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A Comparative Analysis of the Provision of Urban Public Transport: Special Reference to Malaga City

Un análisis comparativo de la provisión del transporte público urbano: Especial referencia a la ciudad de Málaga

Macarena Marchante-Lara Carlos G. Benavides-Chicón University of Malaga

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SUMMARY

Currently, the role of public transport is undeniable: large urban areas are not viable unless suitable public transport is available. This paper characterizes the urban public bus network in Malaga City and compares it to other Spanish metropolitan areas, such as Madrid and Barcelona. We analyze the legislation, regulation, organization and funding of the sector. A comparative analysis of urban mobility in Spanish metropolitan areas and major cities is also presented. Finally, we describe public transport supply from the point of view of overall service and service quality in particular.

RESUMEN

Actualmente, las grandes áreas urbanas no son viables sin la existencia de un transporte público adecuado. Este trabajo caracteriza el transporte público urbano de autobuses de la ciudad de Málaga tomando como referencias otras áreas metropolitanas españolas como Madrid o Barcelona. Se analiza el marco general en el que se desarrolla, atendiendo a su regulación, organización y financiación. Se presenta un análisis comparativo de la movilidad urbana de áreas metropolitanas españolas y sus ciudades principales. Finalmente, se estudia la oferta de transporte, desde la perspectiva de los aspectos generales del servicio, y en particular, desde la calidad del servicio.

1. INTRODUCTION

The focus of this study is the area covered by the *Consorcio de Transportes del Área de Málaga* (Malaga Area Transport Consortium). This includes Malaga City and 12 municipalities which are satellite towns that comprise residential areas, industrial estates, and commercial and service sites.

The metropolitan area of Malaga includes the following modes of transport (OMM, 2007):

- Urban buses: There are buses in all the main municipalities, the most important being Malaga city.
- Suburban buses: All bus lines in the metropolitan area are under the control of the Malaga Area Transport Consortium, which provide services to the 13 municipalities that belong to this metropolitan area.
- Short-distance trains: This service is part of the short-distance railway network run by RENFE (the Spanish National Railway Network).

This paper characterizes the public bus market by analysing demand and supply separately. Section 2 provides an overview of the regulation, organization and sources of funding of urban public transport in Spain. Section 3 analyses the demand for public transport services using a comparative analysis of mobility in the Spanish metropolitan areas and major cities. Finally, Sections 4 and 5 describe the supply of public transport services in relation to the actual networks available and service quality. The final section presents the conclusions and further considerations.

2. GENERAL CONSIDERATIONS REGARDING URBAN PUBLIC TRANS-PORT

According to current legislation, public transport must comply with certain regulations that drive the way it is organised and funded.

2.1. Regulation

In general, urban public transport in Spain has been inconsistently regulated due to the absence of an integrating concept for this service (CCA, 2003). In 1978, the promulgation of the Spanish Constitution and the transfer of power to the new autonomous regions were starting points to address this issue.

Article 137 of the Spanish Constitution states that municipalities and any otherterritorial body into which the Spanish State is organised (Autonomous Regions and Provinces) "...are provided with autonomy for managing their own local interests". This constitutional guarantee of local autonomy is again mentioned in Article 140: "...the Constitution guarantees the autonomy of the municipalities. They shall enjoy full legal status". Given that urban public transport is a sector that has a direct effect on the local community, it would appear natural for it to be under the jurisdiction of the municipalities.

However, the Constitution does not specify the actual interests in which the municipalities are entitled to participate. This issue is regulated by the *Ley 7/1985*, *de 2 de abril, Reguladora de las Bases del Régimen Local* (The 7/1985 Act Regulating Local Systems). This act defines urban public transport (Article 86.3) as an essential service and states that it falls under the authority of local governments. In fact, it is one of the minimum services that any municipality with more than 50000 inhabitants is required to supply. In Andalusia, 29 municipalities have a population greater than this figure (Table 1).

Provinces	more than 50000		
Almeria	3		
Cadiz	8		
Cordoba	1		
Granada	2		
Huelva	1		
Jaen	2		
Malaga	8		
Seville	4		
TOTAL	29		

TABLE 1

MUNICIPALITIES WITH MORE THAN 50000 INHABITANTS IN ANDALUSIA BY PROVINCE (DATA: 1 JANUARY, 2009)

Source: Authors, based on data from the Spanish National Institute of Statistics (INE).

Public transport is thus under the jurisdiction of each municipality, which is both the proprietor and basic unit for coordinating the different modes of transport. The municipality is also responsible for all management and administrative matters. In fact, within current Spanish regulations, urban transport is generally under the management of the local administration. However, the description of competences comes under the legal framework established by the Central or Autonomous governments, as provided in Article 25 of the Law 7/1985. In addition, the increasing

relevance of metropolitan transport, which has been driven by the transformation of urban and suburban transport, has led to supra-local bodies becoming involved and regional governments increasing their level of involvement. This means that the final delimitation of competences and the legal system they come under depend on regulations emitted by central, regional and local authorities.

