TRAFFIC REGULATION AND PARKING MANAGEMENT OF TOURIST COACHES IN URBAN AREAS: AN OVERVIEW AT EUROPEAN SCALE

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ABSTRACT

In recent years, more and more municipalities have introduced the analysis of tourist transport demand in their own strategies for local mobility systems, focusing on the impacts of tourist coaches circulation and parking operations on the urban environment and its accessibility. Regardless of the city pattern, mobility management of tourist coaches is based on some key factors which affect the planning of dedicated parking areas. This paper focuses on these elements and analyses at European level several tourist coach tour schemes and/or related parking plans. It also provides an overview that describes the peculiarities of the different parking plans in cities of different sizes - from Brussels (140,000 inhabitants) to Rome (2.7 million inhabitants), including Salzburg, Amsterdam, Munich, Barcelona and Paris. Some interesting concepts emerging from such analysis are as follows. Firstly, tourist coach plans generally set parking charges and time-limited occupancy policies that vary on the basis of parking lots typology and supply availability. Secondly, Municipalities managing urban areas equipped with a limited parking supply usually set strict circulation and parking schemes and locate public transport services terminals next to long-stay parking areas. Other urban contexts are provided with few parking lots that are well integrated within the public transport network, whereas metropolitan areas generally offer

numerous parking lots dislocated both within the peripheral and the inner city, depending on different levels of access and parking conditions. Finally, two common elements are essential to guarantee efficient coach plans. The first deals with plan dissemination; in particular, every Municipality aims at informing coach drivers/operators about urban access conditions and location of parking lots via local signposts and brochures or maps at entry/check points. Within larger urban areas, coaches operators can also consult an e-plan (available via web) to prepay parking passes and get information on the real traffic condition and actual parking availability. The second is based on monitoring coaches (at access/check points, at parking bays and on-street) and aimed at guaranteeing compliance of the rules, in terms of no-parking zones and time limits, as well as reducing coach traffic load on accessing and connecting road links.

Keywords: parking management, tourist coaches, coach plans, urban areas.

INTRODUCTION

In recent years, more and more municipalities have introduced the analysis of tourist transport demand in their own strategies for local mobility systems, focusing on the impacts of tourist coaches circulation and parking operations on the urban environment and its accessibility. Regardless of the pattern (metropolitan, urban, rural, etc.), mobility management of tourist coaches is based on some key factors which affect the planning of dedicated parking areas. The size of the urban area is one of the major parameters influencing capacity [1], i.e. the location and typology of coach parking areas. For example, a single parking lot can represent a good balance for small urban or rural areas. When urban and/or land-use constraints are not present, this facility can probably be located in a central position, a sort of barycentre ideally equidistant from the main tourist sites and providing good pedestrian accessibility for visitors. However, this represents a particular case mainly occurring in rural contexts and/or poorly urbanized places. In larger European cities coach parking plans are generally based on a relatively uniform distribution of parking spaces spread over the whole municipal area. Such a practice is meant to improve local accessibility by avoiding a concentration of tourist traffic flows headed to a single parking destination and to better distribute land surfaces dedicated to coach stops and parking. Just as an example, it is interesting to illustrate the parking design standards (Figure 1) which, like all transport related activities (static and dynamic), take up a large area of land surfaces:

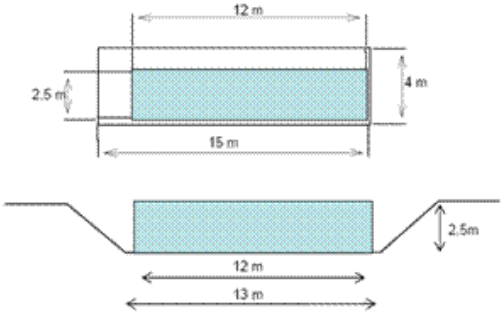


Figure 1 - Design standard for coaches spaces (above) and pick-up/drop-off points (below)

In fact, considering that touring coaches are 12.0 m long x 2.5 m wide, the minimum space required for passengers pick-up/drop-off is 13.0 m x 2.5 m. Moreover, such space must provide a straight kerbside and there must not be any other designated parking either in front or behind the coach bay. Where pick-up/drop-off points are in a dedicated bus bay on kerbs, footways or near dedicated car parking areas on main road axes, a minimum length of 19.0 m is required with a midsection of 13.0 m x 2.5 m. In both cases, for each additional coach drawing into the point at the same time, a 12.0 m length should be added to the overall length [2].

Land is a precious resource and is becoming scarcer and scarcer, especially in urban and high density environments. As a result of such great consumption of land and major local and diffused congestion in urban areas caused by coaches tours - not only on the links close to tourist attraction sites but also on the surrounding road network – the common criteria adopted aim at limiting coach traffic on main access arterial links, allowing temporary stops (drop-off/pick-up points) and parking (on-street and in the dedicated bays) only in selected zones.

TOURIST COACHES PARKING SUPPLY ANALYSIS AT EUROPEAN SCALE

Based on the above-mentioned factors, in terms of the number of parking areas and territorial range, the next step deals with a critical analysis at European level of several tourist coach tour schemes and/or the related parking plans, in order to provide an overview describing the peculiarities of the different parking plans in cities of different sizes - from Brussels (140,000 inhabitants) to Rome (2.7 millions inhabitants), including Salzburg, Amsterdam, Munich, Barcelona and Paris.

Salisbury (45,000 inhabitants)

Salisbury is a fine medieval town situated in Southern England's rural heartland, namely South Wiltshire, and is 150 km from London. In recent years there has been an important increase in the number of visitors to Salisbury, mainly in the summer season, and almost 10% of them come in organized coach parties. According to tourist transport demand data [3] and compared with the results of a survey conducted two years ago, such trend is destined to rise as tour groups have increased by a yearly average of 2.5 %.
In Salisbury the main attractions in the historical centre are within walking distance. The urban area is served by two main coach parking area (Figure 2), respectively called *Millstream* and *Britford Park & Ride*, located at the opposite sides of the city centre.

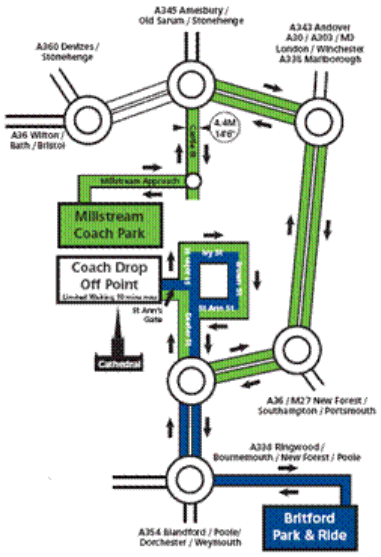


Figure 2 – Coach parking areas and recommended routes [2]

The former has a capacity of 23 bus parking spaces, is a fully-equipped area (including a drivers rest room with seating, television and snack/drink vending machine) and is connected to a visitors walkable access to the *Cathedral*. The second is located about 1.5 km from the centre, has 18 parking spaces and is more convenient for coaches coming from the South; in fact, coach drivers can stop at the drop-off and pick-up point located in *St. John Street* (close to the cathedral) and then park in *Britford P&R* and use a free bus ticket to the city [4]. The municipality has also distributed the recommended routes map in order to provide drivers with information on easy routes to the three different parking zones and also on the Castle street restriction for coaches over 4.4 m in height.
During the summertime, the city access points are also manned by traffic staff providing drivers with information on parking and routes in order to monitor mobility conditions and improve local accessibility.

