas;
- adoption of traffic limitation measures to prevent air pollution;

- issuing of immediate and urgent measures facing alarm or critical situations by mayors;
- provision of preliminary air quality assessment within the municipal area, highlighting the areas and populations that are most affected by pollution;
- drawing up of the Annual Report on Air Quality;
- enforcement of planned, permanent, or periodic traffic limitation or banning measures;
- adoption of effective traffic limitation measures on an annual basis.

More detailed descriptions of the Municipal Authorities powers and actions have been provided because it is at this territorial scale that a whole set of actions are undertaken leading to sustainable mobility conditions.

4. Planning tools and actions for the sustainable mobility

Law 122/1989, which first introduced specific strategies aimed at the reduction of urban motor vehicle traffic through the development of parking areas within the framework of PUP, can be regarded as the first initiative in favour of sustainable mobility. It is a sectoral and partial initiative, which has been further amended and approved by means of the DPR 29 August 1991, with a special focus on environmental protection.

A more systematic approach to the problem is undertaken by the new “Road Code” (April 1992) introducing the PUT, specifying the scope, objectives and contents of the action.

PUT are legally binding plans that must be complied by all the municipalities with more than 30,000 inhabitants and by municipalities with a lower resident population subject to seasonal “*peaks of tourists flows*” or “*an especially large number of commuters*” or “*at any rate, due to other special reasons, concerned by heavy traffic congestion*”.

It is a short-term technical and administrative instrument, designed to improve traffic and road safety conditions, to reduce air and noise pollution and energy consumption in compliance with the thresholds fixed by the law. Furthermore, inter-city road traffic plans (as provided by article 36), must be co-ordinated and integrated with other town-planning tools, air quality protection and reclamation plans and regional and provincial transport plans.

In particular, to assure public health protection, the reduction of air and noise pollution can be achieved by means of the following actions:

- planned motor vehicle fuel quality controls; motor vehicle noise and polluting emissions control campaigns; use of clean energy-driven motor vehicles; active and passive noise reduction measures,
- traffic flow controls,
- mobility demand control and guidance actions,

- reduced motor vehicle movement.

The objectives set in our paper have led us to analyse a few PUTs implemented in Italy to assess the way in which this experience has worked within the national context and also to assess the effectiveness in the reduction of air pollution levels. The effectiveness of these plans and programmes is now being assessed by a newly developed “Observatory on Urban Traffic Plans ”, whose purpose is to verify the state of implementation and to promote the publishing of effective solutions and best practices.

In particular, with reference to air pollution, these provisions must apply to towns and cities located in areas at risk of air pollution peaks, as decided by regional authorities in compliance with article 9 of the Decree issued by the Ministry of the Environment on 20 May 1991 on the "*Criteria for the collection of data concerning air quality*". Furthermore, special provisions have been introduced to protect especially vulnerable city areas, due to heavy exposure to air pollution. These areas are identified by the operational plans for the management of emergency situations, as set forth by the same DM 20.5.91 and as envisaged by the competent authority appointed by Regions in compliance with DPR 10 January 1992, "*Guidance and co-ordination of the urban pollution detection systems*".

In general, the implementation of actions envisaged by PUT, through the streamlining of traffic and a more rational use of private motor vehicles, should lead to a reduction of air and noise pollution levels (under normal weather conditions) below the set thresholds. This does not prevent special weather conditions from leading to a worsening of air pollution up to a state of alarm or warning, as set forth by DM dated 15 April 1994 and by its following updates. In this case special urgent actions must be implemented, which involve an important reduction in the use of private motor vehicles – at least those not complying with the latest laws on the reduction of polluting emissions (and, on the other hand, taking into account other less polluting and zero-emission motor cars and motorcycles) – as envisaged by PUT, in compliance with the operational action plan set forth by article 9 (DM 20 May), as previously mentioned.

The revised Road Code (DL dated 10 September 1993, no. 360) provide that the municipalities, which belong to the category identified by the General Inspectorate for Road Movement and Safety, are allowed to introduce an entrance fee for the access or transit of motor vehicles within those areas subject to traffic restrictions, according to the road-pricing principle.

The Inter-ministerial Decree dated 27 March 1998 on ("*Sustainable Mobility in urban areas*"), which confirms the obligation by Regional Authorities to adopt the PTRQA by 30 June 1999, envisages new planning tools, such as the so-called PUM. PUM is a medium-long term strategic plan, to tackle mobility issues, whose solution requires substantial time and financial investment and provides for the new *Mobility Manager* profile to be appointed by local authorities and by medium and large-sized firms (with more than 300 employees).

