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# Urban Quality vs Single Travel: the Personal Rapid Transit

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## ABSTRACT

The great increase in the demand for private mobility with the consequent macroscopic growth of channels to meet it, together with short-sighted policies of transport and urban development spread above all in Italy, has produced pollution, congestion and unlivability in the last fifty years. The hope of assuring the maximum individual freedom of travel to people living in consolidated urban centres, in addition to those living in the outskirts arisen and developed without any reasonable urban logic, still goes on producing congestion of vehicular traffic, considered, by the majority of citizens, the main cause of the deterioration of the quality of life in our cities. Indeed, also the most recent reports on environment in Italian cities show that the pollution levels are increasing in the big cities, although the news are full of very expensive projects, innovative solutions and unexpected goals continuously shown by public administrations. One of the main environmental detractors is car traffic, which has recently gained on public transport. Unlike the previous period. Most of mobility policies implemented in our cities aims at reaching the modal balance by means of measures for controlling and managing the demand for mobility, for mitigating traffic and limiting circulation., such as the road pricing and the parking strategies; for developing and increasing public transport and not polluting means of transport, car sharing and car pooling. All of them have showed modest results both in terms of pollution reduction and vehicular traffic reduction. For over fifty years, mostly in the United States, the Personal Rapid Transit has been tested, a system of public transport trying to join two apparently incompatible factors: the possibility of assuring individual travels and the need for decreasing the levels of acoustic and air pollution as well as the congestion caused by private vehicular traffic. In Italy this system is still not well known despite the versatility of its fields of application.

In the United States and all over the world the most successful applications concern circumscribed mono-functional urban ambits, such as large areas for offices, airports and so on, but the characteristics of this system - such as flexibility, capability of integration with other wide-range systems of public transport, little dimensions of the exchange junctions, quite low cost - can allow to realize it also in different typologies of area. If many people are doubtful about the effectiveness of this system, on the contrary, other people think that its steady implementation and experimentation is necessary to improve urban liveability. These last ones believe, in fact, that the combination of small vehicles similar to private car, the advantage of trips without intermediate stops and changes of car, cost reduction, possibility of a wider accessibility not reachable by traditional means of public transport are the key basic elements to replace car travels with low polluting means of public transport.

## The drug of the city is the car

The need for working to improve the levels of sustainability in the urban systems of developed and less developed countries has stressed as main factor of urban entropy the use of private car and the resulting traffic congestion. The great increase in the demand for private mobility with the consequent macroscopic growth of channels to meet it, together with short-sighted policies of transport and urban development spread above all in Italy, has produced pollution, congestion and unlivability in the last fifty years.

The hope of assuring the maximum individual freedom of travel to people living in consolidated urban centres, in addition to those living in the outskirts arisen and developed without any reasonable urban logic, still goes on producing congestion of vehicular traffic, considered, by the majority of citizens, the main cause of the

deterioration of the quality of life in our cities. Indeed, it produces occupancy of urban and road space worsening the city usability, waste of time because of long and stressing permanence into car, air pollution despite the technological progress of fuel and vehicles, high noisiness and many road accidents (ISSI, 2010).

The reports of Legambiente on pollution in the Italian cities show, in fact, that in the big cities year by year the pollution levels are increasing, although the news are full of very expensive and ambitious projects, innovative solutions and unexpected goals continuously shown by public administrations.

The comparison based on 125 environmental parameters among the Italian cities shown a month ago by the 2010 Legambiente Report, carried out with the scientific support of Ambiente Italia and the collaboration of the Sole 24 Ore, places the big cities in the lower positions of the classification.