Brussels (140,000 inhabitants)

In the last decade the city of Brussels has seen a meaningful increment in the number of visitors, of whom approximately 70% are “business” visitors, mainly linked to the European Commission and to several international Bodies. However, in recent years, also “leisure” visitors have increased by about 50% from 1997 to 2003 [5]. In addition, tourism stays are up by 66.3% on 1997, by 37.09% on 2000 and by 6.5% on 2006 [6] and it is also estimated that such trend will continue thanks to the Tourist Office’s successful promotion of numerous tourist attractiveness and events.
Concerning the mobility system, Brussels presents the following features:

> *with one vehicle for less than two inhabitants, Brussels has one of the highest motorisation rates in Europe. This can be partly explained by the fact that, thanks mainly to Expo 58, efficient road infrastructures were*

> *quickly available to the public at the very time the automobile "took-off" which reinforced the "4-wheel dream" [Hubert, 2008]. The result is a discrepancy between an oversized road and parking lot infrastructure in some areas and the capacity of a city where most neighbourhoods were not designed with cars in mind.* [7]

and this is the reason why the configuration of parking supply privileges mainly accessibility for coaches coming from the northern areas area of the city. In fact, Brussels is provided with ten main designated areas for tourist coaches parking; in particular, these areas are all inside the ring road (approximately 9 km from the city centre) and have different time limits - short, medium and long stop - and capacity from 4 to 16 spaces (Figure 3).

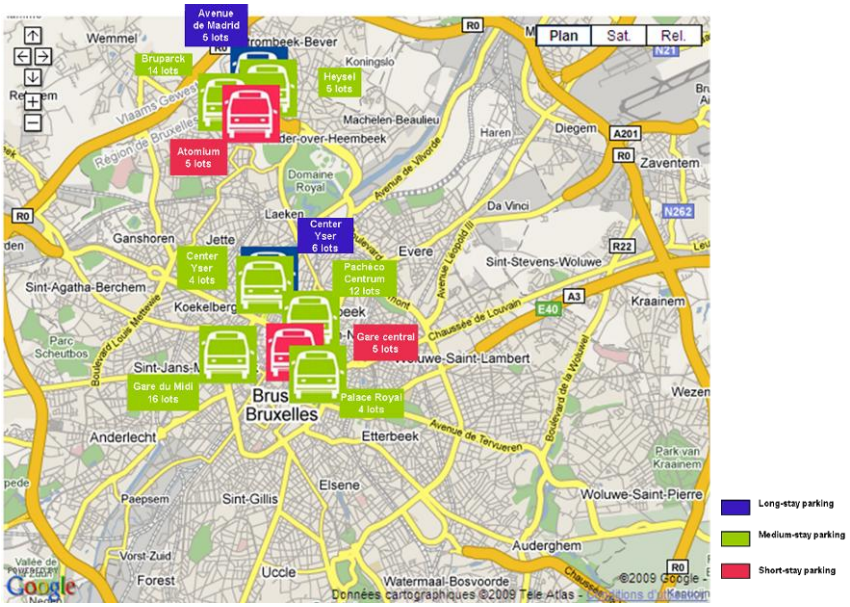


Figure 3 – Brussels: coach parking locations [5]

There are two long-stay parking areas where parking is allowed for more than five hours and/or for one night; in particular, the former is located in a peripheral zone close to the external road ring, while the latter is within the inner urban road ring (nearly 5 km from the centre). In addition, six medium-stay parking zones, where parking is limited to five hours a day, are distributed within the urban area. The total medium-stay capacity is 55 spaces all placed in equipped bays and dedicated spaces located along the kerbsides. Parking spaces with an average fee of 10 euros/day are distributed as follows:

1. Heysel (5 spaces) e Bruparck (14 spaces) in the North sector;

2. Boulevard Pacheco (12), Center Ysér (4), Gare du Midi (16) and Palace Royal (4) in the city center.

Moreover, there are two short-stay parking areas, respectively located close to the central railway station (*Rue Cardinal Mercier*) and the *Atomium* where 30 minutes stops plus visitors drop-off/pick-up are allowed.

Salzburg (150,000 inhabitants)

The Austrian town is a well-known international venue hosting famous festivals. It is also an important tourist destination as it organizes numerous permanent and seasonal events that attract a growing number of visitors every year
At present Salzburg is not equipped with a tourist coach parking plan even if, being one of UNESCO world heritage sites, the municipality is in need of a plan to monitor and manage visitor flows (individual and in group). This plan could lead to regulation of tourist coaches mobility within the urban area.
Within the urban perimeter, tourist coaches parking is allowed only in designated zones, as well as in areas belonging to hotels and restaurants. Depending on which direction they come from, arriving coaches are directed towards well-defined parking spaces [8] (Figure 4)

Figure 4 - Parking areas and their connection to the terminals located close to the pedestrian zone (border line in red) [5]

In particular, northward bound coaches are routed to the *North* long-stay parking area, whereas there are two additional long-stay parking areas (*South* and *Hellbrunn*) dedicated to southward bound coaches on the opposite side of the urban centre. The *North* and *South* areas offer a 38 euros/day fee (vehicle access is allowed times after time during the day); the the *Hellbrunn* area charges 10 euros/hour or 50 euro/day; such area is free for Water Games visitors.
A shuttle service connecting the historical city centre and the North parking area (four trips/day) is available. It is available only for coaches drivers to allow them to get to their parked vehicles in the parking area and then to join tourists at meeting points situated just outside the pedestrian zone. Such points are closely monitored in order to make sure the time limit for passengers boarding/alighting is respected and also to guarantee fast coach turn-over (rotation in parking spaces use). This reduces the chances of vehicles queuing that create traffic congestion in the surrounding road links. In addition, public transport links the

South parking: the route developed mirrors route of the shuttle service and conveys tourists to the historical centre easily.

Amsterdam (755,000 inhabitants)

Amsterdam is the "town of the canals" and, for its special orographic system and road network configuration, provides only few dedicated spaces for coach traffic and parking in the historic city centre. In fact, within the urban area coach traffic flow is routed along the main radial access roads and bypasses leading to the urban centre along which numerous passengers drop-off/pick-up points are distributed.
Five additional dedicated long-stay coach parking areas are provided to integrate such short-stay parking system. The former are mainly stopping areas having an average capacity of 1-3 spaces placed along the kerbside: three are distributed in the North-East sector (respectively named P2, P4 and P5), one is located in the South-West area (P3) and the last one, a park & ride facility (P1) is sited in the East area (Figure 5).