These firms and the public authorities are required to adopt “*a home/work transport plan for their employees... targeted to the reduction in the use of their individual private means of transport and to a better working hour organisation and to a reduction of traffic congestion*”. Furthermore, public authorities are invited to appoint a *mobility manager* in charge of the implementation of mobility governance tools, the promotion and dissemination of new mobility solutions (such as *car-sharing* and collective taxis) and the definition of a progressive introduction of low-environmental-impact motor vehicles.

The DM 21 April 1999, n. 163 (“*Identification of environmental and health criteria to serve as reference for city mayors for the adoption of car restriction measures*”) introduces the “*Identification of environmental and health criteria that serve as reference for mayors to adopt car restriction measures aimed at the reduction of benzene, hydrocarbons and PM₁₀ concentrations within acceptable thresholds*”.

It sets forth the urban air quality assessment methodologies and timetables and, at the same time, it sets the traffic restriction criteria aimed at assuring a proper air quality protection. According to the air quality assessment results – that must be carried out every year - mayors can outline a few planned, either permanent or periodical, actions aimed at either banning or limiting traffic for air pollution prevention purposes. These actions might include paying parking lots, pedestrian precincts, areas subject to traffic limitation, “*road pricing*”, cycle paths and planned traffic-free zones.

The type and extent of either traffic limiting or banning actions in force throughout the year must be targeted to the removal of traffic-induced air pollution “*structural*” causes and they cannot therefore be regarded as temporary “*emergency*” actions. To prevent the ban from turning into a stop-gap measure, specific actions must be implemented, which must be targeted to:

- clearly define the improvement expected in the individual areas involved;
- clearly define the control procedures for the enforcement of measures and assessment of results;
- adopt alternative measures to assure people and freight transport within the areas subject to traffic restrictions.

Three recent Decrees by the Ministry of the Environment envisage specific rules and regulations, which define in details the *subsidies and incentives provided to Municipalities that will implement traffic-reduction policies*. These measures are specifically designed to assure the implementation of policies targeted to the promotion of sustainable mobility.

The first decree on “*Subsidies to Municipalities for mobility governance*” is aimed at integrating the decree dated 27 March 1998, which envisages co-funding for those projects put forward by Municipalities or by Municipalities Associations for the development, integration or completion of already existing plans designed by the corporate mobility managers working in private firms.

The second decree - "*Incentives to Municipalities for the car sharing programme*" - sets forth subsidies for the so-called "ICS - Car-Sharing Initiative", a national co-ordination unit promoting car sharing.

The third decree on "*Subsidies to Municipalities for the development of sustainable mobility-oriented integrated actions and radical policies*" envisages a funding – among other actions - of a few billion lire to finance those municipalities that implement "radical" action policies, such as: collective taxies or innovative collective means of transport, traffic-reduction actions within the city centre, electrical vehicles for public transport, fleets of bicycles and electrical vehicles belonging to the municipality or to other public authorities, monitoring of air pollutants, best practices concerning anti-pollution devices or vehicles.

Along with these specific local-scale initiatives, the central Government has adopted two national plans defining a consistent framework for a sustainable oriented economic and spatial system to be implemented on national level.

These two plans in support of sustainable mobility are the NPNSS (1999) and the PGTL (2000).

With reference to sustainability, these are the objectives pursued by NPNSS:

1. reduction in energy consumption and greenhouse gases;
2. reduction of traffic-induced harmful effects on health, in compliance with the "Charter on transport, health and environment" (WHO, June 1999), setting a few guidelines to integrate citizen health protection with the transport policies and the spatial planning;
3. reduction of the environmental impact through management and control policies and activities locally carried out;
4. reduction of car accident casualties, with reference to the "National Plan for Road Safety" introduced by the last Financial Law;
5. greater accessibility to weak categories;
6. economic impact reduction of transport related activities, i.e. the reduction of overall external costs (a reduction, which is unfortunately characterised by arbitrary criteria).

The PGTL basic principles are the "liberalisation of the transport market" and entrusting of planning powers with two institutional authorities, at the national and regional levels. These powers are intended as distinct and complementary: they are bound, on the one hand, to reduce environmental pollution levels and, on the other hand, to raise transport safety standards.

Sustainable mobility is the central issue (PGTL, page 27). Hence, the planned environmental strategies to be implemented within the year 2010 mainly concern the following actions:

- reduction of damage caused by road transport and by motor vehicles utilisation modalities,
- technological innovation development,

promotion of collective transport,
rationalisation of freights logistic chains and distribution processes,
provision of suitable support facilities, financial and regulatory framework to promote the development of long-haul transport of goods through other modes of transport different from road.

Hence, three possible strategies may be envisaged:

1. fostering an overall reduction of motor vehicle transit at equal accessibility and social and economic development conditions;
2. fostering the transfer from high environmental impact to environment-friendly modes of transport;
3. promoting reduction in energy consumption and emissions per unit of transport through an improvement of energy and environmental efficiency of the means of transport and of their use.