PZ	CITTÀ	%	'09	DIF	PZ	CITTÀ	%	'09	DIF	PZ	CITTÀ	%	'09	DIF
1	Belluno	71,48%	2 <sup>a</sup>	1	36	Matera	53,23%	42 <sup>a</sup>	6	71	Lecco	46,99%	81 <sup>a</sup>	10
2	Verbania	70,41%	1 <sup>a</sup>	-1	37	Rimini	53,04%	30 <sup>a</sup>	13	72	Ragusa	46,63%	84 <sup>a</sup>	12
3	Pravara	67,48%	3 <sup>a</sup>	0	38	Ravenna	52,84%	41 <sup>a</sup>	1	73	Vicenza	46,40%	79 <sup>a</sup>	6
4	Trento	67,32%	6 <sup>a</sup>	2	39	Ancona	52,81%	24 <sup>a</sup>	-15	74	Torino	45,92%	77 <sup>a</sup>	3
5	Bolzano	64,06%	4 <sup>a</sup>	-1	40	Biella	52,62%	31 <sup>a</sup>	-9	75	Roma	45,78%	62 <sup>a</sup>	-13
6	Siena	62,65%	5 <sup>a</sup>	-1	41	Inesle	52,41%	23 <sup>a</sup>	-18	76	L'Aquila	45,70%	63 <sup>a</sup>	-13
7	La Spezia	62,57%	8 <sup>a</sup>	1	42	Avi	52,17%	26 <sup>a</sup>	-16	77	Cosenza	44,75%	55 <sup>a</sup>	-22
8	Pordenone	61,89%	37 <sup>a</sup>	20	43	Loai	51,70%	60 <sup>a</sup>	17	78	Rieti	44,74%	32 <sup>a</sup>	-16
9	Bologna	61,86%	9 <sup>a</sup>	0	44	Vercelli	51,61%	47 <sup>a</sup>	3	79	Lecco	44,69%	30 <sup>a</sup>	-19
10	Livorno	61,38%	12 <sup>a</sup>	2	45	Firenze	51,53%	38 <sup>a</sup>	-7	80	Taranto	44,63%	72 <sup>a</sup>	-8
11	Savona	61,33%	7 <sup>a</sup>	-4	46	Macerata	51,49%	27 <sup>a</sup>	-19	81	Alessandria	43,11%	68 <sup>a</sup>	-13
12	Rovarno	61,03%	18 <sup>a</sup>	6	47	Ascoli P.	51,42%	50 <sup>a</sup>	12	82	Como	42,27%	86 <sup>a</sup>	4
13	Catania	60,22%	10 <sup>a</sup>	3	48	Cagliari	51,22%	29 <sup>a</sup>	-19	83	Benevento	42,14%	71 <sup>a</sup>	-12
14	Ferrara	59,28%	36 <sup>a</sup>	22	49	Pesaro	50,97%	36 <sup>a</sup>	7	84	Viterbo	42,07%	94 <sup>a</sup>	10
15	Venezia	59,14%	14 <sup>a</sup>	-1	50	Varese	50,81%	35 <sup>a</sup>	-13	85	Pistic	41,06%	69 <sup>a</sup>	-10
16	Prato	58,89%	17 <sup>a</sup>	1	51	Brescia	50,69%	48 <sup>a</sup>	3	86	Peggie C.	41,30%	76 <sup>a</sup>	-10
17	Asolo	58,57%	15 <sup>a</sup>	2	52	Isania	50,32%	75 <sup>a</sup>	43	87	Foggia	40,67%	82 <sup>a</sup>	5
18	Reggio E.	58,28%	28 <sup>a</sup>	10	53	Aviano	50,29%	64 <sup>a</sup>	11	88	Catanzaro	40,54%	85 <sup>a</sup>	-3
19	Salerno	58,13%	34 <sup>a</sup>	15	54	Bari	49,80%	61 <sup>a</sup>	7	89	Napoli	38,88%	92 <sup>a</sup>	3
20	Genova	57,81%	13 <sup>a</sup>	-7	55	Cosenza	49,46%	67 <sup>a</sup>	17	90	Napoli	37,57%	93 <sup>a</sup>	3
21	Monza	57,56%	11 <sup>a</sup>	-10	56	Novara	49,20%	53 <sup>a</sup>	-3	91	Collezio	36,70%	90 <sup>a</sup>	8
22	Oristano	57,20%	74 <sup>a</sup>	52	57	Massa	49,02%	57 <sup>a</sup>	0	92	Cinra	36,10%	97 <sup>a</sup>	5
23	Cremona	57,20%	19 <sup>a</sup>	-4	58	Chieti	48,99%	43 <sup>a</sup>	-13	93	Imperia	35,38%	87 <sup>a</sup>	-6
24	Modona	56,64%	44 <sup>a</sup>	20	59	Catania	48,77%	83 <sup>a</sup>	24	94	Frosinano	35,17%	103 <sup>a</sup>	6
25	Perugia	56,34%	16 <sup>a</sup>	-6	60	Vercina	48,74%	52 <sup>a</sup>	-8	95	Messina	34,74%	96 <sup>a</sup>	-1
26	Palenza	56,20%	40 <sup>a</sup>	14	61	Brescia	48,61%	70 <sup>a</sup>	0	96	Napoli	34,53%	89 <sup>a</sup>	7
27	Terni	55,48%	21 <sup>a</sup>	-6	62	Pavona	48,34%	54 <sup>a</sup>	-8	97	Agigena	32,18%	101 <sup>a</sup>	4
28	Piacenza	55,21%	51 <sup>a</sup>	23	63	Milano	48,18%	46 <sup>a</sup>	-17	98	Trapani	30,70%	98 <sup>a</sup>	0
29	Avellano	55,11%	80 <sup>a</sup>	51	64	Imperia	48,18%	66 <sup>a</sup>	2	99	Viterbo	30,17%	88 <sup>a</sup>	-11
30	Udine	54,90%	33 <sup>a</sup>	3	65	Reggio	48,06%	58 <sup>a</sup>	-7	100	Lecce	29,98%	91 <sup>a</sup>	-9
31	Pisa	54,06%	25 <sup>a</sup>	-6	66	Pescara	47,75%	65 <sup>a</sup>	-1	101	Fulera	29,30%	90 <sup>a</sup>	-11
32	Genova	54,79%	22 <sup>a</sup>	-10	67	Sassari	47,38%	49 <sup>a</sup>	-18	102	Crotone	29,09%	102 <sup>a</sup>	0
33	Trani	54,01%	45 <sup>a</sup>	12	68	Lucera	47,17%	75 <sup>a</sup>	-7	103	Catania	21,57%	103 <sup>a</sup>	0
34	Pavia	54,00%	20 <sup>a</sup>	-14	69	Treviso	47,20%	78 <sup>a</sup>	0					
35	Sondrio	53,41%	79 <sup>a</sup>	38	70	Campobasso	47,04%	30 <sup>a</sup>	31					