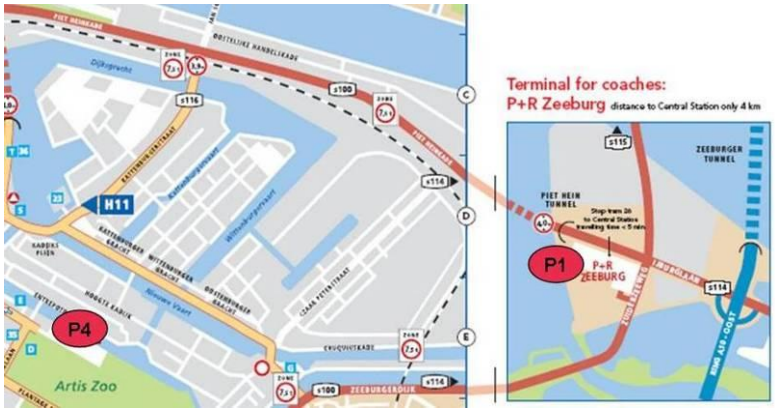


Figure 5 - Location of the Park and Ride of Zeeburg [9]

In addition, there are 24 coach stop points (identified using a progressive alphanumeric code from H1 to H24) close to the main tourist points of interest, a total of 43 spaces for fast vehicles turn-over (accessible from 7.00 a.m. to 7.00 p.m).
In particular, concerning the parking zones, the *Zeeburg* (P1) park & ride is located near the urban road ring and has 20 coach spaces. This area is open 24 hours/day and kept under CCTV surveillance. The tariff is 6 euros for the first three hours and then 2.50 euros/hour for every additional hour to be paid in advance. The other parking areas, P2 and P3 (Figure 6), are located on different sides of the urban centre and both provide good parking capacity. In particular, P2 is located centrally and can hold a maximum of 33 coaches; P3 is positioned close to the peripheral road ring on the South-West and has a capacity of 25 coaches. Both parking areas are open 24 hours/day and the tariff is 10 euros/hour or fraction of an hour. There is not a maximum time limit and in the winter period its is possible to park in P3 at the reduced tariff of 2.50 euros/hour [9].

Figure 6 - Amsterdam: drop-off and pick-up points (in dark blue) and coaches parking areas [9]

Finally, P4 and P5 are dedicated to the exclusive use of two particular tourist sites; P4 is free of charge for vehicles accompanying *Artis Zoo* visitors and provides spaces for 18 coaches from 9.00 a.m. to 5.00 p.m; similarly, P5 provides 20 spaces for tourist coaches taking visitors to the *Gassan Diamond* centre (one of the most important diamond cutting companies in the Dutch capital) that is open from 9.00 a.m. to 5.30 p.m.

Munich (1.300.000 inhabitants)

Munich is a very popular tourist destination thanks to the Oktoberfest (6 million visitors/year) and the traditional Christmas markets (nearly 3 million visitors/year). It stages many other international events (fairs, concerts, festival, etc.) that attract huge flows of visitors many of whom are part of organized groups coming to the city by tourist coaches [10].
The city is provided with three temporary passengers boarding/alighting points located along the inner ring road (*Altstadtring*) and close to the town centre (Figure 7); they are connected to the main tourist sites by a pedestrian walkway (5 -10 minutes walking).

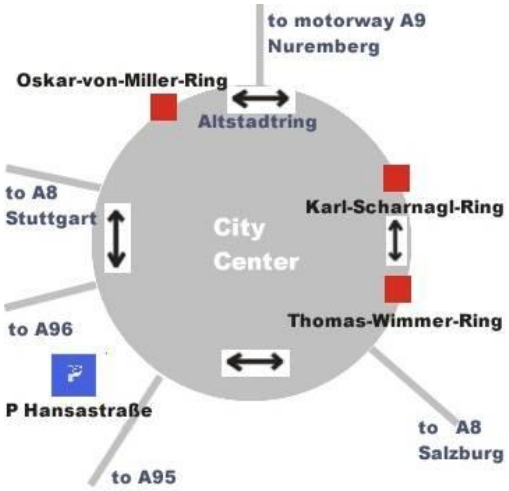


Figure 7 - Points of passengers boarding/alighting points (in red) close to the centre of Munich [10]

In particular, the *Oskar-von-Miller-Ring*, which is the access point for vehicles coming from the North-East, can accommodate 4-5 coaches at the same time; the *Karl-Scharnagl-Ring*, access point for coaches coming from the South-East, is provided with 5 spaces; finally, the *Thomas-Wimmer-Ring* access point for vehicles coming from the South is provided with 5 temporary stop spaces. The average distance to be covered on foot varies from 300 m (distance between the *Pinakotheken* and the first access point) to 700 m (distance between *Marienplatz* and the third access point).
Furthermore, in the South-West sector there is a large coach parking supply available for vehicles gravitating towards the urban centre; such parking area is located in *Hansastrasse* and provides 80 coach spaces (Figure 8).

Figure 8 - Hansastrasse parking area (source: Eurocities AG; stadtplandienst. De)

At present, the city is also provided with three park & ride terminals (Figure 9) situated near the main road axes and conveniently sited for fast access to the metro network.

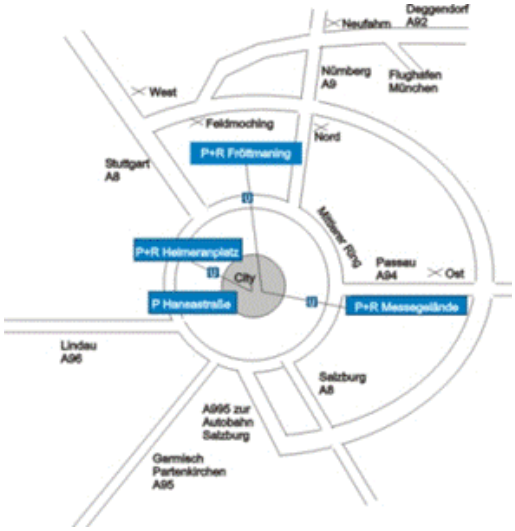


Figure 9 - Location of the park & ride nodes within in Munich [11]

In detail, the U6 metro line conveys visitors to *Marienplaz* in about 17 minutes from the *Fröttmaning* park & ride located to the North; such area has 25 spaces dedicated to temporary stops and 25 additional long-stay coach spaces. The daily tariff is 1 euro for the

first day and 3 euros/day for every additional day. The U2 metro line from the *Messestadt Ost* parking area (located in the East periphery of the urban centre) takes just over 20 minutes to get to the city centre (*Hauptbahnhof*). This parking area offers 12 places for stops and 3 parking spaces; parking is free for the first day and then 3 euros/day for every additional day. Finally, the third parking area (*Heimeranplatz*) is located in the Western zone close to the historical centre. It costs 1,50 euros/day and has short-stay 12 and 2 long-stay parking spaces. It links up with the U4/5 metro line that reaches the city centre (*Stachus*) in 5 minutes [11].
In brief, the entire tourist coaches park and ride supply provides 30 parking spaces and 49 tourist drop-off/pick–up points.

Barcelona (1,600,000 inhabitants)

It is the capital of Catalonia and one of the European cities that has experienced the highest rates of growth of tourist flows over the last years. This is a result of its numerous sites of interest as well as of the increase of maritime passengers traffic. Indeed, today Barcelona is the most important port of the Mediterranean for cruise ship tourism [12].
Some large parking areas have been built to welcome tourist coaches groups coming into the city. Only one is reserved for tourist coaches, while the remaining are destined to mixed use of coaches and motor vehicles. Two of such areas (respectively *García* Faria and *Moll d'Espanya*) are distributed along the *Ronda del Litoral* almost diametrically opposite to the port, while the remaining areas are slightly farther away from the waterfront (Figure 10).

