EMTA
EUROPEAN METROPOLITAN TRANSPORT AUTHORITIES

CONSORCIO TRANSPORTES MADRID

EMTA BAROMETER OF PUBLIC TRANSPORT IN EUROPEAN METROPOLITAN AREAS. 2002

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1. Introduction

The association of European Metropolitan Transport Authorities (EMTA) brings together the public authorities responsible for planning, co-ordinating and funding the public transport systems of 28 of the European largest metropolitan areas.

A precise knowledge of reality is a prerequisite to define pertinent policies. This is particularly true in the field of public transport, where decisions affect the daily lives of millions of people and where the investment and operation costs of complex systems often amount to millions, if not billions, of Euros. They also have a determinant impact on the economic dynamism and environmental quality of urban areas.

In this context, comparison of data between territories facing the same kinds of challenges ("benchmarking") is a useful source of information for decision makers. One always learns by taking some distance from one's own local context and by looking at how others proceed. The *EMTA Barometer of public transport in the European metropolitan areas* aims to provide such comparative insight.

Where they exist, **public transport authorities are the only organisations with a broad view of mobility issues in large urban contexts**. Metropolitan areas have indeed multi-modal and multi-operators public transport networks. But these different means shall not hide the reality of trips as perceived by passengers, which is, or shall be, that of integrated systems. Data collection shall therefore be a key responsibility of public transport authorities. To achieve this end, it is important to:

- **define pertinent territories**, corresponding to the reality of mobility of people. In too many cases, analysis is still confined to the administrative boundaries of local authorities or to the territory served by a given transport company, which don't always fit with the territory experienced by the people;

- **determine a set of key indicators** that shall be collected and reviewed regularly so as to have a clear view of the main trends under way;

- **take into account not only public transport, but also mobility in a broader sense**, including of course trips involving private cars, but also taxis, bicycle, and walking.

This is not an easy task, as can testify the numerous attempts to carry out such benchmarking, which usually stumble on methodological difficulties such as:

- the definitions of indicators are not the same in many cities and countries;

- the availability of data is very heterogeneous depending on countries, and sometimes even between cities of a same country;

- even when the data exist, it is rare that a single organisation has them all. Their collection therefore requires a big amount of work;

- lastly, the comparison of data is a difficult exercise since it requires comparable contexts. This raises the question of the definition of pertinent territories of comparison. As an example, the city of Berlin (3.6 million inhabitants on 890 km²) cannot really be compared with the city of Paris (2.1 million inhabitants on 105 km²), but rather with Paris and its first ring of suburbs (6.1 million inhabitants on 760 km²). This means that the analysis of raw data needs to look carefully at the geographical, institutional and human reality behind names of territories, so as to be able to draw some kinds of conclusions. In this *Barometer*, for example, data are based on the territories of public authorities which submitted them.

These difficulties and biases are well known from experts. EMTA thinks it is time that a process of harmonisation of definitions could be undertaken at the European level, in co-operation with the representatives of the public transport sector. It is desiderable the indicators used in the Barometer becomes more harmonised in the next years for the metropolitan areas concerned.

21 metropolitan areas have contributed to this second edition of the *EMTA Barometer of public transport*, by providing data based on the year 2002 : Athens, Barcelona, Berlin-Brandenburg, Bilbao, Birmingham-West Midlands, Brussels, Dublin, Frankfurt RheinMain, Helsinki, Lisbon, London, Madrid, Manchester, Paris-Ile de France, Prague, Sevilla, Stockholm, Valencia, Vienna-Eastern Austria, Warsaw, and Zurich.

This edition of the *Barometer* provides more data than the first one in 2002 (referenced to year 2000 data), and about more cities. **It illustrates the diversity of public transport systems and public transport policies in the European largest cities**.

The information contained in this report shall help local decision makers and transport authorities to improve the mobility patterns in their territories, so that passengers have at their disposal some reliable, comfortable, safe, and environmental-friendly public transport systems.

Lastly, I would like to thank all the transport authorities that contributed to the updating of this *Barometer* – the collection of data required a huge amount of work – as well as Carlos Cristóbal Pinto, Head of the department of Studies and Planning of the Consorcio Regional de Transportes de Madrid, and Tomás Melero, chief of project, who have prepared this report.

Stéphane Lecler

Secretary General of EMTA

2. Basic Data of Metropolitan Areas

These background data have two main aims:

-on the one hand, they show a snapshot of the metropolitan areas through basic figures

-on the other hand, they can be used as reference indicators that enable to compare the transport items described along the present report in relative terms, which means more homogeneus among the different cities. An example of this, the bus network length divided by population or by surface covered is a more accurate approach to the supply level than the absolute value of network length.

Table 1. Basic Data of Metropolitan Areas*

	Population (inhabitans)	Surface (km^2)	Built Surface (km^2)	Nº of Jobs	Family size	Annual GDP per capita (Euro)
Athens	3,659,145	1,450		1,533,100	3.0	12,700.0
Barcelona	4,482,623	3,236	588	2,032,745	2.8	20,146.0
Berlin-Brandenburg	5,987,640	30,367	2,615	2,663,000	2.0	
Bilbao	1,145,709	2,217		353,792	3.0	18,525.0
Birmingham West-Midlands	2,555,592	899		1,301,000	2.4	16,660.0
Brussels	2,334,826	5,162 [1]	1,140	1,006,652		50,000.0
Dublin	1,535,000	969		651,104	3.0	36,500.0
Frankfurt RheinMain	5,256,937	13,374		1,966,392		29,320.0
Helsinki	965,000	750		570,000	2.1	37,000.0
London	7,410,800	1,580		4,483,583	2.4	25,333.7
Madrid	5,423,384	8,030	891	1,804,042	2.9	22,818.0
Manchester	2,482,352	1,272		1,153,000	2.4	13,832.0
Paris Ile-de-France	10,952,000	12,070	2,370	5,042,000	2.0	37,472.0
Prague	1,663,056	3,749		730,000	2.4	8,470.0
Sevilla	1,121,208	1,387	171	287,271	3.0	15,457.0
Stockholm	1,850,000	6,500				
Valencia	1,562,342	1,503		509,383	3.3	16,181.0
Vienna Eastern Austria	2,616,000	8,841		1,042,000	2.1	24,400.0
Vilnius	553,300	402	81	224,800	3.0	4,229.0
Warsaw	1,630,000	518				
Zurich	1,223,101	1,834	239	746,751		48,000.0

1= In 2002 after a study about urban sprawl, the Brussels metropolitan surface was increased from 1.200 km2 to 5.000 km2

As a first general comment, the table 1 shows that the territories concerned are a very heterogeneous group in all the aspects surveyed. In terms of population, for example, the ratio between the most populated area (Paris-Ile de France) and the least (Vilnius) reaches 20, while in

[1] In order to compare easily between the different charts, all the metropolitan areas that have contributed tp this updating of the *EMTA Barometer* appear in all charts. When a particular data it is not available, there is an empty space beside the name of the metropolitan area.

*In order to compare easily between the different tables and charts contained in this report, all the metropolitan areas that have contributed to this updating of the *EMTA Barometer* appear in all tables and charts. When a particular data is not available, there is an empty space beside the name of the metropolitan area.

economic terms, the GDP per inhabitant is more than ten times bigger in Brussels or Zurich than in Vilnius.

The 21 areas surveyed in this *Barometer* have a total population of 63 million people, that is to say 14% of the EU25, with two giants (London and Paris-Ile de France) ranking among the most populated urban areas in the developed world, and having more inhabitants than some EU countries. Several territories of around 5 million inhabitants (Barcelona, Berlin, Frankfurt-RheinMain, Madrid) also appear as major urban concentrations.

The figures of surfaces reflect the different sizes and densities of cities, but also the different administrative and institutional organisations of local authorities. They highlight the differences between countries where public transport systems are co-ordinated on a regional basis and where large parts of rural areas are integrated in the provision of services, like Germany, and those where public transport is organised on a more urban and local scale. This aspect is confirmed by the indicator of built surface, which reaches less than 20% of total surface in many cases (19.6% in Paris-Ile de France and only 8.6% in Berlin).

Family size data don't allow a clear geographical split even though, in general, Southern European families have around three members, meanwhile Northern Europe are closer to two.

The number of jobs provided on the territories is correlated to the number of families, with one job per family in average. In London this figure rises to 1.45, which can be explained by the fact that the British capital city provides jobs for many employees living outside its administrative boundaries. In the other side appears Sevilla (0.76) which could illustrate the high level of unemployment in the capital city of Andalusia.

2.1 Evolution of Population and Spatial Settlement

2.1.1 Evolution of Population

Most urban areas surveyed have seen an increase of their population over the past 10 years (see chart1 on the left side). The average growth rate is around 4.5% for the cities which have provided data, Dublin ranking first with a growth estimated at 12.4% for the period 1992-2002 (the percentage available is 13.7% between 1991 and 2002). This strong development is all the more impressive since Ireland's population only grew by 2% during the same time. Helsinki comes second, with a growth of nearly 13%, followed by Madrid (9.6%).

Among the urban areas that have provided data, only Bilbao, Manchester, and Vilnius have seen a decrease in their population, a situation probably linked to the economic difficulties of these territories of old industries.

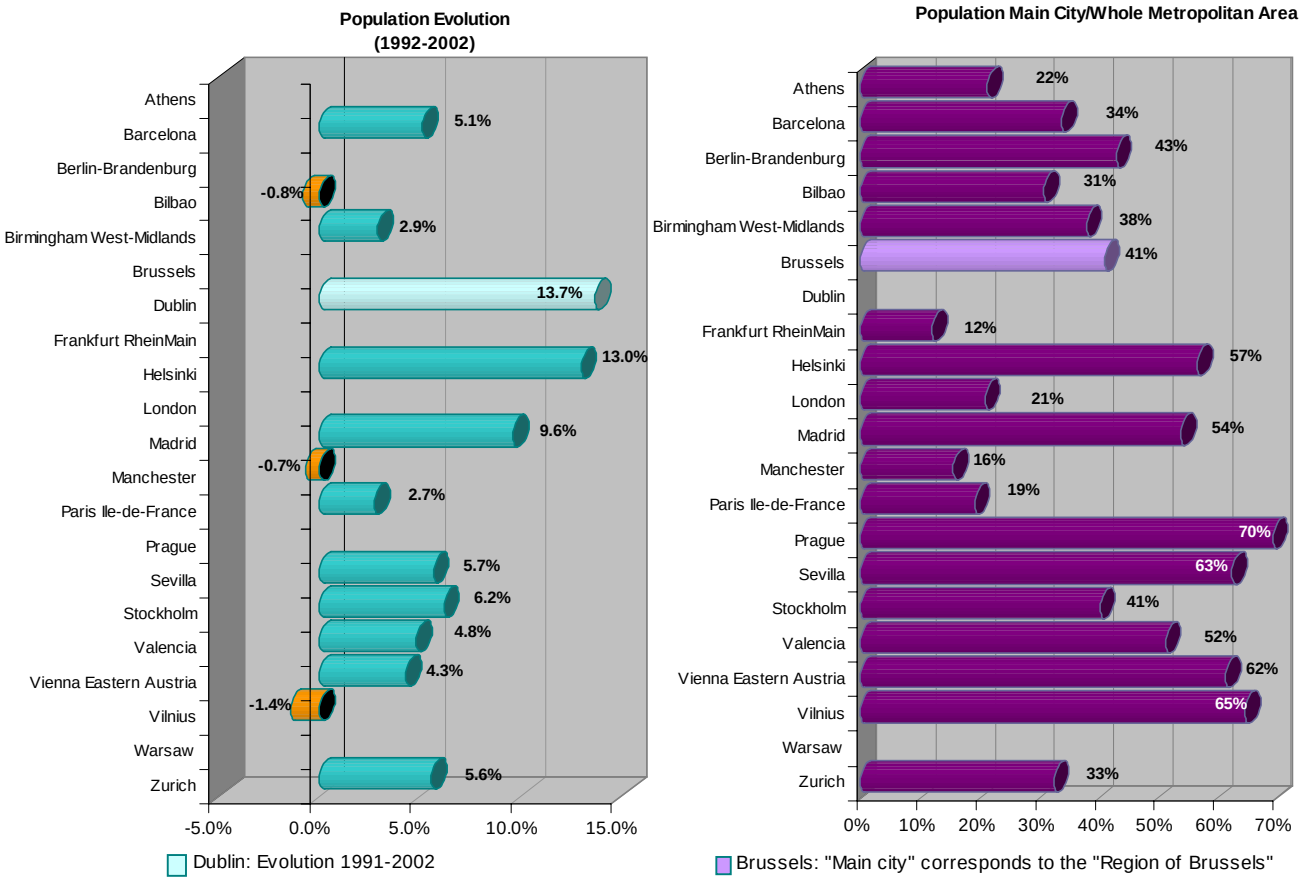
2.1.2 Structure of Metropolitan Area

The weight of the main city over the whole metropolitan area is roughly a 40% of total population with large differences (chart 1 on the right part), illustrating the diverse administrative frameworks and histories of the cities.

Cities like Prague and Vienna cover large territories (more than 400 km²), where the majority of the population is located. In the same way, Spain usually has main cities representing more than 50% of the overall population of the metropolitan areas, at the exception of Bilbao because the metropolitan ring is a continous urbanised territory integrated by several cities.

Contrary to these cities, this rate falls below 20% in Paris-Ile-de-France, where the city of Paris itself “only” has 2 million inhabitants on a territory of 100 km² which covers a small part of the urban area, and in Frankfurt-RheinMain (12%), a typical feature of German conurbations. These different urban layouts have strong consequences for the co-ordination of the provision of public transport between the various local authorities concerned.

Chart 1. Indicators of Metropolitan Area Structure



In the case of London, it is not really pertinent to speak of "Main city", since there is only one city (Greater London), but with several boroughs. The figure mentioned for main city refers, in fact, to what is called "Inner London", that is to say the city of London and the first ring of boroughs.

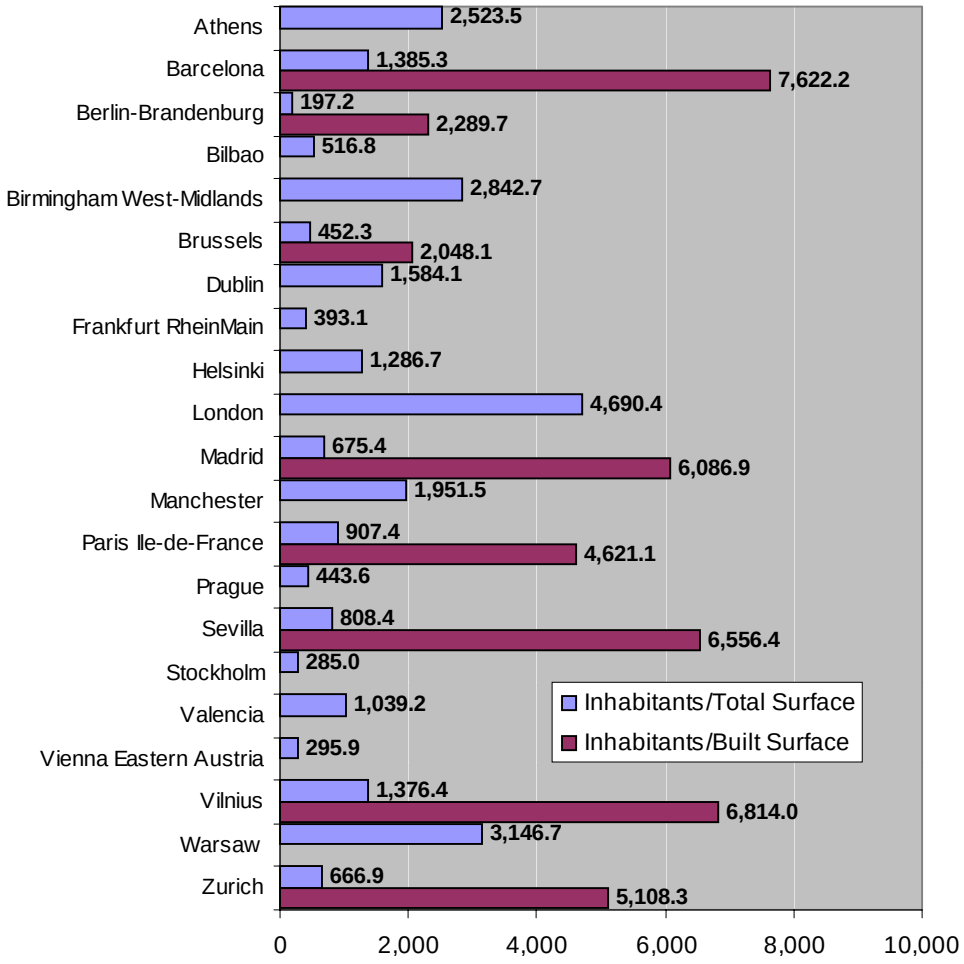
2.1.3 Density of population

The strong variations in densities of inhabitants, especially comparing built and total surface densities, illustrate the diversity in urban and administrative frameworks along Europe, as is showed in chart 2.

Metropolitan areas whose administrative boundaries cover mostly urbanised areas (as London and Birgminham-West Midlands) reach much higher densities than those including large rural parts (as Berlin-Brandenburg, Frankfurt-RheinMain, Paris-Ile de France, Stockholm and Vienna-Eastern Austria).

As a consequence, it is more pertinent to look at the density of built areas, which reach very high levels in cities with a tradition of collective housing (Spain and former communist countries).