As a whole, these two plans define the framework within which the Public Administration, firms and households have to operate to adopt behaviours in line with mobility and transport needs.

4.1 The “Environment-friendly Sundays”

Among the various specifically targeted traffic-reduction initiatives, the so-called “*Environment-friendly Sundays*” were launched by the Ministry of the Environment. These initiatives are aimed at promoting both public information and awareness raising campaigns on sustainable mobility and actions geared to reduce urban traffic environmental impact and at promoting sustainable mobility systems. Within this framework, as set forth by the DM 25 January 2000, DM 8 February 2000 and D.M. 17 February 2000, the following municipalities are eligible for co-funding applications (provided that they have subscribed to this initiative before January 31st 2000):

- municipalities with a population of more than 100,000 inhabitants,
- municipalities with a population of less than 100,000 inhabitants, included in the regional lists in accordance with DM 20 May 1991,
- municipalities, which are chief towns of province, even though with a population of less than 100,000 inhabitants,
- municipalities associations with an overall population of more than 150,000 inhabitants.

The DM 29 May 2000 has further widened the scope of municipalities eligible for co-funding applications.

145 municipalities have joined the “*Environment-friendly Sunday*” initiative. The first event was organised on 6th February 2000. As against the previous event held on September 22nd 1999 – with 90 municipalities joining the event - a 60% increase in participation was recorded, uniformly distributed throughout the national territory (among the largest cities, Milan also took part in the initiative, unlike the

previous year). This proposal is not only intended to meet the growing demands for a better quality of life, but also to promote the testing of alternative mobility forms. To this end, the use of bicycles, electrical motorbikes, electrical minibuses and collective taxis (car-sharing solutions) will have to be encouraged.

A set of “Environment-friendly Sundays” were held on March 5th, April 9th, June 4th, September 22nd, October 1st, November 5th, and December 3rd 2000.

The initiative is scheduled to continue also in the year 2001, to be held on 5 “Environment-friendly Sundays”, on February 11th, March 11th, April 8th, May 13th and June 10th 2001.

The success of the initiative promoted by the Ministry of the Environment has outlived all expectations. The opinion polls results – as requested by the Ministry of the Environment to assess the degree of appreciation of these car-free Sundays by citizens – undoubtedly show a wide public consensus, with 90% of interviewees who reported to be in favour of this initiative. In particular, 8 citizens out of 10 advocate for such initiatives to be undertaken by municipalities much more frequently, at least once a week. Citizen appreciation is mainly due to the rediscovery and enhancement of the historical and cultural assets of their cities.

As far as the measurement of emissions is concerned, a significant drop in primary pollutants levels directly released by private motor vehicles (carbon monoxide, benzene, nitrogen monoxide) can be recorded in pedestrian precincts. Whereas, there seems to be no direct correlation between private car traffic and secondary pollutants, which develop as a consequence of chemical and physical transformations (nitrogen dioxide, most PM10), which are correlated to other factors, such as weather conditions.

Hence, if on one hand the event has undoubtedly aroused great public interest, due to the information and awareness raising action it involved, on other hand, the need emerges for more regular and less episodic initiatives of this kind, which can assure a long-lasting and effective improvement of air quality in the urban environment.

5. Regional, provincial and municipal actions for air pollution abatement and mobility regulation

All these Authorities (Regions, Provinces and Municipalities) are engaged in sustainable mobility by means of various tools. Regional Authorities are active in the definition of plans and policies for air pollution abatement and for mobility control. General laws set forth the various local authorities powers and make reference to sector-specific operational tools for the definition and implementation of effective measures with reference to air pollution abatement and mobility regulation to be agreed upon with Provincial and Municipal authorities as well.

A few considerations concerning **only** the Emilia Romagna Region, in particular, will now be made.

Emilia Romagna is one of the most active Regions in the environment protection field. The first environmental measure dates back to the LR n. 6 dated 22 January 1980 on “*New actions by the Region for the air pollutants prevention and control*”, through which the Region promoted the development, accomplishment and strengthening of air pollutants monitoring networks.

Without entering too much into the details of the various rules and regulations, it is yet important to highlight the measure concerning environment-related information: LR n. 15, dated 16 May 1996, “*Promotion, organisation and development of environmental education and information activities*”. The issues concerning transport safety and the use of safer and less polluting transport means are dealt with by other rules and regulations, which aim at:

- promoting a rational traffic organisation both through the development of intermodal systems, safety and quality improvement;
- promoting the sustainable mobility culture.