By analysing current legislation, we can derive the rules that are applied to urban public transport. Firstly, the Autonomous Communities have assumed exclusive competence over urban public transport in Spain. In the case of Andalusia, this is stated in several Articles in the Statutes of Autonomy; in 2003, a law was drawn up that fully regulates the management of urban and metropolitan transport based on national regulations on suburban transport. Secondly, local regulations are always secondary to any regional or state legislation. Section 2.2 provides an overview of how Spanish urban public transport is regulated by characterizing its organization and sources of funding.

2.2. Organization and financing

The manner in which urban public transport services are provided is an important issue. In Andalusia, the Andalusian Law 3/1985 of 22 May 1985, does not expressly state that regular public transport for the general use of passengers is to be defined as public services owned by the municipality. However, Article 9 implicitly assumes that this is the case by establishing that such services should be provided by local government franchisesor by other management approaches. Finally, the different forms of management are actually described in the Law 7/1985.

According to the articles of this law (section 85.1), local public services, including public transport, can be provided directly or indirectly by local authorities (individual model) or in partnership with other municipalities (partnership model). The choice of one or another model is made by the local council at a plenary meeting, as established by Article 22.2.f of this law. Figure 1 shows the most frequently service provision options according to current local regulations in Spain.

The direct provision of a local public service means that the actual Council is liable for the service and is in charge of managing and running the service. This can be done under a partnership model –by creating a *Mancomunidad (Local authority community)* or a consortium– or under an individual model, whereby an existing department from the council is assigned to the task, or a new body with legal standing is created for this purpose and a separate budget assigned to it by the council.

On the other hand, indirect service provision involves transferring the provision of services to a third party, either public or private. However, liability and control over the service still falls to the proprietor of the services, i.e. the city or town council. Within the indirect service provision model there are two main possibilities: the city council licences the service to a third party, usually a private company for a given period and under known conditions, or the Council becomes actively involved in the provision of the service.

FIGURE 1



Source: Mora, 2008.

Currently, the models most widely used in Spain for the provision of public transport are based on either direct service provision, involving the creation of a corporation with 100% municipal capital, or indirect service provision via a local government franchise (Delgado *et al.*, 2009). However, to meet the specific needs of large metropolitan areas requiring not only urban transport, but also suburban transport, some city councils have opted for partnership models in the form of *mancomunidades* or consortia, that bring together both public corporations and private licensed enterprises.

We now describe the models of service provision chosen by the 29 municipalities with more than 50000 inhabitants in Andalusia. Four of the municipalities have opted for direct service provision via a municipal corporation (Cordoba, Huelva, Malaga and Seville). The remaining municipalities have chosen indirect service provision using government franchising. The exception is Sanlucar de Barrameda, which opted for a mixed partnership. It should be noted that whatever model is chosen, the organisation providing the service has a monopoly on the service. However, when municipalities provide the service via a municipal corporation they may outsource some transport lines to other licensed firms (CCA, 2003).

Regarding metropolitan public transport in Andalusia, service provision is organised according to nine major urban areas: Seville, Malaga, Granada, Cadiz, Campo de Gibraltar, Huelva, Almeria, Cordoba and Jaen, which comprise more than 5 million population (Hidalgo, 2008). Under the 2/2003 Andalusian Law of 12 May 2003, the metropolitan consortium was chosen as the best way to provide public services in these areas, and thus the nine major metropolitan areas in Andalusia are currently run by consortia.

The other important issue refers to the sources of financing of public transport services (Carbonell and Cano, 2006). The provision of a high-quality public transport network that enables citizens to move with fluidity, regularity and comfort through the municipality at a reasonable price is probably the main challenge in the sector. Regional regulations, including the 2/2003 Andalusian Law (Article 32), state that urban transport should be funded by the following revenues:

- Revenues directly obtained from the service's users and the exploitation of other resources belonging to the operating companies.
- Taxes that may be applied for this specific purpose.
- Contributions made by the different public bodies in accordance with agreements and contracts, if pertinent.
- Any other way accepted by the legal system.

In the case of Andalusia, the main financial sources are the fees paid by users; the capital provided by the municipalities and the subsidies awarded by the central government according to Budgetary Laws.

The foregoing section introduced the main aspects of the regulation, organization and financing of urban public transport in Spain as a whole, and in Andalusia in particular. We drew attention to the fact that urban public transport in Malaga City is provided via a direct model that gave rise to the creation of a municipal corporation called EMT. In addition, the need to coordinate the development of facilities and to manage and run the transport services within the metropolitan area of Malaga led to the creation of the Malaga Area Transport Consortium, which was established on September 18, 2003, and of which the EMT is part.

3. CHARACTERISTICS OF URBAN MOBILITY IN MALAGA CITY

In order to contextualize the analysis, data from Malaga city and its metropolitan area are compared to data from other Spanish urban and metropolitan areas. The data were provided by the Observatorio de la Movilidad Metropolitana (OMM, Spanish Metropolitan Mobility Observatory), which is composed of the Autoridades de Transporte Público (ATP, Spanish Public Transport Authorities) from the major Spanish metropolitan areas, the Ministry of Environment, Rural and Marine Affairs, and the Ministry of Development (Ministerio de Fomento). The OMM has been providing reports on Spanish metropolitan areas have been progressively incorporated. Currently, data are provided by 17 ATPs, which cover 23 million people, representing 50% of the total Spanish population (Cascajo *et al.*, 2008). For this reason, it is of interest to compare data on urban public transport in Malaga City to the data provided by the OMM.