Chart 2. Population Density (inhabitant/km^2)



3. Mobility

This section contains data about:

- the main characteristics of trips (distance, duration) and modal splits

- car ownership rates and number of taxis

- traffic safety (car accidents)

Table 2. Mobility Parameters

	Trips per person per day	Motorised trips		Home to work or school trips/ total trips (%)	Car ownership rate (veh./1,000 inh.)	Number of taxis	People killed in road accidents / million inh.	People injured in road accidents / million inh.
		Average duration (min)	Average distance (km)					
Athens	1.7	40.0	9.0	38.0	330	14,000	118	206 [3]
Barcelona	1.6	31.7	9.1	27.1	458	11,189	59	4,855
Berlin-Brandenburg	Approx. 2.9			43.0	438		73	5,414
Bilbao	2.3	34.4 [6]	6.4 [6]	59.0 [2]	411	1,303	53	2,838
Birmingham West-Midlands					453			
Brussels	3.9			45.3	480		75	400
Dublin	Approx 3	31-21.5 [4]	8.4	92.0 [5]	390	9,500	35	1,764
Frankfurt RheinMain					566	~4,093	39	5,638
Helsinki	3.6	25.0	8.5	32.0	345	1,910	36	1,347
London	2.8	33.0	7.5	16.0	370			
Madrid	2.2	42.4	8.1	65.0	414	14,501	71	3,442
Manchester	2.4	24.0	15.6	39.1 [2]	411	1,650+8,300	36	6642(363) [3]
Paris Ile-de-France	3.7	44-20 [4]	6.7	31.0	454	17,061	65	3,194
Prague		30-44						
Sevilla	2.3	24.0	6.7	49.7 [2]	384	2,573	146	5,060
Stockholm					400			
Valencia	2.5				468.0	2,799		
Vienna Eastern Austria	2.6	42.0	12.3	31.0	431.0			
Vilnius	3.0	37.0 [7]		84.4 [5]	330.0	1,249	107 [8]	2,078 [8]
Warsaw	4.0							
Zurich					618		61	3,318

1= Manchester: normal + pre-book only taxis
2= Bilbao: 42% work 17% school
Manchester: 26.2% work 12.9% school
Sevilla: 30.51% work 19.14% school
3= Athens: Severely injured
Manchester: in parenthesis, seriously injured
4= Dublin: a.m. Peak-Off Peak; Paris: PT-Private Car
5= In Dublin and Vilnius only Peak Hour considered
6= Bilbao: Only Public Transport considered
7= Vilnius: Trips by personal car (data 2001)
8= Vilnius: year 2003 data

3.1 Main Characteristics of Trips

The number of daily trips per person seems to vary significantly between the metropolitan areas. It must first be said that there might be some methodological bias in the calculation of this indicator, since the definition of a trip is not always the same (some cities don't take into account the trips under a certain length, for example). In spite of this, in most cities, the number of daily trips per person is comprised between 2 and 3, which can seem a relatively small number, but which is an average taking into account the whole population, including the persons who do not move at all (handicapped people, infants).

The average duration of motorised trips is comprised between 25 and 45 minutes, and the distance between 6 and 9 km. On the basis of 2-3 trips per person every day, this means that a majority of people spend more than one hour travelling daily in metropolitan areas, highlighting the need to

provide safe and comfortable transport systems to make this long period of time as pleasant as possible.

It shall be noticed that, in Paris-Ile de France, private car trips are twice shorter than public transport (20 minutes against 44), which can mean that public transport is used for longer trips than private car, and that average speed is lower for public transport.

Contrary to what could be expected, there doesn't seem to be any clear relationship between average distance trip and city size, metropolitan area surface or population density. As an illustration, in the most populated cities under survey (London and Paris) the average trip is quite shorter (7.5 and 6.7 km by order) than in some medium size metropolises as Manchester (15.6 km) and Vienna (12 km). This apparent paradox certainly has to do with the urban structure (layout of jobs, housing areas and commercial sectors, for example) of the territories concerned.

The average speed, derived from average time and distances travelled, reaches, in average, 15 km/h. This low figure illustrates both the high level of traffic congestion in the metropolitan areas, and the low speed of public transport.

Looking into mobility, trips to work or to school, which are called obliged or recurrent mobility, must be analysed carefully, because they still make up between a third and a half of the total number of trips.

3.2 Modal Split

Madrid is the only major European metropolitan area among those surveyed, where public transport accounts for more than 50% of all motorised trips (54%).

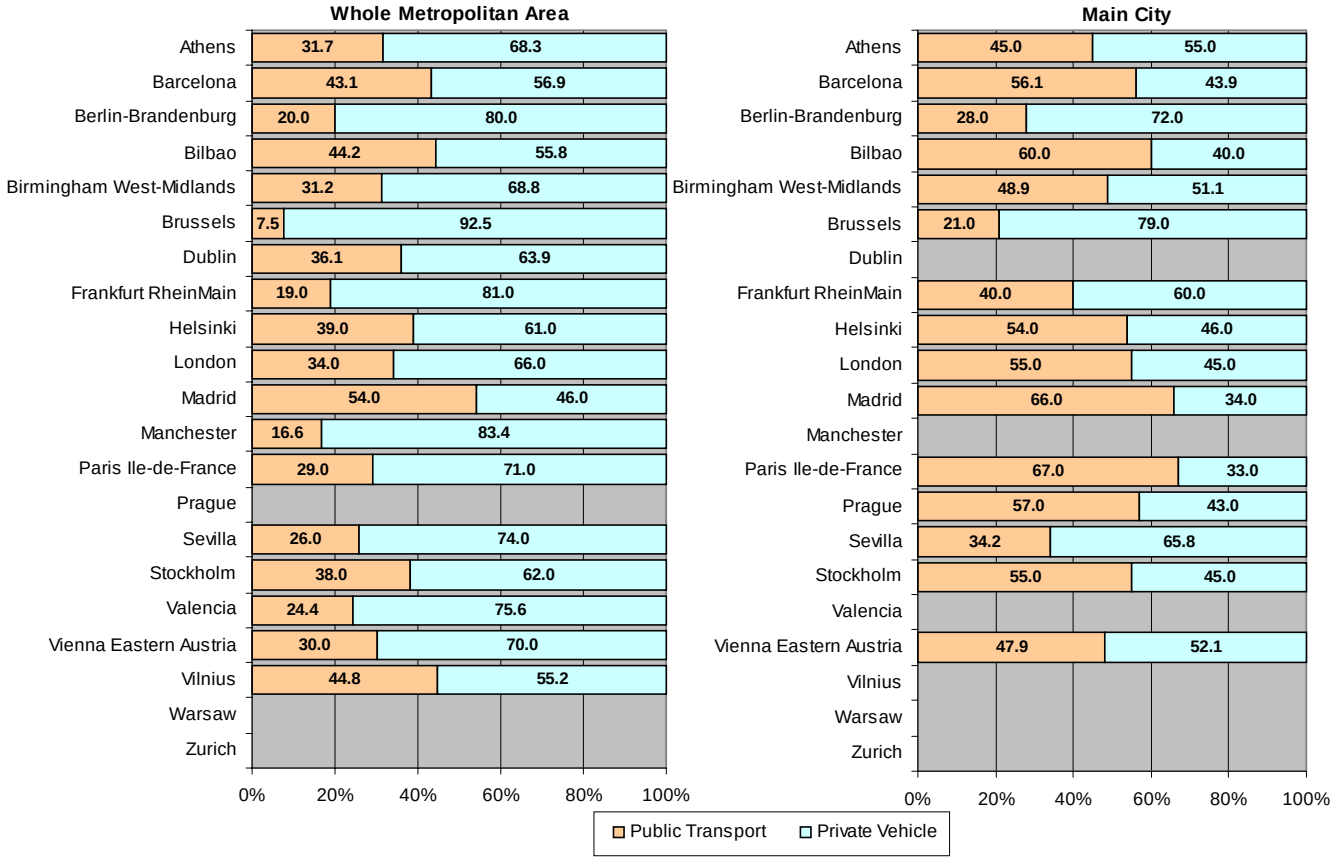
This result is all the more positive as the car ownership rate in the Spanish capital city is among the highest of the cities surveyed. Other metropolitan areas with more than one third of motorised trips done by public transport include Barcelona, Bilbao, Dublin, Helsinki, London, Stockholm, and Vilnius. At the other extremity, Brussels and Frankfurt RheinMain have less than 10% of their motorised trips done by public transport.

In the main city of the metropolitan areas, a majority of cities achieve more than 50% of modal share for public transport, Paris and Madrid leading with a rate of two thirds of all motorised trips, illustrating the very dense public transport systems irrigating the heart of the two capital cities.

The strong gap between modal share in the main city and in the whole metropolitan area (where public transport accounts, in average, for 30% of motorised trips) illustrates one of the main challenges facing public transport authorities and operating companies in the coming years: develop public transport in the suburbs and the less dense parts of the metropolitan areas.

This is particularly true in the metropolitan areas where the main city represents a small proportion of the total population of the metropolitan area (Paris, Frankfurt).

Chart 3. Modal Split in the Metropolitan Areas



3.3 Car and Taxi Characteristics

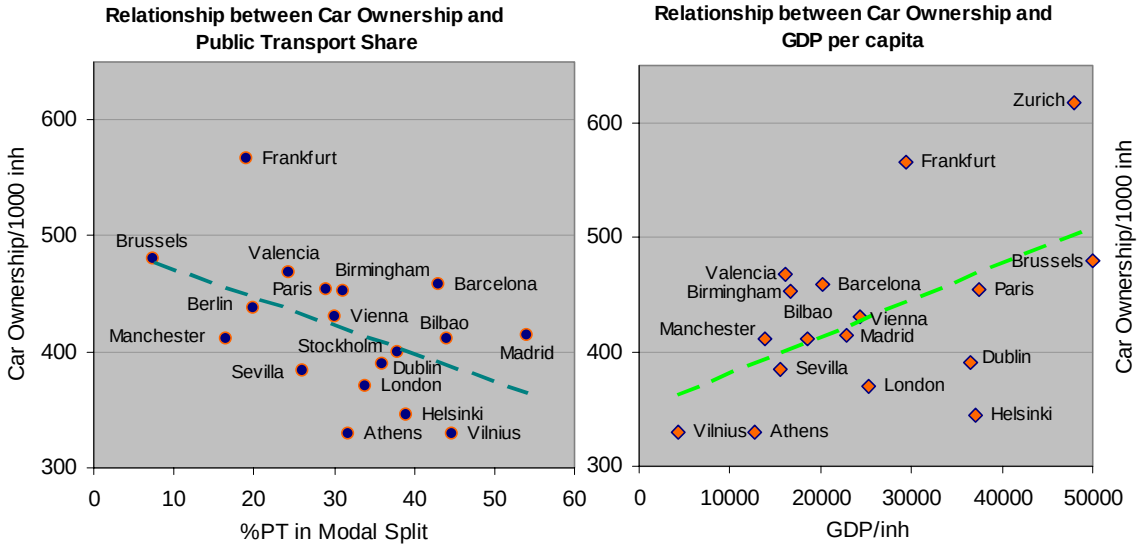
Car ownership rates mentioned in Table 2 must be looked at carefully because the different size of territories surveyed and the inclusion of rural areas can lead to high biases in this indicator.

The data provided in Chart 4 show a weak link between economic wealth and car ownership rates, on the one hand, and car ownership rates and car modal split, on the other hand, with large variations in some cases.

Other factors like urban density, family size, existence of efficient public transport systems, or the cost of using and parking of cars can lead to lower car ownership rates. This seems particularly true in the case of London, which has among the lowest rates in the cities surveyed.

The number of taxis differs substantially between the metropolitan areas, with some cities having less than 1 taxi per 1,000 inhabitants (Frankfurt RheinMain) and others more than 5 (Dublin, London). Among the cities surveyed, the average rate is between 2.5 and 3 taxis per 1,000 inhabitants. The high levels in the United Kingdom are explained by the existence of two categories of vehicles: licensed taxis on the one hand (20,000 in the case of London), and private hire vehicles available for pre-booking on the other hand (40,000 in London).

Chart 4. Link between Car Ownership and GDP and Modal Share of Public Transport



3.4 Traffic Safety

The number of persons killed every year in traffic accidents amounted to 3,145 in the 14 cities that have provided data, highlighting the heavy death toll of road traffic in metropolitan areas, which reaches hundreds of persons killed every year in some cities. And these figures certainly underestimate the reality in some countries which don't take the same period of time after the accident to consider that a fatality is due to a road accident.

Among the areas surveyed, the number of people killed every year in road accidents reaches an average 80 fatalities per million inhabitants, with significant differences between the metropolitan areas with the lowest death tolls (30 persons killed per million inhabitants in Dublin and Manchester) and those with the highest (more than 100 in Vilnius, Athens and Sevilla).

It should be noticed that there is no direct correlation between car ownership rate and number of road accidents (Zurich, where can ownership rate is double that in Vilnius, had roughly twice less victims than the Lithuanian capital city).

4. Description of the Public Transport System

4.1 Public Transport Supply

4.1.1 Characteristics of Bus Supply

All metropolitan areas have very dense networks of bus routes, as illustrated in Table 3.

The average length of routes is 20 kilometres in the cities surveyed, but this figure doesn't reflect the strong differences between strictly urban routes, generally shorter, and interurban ones, longer (for example in Sevilla, average length of 10 km for urban routes and 30 km for interurban). Countries with a strong pattern of interurban bus routes (Spain for example) often have very long bus routes (more than 40 kilometres in Bilbao and Madrid in average).

Table 3. Characteristics of Bus Supply

	Number of Lines	Lines length (km)	Stops Line	Number of Vehicles	Veh-km (million/year)	Number of Operators
Athens	324	6,886	19,603	2,460	99.0	2
Barcelona	438	9,200	13,000	1,682	93.2	39
Berlin-Brandenburg	1,030	16,674		2,778	156.0	25
Bilbao	142	6,582	5,490	457	32.8	6
Birmingham West-Midlands	500	7,524	16,000	2,200	140.0	50
Brussels	101	696		691	20.5	3
Dublin	126	3,869		1,062	57.6	1
Frankfurt RheinMain	750-800		8,000	5,000	122.0	141
Helsinki	260	3,500		1,500	89.0	12
London	>700	3,730 [1]	17,000 [3]	6,500	415.0	30
Madrid	556	22,186	24,707	3,394	239.4	34
Manchester	630	2,300 [1]	6,200 [3]	3,000	126.0	50
Paris Ile-de-France	1,191	18,693	27,309	8,304	283.8	80
Prague	385	4,912		1,285	80.0	14
Sevilla	91	1,894 [1]	2,801	481	24.4	10
Stockholm	469	9,323	5,500	1,800		3
Valencia	108	3,689	5,672	605	30.9	9
Vienna Eastern Austria	254	6,046	7,500	1,170	97.0	13
Vilnius [2]	163	1,972	1,090	990	31.0	24
Warsaw	189	3,257	3,374	1,673	100.4	3
Zurich	223	1,591		643	37.8	14

1= London, Manchester and Sevilla: Network length (if several lines have a common section is count once)

2=Vilnius: Bus+Trolleys.

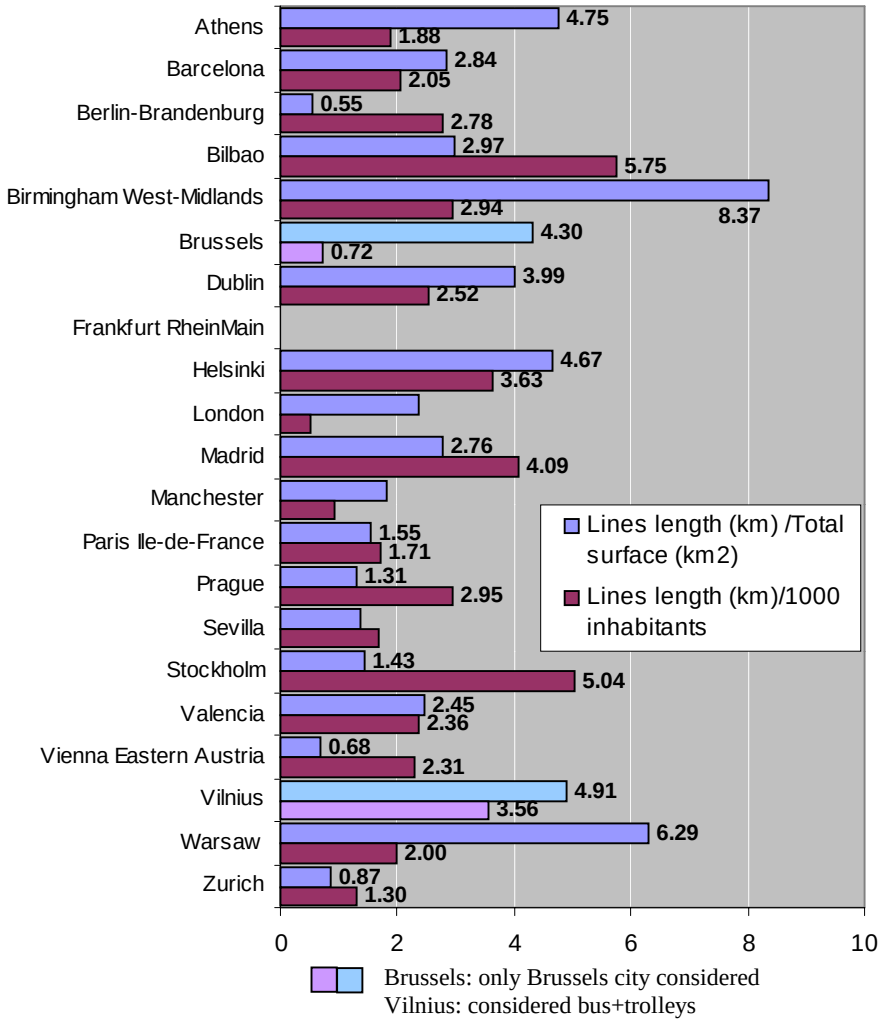
3= Stops network (they are counted once, even if several lines stop in it)

The number of companies in charge of operating these routes varies from a single one in Dublin up to 140 in Frankfurt RheinMain. This strong variation depends on the regulatory framework (competition vs monopoly) and, even more, on the size of the territory concerned. For example, the high number of bus companies in Paris-Ile de France (80) has nothing to do with competition, but only with the size of the territory (12,000 km²), that covers tens of sub-centers remote from the core

of the metropolitan area, which used to be served historically by small independent private companies.