Italian cities classification based on environmental indicators by Legambiente 2010.

For example, as regards the ozone concentration in Milan, the threshold has been passed 60 times in 2010 against the 41 times of the previous year.

Belluno, ranked second in 2009, this year has overcome all for air quality, waste separation and number of passengers of local public transport.

The most critical data for big cities concern private car traffic, the difficulty in creating pedestrian precincts, restricted traffic area, sewage disposal, lack of efficiency in public transport and a chronic lack of green areas, as confirmed by the 2010 Isfort Report.

So Genoa shifts to the 32<sup>nd</sup> position (it was the 22<sup>nd</sup> in the previous edition); Milan shifts to the 63<sup>rd</sup> position (but it was the 46<sup>th</sup> the previous year); Rome to the 75<sup>th</sup> position (it was the 62<sup>nd</sup>); Naples to the 96<sup>th</sup> position (it was the 89<sup>th</sup>); Palermo to the 101<sup>st</sup> position (it was the 90<sup>th</sup>).

Among the big cities, only Turin keeps the same position and this year is the 74<sup>th</sup> in the ranking while it was the 77<sup>th</sup> the previous year, because it has shown a little improvement in the Pm10 average and mainly in the ozone one, in such sectors as public transport, water consumption and waste as well as in production and waste separation, which reach 42%.

Again car traffic is one of the most important environmental detractors, a very high number of cars moves, a record in Europe, and it keeps on increasing above the carrying capacity of the Italian

cities. That emergency cannot be solved only by new less polluting cars, but calls for a necessary reduction in the use of cars.