The ways in which the various authorities operate in the sustainable mobility area are specified under LR n. 52 dated 26 April 1999, which, in addition to the re-definition of the various bodies and authorities’ powers– in particular, the Regional authority, the Provincial and Municipal authorities, the Metropolitan Areas and ARPA –, also sets the criteria for air quality protection and control, through the setting up of a regional control system and the drawing up of extra-urban and urban traffic plans. The Emilia-Romagna Region has not yet adopted the PTRQA, but it is now devoting an ever growing attention to the definition of tools for the Plan definition, such as the *Report on the State of the Environment*, in addition to other reports concerning mobility and transport.

Over the past decade, a substantial increase in the transport demand has taken place in the Region. The extra-urban transport demand reaches peaks up to 2 million movements every day. In 83% of cases, these movements take place through one’s own private means of transport. It is against this background that the PRIT has recently been approved. It is specifically designed to make transport more efficient and effective, to reduce its costs, as well as its environmental impact and to assure citizens and firms a better accessibility throughout the regional territory.

5.1 Significant air pollution abatement and mobility regulation: administrative provisions adopted by Provincial and Municipal Authorities

Generally speaking, the policies adopted by the Provincial and Municipal Authorities to reduce air pollution can be defined as “short-term” and “medium-long term” actions:

Short-term policies are based on:

- limitation of parking facilities in the city centre;
- tax or toll to be levied on the street network use;
- creation of traffic-restriction areas;

- creation of bus lanes;
- increase of the paying car parking areas;
- economic incentives to promote the use of means of transport running on alternative clean fuels;
- introduction of car-pooling routes;
- traffic stoppage on pre-set days (e.g. the environment-friendly Sundays)

Long-term policies are based on:

- creation of equipped pedestrians zones;
- building of cycle paths;
- building of exchange parking areas;
- strengthening of ring and radial roads;
- building of road tunnels and underground lines.

A brief overview of the policies adopted in the Bologna area will now be outlined.

5.2 Sustainable mobility-oriented actions in the Bologna area

The survey has mainly focused on the PUT implemented in the Bologna metropolitan area (as well as in other Italian Municipalities, including various municipalities of different demographic and geographical size).

The availability of the basic documents integrated by the knowledge of this specific context allowed to use this area as a significant test to assess traffic plans effectiveness in improving air quality and mobility. PUT experiences date back to the first half of the 90's. This allows us to make a few considerations – although with the due care - on the follow-up of these plans.

5.2.1 The PGTU of the city of Bologna

The analysis of the knowledge underlying the PGTU (which is the first design level of a PUT) of the city of Bologna highlights the environmental critical points in the urban area, which requires structural actions in the field of mobility and transport. In particular, the benzene monitoring campaign, by means of passive samplers, highlighted values higher than $10 \mu\text{g}/\text{m}^3$ – the reference threshold set as mobile mean of the daily recorded values, in accordance with the Ministerial Decree DM dated 25.11.94 – in many areas of the historical centre. This situation is even more critical if it is considered with reference to the threshold introduced by UE directives, corresponding to the $5 \mu\text{g}/\text{m}^3$

At present, the most critical pollutants detected in the Bologna area are:

- nitrogen dioxide NO_2 ,
- total suspended particulate,
- particulate PM_{10} ,

- benzene.

Throughout the year 1999, the nitrogen dioxide values remained within the thresholds set by the law. Hence, although it is constantly monitored and although the values surveyed are close to the critical values, this pollutant is not considered to be the most critical one. The most worrying concerns benzene and PM10 concentrations; in particular, the analyses have pointed out that motorcycles are the primary source of benzene. In general, in order to protect the most environmentally sensitive areas in a more effective and durable way, in full compliance with the future air quality standards, the following actions have been envisaged by PGTU:

- reduction of motor vehicles movement in general and, in particular, of the most polluting ones,
- reduction of motor vehicles polluting capacity,
- streamlining and reduction of traffic flows.

With reference to pollution problems, the Bologna PGTU is intended to promote a growing dissemination of environment-friendly means of transport, by replacing the present motor vehicle fleet with a new low-emission one, to be implemented by means of:

- tax allowances and incentives to motor vehicle owners who decide to install new LPG or methane-propelled systems, in compliance with current safety rules;
- definition of an official price-list for the propeller conversion (to either LPG or methane) in agreement with the business operators; about 10-15% price discounts might be envisaged;
- installation of a propeller conversion system at very low interest rates, through agreements with local banks.

The main goal is to replace at least 3,000 motor vehicles every year, accounting for 12,5% of the most polluting fleet (category A), namely 3% of motor vehicles that are not equipped with a catalytic converter. This operation is favourable for users not only because of these incentives, but also because there are further advantages due to the lower cost of alternative fuels (LPG or methane).

The DL 29/4/99 on the scrapping of old motor vehicles - envisaging strong incentives for the purchase of two-, three- and four-wheel electrical vehicles - has substantially accelerated the fleet renewal process. The Public Administration will also support these incentives through the introduction of road traffic rules to foster the spreading of the electrical vehicles.