Figure 10 - Distribution of coach parking areas managed by BSM (source: www.zonabus.bsmsa.cat)

The *García Faria* stand is dedicated to coach parking, has a capacity of 178 spaces and it is open 24 hours/day. The *Moll d'Espanya* stand is an open-work area located close to the Cruise Terminal and dedicated to mixed parking of coaches and cars. The *Wellington - Zoo* parking area is also dedicated to mixed parking and has 193 spaces. It is located in a more

decentralized position respect to the city centre, but it is well connected to it by public transport (by streetcar *Trambesos* T4 line, Wellington stop, and by metro L1 line, Navy station). This area is open from 7.30 a.m. to 9.30 p.m. Such areas (under 24 hour CCTV surveillance) are managed by BSM (Barcelona Service Municipality) and cater for persons with special needs. Currently, the same tariff is applied to the three stands: 5 euros/hour and 40 euros/day; overnight stay (9.00 p.m. – 9.00 a.m.) 20 euros/night. In addition, there are two further BSM-run areas equipped for mixed parking; such areas are respectively called *Foc*, with a total capacity of 124 spaces, and *Consell De Cent* which offers a total of 24 parking spaces. Moreover, there are several short-stay parking areas, called “blu zones”, where the time limit is two hours and further 11 drop-off/pick-up points close to the main tourist sites of interest.

It is noteworthy that all the parking terminals and stop points system is well connected to the public transport network, providing an excellent level of integration and service accessibility. In particular, the city’s metro network is made up of 9 lines covering a total of 108 km, plus several bus and suburban railroad lines (Figure 11). In detail [13], the transport sub-networks are as follows:

- three suburban railroad lines managed by *Ferrocarrils de la Generalitat* (FGC) and developed over 24 km network;
- *Trambaix* and *Tranbesos* streetcar lines covering over 40 km;
- a fleet of 1,000 new generation buses (low-flow cars) operating along 80 lines, connecting all the urban area and also offering excellent territorial accessibility.

Figure 11 - Barcelona public transport network (streetcar, subway and urban/suburban railroad) [14]

In summer 2009, the Barcelona City Council enhanced coach parking supply by 18%; this measure aimed at satisfying tourist traffic demand – currently estimated as 1,200 coaches/day coming into the city during peak periods – and was integrated with a specially created new web-based tool that allowed drivers to download GPS coordinates (which can be installed on personal satellite navigators before arrival) of the main tourist sites and recommended routes, drop-off/pick-up points (ten minutes time-limit) and parking areas [15].

Paris (2,201,578 inhabitants)

The Municipality of Paris, in cooperation with the main tour operators, the public transport company (RATP - *Autonomous Régie des Transports Parisiens*) and the Prefecture of Police, has undertaken a set of measures aimed at regulating the circulation and parking of tourist coaches inside the urban area, in order to:

- reduce the negative impacts caused by vehicular traffic, in terms of congestion and environmental and noise pollution, on the main accessing and connecting arterial roads;
- offer a high level of service to coach companies providing tourist transport services, and also to improve accessibility to major tourist attractions.

The main measures came into effect in 2003 and focused on the high tourist coach flows than pass through and stay within the Parisian urban area every day. In fact, according to figures published by the Tourist Office, every day about 2,000 coaches arrive in the French capital, 1,400 of them carrying tourists. Furthermore, at rush hours there are about 300 coaches moving around in the main tourist areas [16].
The Municipality has provided 422 tourist coach spaces distributed within 31 parking stands (Figure 12) of which:

- 9 are short-stay parking areas located centrally for a maximum stay of three hours (open from 8.00 a.m. to 7.00 p.m.);
- 22 long-stay parking areas distributed starting from the urban centre towards the outskirts (maximum stay 24 hours).

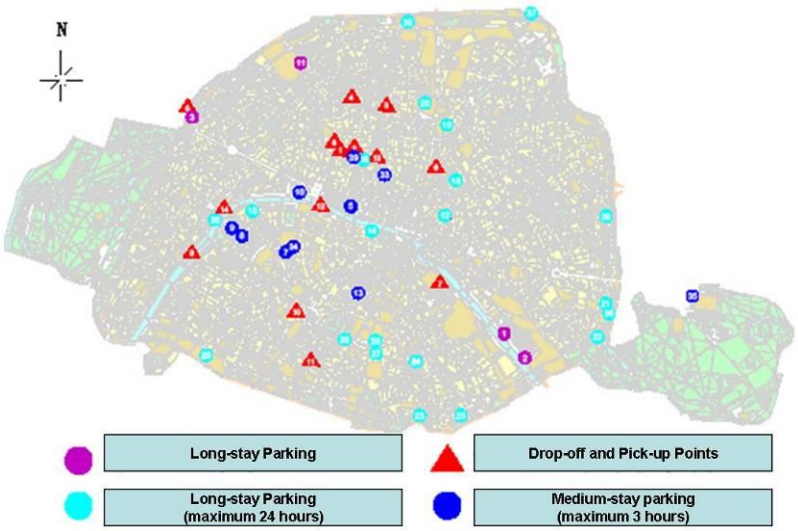


Figure 12 - Distribution of parking and stop points dedicated to tourist coaches [16]

In addition there are, respectively:

- 4 long-stay parking areas of which two are located in the South-East area and two in the North-West, where parking for over 24 hours is permitted;
- numerous temporary stop points where parking is permitted (for a maximum of fifteen minutes) in order to drop-off and pick-up passengers.

In any case, the distribution of parking facilities has been designed on the basis of the weight, in terms of appeal and consequent impact of tourist coaches flows on urban traffic, of 14 specific zones that are defined strategic for coaches management. In such strategic zones, stops and parking are allowed[1] only in selected bays and spaces (Figure 13):

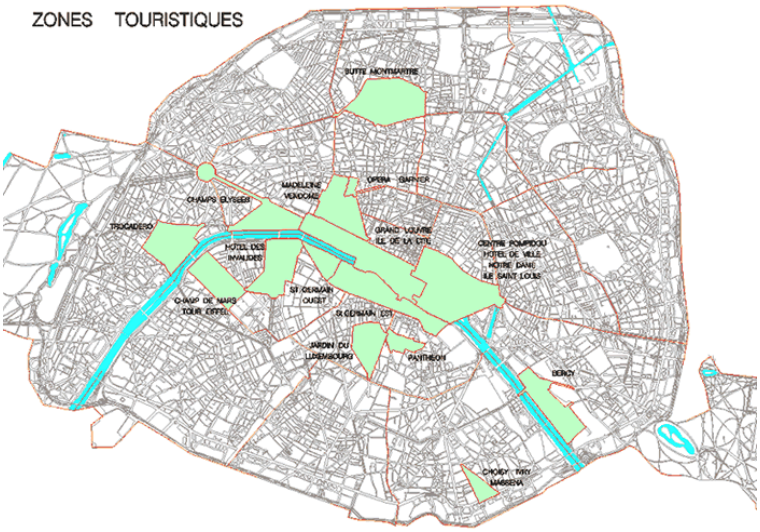
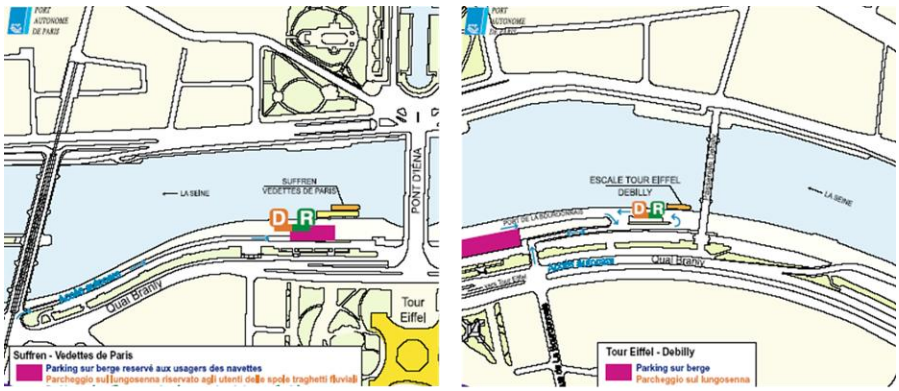