One single company operates an average 16 routes, but this figure is in reality smaller (12) once the major historic public companies have been left aside (ETHEL's 282 bus routes in Athens, BVG's 210 in Berlin, EMT's 174 in Madrid, RATP's 320 in Paris, DP's 210 in Prague, Wiener Linien's 80 in Vienna).

Chart 5. Bus Lines Density



As shows Chart 5, the density of lines in terms of surface is very high in Birmingham-West Midlands, which is followed by Varsaw as the second denser area. This figure can be understood as a consequence of a small area (550km²) and the insufficient provision of alternative public transport modes as metro in Birmingham-West Midlands.

In terms of density of bus lines measured in terms of population covered, three cities are above 4km of lines per inhabitant (Bilbao, Stockholm and Madrid).

4.1.2 Characteristics of Metro Supply

Metro networks, which are underground light rail systems, are often at the core of the public transport systems of metropolitan areas. They can be devised to serve mostly the centers of urban areas, as in Athens, Paris or Berlin or to serve larger metropolitan territories as in Valencia, London and, in the last years, Madrid.

It can be noticed that the existence of underground networks is related to the population of the metropolitan areas. Under 1.5 million inhabitants, none of the cities surveyed has a metro system, at the exception of Bilbao. Above this threshold, only Birmingham hasn't developed one.

Table 4. Characteristics of Metro Supply*

	Number of Lines	Network Length (km)	Network Stations	Number of Vehicles	Veh-km (million/year)	Number of Operators
Athens	3	40	73	340	33.0	2
Barcelona	8	108	128	620	72.6	2
Berlin-Brandenburg	9	144	170	1,391	134.0	1
Bilbao	2	34	32	37	13.8	1
Birmingham West-Midlands						
Brussels	3	35	64	217	16.0	1
Dublin	Future					
Frankfurt RheinMain	9	58	84	160	61.0	1
Helsinki	2	21	16	54	11.7	1
London	12	408	275	598	74.0[1]	1
Madrid	12	179	158	1,357	125.8	2
Manchester	3	38	36	32	3.1 [1]	1
Paris Ile-de-France	16	218	380	3,548	212.6	1
Prague	3	50	51	350	36.0	1
Sevilla	Future					
Stockholm	7	108	100	630		1
Valencia	2	118	86	76	5.1	1
Vienna Eastern Austria	5	61	86	431	57.9	1
Vilnius						
Warsaw	1	14	14	136	11.2	1
Zurich						

1= London and Manchester: million train-km/year; rest of cities million coach-km/year

Three quarters of the metropolitan areas surveyed (16 cities) have a metro system and two more cities, Dublin and Sevilla, are, currently, developing metro networks.

The most developed systems (see Table 4) are those in Paris (16 lines), London and Madrid (12 lines), Berlin and Frankfurt (9 lines).

The average length of a metro line among the cities surveyed amounts to 17 kilometres. The longest lines (34 km in average in London and more than 50 km in Valencia) serve a large part of the whole

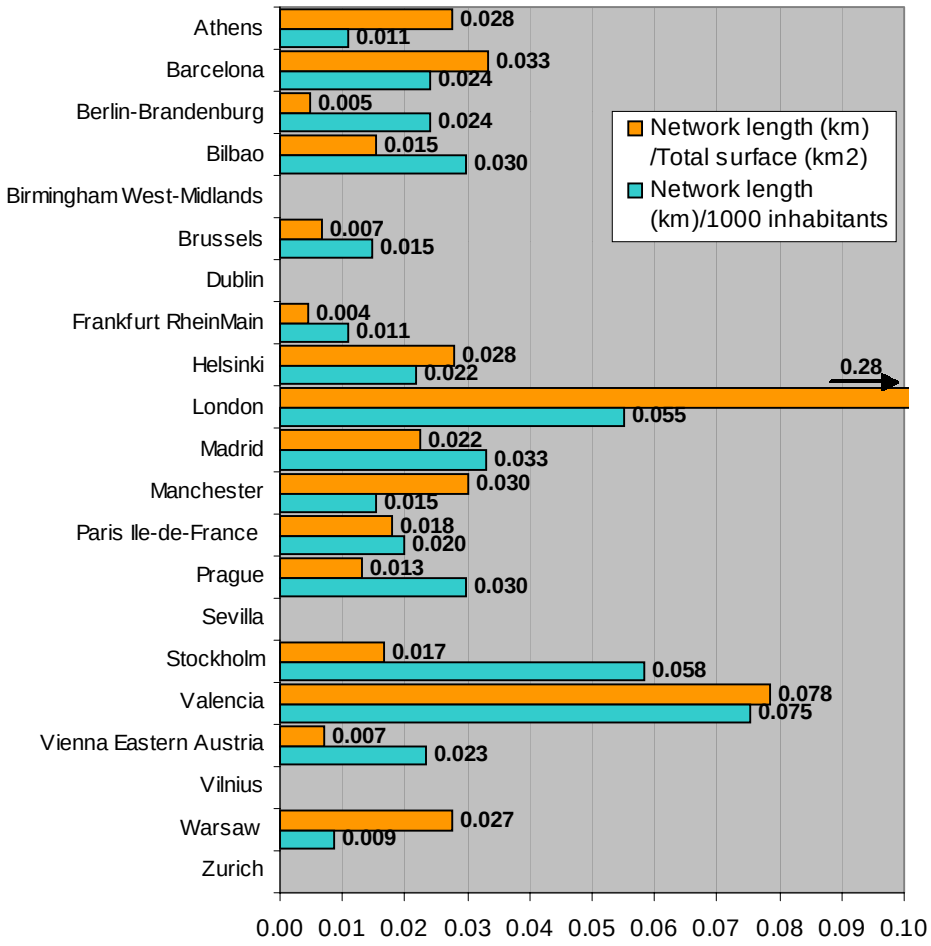
* In Manchester, the Metro system has characteristics of both metro and tramway. GMPTE, the passenger transport executive, has suggested to analyse it with the other metro systems.

metropolitan area, while others (Athens, Brussels, Paris) serve mostly the central part of the urban territory.

Aside from Athens, Barcelona and Madrid which have at least two operators, all the other metro systems are operated by one single company, which is public in most cases, but can be private in some (Stockholm).

The average distance between two stations (calculated as network length divided by number of stations) amounts to 1 kilometre in the cities surveyed, with the longest networks having more distant stations (1.5km in London, 1.4km in Valencia), while the average distance is less than 0.6km in Athens and Paris.

Chart 6. Metro Network Density



In some large regions (Berlin, Frankfurt, Paris or Vienna) the rates of density of Chart 6 appear very small, but this doesn't reflect the real density of the metro network, which serves only a small part of the territory, where the density can be among the highest in the world, as in Paris. In these cases, the network is inside the main city boundaries (ex. in Berlin, only the surface of the Land of Berlin, and not Brandenburg, in Frankfurt, only the surface of the city of Frankfurt, in Vienna, only the surface of the city, same comment in Paris).

4.1.3 Characteristics of Suburban Railway Supply

Nearly all the territories surveyed have a suburban rail network serving regional and metropolitan purposes. Table 5 shows the number of regular lines served that can vary from a few (2 in Sevilla) to tens of them (70 in Berlin-Brandenburg, around 40 in London and Paris, 35 in Frankfurt-RheinMain and Vienna, 25 in Prague). Athens intends to inaugurate several suburban railway lines, including one serving the new international airport, in the aftermath of the Olympic Games of 2004.

Table 5. Characteristics of Suburban Railway Supply

	Number of Lines	Network Length (km)	Network Stations	Number of Vehicles	Veh-km (million/year)	Number of Operators
Athens						
Barcelona	6	546	157	651	78.4	2
Berlin-Brandenburg	70	3,107	523	1,920	69.0	3
Bilbao	7	197	105	51	2.5 [1]	3
Birmingham West-Midlands	8	186	71	112		5
Brussels		100	100			1
Dublin	4	94	45	524		1
Frankfurt RheinMain	35	1,500	372	3,000	38.5	6
Helsinki	5	60	34	94	7.0	1
London	>40	788	>500		178.0	>12
Madrid	10	336	92	868	101.8	1
Manchester	9	319	98	80	6.4	2
Paris Ile-de-France	40	1,401	446	4,809	429.3	2
Prague	26	639	219			1
Sevilla	2	30	7			1
Stockholm	3	186	50	314		1
Valencia	5	101	27	34		1
Vienna Eastern Austria	34	1,576	1,157	1,384	31.6	3
Vilnius						
Warsaw						
Zurich	24	660	176	511	16.6	3

1= Only Euskotren (Regional Railways Company) expresed in train-km

The average distance between two stations amounts to 2.8 kilometres, that is to say three times as much as in the case of metro systems. But it varies from 1.5 km or less (Brussels, London and Vienna) to nearly 6 km in Berlin-Brandenburg, the latter being explained by the size of the territory (30,000 km²).

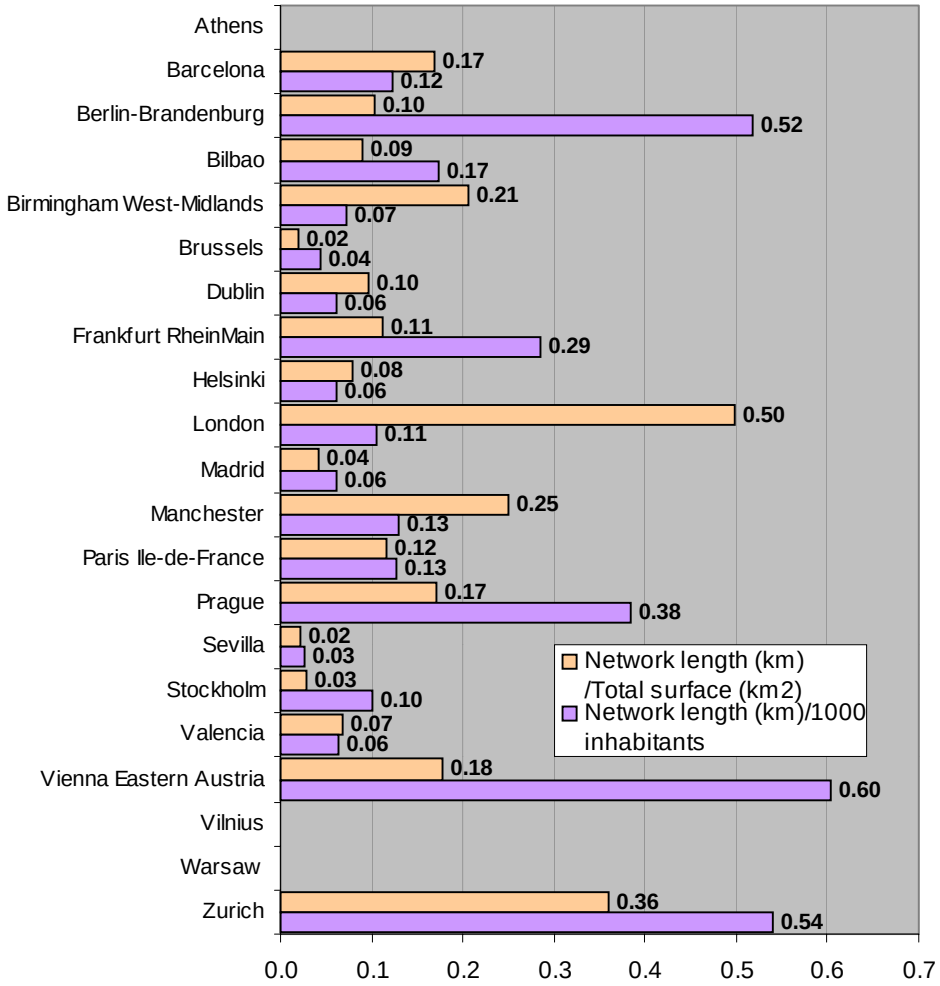
In a majority of cases, the operation of the networks is divided between several companies, the greatest number being reached in London (more than 10). In Spain and Austria, it is split between several public companies, some being national (Renfe, ÖB) and others local (FGC, Wiener Lokalbahnen, etc.). In Germany, the introduction of competition for the award of regional rail service contracts has led to an increase in the number of operating companies over the past years.

In absolute values, Berlin leads in terms of number of lines and network length. Chart 7 shows that Central European metropolitan areas (Berlin-Brandenburg, Frankfurt-RheinMain, Vienna-Eastern Austria and Zurich) have large networks in relation to their populations (more than 0.3km per 1,000

inhabitants), as opposed to Southern countries like Spain (less than 0.1km per 1,000 inhabitants in all cities expect Barcelona), where rail has always lagged behind coaches for inter-urban trips.

Differences in the institutional frameworks and surfaces covered explain, once again, why London or Birmingham-West Midlands, reach such high densities (small territories).

Chart 7. Suburban Railways Network Density



4.1.4 Characteristics of Tram Supply

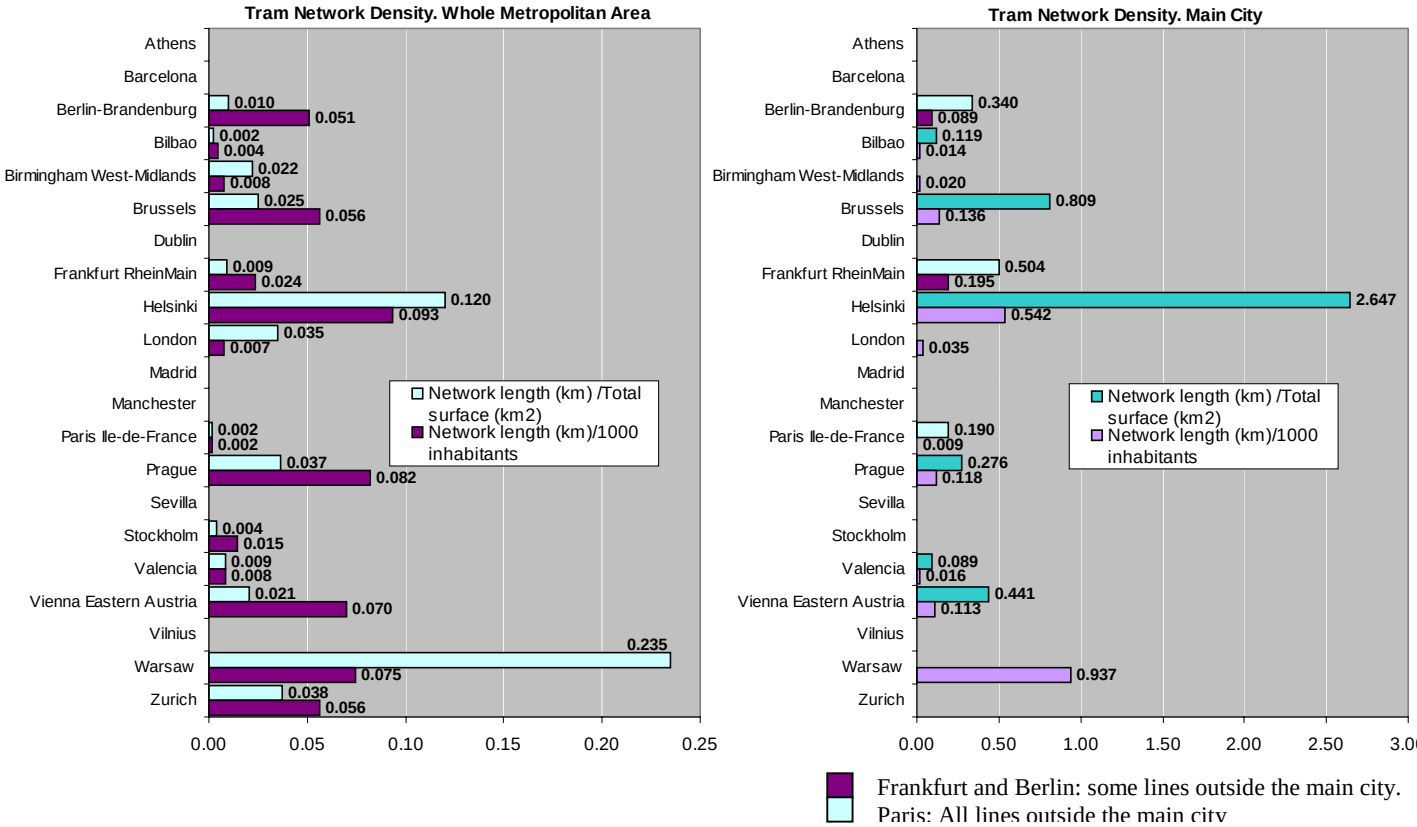
Two thirds of the cities surveyed have tram networks, and among them, six built new networks from zero over the past decade (France, Spain, UK). Four additional cities shall join them soon, illustrating the attractiveness of this transport mode in most European countries at the moment.

Table 6 shows that, as for heavy rail, Central and Eastern European countries have the largest tram networks (49 lines in Berlin-Brandenburg, 32 in Prague, 32 in Vienna and 32 in Warsaw), which can be explained by the fact that their cities never removed the trams from their streets, contrary to most other European cities.