Furthermore, according to the PGTU indications to reduce the dust pollution, - which is mainly caused by traditional diesel engines - the Municipality has envisaged the following strategies:

- night street-cleaning of the city Historical Centre;
- higher frequency for emissions control;
- diesel engines running on “clean” fuels;

- installation of particulate emission reducing devices on diesel engines running on traditional fuel.

PGTU has led the Municipal Authority to adopt strict traffic-restriction measures, thus banning from central areas those vehicles that are not equipped with a catalytic converter. In particular, those motorcycles that are not in compliance with EU regulations are not allowed to access the areas subject to traffic restriction, during certain days of the week, in certain time brackets, applying both to residents and to non-residents (at present it would be impossible to make a distinction between motorcycles belonging to residents and to non residents, unless specific individual checks were made by the police, which would, yet, make the patrolling action expensive and ineffective).

Similar initiatives have been undertaken by ATC (namely, the transport company with a public majority share-holding charged for the transport services in the Province of Bologna); it has envisaged a plan for the electrification and methane-transformation of the present bus fleet, in addition to the already existing "eco-compatible" vehicles, as part of a broader environmental strategy, whose main purpose is to supply an ever more environment-friendly service.

Furthermore, the company has put forward a funding plan to the Ministry of the Environment for the introduction of bi-power and methane-fuelled buses. Upon the programme completion, 34% of the bus fleet will be made up of eco-compatible vehicles. They will mainly be used for the city centre regular bus service. The use of public means of transport instead of private motor vehicles will be enhanced through the implementation of a railways public transportation network covering the whole city, which will especially be designed to serve commuters between the city of Bologna and its provincial area, also in view of the increasing number of commuters, that could lead to a further increase of the traffic congestion of the urban area and of its surroundings. The key element of the project is the reorganisation of the metropolitan railways transportation through a regular service, based on a new stations and stops system along the already existing railways lines, adjusting the principles underlying the Paris RER and German S-bahn to the Bologna reality.

Finally a proposal has been put forward for the development of a mobility integrated system, including a tramline and a light metropolitan line, using the same carriage-way, to be integrated with the railways services at different levels (national, regional and metropolitan) and with the private transport exchange nodes. The effects expected from the development of this network are a substantial reduction of motor vehicle traffic, with a consequent increase in the number of public transport users and a redistribution of flows of access to the urban central area.

To increase bicycle mobility, the Bologna PGTU (as well as all the other PGTUs taken into account) has highlighted the need for co-ordination with town-planning projects to equip them with an ever larger number of cycle paths as part of the

whole mobility network. The following actions have been envisaged to promote the use of bicycles for daily movements:

- installation of suitably safe bike racks by the Municipality;
- incentives for private individuals to install and manage bike racks at their own expenses on tax-free public property;
- provisions of bicycles on rent in exchange parking areas.

Moreover, cycle paths seem to be designed by people who have never ridden a bike. Cycle paths must be designed in compliance with strict safety rules rather than being cut out from spaces, competing against both pedestrians and motor vehicles.

Although evidence is still to be provided, the feeling is widely spread that not enough cycle paths have been built proportionately with the amount of people using this mean of transport. In my opinion, new bicycles users attractiveness is affected by:

- keeping this “weak users group” separate from the rest of the traffic;
- lack of bikers proper legal protection. Bikers should be protected from other means of transport as is today the case for pedestrians.

Furthermore, in the framework of actions envisaged by the previously mentioned PUM, a mobility manager has recently been appointed by the Municipality of Bologna. Furthermore, the Municipality has started up a project, which is still at the initial stage, to develop a co-ordination and support facility for corporate mobility managers to be hired by firms in the city of Bologna, in compliance with the above mentioned decree. The objective is to reach a motor vehicle traffic reduction through the reorganisation and guidance for systematic mobility demand segments featuring homogeneous characteristics. Within the framework of a broader sustainable mobility strategy, the Municipality of Bologna, in co-operation with ATC and COTABO (a taxi co-operative), has launched a collective car-pooling pilot service, which might be an original solution for the rationalisation of commuters movements.

Another project is now underway: it is the so-called “*Bologna car sharing service*” which consists of the management of a fleet of cars, including low- or zero-environmental-impact vehicles (electrical, bi-power, methane or LPG fuelled vehicles, equipped with polluting emission abatement devices) in order to reduce the use of private cars and especially the ownership of normally under-used individual cars (less than 6,000 Km per year).

