

Toronto 2004 - Windsor Workshop - Transportation Technology & Fuel Forum
Session 4C: Reducing Pollution in Urban Areas — Case Studies on Programs and Policies

Air Pollution in Cities and Transportation Policies: Italian Case Studies M. C. Cirillo, S. Brini, P. Villani,
M. A. Alessandro, A. Cataldo, D. Ceremigna, F. Falcioni

Environment and Urban Mobility

The environmental transportation costs refer to both macro impacts evaluated on large areas and territorial impacts calculated in proximity to the transport infrastructures.

Macro impacts refer to all the damages caused by the transportation sector in terms of emissions and climate alteration, while territorial impacts include air pollution, sound emissions, barrier effect, landscape damages and all the risks connected with the soil stability and water pollution, both superficial and deep one too.

Some of these externalities has already been incorporated in fiscal laws and insurance policies, but only in recent times we start calculating all the costs connected with the road accidents which accounting for 2,5 – 3% of EEC GNP, and refer to the losses in productive capacity, human and health costs and material damages.

However it's reasonable to believe that in many contexts these externalities aren't considered, with the result to produce economic inefficiency, serious damages both the people and the climate.

The road transport surely produces the worst externalities, above all in metropolitan areas in proximity to the principle highways, where big traffic jams cause very strong polluting emissions.

In the pictures below they are showed the whole vehicular flows in Italian and French networks and the flows only belong to the transport of goods: the problems are equals and they are connected with the necessity to move inside the more and more spread metropolitan areas, above all from the citizen located outside the cities.

There are three fundamental aspects to point out:

- 1) social and economic costs caused by more and more spread mobility (accidents, environmental costs produced by traffic jams);
- 2) running expenses of urban centres more and more extensive and continuous (metropolitan areas) where the number of commercial activities rise. Long the highways and the principle locations there are different functions (commercial, hobbies, multiplex, etc...) in order to increase the number of users/customers. But this process produces the functional collapse of the road infrastructures in a long time.
- 3) Costs refer to the only logistic sector, which is often indicated as the first responsible both the road accidents and environmental pollution. The logistic sector has only tried to face the market competition in a context with total absence of rules and incentives for intermodality.

Costs produced by the accidents

About 40% of road accidents are due to the bad driving of the users, while the residual 60% depends on the bad conditions of the roads (geometric form, traffic signs, paving, etc...)

According to the Istat data in 1999, the number of accidents, above all fatal ones, confirms the good security of superhighways, where the accidents accounting for 6,5% and the fatal ones accounting for 12,1%; highly dangerous are instead the urban streets where happens about 74,6% of the total accidents and 41,4% of them are fatal ones; State roads follow with 9% of accidents and 23,8% of deaths, while provincial roads seem rather sure with 3,6% of accidents and 6,5% of deaths.

The accidents that include commercial vehicles have doubled in the decade from 1986 to 1996, changing from 17 to 34 percent of the total accidents; also this last date points out the strong increase in the transport of goods in our roads.

Environmental costs

In this paragraph we analyse all the information about stocks and typologies of vehicles circulating in Italy, since this aspect really affects on the economic/social system because it is strictly connected with the movement of people and goods.

In 1999 the ratio between people and cars was equal to 1,8; in the decade from 1990 to 1999 this value was indeed changed from 2,11 to 1,80 just mentioned, in consideration of a constant decrease of population which was reduced about 0,05%. In 2000 this ratio was further on reduced, standing about 1,76.

These figures indicate an increase in the use of private vehicle from Italians; it's enough to say that Italian families assign about 15% of their consumptions in transport expenses and it's reasonable to believe that most of these charges are attributable to private transport vehicle.

Furthermore we point out that in 1999 and 2000, about 95% of the circulating cars were fed with petrol and diesel, while only the residual 5% were fed with GPL, methane and electricity.

It's important to put in evidence that in these last years the composition of the just mentioned 95% has been made up by a substantial increase of the cars fed with petrol, accounting for 11,75% in 1998, 12,90% in 1999 and 14,35% in 2000.

The consumption of diesel for cars in Italy, in 2000, was equal to 22.166.000 tons (it was equal to 17.156.000 in 1998): it has indeed continued the lessening in petrol consumption (less 3,0% than the first six months in 2001) with a shift on demand of diesel, whose consumption has generally increased for 4,4% in consequence of the increasing modification of Italian car stock in favour of diesel cars.

The chance to launch the diesel emulsions on the market in a short period should be a strong incentive for the research of new products: it's possible to calculate that in urban areas some benefits would be immediately perceived, since the light (until 3,5 tons) vehicles for transport of goods and diesel cars accounting for 54% on the total of the powders let in the atmosphere.