Next, we present details on the population, area and the number of municipalities included in the metropolitan area –defined as the territory covered by the ATP– under study. These metropolitan areas are divided into three groups according to the size of the population:

- Large (more than 1 million population): Madrid, Barcelona, Valencia, Murcia, Seville and Asturias.
- Medium (between 500 000 and 1 million population): Malaga, Majorca, Gran Canaria, Gipuzkoa, Bay of Cadiz, Camp de Tarragona and Granada.
- Small (less than 500 000 population): Alicante and Pamplona.

This information allows us to compare the Malaga area to other Spanish areas. A common characteristic of the ATP areas is that they are located in coastal areas, with the exceptions of Madrid, Seville and Pamplona. Although many areas in Spain are undergoing substantial depopulation, the areas under consideration present the highest population growth (Pardeiro *et al.*, 2006). According to the data presented in Table 2, Malaga is one of the Spanish cities with a population of more than 500 000, together with Madrid, Barcelona, Valencia and Seville. However, the metropolitan area of Malaga is ranked as being of medium size¹.

¹ Along the article we refer to metropolitan areas by their names, and when we talk about the main city we specify "city" close to the name in order to differentiate it from the metropolitan areas which have the same name as the main city.

One indicator that clearly illustrates the differences between areas is the population concentration ratio (Table 2). This ratio is calculated by dividing the main city area population by the population of the metropolitan area. The results show that more than half the population is concentrated in Malaga city (58%). This is in contrast to other areas with a more dispersed population, such as Asturias, the Bay of Cadiz and Camp de Tarragona, where the population is not concentrated in a single nucleus.

GENERAL CHARACTERISTICS OF THE MAIN CITIES IN SPANISH
METROPOLITAN AREAS (DATA: 1 JANUARY, 2008)

TARLED

	METROPOLITAN AREA		MAIN CITY AREA			Population		
	Surface area (km ²)	Population	Density (inhab/ km²)	Municipalities	Surface area (km²)	Population	Density (inhab/ km²)	concentration ratio
Madrid	8,030	6,271,638	781	179	606	3,213,271	5,304	51
Barcelona	3,239	4,929,000	1,522	164	102	1,616,000	15,921	33
Valencia	1,415	1,775,714	1,255	60	137	807,200	5,898	45
Murcia	11,313	1,426,109	126	45	886	430,571	486	30
Seville	1,997	1,293,703	648	32	141	699,759	4,952	54
Asturias	10,604	1,080,138	102	78	187	220,644	1,182	20
Malaga	1,258	972,762	773	13	395	566,447	1,435	58
Majorca	3,623	855,343	236	53	214	396,570	1,857	46
Gran Canaria	1,560	829,597	532	21	101	381,123	3,773	46
Gipuzkoa	1,980	701,056	354	88	267	184,248	690	26
Bay of Cadiz	2,905	701,275	241	9	14	127,200	8,958	18
Camp de Tarragona	2,999	599,804	200	131	65	137,536	2,109	23
Granada	861	500,479	582	32	19	236,988	12,216	47
Alicante	355	452,462	1,275	5	201	331,750	1,650	73
Pamplona	92	318,865	3,481	18	25	197,275	7,860	62

Source: OMM, 2010.

Note: Main cities of the following **metropolitans areas** are: Oviedo **(Asturias)**; Palma **(Mallorca)**; Las Palmas **(Gran Canaria)**; San Sebastian **(Gipuzkoa)**; Cadiz **(Bay of Cadiz)**; Tarragona **(Camp de Tarragona)**. In the case of metropolitan areas that are not specified, the name of the main city coincides with the name of the metropolitan area. Thus, the metropolitan area of Malaga replicates what could be considered the "traditional" pattern in Spain, i.e., a core nucleus or city which is more densely populated and a progressively less populated metropolitan area.

However, this trend has reversed in recent decades, with metropolitan areas becoming more populated (Montosa, 2012). The influence of social and economic variables, such as the lack of land for development in the cities, rising housing prices, the decentralization of many services and improved transport infrastructures, has encouraged the development of new populated areas around large cities or the growth of existing ones (Cascajo *et al.*, 2008). This has significant implications for transport planning. Given the ongoing changes in settlements regarding size and structure, the creation of permanent public transport facilities is not an easy task. Any public transport system is driven by the patterns of settlement and these needs to be taken into account when studying the supply and demand for public transport.

Figure 2 shows the growth of the population expressed as a percentage during the period 2002-2008. With the exception of Alicante, in all areas the relative increase in the metropolitan area has been greater than in the main city; this trend is particularly marked in Malaga. It must be noted that the number of municipalities included in the metropolitan areas is the same for all the period analysed. Therefore, the increase of population is not due to the incorporation of new municipalities in the ATPs.