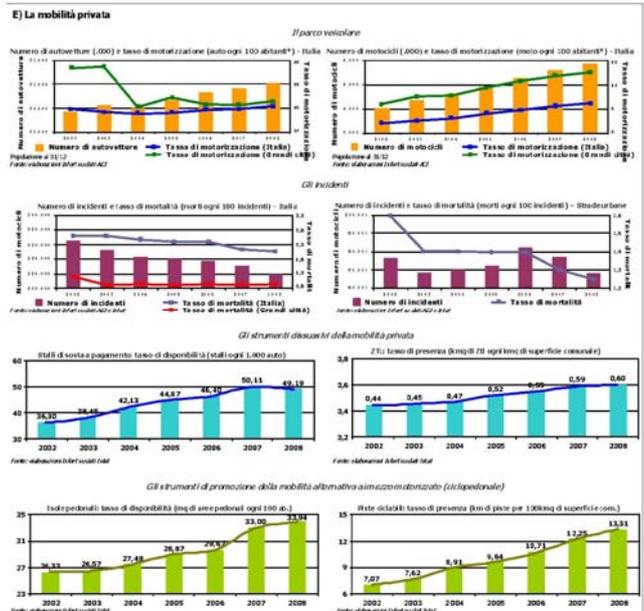
Besides, it should be dealt with a clear, consistent and integrated strategy and not with episodic, extemporaneous and not coordinated measures.

As already said, also the Isfort issued in May 2010, although defining the 2009 as a year of transition because of the world crisis, which has affected massively Italy too, defines cities and urban mobility as central element in the national economic and social dynamics, after a declining trend.

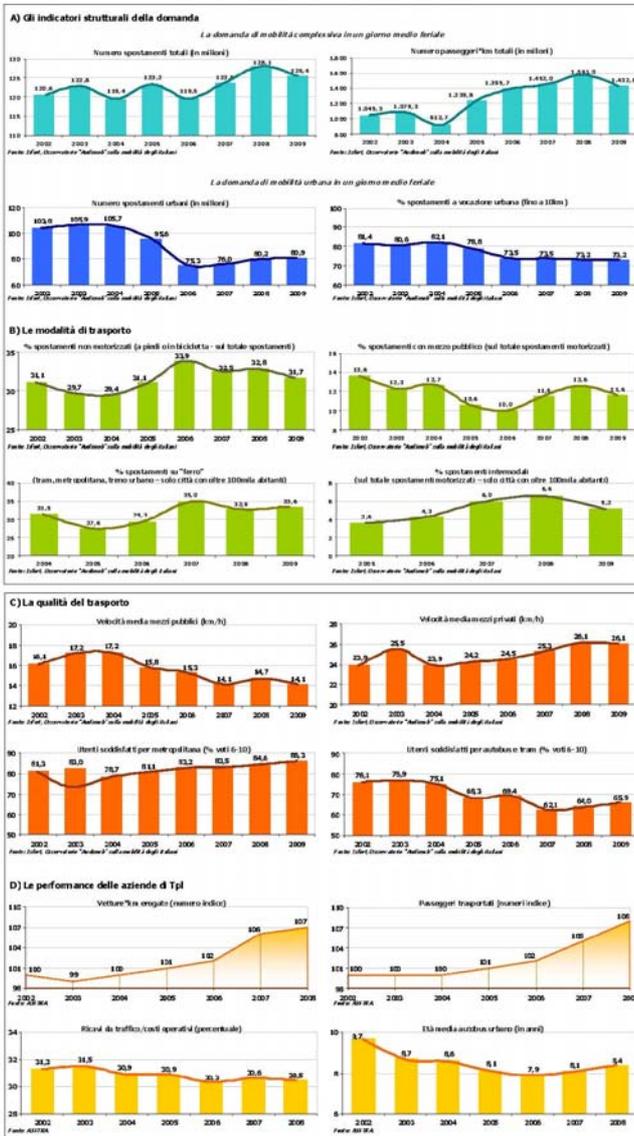
As regards transport, "the collective modalities overturn, in negative way, the most favourable dynamic recorded in 2007 and 2008: in fact public means of transport loose passengers (-5,4% compared with 2008, with less reductions in medium and big sized cities) and modal weight (from 12,6% of car travels in 2008 to 11,6% in 2009), aligning as market share with the (modest) levels reached in 2007" (Isfort, 2010).

Unlike what occurred in the two previous years, then, in 2009 collective transport did not succeed in reaching the additional share of demand and indeed its real presence has decreased in absolute values.