The analysis of diesel vehicle stocks can be completed with the evaluations of vehicles used for the transport of goods matriculated in Italy, which however don't consider an important percentage about stranger heavy (over 3,5 tons) vehicles that circulate on our national territory. The figures point out a strong presence (75,5%) of medium/small vehicles (with capacity until 1,6 tons).

The table below shows as 60,97% of heavy vehicles (over 3,5 tons) was matriculated before 1993. All these information point out that it is necessary to pay really attention to the possible reduction of polluting substances *ab origine*, by the launch diesel at low environmental impact (ultra low sulfur diesel and water-in-

fuel-emulsions) on the market because the substitution of the whole car stock will be only able to happen in a very long time period.

Running expenses of urban centres more and more extensive and continuous

According to the economic theory, the transport networks produce some objective conditions (externalities) which make attractive a local system because they create some utilities that there aren't anywhere. These utilities allow lower costs for the single business.

According to the ecological theory, instead, the transport networks generate some negative externalities because they change ecosystems and destroy some important natural resources. In this sense they contribute to stop the regeneration both the natural systems and the energetic and biodinamic chains.

These theories reflect the American and European schools' studies. The European one is more oriented to calculate the economic and geographic effects and particularly interested to describe all perspectives coming from infrastructure, while the American one is more oriented both the evaluation of the environmental impacts and the social/economic effects through methodologies already studied for a long time.

Some theoretical subject

According to the economic theory there is a cumulative and circular causal relation between local development and increase in the network of transportation: in particular, development means major attractiveness for the local system, both the enterprises and the families, which increases the mobility demand and the building of new networks, and the process start again.

This local development model was particularly made up in post war period into the analysis and evaluations which led the building of infrastructure networks in industrialized countries.

Now this model seems rather out of date for its simplicity and a new sensibility is now developing as regards the undesired and unexpected effects of the old evaluations, and about the improvement and the efficacy of public expenditure.

In the definition of perspectives and in the evaluation of infrastructure politics, it is necessary to include all the benefits and undesired impacts, both direct and indirect too, which are often difficult to calculate *ex ante*.

In particular the indirect factors refer to the whole structure of the local territorial system and they are: physical characteristics and territorial morphology, the use and the value of the soil, its functional specialization, both direct and indirect available resources (landscape, architectures with high symbolic value, etc...), all changes in progress, the people and their different targets, the connected capacities, modalities and achievement times, costs and efficacy, running expenses.

The consequences of a transport infrastructure can be complicated and all chances connected with its building could produce the improvement of the system or its decline, or more probably, new combinations of opportunities and risks, which change the development process of a local system on new levels.

A first possible generalization regards the use and the value of the soil: the lines change both the functions and the structure of the territory and furthermore, they modify the hierarchy junctions and the prices of the areas.

In addition to the value of the soil and the specialization of the areas, many researches point out all the effects caused by transport networks.

Both house and enterprise locations shouldn't only depend on physical characteristics of an area or from planning regulations, but also from the prevalent typology of transport in the area: "A network transport based on the use of car (and therefore on highways) supports a spread urbanization founded on mono familiar houses, while a network based on collective transports, above all railway ones, promotes a linear urbanization based on joint ownership with strong density in proximity to the railway stations".

In general, the public transport produces positive effects in the cities, but also we note a strong difference in the zones where the bus stops are rather distanced. In particular, the places located in proximity to the bus stops take on an higher value (commercial, real, etc...) than other places located farther away from the bus stops.

The positive effects produce by the increase in transport networks are greater in the peripheral areas either in structural decline areas or in new urbanization ones not consolidate yet, than those central areas with a stronger structure of enterprises and houses.

The mobility demand has increased very much through the increase in the use of private vehicle for mobility of passengers and goods. Instead the users of collective vehicle have been unchanged and however their percentage has decreased in relative terms.

In Italy the increase in demand for transport of passengers has been due to some different reasons, like the rise of the incomes, the change of consumption models, and the politics of tertiarization and decentralization in the enterprises.

The analysis of the quantities refer to the traffic of passengers and goods points out the absolute prevalence of road transport, with these aspects: 1) high concentration in some critical roads; 2) an unbalanced territorial distribution of mobility demand; 3) high movements of passengers and goods for small and medium distances.

In Italy these aspects are really stronger than other European countries. The prevalence of road transport is particularly located in proximity to the urban areas and also for the goods there has been a decrease in the railway transport and coasting trade too, while road transport has increased in spite of the development of combined transport and transshipment too.

In 2010 about 75% of the flows will be concentrated on a few routes represented from the connections between the principle logistic centres and cities, which are already overloaded today.