FIGURE 2 POPULATION GROWTH IN THE PERIOD 2002-2008

Source: Authors, based on INE

Figure 3 shows the motorization rates for cars and motorbikes in the main cities referred to Malaga City has a large number of vehicles for its population, given that its motorization rate for cars is 473, which is similar to cities such as Madrid (497). The motorization rate for motorcycles (134) is also high because the local climate favours the use of these vehicles.



FIGURE 3 MOTORIZATION RATE 2008 (VEHICLES/1000 INHAB)

These facts, together with the location of Malaga –which has many hills with residential areas built on them– the absence of major roads and avenues, plus poor driving habits (e.g. double parking and parking at bus stops), makes the provision of urban public transport in Malaga rather difficult (OMAU, 2006). Taken together, these factors make it even more crucial to improve the users' perception of a quality service to encourage the use of public transport.

Source: Authors, based on SIMA and OMM (2010)

MODES OF TRANSPORT USED FOR REGULAR TRAVELLING (%)						
City Transport	Malaga	Seville	Valencia	Madrid		
Private car	34.0	26.1	32.7	20.4		
Motocycle	3.8	-	3.7	-		
Public transport	9.5	17.4	14.6	27.4		
Other motor vehicle	3.2	7.4	3.5	4.5		
By foot	49.5	49.1	45.5	47.7		
TOTALS	100.0	100.0	100.0	100.0		

TABLE 3 MODES OF TRANSPORT USED FOR REGULAR TRAVELLING (%)

Source: CIEDES, 2005.



Source: Authors, based on OMM (2010, 2004)

Note: Due to the difficulty in obtaining homogeneous information concerning the demand for urban bus service, we have used the data provided by the OMM reports. These reports compare the variation in the number of trips divided by the population of the metropolitan areas to be able to compare the data in several areas throughout Spain.

According to a recent survey on mobility carried out by the Observatorio Provincial de Sostenibilidad in Malaga (OPS, 2008), 94% of the participants gave work as their main reason for travelling and 6% gave study; 70% gave recreation as their second reason for travelling. Table 3 presents the distribution of modes of transport (in percentages) in Malaga and other Spanish cities. The main mode of transport in Malaga is private car followed by public transport, which, in the case of Malaga, is by bus. The limited use of public transport in Malaga is noteworthy compared to other Spanish cities. In Malaga city, most people use private vehicles –either cars (34.0%) or motorcycles (3.8%)– whereas public transport is the least used (9.5%). However, as shown in Figure 4, the largest increase in demand (34.8%) for bus services, in metropolitan areas, has occurred in the metropolitan area of Malaga followed by Granada (20.3%) and Pamplona (15.4%).

4. THE SUPPLY OF TRANSPORT SERVICES IN MALAGA: EMPRESA MALA-GUEÑA DE TRANSPORTES

The EMT supplies bus services in Malaga and is registered in the Spanish National Classification of Economic Activities under code 60212. The City Council of Malaga created the EMT in 1984 to replace the old municipal urban transport services that had existed since 1 December, 1949.

To meet the need for mobility in Malaga, the EMT has 37 day lines and 3 night lines that cover the city following radial, circular and transverse routes. Most radial lines start from the city center and go to the periphery; the transverse lines form a network joining the peripheral areas of the city; the circular lines are located in areas requiring this type of service and provide a more frequent service, mainly in the city center. Currently, the EMT bus fleet has 257 vehicles (EMTSAM, 2010).

In recent years, the EMT has increased its efforts to use environmentally friendly fuel as much as possible. This objective was included in the 4-year Strategic Plan in 2005. Then, when almost the entire fleet used petrodiesel (73.46%), a trend already existed toward the use of cleaner fuels, such as compressed natural gas (CNG; used by 0.95% of the fleet) and biodiesel (25.59% of the fleet). According to EMTSAM (2010), around a quarter of the bus fleet use petrodiesel (24.51%), whereas more than half use biodiesel (53.70%); the remainder use other sustainable fuels.

In addition to addressing environmental issues, the EMT is improving the fleet by focusing on accessibility. In fact, 93% of the buses are adapted to people with reduced mobility (PRM) by including an access ramp.

The PRM policy was listed in the 2007-2011 Strategic Plan for Universal Access in Malaga and approved in 2008. The EMT agreed to allocate 17.2 million Euros to adapt its buses (Roche, 2008) over the ensuing 4 years.

Bus stops have also been adapted to improve access. During the 1990s, urban planning in Malaga required developers to build bus stops with lay-bys such that the buses did not interfere with traffic flow. This involved taking space from the pavements and thus reduced pedestrian passage. Furthermore, particularly at rush hour, private cars were parked in them, forcing the buses to stop in the middle of the road, with the added problem of bus users having to cross a row of parked cars in order to board the bus. Therefore, a policy that had been designed to facilitate traffic flow had the following negative impacts:

- They reduced pavement capacity and hindered pedestrians.
- They hindered access to the buses by all bus users and disabled people in particular.
- They hindered the possibility of installing bus shelters with information display boards.
- They hindered traffic flow.