Figure 13 - Strategic tourist zoning by the Prefecture of Paris [17]

Special conditions have been also set for accessibility to the two islands of the river Seine, *Ile del la Citè* and *Ile Saint Louis*, where tourist coaches stop and parking is not allowed. Consequently, coach flows are directed towards four parking areas nearby having a overall supply of almost 200 coach spaces distributed as follows: *Bercy* (80 spaces), *S. Emilion* (18 spaces), *Pompidou Centre* (19 spaces with a height limit of 3.60 m) and *Carrousel du Louvre* (80 spaces). Since a regular boat service takes visitors to the islands, coaches can stop at the drop-off/pick-up points and in the parking zones located close to *Suffren*, *Bercy* and *de la Bourdonnais* piers (Figure 14).



Port de Suffren ***Port de de la Bourdonnais***

Figure 14 - Riverside parking reserved for direct tourists boarding [17]

[1] No respect of the no–parking prescriptions envisages a fine of 135 euros both for coaches and vehicles having a static volume of 20 m^2.

A charge (payable through the Pass Autocar system – PA) is applied for tourist coaches stops over fifteen minutes, for the use of the parking areas and also for the dedicated bays sited along the main road axes. The PA system was introduced in 2004 and is based on advance reservation and payment via internet via a user-account. The pass permits coaches to park a number of times per a day in dedicated areas. Such permit is numbered and must be stamped by drivers on an A4 sheet of paper prior to arrival and displayed on the vehicles' windshield. Furthermore, once drivers arrive at the electronic gate, they have to key in the permit's pre-assigned numerical code and PIN code provided during the web purchase in order to gain access to the parking areas. Permits cost between 20 euros and 50 euros depending on the period of day (morning, afternoon, etc.) as well as the time slot (6, 8, 11, 15 or 24 hours) [18].
A PA subscription is also available for tourist operators frequently travelling within the Parisian circuit; this option not only offers cheaper tariffs, but also makes reservation and the utilization of personal codes more user-friendly. Users can buy "parking units" (access threshold is 800 units) having a validity of 90 days. Like the daily pass, it comes as an A4 sticker, and must be signed by users every month, whereas a smart card gives access to parking areas. The swipe card costs 10 euros and the unit cost varies from 1 euro (800 units) to 0.90 eurocents (more than 1,800 units), to 0.80 eurocents (more than 5,400 units). The deductable units vary from a minimum of 20 (6 hours/day) to a maximum of 50 units (24 hours/day). Obviously, this service becomes economically viable over the threshold of 800 units, that are equivalent for example, to 40 days with 6 hours parking per day or 26 days coach parking of about 13 hours or 16 days with 24 hours parking.

Moreover, a River Boat Pass Autocar (RBPA) is available for the regular boat shuttle services going to both river islands. It can be purchased and booked on the web. This pass permits consecutive 4 hour stays for a total cost of 10 euros in numerous parking terminals (Figure 15) situated in central (i.e. *Carrousel-Louvre* or *Avenue Bouvard*) and in suburban zones (*Bercy* or *Pershing*).

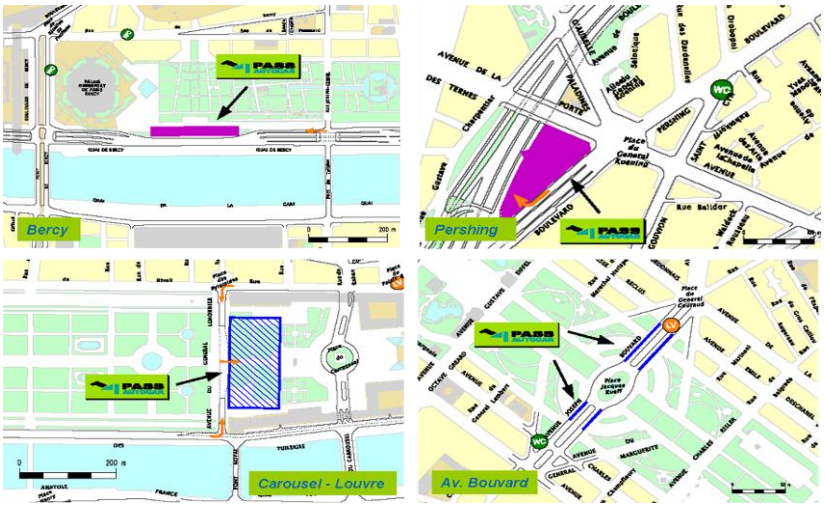


Figure 15 - Central (downwards) and suburban (upwards) parking dedicated to PA [17]

The PA system aims at optimizing utilization rates of coach parking areas providing, in the meantime, drivers with a high level of real-time information about spaces availability, and directing them towards less congested parking areas and then supplying a decision support tool to choose the best routes within the urban area.

The Paris tourist coach plan has been an important opportunity to resolve a critical problem dealing with the management of great numbers of daily coaches arrivals which until mid 2003 were not controlled and parked in spaces free of charge. Currently, the coach plan works as an integrated tool aimed at guaranteeing regular coaches access and parking procedures; such tool has been designed to provide information on pass systems and sales and customers' registration and to manage real-time monitoring of vehicles flows and parking via web and on-site.
The main measures enacted within the Paris central area since 2003 can be summarized as follows:

1. the setting up a new tourist parking supply near the road side curbs and on dedicated holding bays. Nodes distribution is as uniform as possible, these being close to the so-defined *strategic* tourist zones;

2. the introduction of a dedicated web information service – where the PA can be purchased – for coach companies and operators to provide info on the parking management system and functions, traffic flows in real time (Figure 16) as well as the occupation rates of parking areas. In this way, the utilization of decentralized or under-used parking is encouraged. An infoline providing the same services is available;

Figure 16 - Real time traffic condition in Paris [17]

3. the setting up of a fidelity system to build tourist companies loyalty by offering them lower parking tariffs;

4. the enhancement of the monitoring system aimed at limiting and/or reducing irregularities during circulation and parking activities in order to prevent congestion phenomena near the sites of interest;

5. the manning of strategic access points to support and direct coach drivers to the available parking areas;