Additional initiatives in the field are undertaken by the Municipality of Bologna, such as:

- participation in the CIVITAS European project (together with other European cities) to test road-pricing solutions for freight haulage within the city historical centre;
- the starting up of a project sponsored by the Ministry of the Environment for the development of *safe pedestrian paths* for home-school itineraries for primary and junior-high school pupils (with a consequent reduction in the use of private

cars by parents accompanying children to school). This aspect has been dealt with more generally within the framework of a national research project on "Children's sustainable city" (Paba, 1998);

- the starting up of a project on *sustainable* street education for children, starting from nursery and primary schools.

The results of a survey carried out in Bologna on a properly selected sample of 1,200 individuals show us what citizens of Bologna expect to attain the sustainable mobility objective.

Question	Incidence %
Better traffic flow control	85.7
Car accident reduction measures	85.5
Parking regulation	76.4
Introduction of fast tramways	72.1
Extension of traffic-free areas	70.5
Traffic flows re-organisation (one-way streets, reserved lanes)	69.5
Removal of architectural barriers	66.4
Strengthening of public railways transport	68.8
Strong increase of cycle paths number	62.2
None of them	0.3

As regards the neighbouring medium-sized municipalities, located both in the Bologna metropolitan area and at a national scale, we can observe that many of them have followed the example set by the Municipality of Bologna, or, in a few cases, they have indeed taken the lead in developing their own PGTU traffic plans.

From a general analysis of the PGTU approved in the Bologna metropolitan area, it emerges that they focus not so much on environment-friendly concerns, but on other issues, such as: parking organisation, traffic flows streamlining, by undertaking new mobility actions and by promoting safer road conditions. Only in a very few cases, strategies aimed at reducing air pollution deriving from traffic have been introduced or pollution detection systems have been installed. Given the small size of these municipalities, the main source of air pollution is mainly linked to activities carried out within the area of the Municipality of Bologna.

The actions, which are generally envisaged by the plans taken into account, concern car flow reduction in certain streets and, in particular, within the historical centres, speed limitation through specific *traffic calming* devices, the building of green buffer barriers around residential areas, the extension of pedestrians precincts and of cycle paths. In particular, the design of new pedestrians tracks has become a recurrent feature of the reviewed plans, even though a few doubts remain about the

actual feasibility of these connections and of their effective contribution to the air quality improvement.

Additionally, in pursuing sustainable mobility aims, a few municipalities have included specific actions in their own PGTU plans for an improvement of their public transport system, which generally aim at making it less polluting, more attractive and accessible for users (design of new bus shelters and stops, organisation of new lines and services, information for users).

5.2.2 A few considerations

A few considerations can be made following the analysis of the PUT and PGTU. A special attention has been paid to these tools, because they are object of study within the spatial planning schools. They can be regarded as the first steps towards the definition of comprehensive sustainable urban and metropolitan plans. Given the complex methodological path that clarifies the role played by space in the pursuance of sustainable mobility, PUT can be characterised as a plan providing solutions to an already undermined situation. As a matter of fact, it is only a starting point towards a deeper analysis of the notions and principles that currently underlie the urban and metropolitan planning practices (Fouchier, 1997), thus fully recognising the mobility high value in establishing links between the new built space organisation forms. These tools contribute to achieve their own specific goal, i.e. air quality improvement, although indirectly, partially and probably only in the medium term.

They can *only indirectly* contribute to this aim, because PUT cannot act on the pollution sources (the polluting emissions released by motor vehicles), but they try to remove environmental criticalities, by promoting a shift from private transportation use towards public transportation modes and, in general, towards an “environment-friendly” mobility (cycle paths, pedestrian tracks, etc.). But the creation of a few pedestrian precincts may simply move a few critical conditions away from a certain area, but without removing them completely.

They can *only partially* contribute to achieve this aim, because only a few relevant and consistent factors are under the municipal authority’s direct control. In particular in the case of small-sized municipalities, the shift from private to public transport mode depends on decisions, which must be made jointly in agreement with other municipalities and with the Public Transport Company, managing the supply of the transport services for this wide area, often relying upon uncertain financial resources.

They can contribute to achieve this aim *only in the medium and long term*, because even if the planned actions were timely implemented, their effective impact always concerns side aspects rather than the core of pollution reduction. Furthermore, the success of some of these aspects depends on individual behaviour changes, which take a long time, even if properly managed and stimulated, through an incentives and penalties system.