TABLE 4 CHARACTERISTICS OF URBAN BUS NETWORKS IN SPANISH CITIES (2008)

	Nº lines	Length of Lines (km)	Bus stops per line	Mean length of lines (km)
Madrid	212	3,781	10,838	17.8
Barcelona	108	1,830	5,599	16.9
Valencia	60	879	2,045	14.6
Murcia	41	658	3,434	16.1
Seville	40	535	1,640	13.4
Oviedo	14	196	750	14.0
Malaga	40	610	1,774	15.3
Palma	25	709	2,191	28.4
Las Palmas	40	813	1,828	20.3
San Sebastian	26	177	1,117	6.8
Granada	28	345	n.a.	12.3
Alicante	15	251	717	16.7
Pamplona	23	370	805	16.1

Source: Based on data from OMM (2010)

To solve these issues, the EMT is developing and implementing a type of bus stop that facilitates access to all people and can be equipped with modern communication systems. The Traffic, City Planning and Social Welfare Departments have participated in this project as well as ONCE, which is one of the largest Spanish foundations for people who are blind or who have severe visual impairment (EMTSAM, 2007). The bus stops have been adapted in two ways: they are provided with a path perpendicular to the street, 1.20 meters wide, as measured from the building facades to the edge of the curb; and there is a strip on the curb alongside the bus stop. The materials used for these differ from the pavement materials so that blind or visually impaired people can detect them by moving their white sticks across the surface. In 2010, the EMT had already adapted 725 bus stops (73% of all bus stops in Malaga municipality).

We now compare urban transport networks in different Spanish cities according to the length and number of lines. Table 4 shows the characteristics of the urban lines in Malaga and other Spanish cities.



FIGURE 5

Source: Based on data from OMM (2010).

According to OMM (2010), in order to directly compare the services provided in the different urban areas, the data is standardised by calculating line density according to the number of inhabitants and surface area. The length of lines per number of inhabitants indicates the level of service provided per capita. The length of lines per surface area shows the geographical extent of these services. If the characteristics of the urban bus network are kept constant, the density according to number of inhabitants varies over time as the population varies, but this does not occur in relation to surface area. Figure 5 and Figure 6 show the density of bus lines and bus stops in metropolitan areas, respectively. The figures together characterize the bus service infrastructure. Most urban areas, including Malaga (1077 km of lines per million population), have a line density per capita ranging from 800 to 2000 km of lines per million population. Surface area density presents more heterogeneous values, ranging from 100 km to 1800 km of lines per 100 km². The surface area density is low in the urban area of Malaga (154 km lines/100 km²). Regarding the density of bus stops, the data is similar. The Malaga area has a similar number of stops per inhabitantto other Spanish cities, but the number of stops per surface area is lower.



Source: Based on data from OMM (2010).

Finally, the EMT has a central depot in Malaga for maintenance and repair. It covers 37020 m² and includes various facilities including areas for fuelling and washing with a sewage treatment plant. The EMT Customer Service offices (130 m²) are located in the city centre.

5. CHARACTERISTICS OF THE PUBLIC TRANSPORT SERVICE: SERVICE QUALITY

This section presents the characteristics of urban public transport in Malaga in relation to service quality. We compare the quality indicators that characterize public transport provision in Malaga from the perspective of users to those in other Spanish cities. We also describe the strategies and policies implemented by the EMT showing the company's commitment to quality service. This description includes the implementation of a management system to obtain quality certificates and the performance of client satisfaction surveys.

5.1. Comparative analysis of quality indicators in public transport service

One of the attributes most often taken into account when evaluating a public transport service is how long the journey takes (Diab and El-Geneidy, 2012). The total time journey on public transport includes the time taken to reach the bus stop, the time spent waiting at the bus stop and the transfer time (Eboli and Mazulla, 2007). The reduction of transfer time is expected to increase transit users' satisfaction (Henser *et al.* 2003). Strategies to reduce total time journey may include reserved bus lanes that allow higher daily commercial speed. Table 5 shows some of the main indicators of quality service, such as the average daily commercial speed, average frequency of buses at rush hour and hours of service, making it possible to compare the values of these indicators for Malaga to other Spanish cities.

	Commercial speed (km/h)	Mean frequency (minutes)	Hours of service
Madrid	13.7	9.4	19.8
Barcelona	11.7	6.0	17.0
Valencia	11.9	6.0	19.5
Murcia	14.2	12.7	n.a.
Seville	12.2	8.0	18.0
Oviedo	15.2	23.1	16.5
Malaga	13.9	9.0	18.0
Palma	16.9	n.a.	21.0
Las Palmas	14.8	n.a.	16.0
San Sebastian	15.4	5.0	19.3
Tarragona	17.8	5.0	15.0
Granada	12.2	11.0	17.0
Alicante	12.0	13.6	16.0
Pamplona	13.1	8.1	16.0
Mean	13.9	9.7	17.6

TABLE 5
MAIN QUALITY INDICATORS OF URBAN PUBLIC TRANSPORT

Note: n.a.: data not available.