6. the distribution of informative brochures and maps (Figure 17) and the use of improved traffic signs and info display panels signalling recommended routes (both main and alternative links) to facilitate readability and understanding, especially for foreign drivers. Additional information on the parking areas where the PA is on sale is provided on the website;

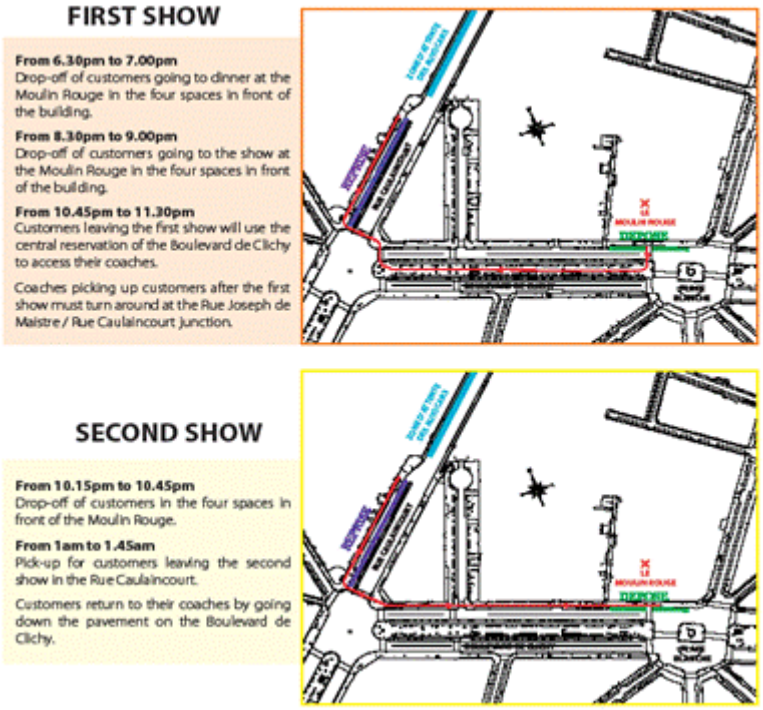


Figure 17 - Regulation of the Moulin Rouges access route [source: Mairie de Paris]

7. the setting up of the RBPA and the public river boat service connecting up the two river islands, and also the overland routes;

8. during the planning phase the creation of a devising table with the actors involved in the process (i.e. Municipality, parking managers) to find the most suitable solutions at local scale which provide tourist operators with high quality service, yet do not conflict with residents' expectations and requirements, and also help limit the environmental impacts caused by increased traffic flows.

Finally, it is noteworthy that such measures have been applied progressively over a five year period and supported by the close cooperation between the Paris Municipality, the Prefecture of Paris and the public transport operator (RATP). It also involved coach line companies as

well as the managers of the most important tourist attraction activities (i.e. the Moulin Rouge administration).

Rome (2,718,768 inhabitants)

As outlined above, management of traffic flows and tourist coaches parking within built environments is a rather elaborate operation, since it requires integrated planning that cannot ignore the real daily transport demand, both systematic and non systematic, in the municipal area. In this sense, the city of Rome represents a emblematic case. In addition to its population of 2,718,768 inhabitants [19], its historical origins and world heritage sites make it one of the most outstanding and, at the same time, crowded tourist sites in the world. For example, in 2007 tourist accommodation facilities in Rome recorded more than 20 million tourists [20], plus about 8,000,000 tourists who visited Rome on board tourist coaches[2].

The tourist coach plan currently in force in Rome was updated by the Municipality in 2006, while the previous one had been drawn up ten years before by the Roman Agency for the Jubilee. The intervention area of the New Tourist Coach Plan (to distinguish it from the Jubilee plan) covers 344 km^2 within the Outer Ring Road (GRA - Grande Raccordo Anulare); this area is in turn subdivided in two different Limited Traffic Zones (LTZ), defined respectively LTZ1 and LTZ 2 and distributed on two concentric surfaces of increasing ray, whose centre is ideally located at the bend of Tiber river, at Tiberina Island (Figure 18).

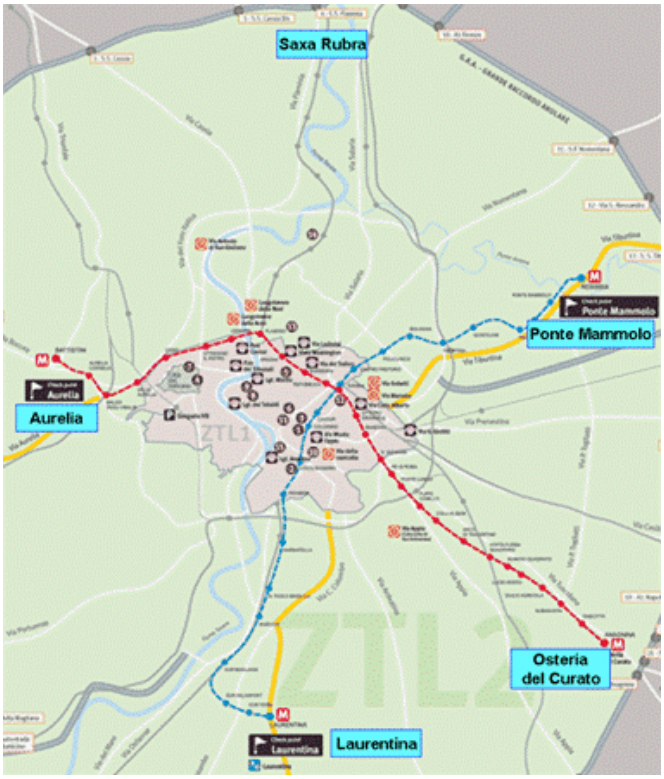


Figure 18 - Circulation and parking of tourist coaches: Rome ZTLs borders [21]

[2] Elaboration, by Atac source (2007), is based on the annual distribution of total purchased parking and transit passes (more than 160,000).

In particular, every coach provided with a travel pass can move within the LTZ2 area where its perimeter overlaps the Outer Ring Road border. Coaches parking is permitted only in some private areas and in five specific parking terminals. Such parking facilities, which offer a total of 135 spaces, are located along the main consular axes and/or radial approach roads and are called, respectively, *Saxa Rubra*, *Mammolo Bridge*, *Tavern of the Curate*, *Laurentina* and *Aurelia*. Three of these (Saxa Rubra, Tavern of the Curate and Aurelia) are open from 6.00 a.m. – to 7.30 p.m., Laurentina is accessible from 6.00 a.m. to 12.00 p.m. while the Mammolo Bridge terminal is open 24 hours/day.
Access to such areas requires vehicles registration and advance payment, via web or on-site, at three specific check points distributed respectively in the West (*Aurelia*), East (*Bridge Mammolo*) or in the South (*Laurentina*) zones. At present web registration offering advance credit card payment is increasing; 82% of a sample of 400 interviewed operators used the web to prepay parking tariffs [21].