This is a slowdown that can be seen also in the supply monitoring, referring to the passengers registered by the public urban transport companies; the 2009 data, regarding only the provincial capitals, point out a substantial "zero growth" after the strong positive mark in 2007 and 2008.



Progressive trends of urban mobility in Italy: private mobility by Rapporto Isfort 2010.



Progressive trends of urban mobility in Italy: the demand indicators and transport modalities by Rapporto Isfort 2010.

Last year some factors have surely penalized collective mobility and further widened the car modal quota. In particular, the decrease in the fuel average price – in 2009 in comparison to 2008 – and the support to car industry by providing incentives for purchasing less polluting cars have encouraged a further modal shift in behalf of cars. Therefore, there is a sort of fluctuation entirely expectable in the prevailing scenario of uncertainty of the general consumptions curve. For some years, the European Commission has been promoting a strategy of progressive decoupling between economy growth and transport growth and, in view of that, suggests several

measures combining fares, modal re-balance and investments targeted to trans European network. As regards Italy, the E.U. points out the incompatibility of our transport system compared with the three dimensions of sustainable development, i.e. the environmental, social and economic dimensions.

Since 2009, the European Union has supported local, regional and national Authorities by means of the Plan of Action on urban mobility, which suggests medium and short term tangible interventions, to be gradually implemented until 2012, targeted to face specific matters linked to urban mobility in integrated way.

The document of the Plan of Action on urban mobility states as follows: "Developing efficient transport systems in urban areas has become an increasingly complex task because of congested cities and urban sprawling growth. To this end, the role played by Public Authorities is crucial, because it should give the planning and financing framework as well as the normative one. The European Union can stimulate the local, regional and national authorities to adopt long term integrated policies, which are essential in complex environments". Among the six tasks foreseen by the Plan of Action, a great importance is given to non polluting urban transport and to the promotion of research and demonstration projects funded by the 7<sup>th</sup> Framework Program for research and technological development, in order to help the introduction of low-emission, zero-emission vehicles and alternative fuel ones on the market, in view of reducing the dependence on fossil fuel.

Besides, the plan promotes integrated policies to face the complexity of urban transport systems, the governance and necessary coherence among different policies, for example between the urban mobility one and the cohesion one, the environment one or the welfare one. The decrease in the use of public transport means causes many perplexities and concerns and should urge to look for technological solutions targeted to assure the maximum efficiency and effectiveness in terms of service, low cost and flexibility of public transport and, contextually, to meet the demand and be compatible, in environmental terms, with the possible evolutions of life styles and behaviours, which are more and more difficult to predict in the present socio-economic context.

### The Personal Rapid Transit

The most important weak points in the use of road and rail public transport are linked to the travelling time and, above all, to the freedom of travelling. The systems of public transport, in fact, are realized to serve the greatest possible number of users contemporaneously, at the expense of the possibility of freely deciding the route and travelling time (according to the

arrival/departure timetables, the compulsory stops, the eventual delay, and so on).

At present, 25% of the overall travels is on foot or by bicycle and the remaining part is by motor vehicles, of which 6% is by motorcycle, 80,5% is by car and 13,5% by public transport. Besides car is used mainly for quite short daily travels: 60% up to 30Km/day, 75% up to 75Km/day, 90% up to 100Km/day.

On the other hand, it is worldwide known that "urban environment is increasingly affected by the economic and social damages caused by traffic: the freedom of travel allowed by car is more and more translated into a reduction of access to the different urban functions.... Now the aim is to use semi-collective transport systems, by introducing the idea of mobility as service.

It is the third way of urban mobility, joining the positive aspects of both collective and individual transport" (Bettini,2004).

The chimera of the freedom of individual travel promised by car becomes, so, an egoistic act that turns against all people, becoming a strong environmental detractor (producing smog, noise, diseases, and so ) and making the accessibility to urban places more complicated.

The majority of the policies implemented in our cities is targeted to modal balance through measures for controlling and managing the demand for mobility, reducing traffic and limiting circulation, such as road pricing, parking strategies; measure for improving public transport and non polluting means of transport, such as car sharing and car pooling.