Source: Based on OMM (2010).

Successive analyses of urban mobility in Spanish cities confirms that urban buses have a lower commercial speed than railways because they lack specially allocated platforms and are exposed to traffic problems, unless they have their own infrastructure (Cascajo *et al.*, 2008).

The average commercial speed of buses for the Spanish cities analyzed ranges from 12 km/h to 17 km/h, with an overall average of 13.9 km/h, which is also the mean commercial speed of buses in Malaga. As mentioned, commercial speed is a key in attracting people to use public transport and so the implementation of independent infrastructures for buses is a good approach that is beginning to be widely implemented. However, very few bus networks currently have special lanes or priority at crossings and thus their operation depends on the amount of traffic. In fact, the total percentage of kilometres of bus lanes over the entire length of bus network in urban areas reaches only 10% in Barcelona and Valencia (Pardeiro *et al.*, 2006). Figure 7 shows the percentage variation in annual average commercial speed for urban areas analyzed during 2002-2008.

The frequency of buses is another parameter that makes public transport attractive to users. Table 5 shows that this parameter varies considerably, ranging from 5 minutes to 23 minutes. Buses in Malaga City have a mean frequency of 9 minutes during the rush hour; this is below the average of other Spanish cities (9.7 minutes). The average number of hours per day the bus service runs in Malaga City is around 18 hours. In this case, there are few differences between cities. Overall, the bus service in Malaga presents slightly better values than other Spanish cities regarding frequency, commercial speed and operating hours.



Source: Based on data from OMM (2010).

Figure 7 indicates the amount of effort invested in improving this important aspect of service quality. Interestingly, during the period under study, this parameter worsened in most of the Spanish cities studied and in particular in Pamplona (-11.5%).

Of note, the greatest increase in this parameter occurred in Malaga City (+6.4%). This finding may be due, among other factors, to the considerable increase in the number of bus lanes introduced. In 2002, there were 2664 m of bus lanes, whereas by 2008 this had increased to 11896 m.

Another factor that encourages the use of public transport is access for, geographic accessibility, and real-time information. As pointed out, 97% of the bus fleet in Malaga is fully adapted to PRM. This percentage is very similar to the one found in larger cities, such as Madrid and Barcelona, where their entire fleet is adapted to PRM. In fact, all the urban areas analyzed present over 75% for this indicator (OMM, 2010). In terms of geographic accessibility, this can be measured by the availability of bus stops near home, as the journey by public transport usually includes walking to the bus stop.

Table 6 shows the percentage of the population with bus stops within 300 m of their home and the number and percentage of bus stops with real-time information displays. The percentage of bus stops with information displays ranges between 0% and 15% with a rather low average (7.2 %); thus, there is room for improvement. Nevertheless, these values are much higher than those found in suburban bus networks (Cascajo, *et al.*, 2008).

Geographic accessibility presents better values than the previous parameter, as 68% of people have a bus stop within 300 m of their homes. In Malaga City the value of these indicators is well above the average; 13.1% of total stops have real-time information displays and 96% of the people have bus stops within 300 m of their home.

In addition, given the relatively recent change in perception among the general public regarding environmental issues, the use of a low-emission fleet represents added value from the point of view of service quality. As mentioned, more than 75% of the vehicles run by EMT in Malaga use environmentally friendly fuels.

However, low-emission buses are defined in terms of engine technology, i.e., buses equipped with an engine whose emission levels are substantially lower than the European standards. These buses include those powered by hydrogen fuel cells, compressed natural gas, liquefied petroleum gas (LPG) or petrodiesel, provided they do not exceed the emission levels set by the European standards Euro IV and Euro V. Of the cities studied, Barcelona, Seville and Malaga alone have bus fleets composed entirely of low-emission buses (data for 2008). Malaga alone has buses compliant with Euro V (OMM, 2010).

ACCESSIBILITY FOR 2008					
	Urban bus stops with real-time information displays	% Urban bus stops with real-time information displays	% Population with a bus stop less than 300 m from home		
Madrid	48	1.1	94		
Barcelona	55	2.2	82		
Valencia	80	7.1	100		
Murcia	21	1.3	n.a.		
Sevilla	100	10.4	96		
Oviedo	75	15.6	n.a.		
Malaga	130	13.1	96		
Palma	90	9.1	68		
Las Palmas	23	2.9	n.a.		
San Sebastian	74	14.9	98		
Tarragona	0	0	100		
Granada	45	15.6	96		
Alicante	20	n.a.	88		
Pamplona	0	0	100		
Mean		7.2	92.5		

TABLE 6 INFORMATION ON URBAN BUS STOPS AND GEOGRAPHIC ACCESSIBILITY FOR 2008

Note: n.a.: data not available

Source: Based on data from OMM (2010).