A further consideration should be made concerning the different role played by PUT, in pursuing the pollution reduction objective, in small-sized municipalities (especially those with less than 30,000 inhabitants, whose PUT plans stem from regional and/or provincial legally binding decisions) as against medium and large-sized municipalities. Even though in both cases, parking and cycle path development policies, etc., prove to be equally effective for the whole mobility system operation, when it comes to air pollution abatement, the contribution which can be given by small-sized municipalities is low (although not totally marginal). At the same time, it should be pointed out that the air quality of these little towns is often affected by the spreading of pollutants coming from outside, from other neighbouring places. Hence, even serious actions run the risk of being totally thwarted by the uncontrolled behaviour of the other neighbouring realities. To conclude, PUT tends to plan actions in a consistent and co-ordinated way, unlike what used to happen in the past. Taken in isolation, PUT cannot of course get rid of the complex traffic and transport related problems affecting the urban fabrics, even though it envisages specifically targeted actions. Assigning PUT a decisive role would be tantamount to misunderstanding “the symbolism of plans with an expected reality”. It is necessary to take action on the causes of the disorder and this requires the full understanding of its mechanisms, which would remain incomprehensible without the recognition of their social complexity and spatial interdependence.

6. Conclusions

To conclude, it can be stated that two main strategies for a sustainable mobility are undertaken in Italy.

First of all, actions are undertaken at central level (in particular, both at a national and at a EU-wide scale): the main tendency is in favour of technological solutions applied to means of transport designed to reduce pollutants emissions, or promoting vehicles running on low or zero -emission fuels.

At the same time, in addition to technological solutions, National Plans (such as the National Plan for Sustainable Development and the General Plan for Transport and Logistic, as above mentioned) have been implemented, which advocate mobility demand control and management activities and control policies on the spatial transformations of urban areas.

At these levels, the provisions that are adopted tend to act both on the demand side and on the supply side. Yet, these provisions – both regulatory provisions and incentives – apply to car drivers in an undifferentiated way. From this point of view, as already pointed out by a few influential scholars (Orfeuil, 1997), it seems necessary to focus actions on special users target groups and to use possible leverages (such as tax levy) in a targeted way, to serve as guidance for car drivers behaviour.

In the general framework, a specific role is played by public information and awareness raising initiatives, such as the “Environment-friendly Sundays”. We

believe that initiatives such as this one are very important, as they facilitate a change in public behaviour patterns in view of sustainable mobility, which cannot be pursued without citizens involvement.

At a local (provincial and municipal) level, plans and programmes are promoted and designed to improve environmental conditions. This strategy stems from the identification of critical situations and leads to a complex set of air pollution control actions which are sometimes more fragmented and sometimes more systematic. The same combination of strategies and actions – mainly oriented on the demand side - is adopted, aiming at changing behaviour patterns both of the citizens and of the firms (both industrial firms and public transportation utilities), through a whole set of incentives and of penalties.

Generally speaking, I believe that a long time is required before a measurable, continuous and generalised air quality improvement takes place. This statement is grounded on the fact that the planned timetable for the achievement of environmentally satisfactory technological results is often subject to postponements (due to technical or technological constraints in the problem solving). It is also based on the consideration that the lines of actions suggested and/or imposed by the plans and programs require a deep change in people and firms behaviours. Such a change can hardly occur if imposed according to a top-down approach. Only through a bottom-up awareness-raising and maturing process can a different cultural attitude towards collective resources – and air in particular – be advocated.

At present only a minority of the population and of industrial firms has adopted such a responsible and mature attitude. The dissemination of this new cultural approach will undoubtedly require a long time. Yet, this process can be accelerated by using all the possible tools (such as, information; training; using market forces for environmental protection purposes; deterrence and incentive-based policies, alternatively, to guide private and public actions), which are able to contribute to improve air quality and, more generally, to protect and enhance environmental assets.

In summary, it can be stated that in Italy, a whole set of initiatives in favour of sustainable mobility have been undertaken. They are substantially the same as those adopted at the national and international scale. The most important point I would like to raise is the need to monitor the results of these actions to assess their efficiency, effectiveness and social acceptance, consistently with the objectives, which have been set forth, also in view of a better urban and regional space quality, which, after all, is the objective to be pursued in the governance of urban and spatial transformations.

References

1. Amendola, G., (a cura di, 1995), *Inquinamenti*, EPC, Roma
2. Ascher, F., (2001), Etretien avec François Ascher. In: *Le journal de l'automobile*, n. 740, 23 février 2001 (In : www.atec-tec.net/fr/its_ews_det.asp?code_ews=124)
3. Ascher, F., (1997), *Les vitesses de la ville*. L'Aube, La Tour d'Aigues