Table 6. Characteristics of Tram Supply

	Number of Lines	Network Length (km)	Network Stations	Number of Vehicles	Veh-km (million/year)	Number of Operators
Athens	Future					
Barcelona	Future					
Berlin-Brandenburg	49	303	551	764	37.0	7
Bilbao	1	5	12	7		1
Birmingham West-Midlands	1	20	23	16	2.0	
Brussels	16	131		292	11.9	1
Dublin	Future					
Frankfurt RheinMain	14	125	188		25.0	3
Helsinki	10	90	242	115	5.5	1
London	2	55	74			2
Madrid	Future					
Manchester						
Paris Ile-de-France	2	20	34	105	4.2	1
Prague	32	137	256	708	50.0	1
Sevilla						
Stockholm	3	27	28	57		1
Valencia	1	13	28	24	0.9	1
Vienna Eastern Austria	32	183	1,132	950	39.4	2
Vilnius						
Warsaw	32	122	514	890	47.5	1
Zurich	13	69	164	348	10.7	1

Chart 8. Tram Network Densities in Metropolitan Area and Main City

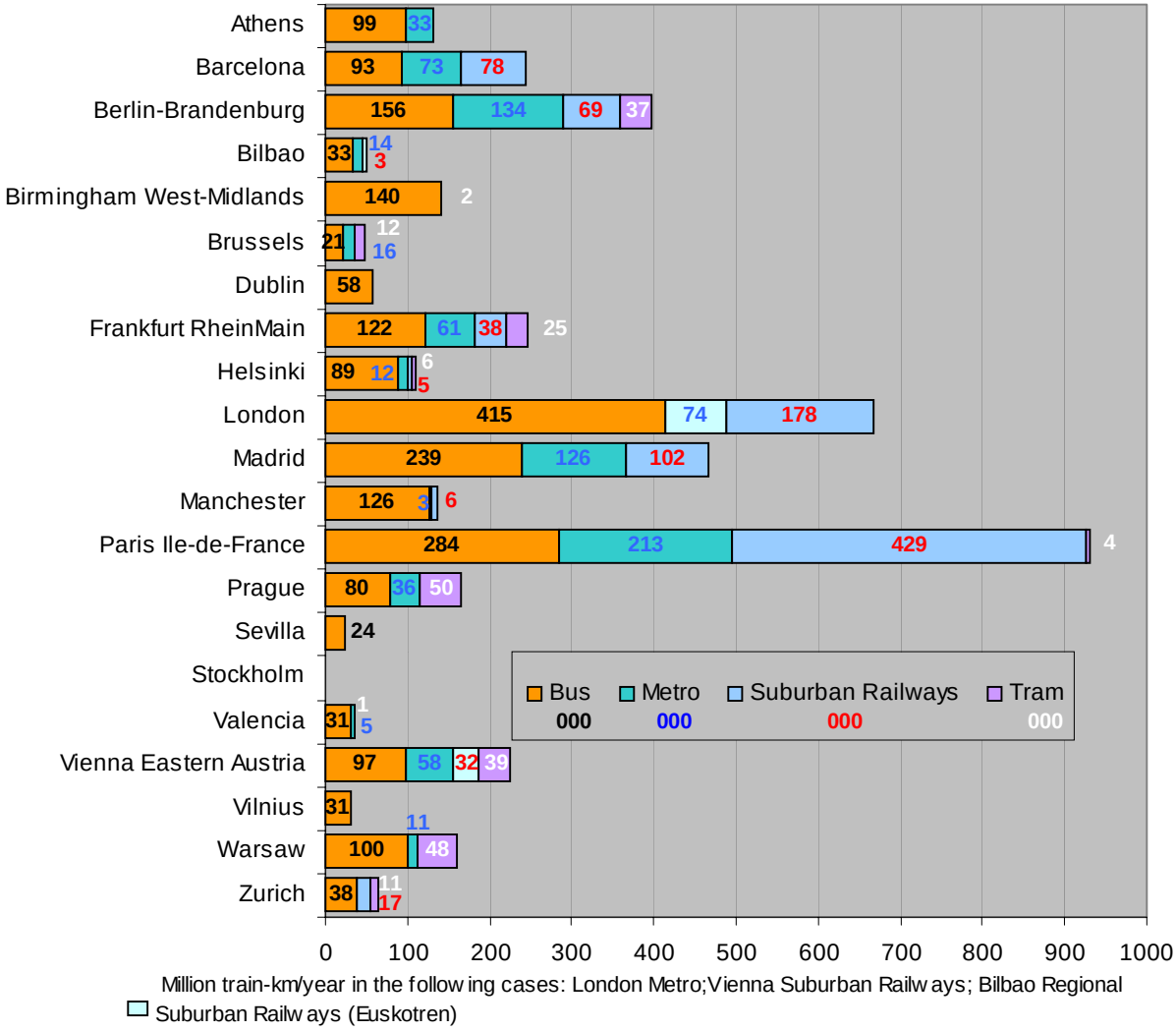


The tramway networks are usually operated by one single operator. When several are mentioned, this refers to large regions with several different, and usually independent, networks (like in Berlin-Brandenburg, where several cities such as Potsdam have tramway networks in addition to the one in Berlin-city).

In most cases, the tramway routes don't serve the whole territory, and it is therefore more pertinent to look at the density in the main city (see right side of Chart 8), especially in the case of very large regions.

4.1.5 Public Transport (Bus, Metro, Tramway and Suburban Railways) Supply

Chart 9. Public Tranport Supply (Million veh-km/Year)*



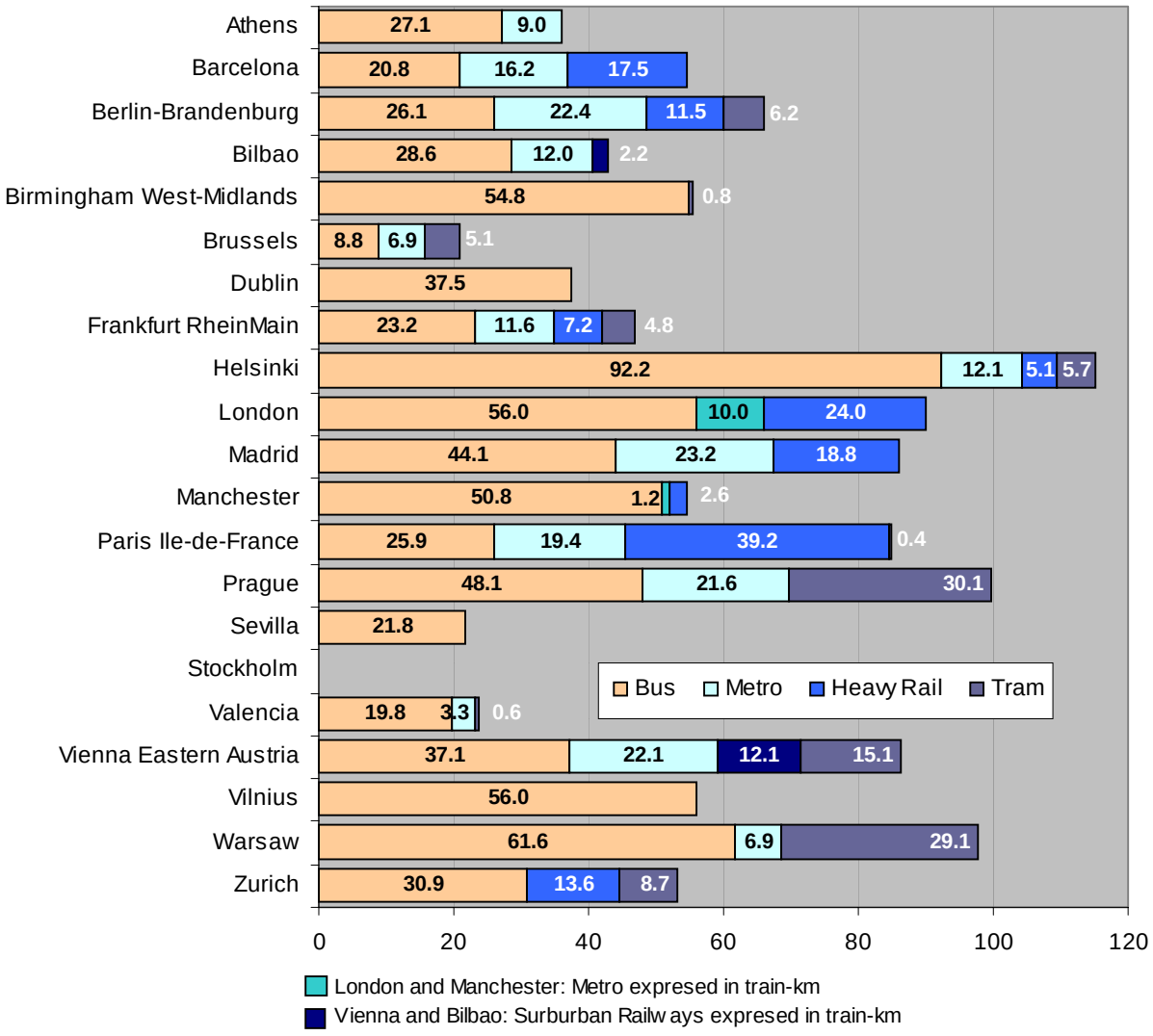
* There is a lack of information for Surburban Railways in the following cities: Athens, Birmingham-West Midlands, Brussels, Dublin, Prague, Sevilla, Stockholm, Valencia, Vilnius and Warsaw. The Chart must therefore be looked at carefully

Chart 9 shows that rail modes account for a large proportion of the provision of public transport services in the European metropolitan areas. In Barcelona, Berlin-Brandenburg, and Paris-Ile de France, more than half of the total public transport supply in vehicles-km is provided by rail modes.

Notwithstanding the fact that many cities were not able to provide data for heavy rail services (illustrating the difficulty to really integrate this mode), and some inconsistencies in the units used (train-km instead of vehicle-km in the UK), this chart shows the key weight of public transport supply in the largest European metropolitan areas (Paris-Ile de France, London, Madrid and Berlin). It can be noticed for example that public transport in Paris-Ile de France accounts for more than half of the total provision of public transport services in France, although the region only makes up 20% of the French population.

The ratio of provision of services on population served shows very strong differences between territories.

Chart 10. Public Transport Supply per Inhabitant (veh-km/ inhabitant)



Like Chart 9, this chart must be looked at carefully, since many cities haven't provided data for suburban railways. This said, it appears that Helsinki leads clearly with more than 115 vehicle-km provided per inhabitant every year. It is also significant that Prague and Warsaw, both former communist countries, rank second and third for this indicator.

After these three cities, only London (even if metro supply is expressed in train-km instead of vehicle-km, thus artificially reducing the indicator), Madrid, Vienna Eastern Austria and Paris Ile de France reach more than 80 veh-km/inh.

Going through the different modes, the highest supply per person is reached by Helsinki for bus services, by Madrid for metro (although certainly behind London in terms of vehicles-km/inhab and Paris if only the population served by the metro is taken into account), by Prague for tram services and, finally, Paris-Ile de France leads for supply per inhabitant of suburban rail services.

4.2 Public Transport Demand

4.2.1 Main Characteristics of Public Transport Patronage

Table 7 confirms the key role of rail systems for mobility of people in some large metropolitan areas (Berlin-Brandenburg, London, Paris-Ile de France), where they account for more than 50% of all passenger-kilometres travelled.

Table 7. Public Transport Demand

	Bus		Metro		Suburban Railway		Tram	
	Trips/year (million)	Passenger-km (million)	Trips/year (million)	Passenger-km (million)	Trips/year (million)	Passenger-km (million)	Trips/year (million)	Passenger-km (million)
Athens	**560.0**		**210.0**					
Barcelona	**297.2**	1,260.0	**362.1**	1,997.0	**140.8**	2,552.0		
Berlin-Brandenburg	468.0	2,354.0	399.0	2,242.0	347.0	4,011.0	167.0	529.0
Bilbao	**58.2**	399.4	**66.7**	404.9	**35.5**	431.5	1.1	2.2[4]
Birmingham West-Midlands	**336.0**				**24.8**		**4.8**	
Brussels	60.0	250.0	96.6	480.0	66.0		57.6	300.0
Dublin	131.4	1,243.0			21.0	1,628.0[3]		
Frankfurt RheinMain								
Helsinki	170.0	1,135.0	**55.0**	385.0	**37.0**	329.0	**56.0**	118.0
London	1,540.0	5,734.0	953.0	7,451.0	655.0	18,454.0	41.3[2]	206.9[2]
Madrid	678.1	6,120.0	565.0	3,162.0	193.3	3,450.4		
Manchester	200.0	1,018.0	13.4	152.0	13.2	242.0		
Paris Ile-de-France	**1,230.0**	4,029.0	**1,283.0**	6,184.0	**3,240.0**	14,278.0		136.0
Prague								
Sevilla	102.4	500.1			2.6	28.4		
Stockholm	160.0	1,509.0	175.0	1,581.0	**64.0**	1,146.0	**25.0**	197.0
Valencia	**119.5**	103.7	**40.3**				**6.3**	
Vienna Eastern Austria	164.0		395.6		79.0		216.1	
Vilnius [1]	222.6	1,064.4						
Warsaw	225.0		60.0				120.0	
Zurich	**169.0**	447.0			**120.0**	1,646.0	**196.0**	350.0

Figures in bold are stages(passenger-line)/year instead of trips(passenger-network)/year

1= Vilnius: Considered Bus+Trolleys

2= London: Croydon Tramlink not included

3=Dublin: long distance Passengers included in Suburban Railway figure

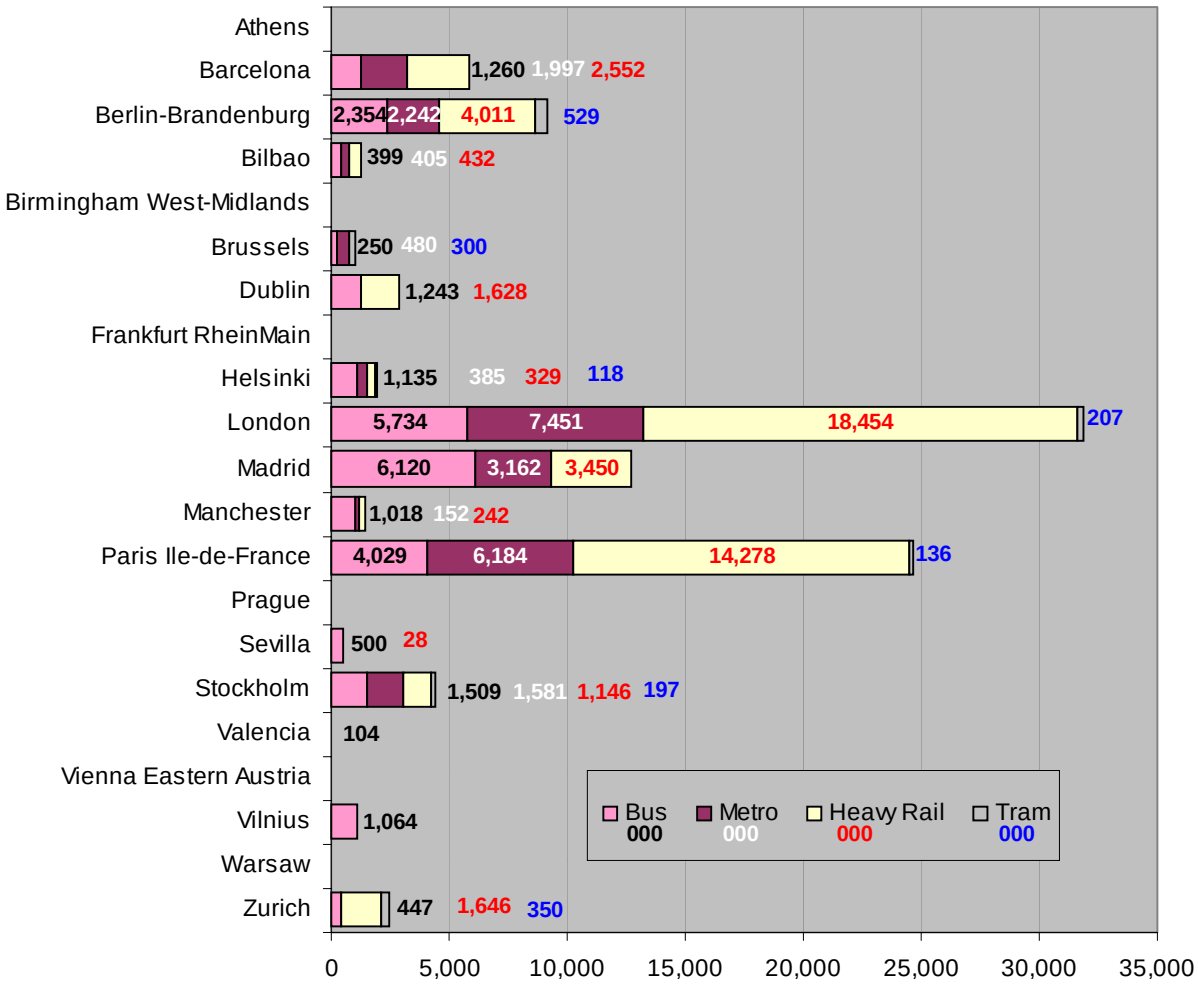
4=Bilbao Tram: figures for 2003 cause it started operating in December 2002

Four metropolitan areas have more than a billion trips by public transport on their territory every year. These are Paris-Ile de France (even though the only figure available is stages and the number of trips must be lower), followed at some distance by London, Berlin-Brandenburg and Madrid. A similar result is found by comparing the number of trips with the supply in veh-km.

The differences in the average distance of trips by public transport is very strong. The average distance travelled in the metropolitan areas surveyed is 7.3km, but in London (11.1km) and Madrid (10.8km) the figure is twice as high as in Berlin (6.3km) and Paris (4.2km).

This illustrates an intensive use within the main city in the case of Paris or Berlin which, furthermore, have very dense public transport networks in the core of the metropolitan areas.