Finally, another service quality indicator is the level of implementation of operations assistance services (OAS). The OAS uses GPS and provides real-time information regarding the time of arrival of the next bus, destinations and so on via displays located at the bus stops. All Spanish cities studied make extensive use of OAS (95% of the buses), except for Seville and Tarragona (with 1% and 15%, respectively). In 1987, when GPS technology was still in its infancy, Malaga had already implemented a GPS system to locate their fleet and increase punctuality. In 2010, 100% of their buses use the OAS system.

5.2. Quality management system and customer satisfaction survey

Different methodologies or models have been developed to give substance to the concept of quality and its relevance to the management of organizations. In

general, quality management is based on two types of models: self-assessment and certificate-driven models (CETMO, 2004).

The most relevant certificate-driven model is represented by the standards created by the International Organization for Standardization (ISO) in many fields. The ISO 9000 family of standards is related to quality standards (AENOR, 2005): ISO 9000:2005 addresses quality management systems, describing their fundamentals and defining related terms; ISO 9001:2008 specifies the requirements of a quality management system in organizations to enhance customer satisfaction via an efficient management system aimed at meeting the customer's requirements; UNE-EN ISO 9004:2009 deals with managing the sustained success of an organization. This standard provides a broader approach to quality management than ISO 9001 because it addresses the needs, expectations and satisfaction of all the stakeholders (AENOR, 2008); finally, ISO 19011:2002 provides guidance on the principles of auditing quality management systems and environmental management systems. Its hould be noted that UNE-EN ISO 9001:2008 is the only standard used for certification.

Another important standard in Spain is the UNE-EN 13816:2003, which describes the requirements for defining and setting goals and measuring service quality in public transport. The standard serves to interpret customers' expectations and their perceptions of quality (AENOR, 2003); it was created to specifically respond to the needs of urban and intercity passenger road transport. It is important to highlight that the standard must be fulfilled by the services and not by the service provider. This means that the certificates are issued to the services offered (lines, operating centres, etc) and not to the organization as a whole.

In addition to the above standards, other standards exist. The ISO 14000 family of standards is related to specifications and guidelines for environmental management systems and include the environmental policies implemented by the organizations to control their impact on the environment. OHSAS 18001:2007 provides certification on occupational health and safety management systems.

The proliferation of management systems has led to the development of other standards that offer guidelines for their integration, such as UNE 66177:2005 (Management Systems: Guide for the integration of management systems).

Regarding self-assessment models that address Total Quality Management, the European Foundation for Quality Management (EFQM)model is one of the most relevant models for transport companies. It was created by the EFQM and since 1992, it has offered the European Quality Award. The application of this model involves assessing eight major criteria for which a number of recommendations and guidelines are provided that help the company analyse their own organization. The model can be applied as tool to encourage organizations that are applying for the award or as a self-assessment tool for organisations that want to know their position in relation to the criteria provided (Sala, 1999).

In Malaga, the EMT has implemented an integrated quality and environment management system that also includes occupational health and safety policies. In 1999, the company obtained the Standard UNE-EN-ISO 9001 after 3 years of dedicated effort that involved changing the work habits of 90% of their workforce via courses and other activities. This quality management system was the most widespread and internationally recognized at the time. This process was conducted with the advice of external consultants from the company Novasoft, and since then, the EMT has continued to periodically renew their license by external audit conducted by The Spanish Association for Standardisation and Certification (AENOR). In 2000, the environmental management system was implemented according to UNE-EN-ISO 14000, and since 2004 the EMT held the Occupational Health and Safety Management System, according to OHSAS 18001. Thus, this company became an exemplary organisation in quality at the national level, as it was the first national urban transport company in Spain to be certified by the three systems mentioned ACAM (2010a).

Table 7 includes the management certificates obtained by Spanish transport companies operating urban buses in the main cities of the metropolitan areas analyzed (data referring to 2008). This information allows us to determine the level of implementation of the EMT's management system compared to other similar Spanish companies.

With some exceptions, such as Majorca and A Coruña, the majority of transport companies have some type of certification. As expected, the majority are certified according to ISO 9001 standards. UNE 13816 is a more recent standard and is thus less widespread. The route to obtaining an integrated management system is often to begin with a quality management system, then an environmental management system and finally the implementation of OHSAS 18001. After quality certification has been obtained, most companies focus on meeting the environmental Standards according to the ISO 14001. Finally, only the bus companies from Granada and Malaga have now an integrated management system encompassing quality standards, environmental impact and risk prevention.

Returning to the instruments used by the EMT for quality management, the company has also implemented the EFQM self-assessment model. As a result of this, and in their efforts to follow the European model of corporate governance, in 2006 the company was awarded the Andalusian VII Award for Excellence in the category of large companies.

In 2010, after auditing the EMT's facilities, the Agencia Estatal de Evaluación de las Políticas Públicas y la Calidad de los Servicios (AEVAL) awardedthecompanythe "Excellent" level according to European Standards. Thus, the EMT became the first company in the transport sector in Spain to receive the "AEVAL Seal", also called the "Gold Seal", having gained more than 500 points. To date, only two other

Spanish companies and organizations –although belonging to other sectors– have been awarded the same level: the EMT is the third company to have received this in Spain (ACAM, 2010b).