The inner urban area, called LTZ1, includes the zone between the Aurelian Wall and the area around St. Peter's, but does not include the area close to the central railway station. Within the LTZ1, coaches access is restricted (threshold value is 300 pass/day) and a proper permit is also required; furthermore, parking is allowed only in specific areas dedicated to short-stay parking (two hour time-limit) located close to the main pedestrian access points to tourist sites. The total short-stay parking supply consists of seven dedicated areas, where average parking capacity is about 9 coach spaces, for a total of 66 parking spaces, available from 7.00 a.m. to 11.00 p.m., on weekdays and holidays. Moreover, inside the LTZ1 there is a proximity parking situated in the West urban area (*Via Gregorio VII*) with spaces for 40 coaches and open from 7.00 a.m. to 1.30 a.m.
The entire ZTL1 parking supply dedicated to tourist coaches amounts to 106 spaces.

The parking supply is flanked by about eleven drop-off/pick up points essentially distributed in the North-East zone of the city and near the main historical and tourist sites, where stops of up to 15 minutes are permitted. For instance, the holding bay in Via Monte Oppio (Figure 19) is located in the influence area of the Coliseum, the Domus Aurea (Nero's Golden House) and Trajan's and the Roman Forum.

Figure 19 – Drop-off/Pick-up points In Monte Oppio

The daily pass can be obtained after registration using the following procedures:

- advance credit card payment via internet (postponed payment for regular customers only);
- at check points or by mail after bank transfer payment (pre-reserved customers);
- on-site payment using cash/credit/bank cards at one of the check points for same day parking (not regular customers).

Different tariff plans have been set depending on the zones chosen for circulating and parking (only LTZ2 or both LTZs). In detail, the LTZ2 access fee varies from 5 to 10 euros/day, whereas within the ZTL1, where stops are allowed only near private areas (i.e. hotels and restaurants), the daily fee goes from 12 to 24 euros. Tariff variations[3] depend on purchase procedure and on customer typologies (regular, reserved online, pre-reserved or not reserved); regular customers can also purchase a special pass offering cheaper pass tariffs[4]. Circulation in both LTZs and stops in dedicated drop-off/pick-up points costs 47 euros/day and by paying twice that amount coach line companies can also make use of short-stay parking spaces.
Proximity parking tickets vary from 11 to 29 euros/hour depending on customer types and time period. Since long-stay parking is not affordable in this terminal, it is clear that such area is essentially geared towards providing coaches arriving from the North-West and those moving within the influence area of the Vatican City, with a good parking supply also guaranteeing fast coach turn-over.
Finally, an additional privately run coach parking supply is located at the Gianicolo Terminal (Figure 20) and provides 94 coach spaces open from 7.00 a.m. to 1.30 a.m. Such terminal also offers direct pedestrian access to St. Peter's Square by a tunnel equipped with escalator and moving walkways. The average parking cost for a maximum three hour stay varies from 6.90 to 10 euros, to which 24 € must be added for traveller drop-off and pick-up activities.

Figure 20 - Gianicolo parking terminal and influence area of Vatican City (source: Rome Municipality)

[3] Whatever solution is chosen, for the vehicles having a superior length to 7 m, the fare is increased of 45 – 50%.
[4] For LTZ2 the subscription cost is, respectively, 25 (monthly), 50 (six-months) and 65 euros (annual); for both ZTLs costs arises to 183 euro (monthly), 308 (six-months) and 395 euros (annual).

In its three years of operation, the tourist coach plan of Rome has shown some important limitations [22]. Indeed, the lack of suitably sized parking supply compared with the increased capacity required by tourist companies, together with the non compliance with road traffic and parking rules in terms of time limits and no-parking zones, has caused some major, not negligible critical situations. Unlike the transitory rules applied for the prior 2000 Jubilee Plan (maxi-fines from 350 to 1,500 € for not respecting speed limits and parking regulations; license suspension for serious traffic infringements, etc.), the existing plan does not envisage special sanctioning measures. Therefore, the lack of deterrent for coach drivers not complying with the regulations has aggravated road traffic conditions, especially in the central area and along the access roads, and this also worsens congestion and environmental pollution.

In September 2009 the Rome Municipality developed the guidelines for the Strategic Plan for Sustainable Mobility (SPSM), also assuming the basis for a new tourist coach plan [23]. Such guidelines outlined the importance of introducing new infrastructural and operational measures aimed at improving the management of tourist coaches circulation and parking. They also provided a proper monitoring system to prevent possible irregularities and, where necessary, to set different sanctions depending on the negative impacts on traffic circulation.
The impact of collective tourist demand on urban mobility, as well as the adjustment of coach parking supply depending on tourist companies' requirements, has been considered. Furthermore, the new approach is environmental-friendly and citizen-friendly and focuses on aspects related to the efficiency and safety factors of the urban road network. Such coach plan will probably come into force in summer 2010 and foresees 5 new long-stay parking zones, 24 short-stay parking areas, and 20 more drop-off/pick-up points where coach spaces will be doubled. As a result, the parking system will offer a total of 530 spaces, i.e. an increase of almost 300 coach spaces compared with the current supply. Particular attention will be also paid to less-pollutant vehicles, such as electric, methane or LPG fuelled ones; these coaches will pay a reduced tariff (up to 50 % discount).

EXPLORING PLANNING CRITERIA AND FACTORS

The tourist coaches mobility planning within Europeans urban areas, regardless of the reference context, is based on some key features characterizing the operations as well as the management of coaches traffic flows and parking.
The right sizing of parking supply and the proper locations of dedicated parking areas and their typology in terms of time slots, are some of the most important driving forces to guarantee the success of the planning activities. Such elements are designed according to the city dimension, its urban structure and shape as well as the road access and distribution network.
As described in the above sections, depending on such elements, European cities have adopted different schemes of traffic and parking management. In order to explore possible criteria and planning aspects related to the above-mentioned schemes, a summary of the

main quantitative parameters is provided in Table 1 which will be followed by a critical qualitative analysis. In order to identify the cities where coaches parking management plays an important role, a derived indicator, namely *parking supply density index*, has been also calculated. Such an indicator, defined as the ratio between the parking spaces availability and the related municipality land size, allows to schematically provide a parking supply functional analysis.

Table 1 - Tourist parking supplied by local municipalities: comparison among some European urban areas

Cities	**Inhabitants**	**Land surface** [km²]	**Parking areas** [number]	**Availability of different parking supply** (short, medium, long-stay and stop points)	**Total coaches parking capacity *** [spaces]	**Parking supply density Index** [spaces/km²]
Salisbury	50.000	n.d.	2	yes	**41**	-
Brussels	140.000	33	10	yes	**66**	**2**
Salzburg	150.000	66	3	no, long-stay only	**n.a.**	-
Amsterdam	755.000	202	5	yes	**116**	**0,57**
Munich	1.300.000	310	4	yes	**110**	**0,35**
Barcelona	1.600.000	101	5	yes	**428**	**4,23**
Paris	2.201.578	105**	35	yes	**422**	**4,01**
Rome	2.718.768	344***	14	yes	241 + 94[a] = **335**[b]	**0,97** [1.5][b]

* drop-off /pick–up points not included
** only the Paris city departments have been considered;
*** only the surface within the Outer Ring Road has been considered (total Rome land surface is 1290 km²);
a: Gianicolo terminal capacity has been included
b: starting from the next summer, parking supply will be increased up to 530 spaces

Municipalities managing small and middle sized urban areas or urban areas equipped with a limited parking supply, usually arrange more strict traffic patterns (lack of alternative routes). However, such areas (in some cases free of charge during the day in the winter) are generally placed out of the built-up area and near bus terminals providing shuttle services to the city centre. In such context, the trip from the parking lot to the centre generally does not take more than 15 minutes.
In cities where these parking areas are located near the urban outskirts, dedicated passengers drop-op/pick-up points are placed about 600-700 meters, i.e. about 5-10 minutes walk from pedestrian zone access points.