Chart 11. Public Transport Demand (Million pax-km/year)



The use of public transport per thousand inhabitants allows to compare the metropolitan areas notwithstanding their size.

The number of yearly trips per inhabitant (Chart 12, on the left side) shows that the inhabitants of ten cities use public transport systems more than 200 times a year.

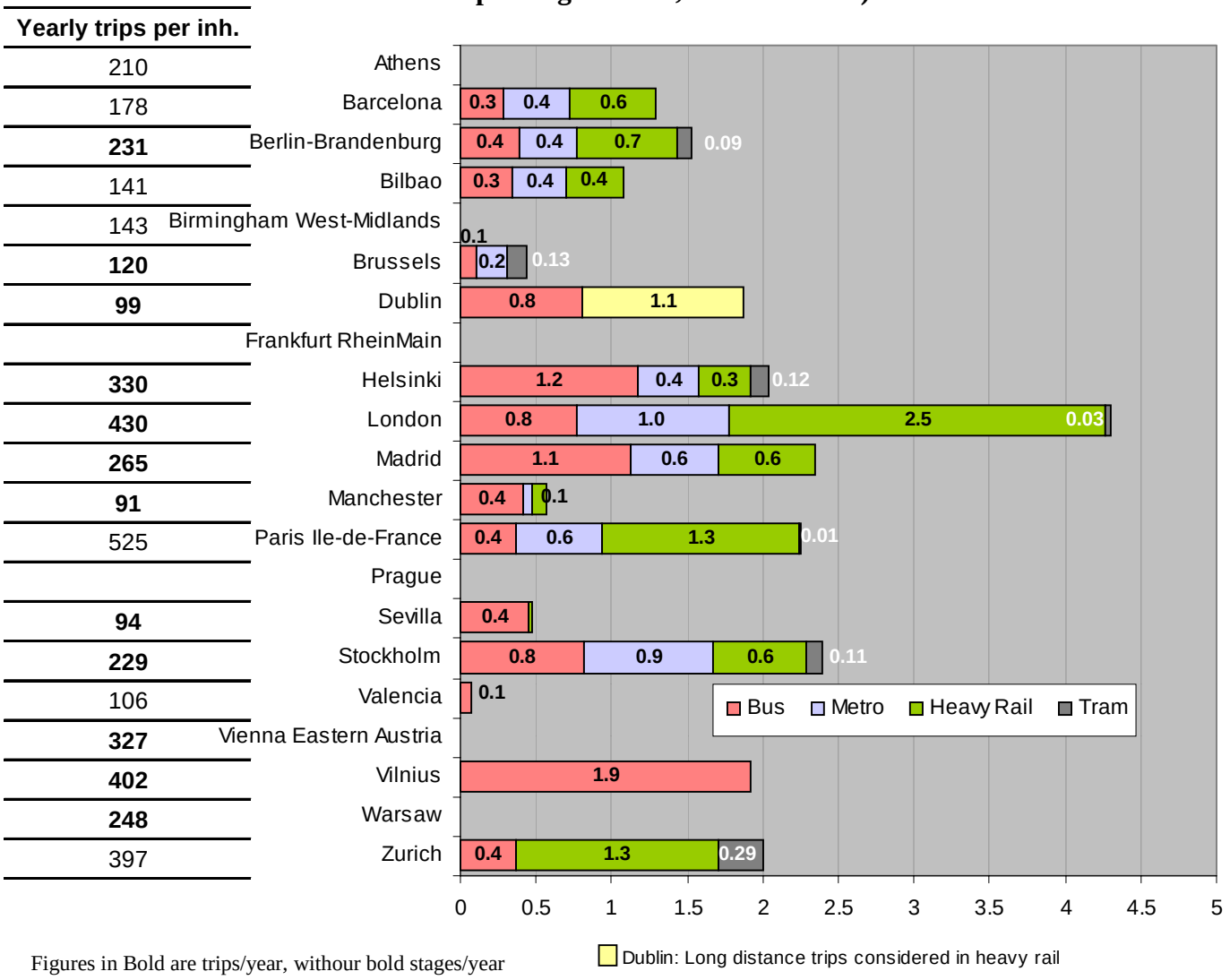
- A group comprising London, Vilnius and, probably, Paris (the figure is comparatively higher for this last city because it is expressed in stages instead of trips) leads with figures that rise over 400 yearly trips.

- Helsinki, Vienna and Zurich (where the figure is in stages by year) reach more than 300 yearly trips.

- Madrid, Warsaw, Berlin-Brandenburg and Stockholm make up the last group with more than 200 trips per year.

If the rate of total daily trips is considered (see Table 2), the figure of Madrid is especially significant, for the Spanish capital city has the lowest rate of daily trips among those ten cities (2.2 trips).

Chart 12. Public Transport Demand per Inhabitant (Passenger-km/ inhabitant & million passenger-km/ 1,000 inhabitant)



Figures in Bold are trips/year, withour bold stages/year

Chart 12 (part on the right) shows that London comes ahead with more than 4,300 passenger-km per inhabitant per year. It is followed, at some distance, by Stockholm (2,400), Madrid (2,300), Paris-Ile de France (2,300), Helsinki (2,000) and Zurich (1,990). The use of suburban railways is especially high in London, Paris and Zurich.

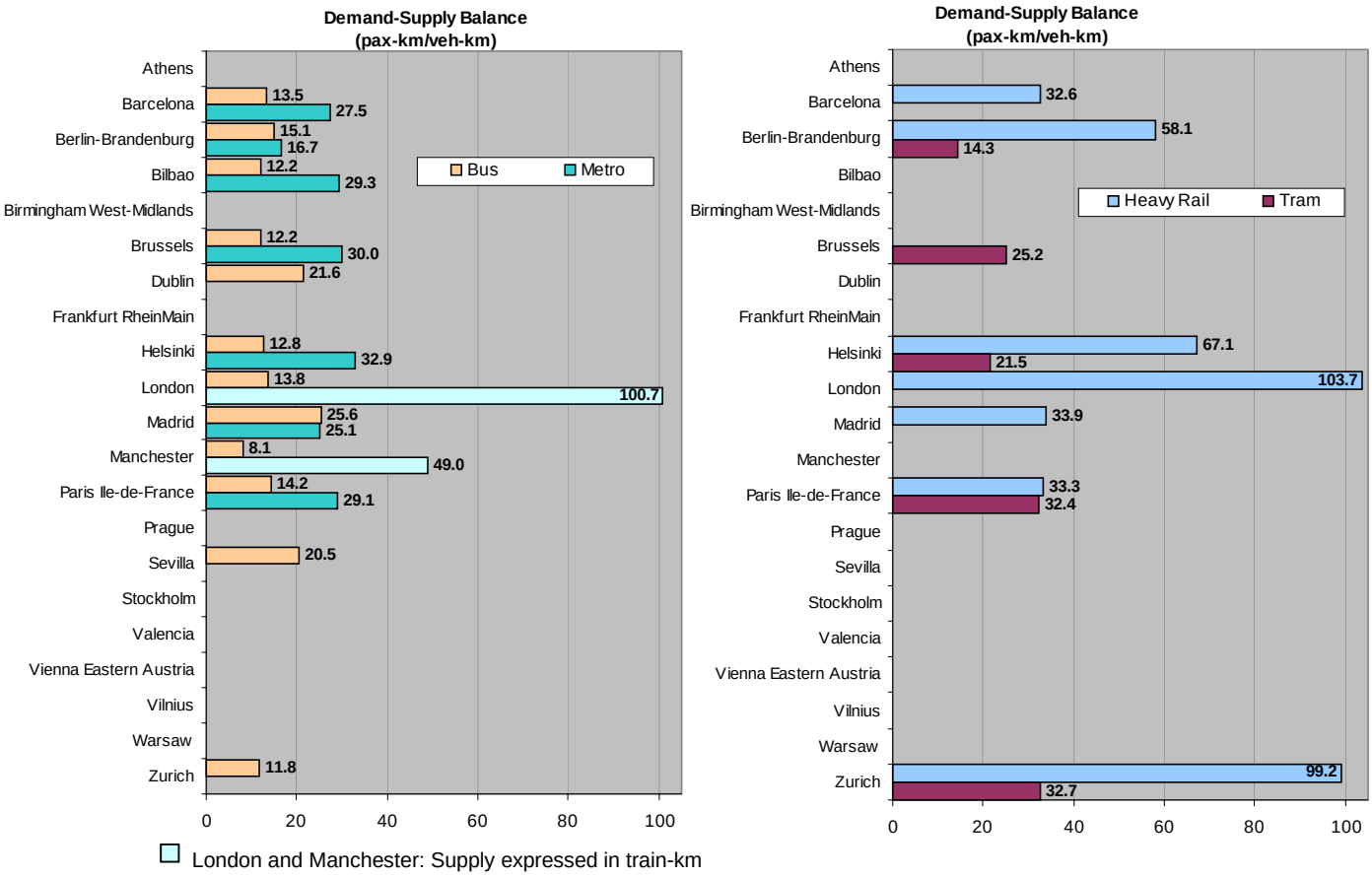
A comparison of the figures of supply and demand per inhabitant shows a higher level of use in London, Paris-Ile de France and Madrid than in Helsinki (which leads in terms of supply per inhabitant) and Berlin-Branderburg.

4.2.2 Intensity of use of public transport

This indicator reflects the number of passengers by kilometer travelled by the vehicle.

Setting up a general rule is not easy, because of the differences among cities for the same mode, as well as, between the modes for a given city.

Chart 13. Demand-Supply Balance per Public Transport Mode (Passenger-km /veh-km)



As could be expected, suburban trains have the highest occupancy rate, because of the bigger capacity of their rolling stock. If London and Manchester are put aside (figures expressed in

passengers by train instead of passengers by vehicle) there seems to be similar occupancy rate in metro and tramway. In Paris, the figure is even higher for tramways illustrating the very strong traffic on the two tramway lines.

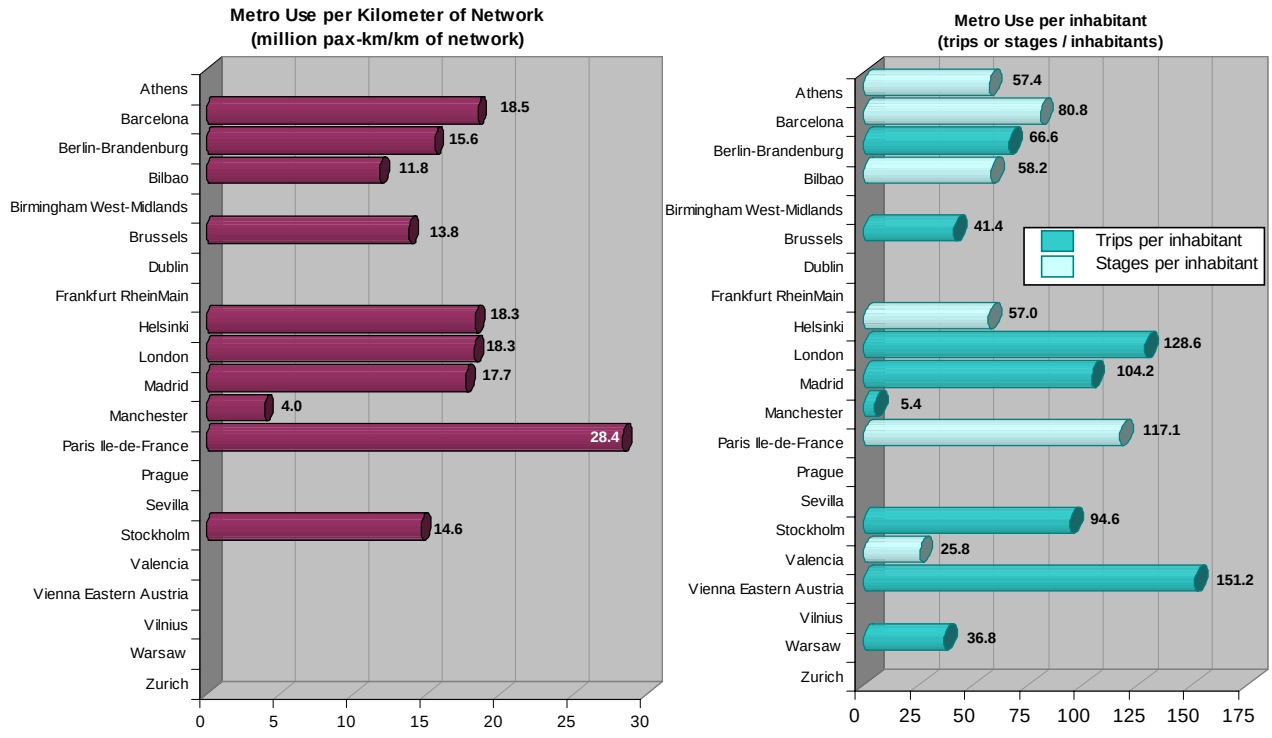
Bus occupancy is the lowest among modes surveyed, with an exception for Madrid. But once again there is little difference with metro or tram, even though vehicle capacity is lower. The flexibility in bus operation that allows to adjust the supply to the demand more easily, can explain, in part, those figures.

4.2.3 Metro use per kilometer of network and Metro use per inhabitant

The use of metro per inhabitant (right side of Chart 14) shows that the metro networks can be divided into three groups. A first category of systems with less than 50 trips per inhabitant per year (Manchester, Valencia and Warsaw), corresponding mostly to recent systems or systems with low capacity; a second category of systems with around 50 trips per inhabitant per year (Athens, Barcelona, Brussels, Helsinki). Lastly cities with more than 100 metro trips per inhabitant per year (Berlin, London, Madrid, Paris, Stockholm, Vienna). In these cities, the metro network is the backbone of public transportation in the heart of the metropolitan area, ahead of bus.

If it is considered that in some of those cities- Berlin, Paris and Vienna- the metro network is only developed inside the main city, then the figure of intensity of use becomes more relevant.

Chart 14. Intensity of Use of Metro Network



Interestingly, most metro networks carry an average of around 15 million passengers-km per kilometre of network every year (left side of Chart 14). Two exceptions are worth noticing: Manchester, on the one hand, which has a much lower rate (6.3) because its metro has characteristics which make it close to a tramway; and Paris, on the other hand, which due to the very high density of inhabitants in the city (20,000 inh/km²) and the great number of stations, attracts a very high number of passengers per kilometre of line.

4.3 Quality of public transport supply

An improvement of the quality of services provided has been regarded by public transport authorities and operators, as one decisive way to improve the attractiveness of public transport systems against private vehicles over the past years.

Quality of service includes very different features. Tables 8 and 9 refer to some basic ones.

Table 8. Supply Quality Indicators on Bus and Metro

	Bus				Metro			
	Commercial Speed (km/h)	Amplitude of Service (hours)	Low floor buses (%)	Average age of vehicles (years)	Commercial Speed (km/h)	Amplitude of Service (hours)	Station accessible for PMR (%)	Average age of vehicles (years)
Athens	10-20	18.0	92.0	7.0	35.0	19.0	85.0	5.0
Barcelona	16.6	17.5	55.0	7.0	28.3	19.8	27.0	17.0
Berlin-Brandenburg	19.5 [1]	20.0 [1]	80.0 [1]	8.0	30.9	20.0	31.0	18.0
Bilbao	20.2	17.0	32.6	7.0	34.0	17.0	100.0	
Birmingham West-Midlands	22.2	22.4	53.0	6.0	No Metro			
Brussels	17.9	19.0	91.0	8.0	29.2	19.5	6.3	16.0
Dublin	14.6-18.5[2]	17.0	35.0	5.5	No Metro			
Frankfurt RheinMain								
Helsinki	25.0	21.0	65.0	5.0	46.0	18.0	100.0	16.0
London	16.5	24.0	85.0	7.4	31.5	19.0	13.0	23.0
Madrid	14.2-27[3]	18.4	56.8	9.2	26.3	19.5	31.0	11.4
Manchester	19.0	21.0	17.0		35.0	17.5	100.0	7.5
Paris Ile-de-France	17-27 [3]	15.5	30.0	10.0	27.0	20.3	6.0	26.0
Prague	26.5	24.0	25.0		35.4	19.0	60.0	13.5
Sevilla	12.5	19.0	38.0	6.7	No Metro			
Stockholm	20.0	19.0	30.0		35.0	19.0	100.0	
Valencia	14.0	18.8	43.0	8.3	29.4	19.0	100.0	13.7
Vienna Eastern Austria	18.4	19.0	60.0		31.3	20.0		
Vilnius	19.7	21.3	3.8	10.7 [4]	No Metro			
Warsaw	17.2	24.0	36.0	10.5	30.9	19.0	100.0	4.5
Zurich	21.3	13-20	9.3	9.0	No Metro			

1= Berlin: Only Berlin City 2=Dublin: Commercial speed in and off peak hour 4=Villnius: Average age of municipality buses.