		MANAGEMENT CERTIFICATES			
	Client satisfaction	Quality		Environmental	Occupational risk prevention
	Surveys	ISO 9001	UNE 13816	ISO 14001	OHSAS 18001
Madrid	V		√ Lines 22 and 75 √		
Barcelona	\checkmark	\checkmark	In several operating centres √		
Valencia	\checkmark		25 certified lines	\checkmark	
Seville		\checkmark			
Oviedo		\checkmark			
Malaga		\checkmark		\checkmark	\checkmark
Palma					
Las Palmas	\checkmark	\checkmark			
San Sebastian			 In process 28 and 5		
Tarragona	\checkmark			\checkmark	
Granada	\checkmark	\checkmark	√ Lines 4 and 8	\checkmark	
Alicante			 √		
Pamplona	\checkmark	\checkmark	Lines		
Vigo		\checkmark		\checkmark	
A Coruña					

TABLE 7 SURVEYS AND CERTIFICATES OBTAINED BY SPANISH TRANSPORT COMPANIES

Source: Prepared from data provided by the Urban Public Transport Companies and OMM.

Furthermore, in the setting of management, assessing customer satisfaction is already a common practice. The ISO 9001 standard includes this as a requirement and the EFQM model considers customer service as the criterion with the greatest weight (CETMO, 2006). In fact, customer satisfaction is a key indicator to assess the overall performance of the organization and its analysis assists in creating a culture of continuous improvement in management. For these reasons, since 2003, the EMT carries out a survey regarding their service and customer satisfaction, like all the other public transport companies studies, with the exception of Alicante (Table 7).

However, Barcelona City is the only city that goes a step further and analyses the results of the customer satisfaction survey by calculating indicators such as the Customer Satisfaction Index (CSI) and the Customer Perception Study (EPC) (Sala, 1999). In other cities, including Malaga, the results of the surveys are designed to show the overall opinion of users regarding their satisfaction with different aspects of the service and its operation. However, no external indexes are available to "hear the voice of the customer", obtain information on how their expectations change over time, and compare the results obtained by other companies in the sector.

6. CONCLUSION

This paper analysed the characteristics of public transport in Spanish metropolitan areas with a special focus on Malaga City. In Andalusia, urban public transport is regulated according to the Ley 2/2003, de 12 de mayo, (Act 2/2003 on the Management of Urban and Metropolitan Transport in Andalusia) and local laws have to comply with this Act. Malaga city buses are run by a municipal corporation, a management model widespread in Spain. The provision of services for the metropolitan area of Malaga is managed by the Consorcio Metropolitano del Área de Málaga. The municipal company EMT is a member of the consortium and is in charge of bus services in Malaga.

Regarding mobility, the usual structure found in urban and metropolitan areas tends to be reversed in Spain and this is particularly marked in Malaga, where the population in the metropolitan area has increased more than in the city itself during the period 2002-2008. The main challenges for public transport in Malaga City are its geographical location, a high rate of traffic and the high use of private vehicles. Although Malaga is the city in which buses are the least used form of transport for travelling to work, it is also the metropolitan area which has undergone the greatest increase in demand for buses since 2002 (34.8%).

Of note, most of the EMT's fleet (over 75%) is powered by sustainable fuel. The comparative analysis of fleets in relation to motor technology shows that only Barcelona, Seville and Malaga have fleets composed entirely of low-emission buses. Additionally, 93% of the EMT vehicles and 73% of the bus stops are adapted for PRM. The direct comparison of public transport services in urban areas regarding surface area and population densities shows that the Malaga area has a population density regarding lines and stations similar to other Spanish cities, although the surface area density is lower.

From the perspective of service quality, the indicators of travelling time (frequency of service, commercial speed and hours of service) show that the EMT's bus services have slightly higher values than other Spanish cities. In particular, Malaga city buses have undergone the greatest increase in commercial speed during the period 2002-2008. Regarding the indicators for access by PRM, geographic accessibility and real-time information, Malaga is in all cases above the average compared to the cities under study. In relation to the implementation of management systems to improve quality, the urban transport companies in Malaga and Granada are the only ones that have an integrated management system encompassing quality, the environment and the prevention of occupational hazards. All the public transport companies studied analyze service delivery and customer satisfaction, with the exception of Alicante.

As mentioned above, most transport companies have already implemented one of the standard quality satisfaction models. Therefore, the information needed to effectively estimate an index of satisfaction is already available. However, this information has been used for practical purposes only in Barcelona. It is the only city conducting analyses that involve creating indicators based on the results of the satisfaction survey. Transport companies could use a satisfaction indicator as a tool to efficiently exploit such data. It is clear that a common satisfaction indicator is needed in order to compare the transport service provided in Spain and have a better understanding of the relationship between customer satisfaction and public transport service quality. At present, there is some research related to satisfaction indicators in several different urban areas (Hensher and Prioni, 2002; Eboli and Mazulla, 2008), but there is no consensus in the use of the satisfaction indicator. Future studies should focus on comparisons with other national and international transport companies to obtain conclusions that are more widely accepted.

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