The points of traffic jam will be on the average of 250-500% and it will be more concentrated. This is an European problem, but UE isn't able, for now, to face this announced catastrophe.

An Italian example – both for now and in the future – is Milan and all Lombard region. With 15,5% of the Italian population, Milan accounts for 19,5% of GNP, 28% of paid VAT, 29% of national imports and 37% of exports, which become 50% if we consider all transits and not only the origins and the destinations.

Many enterprises have moved their stocks in Lombard, while a lot of GDO enterprises (Rinascente, Coin-Oviesse-Standa, Pam, Auchan, etc...) have got in Lombard their sorting centre which supplies all stores distributed on the whole national territory or however in a big zone. It's not surprising that in Lombard the

road traffic has been increasing at 5,2% for a year (it's the double compared to Italian average). This percentage takes to the doubling every 10 years, but in spite of this, there hasn't been any solution about the building of new infrastructure for goods.

The locations with better road accessibility recently seem the best solution for tertiary and commercial functions (according to what happens in Italy and France) in order to increase the number of users/customers. But this trend is seriously damaging the logistic sector and the use of road infrastructures where the flow of vehicles is slow down in different hours in a day.

In this sense it is necessary that the "new central positions" (as town-planners define the biggest commercial centres) must be connected with the collective transport network.

From a recent research carried out by Confetra for road carriers – register, over 40% of enterprises often come back with an empty load (from 75 to 100% of cases), while only the 13,4% of them always come back with a full load. About 60% of them come back with an empty load for over 50% of cases¹.

In local range, the productivity of deliveries – measured as quintal/day/mean – has halved in these last 10 years, because:

- 1) Transported quantities have decreased;
- 2) The store retails have a bigger range of products and they get in touch with more suppliers;
- 3) Logistic's areas are more and more limited;
- 4) The trucks make less deliveries owing to the traffic jam.

Instead the logistics' incomes have unchanged or sometimes decreased owing to a strong competition. It would be different if all operators used one or a few platforms which must be built with state contributes, as already done in Germany. Logistic platforms are the interchange places for between long and short distance transports and between different typologies of transport: cross-docking centres, warehousing / manufacturing / logistics and supply chain issues should be available for everyone (manufacturers, GDO enterprises, carriers, wholesaler, etc...).

It is only enough the physical space, but it is necessary a strong state contribute to attract many operators. In Germany, the traffic on long distances has decreased (less 25-30%) owing to a bigger filling of vehicles and also the local traffic has decreased (less 10-15%) owing to a better productivity of deliveries carried out with the agreement of enterprises which supply different retails and purchase services from different carriers.

Other possible actions

¹ The reasons of these journeys with an empty load are:

- 1) lack of balance in the traffic flows between North and South;
- 2) Some factories concentrated in small areas (iron metallurgy, chemistry)

Difficulty to find compatible loading (tanks for agricultural products, or chemistry substances, etc...)

It should be expected the implementation of a system able to increase the filling rate of vehicles, equal to 1,23 in Lombard, through incentives for car pooling, in order to achieve a reduction in vehicular flows on the principle roads without sacrificing the chance to move for people and goods.

It is above all an environmental target and it is connected with the less emissions produced by circulating cars: every type of organization about road transport demand can reduce the number of circulating cars for 20 –25% if, for example, everyone practised car pooling an only working day for a week.

The social consequences are obvious and they produce benefits for the whole community:

less travel time: less vehicles on the roads travels more quickly, and this benefit is important both usual workers and carriers but above all for the users of public transport; this last one is indeed seriously damaged by low commercial speed (11,3 Km/h in the cities and about 23 Km/h in inter urban areas);

less daily stress: this last one is a direct consequence of less time spent in the traffic jam. It's possible to plane better all activities in a day, and utilise the residual time for shopping or hobbies;

less pollution produced by vehicles used for transport of goods: the commercial vehicles that circulate on the Lombard roads represent a percentage between 10 and 14% of total circulating vehicles.

A system able to reduce the number of the circulating cars would increase the average speed of commercial vehicles, and with the same number of travels, there would be less polluting emissions. The saving of time for all carriers could cause positive effects for the whole logistic sector;

less accidents: Lombard is one of the most dangerous regions as regards road accidents (about 300 deaths for a year) and ring-roads of Milan the most dangerous ones in Italy (after Naples ring-road): on these roads about 170.000 vehicles usually travel for a day, with 9,1 accidents for kilometre for a year (East ring-road), 6,7 accidents for kilometre (West ring-road, A8 Milano – Varese) for a year too.

SS (State Road) 36 Valassina, for example, is also very dangerous although there are only 2,68 accidents for kilometre for a year and 365 accidents for a year.