3 = Madrid and Paris: Commercial speed for urban and suburban buses

Table 9. Supply Quality Indicators on Suburban Railways and Trams

	Suburban Railways				Tram			
	Commercial Speed (km/h)	Amplitude of Service (hours)	Station accessible for PMR (%)	Average age of vehicles (years)	Commercial Speed (km/h)	Amplitude of Service (hours)	Station accessible for PMR (%)	Average age of vehicles (years)
Athens					No data			
Barcelona	46.0	19.0	33.0	10.0				
Berlin-Brandenburg	38.0	21.0	70.0		19.6	20.0	100.0	12.0
Bilbao	40.0 [2]	17.0		18.6/10/1 [3]	18.6	17.0	100.0	
Birmingham West-Midlands	41.0	17.6	1.0	17.0	33.3	17.6	100.0	3.0
Brussels	60.0			25.0	16.7	19.0	10.0	30.0
Dublin	30-45 [1]	18.0		7.2				
Frankfurt RheinMain								
Helsinki	50.0	20.0	100.0	25.0	16.0	20.0	80.0	20+
London	41.4				23.0			
Madrid	53.5	18.0						
Manchester	40.0			20.6				
Paris Ile-de-France	45.0	19.7	20.0	18.0	22.0		100.0	6.0
Prague	38.6	21.0			19.5	24.0		17.8
Sevilla			100.0					
Stockholm	60.0		100.0		30.0		100.0	
Valencia	57.8	17.3	3.7		17.5	18.5	100.0	8.2
Vienna Eastern Austria		20.0			15.5	19.0		
Vilnius					18.7	20.0		
Warsaw					14.9	20.0	40.0	20.0
Zurich	56.5	20.0		13.0	15.4	20.0		26.0

1=Dublin: 30 km/h for DART, and 45 km/h for GDA 2=Bilbao:Only Euskotren (Regional Suburban Railways Company)

3=Bilbao: Average Age by Operator: Euskotren/Renfe/Feve

4.3.1 Commercial Speed

The data provided by the transport authorities confirm the hierarchy of the different transport modes in terms of commercial speed: 47km/h in average for heavy rail services, 32km/h in average for metro systems, 20km/h for tramways, and 19km/h for bus services.

The data for bus routes are in fact usually a mean figure between urban routes, whose commercial speed is often smaller than this (<15km/h in many cases), and inter-urban routes, which reach high commercial speeds (>25km/h). They must therefore be looked at carefully.

The commercial speed of tramways is worth noticing. Aside from Birmingham, Paris (T2) and Stockholm, most tramways drive little faster than buses, even when one only considers urban bus routes. This can mean either that the reason for choosing tramways instead of bus lies in other factors than commercial speed (for example: capacity, regularity, positive image, possibility to reshuffle the urban environment), or that tramways don't benefit from their full potential (that can be reached when they have segregated tracks and priority at traffic lights).

4.3.2 Amplitude of service

The amplitude of transport services is, on average, similar between all modes (slightly above 19 hours of service per day). Service from 5am to midnight is a usual pattern in most cities.

However, when one looks at the figures carefully, some different approaches appear. In lots of cities (London, Manchester, Prague, Warsaw), bus services are operated daily during longer time than heavier modes like tramway or metro. It can indeed seem logical to close the heavier modes when traffic goes down during the night, and only keep buses, whose costs of operations are lower. Contrary to this, bus services have a shorter amplitude of services than metros in Athens, Barcelona, Madrid and Paris. In these cities, some specific night bus routes are operated during closure of the metro, but their routes are usually very different from daily bus routes.

In Berlin, Birmingham, Helsinki, Manchester, and Vilnius, bus services are operated during more than 20 hours every day, London, Prague and Warsaw ranking first with many bus routes operating 24 hours a day.

4.3.3 Accessibility of networks to people with reduced mobility

Buses

The share of low floor buses in the fleets of rolling stock varies a lot between the cities. In half of the metropolitan areas, there are more than 50% low floor vehicles in the bus fleets, with some very high levels in Athens (92%), Brussels (91%), London (85%) and Berlin city (80%). At the other end, less than a third of vehicles are low floor in Manchester and Paris. It is to be noticed that the cities with the lowest proportion of low floor buses are also those where buses are the older (Paris, Vilnius, Warsaw).

Accessibility of metro

The situation is very heterogeneous between cities with recent metro systems, usually totally accessible (Bilbao, Helsinki, Manchester, Stockholm, Valencia and Warsaw), and the old systems, whose accessibility still remains very low (less than 15% of stations accessible in London and Paris).

The average age of the rolling stock is close to 15 years. It is worth noticing that the two largest and oldest metro systems (London and Paris) are also those with the oldest rolling stock (respectively 23 and 26 years old).

Accessibility of heavy rail systems

Aside from a few cities which seem to have invested to achieve full, or at least good accessibility of their heavy rail systems (Berlin, Helsinki, Stockholm), most heavy rail systems are very little accessible for people with reduced mobility (less than one third of stations accessible in Barcelona, Birmingham, Paris, Valencia).

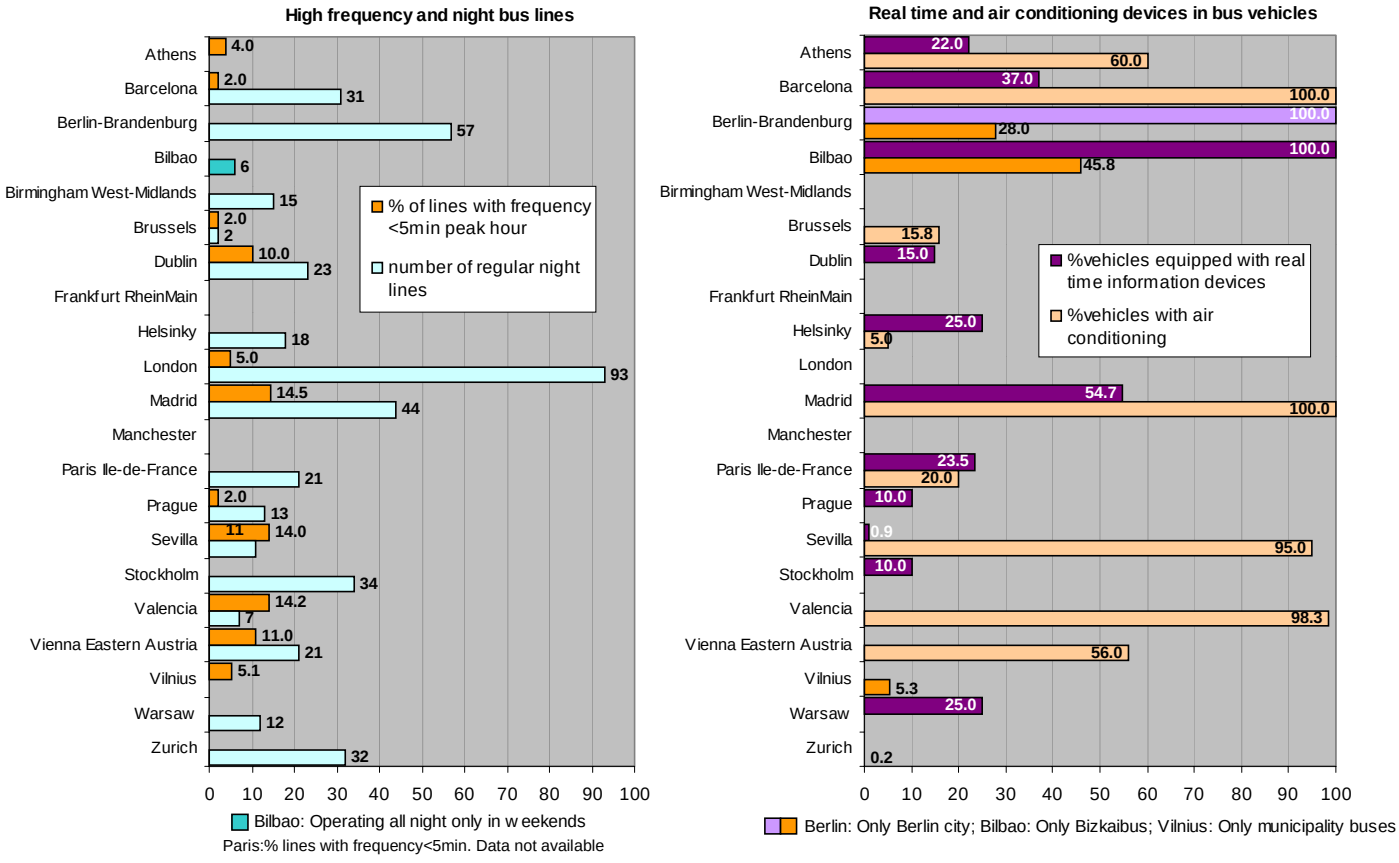
The average age of the rolling stock in the cities which have provided this information amounts to 17 years old.

Accessibility of tramways

Aside from a few old tramway systems (Brussels, Prague, Warsaw), most European metropolitan areas provide fully accessible tramway systems. The young age of their rolling stock (less than a decade in Birmingham, Paris-Ile de France and Valencia) makes it easier to achieve good accessibility.

4.3.4 Bus Quality Indicators

Chart 15. Bus Quality Indicators



Frequencies and night services

Most metropolitan areas surveyed in the *Barometer* provide regular night bus services, only in the week-end for some of them. In average the number of night bus lines reaches 10% of the number of lines provided during day time. This figure must be looked at carefully, because in many cities, regular night bus lines are longer than daytime lines and cannot therefore be compared easily.

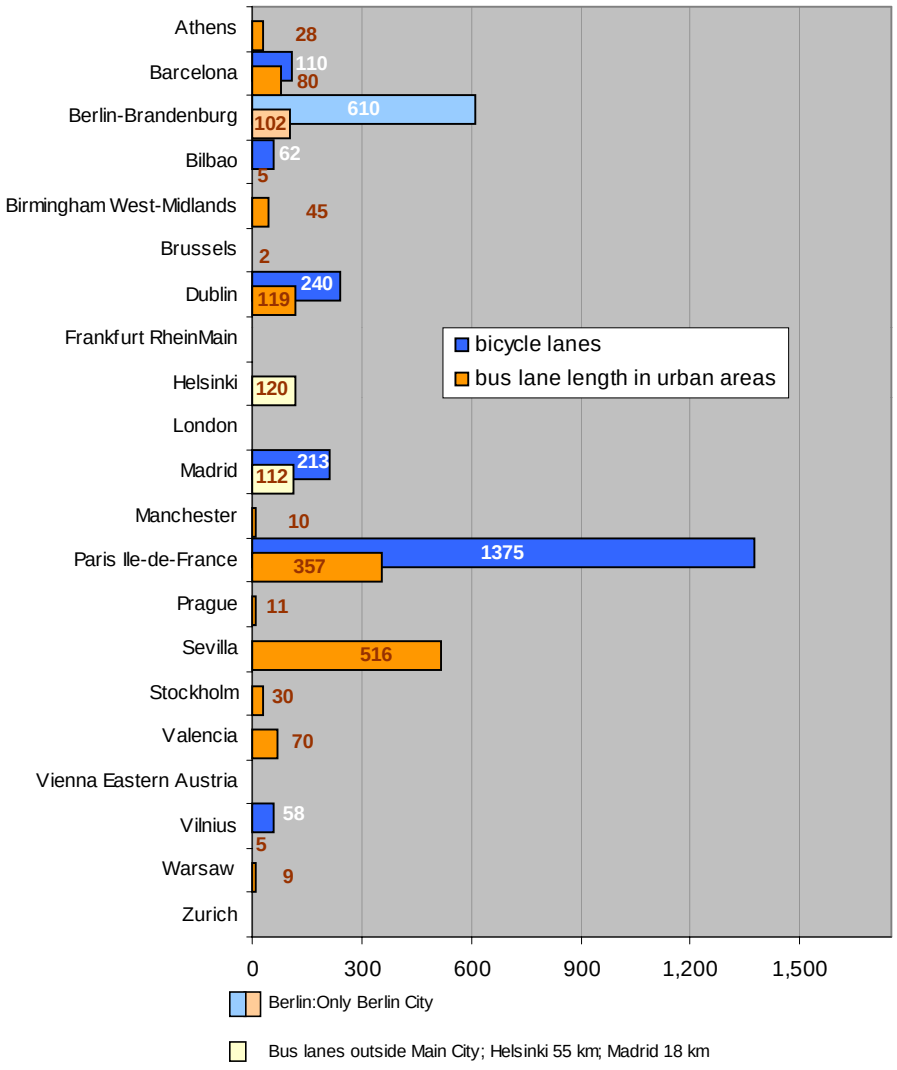
Dublin, London, Sevilla and Zurich are the cities providing the highest number of night bus lines in comparison to daytime services (93 regular night bus lines in London).

Air conditioning and real time information devices

As could be expected, most Southern metropolitan areas have very high rates of buses equipped with air conditioning (close to 100% in Barcelona, Madrid, Sevilla and Valencia). Among the other cities, the case of Vienna (56%) is worth noticing.

Concerning real time information, the levels of equipment differ a lot, from nearly zero in some cities up to 100% in Berlin city. It seems however that most cities still have less than 50% of equipment.

Chart 16. Dedicated Bus and Bicycle Lanes (km)*



* Bicycle lanes are included in this section in order to show an indicator of the effort that is being done in some metropolitan areas to create alternative infrastructures to the private car oriented ones.

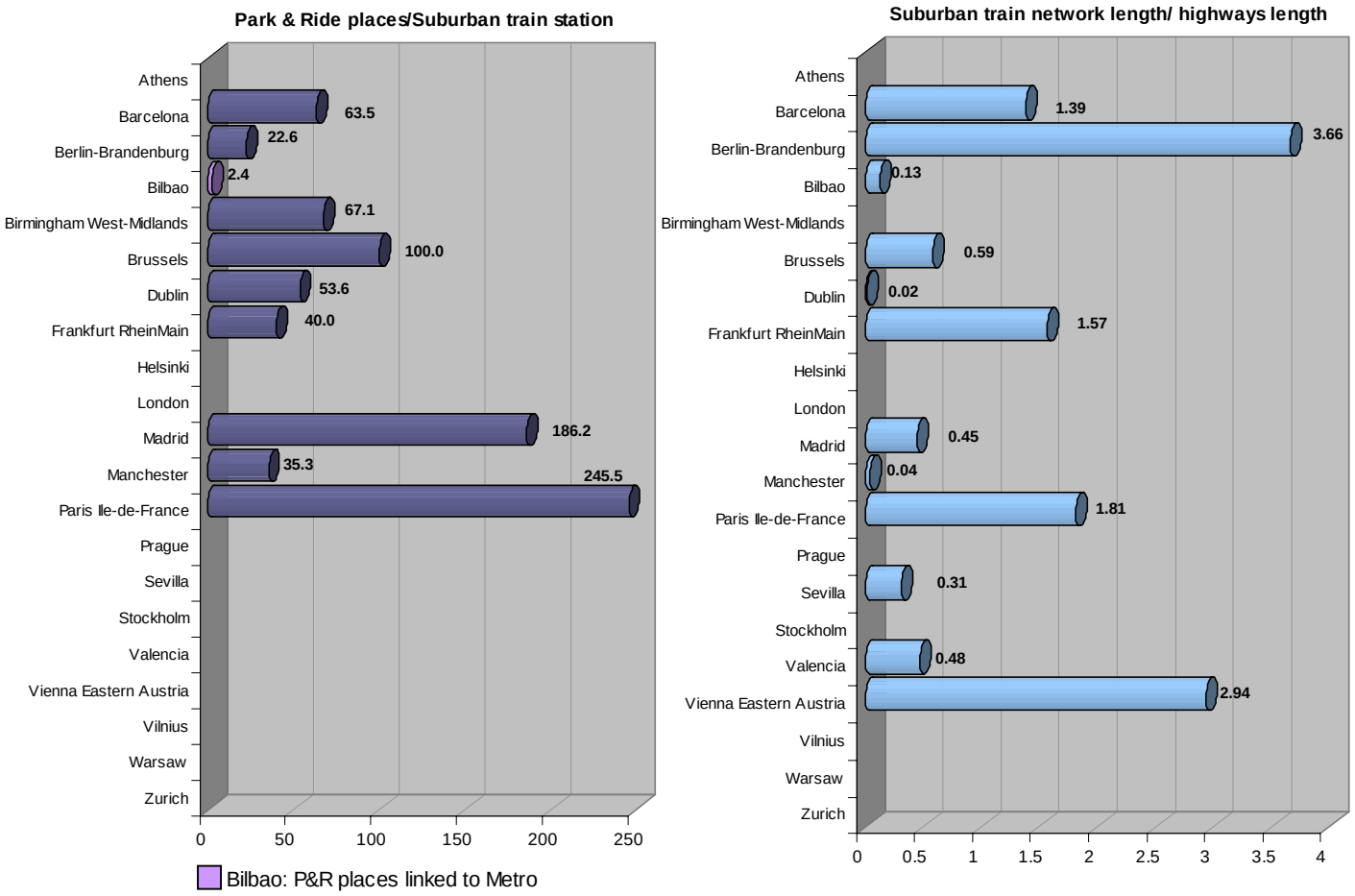
Bus lanes

Chart 16 shows that the cities surveyed have different policies regarding bus lanes. Only Paris, Sevilla and Dublin have more than 100km of dedicated bus lanes. It can be noticed that in two metropolitan areas, Helsinki and Madrid, some bus lanes have been set up on inter-urban roads.

4.3.5 Suburban train quality indicators

Although data are not available for all the cities, Chart 17 (left part) illustrates the strong policies carried out in Paris-Ile de France and Madrid to promote park and ride facilities. In Paris, more than 110,000 parking lots are available close to railway stations. This policy, which has been carried out for 40 years, led to a high share of public transport for radial trips between the suburbs and the centre of the metropolitan area (55%).

Chart 17. Suburban Railways P&R lots by Station and Network Kilometers Compared to High Capacity Roads



Park and Ride facilities have a direct effect on one of the main problems of transport systems of metropolitan areas, which is the congestion on the main roads leading to the city centres at peak hours. Every P&R lot occupied means a car out of road.

It is interesting to consider that private vehicle traffic avoided in Madrid's roads from park & ride facilities is equal to the capacity of four motorway lanes for two hours, that is to say about 10% of the whole number of cars entering Madrid city in the morning rush hour everyday[*].

The contrast between high capacity roads and public transport high capacity systems (railways) shows a clear bet for railways in Berlin-Branderburg and Vienna Eastern Austria where there are three times more tracks than asphalt; and a slight advantage in Paris, Barcelona and Frankfurt-RheinMain.