4. Banister, D., Stead, D., Steen, P., Akerman, J., Dreborg, C., Nijkamp P., and Schleicher, R. (2000), *European Transport Policy and Sustainable Mobility*. Spon Press, London
5. Cervero, R., (1998), *The Transit Metropolis. A Global Inquiry*. Island Press, Washington, D.C.
6. Comune di Bologna, U.O. Traffico e Trasporti, (2000, a cura di), *Piano Generale del Traffico Urbano (mimeo)*
7. Evans, S. and Oswald, A., (1999), A Non-Technical Paper on the Case for Road Pricing. To be published on *Transport Review*.
8. Federtrasporti, (ed., 1998), *Rapporto 1998, Modelli di valutazione strategica alla scala europea*. Roma, (mimeo).
9. Fouchier, V., (1997), La planification urbaine peut-elle conduire à une mobilité durable? (In : www.x-environment.org/Jaune-Rouge/JR1997/fouchier.html)
10. Fullerton, D. and West, S.E., (2000), Tax and Subsidy Combination for the Control of Car Pollution. WP 7774, NBER, Cambridge, MA (In: www.nber.org/papers/w7774)
11. Fuzio, R., (1994), *Testo unificato della normativa sull'inquinamento atmosferico da traffico veicolare*, Giuffrè Editore, Milano
12. Kolstadt, C.D., (1986), Empirical Properties of Economic Incentives and Command-and-Control Regulations for Air Pollution Control. In: *Land Economics*, **62**, 3; pp. 250-268
13. Ministero dei Trasporti e della Navigazione, Ministero dei Lavori Pubblici e Ministero dell'Ambiente (a cura di, 2001), *Piano generale dei trasporti e della logistica*. Roma, gennaio (mimeo)
14. Morin, E., (1995), *Sociologie*. Fayard, Paris.
15. Nagurney, A., (2000), *Sustainable Transportation Networks*. Edward Elgar, Cheltenham UK
16. Orfeuil, J.P., (1994), *Je suis l'automobile*. L'Aube, La Tour d'Aigues ; p. 85
17. Orfeuil, J.P., (1997), Qui paye quoi pour aller où ? La mobilité dans la ville éclatée. (In : www.x-environment/Jaune-Rouge/Orfeuil.html)
18. Orfeuil, J.P., (2000), *L'evoluzione de la mobilité quotidienne*. Les Collections de l'INRETS. Paris.
19. Orfeuil, J.P., (2001), *L'automobile en questions*. La Documentation Française. Paris
20. Ortega Y Gasset, J., (1972), *La rebelión de las masas*. Espasa-Calpe, XIX ed., col. Austral, Madrid, Prima ediz., 1930
21. Paba, G., (1998), I bambini, la città, lo spazio pubblico: itinerari per una città sostenibile ed aperta. Memoria presentata al Seminario Nazionale "Idee e progetti per la città sostenibile delle bambine e dei bambini"; Firenze, 22-23 giugno; (In: www.minori.it/Conf/paba.html)
22. Pucher, J., (1990), Capitalism, Socialism and Urban Transportation. In: *JAPA*, **56**, 3, summer; pp. 278-296
23. Pucher, J. and Lefèvre, C., (1996), *The Urban Transport Crisis in Europe and North America*. McMillan Press, Basingstoke, UK
24. Romanazzo, M. e Valentini, M.P. (2001), Settore Trasporti. Documento Master. In: Ministero dell'Ambiente ed ENEA (a cura di), *Nuovo Piano Nazionale per lo Sviluppo Sostenibile*. Roma (mimeo)
25. Sartzetakis, S.E., (1999), *On the Efficiency of Competitive Markets for Input Quotas: the Case of Emission Permit Trading*. Nota di lavoro 93.99. Fondazione Enrico Mattei, Roma.
26. Stavins, R.N. (1988, ed.), *Project 88. Harnessing Market Forces to Protect Our Environment*. Research Paper of J. F. Kennedy School of Government. Harvard University. Cambridge, Ma., (mimeo)
27. Tondelli S., (2000), La modellazione del ciclo della mobilità. In: *Il governo della mobilità per la pianificazione e progettazione della qualità urbana*, Progetto Pluriennale di ricerca, E.F. 1998,

Dipartimento di Architettura e Pianificazione Territoriale, Università di Bologna, Facoltà di Ingegneria (*mimeo*)

Referring to the Urban Traffic Plans the following reviews are analyzed:

1. *Urbanistica Informazioni*
2. *Mobilità e Traffico Urbano*

The documents (papers and maps on the web) produced by the Italian municipalities are also analyzed.

url:

http://www.provincia.bologna.it	http://www.comune.bologna.it	http://www.comune.roma.it
http://www.comune.torino.it	http://www.comune.trieste.it	http://www.comune.venezia.it
http://www.arpa.emr.it	http://www.provincia.torino.it	http://space.tin.it
http://www.astrea.it	http://www.ambiente.it	http://spazioweb.inwind.it
http://www.ingegneria.unige.it	http://www.cnapmi.org	http://www.eea.eu.int
http://www.enea.it	http://www.epa.us	http://www.unep.org
http://www.ipa.it	http://www.normeinrete.it	http://www.oecd.org

Research supported by the University of Bologna with the Research Project:

“The mobility management for the planning and design of the urban quality”