Until now all of them have got scarce results as regards both pollution reduction and reduction of car-produced traffic congestion. For over fifty years, mainly in the United States, the Personal Rapid Transit has been pursued and tested.

It is a public transport system attempting to join two apparently incompatible factors: the possibility of providing individual travels and the need for helping reduce acoustic and air pollution and congestion caused by private car traffic, which drastically lower the livability in many urban areas, first of all in the big ones.

In Italy this system is almost unknown despite the versatility and flexibility of its applications.

In the United States and worldwide the most successful experimentations affect mono-functional and circumscribed urban ambits, such as wide areas destined to offices, airports, and so on, but the peculiarities of this system, such as flexibility, capacity of integrating with other long-range public transport systems, the small sizes of exchange junctions, the quite low cost, can allow their realization in a wide typology of areas.

This new concept arose in the United States during the Fifties, but its most important evolution took place in the Nineties of last century.

Thanks to the growth of computer potentials, it was possible to plan and simulate all the PRT components and contextually realize the elements of system control and management.

If many people are still skeptic about the effectiveness of the system, which gives the possibility of individual travels by public means of transport (Tegnér, 1998), on the contrary, others think that its continuous experimentation is fundamental in order to improve urban quality.

Actually, these last ones think that the combination of small vehicles similar to private cars, the advantage of no intermediate stops and change of vehicle, cost reduction, possibility of a wider accessibility, which cannot be reached by mass transport vehicles, are the key-characteristics in order to replace car travels with low polluting public means of transport.

In details, the advantages of this system for the users are the following:

- full automation of vehicles;
- the exclusive use for carrying single users or small groups of users
- total freedom from timetables;
- no intermediate stops;
- no change of vehicle;
- high travel comfort
- consequent time saving;
- travel cost more in accordance with the use.

The characteristics representing the advantages for urban sustainability are the following:

- reduced invasiveness of the reserved place;
- reduced size of the stations;
- great freedom of stations placement;
- widespread distribution of exchange junctions;
- system modularity;
- no polluting emissions;
- reduced noise.

#### Researches and experimentations on Personal Rapid Transit

From 2001 to 2004, The European Union financed, through the Fifth Framework Program a project targeted to make a technical, environmental, social and economic assessment of the Personal Rapid Transit system, also by making a comparative assessment of its implementation in four European cities with different characteristics, and a comparison with their different modalities of public transport.

The main issues of this research project have pointed out that the Personal Rapid Transit assures high accessibility and, at the same

time, gives sustainable solutions in environmental and economic terms.

Therefore, in theory, the Personal Rapid Transit appears more attractive than the traditional systems of public transport, as it issued by the sample cities chosen.

Indeed, the PRT can entail negative risks due to its scarce testing as public mean of transport.

Many other studies have been carried out worldwide on the realization of personal rapid transit systems, in central urban areas and in wider regions, among which the study carried out in 1998 for the Transek Consultants Company - which proposed the PRT in Stockholm - and the project proposal of the University of Princeton in 2005- for the realization of PRT in New Jersey - are very interesting for the in-depth investigation on the demand, the actual possibilities of realization, the realistic reduction of car travels and cost benefits of the project proposal. Most studies reach common conclusions that can be summed up as follows: the Personal Rapid Transit reduces pollution and travel time, mostly the commuter ones, produces economic advantages by cutting down travel time in favor of work time, improves the residents quality of life, cuts the number of road accidents; reduces the congestion due to vehicle traffic and pollution.

The PRT service is very good for residents mainly in their daily travels for work, school, shopping and free time.

One of the most ambitious projects of PRT is connected with the establishment of the new city of Masdar planned by Norman Forster. Masdar city is going to rise on an area of 649ha, of which 600ha will be built; it will accommodate 50.000 inhabitants and will have the characteristics of a sustainable city. Since it has been conceived in view of absolute sustainability and total absence of polluting emissions, Masdar will use no fuel-based mean of transport. Car will be used in a very limited way and made available only as car sharing. To move inside Masdar the residents will rely on a compact network of pedestrian routes, cycle lanes and an efficient and innovative rail-based public transport system, the Personal Rapid Transit (<http://archema.org>).

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