[*] Source: "Observatorio de la Movilidad Metropolitana". Ministerio de Fomento. Madrid, 2004

5. Financial Aspects

5.1 Public Transport System Costs and Revenues

Table 10 shows that all metropolitan public transport systems need, in some grade, public subsidies to cover their operational costs, a reality due to their public service role and the existence of reduced social fares, among other reasons.

Table 10. Main Costs and Revenues of the Public Transport System

	Yearly Operation Cost (MEURO / year)	Revenues From Ticket Sales (MEURO / year)	Public Subsidies (MEURO / year)	Yearly Operation Cost				Revenues From Ticket Sales				Public Subsidies			
				B	M	HR	T	B	M	HR	T	B	M	HR	T
Athens	345.0	257.0	88.0	70%	30%	0%		65%	35%			83%	17%		
Barcelona	472.2	257.5	188.0												
Berlin-Brandenburg															
Bilbao	153.86	74.72	79.16	66%	27%	7%		51%	43%	6%		80%	13%	8%	
Birmingham West-Midlands															
Brussels	358.0	118.8	214.8												
Dublin	278.3	184.2	129.4	77%		23%		86%		14%		43%		57%	
Frankfurt RheinMain	1,084.0	485.0	458.0												
Helsinki	264.0	164.0	100.0	66%	7%	16%	11%								
London	4,480.6	2,804.5	2,439.0		53%				63%				38%		
Madrid	1,174.8	797.4	485.1	46%	36%	18%		53%	28%	19%		28%	41%	31%	
Manchester	422.0	233.3	188.7	60%	6%	34%		72%	11%	17%		44%	1%	55%	
Paris Ile-de-France [1]	6,200.0	2,300.0	1,360.0												
Prague	339.0	81.0	236.0												
Sevilla	7.5	5.9	1.7												
Stockholm	790.0	366.0	424.0												
Valencia															
Vienna Eastern Austria															
Vilnius	26.5	16.5	8.3												
Warsaw															
Zurich	456.6	272.7	183.9												

B: Bus; M: Metro; HR: Heavy Rail; T: Tram

1= Paris: Most revenues (around 42%) come from a tax dedicated to public transport paid by local employers

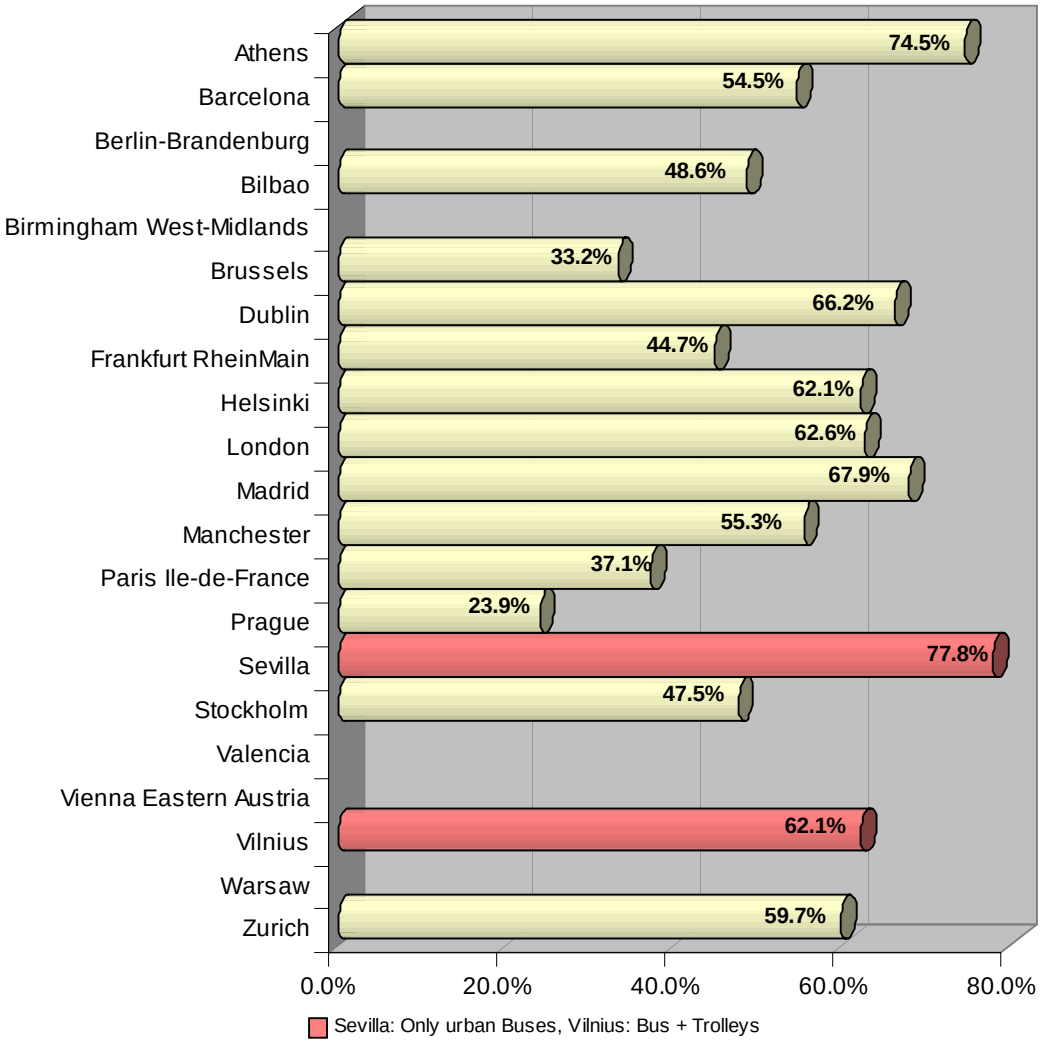
Barcelona: In operations cost and subsidies RENFE (National Railways) and Suburban buses not included
Bilbao: National Railways (RENFE and FEVE) not included.
Brussels: Suburban Railway not included
Prague: In operations cost and subsidies Suburban Railway not included
Sevilla: Only urban bus figures considered
Vilnius: Figures add Bus and Trolley

5.1.1 Coverage of operational expenses of public transport by fare revenues and weight in the cities' GDP

Among the cities which provided data, the rate of coverage of operational costs by fare revenues reaches 47% in average.

The highest levels (more than 60%) are reached in Dublin, London and Madrid, while Brussels, Paris-Ile de France and Prague reach only one third or less.

Chart 18. Coverage of Costs of Operation by Fare Revenues



The lack of information in some cities, specially concerning suburban railways, reduces the value of the data.

For this reason, when the information is available, the coverage rate is shared by mode, that shows clearly which of them have been considered in the calculation, i.e. the coverage rate in Sevilla is 78%, but only the mode bus is considered, which means a poor information about the whole public transport system coverage rate.

When several modes are involved the chart allows to know the weight of different modes in public transport financial schemes, expressed in relative terms.

5.2 Fares and Financial Policy

Table 11. Fares of Integrated Transport Tickets. Main City

Prices in euro.
Exchange rates used:
1€=1.57 FC 1€=0.69 £
1€= 9.05 SEK

	Main City						
	Single ticket	**Day pass**	**Multiple trips coupon**	**Monthly pass**	**Yearly pass**	**Student pass**	**Eldery people pass**
Athens [1]	0.45-0.70			35 or 17.5	175-350	**8.8 or 17.5**	
Barcelona	1.0	4.2	**0.56**	36.3	100.0[6]	*85.0*	0.24-0/trip
Berlin-Brandenburg [1]	2.1	6.1		56.0	532.0	23.0	38.0
Bilbao [2]	1.0			23.0	200.0	145.0	0.25/trip
Birmingham West-Midlands	1.9	7.2		61.0	718.1	182.4	free
Brussels [1]	1.4	3.6	**0.90**	36.0	360.0	270.0	free [3]
Dublin	1.0		*7.70*	76.0	850.0	**69.0**	free
Frankfurt RheinMain	1.9		*4.45*	59.7	597.0	**44.8**	
Helsinki	1.5		**1.01**	34.0			
London	1.9		*7.29*	90.7	943.8	**37.5**	free
Madrid	1.0		**0.50**	32.3	355.3	**22.1**	**8.7**
Manchester							
Paris Ile-de-France	1.3	5.0	**0.96**	46.1	467.3	242.1	free [3]
Prague	0.4			13.3	120.3	**3.2**	
Sevilla [1]	0.9		**0.38**	26.0		**13.0**	free
Stockholm	2.2			55.4			
Valencia	0.9		*4.60*	29.5		**22.1**	12.0
Vienna Eastern Austria	1.5	5.0	**1.50**	45.0	409.0	**19.6**	204.0
Vilnius [1]	0.2	1.2		14.5		**2.9**	**7.2-2.9** [5]
Warsaw [1]	0.6	1,7		18.0	45.2	**9.0**	**9.4** [4]
Zurich	1.3		**1.12**	28.0	272.0 [7]		

Legend multiple trip coupon:**Bold=fare per trip**;*cursive= coupon price*

Legend for student and eldery people pass: **Bold=monthly**; underlined=yearly; *cursive=3 months*

1=Vilnius: metropolitan ring fares
Brussels and Sevilla: city center and metropolitan ring fares
Berlin and Warsaw: metropolitan ring and whole area fares
Athens: Same prices for city center and whole metropolitan area

2= Bilbao: There is a common ticket (creditrans) but fares depend of the transport operator.

3= Brussels: not free in train; Paris:free under certain conditions (revenues, former soldiers, etc.)

4= Warsaw: free for people over 70 years old

5= Vilnius: elderly people 70-85 years old and some groups of disabled people 80% discount

6= Barcelona: three months pass

7=Zurich: Yearly pass data of year 2004

Table 12. Fares of Integrated Transport Tickets. Whole Metropolitan Area

	Whole Metropolitan Area						
	Single ticket	**Day pass**	**Multiple trips coupon**	**Monthly pass**	**Yearly pass**	**Student pass**	**Eldery people pass**
Athens [1]	0.45-0.70			35 or 17.5	175 or 350	**8.8-17.5**	
Barcelona	4.1	12.0	**2.44**	103.0	274.3[6]	*233.2*	
Berlin-Brandenburg [1]	35.7			142.8	1,357.0	107.1	
Bilbao	1.2			46.50	441.8	203.0	0.25/trip
Birmingham West-Midlands	1.9	7.18		81.2	962.19	227.0	free
Brussels [1]	1.8	3.7	**1.20**	58.7	532.3	401.0	free [3]
Dublin	2.6		*7.70*	81.2	962.2	**227.0**	free
Frankfurt RheinMain	11.00/6.60		*22.00*	188.7	1,087.0	**141.5**	
Helsinki	3.0		**2.20**	61.0	610.0	**46.0**	**46.0**
London	3.4		*15.30*	204.3	2,127.8	**87.4**	free
Madrid	2.6		**2.00** [2]	58.9	647.4	**39.0**	**8.7**
Manchester							
Paris Ile-de-France	18.0	18.0	**14.40**	128.0	1,298.8	742.5	
Prague	1.3			29.4			
Sevilla [1]	1.0		**0.75**				0.5/trip
Stockholm							
Valencia	1.9		*9.25*	43.3		**32.5**	
Vienna Eastern Austria				167.9	1,631.3	**19.6**	
Vilnius [1]							
Warsaw [1]	1.2	3.40		24.3	61.00	**12.1**	**12.6** [4]
Zurich	9.1	28.1	**7.53**	130.0	1,118.0 [7]	**94.0**	**94.0**

Categories of fares

As Table 11 and 12 show, most cities surveyed have a wide range of tickets available, with single tickets, tickets for youngsters or students, tickets for elderly people, and season passes usually valid for a day, a week, a month, or a year.

Yearly passes account for the majority of season passes in Zurich, but don't exist in Sevilla.

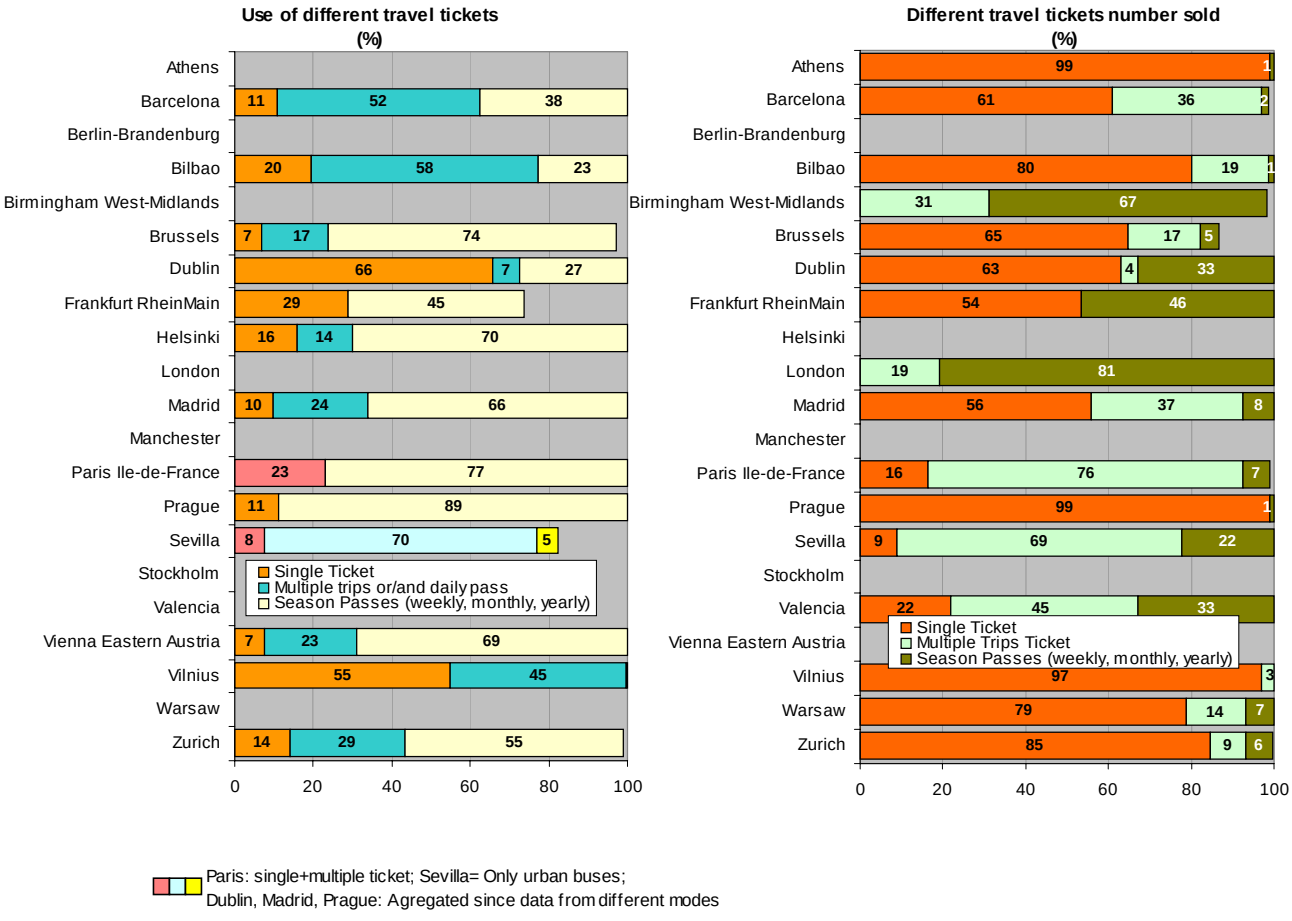
Price of single ticket

The price of a single ticket in the main city varies ten times from 0.2 Euros in Vilnius to more than 2 Euros in Berlin and Stockholm.

The distribution between these limits is roughly homogeneus with ticket price for some of the cities surveyed close to 0.5; 1; 1.5 and 2 Euros.

5.2.1 Travel tickets distribution in use and sales

Chart 19. Travel Tickets shared by Use and Sales of the different Transport Titles



Season passes represent an increasing proportion of tickets used for public transport trips, and can reach more than two thirds of trips in some metropolitan areas (Brussels, Helsinki, Madrid, Paris-Ile de France, Prague and Vienna-Eastern Austria). Season fares enable passengers to travel at cheaper prices, and spare them time since they don't have to buy tickets as often.