A frequent formula envisages the distribution and collection of visitors groups at specific points provided with good vehicular accessibility. At these points coaches can stop to drop off visitors in the morning and pick them up in the evening after they have spent the free time allocated to them in the tourist zone (moving around on foot or by public transport). Such procedure is also used to manage the logistics of the groups staying in hotels in pedestrian areas; in this case, dedicated collection points near the hotel area of influence are defined.

Since congestion phenomena and environmental pollution represent critical issues, several cities limit the number of coaches coming into the urban area, constraining their circulation essentially to the main road axis. Such access and distribution roads, developed tangentially and/or radially to the urban area, give access to areas in the vicinity of the historical centre gateways. Hence, a common practice envisages the arrival of coaches in such areas, some of these being defined as proximity parking, where tourists can alight from vehicles and then walk towards the historical sites (essentially included in the limited traffic area or pedestrian zones) .
In metropolitan areas where tourist poles are decentralized and distributed over greater distances, coaches transfer tourist groups from one side of the city to the other. If visits are relatively short (20-30 minutes), vehicles can park in areas dedicated to temporary stops or in proper bays, generally placed at 300 - 400 meters from the final destination.

The local administration's recent awareness of the problems and impacts related to tourist coach transport within urban areas is noteworthy; for example, prior to the Jubilee of 2000 the city of Rome had not been prepared any type of tourist planning related to coach parking management. Whereas in another metropolitan environment, i.e. Paris, space occupancy was free of charge and the time period was almost unlimited until 2003.

Planning in metropolitan contexts is based on a synergy of the principal and complementary measures. In particular, the Paris Plan proposed a systemic approach that, starting with a zoning of areas defined strategic in terms of "tourist weight", drew up a well defined coach parking scheme on the territory using a user-friendly payment system (in terms of tariff plan and purchase procedures), also via web. Above all a complementary measure provides strict control of occupancy rate rotation in the short–stay parking areas.
After testing the current plan for a four-year period, the Municipality of Rome requires an upgraded plan – at present this document is still in the planning phase - aimed at creating a more sustainable and integrated approach involving both mobility (private and public) and coaches parking supply systems. To this end, the document addresses respectively: increased and more uniform distribution of parking lots, better connections to the public transport network; more effective information on dedicated services to coach companies, simplification of the parking tariff system and payment procedures, real time information system showing local traffic conditions and parking supply availability and, finally, better control of parking rules compliance (the fines will be increased from 35 to 415 €). Indeed, the last complementary measure is essential to achieve effective planning and management of collective tourist demand.

Furthermore, monitoring both tourist coaches circulation within the urban area and the occupancy rate of single parking areas is a key factor to better calibrate parking supply sizing, depending on real tourist traffic flows. It prevents parking overflow conditions and improves tourist transport demand taking into account seasonal and sporadic variations. However, regardless of urban environments analyzed, such kind of data (i.e. daily coaches access, parking occupancy rates, turnover, etc.) are generally sparse and/or not available in a homogeneous format. Therefore, this lack of information as well as the lack of specific

coach parking urban standard does not allow to analyzed in a harmonized manner the equilibrium between the tourist coach parking supply and the related transport demand. As a result, the assessment of the coherence between the planning schemes and the coach traffic volumes is rather difficult to achieve. Regarding this issue, and in order to delineate possible coach-related principles, a first step could be addressed to some car parking planning practices, also considering that a likely conversion factor of coach parking space in "equivalent cars" space is about 4,6 (a coach-related road consumption is about 55 m^2 versus a 12m^2 surface occupied by a car).
In particular, in "car oriented" urban environments, a conservative car parking approach is generally based on 85th percentile demand curves, namely 85 % of sites will have free spaces even during peak hours, as well as on a 85th occupancy rate, that is the threshold value beyond which parking areas are considered full [24]. However, since such a standard is based on a parking spaces oversupply with respect to the actual demand, in several cases it is not a good practice; in fact, it can indirectly produce an increase of daily vehicles access, also expanding critical traffic flows interferences on the whole urban network. A more reliable planning practice deals with a *contingency–based planning* method, aimed at selecting specific solutions that can be progressively applied, according to the future requirements. In particular:

> *The lower-bound value is initially supplied, conditions are monitored, and various strategies are identified for implementation if needed……. This allows planners to use lower parking standards with the confidence that any resulting problems can be easily solved.* [24]

Another standard can be borrowed from parking car in residential areas [25] where, with reference to the accessibility to public transport service, a 15% reduction of parking space provision can be proposed whereas almost 50% of sites of interest are included, for example, within a 500 m radius of subway stations.
Although the slavish application of the above-mentioned criteria to coach parking management cannot be considered a desirable and feasible practice, they can certainly suggest further reflections on tourist coach parking design and planning exercise, in terms of possible principles and standards.

CONCLUSIONS

Traffic regulation and parking management of tourist coaches in urban areas entail a certain level of complexity which increase depending on the area size and its tourist pull function, as well as on the transport network structure. Such management, if not properly arranged, can produce not-negligible friction elements on the usability of the urban spaces as well as on local mobility patterns. Therefore, this can reduce the level of services of road networks and the performance of on-surface public transport services; it also produces some concomitant negative externalities, such as environmental and noise pollution as well as reduced urban transport system safety.

The increased interference created by coach traffic flows on the quality of urban life has induced local administrations to introduce a set of dedicated and complementary measures, many of which are common to several urban contexts.
However, due to the lack of homogeneous traffic data and coach parking standards in urban areas, the assessment of the coherence between the analyzed coach plans and the tourist traffic volumes is rather difficult to achieve. In any case and in order to define some design and planning standards, after introducing an equivalent factor (most likely, 1 coach space = 4,6 car spaces), some elements can be initially developed according to the car parking planning practices.
Anyway, the critical analysis on different European coach traffic schemes and parking plans highlighted some interesting concepts. Firstly, tourist coach plans generally foresee parking charges and time-limited occupancy policies that vary depending on parking spaces typology and supply availability. Secondly, municipalities managing urban areas equipped with a limited parking supply, usually set up strict circulation and parking schemes locating, at the same time, public transport services terminals next to long-stay parking areas. Other urban contexts are provided with few parking spaces that are well integrated with the public transport network, whereas metropolitan areas generally offer numerous parking spaces dislocated within the peripheral, as well as the inner, city according to different levels of access and parking conditions.
Finally, two common elements are essential to guarantee efficient coach plans. The first deals with plan dissemination; in particular, every Municipality aims at informing coach drivers/operators (i.e. by local signposts, maps at entry/check points) about urban access conditions and location of parking lots. Within larger urban areas, coach operators can also count upon an e-plan to prepay parking passes and be informed of the real traffic conditions and current parking availability. The second is based on coach flows monitoring (at access/check points, at parking bays and on-street) aimed at guaranteeing compliance of the rules, in terms of no-parking zones and time limits, as well as the reduction of coaches traffic load on accessing and connecting road links.

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