A system able to reduce the number of vehicles on Lombard roads could decrease the number of accidents and consecutively, less social costs due to the loss in productive capacity, human and health costs, material damages.

A system for the implementation of car pooling is particularly suitable for all workers usually use their own vehicle. From a recent statistic research called "Analysis of house-work movements for workers of Comune di Milano" we note a different use of the private car from who lives inside the city than who lives outside of it. The sample chose is surely good because there were filled in 10.299 forms. From the table below, we note a major use of the private mean from who lives outside Milan.

Municipal workers use their car (including also who changes different vehicle to get his office) are equal to 3.549, about 34,6% of the whole sample.

About 56,7% of them is available to participate to group transport systems. The 42,12% of the sample is favourable to Car Pooling, and 26,09 of them is available without conditions, while the residual 16,03% is available under these conditions:

- 1) with a system able to get in touch who carries out the same way;
- 2) the whole time of the journey must be unchanged.

On these conditions an apposite telematic platform will have to be developed.

Further researches point out similar results, for example an Isfort (Institute for Training and Research in the field of Transport) research called "Culture, behaviours, inclinations of Italians who move. Auditel of mobility", carried out, on a sample of 2.000 phone interviews carried out in Milan in December 2001.

The 35% of interviewed people who use their own cars every day are available to share their house-work movements with others.

As showed in the table below, the most important parameter is the time taken for the journey: the sum of the first three percentage values is indeed equals to 78,1%.

The cost of the journey is a negligible parameter or however it doesn't change the usual behaviour of Milan's citizens.

Therefore it will be better to achieve a system able to meet both the supply and the demand of transport long particular road axes.

Availability to share my travel with others (val. %)	Milano
If you did not modify my timetables too much	30,8
If you could contact who completes distance house-work to the same hour	28,8
If the time of movement were unchanged	18,5
In order to avoid of driving a car	11
In order to know new colleagues	6,2
If you had to pay for the parking	4,8
Total	100

References

- ACI, *Annuario statistico*, Roma, 2002
- ACI, *Rapporto annuale*, Roma, 2002
- Brizzi G, Laviola L., Raponi F., *Lamiere contorte: Gli incidenti stradali in Italia*, Eurispes, Roma 1999
- Centro Studi Confetra, *Profili dell'autotrasporto di cose in Italia* Quaderno n° 87/4 - gennaio 2001
- European Commission, *Towards Trans-European Networks*. Bruxelles, 1992
- Da Rios G., Gattuso D., *La mobilità delle merci nell'area milanese*, Franco Angeli, Milano, 2003
- Dematteis G., *Grandi opere e contesti territoriali locali*, in A. Clementi (a cura di), *Infrastrutture e piani urbanistici*. Roma: Fratelli Palombi Editori, 1996
- European Commission, *Auto-Oil II Cost-effectiveness Study*, 1999
- Eurostat, *Statistics Transport infrastructure in the European Union and Central European Countries 1990-1999*, European Communities, aprile 2002
- Isfort *Culture, behaviours, inclinations of Italians who move. Auditel of mobility*, Roma, 2002

Istat, *Import ed export per modo di trasporto*, Roma, 2002

Istituto G. Tagliacarne, *La dotazione delle infrastrutture per lo sviluppo delle imprese nelle 103 province*, Unioncamere, 1999

Leonida G., *Infrastrutture e logistica urbana*, in *Euromerci*, n.1-2, 1997

Lucchesi F., *La rete e i nodi del trasporto aeroportuale in Italia*, in C. Capineri, M. Tinacci Mossello (a cura di), *Geografia delle comunicazioni. Reti e strutture territoriali*. Torino, Giappichelli Editore, 1996

Ministero dei trasporti e della navigazione, *Conto Nazionale Trasporti 2000*, Roma

Ministero del Tesoro, *Quaderno dei prodotti petroliferi, Consumi e prezzi interni e internazionali*, marzo 2001

Siiv, *Libro bianco sulle criticità del sistema infrastrutturale italiano*, 2001

Villani P., "*Scenari insediativi e di domanda di trasporto al 2010: una metodologia e un'applicazione in una regione italiana*", con R.Camagni, R.Capello, A.Faggian – Progetto Finalizzato Trasporti 2 – CNR, Napoli, 1999

Villani P., "*Scenari di sviluppo dell'economia e del sistema insediativo*" con R.Camagni, Quaderni di Urbanistica n.2 - 2000 pagg 117-125

Villani P., "*La mobilità nell'area milanese. Il traffico merci*" in *Logistica Management*, Edizioni Ritman, Milano, settembre 2002

Villani P., *Modello costi-benefici per la valutazione dei progetti di investimento nei sistemi di trasporto pubblico e nelle infrastrutture stradali*, ANPA, Roma, 2002