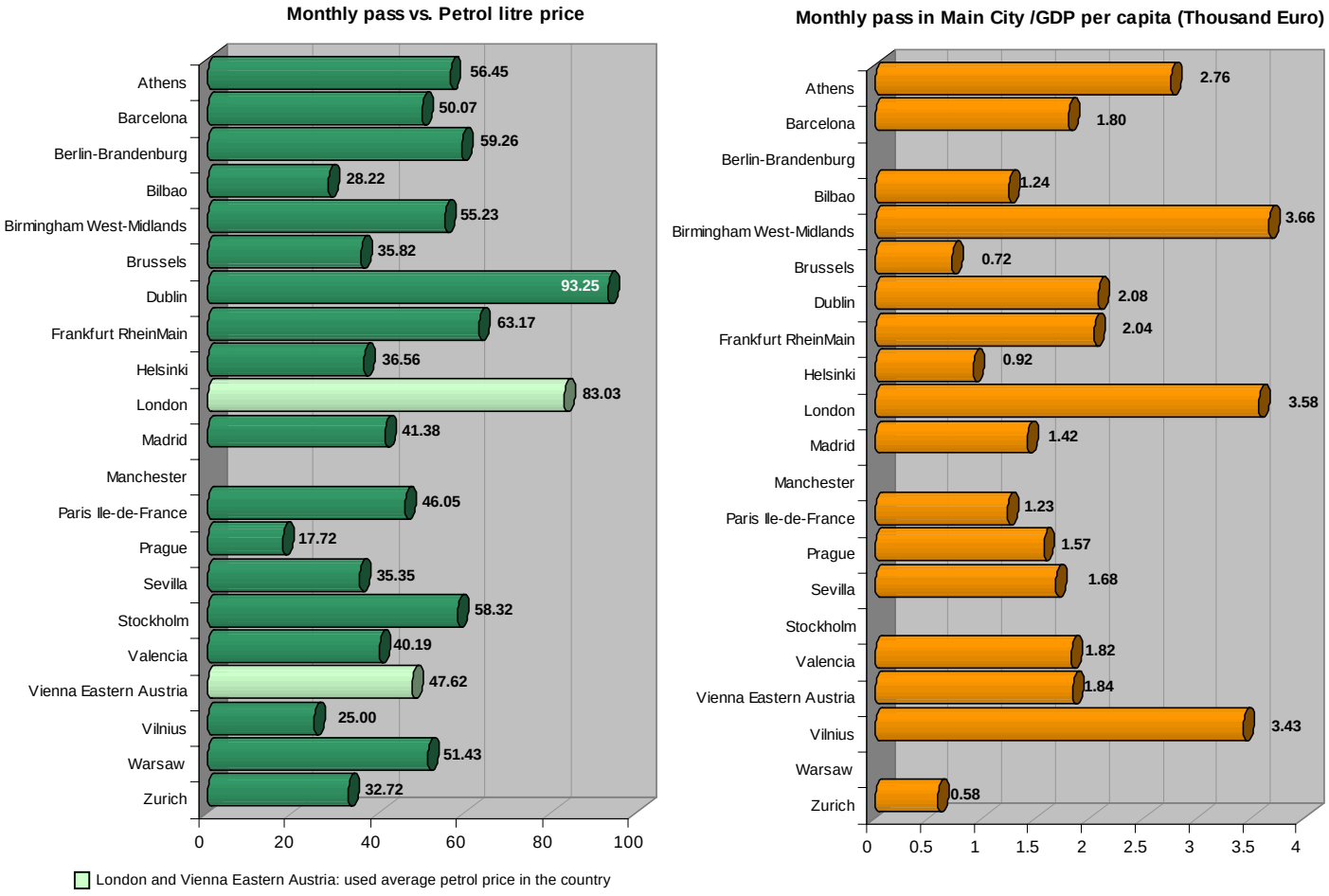
The analysis of how the share of tickets use is translated into the number of tickets sold (right side of Chart 19) shows an intensive use of season passes, because a low percentage (between 5% and 8%) of titles sales accounts for, as was said above, more than two thirds of trips in Brussels, Zurich, Paris-Ile-de-France and Madrid. The most spectacular case is Prague, where 1% of tickets sold are season passes and are used to a 89% of trips.

5.2.2 Public transport price compared to petrol price and GDP

A monthly pass valid for trips in the main city costs, in average, 50 times the price of a liter of petrol in the cities surveyed, as reflected in Chart 20.

The petrol price has been calculated on the basis of the average local price of a liter of diesel petrol and a liter of unleaded 95 petrol for every metropolitan area.

Chart 20. Monthly Pass Fares in main city vs. Petrol Price and GDP

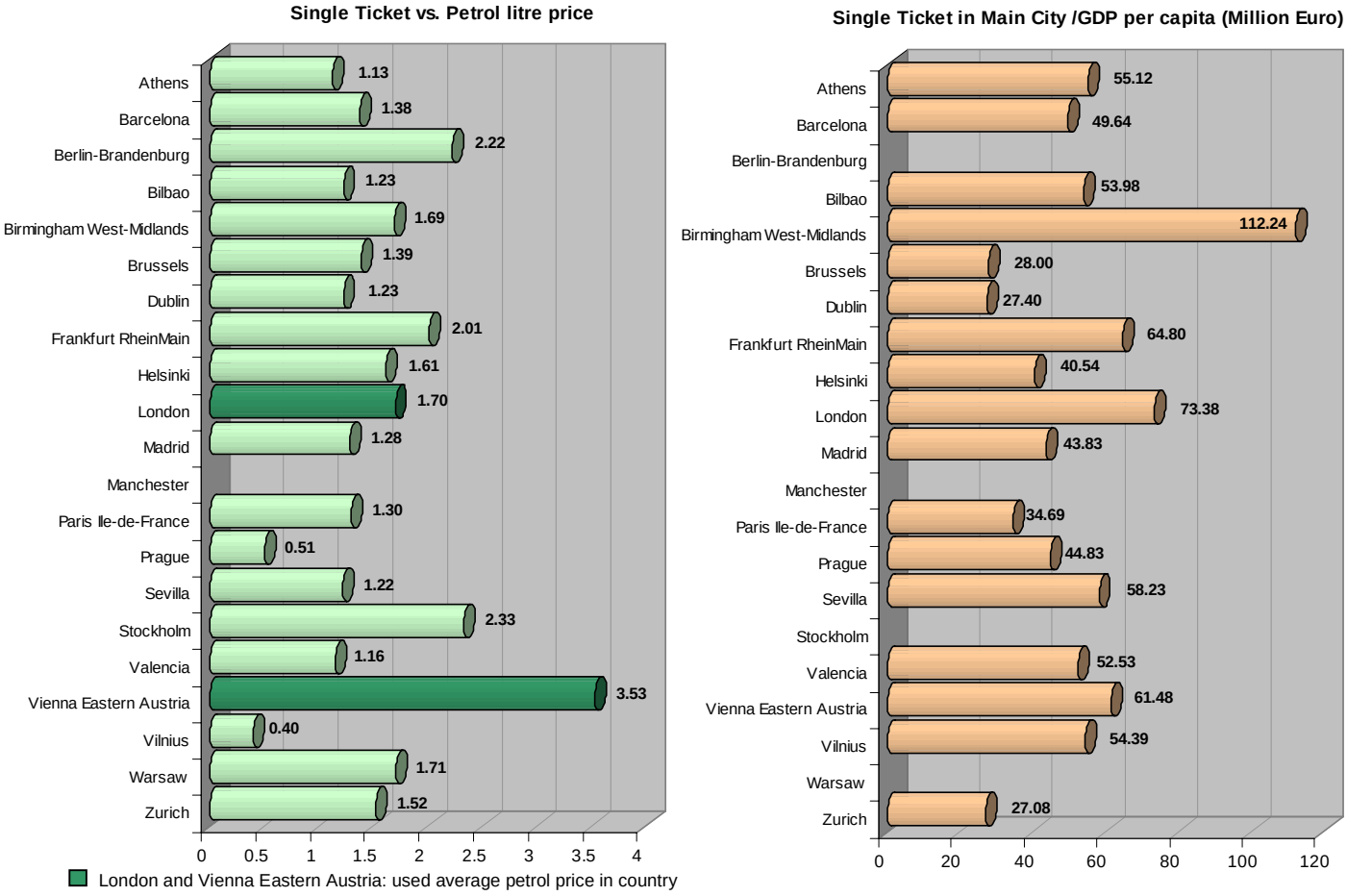


Considering this point of view, monthly passes are especially attractive vs petrol in Prague, Vilnius, Bilbao, and Zurich, while they are, on the contrary, relatively expensive in Dublin and London.

The attractiveness of single ticket, compared to petrol price (Chart 21), is clearly higher in Vilnius and Prague, which have, in absolute terms, the cheapest fares of the cities surveyed. In the other side Vienna has a single ticket fare 3.5 times more expensive than a liter of petrol.

This shows that public transport fares have a much more wide range than petrol price along the European metropolitan areas surveyed.

Chart 21. Single Ticket Fares vs. Petrol Price and GDP



When compared, as is shown in Chart 21 on the right, the price of single ticket with the GDP per inhabitant of each territory, the differences among the various cities become smaller; most of them being within a margin of +/- 25% from the average.

The ratio of the price of a single ticket on local GDP also brings interesting results: Athens and Vilnius, which have apparently quite cheap prices for single tickets (respectively 0.2 Euros and 0.6 Euros) are in fact very close, but above, to the European average (index 54 in Vilnius and 55 in Athens for a European average of 52). In the same way, if Birmingham West-Midlands Frankfurt-

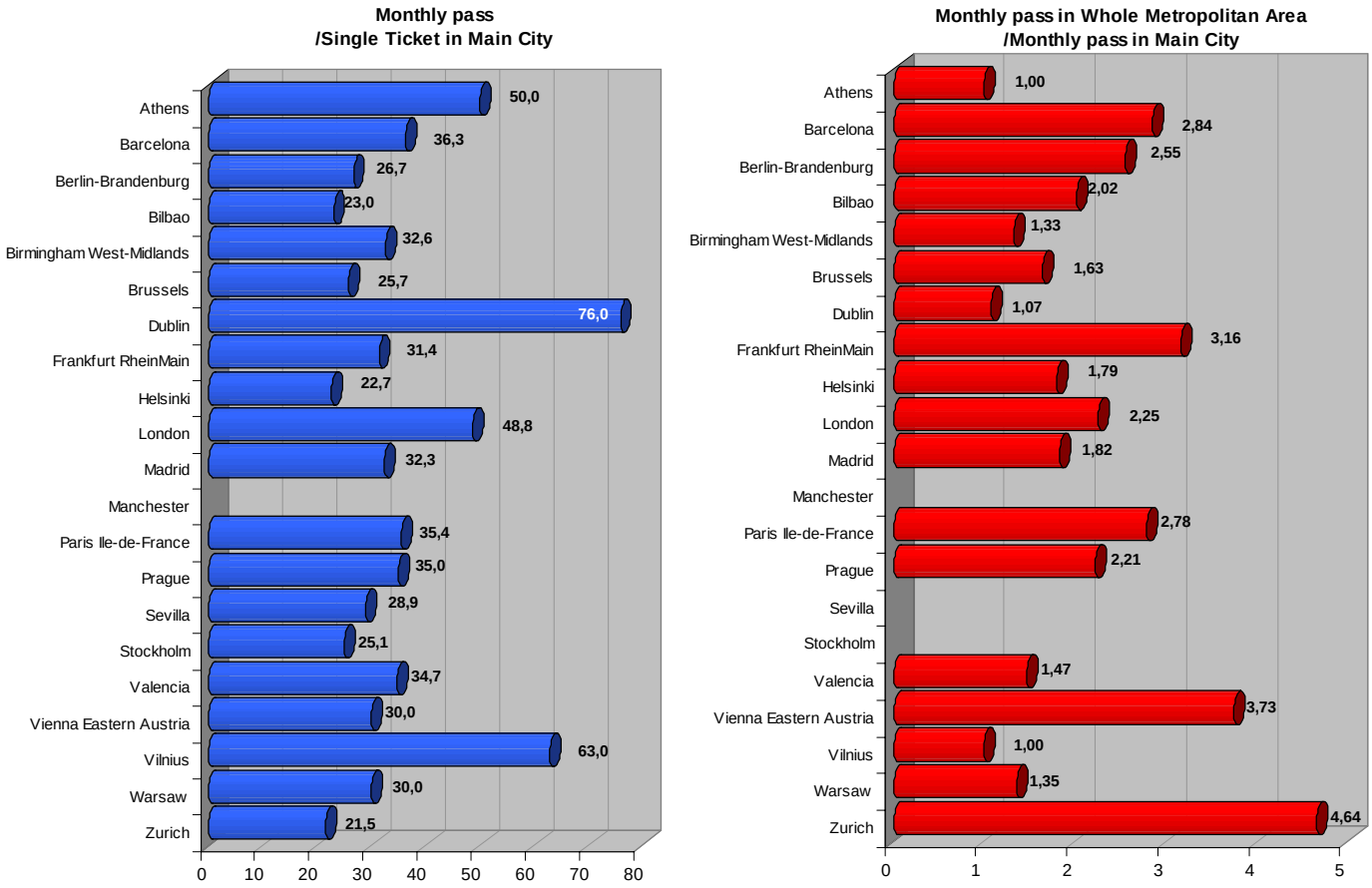
RheinMain, London, and Vienna are above the European average, Dublin and Zurich are much below.

When monthly pass is also considered, as in Chart 20 on the right, the conclusion is that Birmingham West Midlands and London are, in both cases, much more expensive than any other metropolitan area surveyed. By contrast, Zurich and Brussels are, in relative terms, the cheapest cities given their economic wealth. Dublin, which is in the second place for single ticket is behind twelve cities for monthly ticket due to the high price of its season passes.

The result for both indicators of Chart 20 for monthly pass points Bilbao as the metropolitan area surveyed that has one of the most attractive fare policy. In the case of single ticket (Chart 21), Dublin is in the first place.

5.2.3 Comparison of Monthly Ticket Price in Main City with other Fares in Main City and the Whole Metropolitan Area

Chart 22. Monthly Pass in Main City vs. Single Ticket in Main City and Monthly Pass in Whole Metropolitan Area



The ratio of the price of a monthly pass divided by the price of a single ticket (Chart 22) allows to know how many times a passenger has to travel every month before he can save money with a pass.

A monthly pass costs in average 35 single tickets in the metropolitan areas surveyed, with a relative homogeneous pricing policy (in most of the cases, the ratio amounts to between 25 and 35). Athens, London, Vilnius and, above all, Dublin, have the least attractive monthly passes.

Not surprisingly, the territories surveyed with the largest surface (Berlin-Brandenburg, Frankfurt RheinMain, Paris-Ile de France, and Vienna-Eastern Austria) are those where the ratio of monthly pass in the whole territory divided by monthly pass in the main city is the highest. However, there are exceptions, like Barcelona, which has a high ratio compared to the size of the territory concerned.

6. Conclusion

The key findings of this survey can be summarised as follows:

- **Mobility keeps some distinctive features in the different European metropolitan areas**, people moving more in Northern than in Southern Europe.

- **Car ownership rates are nearly twice as high in some cities as in others** (more than 600 cars per 1,000 inhabitants in Zurich vs less than 350 in Athens and Vilnius). There doesn't seem to be any clear relationship between car ownership and public transport use, although the regression line shows a trend to a higher use of public transport for the cities with the lower car ownership values.

- **Public transport systems account for more than 50% of all motorised trips in the densest parts of most European metropolitan areas**, illustrating their fundamental economic, social, and environmental role in large urban territories. In the whole metropolitan areas, the use of public transport is however much lower. This can be explained, in some cases, by an insufficient provision of public transport. But other factors such as the characteristics of urban development (density) and the provision of road infrastructures can also have a determinant impact.

- **The death toll linked to car traffic in the European metropolitan areas is still very heavy (more than 3,000 people killed in the cities surveyed in 2002) and varies a lot**: from 3 persons killed per 100,000 inhabitants every year in the most secure cities, to more than 10 in others.

- **Bus services still make up a very large part of the provision of public transport services in most metropolitan areas**, and shall therefore not be neglected. Only in some of the biggest metropolitan areas do rail modes (metro and railways) account for the major share of supply, which reflects the scale factor related to these modes.

- **The number of tramway routes and systems is increasing very fast in several European metropolitan areas**, confirming the renewed success of this ancient technology after decades of decline.

- **In several metropolitan areas, surburban railway services are still not regarded as a full part of the public transport system**, although the experience of some cities shows that they can play the role of backbone of mass transit systems. Integration of these services with the other urban modes could be improved a lot.

- **The average number of yearly trips per person by public transport is slightly over 200 trips, although some metropolitan areas reach twice as high figures**.

- **The public transport vehicles occupancy can be considered quite low in average.** Between a third and a half of vehicle capacity is not used in average, being a little bit lower in metro and railways modes.

- **The rates of coverage of costs of operation by fare revenues are also varying greatly**, some cities nearing balanced situation, while in others, the rate is much below 50%. Lower fares don't mean necessary lower coverage costs of operation, proving the importance of efficient and cost-effective operation of services.

- **The fare policies and fare levels differ a lot between the various metropolitan areas**, the price of a single ticket varying from less than 0.20 Euros up to nearly 2 Euros for similar trips. The range is wider than direct cost for other modes as a liter of petrol for private car.

- **The share of season passes in public transport varies a lot between the different metropolitan areas but seems to be growing everywhere.** Some cities have more than 50% of all passengers using season passes (daily, monthly and yearly) while a very small group of cities hardly have such tickets available.

7. Annex I : List of Cities Surveyed

This second edition of the EMTA Barometer of public transport in the European metropolitan areas, updates and enlarges the scope of the first one published in 2002, which was based on data of the year 2000. 21 Public Transport Authorities members of EMTA have contributed to this new edition (15 cities had taken part in the first edition).

Table 13. List of Cities Surveyed

Metropolitan area	Authority	Data Available	
		Barometer 2004	Barometer 2002
Athens	OASA	Yes	Yes
Barcelona	ATM	Yes	Yes
Berlin-Branderburg	VBB	Yes	No
Bilbao	CTB	Yes	Yes
Birmingham-West Midlands	Centro	Yes	No
Brussels	STIB-MIVB	Yes	Yes
Dublín	DTO	Yes	No
Frankfurt-RheinMain	RMV	Yes	No
Helsinki	YTV	Yes	Yes
London	GLA	Yes	Yes
Madrid	CRTM	Yes	Yes
Manchester	GMPTE	Yes	Yes
Paris Ile-de-France	STIF	Yes	Yes
Prague	ROPID	Yes	Yes
Sevilla	CTS	Yes	Yes
Stockholm	ABSL	Yes	Yes
Valencia	ETM	Yes	No
Viena-Eastern Austria	VOR	Yes	Yes
Vilnius	MESP	Yes	Yes
Warsaw	ZTM	Yes	No
Zurich	ZVV	Yes	Yes

The questionnaire used to prepare this Barometer contained 745 questions which have meant a big work for the collection of data.

The general lack of information in some aspects and the difficulty to compare non homogeneous data means that it has not been possible to present all of the data collected.

8. Anex II: List of Tables and Charts Contained in the Report

8.1 List of Tables

8.2 List of Charts